The Mariana Islands Training and Testing

Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS)

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Training and Testing Activities
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3.6 Marine Birds

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MARINE BIRDS SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following were analyzed for marine birds:

- Acoustic (sonar and other active acoustic sources; underwater explosives; swimmer defense airguns; weapons firing, launch, and impact noise; vessel noise; and aircraft noise)
- Energy (electromagnetic devices)
- Physical disturbance and strike (aircraft and aerial targets, vessels, in-water devices, military expended materials, ground disturbance, and wildfires)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary (impacts associated with sediments, water quality and air quality)

Preferred Alternative (Alternative 1)

- Acoustic: Pursuant to the Endangered Species Act (ESA), the use of sonar and other active acoustic sources, underwater explosives, swimmer defense airguns, vessel noise, and aircraft noise would have no effect on ESA-listed marine birds.
- Energy: Pursuant to the ESA, the use of electromagnetic devices would have no effect on ESA-listed marine birds.
- Physical Disturbance and Strike: Pursuant to the ESA, the use of aircraft, vessels, in-water devices, and military expended materials would have no effect on ESA-listed marine birds.
- Ingestion: Pursuant to the ESA, the potential for ingestion of military expended materials would have no effect on ESA-listed marine birds.
- Secondary: Pursuant to the ESA, secondary stressors would have no effect on ESA-listed marine birds. There is no critical habitat for ESA-listed marine birds within the MITT Study Area.
- Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations.

3.6.1 INTRODUCTION

This section focuses on marine birds that breed in or migrate through the Mariana Islands Training and Testing (MITT) Study Area (Study Area). This large category includes seabirds, shorebirds, or other birds that use the marine environment. Some of these birds are year-round residents in the Mariana Islands, while some species are migratory. Seabirds are birds whose normal habitat and food source is the sea, whether they utilize coastal waters (the nearshore), offshore waters, or pelagic waters (the open sea) (Harrison 1983, U.S. Fish and Wildlife Service 2005). Shorebirds are birds that primarily forage in coastal waters (including beaches, tidal areas, and estuaries) and inland freshwater marshes and riverine areas (Temple 2001, Engilis and Naughton 2004). This section provides profiles of Endangered Species Act (ESA)-listed species, a list of species protected under the Migratory Bird Treaty Act (MBTA) and considered by the United States (U.S.) Fish and Wildlife Service to be Birds of Conservation Concern, and a general description of major species groups of birds in the Study Area.

Section 3.6.1 (Introduction) provides an introduction of major taxonomic groups of marine birds that may be found within the Study Area, as well as regulatory frameworks concerning these species. Section 3.6.2 (Affected Environment) provides more detailed information on known occurrences and behavior at sea and on land, as well as detailed species descriptions for special status species. Complete analysis and summary of potential impacts of the Proposed Action on birds are found in Sections 3.6.3 (Environmental Consequences) and 3.6.4 (Summary of Potential Impacts on Marine Birds), respectively.

3.6.1.1 Endangered Species Act

Three seabirds that occur in the Study Area are listed under the ESA as threatened or endangered species. The short-tailed albatross (*Phoebastria albatrus*) and Hawaiian petrel (*Pterodroma sandwichensis*) are listed as endangered, and the Newell's shearwater (*Puffinus auricularis newelii*) is listed as threatened. The Hawaiian petrel and Newell's shearwater rarely occur within the Study Area. The status, presence, and nesting occurrence of ESA-listed seabirds in the Study Area are provided in Table 3.6-1. In 2010, the U.S. Fish and Wildlife Service (USFWS) concurred with the U.S. Department of the Navy's (Navy's) determination that training activities included in the Mariana Islands Range Complex (MIRC) Environmental Impact Statement (EIS)/Overseas EIS (OEIS) would have no effect on the short-tailed albatross, Hawaiian petrel, or Newell's shearwater (U.S. Fish and Wildlife Service 2010). In early 2015, the Navy and USFWS completed Section 7 ESA consultation with the issuance by the USFWS of a new Biological Opinion for activities proposed in this EIS/OEIS (U.S. Fish and Wildlife Service 2015). Like the 2010 Biological Opinion, the activities proposed in this EIS/OEIS would have no effect on ESA-listed marine birds. Other ESA-listed bird species do occur within the MITT Study Area, but these species are associated with terrestrial habitats and are therefore analyzed for impacts in Section 3.10 (Terrestrial Species and Habitats). These bird species include the Mariana swiftlet (*Aerodramus bartschi*), Mariana crow (*Corvus kubaryi*), Mariana common moorhen (*Gallinula chloropus guami*), Micronesian megapode (*Megapodius laperous*), Nightingale reed warbler (*Acrocephalus luscinia*), and Rota bridled white-eye (*Zosterops rotensis*).

Table 3.6-1: Endangered Species Act Listed Seabird Species Found in the Study Area

Species Name and Regulatory Status			Presence in Study Area[1]	
Common Name	**Scientific Name**	**Endangered Species Act Status**	**Open Ocean/ Transit Corridor**	**Coastal/ Breeding Areas[2]**
Hawaiian petrel	*Pterodroma sandwichensis*	Endangered	Yes	No
Short-tailed albatross	*Phoebastria albatrus*	Endangered	Yes	No
Newell's shearwater	*Puffinus auricularis newelli*	Threatened	Yes	No

[1] No Endangered Species Act-listed seabird has been observed on land within the Mariana Islands. These seabirds were observed at sea during marine mammal surveys in 2007 (U.S. Department of the Navy 2007).
[2] See Table 3.6-5 for a list of known breeding locations for seabirds within the Study Area.

3.6.1.2 Migratory Bird Treaty Act Species and 50 Code of Federal Regulations Part 21.15 Requirements

Marine birds in the Study Area include those listed under the MBTA of 1918 (16 United States Code 703–712; Ch. 128; 13 July 1918; 40 Stat. 755 as amended) (U.S. Department of Defense and U.S. Fish and Wildlife Service 2006). A migratory bird is any species or family of birds that live or reproduce in or migrate across international borders at some point during their annual life cycle. The MBTA established federal responsibilities for the protection of nearly all species of birds, eggs, and nests. In 2006, the USFWS and U.S. Department of Defense (DoD) signed a Memorandum of Understanding to promote conservation of migratory birds (U.S. Department of Defense and U.S. Fish and Wildlife Service 2006). Of the 1,007 species protected under the MBTA, over 100 species are known or believed to occur in the Study Area. These species are not analyzed individually, but rather are grouped based on taxonomic or behavioral similarities based on the stressor being analyzed. The summary of conclusions of potential impacts on species protected under the MBTA is presented in Section 3.6.3 (Environmental Consequences).

Through the National Defense Authorization Act, Congress determined that allowing incidental take of migratory birds as a result of military readiness activities is consistent with the MBTA. The Final Rule was published in the Federal Register on 28 February 2007 (Federal Register Volume 72, No. 29, 28 February 2007), and may be found at 50 Code of Federal Regulations (C.F.R.) Part 21.15. Congress defined military readiness activities as all training and operations of the Armed Forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for the proper operation and suitability for combat use. The measure directs the Armed Forces to assess the effects of military readiness activities on migratory birds, in accordance with the National Environmental Policy Act. It also requires the Armed Forces to develop and implement appropriate conservation measures if a proposed action may have a significant adverse effect on a migratory bird population. Specifically, 50 C.F.R. Part 21.15 specifies a requirement to confer with the USFWS when the military readiness activities in question will have a significant adverse effect on a population of migratory bird species. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a population of migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. A population, as used in 50 C.F.R. Part 21.3 (definitions), is defined as "a group of distinct, coexisting, same species, whose breeding site fidelity, migration routes, and wintering areas are temporally and spatially stable, sufficiently distinct geographically (at some point of the year), and adequately described so that the population can be effectively monitored to discern changes in its status."

The Navy identified two species that breed on Farallon de Medinilla (FDM) that may warrant conferring with the USFWS because of regional distributions and use of FDM as a rookery. The great frigatebird (*Fregata minor*) may occasionally nest on FDM, which is one of only two small breeding colonies known to exist within the Mariana Islands. The masked booby (*Sula dactylatra*) breeds on FDM, the largest breeding colony in Mariana Islands. Because of the apparent importance of FDM to these two species, the great frigatebird and masked booby are analyzed in more detail in this section, with an emphasis on how military use of FDM may impact these species. Further, an analysis is presented in this section as to whether military use of FDM may significantly affect populations, pursuant with 50 C.F.R. Part 21.15.

For the purposes of this analysis, the Navy examined the best available distribution data for the masked booby and great frigatebird within the western and central Pacific basin. This information is described in further detail in Section 3.6.2.6 (Rookery Locations and Breeding Activities within the Mariana Islands Training and Testing Study Area). For the great frigatebird, breeding on FDM is rare and sporadic. FDM does not appear to be a stable breeding location. Further, statistical analyses of survey data collected over the past 18 years at FDM (as described in Section 3.6.2.6) demonstrated that no definite conclusions about long-term population trends can be reached, i.e., the results are statistically non-significant.

FDM has been used as a bombing range since 1971, and the U.S. government entered into a formal lease agreement for military use of the island with the Commonwealth of the Northern Mariana Islands (CNMI) in 1983 (United States of America and Commonwealth of the Northern Mariana Islands 1983).

3.6.1.3 United States Fish and Wildlife Service Birds of Conservation Concern

Birds of Conservation Concern are species, subspecies, and populations of migratory and non-migratory birds that the USFWS determines through policy documents to be the highest priority for conservation actions (U.S. Fish and Wildlife Service 2008a). The purpose of the Birds of Conservation Concern category is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions needed to conserve these species. The USFWS maintains a list of Birds of Conservation Concern (U.S. Fish and Wildlife Service 2008a). There are five species considered Birds of Conservation Concern that occur within the Study Area. These species are the black-footed albatross (*Phoebastria nigripes*), Audubon's shearwater (*Puffinus lherminieri*), Christmas shearwater (*Puffinus nativitatis*), Herald petrel (*Pterodroma arminjoniana*), and Tahiti petrel (*Pseudobulweria rostrata*). Four of these species were observed at sea during the 2007 Mariana Islands Sea Turtle and Cetacean Survey, with the lone exception being the Christmas shearwater (U.S. Department of the Navy 2007). This species is known to occur in the northern portion of the Mariana archipelago (Pratt et al. 1987). Only the Audubon's shearwater has been observed on Guam, Tinian, and FDM and is thought to be a rare, non-breeding visitor to these islands (Pratt et al. 1987). Table 3.6-2 lists Birds of Conservation Concern, as well as seabirds and shorebirds, known to breed within the Study Area.

3.6.1.4 Major Bird Groups

There are six major groups of seabirds, shorebirds, and other birds associated with marine and freshwater habitats within the Study Area. These major bird groups are listed in Table 3.6-3. Some of these birds breed on land within the Mariana Islands and forage in freshwater or brackish waters (such as estuaries and inland freshwater wetlands).

Seabirds are primarily open ocean or coastal water feeders. Seabird species that forage in the open ocean are strictly marine, ranging far out to sea and returning to land only to breed. Laysan, black-footed, and short-tailed albatrosses, and sooty and arctic terns are examples of Pacific seabirds that live and feed in the open ocean (U.S. Fish and Wildlife Service 2005). Major seabird groupings include Pelecaniformes (pelicans, cormorants, gannets, and frigatebirds), Phaethontiformes (tropicbirds), and Procellariiformes (albatrosses, petrels, storm-petrels, and shearwaters). Charadriiformes include species that are considered both seabirds and shorebirds. Within this taxonomic group, skuas, jaegers, gulls, terns, and noddies have more pelagic characteristics and are therefore considered to be seabirds. Plovers, tattlers, sandpipers, and phalaropes are species groupings within the Charadriiformes that are considered shorebirds. Shorebirds rarely range far from land (except during migrations), foraging in marine, estuarine, freshwater, and sometimes terrestrial habitats, and most return to land to roost at night. Anseriformes (ducks, geese, swans, and wigeons) are considered wading birds. These birds are closely associated with freshwater and brackish habitats. Other bird species that are not considered seabirds or shorebirds may rarely visit the Mariana Islands. For instance, rare occurrences of ospreys (Pratt et al. 1987) and peregrine falcons (Aguon et al. 2000) have been reported on Guam. Because these migratory birds of prey are closely associated with marine and estuarine environments (and prey on seabirds and shorebirds), they are included in Table 3.6-3 as a sixth major grouping.

Table 3.6-2: United States Fish and Wildlife Service Birds of Conservation Concern and Breeding Seabirds within the Study Area

Common Name	Scientific Name	Breeding location on DoD Owned or Leased Property[1]	Other Islands within the Study Area[2]
Black-footed albatross	*Phoebastria nigripes*	**-**	**-**
Audubon's shearwater	*Puffinus lherminieri*	**-**	**-**
Christmas shearwater	*Puffinus nativitatis*	**-**	**-**
Herald petrel	*Pterodroma arminjoniana*	**-**	**-**
Tahiti petrel	*Pseudobulweri a rostrata*	**-**	**-**
Red-tailed tropicbird	*Phaethon rubricauda*	-	Uracas, Maug, Pagan, Guguan, Rota
White-tailed tropicbird	*Phaethon lepturus*	-	Guguan
Wedge-tailed shearwater	*Puffinus pacificus*	-	Saipan, Naftan Rock (off Aguiguan)
White tern	*Gygis alba*	NBG Main Base (Neye Island[3] north coast of Orote Point and rocky offshore islets, trees on the main installation), Tinian (Puntan Masalok), FDM	Uracas, Pagan, Agrihan, Asunción, Maug, Alamagan, Guguan, Sarigan, Anatahan, Saipan, Aguiguan
Sooty tern	*Sterna fuscata*	FDM	Uracas, Maug (possible), Asunción, Guguan, Naftan Rock (off Aguiguan)
Black noddy	*Anous minutes*	NBG Main Base (Neye Island), Andersen AFB (shoreline between Pati Point and Tagua Point), Tinian (Puntan Masalok), FDM	Uracas, Maug, Asunción, Agrihan, Pagan, Guguan, Aguiguan
Brown noddy	*Anous stolidus*	NBG Main Base (Orote Island and rocky offshore islets, Neye Island[3]), Andersen AFB (shoreline between Pati Point and Tagua Point), Tinian (Puntan Masalok), FDM	Uracas, Maug, Asunción, Agrihan, Pagan (Tograi Rock, possible), Alamagan, Guguan, Sarigan, Anatahan (Bird Rock), Saipan, Aguiguan (and Naftan Rock), Rota
Masked booby	*Sula dactylatra*	FDM	Uracas, Maug, Guguan
Red-footed booby	*Sula*	FDM	Maug, Asunción, Pagan, Guguan, Rota
Brown booby	*Sula leucogaster*	FDM	Uracas, Maug, Asunción, Agrihan, Pagan, Alamagan, Guguan, Sarigan, Anatahan, Saipan, Naftan Rock, Rota
Great frigatebird	*Fregata minor*	FDM	Maug (possible)

[1] There are over 100 species of seabirds and shorebirds known to occur or likely to occur within the Study Area. This table lists birds that are known to breed or likely to breed on DoD-owned or leased lands and other islands within the Study Area, as well as birds considered by the U.S. Fish and Wildlife Service as Birds of Conservation Concern. Birds of Conservation Concern are highlighted in bold.
[2] These islands are located within the Study Area; however, these islands do not include Navy owned or leased lands. Limited training activities may occur on Rota and Saipan through special use agreement with local authorities.
[3] Breeding activity at Neye Island or species is questionable due to the possible presence of brown treesnakes
Notes: Andersen AFB = Andersen Air Force Base, DoD = United States Department of Defense, FDM = Farallon de Medinilla, NBG = Naval Base Guam
Sources: Reichel (1991), Lusk et al. (2000), Wiles (2005), National Oceanic and Atmospheric Administration (2005a, b, c, d, e), U.S. Department of the Navy (2013a), U.S. Fish and Wildlife Service (2011a).

3.6.1.5 Areas Included in the Analysis

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), the MITT Study Area includes approximately 502,000 square nautical miles (nm^2), all of which may be used by species belonging to the six taxonomic orders listed in Table 3.6-3. Chapter 2 (Description of Proposed Action and Alternatives) also describes the areas owned or leased by the DoD on Guam and the CNMI.

Table 3.6-3: Descriptions and Examples of Major Taxonomic Groups within the Study Area

Major Taxonomic Groups[1]		Vertical Distribution in the Mariana Islands Training and Testing Study Area		
Common Name (Taxonomic Group)	**Description**	**Open Ocean Areas**	**Bays, Estuaries, and Rivers**	**Inland Wetlands and Open Upland Areas**
Boobies, pelicans, cormorants, and frigatebirds (order Pelecaniformes)	Diverse group of large, fish-eating seabirds with four toes joined by webbing, often occur in large flocks near high concentrations of bait fish.	Airborne, surface, water column	Airborne, surface, water column	Potential foraging in freshwater wetlands
Tropicbirds (order Phaethontiformes)	Fish-eating group of birds, nesting in solitary pairs away from other breeding concentrations of seabirds.	Airborne, surface, water column	Airborne, surface, water column	Potential foraging in freshwater wetlands
Albatrosses, petrels, shearwaters, and storm-petrels (order Procellariiformes)	Group of largely pelagic seabirds, fly nearly continuously when at sea, and soar low over the water surface to find prey, some species dive below the surface.	Airborne, surface, water column	Airborne, surface, water column	Potential foraging in freshwater wetlands
Phalaropes, plovers, tattlers, sandpipers, gulls, noddies, terns, skimmers, skuas, and jaegers (order Charadriiformes)	Diverse group of small to medium sized shorebirds, seabirds and allies inhabiting coastal, nearshore, and open-ocean waters	Airborne, surface, water column	Airborne, surface, water column	Potential foraging in freshwater wetlands, potential foraging in open grasslands and mowed areas
Wading birds, such as ducks, herons, wigeons (order Anseriformes)	Plant and fish eating group of shorebirds with close associations with freshwater breeding and wintering grounds.	Airborne	Airborne, surface, water column	Airborne, surface, water column
Birds of prey, such as osprey and peregrine falcons (order Accipitriformes)	Birds of prey, rare occurrences within the Mariana Islands, preying on seabirds and shorebirds	Airborne	Airborne, surface (for foraging)	Airborne, surface (for foraging)

[1] Major taxonomic groups based on American Ornithologists Union's Checklist of North American Birds (7th Ed.) (Chesser et al. 2009) and Sibley (Sibley 2000).

Not all of the land areas within the MITT Study Area are included for analysis for potential impacts on seabirds and shorebirds. For instance, some land training areas on Guam do not contain seabird or shorebird habitats, and therefore the likelihood of potential impacts due to training and testing activities is negligible. Rota is excluded from the analysis because training activities on Rota occur in urban and developed settings, such as urban warfare exercises. Saipan is also not included in the analysis for seabirds and shorebirds, although this island supports occasional land training. The area identified for land training activities is the Marpi Maneuver Area, and it does not contain aquatic or marine habitats or terrestrial roosting habitats for seabirds or shorebirds.

Based on these criteria, only the following land areas within the Study Area are carried forward for analysis: Andersen Air Force Base, Naval Main Base (Naval Base Guam Apra Harbor, Sasa Valley and Tenjo Vistas Tank Farms, and Naval Base Guam Munitions Site), Tinian Military Lease Area, and FDM. These areas are described in more detail throughout this section.

3.6.2 Affected Environment

Seabirds, shorebirds, and other species that use the marine environment occur within the Study Area year-round, seasonally, or during migration seasons. Some of these bird species are considered rare vagrants, their known ranges are thought to be outside of the Study Area, however, may transit the Study Area because of storm fronts or other weather-related factors.

Inhabited islands within the Study Area have been extensively altered by humans and support a wide array of introduced predators, plants, and invertebrate pests. The largest inhabited islands are located in the southern portion of the Marianas Archipelago (Guam, Rota, Saipan, and Tinian) and support less than 4 percent of the 265,000 seabirds estimated to occur within the Study Area (U.S. Fish and Wildlife Service 2005). The most important colony locations for seabirds are in the northern portion of the Mariana archipelago, particularly Uracas, Maug, Guguan, Asunción, FDM, and Naftan Rock off of Aguiguan (Reichel 1991, U.S. Fish and Wildlife Service 2005). These islands are of little commercial value, and with the exception of FDM, are all designated by CNMI as wildlife areas or sanctuaries (Reichel 1991, U.S. Fish and Wildlife Service 2005).

Ocean habitats are dynamic and often change in size, shape, magnitude, and location as water masses of varying temperature, salinity and velocity converge and diverge (U.S. Fish and Wildlife Service 2005). Dynamic habitats are also created when water interacts with ocean floor topography (such as islands, seamounts, and ocean trenches). Current convergences and eddy effects (created by islands) promote productivity and concentrate prey for seabirds (Mann and Lazier 1996, Oedekoven et al. 2001). Generally, most fish are found in schools close to land, and consequently most distinctive seabirds of this region (e.g., tropicbirds, boobies, frigatebirds, and several species of terns) keep to nearshore or coastal waters (McGowan et al. 2003).

Nonresident migrant shorebirds, such as the Pacific golden plover, migrate to Guam and the CNMI during winter months along the West Pacific Flyway. There are no breeding shorebirds in the Mariana Islands (Engilis and Naughton 2004). The West Pacific Flyway, shown in Figure 3.6-1, includes various other Pacific archipelagos, such as New Zealand, Samoa, Line Islands, Phoenix Islands, Hawaii, and continental sub-arctic and arctic regions in Alaska. Upon arrival, the Mariana Islands provide limited resources for shorebirds due to small island size, narrow intertidal zones, and lack of extensive mudflats (Parish et al. 1987). The highest quality habitats for wintering shorebirds are found on Guam and Saipan (Stinson et al. 1997). During the wet season, approximately June through November, ephemeral basins with short grass, exposed mud, and shallow pools provide habitat for migratory shorebirds wintering in the islands. Larger expanses of short grass habitats associated with military bases, airports, golf courses, fields, and residential parks are utilized by golden-plovers and, to a lesser extent, turnstones (Engilis and Naughton 2004).

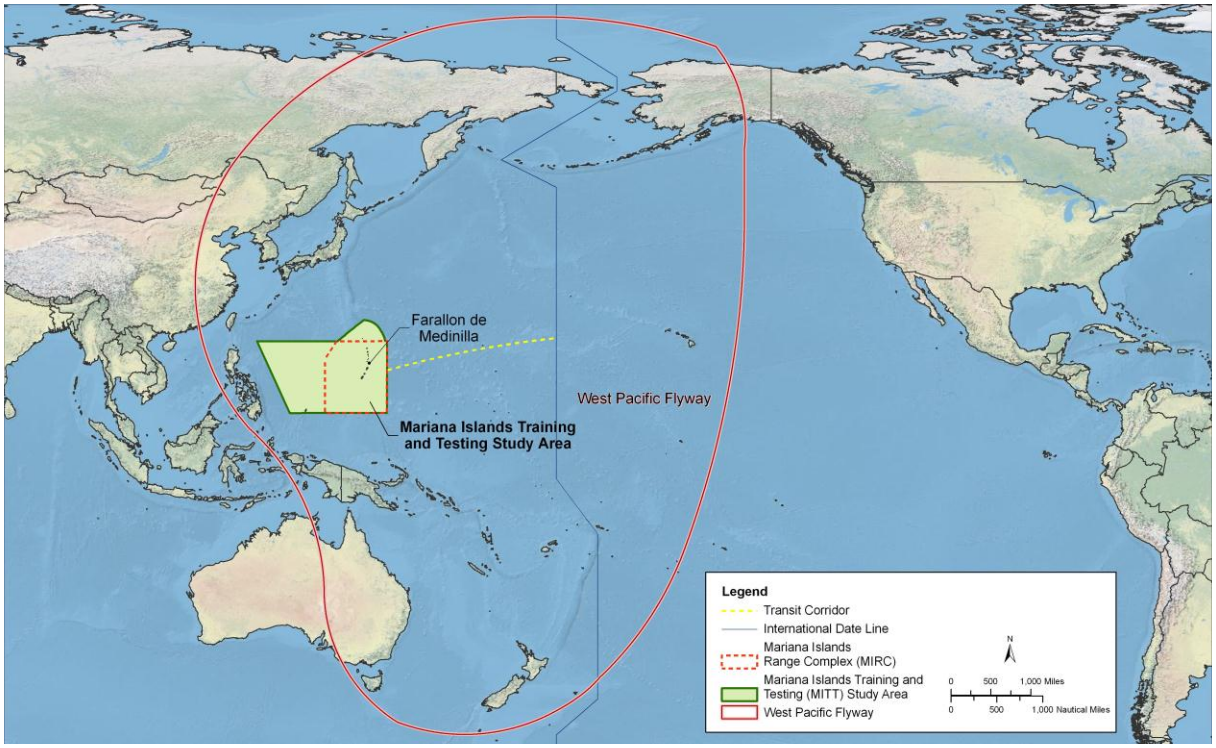


Figure 3.6-1: West Pacific Flyway

3.6.2.1 Group Size

A variety of group sizes and diversity may be encountered throughout the Study Area, ranging from solitary migration of an individual bird to large concentrations of mixed-species flocks. Flock size is likely dependent on the type of species, proximity to land, and seasonality of prey species. For instance, seabird species such as boobies, noddies, shearwaters, and white terns are frequent above tuna schools, while albatrosses and petrels tend to be more solitary (Squire et al. 1977).

3.6.2.2 Diving

Most seabirds found within the Study Area will feed by diving, skimming, or grasping prey at the water's surface or within the upper portion (1–2 meters [m] [3–6 feet {ft.}]) of the water column (Sibley 2000). Plunge-diving, as utilized by terns and pelicans, is a foraging strategy in which the bird hovers over the water and dives into the water to pursue fish. Diving behavior in terns is limited to plunge-diving during foraging (Tremblay et al. 2003) and, in general, tern species do not usually dive deeper than 3 ft. (1 m).

3.6.2.3 Bird Hearing

Although hearing range and sensitivity has been measured for many land birds, little is known of seabird hearing. The majority of the published literature on bird hearing focuses on terrestrial birds and their ability to hear in flight. A review of 32 terrestrial and marine species reveals that birds generally have greatest hearing sensitivity between 1 and 4 kilohertz (kHz) (Ryals et al. 1999). Very few can hear below 20 Hertz (Hz), most have an upper frequency hearing limit of 10 kHz, and none exhibit hearing at frequencies higher than 15 kHz (Dooling et al. 2000). Hearing capabilities have been studied for only a few seabirds (Beason 2004, Beuter et al. 1986, Thiessen 1958, Wever et al. 1969); these studies show that seabird hearing ranges and sensitivity are consistent with what is known about bird hearing in general.

There is little published literature on the hearing abilities of birds underwater. In fact, there are no measurements of the underwater hearing of any diving birds (Therrien et al. 2011). There are some studies of bird behavior underwater when exposed to sounds, from which some hearing abilities of birds underwater could be inferred. Common murres (*Uria aalge*) were deterred from gillnets by acoustic pingers emitting 1.5 kHz pings at 120 decibels (dB) referenced (re) to 1 micropascal (μPa); however, there was no significant reduction in rhinoceros auklet (*Cerorhinca monocerata*) bycatch in the same nets (Melvin and Parrish 1999). In another study, firing of guns over water deterred African penguins (*Spheniscus demersus*) from an area, but playback of Orca *(Orcinus orca)* vocalizations did not (Cooper 1982).

3.6.2.4 General Threats

Threats to seabird populations in the Study Area may include human-caused stressors such as incidental mortality from interactions with commercial and recreational fishing gear, introduced/non-native species, disturbance and degradation of nesting areas by humans and feral animals, egg collecting, noise pollution from construction and other human activities, nocturnal collisions with power lines and artificial lights, and pollution, such as that from oil spills and plastic items (Clavero et al. 2009, International Union for Conservation of Nature and Natural Resources 2010, North American Bird Conservation Initiative 2010, U.S. Fish and Wildlife Service 2005, 2008b). Predation of seabird eggs, chicks, and eggs by invasive species is of particular concern. Disease, volcanic eruptions, storms, and harmful algal blooms are also threats to seabirds (Jessup et al. 2009, North American Bird Conservation Initiative 2010, U.S. Fish and Wildlife Service 2005, 2008b). In addition, seabird distribution, abundance, breeding, and other behaviors are affected by cyclical environmental events, such as the El Niño Southern Oscillation and Pacific Decadal Oscillation in the Pacific Ocean (Vandenbosch 2000), as noted in Section 3.1 (Sediments and Water Quality).

An estimated 39 percent of seabirds that depend on ocean habitats are declining (North American Bird Conservation Initiative 2010). In the long term, climate change could be the largest threat to seabirds. Climate change effects include changes in air and sea temperatures, in precipitation, in the frequency and intensity of storms, in pH level of sea water, and in sea level rise. These changes could affect overall marine productivity and biodiversity, which could affect the food resources, distribution, and reproductive success of seabirds (Duffy 2011, Aebischer et al. 1990, Congdon et al. 2007, North American Bird Conservation Initiative 2010). Projections indicate that a 1 m (3.3 ft.) rise by the year 2100 is plausible (Fletcher 2009). As a result, seabird nesting colonies that occur along sections of coastlines undergoing sea level rise may experience a loss of nesting habitat (Congdon et al. 2007).

Threats to shorebirds in the Mariana Islands include degradation of wetlands, ephemeral basins, tidal flats, and mangrove estuaries; loss of seasonally flooded agricultural lands from expanded development; and predation by brown treesnakes and introduced feral animals. For a more detailed discussion of introduced animals on Guam, Rota, Tinian, Saipan, and FDM, see Section 3.10 (Terrestrial Species and Habitats).

3.6.2.5 At-Sea Observations of Seabirds and Shorebirds

Distribution and abundance vary considerably by species, with some species primarily occurring in nearshore habitats and others primarily occurring in offshore pelagic habitats. The area from the beach to about 10 nautical miles (nm) offshore provides foraging areas, a migration corridor, and winter habitat for various breeding and transient pelagic seabirds and shorebirds. Wintering shorebirds and transient shorebirds on the way to other wintering grounds are commonly observed in open areas (e.g., mowed grassy and paved areas) throughout the Mariana Islands. Pelagic seabirds are widely distributed throughout the Marianas, but they tend to congregate in areas of high productivity and prey availability. The Navy-funded Mariana Islands Sea Turtle and Cetacean Survey observed a total of 40 bird species along four legs (trips), accounting for 814 individual observations of seabirds and shorebirds within the cruise area (U.S. Department of the Navy 2007). Figure 3.6-2 shows the general location of survey legs for the Mariana Islands Sea Turtle and Cetacean Survey, and Table 3.6-4 lists each species observed during each survey leg. Figure 3.6-2 also shows known rookery locations for breeding seabirds within the Study Area from other sources.

3.6.2.6 Rookery Locations and Breeding Activities within the Mariana Islands Training and Testing Study Area

Seabirds are known to breed in a few locations on DoD-owned and leased properties within the Study Area. Table 3.6-5 lists each property that supports breeding activities of seabirds. These areas are described in more detail in the following subsections. Rota and Saipan also support important breeding marine bird rookeries, such as I'Chenchon Bird Conservation Area on Rota and Bird Island of Saipan. These areas are not within or proximate to land training activities within the Study Area; therefore, these areas are excluded from the analysis.

3.6.2.6.1 Guam

The introduction of brown treesnakes (*Boiga irregularis*) and rats (*Rattus* spp.) are primarily responsible for the extirpation of avian species on Guam, and successful seabird breeding activities can only occur where brown treesnakes cannot easily access (GovGuam Division of Aquatic and Wildlife Resources 2006). For example, Pacific reef herons (*Ardrea sacra*) historically bred along the western coast from Orote Point to Cocos Island (Lusk et al. 2000), and the disappearance of this species coincided with the declines of forest bird species attributed to predation in the 1980s and 1990s (Rodda et al. 1997, Savidge 1987). The Mariana mallard (*Anas platyrhyncos*) and the white-browned rail (*Poliomnas cenereus*), however, were extirpated from Guam prior to the arrival of the brown treesnake (Savidge 1987).

Some nesting activities can persist on Guam in areas out of reach of introduced predators. Brown noddies (*Anous stolidus*) nest and roost on steep cliffs, rocky offshore islets, and on channel makers in Outer Apra Harbor. Additionally, this species roosts on at least two small emergent rock islands off the north and south coast of Orote peninsula. Brown boobies (*Sula leucogaster*) also nested on Orote Island previous to the construction of Kilo Wharf, but no longer nest on Guam. The coastal islets, reef flats, grassy fields, and other open areas on Guam provide seasonal foraging habitat to any number of migratory shorebirds (U.S. Department of the Navy 2013a).

Estuarine wetlands occur in areas of tidal intrusion or brackish water and consist primarily of mangroves and the lower channels of rivers. The largest concentrations of mangroves exist along the eastern shores of Naval Base Guam Apra Harbor and are considered the most extensive and diverse in the Mariana Islands (GovGuam Department of Aquatic and Wildlife Resources 2006). Marshes of bulrushes (*Scirpus littoralis*) are found at several locations in Naval Base Guam Apra Harbor. The largest area is the artificial San Luis Ponds, an important foraging location for many species of migratory shorebirds (GovGuam Department of Aquatic and Wildlife Resources 2006, U.S. Department of the Navy 2013a). Locations of known breeding sites of seabirds on Guam are shown in Figure 3.6-3.

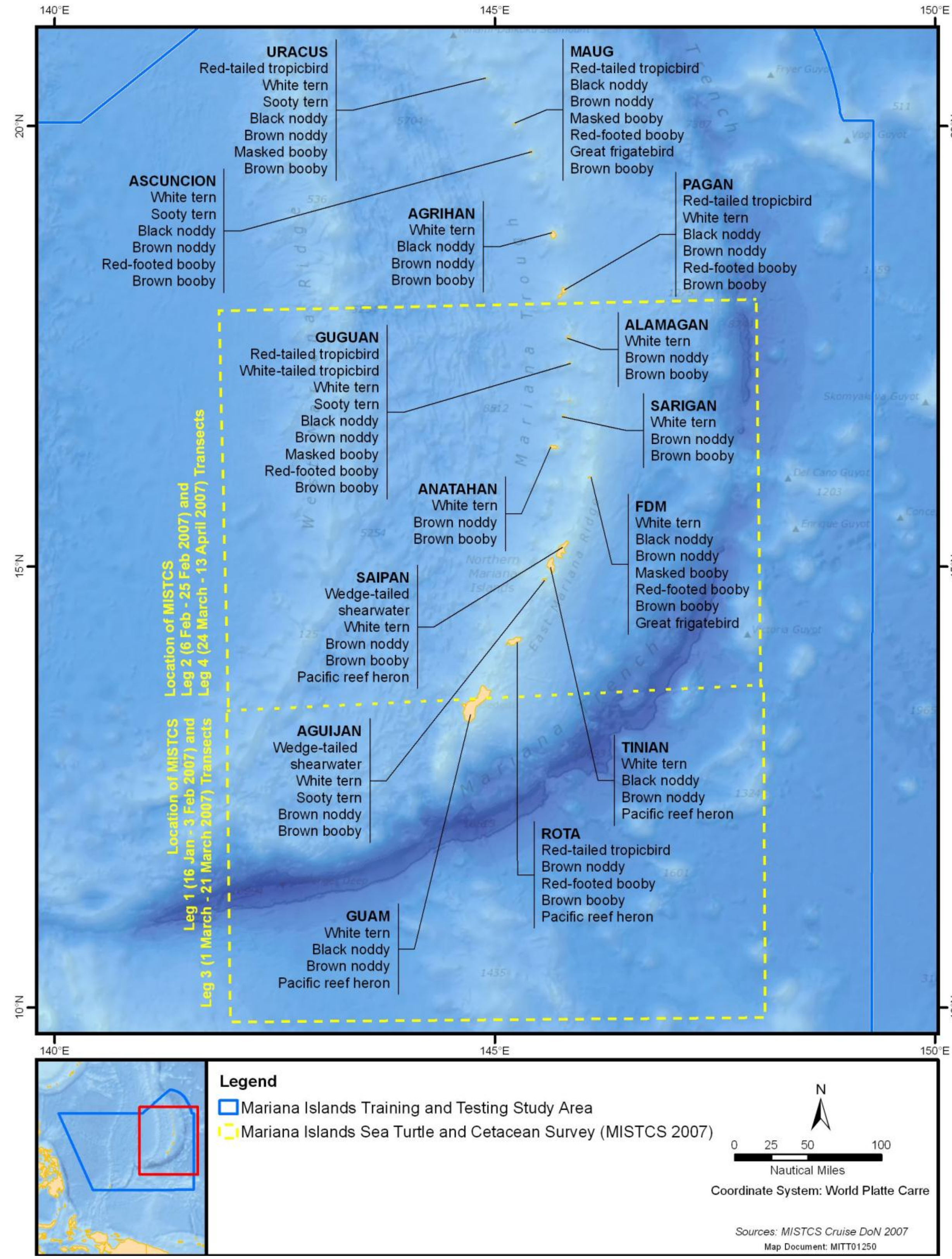


Figure 3.6-2: Breeding Locations of Seabirds within the Mariana Islands

Table 3.6-4: Pelagic Marine Bird Observations within the Study Area

Family	Common Name[1]	Scientific Name	MISTCS Survey Leg[2]				TOTAL
			Leg 1	Leg 2	Leg 3	Leg 4	
Albatrosses Family Diomedeidae	Short-tailed Albatross	*Phoebastria albatrus*	-	1	-	1	*2*
	Black-footed Albatross	*Phoebastria nigripes*	-	-	-	1	*1*
Petrels and Shearwaters (Family Procellariidae)	Tahiti Petrel	*Pseudobulweria rostrata*	3	-	-	2	*5*
	Mottled Petrel	*Pterodroma inexpectata*	-	-	1	-	*1*
	Kermadec Petrel	*Pterodroma neglecta*	3	4	-	1	*8*
	Herald Petrel	*Pterodroma arminjoniana*	6	3	2	1	*12*
	Hawaiian Petrel	*Pterodroma sandwichensis*	3	-	-	-	*3*
	White-necked Petrel	*Pterodroma cervicalis*	5	-	-	-	*5*
	Bonin Petrel	*Pterodroma hypoleuca*	7	12	9	7	*35*
	Black-winged Petrel	*Pterodroma nigripennis*	-	-	-	1	*1*
	Bulwer's Petrel	*Bulweria bulwerii*	6	4	1	1	*12*
	* White-chinned Petrel	*Procellaria aquinoctialis*	-	-	-	1	*1*
	Streaked Shearwater	*Calonectris leucomelas*	4	9	15	10	*38*
	Flesh-footed Shearwater	*Puffinus carneipes*	-	1	3	9	*13*
	Wedge-tailed Shearwater	*Puffinus pacificus*	8	13	16	20	*57*
	Short-tailed Shearwater	*Puffinus tenuirostris*	-	-	-	4	*4*
	* Little Shearwater	*Puffinus assimilis*	-	-	1	1	*1*
	Audubon's Shearwater	*Puffinus lherminieri*	1	-	1	-	*2*
	Wilson's Storm Petrel	*Oceanites oceanicus*	-	-	-	2	*2*
	* Wedge-rumped Storm Petrel	*Oceanodroma Tethys*	-	-	1	-	*1*
	Leach's Storm Petrel	*Oceanodroma leucorhoa*	-	-	1	7	*8*
	* Swinhoe's Storm Petrel	*Oceanodroma monorhis*	-	1	-	1	*2*
	Matsudaira's Storm Petrel	*Oceanodroma matsudairae*	12	20	16	20	*68*

Table 3.6 4: Pelagic Marine Bird Observations within the Study Area (continued)

Family	Common Name[1]	Scientific Name	MISTCS Survey Leg[2]				TOTAL
			Leg 1	Leg 2	Leg 3	Leg 4	
Tropicbirds (Family Phaethontidae)	Red-tailed Tropicbird	*Phaethon rubricauda*	5	13	5	11	*34*
	White-tailed Tropicbird	*Phaethon lepturus*	11	6	10	7	*34*
Gannets and boobies (Family Sulidae)	Masked Booby	*Sula dactylatra*	-	7	1	9	*17*
	Red-footed Booby	*Sula*	11	20	16	19	*66*
	Brown Booby	*Sula leucogaster*	5	9	16	18	*48*
Frigatebirds (Family Frigitatidae)	Great Frigatebird	*Fregata minor*	9	7	7	6	*29*
Skuas and jaegers (Family Stercorariidae)	Pomarine Jaeger	*Stercorarius pomarinus*	-	-	7	8	*15*
	Parasitic Jaeger	*Stercorarius parasiticus*	-	1	7	5	*13*
	Long-tailed Jaeger	*Stercorarius longicaudus*	1	2	11	17	*31*
Terns, noddies (Family Sternidae)	Gray-backed Tern	*Sterna lunata*	-	-	-	6	*6*
	Sooty Tern	*Sterna fuscata*	18	20	16	20	*74*
	Black Noddy	*Anous minutes*	6	10	11	9	*36*
	Brown Noddy	*Anous stolidus*	7	11	15	20	*53*
	White Tern	*Gygis alba*	16	20	16	20	*72*
Plovers (Family Charadriidae)	Pacific Golden Plover	*Pluvialis fulva*	-	1	-	-	*1*
Sandpipers, curlews, snipes (Family Scolopacidae)	Far Eastern Curlew	*Numenius madagascariensis*	-	-	1	-	*1*
	Common Sandpiper	*Actitis hypoleucos*	-	-	-	1	*1*

[1] Species marked with an asterisk (*) are believed sufficiently rare, unexpected, and without precedence in the Mariana Islands Sea Turtle and Cetacean Survey study area that in the absence of photo or specimen documentation and such sightings supported only by written field notes, should be regarded here as hypothetical.
[2] MISTCS study area shown in Figure 3.6-2.
Note: MISTCS = Mariana Islands Sea Turtle and Cetacean Survey
Source: U.S. Department of the Navy 2007

Table 3.6-5: Known Rookery/Nesting Locations on Department of Defense Owned or Leased Lands within the Mariana Islands Training and Testing Study Area

DoD Owned or Leased Property	Rookery/Nesting Location	Species Supported
Guam		
Naval Base Guam Main Base	North coast of Orote Peninsula, rocky offshore islets	Breeding for white terns
	Orote Island, rocky offshore islets	Brown noddies (approximately 150 individuals reported in 2005)
	Neye Island	Breeding location for black noddies, brown noddies, Pacific reef-herons, white terns, yellow bitterns[1]
	Portions of Main Base	Possible breeding for white terns and noddies on portions of the Main Base.
Andersen Air Force Base	Shoreline between Pati Point and Tagua Point	Breeding for black noddies and brown noddies
Tinian		
Tinian Military Lease Area	Puntan Masalok	Known breeding for black noddies, brown noddies, boobies
	Unai Dankulo	Known breeding for Pacific reef herons
	Puntan Lamanibot	Known breeding area for Pacific reef heron
Farallon de Medinilla		
Farallon de Medinilla	Cliffline habitats and Islets	Known breeding for black noddies, brown noddies, brown boobies, masked boobies, red-footed boobies, white terns, great frigatebirds
	Upland vegetated areas	

[1] Breeding activity at Neye Island is questionable due to the possible presence of brown treesnakes
Note: DoD = Department of Defense
Sources: National Oceanic and Atmospheric Administration (2005a, b, c, d, e), U.S. Department of the Navy (2013), Mosher (2013).

rightCommon marine bird species seen on Guam include residents and migrant visitors, such as the wandering tattler (*Tringa incana*), common sandpiper (*Actitis hypoleucos*), brown noddy, white tern (*Gygis alba*), black noddy (*Anous minutus*), and brown booby. Most common among the annual visitors to the island are the Pacific golden-plover (*Pluvialis fulva*), Mongolian plover (*Charadrius mongolus*), Siberian tattler (*Tringa brevipes*), whimbrel (*Numenius phaeopus*), ruddy turnstone (*Arenaria interpre*s), and cattle egret (*Bubulcus ibis*), which might have become established on Guam (U.S. Department of the Navy 2013a). To date, more than 80 migrant and vagrant species have been recorded on Guam.

3.6.2.6.2 Tinian

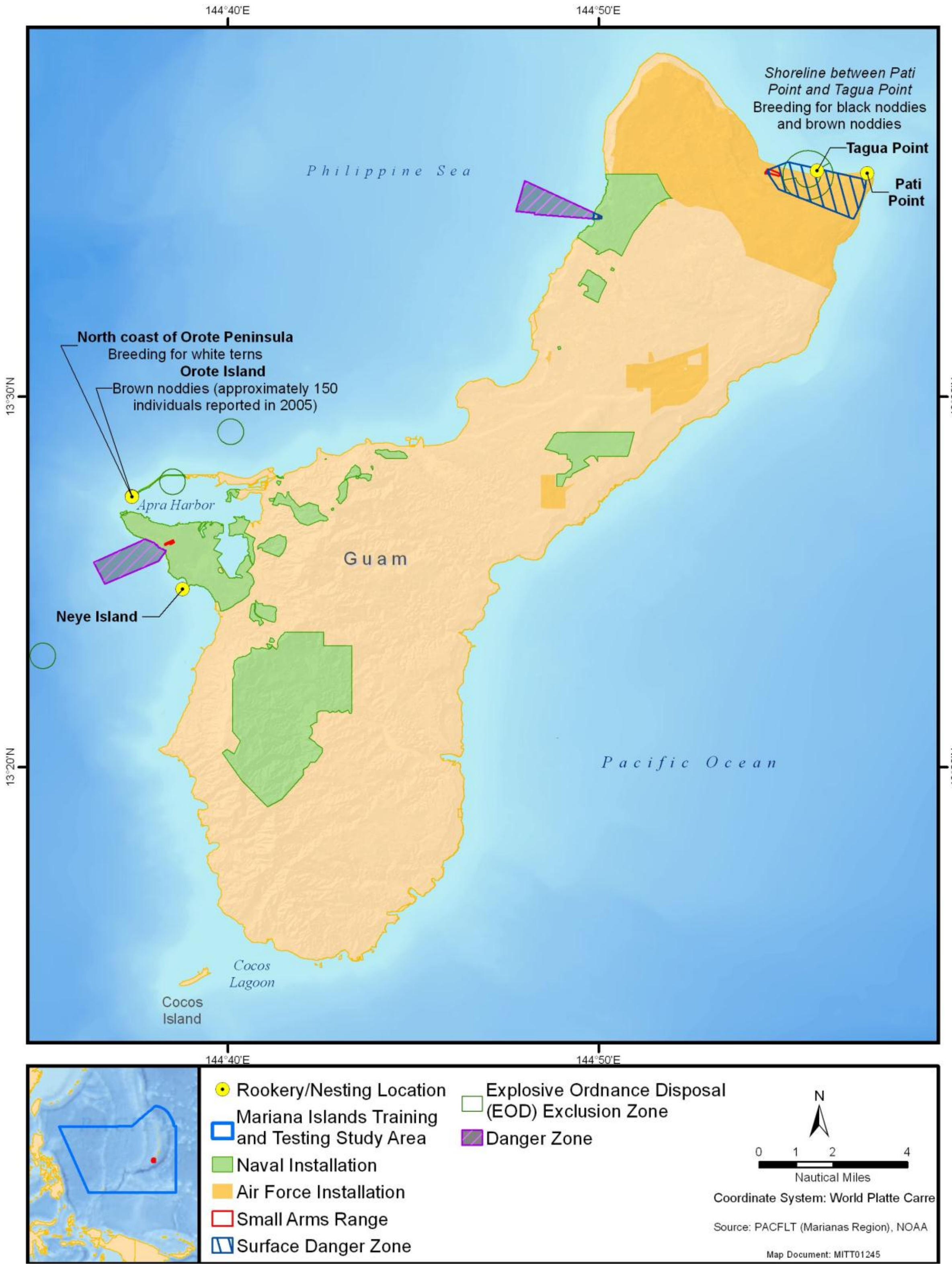
Tinian serves as an important stopover location for migratory birds. These birds use Tinian to rest and forage during their respective non-breeding seasons. For shorebirds such as common sandpipers, Pacific golden-plovers, ruddy turnstones, and whimbrels, exposed coral reef and open field habitats are likely common observation locations on Tinian. Navy biologists have recorded black noddies, brown noddies, white terns, brown boobies, masked boobies, red-footed boobies, Pacific reef herons, yellow bitterns, great frigatebirds, red-tailed tropicbirds, and white-tailed tropic birds on Tinian (U.S. Department of the Navy 2013a). Hagoi is a unique inland freshwater wetland area within the Military Lease Area. This wetland, however, is clogged with thick stands of *Phragmites karka*, which limits the use of Hagoi for migrant shorebirds and waterbirds. In 2008, a black-winged stilt was seen at Hagoi by Navy biologists and is considered a rare occurrence (U.S. Department of the Navy 2013a). Waterfowl, such as Eurasian wigeons and tufted ducks, and waterbirds, such as black-crowned night-herons and Swinhoe's snipe, are typically associated with standing water sources and may occur at the Hagoi wetland area. Gray-backed terns, sooty terns, and white terns also likely forage in the Hagoi Wetland as well as Tinian's near-shore waters (U.S. Department of the Navy 2013a).

Along the Military Lease Area coastline, Puntan Masalok (Masalok Point), rocky exposed coastlines of Unai Dankulo, Puntan Tahgong (Tahgong Point), and Puntan Lamanibot (Laminibot Point) have been identified as potential habitat for pelagic birds and shorebirds, including white-tailed tropicbirds, common sandpipers, Siberian tattlers, ruddy turnstones, wandering tattlers, whimbrels, black noddies, brown noddies, boobies, and Pacific reef herons. Environmental Sensitivity Index Maps (National Oceanic and Atmospheric Administration 2005a, b, c, d, e) show breeding activity at Puntan Masalok for black noddies, brown noddies, and boobies; Pacific reef herons breeding at Unai Dankulo and Puntan Lamanibot. Figure 3.6-4 shows the location of known breeding locations within military-leased properties on Tinian. The USFWS conducted shoreline surveys in 2008 and observed numerous Siberian tattlers and wandering tattlers, reef herons, black noddies, and white terns (including one large colony of 30-plus white terns roosting in mature langasat trees [*Barringtonia asiatica*]). No black noddy nesting areas were observed on Tinian during the survey. Most birds observed were along the western coastline that consists of flat coralline shelves along the water with large boulders in the bays and protection from the prevailing winds. White-tailed tropicbirds, black noddies, and white terns were noted in point transect surveys on Tinian and the white tern total population was estimated at approximately 18,000 birds (Kessler 2009).

3.6.2.6.3 Farallon de Medinilla

Although FDM never likely supported a permanent human settlement, FDM does have a history of exploitation for human consumption. At the turn of the 20th century, exotic feathers for the European, American, and Australian hat industry were in high demand. Historical records show that between 1897 and 1915 more than 3.5 million seabirds were killed on islands in the central Pacific Ocean, including FDM and other islands in the Marianas (Spennemann 1999). The Northern Marianas at the time were controlled by Germany, which purchased the islands from Spain in 1898 (Spennemann 1999). Germany supplied licenses to private companies for the harvest of native birds with little regulatory control. Tropic birds, brown boobies, frigatebirds, and white terns were especially sought after and hunted to the verge of extinction (Spennemann 1999). FDM was leased by Germany in 1909 for the exploitation of birds. By the end of the lease, which terminated in 1911, bird numbers were reduced to the point where further hunting became uneconomical. German control over the Northern Mariana islands was lost in 1914 when the islands were annexed by Japan (Spennemann 1999).

Breeding has been reported on FDM for seven seabird species (black noddies, brown noddies, brown boobies, masked boobies, red-footed boobies, white terns, and great frigatebirds) (Reichel 1991, Lusk et al. 2000, U.S. Department of the Navy 2013a). Booby species are the most readily identifiable due to their numbers and individual sizes. The other species-breeding locations are either dispersed or breeding activity is sporadic. Lusk et al. (2000) visited the island in November 1996 and confirmed breeding on FDM for the great frigatebird, while others have reported the great frigatebird as only roosting on FDM (Reichel 1991). Lusk estimated 25 birds, including several juveniles roosting with the main group or flying near shore. Several nests were observed, one with a single egg. The most recent report of a great frigatebird, however, was a single individual observed in December 2011 (U.S. Department of the Navy 2013b).



Note: The current status of Neye Island as a breeding colony is unknown.

Figure 3.6-3: Known Breeding Locations for Seabirds on Military Lands on Guam

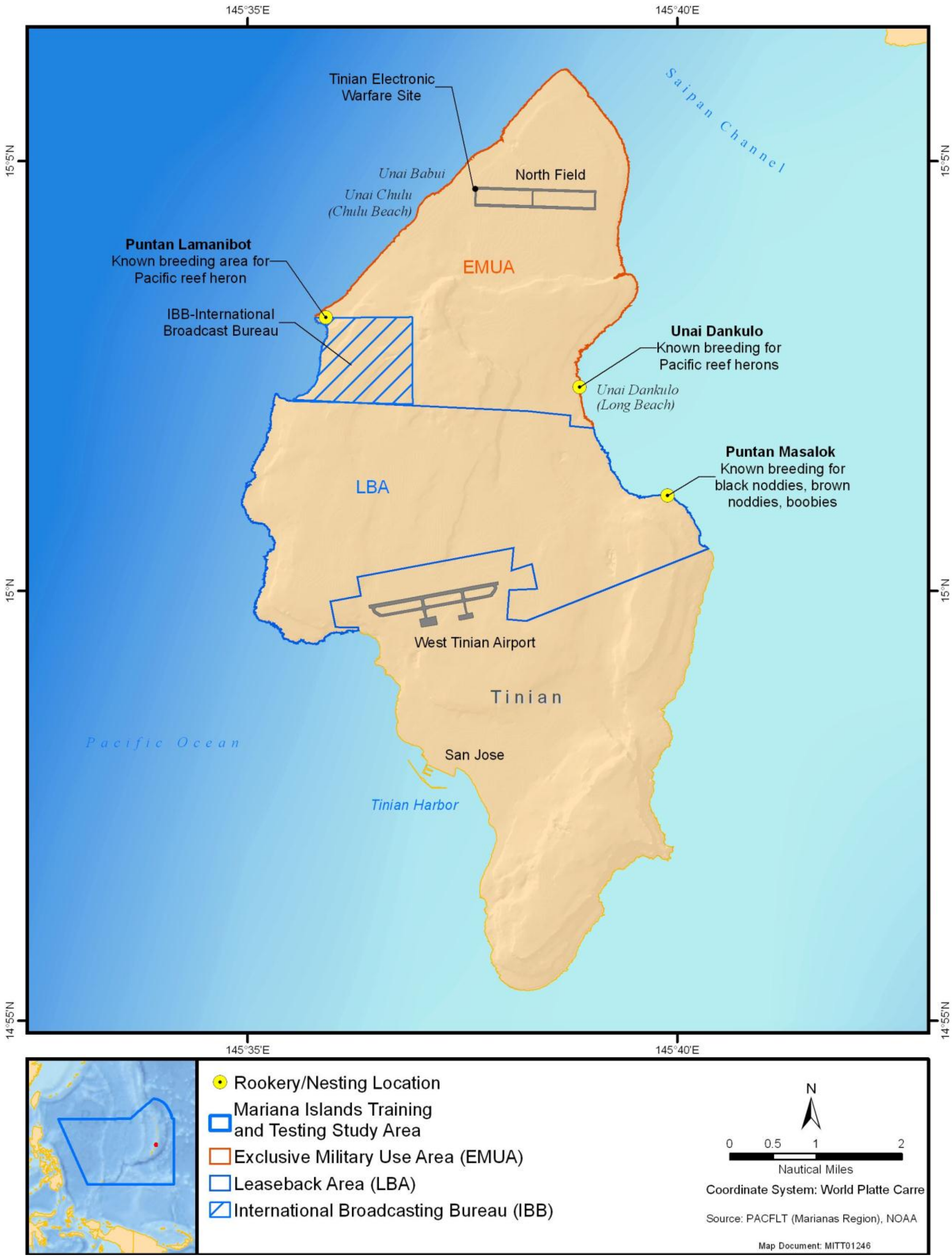


Figure 3.6-4: Known Breeding Locations for Seabirds on Military-Leased Areas on Tinian

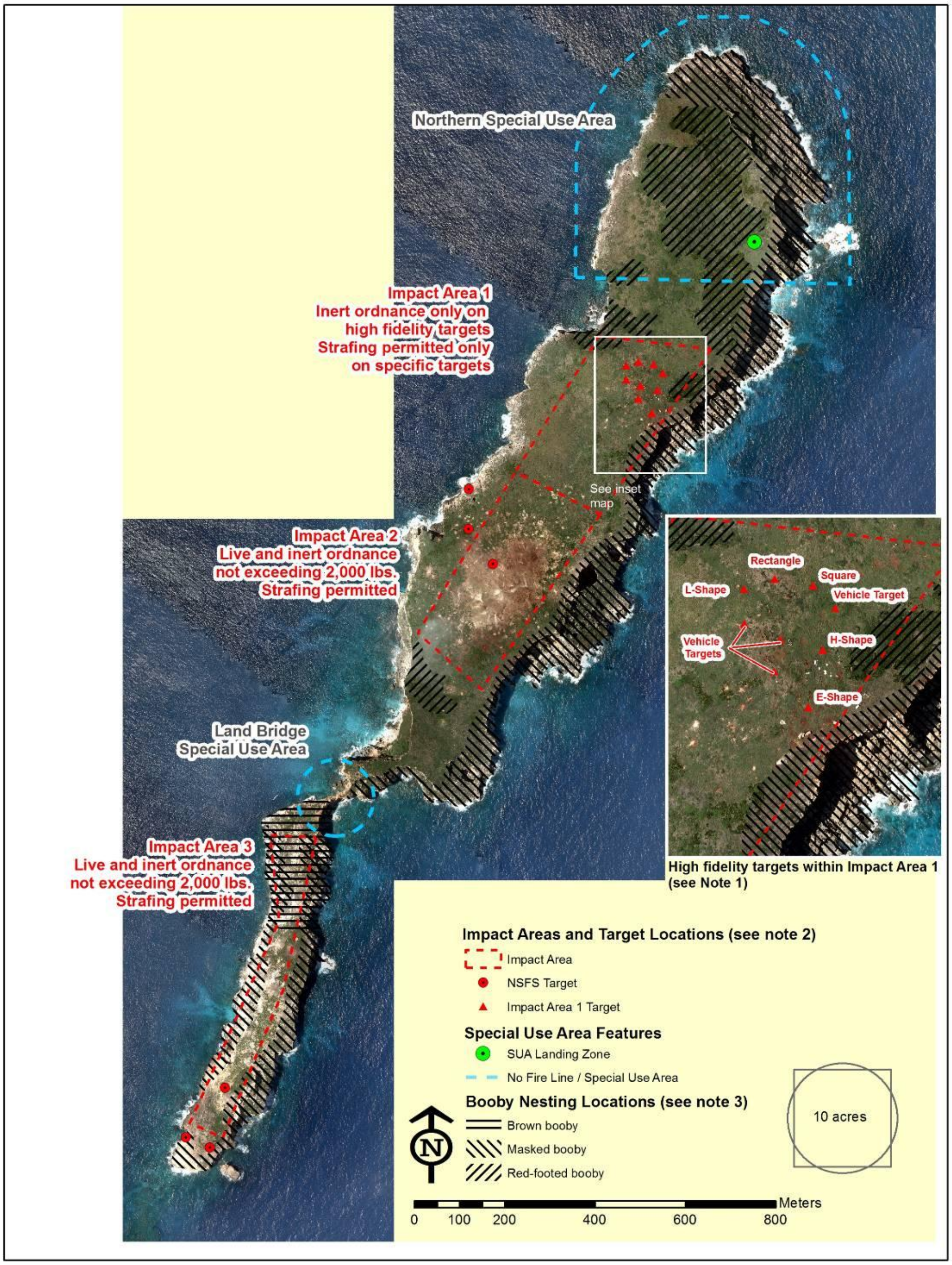
From 1997 through 2013, regular seabird surveys of FDM were conducted via helicopter. The surveys were conducted most months from 1997 to 2008 (125 times out of a total 144 months). From 2009 through 2013, the surveys were conducted on a quarterly basis. Over the entire 17-year period (204 months), aerial surveys of FDM were conducted 153 times. The three booby species were the most abundant seabirds on FDM and large enough to be observable from the helicopter. Navy surveyors have divided the island into five survey blocks, where each section runs from the outside edge (from the water) to the center of the island. As the chartered helicopter makes one pass by the east side and one pass by the west side of the island, each survey block is systematically searched (with the aid of image stabilizing binoculars) for the three booby species that may be roosting or nesting. Birds in flight are not counted. Great frigatebirds in flight or on the roost are noted when seen, as are turtles, marine mammals, and rare or unusual species for the island. Observations are also recorded during the transit to and from Saipan. After seabirds are counted the helicopter flies around the island again, and multiple photographs of the island are taken to document habitat condition and other noteworthy occurrences (U.S. Department of the Navy 2013b).

From 1997 through 2014, regular seabird surveys of FDM were conducted via helicopter. The survey entailed the chartered helicopter making one pass by east side and one pass by the west side of the island, during which, booby detections by species were recorded, with aid of image stabilizing binoculars. Other seabird species along with sea turtles and marine mammals are also noted (U.S. Department of the Navy 2013b). The surveys were conducted most months from 1997 to 2008 and on a quarterly basis from 2009 – 2014. The survey results are reported to the USFWS Pacific Islands Fish and Wildlife Office, in accordance with annual reporting requirements specified in recent Section 7 ESA consultations. The studies are also shared with local agencies within the CNMI.

The surveys have shown seasonal and annual fluctuations of masked boobies, red-footed boobies, and brown boobies. During the 159 counts conducted between February 1997 and August 2014 a total of 8,786 brown booby, 15,878 masked booby, and 57,304 red-footed booby were recorded. The numbers detected during each count ranged from 0 to 447 for brown booby, 6 to 404 for masked booby, and 42 to 915 for red-footed booby. Counts averaged 55.26 (± 87.67 SD) for brown booby, 99.86 (± 59.06) for masked booby, and 360.40 (± 184.75) for red-footed booby (Camp et al. 2014).

Figure 3.6-5 shows the location of rookeries for the three booby species. Lusk et al. (2000) first mapped the rookery locations, and the Navy has updated the locations based on observations made during the aerial surveys described above. Lusk et al. (2000) reported a small great frigatebird rookery; however, breeding has not been reported during any of the periodic surveys completed by the Navy.

Figure 3.6-6 summarizes the number of masked boobies observed on FDM during the helicopter-based surveys, Figure 3.6-7 summarizes the number of red-footed boobies observed, and Figure 3.6-8 summarizes the number of brown boobies observed (Camp et al. 2014). Results of statistical analyses of survey data collected from 1997 – 2014 on all three booby species demonstrated that definite conclusions cannot be reached regarding long-term population trends, i.e., the results are statistically non-significant.

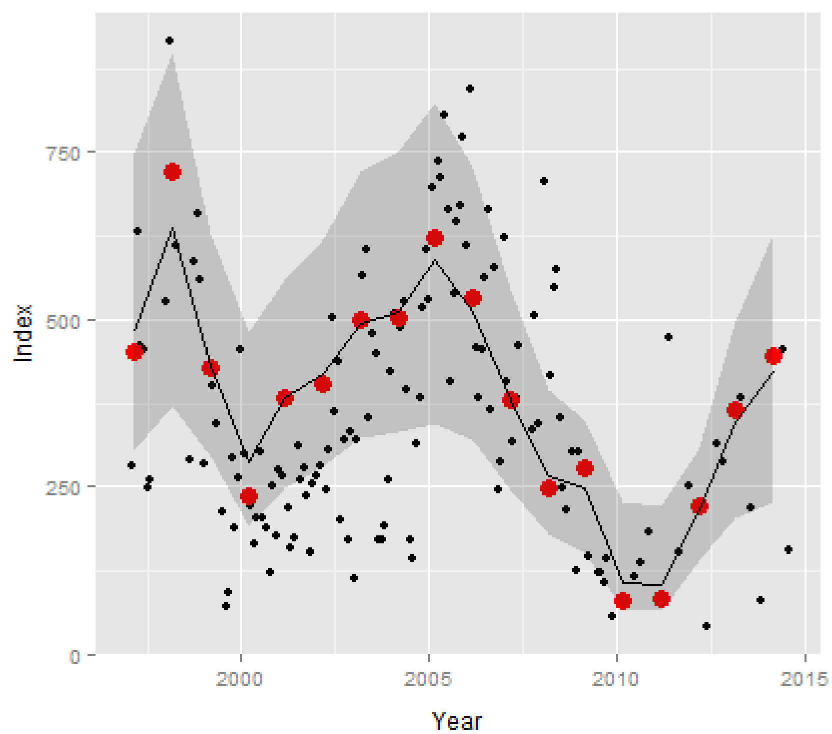


Note 1: Target vehicles, rectangular target, square target, and L-shaped target receive only lightweight inert ordnance not exceedingl100 pounds (lb.) Strafing prohibited. The H-shaped target may be targeted with inert ordnance not exceeding 500 lb. Strafing prohibited. The E-shaped target may be targeted with inert ordnance not exceeding 2,000 lb. Strafing authorized.
Note 2: Areas outside of designated Impact Areas are considered "No Fire Areas" in accordance with COMNAVMARIANASINST 3500.4A.
Note 3: Booby nesting locations are updated based on (1) observations of booby nesting during periodic aerial surveys (now conducted quarterly, (2) species-specific habitat preferences, and (3) information provided by Lusk et al. 2000.

Figure 3.6-5: Seabird Rookery Locations on Farallon de Medinilla

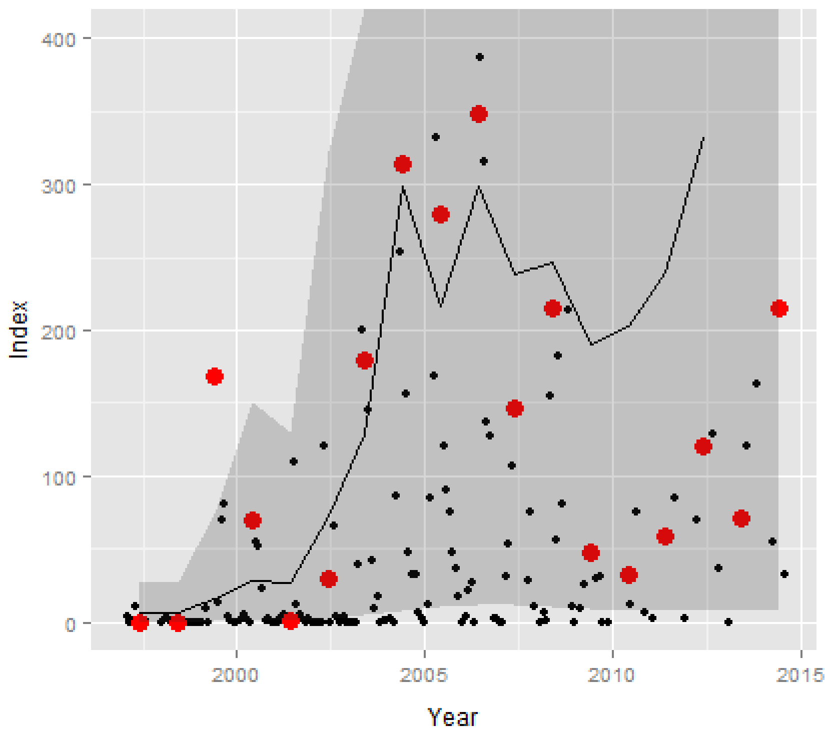
Note: This figure shows the masked booby trend in counts and evidence of trend based on state-space model. The black dots are count data collected between 1997 and 2014, red dots are the counts during the preferred month for assessing trends, the trend is represented by the black line, and the 95 percent credible interval trend uncertainty is the shaded region (from Camp et al. 2014)

Figure 3.6-6: Masked Booby Trend in Counts at FDM



Note: This figure shows the red-footed booby trend in counts and evidence of trend based on state-space model. The black dots are count data collected between 1997 and 2014, red dots are the counts during the preferred month for assessing trends, the trend is represented by the black line, and the 95 percent credible interval trend uncertainty is the shaded region (from Camp et al. 2014).

Figure 3.6-7: Red-footed Booby Trend in Counts at FDM



Note: This figure shows brown booby trend in counts and evidence of trend based on state-space model. The black dots are count data collected between 1997 and 2014, red dots are the counts during the preferred month for assessing trends, the trend is represented by the black line, and the 95 percent credible interval trend uncertainty is the shaded region which extends beyond the index range displayed (from Camp et al. 2014).

Figure 3.6-8: Brown Booby Trend in Counts at FDM

3.6.2.7 Short-Tailed Albatross (*Phoebastria albatrus*)

The short-tailed albatross (*Phoebastria albatrus*) was formerly in the genus *Diomedea* and known as Steller's albatross; it is the largest of the North Pacific albatrosses.

3.6.2.7.1 Status and Management

The short-tailed albatross is widely regarded as one of the rarest species of albatrosses and one of the world's rarest birds (Harrison 1983, International Union for the Conservation of Nature and Natural Resources 2010). The short-tailed albatross is listed as endangered under the ESA throughout its range. No critical habitat is designated for this species because little is known about its life in the open ocean (U.S. Fish and Wildlife Service 2005).

3.6.2.7.2 Habitat and Geographic Range

Short-tailed albatrosses are typically found in the open ocean and tend to concentrate along the edge of the continental shelves (U.S. Fish and Wildlife Service 2005). Upwelling zones are not only nutrient rich, but they also bring prey (e.g., squid and fish) typically found only in deeper water to the surface, where they become available to albatrosses. Upwelling occurs when the wind moves warm, nutrient poor water away from the area, which allows colder, nutrient rich water to rise to the surface of the ocean. Short-tailed albatross nest on isolated, windswept, offshore islands with restricted human access (U.S. Fish and Wildlife Service 2005). Their at-sea distribution includes the entire North Pacific Ocean north of about 20 degrees (°) north (N) latitude. Short-tailed albatrosses move seasonally around the North Pacific Ocean, with high densities observed during the breeding season (December through May) in Japan and throughout Alaska and along the west coast of North America during the non-breeding season (April through September) (U.S. Fish and Wildlife Service 2008b). Non-breeding subadults can be found in all areas throughout the year. They are seen in the North Pacific Subtropical Gyre (U.S. Fish and Wildlife Service 2005). Figure 3.6-9 shows the known regular range of the short-tailed albatross, as well as known nesting locations and islands where the short-tailed albatross is believed to be extirpated.

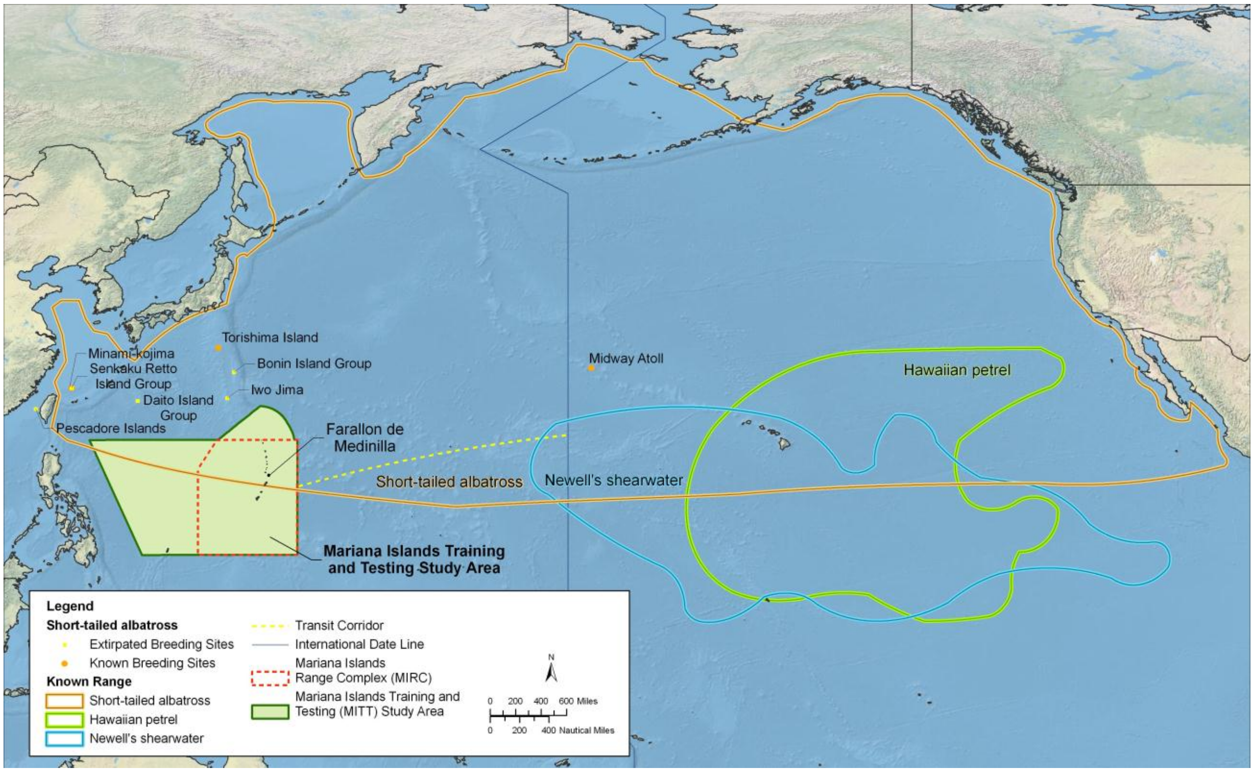
Short-tailed albatrosses nest in open, treeless areas with low, or absent vegetation. Short-tailed albatrosses spend much of their time feeding in shelf-break areas of the Bering Sea, the Aleutian island chain and in other Alaskan, Japanese, and Russian waters, as they require nutrient-rich areas of ocean upwelling for their foraging habitat (U.S. Fish and Wildlife Service 2008b).

3.6.2.7.3 Population and Abundance

Prior to its exploitation, the short-tailed albatross was possibly the most abundant of the three North Pacific albatross species (U.S. Fish and Wildlife Service 2005). By the 1950s, this species was nearly extirpated in the Pacific as populations were harvested by feather hunters. Presently, fewer than 2,000 short-tailed albatrosses are known to exist. The species is known to breed on four islands (Agreement on the Conservation of Albatrosses and Petrels 2012). Torishima, where 80–85 percent of short-tailed albatrosses breed, is an active volcano, and Tsubame-zaki, the natural colony site on the island, is susceptible to mud slides and erosion. An artificial colony has also been established in another area less prone to erosion on Torishima. As of the 2004–2005 season, four pairs have nested and fledged chicks at the artificial colony site. Most of the remaining short-tailed albatrosses breed at Minami-kojima in the Senkaku Islands, to the southwest of Torishima, where volcanism is not a threat (U.S. Fish and Wildlife Service 2005). Both islands are controlled by Japan; however, the Senkaku Islands (including Minami-kojima) are claimed by the People’s Republic of China and Taiwan (Republic of China).

In late 2010 two short-tailed albatross nests were recorded, one each on Kure Atoll and Midway Atoll, both of which contained an egg that was incubated. The nest on Midway Atoll successfully fledged the first chick outside of Japan in June 2011, but the nest on Kure Atoll had failed by late December 2010. Short-tailed albatrosses have begun breeding on Kure Atoll again, and at the same nest site as in 2010, with the birds arriving to Kure Atoll in late October 2011 (Agreement on the Conservation of Albatrosses and Petrels 2012). On Midway, the pair returned in October 2011, with an egg observed on 14 November 2011 (BirdLife International 2012).

Two observations of short-tailed albatross were recorded during the 2007 Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007). Breeding does not occur within the Mariana Islands, and there are no known nesting attempts on islands within the Mariana archipelago (U.S. Fish and Wildlife Service 2008b). Although short-tailed albatrosses have been observed in less productive waters far from regions of upwelling, the extremely rare observations in these areas suggest these birds may simply be moving between areas of favored habitat.



Notes and Sources: Short-tailed albatross pelagic range and breeding sites from U.S. Fish and Wildlife Service (2005, 2008b). Newell's shearwater range and from BirdLife International (2010a, b). Hawaiian petrel range from Birdlife International (2010b).

Figure 3.6-9: Pelagic Ranges and Breeding Locations for the Short-Tailed Albatross, Newell's Shearwater, and Hawaiian Petrel

3.6.2.7.4 Predator-Prey Interactions

Short-tailed albatrosses are surface feeders and scavengers, feeding more inshore than other North Pacific albatrosses. In Japan, their diet consists of shrimp, squid, and fish (including bonita, flying fish, and sardines); diet information is not available for birds in the Study Area (U.S. Fish and Wildlife Service 2005). Short-tailed albatross chicks are depredated by other birds (U.S. Fish and Wildlife Service 2005).

3.6.2.7.5 Species-Specific Threats

Short-tailed albatrosses have survived multiple threats to their existence. During the late 1800s and early 1900s, feather hunters clubbed to death an estimated five million of them, stopping only when the species was nearly extinct (U.S. Fish and Wildlife Service 2001). In the 1930s, nesting habitat on the only active nesting island in Japan was damaged by volcanic eruptions, leaving fewer than 50 birds by the 1940s. Loss of nesting habitat to volcanic eruptions, severe storms, and competition with black-footed albatrosses for nesting habitat continue to be natural threats to short-tailed albatrosses today. Human-induced threats include hooking and drowning on commercial longline gear, entanglement in derelict fishing gear, ingestion of plastic debris, contamination from oil spills, and potential predation by introduced mammals on breeding islands. In the past, introduced predators impacted populations on Kure and Midway. Rats have been eradicated from all major breeding areas, although rats and cats persist on Wake and some potential islands in the Mariana archipelago, which may hinder recolonization of these sites (U.S. Fish and Wildlife Service 2005).

3.6.2.8 Hawaiian Petrel (*Pterodroma sandwichensis*)

The Hawaiian petrel (*Pterodroma sandwichensis*) was recently split from the Galapagos petrel (*Pterodroma phaeopygia*) based on genetic and morphological evidence; before the split they were collectively known as the dark-rumped petrel (BirdLife International 2010c, U.S. Fish and Wildlife Service 2005).

3.6.2.8.1 Status and Management

The Hawaiian petrel nests only in Hawaii and is listed as endangered throughout its range under the ESA (U.S. Fish and Wildlife Service 2005); there is no designated critical habitat. The greatest threat to adult survival and breeding success is predation by introduced animals, such as mongooses, cats, and rats. In some cases, predation has caused more than 70 percent nesting failure, and management activities have focused on predator reduction (U.S. Fish and Wildlife Service 2005, 2008a).

3.6.2.8.2 Habitat and Geographic Range

Hawaiian petrels nest only in Hawaii, specifically in the main Hawaiian Islands, though there are specimen records from Japan, Philippines, and Moluccas at the western edge of the distribution, as well as the rare sightings along the west coast of North America. An incidental observation of a Hawaiian petrel was recorded during line transect surveys in the Mariana Islands in 2007 (U.S. Department of the Navy 2007). Hawaiian petrels range far to find their widely dispersed food sources (U.S. Fish and Wildlife Service 2008a). They feed primarily on squid, but also on fish, crustaceans, and plankton found at the surface, and they are also known to scavenge. They do not seem to dive or swim underwater, and are seen more frequently when the wind is blowing at least 12.5–25 miles (mi.) (20.1–40.2 kilometers [km]) per hour. Like other seabirds, Hawaiian petrels are long-lived and lay only a single egg per year, making them very susceptible to population declines. They are believed to be monogamous and show mate fidelity. During their March–October nesting season they return to the same nesting burrows year after year, entering and exiting their burrows only under the cover of night. Radar studies on Kauai indicate that birds come and go from breeding areas in greatest numbers 2 hours after dusk and 2 hours before dawn (BirdLife International 2010a). Currently threatened nesting habitat has forced them to adopt marginal, high elevation sites, but historically they occupied low-elevation sites easily accessible to the ocean. They range up to approximately 930 mi. (1,496.7 km) from the Hawaiian Islands during the breeding season, with only rare sightings in these waters from January through March. See Figure 3.6-9 for a map of the known regular pelagic range of the Hawaiian petrel.

3.6.2.8.3 Population and Abundance

The Hawaiian petrel formerly nested in very large numbers at multiple sites on all of the main islands in the Hawaiian chain except Niihau; however, hunting of nestlings, habitat modification, and the introduction of predators and disease-carrying mosquitoes eliminated the nesting populations closer to sea level so that remaining colonies are restricted to a few remote high elevation sites (U.S. Geological Survey 2008). The Haleakala National Park on Maui Island houses the largest known breeding population of 450 to 650 pairs, and Kauai is suspected of having as many as 1,600 breeding pairs. Small numbers have bred on the Island of Hawaii on both Mauna Loa and Mauna Kea volcanoes. Recent at-sea surveys estimate the population at approximately 20,000 individuals (BirdLife International 2010a). These birds may range thousands of miles from their nesting colonies, even during the breeding season (U.S. Fish and Wildlife Service 1983, 2005). Three Hawaiian petrels were observed during the 2007 Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007). There are no records of occurrence on any of the islands within the Study Area.

3.6.2.8.4 Predator-Prey Interactions

Hawaiian petrels eat mostly squid (50 to 75 percent of their diet), fish, and crustaceans (International Union for Conservation of Nature and Natural Resources 2010). They forage both night and day, capturing their prey by resting on the water surface and dipping their bill and by aerial pursuit of flying fish (International Union for Conservation of Nature and Natural Resources 2010). The foraging member of a pair may fly up to 930 mi. (1,497 km) from the nesting island (U.S. Fish and Wildlife Service 2005). Adult and young Hawaiian petrels are preyed on by introduced animals such as mongooses, cats, and rats.

3.6.2.8.5 Species-Specific Threats

Threats to this endangered seabird include predation by introduced mammals, development, light attraction and collision, ocean pollution, and disturbance of its breeding grounds. The petrel does not have any natural defenses against predators such as rats, feral cats, and mongooses, and its burrows are very vulnerable. Collisions with artificial lights, utility poles, and fences kill Hawaiian petrels on some islands (International Union for Conservation of Nature and Natural Resources 2010).

3.6.2.9 Newell's Shearwater (*Puffinus auricularis newelli*)

The classification of the Newell's shearwater is in flux. It was, until recently, regarded by some authorities as a distinct species, *Puffinus newelli* (BirdLife International 2010b). The U.S. Fish and Wildlife Service (2005) identifies Newell's shearwater as a subspecies of Townsend's shearwater. Newell's shearwater is also known as Newell's dark-rumped shearwater.

3.6.2.9.1 Status and Management

Newell's shearwater is an ESA-listed threatened species, nesting only in the Hawaiian Islands. A federal recovery plan was finalized in 1983 (U.S. Fish and Wildlife Service 1983). In July 2010, the USFWS completed a status review for this species, and opted to not elevate the status to endangered. This species is currently monitored on the island of Kauai, where 75–90 percent of the Newell's shearwater population nests (U.S. Fish and Wildlife Service 2011a).

3.6.2.9.2 Habitat and Geographic Range

In breeding habitats, Newell's shearwaters favor mountain regions for nesting, often on inaccessible cliff areas or steep slopes (U.S. Fish and Wildlife Service 1983). These breeding habitats are restricted to the Hawaiian Islands, primarily on Kauai.

In pelagic habitats, Newell's shearwaters are well known by the Pacific tuna industry for their association with tuna and large billfish (U.S. Fish and Wildlife Service 2005). During the breeding season, low densities of birds occur short distances west and north of Hawaii (to about 25°N), and some Newell's can be found within a few hundred kilometers of their breeding colonies. This species is highly pelagic; found flying in areas of the ocean characterized by a deep thermocline and depths of more than 2,000 m (6,562 ft.). Newell's shearwaters can be found in the deep water regions of the Equatorial Countercurrent year-round, to the south of the Hawaiian Islands (to 25° south) and east of the Hawaiian Islands (to about 120° west) (U.S. Fish and Wildlife Service 2005). See Figure 3.6-9 for a map of the known regular pelagic range of the Newell's shearwater.

3.6.2.9.3 Population and Abundance

In 1995, the population of the Newell's shearwater was estimated at 84,000 birds (Spear et al. 1995), with approximately 75 percent occurring on Kauai, Hawaii (Ainley et al. 1997). This estimate included both breeding and non-breeding birds. Population models incorporating best estimates of breeding success and factoring in variables for mortality (e.g., predation, light attraction, and collision) predicted an annual population decline of approximately 60 percent over 10 years (U.S. Fish and Wildlife Service 2011a). During the 2007 Mariana Islands Sea Turtle and Cetacean Survey, no Newell's shearwaters were observed (U.S. Department of the Navy 2007). The majority of the survey effort (January through April of 2007) occurred outside of the breeding season when this species breeds in the Hawaiian Islands. This is the time of year the Newell's shearwater would most likely be found in the open ocean portions of the Study Area. Newell's shearwaters are considered rare visitors to Guam and the CNMI.

3.6.2.9.4 Predator-Prey Interactions

Although diet is not well known, evidence suggests that squid are a major dietary item. Newell's shearwaters capture food by pursuit-plunging (diving into water and swimming after prey), usually in company with multispecies feeding flocks associated with tuna (BirdLife International 2010b). This species is not attracted to discarded fish byproducts and does not follow ships (U.S. Fish and Wildlife Service 2005). Newell's shearwaters are preyed on by introduced animals at their breeding sites, such as cats and birds such as barn owls (Ainley et al. 1997). Nocturnal activity and cavity-nesting behaviors are their only defense against mammalian predators.

3.6.2.9.5 Species-Specific Threats

Historical threats included subsistence hunting by Polynesians and predation by rats, dogs, and pigs. Current threats include artificial lights (e.g., street and resort lights) along the coast that blind and disorient fledglings. Once on the ground, these fledglings are unable to fly and thousands are killed each year by cars, cats, and dogs. In addition, adults can collide with power facilities and associated utility wires and associated lines are in the direct path of known Newell's flight corridors. Additional threats are the loss and degradation of forested habitat caused by introduced plants and herbivores (U.S. Fish and Wildlife Service 2011a).

3.6.2.10 Great Frigatebird (*Fregata minor*)

3.6.2.10.1 Status and Management

The great frigatebird (*Fregata minor*) is not an ESA-listed species. This species, however, is protected under the MBTA and provisions set forth in 50 C.F.R. Part 21. The last record of great frigatebird nesting on FDM was reported in 1996 (Lusk et al. 2000); however, other surveys suggest that they are just roosting, not nesting (Reichel 1991). Great frigatebirds are noted when observed during quarterly aerial surveys over FDM.

3.6.2.10.2 Habitat and Geography

The great frigatebird has a wide distribution throughout the tropical Pacific, with Hawaii as the northernmost extent of their range. In the Central and South Pacific, colonies are found on most island groups from Wake Island to the Galapagos Islands to New Caledonia, with a few pairs nesting on Australian possessions in the Coral Sea. Colonies are also found on numerous Indian Ocean islands, including Aldabra, Christmas Island, and Mauritius (Pratt et al. 1987). Great frigatebirds undertake regular migrations across their range, including both seasonal trips and more infrequent widespread dispersals. They are likely most abundant within 50 mi. (80 km) of breeding and roosting sites (Clements 2000).

3.6.2.10.3 Population and Abundance

The world population of great frigatebirds is estimated to range between 500,000 and 1,000,000 birds and is comprised of five recognized distinct subspecies (U.S. Fish and Wildlife Service 2005). Great frigatebirds that breed in the western and central Pacific belong to the subspecies *F. m. palmerstoni* (U.S. Fish and Wildlife Service 2005). Most of this Pacific population is located in the Northwestern Hawaiian Islands, which supports an estimated 10,000 pairs (Lusk et al. 2000, Pratt et al. 1987). Niihau supports an estimated 3,500–4,500 pairs, and Layson Atoll supports 2,000–2,500 pairs. Other islands in the Pacific that support small colonies include Howland, Baker, Jarvis, Johnston Atoll, and Christmas Island (U.S. Fish and Wildlife Service 2005, Reichel 1991, Schreiber and Schreiber 1988). In the Marianas, two small colonies have also been reported on Maug and FDM (U.S. Fish and Wildlife Service 2005, Schreiber and Schreiber 1988).

The last record of great frigatebird nesting on FDM was reported in the mid-1990s. In November 1996, personnel from the USFWS and Brigham Young University (Hawaii) discovered a breeding colony on FDM estimated at 25 birds, including several juveniles roosting with the main colony or flying near shore. Nests were constructed in low trees 5–6.5 ft. (1.5–2 m) off the ground (Lusk et al. 2000). Since 1997, Navy biologists have conducted periodic aerial surveys by helicopter over FDM for the purpose of conducting bird counts of nesting brown, masked, and red-footed boobies. Other species of concern, such as the great frigatebird, are noted during these surveys. These surveys suggest that great frigatebird sightings are seasonally dependent, with most sightings reported between December and March, which coincides with their nesting seasons (U.S. Department of the Navy 2013b).

3.6.2.10.4 Predator-Prey Interactions

Great frigatebirds usually feed in mixed-species flocks over tuna schools, with a diet consisting primarily of flying fish and squid, which must be captured at or above the water surface. They do not rest on the water or plunge dive in pursuit of prey. There have been many reports of kleptoparasitism (a form of feeding in which one animal takes prey or other food from another) (Harrison 1983, Pratt et al. 1987).

3.6.2.10.5 Species-Specific Threats

The USFWS Seabird Conservation Plan (U.S. Fish and Wildlife Service 2005) lists habitat destruction, disturbance, and introduced predators to limit populations. The most important factor appears to be introduced predators, such as rats and feral cats, which have had devastating effects on island populations. For example, Polynesian rats have caused total nest failures on Kure Atoll (Harrison 1990). The eradication of feral cats from Howland, Baker, and Jarvis islands has resulted in a rebound in great frigatebird populations (Rauzon et al. 2002).

3.6.2.11 Masked Booby (*Sula dactylatra*)

3.6.2.11.1 Status and Management

The masked booby (*Sula dactylatra*) is protected under the MBTA and provisions set forth in 50 C.F.R. Part 21. The masked booby breeds on FDM. This breeding colony is reported as the largest breeding colony in Mariana Islands (Lusk et al. 2000). Masked booby population trends are measured during quarterly aerial bird counts at FDM by Navy biologists (U.S. Department of the Navy 2013b).

3.6.2.11.2 Habitat and Geography

Masked boobies breed on oceanic islands and atolls, tending to nest on open ground near cliff edges or on low sandy beaches. They have a pantropical distribution, and the largest colonies in the Pacific include Howland, Baker, and Jarvis islands, as well as locations in the Northwestern Hawaiian Islands (U.S. Fish and Wildlife Service 2005). Masked boobies forage in offshore and pelagic waters, and are most abundant in the vicinity of breeding islands; however, they can be encountered far out at sea. During nonbreeding periods, adults may visit sites 600–1,200 mi. (1,000–2,000 km) from breeding colonies (O'Brien and Davies 1990).

3.6.2.11.3 Population and Abundance

The world population is distributed widely and difficult to estimate, but is thought to be several hundred thousand birds and comprised of four recognized distinct subspecies (U.S. Fish and Wildlife Service 2005). Masked boobies that breed in the central and western Pacific belong to the distinct subspecies *S. d. personata*. The Northwestern Hawaiian Islands supports up to 2,500 pairs. Large colonies are also found on Jarvis (up to 1,200 pairs), Howland Island (over 1,500 pairs), and Baker Island (over 1,500 pairs) (U.S. Fish and Wildlife Service 2005). Smaller colonies also occur in American Samoa, Palmyra, and Johnston Atoll. Wake Island was recolonized by a banded bird from Johnston Atoll (Rauzon et al. 2002). In 2005, 600 masked booby pairs were reported in the Mariana Islands (U.S. Fish and Wildlife Service 2005).

Figure 3.6-6 is a scatter plot of masked booby observations recorded during FDM helicopter-based surveys. The masked booby population on FDM has exhibited multi-year fluctuations, but has remained relatively stable since monitoring began in 1997 (U.S. Department of the Navy 2013b). The peaks and dips in counts over the years suggest an average population of approximately 100 masked boobies on FDM.

3.6.2.11.4 Predator-Prey Interactions

Masked boobies feed by plunge diving and can be found more than 100 mi. (160 km) from land. They forage by themselves or in mixed-species flocks associated with schooling tuna. Most of their diet is fish, with flying fish and jacks as the most important prey species. Squid also make up a small portion of the diet.

3.6.2.11.5 Species-Specific Threats

The USFWS Seabird Conservation Plan (U.S. Fish and Wildlife Service 2005) lists habitat destruction, invasive weeds, disturbance, and introduced predators as the major threats to masked booby populations. Encroachment of invasive weeds has made suitable habitat unusable for masked boobies (Harrison 1983). Introduced predators, such as rats and cats have negatively impacted populations. Rebounding populations of masked boobies at Howard and Baker has been attributed to successful cat eradication activities (Rauzon et al. 2002). Military use of FDM has likely killed masked boobies, but the population trend has remained relatively stable since monitoring began in 1997 (

Figure 3.6-6) (U.S. Department of the Navy 2013b).

3.6.2.12 Major Marine Bird Group Descriptions

For taxonomic purposes, individual bird species may be grouped together in families, which is the taxonomic classification that contains at least one genus. The families of seabirds, shorebirds, and other birds that use the marine environment that are known to occur within the Study Area are described below. The species within each family that have been observed at sea or on land within the Study Area are discussed under each family heading. Families are listed in taxonomic order. Taxonomic and nomenclatural changes have been updated through the 50th supplement to the American Ornithological Union's Check-list of North American Birds (7th ed.) (Chesser et al. 2009).

3.6.2.12.1 Cormorants, Frigatebirds, Gannets, and Boobies (Order Pelecaniformes)

3.6.2.12.1.1 Phalacrocoracidae (Cormorants)

Cormorants are medium-sized diving birds with long, hook-tipped bills (Pratt et al. 1987). Only one species of cormorant breeds in the tropical Pacific, the pelagic cormorant, (*Phalacrocorax pelagicus*), which breeds around North Pacific coasts from Taiwan to California (Pratt et al. 1987). The only cormorant species confirmed within the Study Area is the little pied cormorant (*Phalacrocorax melanoleucos*), which is considered a rare visitor to the CNMI. No records are associated with Navy lease lands in the CNMI, including FDM.

3.6.2.12.1.2 Fregatidae (Frigatebirds)

Members of the Fregatidae family are large seabirds, with iridescent black feathers, a wingspan up to 7.5 ft. (2.3 m) and deeply-forked tails. The males inflate red-colored throat pouches to attract females during the mating season. Frigatebirds are distributed globally in tropical oceans. These birds do not swim and cannot walk well, and cannot take off from a flat surface, needing a slope or drop-off (e.g., a cliff) to take off. Frigatebirds are able to stay aloft for more than a week, landing only to roost or breed on trees or cliffs (Lusk et al. 2000).

The great frigatebird is discussed in more detail in Section 3.6.2.10 (Great Frigatebird [*Fregata minor*]). The last record of nesting activity was reported in 1996 (Lusk et al. 2000). Great frigatebirds are occasionally observed during Navy aerial surveys, but no evidence of continued nesting has been reported. If frigatebirds nest on FDM, it is likely infrequent. Maug supports a small colony of great frigatebirds (U.S. Fish and Wildlife Service 2005). Unlike the great frigatebird, the lesser frigatebird (*Fregata arial*) does not breed within the Study Area, although Pratt et al. (1987) reports rare sightings of the lesser frigatebird on Tinian.

3.6.2.12.1.3 Sulidae (Gannets and Boobies)

Members of the seabird family Sulidae are medium to large coastal seabirds that plunge-dive for fish. Three species of booby are found within the Study Area. FDM is the location of the largest nesting colony for the brown booby in the Mariana and Caroline Islands. The masked booby (*Sula dactylatra*) breeds on FDM, while the red-footed booby (*Sula sula*) breeds on FDM and Rota (U.S. Department of the Navy 2013a). Monthly aerial surveys via helicopter by Navy biologists over FDM for bird counts show distinct oscillations in the booby populations on this island (U.S. Department of the Navy 2008). The period from 1999 to 2002 was a low period, followed by increasing numbers recorded from 2003 through 2005. Decreases in booby numbers continued from 2006 through 2007.

3.6.2.12.2 Tropicbirds (Order Phaethontiformes)

3.6.2.12.2.1 Phaethontidae (Tropicbirds)

Tropicbirds are seabirds with predominantly white plumage and elongated central tail feathers. Their bills are large, powerful and slightly decurved, and they have large heads and short, thick necks. The three species within this family have a different combination of black markings on the face, back, and wings, distinctive to each species. Two of the three species of tropicbirds are known to occur within the Study Area (Pratt et al. 1987).

The red-tailed tropicbird (*Phaethon rubricauda*) and the white-tailed tropicbird (*Phaethon lepturus*) are known to occur on Tinian and FDM, as well as in open waters of the Study Area (U.S. Department of the Navy 2007). The red-tailed tropicbird is the rarest of all tropicbird species, but is widely distributed with colonies on islands from Hawaii to Easter Island and Mauritius. The white-tailed tropicbird is the smallest of the three species within the Phaethontidae family. It occurs in the tropical Atlantic, western Pacific, and Indian Oceans. Breeding locations are recorded from Guam, Rota, Tinian, and FDM. Both species were observed during the Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007).

3.6.2.12.3 Albatrosses, Petrels, Shearwaters, and Storm Petrels (Order Procellariiformes)

3.6.2.12.3.1 Diomedeidae (Albatrosses)

Albatrosses range widely in the southern hemisphere and the North Pacific, although occasional vagrants are recorded in the North Atlantic (Pratt et al. 1987). Albatrosses are among the largest of flying birds, and great albatrosses (*Diomede*a spp.) have the largest wingspan of any extant birds.

Albatrosses are highly efficient in the air, using dynamic soaring and slope soaring to cover great distances with little exertion. They feed on squid, fish, and krill by scavenging, surface seizing, or diving. Albatrosses are colonial, mostly nesting on remote oceanic islands, often with several species nesting together. Pair bonds between males and females form over several years with the use of 'ritualized dances,' and will last for the life of the pair. A breeding season can take over a year from laying to fledging, with a single egg laid in each breeding attempt (Pratt et al. 1987).

Both albatross species (black-footed albatross and short-tailed albatross) occurring within the Study Area are considered vagrant migrants, are rarely documented more than once per year, and range throughout the North Pacific (Pratt et al. 1987). Black-footed albatrosses may have nested in the Marianas in historic times, with the only evidence derived from skins and eggs collected on Agrihan in the late 1800s. There are also unconfirmed reports of nesting in the early 20th century on Uracas and Asunción, and they are generally thought of as extirpated breeders in the Mariana Islands (Reichel 1991). Both albatross species were observed at sea, however, during the 2007 Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007).

The black-footed albatross nests colonially on isolated islands of the Northwestern Hawaiian Islands (such as Laysan and Midway), and the Japanese islands of Torishima, Bonin, and Senkaku. Their range at-sea varies during the seasons (straying farther from the breeding islands when the chicks are older), and they make use of great areas of the North Pacific, feeding from Alaska to California and Japan. The USFWS has initiated a status review to determine if listing the black-footed albatross under the ESA is warranted (Agreement on the Conservation of Albatrosses and Petrels 2012).

The short-tailed albatross breeds almost exclusively on Torishima and Minami-kojima in the Senkaku Islands. Recent nesting has been reported on Kure and Midway Atolls (Agreement on the Conservation of Albatrosses and Petrels 2012). The short-tailed albatross' range overlaps with the black-footed covering most of the northwestern and northeastern Pacific Ocean. The world population of short-tailed albatrosses is currently estimated at 2,000 birds (U.S. Fish and Wildlife Service 2008b). The short-tailed albatross is described in more detail in the ESA-listed species discussion in Section 3.6.2.7.1 (Short-Tailed Albatross Status and Management) within this section.

3.6.2.12.3.2 Procellariidae (Shearwaters and Petrels)

Shearwaters and petrels are medium-sized, long-winged seabirds most common in temperate and cold waters. Shearwaters and petrels come to islands and coastal cliffs to breed, with some breeding locations in the tropics. They are nocturnal at the colonial breeding sites, preferring moonless nights to minimize predation. Outside of the breeding season, they are pelagic (found in open ocean waters) and most are long-distance migrants. Shearwaters and petrels feed on fish, squid, and similar oceanic food. Numbers of shearwaters and petrels have been reduced due to predation by introduced species to islands, such as rats and cats. Some loss of birds also occurs from entanglement in fishing gear (Reed et al. 1985). The general problem of light attraction is worldwide among the Procellariiformes; at least 21 species of this family are known to be attracted to man-made lights (Reed et al. 1985). Fledglings typically take first flight at night, homing in on reflected natural light from the ocean. Artificial light can attract these fledglings to lighted infrastructure, causing exhaustion and increasing the probability of collision with buildings, utility poles, illuminated windows, and other structures.

Most species of this family observed within the Study Area are considered visitors (Pratt et al. 1987, U.S. Department of the Navy 2007). Shearwaters and petrels do not breed on DoD-owned or leased lands within the Study Area. After cats and rats were removed from Managaha Island, an islet off Saipan's eastern coast, a breeding colony of wedge-tailed shearwaters was established (Brooke 2012). Shearwaters and petrels primarily utilize offshore and coastal waters for foraging and are typically concentrated along upwelling boundaries and other water mass convergence areas (Spear et al. 1995, U.S. Fish and Wildlife Service 2005). The Hawaiian petrel, observed during the 2007 Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007), is protected under the ESA, and is described in more detail in the ESA-listed species discussion within this section.

3.6.2.12.4 Phalaropes, Plovers, Gulls, Noddies, Terns, Skua, and Jaegers (Order Charadriiformes)

3.6.2.12.4.1 Charadriidae (Plovers)

Members of the Charadriidae family include plovers, which are generally considered shorebirds. Plovers are distributed through open country worldwide, mostly in habitats near water. Plovers hunt by sight, rather than by feel as longer-billed shorebirds do. Their diet includes insects, worms, and other invertebrates, depending on habitat (Pratt et al. 1987).

Seven plovers are known to winter in or visit the Study Area. No plovers are known to breed within the Study Area, and only two species are considered winter migrants; the other five are visitors to the Study Area. The Pacific golden plover (*Pluvialis fulva*) is known to occur on all islands within the Study Area, including Guam, Rota, Tinian, and FDM. The breeding habitat of the Pacific golden plover is arctic tundra from northernmost Asia into western Alaska. It nests on the ground in dry, open areas. Winter grounds are spread throughout the Pacific Basin, and migration routes follow the Central Pacific Flyway to reach the Mariana Islands (Pratt et al. 1987). Pacific golden plovers were observed in the open ocean on the 2007 Mariana Islands Sea Turtle and Cetacean Survey cruise (U.S. Department of the Navy 2007), and during the winter months are known to frequent open areas of the Navy owned and leased lands on Guam and the CNMI, as well as Andersen Air Force Base.

3.6.2.12.4.2 Larinae (Gulls)

Gulls are not common in the tropical Pacific (Pratt et al. 1987), preferring shallow water habitats in temperate and polar climates along coasts and inland rivers and lakes. Gulls that are observed in the Mariana Islands are generally associated with rare visitations and winter migrations. The common black-headed gull (*Larus ridibundus*) and salty-backed gull (*Larus schistisagus*) are the only gull species observed within the Study Area, with observations on Guam and Tinian (Pratt et al. 1987). Harrison

(1983) and Sibley (2000) note that the occurrence of the common black-headed gull is associated with harbors and bays.

3.6.2.12.4.3 Haematopodidae (Oystercatchers)

Oystercatchers are large, stocky shorebirds with distinct patterns of black and white with bright red bills, and are generally associated with rare visitations in the tropical Pacific. One Eurasian oystercatcher (*Haematopus ostralegus*) was observed and photographed on Guam in 1980 and remained on the island for at least a year (Pratt et al. 1987).

3.6.2.12.4.4 Sternidae (Terns and Noddies)

Terns and noddies are seabirds in the family Sternidae with worldwide distribution (Pratt et al. 1987). A recent taxonomic revision now separates terns and noddies out of the gull family Laridae (van Tuinen et al. 2004). Terns generally are medium to large birds, typically with gray or white plumage, often with black markings on the head. They have longish bills and webbed feet. Terns and noddies are lighter bodied and more streamlined than gulls, with long tails and long narrow wings. Terns and noddies hunt fish by diving, often hovering first for a few moments before a dive.

Ten species of this family are known to occur within the Study Area as residents or rare visitors. The brown noddy and black noddy are known to nest at FDM (U.S. Department of the Navy 2007); the black noddy also nests on Aguiguan (Commonwealth of the Northern Mariana Islands Division of Fish and Wildife 2005, Kessler 2009). Both of these species were also observed in open waters during the Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007). The brown noddy is a tropical seabird with a worldwide distribution, ranging from Hawaii to the Tuamotu Archipelago and Australia in the Pacific Ocean, from the Red Sea to the Seychelles and Australia in the Indian Ocean, and in the Caribbean to Tristan da Cunha in the Atlantic Ocean. The brown noddy is colonial, usually nesting on cliffs or in short trees or shrubs, and occasionally nests on the ground. The female lays a single egg each breeding season. The brown noddy breeds on FDM, Rota, and Guam (U.S. Department of the Navy 2013a). Orote Island on Guam supports a large brown noddy nesting colony (approximately 150 birds). Additional roosts for brown noddies are found on at least two small emergent rock islands off the north and south coast of Orote Peninsula (Lusk et al. 2000).

The black noddy is smaller than the brown noddy with darker plumage, a whiter cap, a longer, straighter beak and shorter tail. The black noddy nests consist of a level platform, often created in the branches of trees using dried leaves covered with bird droppings. One egg is laid each season, and nests are re-used in subsequent years. The black noddy is distributed worldwide in tropical and subtropical seas, with colonies widespread in the Pacific Ocean and more scattered across the Caribbean, central Atlantic and in the northeast Indian Ocean. At sea, it is usually seen close to its breeding colonies within 50 mi. (80.5 km) of shore. Birds return to colonies, or other islands, in order to roost at night. The black noddy nests on Aguiguan, a small island south of Tinian (Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife 2005).

The gray-backed tern (*Sterna lunata*) has not been observed on land within the Study Area; however, this species was observed in open water during the 2007 Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007). The gray-backed tern breeds on islands of the tropical Pacific Ocean. At the northern end of its distribution it nests in the Northwestern Hawaiian Islands (with the largest population occurring on Lisianski Island) and two small islets off Oahu; in the east as far as the Tuamotu Islands, with other colonies occurring in the Society Islands, the Line Islands, Phoenix Islands, Mariana Islands, and American Samoa. There are unconfirmed reports of breeding as far south as Fiji, and as far east as Easter Island. Outside of the breeding season the species is partly migratory, with birds from the Hawaiian Islands flying south. It is thought that birds in other parts of the Pacific are also migratory and disperse as far as Papua New Guinea, the Philippines, and Easter Island (U.S. Fish and Wildlife Service 2005).

The sooty tern (*Sterna fuscata*) utilizes areas of the Navy Main Base and Fena Reservoir on Guam (GovGuam Department of Aquatic and Wildlife Resources 2006, U.S. Department of the Navy 2013a), and was observed in open waters during the Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007). Sooty terns are known to visit FDM (U.S. Department of the Navy 2013a). This tern is migratory and dispersive, wintering more widely through the tropical oceans. Compared to other terns, the sooty tern is more characteristically marine. Sooty terns breed in colonies on rocky or coral islands. Nests are simple and consist of a ground scrape or hole in which one to three eggs are laid. Sooty terns feed by picking fish from the surface in marine environments, often in large flocks, and rarely come to land except to breed. This species can stay out at sea (either soaring or floating on the water) for 3 to 10 years (Pratt et al. 1987).

The white tern (*Gygis alba*) has been observed on Andersen Air Force Base, Navy Main Base and Fena Reservoir on Guam. This tern species has also been observed on Tinian and FDM, as well as open waters within the Study Area (U.S. Department of the Navy 2007, 2013a). White terns nest throughout the CNMI and are considered common. This tern ranges widely across the Pacific and Indian Oceans, and also nests on some Atlantic islands. White terns nest on coral islands, usually on trees with thin branches but also on rocky ledges and on man-made structures. The white tern breeds on Guam, Rota, Tinian, Saipan, and FDM (U.S. Fish and Wildlife Service 2011a, b).

3.6.2.12.4.5 Glareolidae (Pratincoles)

Members of the Glareolidae family differ from most other shorebirds in that these species typically feed in the air (most shorebirds forage on the ground). Only one species, the Oriental pratincole (*Glareola maldivarum*), is thought to occur within the Mariana Islands. Pratt et al. (1987) lists two "hypothetical" observations on Guam and Saipan; the Oriental pratincole would be considered a rare visitor to the islands.

3.6.2.12.4.6 Stercorariidae (Skuas and Jaegers)

Members of the seabird family Stercorariidae are ground nesters in temperate and arctic regions and are long-distance migrants (Pratt et al. 1987). Outside the breeding season they feed on fish, animal entrails, and carrion. Many are partial kleptoparasites, chasing gulls, terns and other seabirds to steal their catches. The larger species in this family also regularly kill and eat adult birds, up to the size of great black-backed gulls (the largest of all gulls). On the breeding grounds they commonly eat lemmings, and the eggs and young of other birds.

The three species of the family Stercorariidae that are known to occur within the Study Area include the long-tailed jaeger (*Stercorarius longicaudus*), the parasitic jaeger (*Stercorarius parasiticus*), and the pomarine jaeger (*Stercorarius pomarinus*). None are known to breed on islands within the Study Area, and no observations of these birds have been recorded on land in the Mariana Islands. The long-tailed jaeger breeds in the high Arctic of Eurasia and North America, with major populations in Russia, Alaska, and Canada and smaller populations around the rest of the Arctic. It is a migrant, wintering in the south Atlantic and Pacific. The parasitic jaeger breeds on coasts of Alaska, as well as coastal and inland tundra regions of northern Canada. This species is also found in Greenland, Iceland, Scandinavia, and northern Russia. In the Pacific, parasitic jaegers winter at sea from southern California to southern Chile and

Australia (U.S. Geological Survey 2008). The pomarine jaeger is mostly a pelagic species occasionally observed inland. A large jaeger, the species is heavyset, having a thick neck with broad-based wings and a wing span that can reach 48 inches (in.) (1.2 m) (U.S. Geological Survey 2008).

3.6.2.12.4.7 Scolopacidae (Sandpipers and Curlews)

The majority of species within the Scolopacidae family eat small invertebrates picked out of mud or soil substrates. Different lengths of bills enable different species to feed in the same habitat, particularly on the coast, without direct competition for food. Sandpipers generally are found on shores and in wetlands around the world, breeding on the Arctic tundra to more temperate areas. Curlews foraging habits are similar to sandpipers, but the species is characterized by a long specialized bill (Pratt et al. 1987).

Twenty-eight species within the Scolopacidae family have been recorded as either winter migrants or rare visitors to Guam, Rota, Saipan, Tinian, and FDM (Pratt et al. 1987, U.S. Department of the Navy 2007). The common sandpiper breeds across most of Europe and Asia, and nests on the ground near fresh water. After breeding season, sandpipers migrate to Africa, southern Asia, Indonesia, and Australia. The common sandpiper forages by sight on the ground or in shallow water, picking up small food items such as insects, crustaceans, and other invertebrates (Pratt et al. 1987). The far eastern curlew (*Numenius madagascariensis*) spends its breeding season in northeastern Asia, including Siberia to the Kamchatka Peninsula, as well as Mongolia. Its breeding habitat comprises marshy and swampy wetlands and lakeshores. Wintering habitat is mostly associated with coastal Australia; however, some migrate to South Korea, Thailand, and New Zealand, preferring estuaries, beaches, and salt marshes. The common sandpiper and the far-eastern curlew were observed during the 2007 Mariana Islands Sea Turtle and Cetacean Survey (U.S. Department of the Navy 2007); however, these birds have not been observed on islands within the Study Area. Birds within this family associated with FDM include the ruddy turnstone (*Arenaria interpes*), a winter migrant, wandering tattler, and whimbrel (*Numernius phaeopus*); the latter two are noted as rare visitors to FDM (Lusk et al. 2000).

3.6.2.12.4.8 Recurvirostridae (Avocets and Stilts)

Members of the Recurvirostridae family are long legged, slender wading birds with black and white contrasting plumage. There are no records of Avocets within the Mariana Islands; however, the black-winged stilt (*Himantopus himantopus*) is known to be a rare visitor to Guam (Pratt et al. 1987) and to Saipan (U.S. Department of the Navy 2013a). This species of stilt, like all stilts, have red or pink legs and straight thin bills.

3.6.2.12.5 Wading Birds, Such as Ducks, Herons, and Wigeons (Order Anseriformes)

3.6.2.12.5.1 Anatidae (Waterfowl Birds: Swans, Ducks, and Geese)

Members of family Anatidae are considered waterbirds with webbed feet and broad flat bills. With the exception of the Mariana mallard, the Anatidae species are considered rare visitors to the Study Area (Pratt et al. 1987), and most observations are associated with palustrine (fresh water) and brackish wetlands of Guam (e.g., Fena Reservoir) and Hagoi on Tinian. Surveys in 2012 for migratory birds at Hagoi reported two pintail ducks (*Anas acuta*) in February and four additional observations in March. The Mariana mallard was last observed in 1979 and is now considered extinct. Mallards are known to hybridize with other members of genus *Anas*, and the Mariana mallard was believed to be a stabilized hybrid population with both common mallard (*Anas platyrhynchos*) and gray duck (*Anas superciliosa*) ancestry (Pratt et al. 1987).

3.6.2.12.5.2 Ardeidae (Herons and Bitterns)

Birds in the Ardeidae family include herons and bitterns. Herons and bitterns resemble birds in some other families, such as storks, ibises, and spoonbills, but differ by flying with their necks retracted, not outstretched. The members of this family are mostly associated with brackish and freshwater wetlands, and prey on fish, amphibians, and other aquatic species. Some members of this group nest colonially in trees, while others, notably the bitterns, use reedbeds on the ground (Pratt et al. 1987).

The 12 members of the Ardeidae family within the Study Area are commonly associated with wetland areas on Guam and Hagoi on Tinian, with occasional sightings on Rota and FDM. Two members of this family (Pacific reef heron and yellow bittern) are known to breed on Guam and the CNMI, including FDM. These two species are considered resident species year round in the Mariana Islands. The yellow bittern has short, yellow legs, with a chin marked by a narrow white stripe. They have brown beaks, gold-yellow colored eyes and the surrounding areas of their faces are normally greenish-yellow. Breeding habitats are closely associated with reedbeds, which are extensively found at Hagoi (composed primarily of *Phragmites karka*), though the yellow bittern has also been observed by Navy biologists nesting in tangantangan (*Leucaena leucocephala*) trees on Guam, including urban landscaped environments with trees and bushes. Pacific reef herons predominantly feed on varieties of nearshore fish, crustaceans, and mollusks. The species nests year round in colonies in mesic wooded areas, including mangroves (U.S. Department of the Navy 2013a).

3.6.2.12.6 Birds of Prey (Order Accipitriformes)

3.6.2.12.6.1 Accipitridae (Eagles, Hawks, Owls, and Ospreys)

The only member of the Accipitridae family to occur in the Mariana Islands is the osprey (*Pandion haliaetus*). Pratt et al. (1987) noted "old observations" from Guam. Ospreys have been observed periodically, with rare records from Rota in 1999 and Guam in 2000. As the largest bird of prey to visit the Marianas, it is unlikely that this bird could visit the Study Area without observation. Therefore, although occurrences of ospreys are possible on Guam and throughout the islands within the CNMI, ospreys can only be considered extremely rare visitors to the Study Area (Wiles 2005). Other rare visitors include the black kite (*Milvus migrans*), gray-faced buzzard (*Butastur indicus*), Chinese goshawk, European hobby, and short-eared owl.

3.6.2.12.6.2 Falconidae (Falcons)

Members of the Falconidae family are small-to medium-sized birds of prey with characteristically pointed wings and long tapering tails. Falcons are diurnal hunters and kill prey with their beaks. Of the 62 species of falcons, only two have been observed within the Mariana Islands (Vice and Vice 2004, Wiles et al. 2000, Wiles 2005). A peregrine falcon was observed in January 2000 at the Guam International Airport (GovGuam Department of Aquatic and Wildlife Resources 2006), and this species in general is believed to be a rare visitor to Guam. A Eurasian kestrel (*Falco tinnunculus*) was observed in December 2000 and January 2001 at the Guam International Airport feeding on Eurasian tree-sparrows (*Passer montainus*) and chasing other birds. Although falcons are not considered seabirds or shorebirds, these two species are generally associated with coastal habitats and feeds mostly on birds, particularly birds associated with marine or freshwater habitats (Wiles 2005, Pratt et al. 1987).

3.6.3 Environmental Consequences

This section presents the analysis of potential impacts on marine birds from implementation of the project alternatives, including the No Action Alternative, Alternative 1, and Alternative 2. Navy training and testing activities are evaluated for their potential impact on marine birds as groups of species characterized by distribution, body type, or behavior relevant to the stressor being evaluated. Activities are evaluated for their potential impact on all marine birds in general. In addition, specific analyses are provided for the three birds in the Study Area listed as endangered or threatened under the ESA and on two birds with important associations with FDM. As described in Section 3.6.2 (Affected Environment), birds are not distributed uniformly throughout the Study Area, but are closely associated with a variety of habitats, with coastal birds and shorebirds concentrated along nearshore habitats and seabirds with patchy (uneven) distributions in offshore and open ocean areas.

The alternatives for training and testing activities were examined to determine if the Proposed Action would produce one or more of the following impacts:

- A direct or indirect impact on marine birds or marine bird populations from mortality attributed to military training and testing activities taking place within the Study Area.
- A direct or indirect impact on marine bird populations from destruction or disturbance of foraging habitat attributed to military training and testing activities taking place within the Study Area.
- A direct or indirect impact on seabird populations from destruction or disturbance of seabird breeding colonies, foraging areas, or roosting areas attributed to military training and testing activities taking place within the Study Area. The only marine birds that breed within the study area are certain species of seabirds.

The consequences of the proposed military readiness activities on non-federally listed migratory seabirds, shorebirds, or other birds that use the marine environment or on modification of their habitat are evaluated based on the criteria described in the Final Rule authorizing DoD to incidentally take migratory seabirds during military readiness activities (50 C.F.R. Part 21, 28 February 2007), which states that military readiness activities are authorized to take migratory birds provided they do not result in a significant adverse effect on a population of a migratory seabird species. Section 3.6.1.2 (Migratory Bird Treaty Act Species and 50 Code of Federal Regulations Part 21.15 Requirements) discusses this regulatory framework in more detail.

General characteristics of all Navy stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis), and general susceptibilities of living resources to stressors were introduced in Section 3.0.5 (Overall Approach to Analysis). Stressors vary in intensity, frequency, duration, and location within the Study Area. Certain activities take place in specific locations or depth zones within the Study Area (see Section 3.0.5, Overall Approach to Analysis), outside of the range or foraging abilities of birds. Therefore, seafloor device strike, cable and wire entanglement, parachute entanglement, and ingestion of munitions were not carried forward in this analysis for birds.

The stressors applicable to seabirds and shorebirds vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to marine birds in the Study Area and analyzed below include the following:

- Acoustic (sonar and other active acoustic sources; explosives; swimmer defense airguns; weapons firing, launch, and impact noise; vessel noise; and aircraft noise)
- Energy (electromagnetic devices)
- Physical disturbance and strike (aircraft and aerial targets, vessels, in-water devices, military expended materials, ground disturbance, and wildfires)
- Ingestion (munitions and military expended materials other than munitions)

- Secondary (impacts associated with sediments, water quality, and air quality)

The specific analysis of the training and testing activities presented in this section considers the relevant components and associated data within the geographic location of the activity and the resource (see Tables 2.8-1 and 2.8-4).

3.6.3.1 Acoustic Stressors

This section evaluates the potential for acoustic stressors to impact birds during training and testing activities in the Study Area. These stressors are associated with sonar and other active acoustic sources; explosives; weapons firing, launch, and impact noise; aircraft noise; and vessel noise. Categories of potential impacts from exposure to explosions and sound are direct trauma, hearing loss, auditory masking, behavioral reactions, and physiological stress. Potential negative nonphysiological consequences to birds from acoustic and explosive stressors include disturbance of foraging, roosting, or breeding; degradation of foraging habitat; and degradation of seabird breeding colonies.

If a seabird is close to an intense noise source, it could suffer auditory fatigue. Auditory fatigue manifests itself as hearing sensitivity loss over a portion of hearing range, called a noise-induced threshold shift. A threshold shift may be either permanent threshold shift (PTS) or temporary threshold shift (TTS). Studies have examined hearing loss and recovery in only a few species of birds, and none studied hearing loss in seabirds (e.g., Hashino et al. 1988; Ryals et al. 1999; Ryals et al. 1995; Saunders and Dooling 1974). A bird may experience PTS if exposed to a continuous sound over 110 A-weighted decibels (dBA) re 20 µPa sound pressure level in air or blast noise over 140 dB re 20 µPa sound pressure level in air (Dooling and Therrien 2012). Unlike other species, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks. Still, intense exposures are not always fully recoverable, even up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al. 1999). Birds may be able to protect themselves against damage from sustained noise exposures by regulating inner ear pressure, an ability that may protect ears while in flight (Ryals et al. 1999). Diving birds have adaptations to protect the middle ear and tympanum from pressure changes during diving that may affect hearing (Dooling and Therrien 2012). Auditory fatigue can impair an animal's ability to hear biologically important sounds within the affected frequency range. Biologically important sounds come from social groups, potential mates, offspring, or parents; environmental sounds; or predators.

Numerous studies have documented that birds respond to anthropogenic noise, including aircraft overflights, weapons firing, and explosives (Larkin et al. 1996; National Park Service 1994; Plumpton et al. 2006). Studies generally indicate that birds hear in-air sounds over a very limited range between 1 and 5 kHz, but specific species hearing can extend to higher and lower frequencies (Beason 2004). The manner in which birds respond to noise depends on several factors, including life-history characteristics of the species, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence or absence of associated visual stimuli, and previous exposure (Larkin et al. 1996; National Park Service 1994; Plumpton et al. 2006). Researchers have documented a variety of behavioral responses of birds to noise, such as alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations. While they are difficult to measure in the field, some of these behavioral responses may be accompanied by physiological responses, such as increased heart rate or short-term changes in stress hormone levels (Partecke et al. 2006).

Chronic stress due to disturbance may compromise the general health and reproductive success of birds, but a physiological stress response does not necessarily indicate negative consequences to individual birds or to populations (Larkin et al. 1996; National Parks Service 1994). The reported behavioral and physiological responses of birds to noise exposure can fall within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. These responses can include activation of the neural and endocrine systems, increased blood pressure, or changes in available glucose and blood levels of corticosteroids (Manci et al. 1988). It is possible that individuals would return to normal almost immediately after exposure, and the individual's metabolism and energy budget would not be affected in the long term. Studies also have shown that birds can become habituated to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al. 1996; National Park Service 1994; Plumpton et al. 2006). However, the likelihood of habituation depends on many factors, including species of bird (Bowles et al. 1991) and frequency of and proximity to exposure. Raptors have been shown to shift their terrestrial home range when concentrated military training activity was introduced to the area (Andersen et al. 1990). On the other hand, cardinals nesting in areas with high levels of military training activity (including gunfire, artillery, and explosives) were observed to have similar reproductive success and stress hormone levels as cardinals in areas of low activity (Barron et al. 2012).

The sensitivity of birds to disturbance may also vary during different stages of the nesting cycle. Similar noise levels may be more likely to cause nest abandonment during incubation of eggs than during brooding of chicks because birds have invested less time and energy and have a greater chance of re-nesting (Knight and Temple 1986). Chronic stress due to disturbance can compromise the general health of birds, but stress is not necessarily indicative of negative consequences to individual birds or to populations (Larkin et al. 1996, National Parks Service 1994). For example, the reported behavioral and physiological responses of birds to noise exposure are within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. Unless repeatedly exposed to loud noises or simultaneously exposed to multiple stressors, it is possible that individuals would return to normal almost immediately after exposure, and the individual's metabolism and energy budget would not be affected. Studies have also shown that birds can habituate to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al. 1996, National Parks Service 1994, Plumpton et al. 2006). Little is known about physiological stress responses of birds that have habituated to noise.

The types of seabirds exposed to sound-producing activities or explosive detonations depend on where training and testing activities occur relative to the coast. Seabirds can be divided into three groups based on breeding and foraging habitat: (1) those species such as albatrosses, petrels, frigatebirds, tropicbirds, boobies, noddies and some terns that forage over the ocean and nest on oceanic islands; (2) species such as pelicans, cormorants, and some terns that nest along the coast and forage in nearshore areas; and (3) those few species such as skuas, jaegers, and several tern species that nest and forage in inland habitats and come to the coastal areas during nonbreeding seasons (Schreiber and Burger 2002).

The area from the beach to about 10 nm offshore provides foraging areas for breeding terns, skimmers, and pelicans; a migration corridor and winter habitat for terns, cormorants, and boobies; and supports nonbreeding and transient pelagic seabirds. Offshore pelagic waters support nonbreeding and transient pelagic seabirds, boobies, and several tern species (Davis et al. 2000, Hunter et al. 2006). Pelagic seabirds are generally widely distributed, but they tend to congregate in areas of higher productivity and prey availability (Haney 1986). Such areas in the Marianas are expected around upwellings and current convergences, which concentrate nutrients to attract seabird prey species.

Birds transiting an area could be exposed to sounds from sources near the water surface or from airborne sources. While foraging birds will be present near the water surface, transiting birds may fly at various altitudes. Some species such as sea ducks and loons may be commonly seen flying just above the water's surface, but the same species can also be spotted flying so high that they are barely visible through binoculars (Lincoln et al. 1998).

Seabirds use a variety of foraging behaviors that could expose them to underwater sound. Most seabirds plunge-dive from the air into the water or perform aerial dipping (the act of taking food from the water surface in flight); others surface-dip (swimming and then dipping to pick up items below the surface) or jump-plunge (swimming, then jumping upward and diving under water). Birds that feed at the surface by surface or aerial dipping with limited to no underwater exposure include petrels, jaegers, and phalaropes. Birds that plunge dive typically submerge for no more than a few seconds, and any exposure to underwater sound would be very brief and occur during rapid pressure changes and proliferation of air bubbles, which would limit exposure time while submerged. Birds that plunge-dive include albatrosses, most tern species, masked boobies, shearwaters, and tropicbirds. Other birds pursue prey under the surface, swimming deeper and staying underwater longer than other plunge-divers. Birds that exhibit this foraging behavior include cormorants, petrels, and shearwaters. Some of these birds may stay underwater for up to several minutes and reach depths between 50 ft. (15 m) and 550 ft. (168 m) (Alderfer 2003, Durant et al. 2003, Jones 2001, Lin 2002, Ronconi 2001). Birds that forage near the surface would be exposed to underwater sound for shorter periods of time, and some exposures may be reduced by phase cancellation near the surface (see Section 3.0.4, Acoustic and Explosives Primer). Sounds generated under water during training and testing would be more likely to impact birds that pursue prey under the surface, although as previously stated, little is known about seabird hearing ability underwater. Birds that forage in the open ocean often forage more actively at night, when prey species are more likely to be near the surface and naval training and testing is more limited.

3.6.3.1.1 Impacts from Sonar and Other Active Acoustic Sources

Sonar and other underwater active non-impulse acoustic sources could be used throughout the Study Area. Information regarding the impacts from sonar on seabirds and the ability for seabirds to hear underwater is virtually unknown. The exposure to these sounds by seabirds, other than pursuit diving species, is likely to be very limited due to spending a very short time under water (plunge-diving or surface-dipping) or foraging only at the water surface. In addition, acoustic effects near the water’s surface may reduce potential sound exposure of shallow diving birds. Pursuit divers may remain under water for minutes, increasing the chance of underwater sound exposure.

Assuming that a bird disturbed by an underwater sound is likely to react to the stressor by swimming to the surface, a physiological impact, such as hearing loss, would likely occur if a bird is close to an intense sound source. In general, birds are less susceptible to both TTS and PTS than mammals (Saunders and Dooling 1974), so an underwater sound exposure would have to be intense and of a sufficient duration to cause TTS or PTS. Returning to the surface would limit extended or multiple sound exposures underwater; however, foraging and hunting behaviors could be interrupted. There have been no studies documenting diving seabirds’ reactions to sonar.

If seabirds that forage underwater are attracted to the presence of a ship equipped with and using active acoustic sources, the diving seabirds could be exposed to underwater sound. Some birds commonly follow vessels for increased potential of foraging success as the propeller wake brings prey to the surface (Hyrenbach 2001, 2006; Melvin et al. 2001). Based on opportunistic foraging by seabirds in wakes of moving ships, any noise generated behind ships does not preclude feeding behaviors. Further, most hull-mounted sonars do not project sound aft of ships, so most birds diving in ship wakes would not be exposed to sonar. In addition, based on what is known about bird hearing capabilities in air, it is expected that diving birds may have limited or no ability to perceive high-frequency sounds, so it is expected that they would not be impacted by high frequency sources such as those used in mine warfare. As stated in Section 3.6.2.3 (Bird Hearing), the few hearing studies on birds suggests that greatest hearing sensitivity for birds is between 1 and 4 kHz, with an upper limit of 15 kHz, and a lower limit of 20 Hz. The greatest hearing sensitivity of birds would be within the lower portion of the mid-frequency sonar active sonar system frequency range (1–10 kHz). See Section 2.3.1.1 (What is Sonar?) for a general discussion of sonar.

3.6.3.1.1.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include activities that produce non-impulse underwater sound from the use of sonar and other active acoustic sources. These activities could occur throughout the Study Area. The number of activities and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources during training activities is discussed in Section 3.0.4 (Acoustic and Explosives Primer). Table 3.0-8 provides a summary of active acoustic hours for each source class category.

Diving birds would be more likely to be exposed to underwater sound in foraging areas. These foraging areas are expected to co-occur with upwellings, which bring nutrients upward through the water column attracting seabird prey species. Therefore, seabirds are more likely to be exposed to underwater sound pressure where sonar overlaps open ocean areas that provide conditions for optimal foraging. Sonar and other active acoustic sources would not be regularly used in near-shore areas that could be used by foraging shorebirds, except during maintenance and for navigation in areas around Naval Base Guam Apra Harbor.

Exposures to acoustic sources sufficiently intense (i.e., of a certain duration or within close proximity) to cause physiological impacts are unlikely. Diving birds may not respond to an underwater sound or may not have the hearing range to detect some sources. However, it is likely that few seabirds would be affected by sonar and other underwater active acoustic sources because sources are used intermittently during a training activity, training activities are dispersed in space and time, and seabirds spend a portion of their time submerged. If a diving seabird does react to an underwater sound source, it is expected to result in a short-term behavioral response, such as a startle or surfacing; and surfacing would eliminate further exposures. Due to the limited duration of training activities and widespread availability of foraging habitat, any sound exposures would be minimal and would not permanently displace an animal from a foraging area. Occasional short-term, behavioral impacts, if they occur, are not expected to result in substantial changes to behavior, growth, survival, annual reproductive success, lifetime reproductive success (fitness) to most individuals; therefore, population-level impacts are not expected.

Short-tailed albatrosses are rare vagrant migrants that forage in offshore, open ocean waters. Short-tailed albatross remain one of the world's most endangered birds (U.S. Fish and Wildlife Service 2005). Considering the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training activities within the Study Area would be extremely low. Birds of this family follow wakes of ships, especially vessels associated with fishing activities (smells attract the birds). Following of ships by seabirds is also believed to increase when the ships dispose of food waste. Pursuant with the Office of the Chief of Naval Operations Instruction 5090.1D, Navy ships are permitted to discharge food waste at sea, but only greater than 3 nm offshore. There are further restrictions on the discharge of food waste for submarines, such as ensuring that food waste does not reach the surface. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents a negligible chance that a direct or indirect impact would occur to this species because of training activities that use non-impulse sound sources.

Hawaiian petrels are also rare migrants that forage in offshore open ocean waters. Petrels forage near the sea surface, and can range 930 mi. (1,500 km) from the Hawaiian Islands; however, the range shrinks for part of the year to surround the Hawaiian Islands, primarily during the breeding season from March through October. There have been no observations of Hawaiian petrels at FDM, and other species of the Procellerridae family have not been observed on or around the island. The described training activities would present no measurable chance for interaction with this species. Considering the rarity of this species and the lack of frequent sightings within the MITT Study Area, chances for its potential interactions with training exercises would be extremely low. The probability of direct or indirect impacts on individuals or populations remains low. The spatial and temporal variability of both the occurrence of a Hawaiian petrel and the training activities conducted within offshore locations near foraging areas presents a negligible chance of direct or indirect impact on this species.

Newell’s shearwaters are also rare migrants that forage in offshore open ocean waters. Petrels forage near the sea surface, and can range 1,500 mi. (2,414 km) from the Hawaiian Islands, which overlaps with the MITT Study Area; however, the range shrinks for part of the year to surround the Hawaiian Islands during breeding season (April through November). Considering the rarity of this species and the lack of frequent sightings within the MITT Study Area, chances for its potential interactions with training exercises would be extremely low. The probability of direct impacts on individuals or populations remains low. The spatial and temporal variability of both the occurrence of a Newell’s shearwater and the training activities conducted within offshore locations near foraging areas presents a negligible chance of direct or indirect impact on this species.

Masked boobies are expected to forage in pelagic waters that may co-occur with Navy training activities that use sonar and other active acoustic sources. A plunge diver, this species may be found in waters greater than 100 mi. (161 km) from land. A submerged masked booby has a very limited exposure time to underwater sound. Based on the available literature for hearing abilities of seabirds while under water, masked boobies are not expected to hear very well under water. Further, exposure to underwater sound would only occur under rapid pressure changes, reducing the actual exposure time to sound. It is unlikely that active acoustic sources used in training activities would disrupt foraging activities of masked boobies. Because of the decreased importance of sound cues for seabirds under water to locate prey, brief exposure time, dispersed locations of Navy training activities, and the availability of pelagic foraging habitats for masked boobies, there would be no adverse population level effects on this species associated with sonar and other active acoustic sources.

Great frigatebirds are also expected to forage in pelagic waters that co-occur with Navy training activities that use sonar and other active acoustic sources. The great frigatebird, however, does not plunge dive and feeds by capturing prey species (primarily fish and squid) at or above the water surface. Therefore, the great frigatebird would not typically be exposed to underwater sound, and the use of sonar and other active acoustic sources would have no adverse population-level effects.

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities under the No Action Alternative would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during training activities described under the No Action Alternative would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Testing activities potentially using non-impulse acoustic sources under the No Action Alternative is restricted to the North Pacific Acoustic Lab Philippine Sea Experiment (Table 2.8-4). Research vessels, acoustic test sources, side scan sonar, ocean gliders, the existing moored acoustic topographic array and distributed vertical line array, and other oceanographic data collection equipment will be used to collect information on the ocean environment and sound propagation. Currently, the array is being used to passively collect oceanographic and acoustic data in the region.

Exposure to seabirds would only occur if a seabird was diving under water at sufficient depths and in sufficient proximity to the sound source. The likelihood of exposure is very small because of the intermittent acoustic exposures in this limited area, and the limited time a seabird would spend under the surface. Because most impacts would be short-term, potential impacts are not expected to result in substantial changes to foraging activity by diving seabirds and would not adversely impact populations of diving seabirds.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities under the No Action Alternative would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during testing activities described under the No Action Alternative would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.1.1.2 Alternative 1

Training Activities

The number of annual training activities that produce in-water sound from the use of sonar and other active acoustic sources during training under Alternative 1 would increase compared to the No Action Alternative, plus new sources would be used with the introduction of the Littoral Combat Ship. Use of sonar and other active acoustic sources during training activities is discussed in Section 3.0.4 (Acoustic and Explosives Primer).

Based on the increased activities under Alternative 1 versus the No Action Alternative, there is an increased probability of more seabirds exposed while underwater to underwater sound generated from sonar and other active acoustic sources. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds as described under the No Action Alternative. Due to the reasons described in Section 3.6.3.1.1.1 (No Action Alternative), any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during training activities described under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Testing activities under Alternative 1 that produce in-water sound from the use of sonar and other active non-impulse acoustic sources that fall within the hearing range of birds would increase compared to the No Action Alternative. The number of activities and their proposed locations are presented in Tables 2.8-2 and 2.8-4 of Chapter 2 (Description of Proposed Action and Alternatives). Use of sonar and other active acoustic sources is discussed in Section 3.0.4 (Acoustic and Explosives Primer).

Based on the increased activities under Alternative 1 versus the No Action Alternative and the additional testing locations, there is an increased probability of more seabirds exposed while underwater to underwater sound generated from sonar and other active acoustic sources. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds, as described under the No Action Alternative for training. Due to the reasons described in Section 3.6.3.1.1.1 (No Action Alternative), any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during testing activities described under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.1.1.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative would also be identical to those described in Section 3.6.3.1.1.3 (Alternative 2).

Pursuant to the ESA, the use of sonar and other active acoustic sources during training activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during training activities described under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Section 3.0.4 (Acoustic and Explosives Primer) describes the use of sonar and other underwater active acoustic sources during testing activities under Alternative 2. Use of sonar and other active acoustic sources would increase under Alternative 2 versus the No Action Alternative. The proposed testing activities would also increase over Alternative 1 by approximately 10 percent. Sonar and other active acoustic sources would be used in waters throughout the MITT Study Area, in the same locations described under Alternative 1. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds, as described under the No Action Alternative. Due to the reasons described in Section 3.6.3.1.1.1 (No Action Alternative), any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Pursuant to the ESA, the use of sonar and other active acoustic sources during testing activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from sonar and other active acoustic sources during testing activities described under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.1.2 Impacts from Explosives and Swimmer Defense Airguns

The potential for birds to be exposed to explosions depends on several factors, including the presence of birds at, beneath, or above the water surface near the detonation; location of the detonation at, below, or above the water surface; size of the explosive; and distance from the detonation. Explosions are associated with detonations of explosive missiles and projectiles in air; explosive grenades, bombs, missiles, rockets, and projectiles at or near the sea surface; mine neutralization charges on the bottom and in the water column; explosive torpedoes near the surface and in the water column; explosive sonobuoys in the water column; other small charges used at various depths during testing; and explosive munitions dropped on land at FDM, such as bombs, missiles, rockets, and projectiles. Section 3.0.4 (Acoustic and Explosives Primer) describes the shock waves and acoustic waves imparted to a surrounding medium by an explosive detonation and how these waves propagate. Because airguns are an impulsive source, with the potential for similar non-traumatic impacts as explosives, they are considered in this section.

3.6.3.1.2.1 Underwater Explosives

Detonations near the water surface or underwater could impact diving birds and birds on the water surface. A seabird close to an explosive detonation could be killed or injured. Blast injuries are usually most evident in the gas-containing organs, such as those of the respiratory and gastrointestinal systems. Blasts can also damage pressure-sensitive components of the auditory system. Most detonations of explosive projectiles near the water surface would release a large portion of the explosive energy into the air.

Detonations that occur underwater, such as explosive ordnance demolition activities, could injure, kill, or disturb diving birds, particularly pursuit divers that spend more time underwater than other foraging birds (Danil and St. Ledger 2011). Studies show that birds are more susceptible to underwater explosions when they are submerged versus on the surface (Yelverton et al. 1973). Detonations are estimated to have lethal impacts on seabirds in water if the impulse exceeds 36 pounds (lb.) (16.3 kilograms [kg]) per square inch (psi)-milliseconds (msec) (psi-msec) (248 Pascal [Pa]-second [sec]) for birds underwater and 100 psi-msec (690 Pa-sec) just below the water surface for birds at the water surface (Yelverton et al. 1973). These impulse levels correspond to the level at which 1 percent of animals would not be expected to survive. Exposures to higher impulse levels would have greater likelihoods of mortality. No injuries would be expected for birds underwater at blast pressures below 6 psi-msec (41 Pa-sec) and for birds on the surface at blast pressures below 30 psi-msec (207 Pa-sec) (Yelverton et al. 1973). Actual ranges to impacts would be based on several factors, including charge size, depth of the detonation, and how far the bird is beneath the water surface. Due to surface image interference (see Section 3.0.4, Acoustic and Explosives Primer), peak pressures due to underwater explosions may be substantially reduced near the surface, reducing potential for injury to birds on the surface and shallow-diving birds.

Because of the differences in acoustic transmission in water and in air, an effect called the Lloyd mirror reflects underwater sound at the water surface so that it does not pass into the air (see Section 3.0.4, Acoustic and Explosives Primer). Sounds generated by most small underwater explosives and airguns, therefore, are unlikely to disturb seabirds above the water surface. If a detonation is sufficiently large or is near the water surface, however, pressure will be released at the air-water interface. Birds above this pressure release could be injured or killed. Cavitation zones near the surface can also disturb or injure birds at or near the surface (see Section 3.0.4, Acoustic and Explosives Primer).

3.6.3.1.2.2 Explosions On Land and In-Air

Explosives detonated at or just above the water surface, such as those used in anti-surface warfare, would create blast waves and acoustic waves that would propagate through both the water and air. The pressure waves could injure or kill birds while either in flight or at the water surface. Experiments that exposed birds to blast waves in air provided a relationship between charge size, distance from detonation, and likelihood of bird injury or mortality (Damon et al. 1974). Table 3.6-6 shows the safe distance from a detonation in air beyond which no injuries to birds would be expected for a representative list of ordnance.

Table 3.6-6: Range to No Injury from Detonations in Air for Birds

Sample Ordnance	Net Explosive Weight	Range to No Injury
76 mm round	0.6–2 lb.	22 ft. (7 m)[1]
5 in. projectiles	6–10 lb.	32 ft. (10 m)[1]
Rolling Airframe Anti-Air Missile	21–60 lb.	70 ft. (21 m)[1]
MK 84	1,000 lb.	900 ft. (274 m)[2]

[1] Damon et al. 1974
[2] U.S. Department of Defense 2004a
Notes: ft. = feet, in. = inches, lb. = pound(s), m = meters, mm = millimeters

Detonations on land at FDM would create blast waves and acoustic waves in air and also transmitted through the ground. Studies focusing on responses of birds on land to explosive noise have shown varied reactions ranging from no response to behavioral (e.g., flushing, cessation of foraging) and physiological responses (e.g., increased heart and respiration rates). Red-cockaded woodpeckers (*Picoides borealis*) successfully raised young near an active bombing range in Mississippi; while other birds at other sites did not. Oahu elepaio (*Chasiempis sandwichensis ibidis*) did not respond in statistically significant or biologically meaningful ways to noise generated by training with 155- and 105-millimeter (mm) howitzers, 60 and 81 mm mortars, hand grenades, and demolition of unexploded ordnance (VanderWerf 2000). Prairie falcons (*Falco mexicanus*) responded to blasts from ongoing civilian construction where the nests sites were not normally exposed to blasting; however, one northern harrier (*Circus cyaneus*) appeared to preferentially hunt near a location where 24 lb. (10.9 kg) bombing occurred. Anecdotal observations indicate the burrowing owl (*Athene cuniculariajloridana*) persists at Eglin Air Force Base on a bombing range where a variety of inert ordnance (rockets, missiles, and bombs, including a 21,700 lb. [9,842.9 kg] massive ordnance air blast bomb) has been used over the last 24 years (U.S. Fish and Wildlife Service 2010).

Behavioral responses (startle response, alert or alarm response, and flushing) to noise are often examined as these response actions result in: birds expending excess energy that is not directed towards reproduction; nest exposure increasing the risk of predation, nest cooling or nest heating which can result in egg and juvenile mortality; or accidentally kicking eggs or juveniles out of the nest. Behavioral responses can also include lower breeding densities in suitable habitats that are subject to noise; therefore, suitable habitat may become otherwise unsuitable due to noise.

Detonations in air during anti-air warfare training and testing would typically occur at much higher altitudes (greater than 3,000 ft. [915 m] above sea level) where seabirds and migrating birds are less likely to be present, although some activities target incoming missile threats at lower altitudes.

At distances beyond those to injury, an explosive detonation would likely cause a startle reaction, as the exposure would be brief and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or a flight response. The range of impacts could depend on the charge size, distance from the charge, and the bird's life activity at the time of the exposure.

Birds have been observed taking interest in surface objects related to detonation activities and subsequently being killed by a detonation (Greene et al. 1985). Fleeing response to an initial explosion may reduce seabird exposure to any additional explosions that occur within a short timeframe. However, seabirds could also be attracted to an area to forage if an explosion resulted in a fish kill. This would only be a concern for activities that involved multiple explosions in the same area within a single activity, such as firing exercises, which involves firing multiple high-explosive 5 in. rounds at a target area; bombing exercises, which could involve multiple bomb drops separated by several minutes; or underwater detonations, such as multiple explosive ordnance demolition charges.

Explosive ordinance demolitions also occur on land; however, explosive devices are detonated under controlled conditions, such as using clear zones and demolition pits. These activities occur at Andersen Air Force Base and the Naval Base Guam Naval Munitions Storage facility, in areas that are not generally associated with seabirds or shorebirds. Therefore, only explosions that occur on land at FDM are included for analysis.

3.6.3.1.2.3 No Action Alternative

Training Activities

Training activities under the No Action Alternative use explosives in air, at the water surface, underwater, and on land at FDM. The number of training activities using explosives and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Appendix A (Training and Testing Activities Descriptions) lists the training activities that use ordnance on FDM. The number of ordnance use on FDM is summarized in Table 3.0-22. On land, explosives used at FDM would range from medium caliber to explosive rounds, and explosive bombs no greater than 1,000 lb. net explosive weight (NEW).

Training activities using explosives would not occur within approximately 3 nm of shore, while lower weight explosives (up to 10 lb. NEW) would occur at underwater detonation sites within Apra Harbor (Outer Apra Harbor Underwater Detonation Site), Piti Point Floating Mine Neutralization Site, and Agat Bay (Agat Bay Floating Mine Neutralization Site). Percussive noise would also be generated in the air (but close to the surface) within the Small Arms Firing Area. The underwater detonations sites within Apra Harbor, Piti Point Floating Mine Neutralization Site, Agat Bay Floating Mine Neutralization Site, and the Small Arms Firing Area are within the nearshore environment of Guam that is likely a primary foraging habitat for seabird species that roost and breed on the island. Figure 2.7-1 shows the location of surface danger zones, exclusion zones around underwater detonation sites, and extended surface danger zones. The training activity areas shown in Figure 2.7-1 do not include fish aggregating devices, artificial reefs, shipwrecks, abandoned vessels, or buoys (e.g., navigational buoys, meteorological buoys) that attract seabird prey species and offer perch sites. Section 3.11 (Cultural Resources) discusses shipwrecks and other submerged resources that may also serve to aggregate fish and therefore seabirds. The Navy routinely avoids locations of known obstructions, including submerged cultural resources such as historic shipwrecks. These avoidance measures prevent damage to sensitive Navy equipment and vessels, ensure the accuracy of training and testing exercises, and limit the possibility of large numbers of seabirds being exposed to explosions.

In open ocean areas further from shore, some surface detonations could occur near areas with the potential for relatively high concentrations of seabirds near upwellings and current conversions, including Firing, Bombing, and Missile Exercises in the Study Area including transit corridors. Any impacts on individual seabirds may be greater in these areas because of the higher NEW explosives used in the training exercises in open ocean areas relative to nearshore areas. Most explosives in air would occur at altitudes above those where most birds would be expected to be present, although some airborne detonations could startle or induce other behavioral responses in foraging birds at lower altitudes. Detonations on land at FDM could directly impact seabirds and migrant shorebirds. As stated in Section 3.6.2.5 (At-Sea Observations of Seabirds and Shorebirds), FDM is the only land training area that supports seabird rookeries and strike warfare training.

While the impacts of explosions on seabirds under the No Action Alternative cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. At sea, detonations of bombs with larger NEWs, any activity employing static targets that may attract seabirds to the detonation site, or multiple detonations that attract seabirds to possible fish kills could be more likely to cause seabird mortalities or injuries. Timing of multiple detonations at the same location may impact birds differently. For example, detonations that occur within a few seconds or minutes of each other may kill or injure fewer birds than detonations that occur within a longer timeframe and allow sufficient time for more seabirds to congregate and feed on fish kills. Any impacts related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent. Because most activities would consist of a limited number of detonations, exposures would not occur over long durations, and activities occur at varying locations, it is expected there would be an opportunity to recover from an incurred energetic cost and individual birds would not be repeatedly exposed to explosive detonations. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected.

On land at FDM, impacts would range from behavioral responses to direct mortality. As stated previously, behavioral responses may include birds expending excess energy that is not directed toward reproduction; nest exposure, increasing the risk of predation; nest cooling or nest heating, which can result in egg and juvenile mortality; or accidentally kicking eggs or juveniles out of the nest. Behavioral responses can also include lower breeding densities in suitable habitats that are subject to noise; therefore, suitable habitat may become otherwise unsuitable due to noise. Lower breeding densities on FDM may result from repetitive explosive noise that spans several seconds or minutes for a single activity and is dispersed throughout a year's worth of training.

Within and adjacent to FDM impact areas (shown in relation to rookery locations in Figure 3.6-5), individual and group mortality of birds is possible depending on several factors, such as the presence of seabirds near the detonation, location of the detonation, size of the explosive, and distance from the detonation. Detonations create blast waves and acoustic waves in air and are also transmitted through the ground, although some of the sound could be attenuated by surrounding vegetation. Noise can result from direct munitions impacts (one object striking another), blasts (explosions that result in shock waves), and bow shock waves (pressure waves from projectiles flying through the air). Noise on FDM during training exercises may be continuous (i.e., lasting for a long time without interruption) or impulse (i.e., short duration). Continuous impulses (helicopter rotor noise, bursts from rapid-fire weapons) represent an intermediate type of sound and, when repeated rapidly, may resemble continuous noise.

Some seabirds and shorebirds on FDM subject to continuous or repetitive loud noise would likely experience stress and vascular alteration (including structural damage) in the ear, such as tympanum rupture, bone fracture, other damage to the ear, and deterioration of brain cells. These impulse noises can cause physical damage at lower intensity than continuous or rapidly repeating noises due to the ear reflex mechanism. Sound levels over 85 dBA are considered harmful to inner ear hair cells; 95 dBA is considered unsafe for prolonged periods; and extreme damage occurs as a result of brief exposure to 140 dBA (Hamby 2004). Hearing loss in birds is difficult to characterize because birds, unlike mammals, regenerate inner ear hair cells, even after substantial loss (Corwin and Cotanche 1988; Stone and Rubel 2000). Recovery from metabolic ear stress can often occur after 10 hours (mammals) post loud impulse noise, even before ear structures are fully recovered. Repeated trauma may prolong the course of hearing sensitivity recovery; however, longer-term recovery from hearing loss is generally expected in birds due to cell regeneration.

High-frequency sounds (sometimes referred to as ultrasound, which exceeds the hearing range of humans) may be generated from munitions explosions and projectile strikes on FDM. This type of sound diminishes very rapidly in air with distance from the source, and seabirds or shorebirds close enough to be adversely affected by the ultrasound produced by military training are likely close enough to be adversely affected by shrapnel, flying rock, or direct strikes. Therefore, ultrasound receives little attention in the terrestrial environment and it should be assumed that if a seabird or seabird nest was close enough to experience impacts from ultrasound, the seabird would likely be impacted directly by the actual munitions (U.S. Fish and Wildlife Service 2010).

Infrasound, which is present in blast and helicopter noise, is generally considered to be below 20 Hz (too low to be heard by humans) and attenuates less in air than audible sound, which means these noises could affect seabirds and shorebirds at longer distances on FDM. Seabirds may use infrasound for communication; however, the extent to which birds are affected by infrasound is speculative (U.S. Fish and Wildlife Service 2010). Infrasound can result in damage to the ears, which may affect the species' ability to hear and may also mask biologically meaningful infrasonic communication between individuals.

Aerial and shore bombardment activities have been conducted at FDM since October 1971. According to the Navy's EIS completed for FDM in 1975, the quantity of ordnance delivered on FDM was approximately 22 tons per month during the peak of training operations during the Vietnam War. These munitions consisted primarily of air-delivered 500 and 750 lb. bombs, but also included approximately sixty 3 in. Naval projectiles fired per month during shore bombardment exercises. Assuming this rate of munitions usage for a period of 42 months (October 1971 through March 1975), approximately 1,019 standard tons of air and surface delivered ordnance was dropped on FDM. The 1975 EIS indicated that training operations at FDM following the Vietnam War effort were likely to reduce loading to 40 tons of aerial munitions delivered per year, with similar shore bombardment totals and the use of four to five air-to-surface “bullpup” missiles per year. The entire land portion of FDM was utilized for aerial and shore bombardment until 1999, when specific impact zones were designated, as well as other protective measures (prohibiting ordnance inert or live ordnance releases north of a “no fire line” and establishing firing direction restrictions) shown in Figure 3.6-5 (U.S. Department of the Navy 2008). The intent of establishing the no fire line was to prohibit any targeting of the relatively higher stature forest located in the northern portion of the island. Between 2005 and 2009, the tonnage of munitions targeted at the impact zones on FDM amounted to an annual average of 214 tons per year, with a decrease to an average of 205 tons per year from 2010 through 2012. The expenditures fluctuate from year to year. It should be noted that the USFWS in 2010 authorized an ordnance assemblage that allowed for 863 tons per year.

The best available data for measuring the impacts of explosives on seabird populations on FDM comes from the helicopter-based surveys for masked booby, red-footed booby, and brown booby. Since 1997, the Navy has conducted these surveys on a monthly basis through 2009 and on a quarterly basis through the present. The population trends (shown in

Figure 3.6-6, Figure 3.6-7, and Figure 3.6-8) show annual and seasonal fluctuations, but relatively stable numbers of individuals for the three booby species over the long-term. Despite the likely injury and mortality to individual seabirds and eggs, and habitat degradation due to the continued military use of FDM, the island continues to be a valuable, important, and productive rookery location in the Mariana archipelago (U.S. Fish and Wildlife Service 2005, Lusk et al. 2000, Reichel 1991).

Other factors associated with the military use of the island may benefit seabirds, such as restricting access to the island and nearshore areas surrounding FDM. FDM and its nearshore area have been an off-limits area to all personnel (both civilian and military) due to safety concerns over unexploded ordnance since 1983, per the lease agreement signed between the U.S. government and the CNMI for military use of the island (United States of America and Commonwealth of the Northern Mariana Islands 1983). Excluding access to land prevents poaching of eggs, a major threat to seabirds identified in the USFWS Pacific Islands Seabird Conservation Plan (U.S. Fish and Wildlife Service 2005). Further, restricting availability of waters from the nearshore of FDM through the issuance of Notices to Mariners (NTM) may decrease fishing pressure and provide refugia for seabird prey species, thereby increasing the availability and ease for seabirds to capture prey near FDM. Further, some degree of habituation to noise generated by munitions use should be expected when the proximity of explosions to seabirds is sufficiently far to not cause injury or death. Based on the continued use of FDM as a breeding location, the relatively stable numbers of individuals of booby species on FDM observed by Navy biologists since the late 1990s, and the varied responses of seabirds to explosions in the literature, some degree of habituation is likely for seabirds at FDM.

Short-tailed albatrosses are rare vagrant migrants that forage in offshore, open ocean waters. Albatrosses forage near the sea surface, utilizing pressure differences created by ocean swells to aid in soaring; they are known to land on islands or offshore rocks. Aviation, ocean, and land training within the MITT Study Area that overlaps areas potentially containing short-tailed albatross includes vessels traveling offshore, ordnance impacting foraging locations, and airspace below 1,000 ft. (305 m).

Short-tailed albatross remains one of the world's most endangered birds (U.S. Fish and Wildlife Service 2008b). Considering the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for interaction with aircraft carriers, especially during the launching or landing of aircraft; however, the probability of direct impacts on individuals or populations remains low. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species.

Hawaiian petrels are also rare migrants that forage in offshore open ocean waters. Petrels forage near the sea surface, and can range 930 mi. (1,500 km) from the Hawaiian Islands, which overlaps with the MITT Study Area; however, the range shrinks for part of the year to surround the Hawaiian Islands. Aviation, ocean, and land training within the MITT Study Area that overlaps with areas potentially containing the Hawaiian petrel includes vessels traveling offshore, ordnance impacting foraging locations (FDM), and airspace below 1,000 ft. (305 m). There have been no observations of Hawaiian petrels at FDM, and other species of the Procellerridae family have not been observed on or around the island. The described training activities would present no measurable chance for interaction with this species. Considering the rarity of this species and the lack of frequent sightings within the MITT Study Area, chances for its potential interactions with training exercises would be extremely low. The probability of direct or indirect impacts on individuals or populations remains low. The spatial and temporal variability of both the occurrence of a Hawaiian petrel and the training activities conducted within offshore locations near foraging areas presents a negligible improbable chance of direct or indirect impact on this species.

Newell's shearwaters are also rare migrants that forage in offshore open ocean waters. These birds forage near the sea surface and can range 1,500 mi. (2,414 km) from the Hawaiian Islands, which overlaps with the MITT Study Area; however, the range shrinks for part of the year to surround the Hawaiian Islands during breeding season (April through November). Ranges for the Newell's shearwater, as with other pelagic seabirds, increase with El Niño events. Aviation, ocean, and land training within the MITT Study Area that overlaps with areas potentially containing the Newell's shearwater includes vessels traveling offshore, ordnance impacting foraging locations (FDM), and airspace below 1,000 ft. (305 m). Although there have been no sightings for the Newell shearwater on FDM, Pratt et al. (1987) reported sightings on Guam, Rota, Saipan, and Tinian; therefore, occurrence at FDM is possible during the non-breeding season (December through March). It should be noted that FDM is far outside the known pelagic range for the Newell's shearwater (see Figure 3.6-9). Considering the rarity of this species and the lack of frequent sightings within the MITT Study Area, chances for its potential interactions with training exercises would be extremely low. The probability of direct impacts on individuals or populations remains low. The spatial and temporal variability of both the occurrence of a Newell's shearwater and the training activities conducted within offshore locations near foraging areas presents an improbable chance of direct or indirect impact on this species.

Masked boobies are expected to forage in pelagic waters that may co-occur with Navy training activities that use explosives. Masked boobies at sea, like other seabirds discussed above, may be subject to injury and death when in close proximity to explosions near the surface, on the surface, or in air. Because of the brief exposure time of explosions at sea, the dispersed locations of Navy training activities that occur in the open ocean, and the availability of pelagic foraging habitats for masked boobies, there is low potential for masked boobies to be subject to the effects of explosives in pelagic foraging habitats. The masked booby has a well-documented breeding history on FDM, an important rookery location for this species. As discussed above, breeding seabirds on FDM including the masked booby would be subject to various forms of sound and pressure waves generated by explosives. Response to these noise types and levels depends on a variety of factors, such as the distance of a masked booby to the explosion and the life stage of the bird. The response types exhibited by the masked booby may include behavioral responses that result in spending excess energy that is not directed towards reproduction; nest exposure, increasing the risk of predation; nest cooling or nest heating, which can result in egg and juvenile mortality; or accidentally kicking eggs or juveniles out of the nest. Direct mortality and injury of masked boobies likely occurs when in close proximity to impact zones on FDM. The preferred breeding areas for this species are not located within the impact zones in the interior portion of the island (see Figure 3.6-5). This species prefers to nest on open or rocky ground often near cliff edges, and Lusk et al. (2000) speculated that the military use of FDM in the interior portions of the island has created additional suitable nesting habitat for this species. Although the masked booby may be subject to short and long-term impacts of explosives use at FDM and individuals likely suffer injury and mortality from explosions, FDM continues to support a relatively stable rookery. Surveys conducted since 1997 by the Navy show periodic and seasonal fluctuations in masked booby populations at FDM, as shown in

Figure 3.6-6, but have remained stable over the monitoring period. Based on the long-term use and stability of the masked booby breeding population on FDM and the wide geographic range and abundance of the masked booby (discussed in Section 3.6.2.11, Masked Booby [*Sula dactylatra*]), the direct and indirect effects of explosions on FDM are unlikely to represent a significant adverse impact on the population of the masked booby.

Great frigatebirds are expected to forage in pelagic waters that may co-occur with Navy training activities that use explosives. Great frigatebirds at sea, like other seabirds discussed above, may be subject to injury and death when in close proximity to explosions near the surface, on the surface, or in air. Because of the brief exposure time of explosions at sea, the dispersed locations of Navy training activities that occur in the open ocean, and the availability of pelagic foraging habitats for great frigatebirds, there is low potential for great frigatebirds to be subject to the effects of explosives in pelagic foraging habitats. Because of the small number of great frigatebirds within the Mariana archipelago relative to other locations (e.g., 20,000 great frigatebirds are estimated to nest in the Hawaiian archipelago), and because great frigatebirds are thought to be most abundant within 50 mi. (80 km) of breeding and roosting sites (U.S. Fish and Wildlife Service 2005), the chances of a great frigatebird subject to explosive impacts associated with Navy training activities at sea is small. Direct mortality and injury of great frigatebirds roosting or breeding likely occurs when in close proximity to impact zones on FDM. Surveys conducted by Navy biologists since 1997 suggest that great frigatebirds may occasionally nest on FDM, and sightings of individuals are generally associated with winter months (U.S. Department of the Navy 2013b). It is possible that military use of FDM since 1971 has degraded nesting habitats for the great frigatebird (this species nests in trees and bushes in nests made out of sticks). Lusk et al. (2000) delineated the small colony along the western coast of FDM (see Figure 3.6-5), but more nesting habitat would likely have been available to the great frigatebird prior to bombing of these interior formerly forested areas. The great frigatebird, however, has likely not bred in the Mariana archipelago in large numbers. Reichel (1991) surveyed available historic estimates for this species, and found only accounts for roosting and, with the exception of Maug, no breeding records in the Mariana archipelago. FDM was not a confirmed breeding site for the great frigatebird until the late 1990s (Lusk et al. 2000). It should be noted that the location of the small colony of frigatebirds identified by Lusk is outside of the closest impact area (Impact Area 2) shown in Figure 3.6-5. Compared to the numbers of great frigatebirds estimated throughout the entire species range (estimated between 500,000 and 1,000,000 birds), and the apparent low numbers of great frigatebirds from historic times through the present, the direct and indirect effects of explosions on FDM would not represent a significant adverse impact on the population of the great frigatebird.

Pursuant to the ESA, the use of explosives during training activities under the No Action Alternative would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosives during training activities under the No Action Alternative would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

The No Action Alternative does not contain any testing activities that use explosives.

3.6.3.1.2.4 Alternative 1

Training Activities

The number of explosive detonations under Alternative 1 would increase over the No Action Alternative. Training would generally occur in the same areas as under the No Action Alternative. Specific training activities using explosives and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Table 3.0-9. Throughout the Study Area, use of explosives would increase from approximately 1,600 explosions under the No Action Alternative to approximately 10,550 explosions. Most of these explosions are from medium-caliber explosive shells, which would occur in waters greater than 12 nm from shore.

In water, training activities using explosives would not typically occur within approximately 3 nm of shore, while lower NEW explosives (up to 20 lb. NEW) would occur at underwater detonation sites at Agat Bay Floating Mine Neutralization Site. Explosives up to 10 lb. NEW would be authorized at Piti Point Floating Mine Neutralization Site and Apra Harbor Underwater Detonation Site.

Appendix A (Training and Testing Activities Descriptions) lists the training activities that use ordnance on FDM. The number of ordnance use on FDM for Alternative 1 is summarized in Table 3.0-22. At FDM, the use of explosive munitions in bombs would increase by a factor of three, and grenades and mortars would increase by a factor of six. Large caliber projectiles with explosive rounds (explosives class E3 [0.6–2.0 lb.]) would increase by approximately 20 percent, while the use of medium caliber projectiles with explosive rounds (explosives class E2 [> 0.25–0.5 lb. NEW]) would decrease by approximately 20 percent, relative to the No Action Alternative. The largest increases proposed under Alternative 1 are with small caliber rounds, a 15-fold increase in small caliber non-explosive rounds. The proposed changes in ordnance use reflect the increased importance of FDM as a training area for close air support type training activities. Although the training mission of FDM would shift toward an emphasis on close air support under Alternative 1, the same training restrictions in place under the No Action Alternative would be implemented. For instance, the live fire and inert range boundaries would remain the same, as would firing direction restrictions to minimize the impact on rookery locations, and the location of the no-fire line would remain the same. In addition, the population trend monitoring for the masked booby, red-footed booby, and brown booby would also continue under Alternative 1.

For the same reasons provided in Section 3.6.3.1.1.1 (No Action Alternative), long-term impacts and potential mortality to a few individuals, and other short-term startle reactions to dispersed training activities that occur in the open ocean, are not expected to result in population-level impacts. ESA-listed seabird species are not known to occur at FDM, therefore, impacts on the short-tailed albatross, Hawaiian petrel, and Newell's shearwater are only possible at sea. These species, however, are rare vagrants in the MITT Study Area. The chances of collocation of activities at sea that use explosives and ESA-listed seabird species transiting the area are negligible. As with the No Action Alternative, explosions on FDM under Alternative 1 may kill or injure individual masked boobies (and other breeding and roosting seabird species) and induce behavioral changes that in turn cause injury or mortality. Based on the long-term use and stability of the masked booby breeding population on FDM and the wide geographic range and abundance of the masked booby (discussed in Section 3.6.2.11, Masked Booby [*Sula dactylatra*]), the direct and indirect effects of explosions on FDM are unlikely to represent a significant adverse impact on the population of the masked booby under Alternative 1. Direct mortality and injury of great frigatebirds roosting or breeding would likely occur under Alternative 1 when a great frigatebird is in close proximity to impact zones on FDM while explosions occur. Compared to the numbers of great frigatebirds estimated throughout the entire species range (estimated between 500,000 and 1,000,000 birds), and the apparent low numbers of great frigatebirds from historic times through the present, the direct and indirect effects explosions on FDM would not represent a significant adverse impact on the population of the great frigatebird under Alternative 1.

Pursuant to the ESA, the use of explosives during training activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosives during training activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Alternative 1 would introduce activities that use explosives as part of air to surface missile testing, anti-submarine warfare tracking testing (using Maritime Patrol Aircraft and sonobuoys), torpedo testing, mine countermeasure (MCM) mission package testing, anti-surface warfare mission package testing, kinetic energy weapon testing (also known as the rail gun), and swimmer defense and diver deterrent testing activities. All explosives used in testing activities occur at sea. Therefore, this device is not expected to result in any impacts on marine birds and will not be further analyzed in this document. The number of activities and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Table 3.0-8.

While the impacts of explosions on seabirds under Alternative 1 cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. Detonations of torpedoes during testing activities may employ static targets that attract seabirds to the detonation site or fish kills from multiple detonations that attract seabirds to possible fish kills could be more likely to kill or injure seabirds. Any impacts related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent. Because testing activities that use explosives would consist of a limited number of detonations, exposures would not occur over long durations, and activities occur at varying locations, it is expected there would be an opportunity to recover from an incurred energetic cost and individual birds would not be repeatedly exposed to explosive detonations. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected.

Short-tailed albatrosses, Hawaiian petrels, and Newell's shearwaters are rare vagrants in the MITT Study Area. The southern portion of the short-tailed albatross range is likely the northern edge of the North Equatorial Current, which overlaps with the MITT Study Area. The ranges of the Hawaiian petrel and Newell's shearwater overlap with the MITT Study Area outside of these species' breeding seasons. They are considered rare vagrant migrants in the MITT Study Area, foraging in offshore, open ocean waters. Testing activities that use explosives have the potential to intersect with transiting short-tailed albatrosses through testing areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with testing activities would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for interaction with vessels involved in testing activities that use explosives. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the testing activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). As with the short-tailed albatross, the rarity of Hawaiian petrels and Newell's shearwaters within the MITT Study Area and the lack of frequent sightings, chances for potential interactions with testing activities that use explosives would be extremely low. None of the testing activities proposed under Alternative 1 involve land training areas; therefore, there would be no impacts on seabirds that nest and roost on FDM or other rookery locations within the Marianas. Masked boobies, great frigatebirds, and other species that visit, roost, or breed within the Study Area would only be exposed to explosions used during testing activities in the open ocean. Because of the availability of pelagic foraging grounds, a tendency for seabirds to use nearshore environments where large explosions are not used as part of testing activities, the widely dispersed locations of testing activities that use explosions, and the widely dispersed locations of seabirds within the Study Area, the chances of injury or harm to seabirds is extremely low. Any mortality or injury of individual seabirds would not represent a significant adverse impact on any population of seabird species.

Under the ESA, the use of explosives during testing activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosives during testing activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.1.2.5 Alternative 2

<u>Training Activities</u>

The number of specific training activities under Alternative 2 using explosives and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Table 3.0-9. Throughout the Study Area, use of explosives under Alternative 2 would increase from approximately 1,600 explosions under the No Action Alternative to approximately 10,800 explosions. Alternative 2 would increase the total number of explosive events by about 300 explosions. As with Alternative 1, most of these explosions are from medium-caliber explosive shells, which would occur in waters greater than 12 nm from shore.

In water, training activities using explosives would not typically occur within approximately 3 nm of shore, while lower NEW explosives (up to 20 lb. NEW) would occur at underwater detonation sites at Agat Bay Floating Mine Neutralization Site. Explosives up to 10 lb. NEW would be authorized at Piti Point Floating Mine Neutralization Site and Apra Harbor Underwater Detonation Site.

Appendix A (Training and Testing Activities Descriptions) lists the training activities that use ordnance on FDM. The number of ordnance use on FDM is summarized in Table 3.0-22. At FDM, the use of explosive munitions in bombs would increase by a factor of three, and grenades and mortars would increase by a factor of six. Large caliber projectiles with explosive rounds (explosives class E3 [0.6 to 2.0 lb.]) would increase by approximately 20 percent, while the use of medium caliber projectiles with explosive rounds (explosives class E2 [> 0.25–0.5 lb. NEW]) would decrease by approximately 20 percent, relative to the No Action Alternative. The largest increases proposed under Alternative 2 are with small caliber rounds, a 15-fold increase in small caliber non-explosive rounds. The proposed changes in ordnance use reflect the increased importance of FDM as a training area for close air support type training activities.

Although the impacts on birds are expected to increase under Alternative 2 compared to the No Action Alternative, the expected impacts on any individual bird would remain the same. For the same reasons provided in Section 3.6.3.1.1.1 (No Action Alternative), long-term impacts and potential mortality to a few individuals, and other short-term startle reactions to dispersed training activities, are not expected to result in population-level impacts.

ESA-listed seabird species are not known to occur at FDM, therefore, impacts on the short-tailed albatross, Hawaiian petrel, and Newell's shearwater are only possible at sea. These species, however, are rare vagrants in the MITT Study Area. The chances of collocation of activities at sea that use explosives and ESA-listed seabird species transiting the area are negligible. As with the No Action Alternative and Alternative 1, explosions on FDM under Alternative 2 may kill or injure individual masked boobies (and other breeding and roosting seabird species) and induce behavioral changes that in turn cause injury or mortality. Based on the long-term use and stability of the masked booby breeding population on FDM and the wide geographic range and abundance of the masked booby (discussed in Section 3.6.2.11, Masked Booby [*Sula dactylatra*]), the direct and indirect effects of explosions on FDM are unlikely to represent a significant adverse impact on the population of the masked booby under Alternative 2. Direct mortality and injury of great frigatebirds roosting or breeding would likely occur under Alternative 2 when a great frigatebird is in close proximity to impact zones on FDM while explosions occur. Compared to the numbers of great frigatebirds estimated throughout the entire species range (estimated between 500,000 and 1,000,000 birds), and the apparent low numbers of great frigatebirds from historic times through the present, the direct and indirect effects of explosions on FDM would not represent a significant adverse impact on the population of the great frigatebird under Alternative 2.

Pursuant to the ESA, the use of explosives during training activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosives during training activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

As with Alternative 1, Alternative 2 would introduce activities that use explosives as part of air to surface missile testing, anti-submarine warfare tracking testing (using Maritime Patrol Aircraft and sonobuoys), torpedo testing, MCM mission package testing, kinetic energy weapon testing, and anti-surface warfare mission package testing. All explosions used in testing activities occur at sea. The number of specific activities and their proposed locations are presented in Tables 2.8-2 and 2.8-3 of Chapter 2 (Description of Proposed Action and Alternatives). Use of explosives and the number of detonations in each source class are provided in Table 3.0-9. Compared to Alternative 1, Alternative 2 testing activities require more explosives, and most of the increases are in relatively small explosive classes between 0.1 and 5 lb. NEW.

While the impacts of explosions on seabirds under Alternative 2 cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. Detonations of torpedoes during testing activities may employ static targets that attract seabirds to the detonation site or fish kills from multiple detonations that attract seabirds to possible fish kills could be more likely to cause kill or injure seabirds. Any impacts related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent. Because testing activities that use explosives would consist of a limited number of detonations, exposures would not occur over long durations, and activities occur at varying locations, it is expected there would be an opportunity to recover from an incurred energetic cost and individual birds would not be repeatedly exposed to explosive detonations. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected.

Short-tailed albatrosses, Hawaiian petrels, and Newell’s shearwaters are rare vagrants in the MITT Study Area. The southern portion of the short-tailed albatross range is likely the northern edge of the North Equatorial Current, which overlaps with the MITT Study Area. The ranges of the Hawaiian petrel and Newell’s shearwater overlap with MITT Study Area outside of these species’ breeding seasons, are rare vagrant migrants that forage in offshore, open ocean waters. Testing activities that use explosives have the potential to intersect with transiting short-tailed albatrosses through training areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with testing exercises would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for interaction with vessels involved in testing activities that use explosives. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the testing activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell’s shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). As with the short-tailed albatross, the rarity of Hawaiian petrels and Newell’s shearwaters within the MITT Study Area and the lack of frequent sightings, chances for potential interactions with testing activities would be extremely low.

Pursuant to the ESA, the use of explosives during testing activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosives during testing activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.1.3 Impacts from Aircraft and Vessel Noise

Various types of fixed-wing aircraft, helicopters, and vessels are used in most training and testing activities throughout the Study Area. Therefore, seabirds and other migratory birds could be exposed to airborne noise associated with fixed-wing aircraft overflights (subsonic and supersonic), helicopter activities, and vessels throughout the Study Area. See Section 3.0.5.3 (Identification of Stressors for Analysis) for a description of aircraft noise generated during training and testing activities.

3.6.3.1.3.1 Fixed-Wing Aircraft

Responses to airborne noise could include short-term behavioral or physiological reactions, such as alert response, startle response, or temporary increase in heart rate, which are likely to be more acute for sonic boom exposures. Maximum behavioral responses by crested tern (*Sterna bergii*) to aircraft noise were observed at sound level exposures greater than 85 dBA re 20 µPa. While the experiment provided good control on simulated aircraft noise levels, preliminary observations of tern colonies responses to balloon overflights suggest that visual stimulus is likely to be an important component of disturbance from overflights (Brown 1990). Raptor and wading bird species have responded minimally to jet (100–110 dBA re 20 µPa) and propeller plane (92 dBA re 20 µPa) overflights, respectively (Ellis 1981). Jet flights greater than 1,640 ft. (500 m) distance from raptors were observed to elicit no response (Ellis 1981). However, herring gulls (*Larus argentatus*) significantly increased their aggressive interactions within the colony and their flights over the colony during overflights with received sound levels of 101–116 dBA re 20 µPa (Burger 1981). The impacts of low-level military training flights on wading bird colonies in Florida were estimated using colony distributions and turnover rates. There were no demonstrated impacts of military activity on wading bird colony establishment or size (Black et al. 1984). Fixed-winged jet aircraft disturbance did not seem to adversely affect waterfowl observed during a study in coastal North Carolina (Conomy et al. 1998).

Most activities using fixed-wing aircraft occur at distances greater than 12 nm offshore. Birds could be exposed to elevated noise levels while foraging or migrating in these open water environments. Most fixed-wing sorties would occur greater than 3,000 ft. (915 m) altitude and would be associated with air combat maneuver training, tracking exercises, and aircraft testing. Typical altitudes would range from 5,000 to 30,000 ft. (1,524 to 9,144 m), and typical airspeeds would range from very low (less than 100 knots) to high subsonic (less than 600 knots). Sound exposure levels at the sea surface from most air combat maneuver overflights are expected to be less than 85 dBA re 1 µPa, based on an F/A-18 aircraft flying at an altitude of 5,000 ft. (1,524 m) and at a subsonic airspeed of 400 knots. Exceptions include sorties associated with air-to-surface ordnance delivery and sonobuoy drops from 500 to 5,000 ft. (152 to 1,524 m) altitude. Bird exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead. Noise from fixed-wing aircraft at airfields (e.g., military airfields on Guam, Tinian North Field, and use of Saipan International Airport) may displace migrating shorebirds from wintering habitat because these species often favor open grasslands and paved surfaces associated with tarmacs.

Some air combat maneuver training would involve high altitude, supersonic flight, which would produce sonic booms, but such airspeeds would be infrequent. Boom duration is generally less than 300 milliseconds. Sonic booms would cause birds to startle, but the exposure would be brief, and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or at worst, a flight response. Because most fixed-wing flights are not supersonic and both seabirds and aircraft are transient in any area, exposure of seabirds in the open ocean to sonic booms would be infrequent. It is unlikely that individual seabirds would be repeatedly exposed to sonic booms in the open ocean.

Birds could sensitize or habituate to repeated exposures to sonic booms and aircraft noise. Habituation seems unlikely in the open water portions of the Study Area given the widely dispersed nature of the operations and the relative infrequency of the activities. Repeated exposures could occur to populations that are not transient, such as nesting birds. It is possible that birds could habituate and no longer exhibit behavioral responses, as has been documented for some impulse noise sources (Ellis 1981, Russel Jr. et al. 1996) and aircraft noise (Conomy et al. 1998). It is also possible that birds could sensitize from routinely flushing when hearing the noise to completely abandoning an area. Austin et al. (1970) reported near-total nest failure of sooty terns nesting in the Dry Tortugas islands within the Navy's Key West Range Complex in the Gulf of Mexico. Birds in this area were regularly exposed to sonic booms during the 1969 nesting season. In previous seasons, the birds were reported to react to the occasional sonic booms by rising immediately in a "panic flight," circling over the island, and then usually settling down on their eggs again. Researchers had no evidence that sonic booms caused physical damage to the sooty tern eggs, but hypothesized that the strong booms occurred often enough to disturb the sooty terns' incubating rhythm and cause nest desertion. The 1969 sooty tern nesting failure also prompted additional research to test the hypothesis that sonic booms could cause bird eggs to crack or otherwise affect bird eggs or embryos. However, the findings of the additional research were contrary to this hypothesis (Bowles et al. 1991, Bowles et al. 1994, Teer and Truett 1973, Ting et al. 2002). That same year, the colony also contained approximately 2,500 brown noddies, whose young hatched successfully. While it was impossible to conclusively determine the cause of the 1969 sooty tern nesting failure, actions were taken to curb planes breaking the sound barrier within range of the Tortugas, and much of the excess vegetation was cleared (another hypothesized contributing factor to the nesting failure). Similar nesting failures have not been reported since the 1969 failure.

3.6.3.1.3.2 Helicopters

Unlike fixed-wing aircraft, helicopters typically operate below 1,000 ft. (305 m) altitude and often as low as 75–100 ft. (23–30 m) altitude. This low altitude increases the likelihood that birds would respond to noise from helicopter overflights. Helicopters travel at slower speeds (less than 100 knots), which increases durations of noise exposure compared to fixed-wing aircraft. In addition, some studies have suggested that birds respond more to noise from helicopters than from fixed-wing aircraft (Larkin et al. 1996). Helicopter flights are generally limited to locations closer to the coast, unless deployed onboard ships. Helicopter flights, therefore, are more likely to impact greater numbers of seabirds that forage in coastal areas than those that forage in open ocean areas. Nearshore areas of the coast are the primary foraging habitat for many seabird species. Noise from low-altitude helicopter overflights may elicit short-term behavioral or physiological responses, such as alert responses, startle responses, or temporary increases in heart rate, in exposed birds.

Touch-and-go landings, bombing runs, and helicopter sorties are impulse activities that repeat at short enough intervals to constitute a continuous exposure. In a literature review of waterfowl response to aircraft, avian response to aircraft was (cautiously) generalized as more intense with helicopters than fixed-wing aircraft, and stronger with slower fixed-wing aircraft than fast fixed-wing aircraft (Plumpton et al. 2006). Increasing horizontal distance resulted in lower response than increasing altitude (Plumpton et al. 2006). Raptors have varied behaviors in response to helicopters and responded similarly to explosions: by remaining on a nest, flushing from an area, and attacking the helicopter. American black ducks (*Anas rubripes*) reacted to 39 percent of military aircraft overflights on their first day of exposure, but after 2 weeks, they responded only 6 percent of the time (Conomy et al. 1998). However, wood ducks (*Aix sponsa*) in the same study continued to respond to aircraft noise (Conomy et al. 1998). Survival of captive black duck chicks was lower in a noisy area than control area; however adults were largely unaffected. Sandhill cranes (*Grus canadensis*) were noted to stay on their nests when helicopter activity was within 131 ft. (40 m) above them and bald eagles remained on their nests until helicopters approached closely (distance not defined). On FDM, adult birds (presumably various species of seabirds) flushed from their nests in response to helicopter landings; however, some returned to their nests within 15 minutes after the disturbance stopped (Lusk et al. 2000).

Foraging marine birds (seabirds, shorebirds, and other birds that use the marine environment) would be present below the altitude of fixed-wing flights, but could potentially be exposed to nearby noise from helicopters at lower altitudes. Altitudes at which birds fly can vary greatly based on the type of bird, where they are flying (over water or over land), and other factors such as weather. Approximately 95 percent of bird flight during migrations occurs below 10,000 ft. (3,048 m) with the majority below 3,000 ft. (915 m) (Lincoln et al. 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. (152 m) and 1,000 ft. (305 m). Aircraft noise from helicopters at airfields (e.g., military airfields on Guam and Tinian North Field, and use of Saipan International Airport) may displace migrating shorebirds from wintering habitat because these species often favor open grasslands and paved surfaces associated with tarmacs.

3.6.3.1.3.3 Vessels

Naval combat vessels are designed to be quiet to avoid detection; therefore, any disturbance to birds is expected to be due to visual, rather than acoustic, stressors. Other training and testing support vessels, such as rigid hull inflatable boats, use outboard engines that can produce substantially more noise even though they are much smaller than warships. Noise due to watercraft with outboard engines or noise produced by larger vessels operating at high speeds may briefly disturb some birds while foraging or resting at the water surface. However, the responses due to both acoustic and visual exposures are likely related and difficult to distinguish. Although loud, sudden noises can startle and flush birds, Navy vessels are not expected to result in major acoustic disturbance of seabirds in the Study Area. Noise from Navy vessels is similar to or less than those of the general maritime environment. Birds respond to the physical presence of a vessel, regardless of the associated noise. The potential is very low for noise generated by Navy vessels to impact seabirds, and such noise would not result in major impacts on seabird populations.

3.6.3.1.3.4 No Action Alternative

Training Activities

Training activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights and vessel movements throughout the Study Area. Most helicopter training would occur adjacent to areas at Naval Base Guam Apra Harbor, Andersen Air Force Base, Tinian landing beaches, and some transits to FDM and to training areas and drop zones at sea.

Birds using wetlands, mud flats, beaches, and other shoreline habitats or shallow coastal foraging areas would be exposed to noise from nearshore helicopter training and aircraft in transit to offshore training areas. The presence of dense aggregations of sea ducks, other seabirds, and migrating land birds is a potential concern during low-altitude helicopter activities. Although birds may be more likely to react to helicopters than to fixed-wing aircraft, Navy helicopter pilots avoid large flocks of birds to protect aircrews and equipment, thereby reducing disturbance to birds as well.

Pelagic seabirds within the Study Area that forage offshore may have greater presence where currents converge and upwellings attract prey to a concentrated area. In these productive areas aircraft overflights may cause more behavioral disturbances in these areas. A seabird in the open ocean would be exposed for a few seconds to fixed-wing aircraft noise as the aircraft quickly passes overhead. Seabirds foraging or migrating through a training area in the open ocean may respond by avoiding areas of concentrated aircraft noise. Exposures to most seabirds would be infrequent, based on the brief duration and dispersed nature of the overflights.

Although noise associated with vessel movements would be produced during most sea-based training activities, the most acute noise exposure would be expected from small craft using outboard engines. Any vessel noise disturbance is expected to be very brief and inconsequential. Any reactions may be due more to visual detection of an approaching vessel than to acoustic disturbance.

Occasional startle or alert reactions to aircraft and vessels are not likely to disrupt major behavior patterns (such as migrating, breeding, feeding, and sheltering) or to result in serious injury to any seabirds. Helicopter overflights would be more likely to elicit responses than fixed-wing aircraft, but the general health of individual birds would not be compromised. For these reasons, the impact of noise produced by aircraft and vessels on seabirds under the No Action Alternative would be minor and short-term. Short-term impacts on individual birds are not expected to impact seabird populations.

Seabirds and shorebirds birds may be exposed to sonic booms infrequently while flying or foraging in the Study Area or while feeding, perching, or nesting on FDM. Anecdotally, birds typically take flight while roosting or nesting during quarterly helicopter-based booby population surveys over FDM; birds that are stationary and not on the wing are counted (U.S. Department of the Navy 2013b). Although no studies are available specific to seabird responses to low-level overflights over FDM, other studies of shorebird responses to military aircraft overflights are helpful. Black, et al. (1984), studied the effects of low-altitude (less than 500 ft. [152 m] above ground level) military training flights with sound levels from 55 to 100 dBA on wading bird colonies (i.e., great egret, snowy egret, tricolored heron, and little blue heron). The training flights involved three or four aircraft, which occurred once or twice per day. This study concluded that the reproductive activity—including nest success, nestling survival, and nestling chronology—was independent of F-16 overflights. Dependent variables were more strongly related to ecological factors, including location and physical characteristics of the colony and climatology. Another study on the effects of circling fixed-wing aircraft and helicopter overflights on wading bird colonies found that at altitudes of 195 ft. (59 m) to 390 ft. (119 m), there was no reaction in nearly 75 percent of the 220 observations. Ninety percent displayed no reaction or merely looked toward the direction of the noise source. Another 6 percent stood up, 3 percent walked from the nest, and 2 percent flushed (but were without active nests) and returned within 5 minutes (Kushlan 1978). These studies, coupled with anecdotal observations on FDM during quarterly seabird monitoring surveys, suggest that aircraft overflights do not have harmful effects on nesting and roosting seabirds on FDM, and that the behavioral responses are short term. Chronic stress, nest abandonment, or population-level impacts are not expected to occur. It should be noted that population trends of the masked booby, red-footed booby, and brown booby have experienced seasonal and annual fluctuations, but the long term trends for these species have remained stable (U.S. Department of the Navy 2013b).

Short-tailed albatrosses, Hawaiian petrels, and Newell's shearwaters are rare vagrants in the MITT Study Area. The southern portion of the short-tailed albatross range is likely the northern edge of the North Equatorial Current, which overlaps with the MITT Study Area. The ranges of the Hawaiian petrel and Newell's shearwater overlap with MITT Study Area outside of these species' breeding seasons, are rare vagrant migrants that forage in offshore, open ocean waters. Aviation training under 1,000 ft. (305 m) and vessels may intersect with transiting short-tailed albatrosses through training areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. Further, albatrosses use dynamic soaring, a technique of flying close to the water surface that takes advantage of the wave fronts. The birds surge forward just ahead of a wave, then climb before the wave dips (Pennycuick 1982). The sound of the waves and soaring close to the wave front would likely make aircraft noise unnoticeable. Further, with the exception of helicopter-based search and rescue training activities, a helicopter flying at wave height is unlikely to continue to generate noise for any lengthy period. Birds of this family follow wakes of ships, slightly increasing the potential for interaction with aircraft carriers, especially during the launching or landing of aircraft; however, the probability of direct impacts on individuals or populations remains low. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). Aviation training under 1,000 ft. (305 m) and vessels may intersect with transiting Newell's shearwaters and Hawaiian petrels through training areas. Because of the rarity of these species in general and the lack of frequent sightings within the Study Area, chances of potential interactions with training exercises would be extremely low.

Pursuant to the ESA, aircraft and vessel noise generated during training activities under the No Action Alternative would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), aircraft and vessel noise generated during training activities under the No Action Alternative would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

As described in Table 2.4-4, the No Action Alternative includes one annual testing event conducted by the Office of Naval Research, which is a continuation of a series of experiments for the North Pacific Acoustic Laboratory Philippine Sea Experiment. The intent of these experiments is to study deep-water acoustic propagation and ambient sound in the northern Philippine Sea. Completion of these experiments involves the use of surface and subsurface vessels. No aircraft are used as part of this testing activity.

Pursuant to the ESA, vessel noise generated during testing activities under the No Action Alternative would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), vessel noise generated during testing activities under the No Action Alternative would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.1.3.5 Alternative 1

Training Activities

Training activities under Alternative 1 would increase fixed- and rotary-wing aircraft overflights and vessel movements throughout the Study Area. Specific activities associated with aircraft overflights are listed in Table 2.8-1. Most helicopter training would occur adjacent to areas at Naval Base Guam Apra Harbor, Andersen Air Force Base, Tinian landing beaches, and some transits to FDM and to training areas and drop zones at sea. Concentrations of vessel movements throughout the Study Area are discussed in Section 3.0.5.3.1.5 (Vessel Noise).

Although noise associated with vessel movements would be produced during most sea-based training activities, the most acute noise exposure would be expected from small craft using outboard engines. Any vessel noise disturbance is expected to be very brief and inconsequential. Any reactions may be due more to visual detection of an approaching vessel than to acoustic disturbance.

Under Alternative 1, seabirds and migratory birds may be exposed to more sonic booms infrequently while flying or foraging in the Study Area or while feeding, perching, or nesting on FDM. Seabirds that roost and breed on FDM would be exposed to more noise from overflights, especially from aircraft used in close air support training activities. At FDM, the number of fixed-wing sorties would increase by a factor of five and rotary wing sorties would increase by 33 percent, relative to the No Action Alternative. The expected duration of each exposure would likely last a few seconds as the aircraft conducts reconnaissance, targeting, and weapons firing (for close air support, the typical munitions would be small- and medium-caliber rounds). Aircraft overflights are expected to elicit short-term behavioral responses in nesting birds at FDM. Based on studies from other nesting bird areas, any period away from the nest would last a few seconds to a few minutes, which is likely not long enough for opportunistic predation of a nest, for example, by rats on FDM.

Occasional startle or alert reactions to aircraft and vessels are not likely to disrupt major behavior patterns (such as migrating, breeding, feeding, and sheltering) or to result in serious injury to any seabirds. Helicopter overflights would be more likely to elicit responses than fixed-wing aircraft, but the general health of individual birds would not be compromised. For these reasons, the impact of noise produced by Navy aircraft and vessels on seabirds under Alternative 1 would be minor and short-term. Short-term impacts on individual birds are not expected to impact seabird populations.

Short-tailed albatrosses, Hawaiian petrels, and Newell's shearwaters are rare vagrants in the MITT Study Area. The southern portion of the short-tailed albatross range is likely the northern edge of the North Equatorial Current, which overlaps with the MITT Study Area. The ranges of the Hawaiian petrel and Newell's shearwater overlap with MITT Study Area outside of these species' breeding seasons, are rare vagrant migrants that forage in offshore, open ocean waters. Aviation training under 1,000 ft. (305 m) and vessels may intersect with transiting short-tailed albatrosses through training areas. Because of the rarity of these species in general and the lack of frequent sightings within the Study Area, chances of potential interactions with training exercises would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for interaction with aircraft carriers, especially during the launching or landing of aircraft; however, the probability of direct impacts on individuals or populations remains low. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). Aviation training under 1,000 ft. (305 m) and vessels may intersect with transiting Newell's shearwaters and Hawaiian petrels through training areas. Because of the rarity of these species in general and the lack of frequent sightings within the Study Area, chances of potential interactions with training exercises would be extremely low.

Pursuant to the ESA, aircraft and vessel noise generated during training activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), aircraft and vessel noise generated during training activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

New vessels proposed for testing under Alternative 1, such as the Littoral Combat Ship, are all fast-moving and designed to operate in nearshore waters. Overall sound levels may increase in these environments. The number of specific activities and proposed locations are discussed in further detail in Tables 2.8-2 and 2.8-4 of Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.5.3.1.5 (Vessel Noise), and Section 3.0.5.3.1.6 (Aircraft Overflight Noise).

Under Alternative 1, 159 activities involving vessel movements are proposed. The testing activities under the No Action Alternative only require one activity per year involving vessel movements. Under Alternative 1, 320 activities involving aircraft movements are proposed, compared to no events under the No Action Alternative. Nearshore waters around rookery and roosting locations will likely support the highest number of seabirds. The response to aircraft and vessel noise would be limited to short-term behavioral responses (moving to a different foraging area, or cessation of foraging activities). It should be noted that the majority of these nearshore testing activities would likely occur around Guam because of the close proximity to Apra Harbor. The high-speed nearshore vessel mission package testing would not occur in nearshore waters adjacent to important rookery locations (e.g., rookery locations on northern islands, FDM, I'Chenchon Bird Sanctuary on Rota). Similarly, there are no testing activities involving aircraft that would fly at altitudes sufficiently low to disturb birds at these rookery locations, including FDM.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). Aviation testing under 1,000 ft. (305 m) and vessels may intersect with transiting Newell's shearwaters and Hawaiian petrels through training areas. Because of the rarity of these species in general and the lack of frequent sightings within the MITT Study Area, chances of potential interactions with testing exercises would be extremely low.

Pursuant to the ESA, aircraft and vessel noise generated during testing activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), aircraft and vessel noise generated during testing activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.1.3.6 Alternative 2

Training Activities

The location of training activities under Alternative 2 is identical to training activities under Alternative 1. There are only slight increases in aircraft and vessel movements compared to Alternative 1; therefore, impacts and comparisons to the No Action Alternative would also be identical to those described in Section 3.6.3.1.3.5 (Alternative 1). Under Alternative 2, marine birds may be exposed to more sonic booms infrequently while flying or foraging in the Study Area or while feeding, perching, or nesting on FDM. Seabirds that roost and breed on FDM would be exposed to more noise from overflights, especially from aircraft used in close air support training activities. At FDM, the number of fixed-wing sorties would increase by a factor of five and rotary wing sorties would increase by 33 percent, relative to the No Action Alternative. The expected duration of each exposure would likely last a few seconds as the aircraft conducts reconnaissance, targeting, and weapons firing (for close air support, the typical munitions would be small- and medium-caliber rounds). Aircraft overflights are expected to elicit short-term behavioral responses in nesting birds at FDM. Based on studies from other nesting bird areas, any period away from the nest would last a few seconds to a few minutes, which is likely not long enough for opportunistic predation of a nest, for example, by rats on FDM. The known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). Aviation testing under 1,000 ft. (305 m) and vessels may intersect with transiting Newell's shearwaters and Hawaiian petrels through training areas under Alternative 2. Aircraft and vessel noise would have no effect on ESA-listed seabird species. This conclusion is based on the rare occurrence of these species within the MITT Study Area, and absence from breeding grounds and rookery sites located within the Study Area, particularly at FDM. This conclusion is consistent with the 2010 Biological Opinion issued by the USFWS Pacific Island Field Office for training within the MIRC.

Pursuant to the ESA, aircraft and vessel noise generated during training activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), aircraft and vessel noise generated during training activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Testing activities proposed under Alternative 2 would increase aircraft flights and vessel movements compared to both the No Action Alternative and Alternative 1, leading to an increase in aircraft- and vessel-related noise in some portions of the Study Area. Under Alternative 2, 181 activities involving vessel movements are proposed. The testing activities under the No Action Alternative include only one activity per year involving vessel movements. Under Alternative 2, 362 activities involving aircraft movements are proposed, compared to no events under the No Action Alternative. Although overall aircraft and vessel noise would increase over the No Action Alternative, impacts on individual birds would be similar. Based on the increased activities under Alternative 2, more birds could be exposed to sound; the number of times an individual bird is exposed could also increase. Similar to the No Action Alternative for training, the responses would be limited to short-term behavioral or physiological reactions, and the general health of individual birds would not be compromised. Short-term impacts on individual birds are not expected to impact seabird populations. Although noise due to aircraft and vessels would increase over Alternative 1, the types of impacts on short-tailed albatrosses, Hawaiian petrels, Newell's shearwater, masked boobies, great frigatebirds, and other marine bird species that visit and breed within the Study Area would be no different from those under Alternative 1.

Pursuant to the ESA, aircraft and vessel noise generated during testing activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), aircraft and vessel noise generated during testing activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from electromagnetic devices.

3.6.3.2.1 Impacts from Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities throughout the Study Area, as described in Chapter 2 (Description of Proposed Action and Alternatives). Electromagnetic training and testing activities include an array of magnetic sensors used in MCM operations in the Study Area. Some electromagnetic devices, such as a vessel radar and radio, are devices that could impact seabirds above the water. Towed electromagnetic device impacts on seabirds would only occur underwater and would only impact diving species or species on the surface in the immediate area where the device is deployed. There is no information available on how birds react to electromagnetic fields underwater.

Electromagnetic devices are used primarily in towed-mine neutralization and port security training. Similar testing activities include the use of electromagnetic devices (e.g., mine detection/neutralization and electromagnetic activities [e.g., Littoral Combat Ship mission package testing. In most cases, such as mine detection/neutralization, the device simply mimics the electromagnetic signature of a vessel passing through the water. None of the devices emit any type of electromagnetic "pulse." The kinetic energy weapon is also included as an electromagnetic testing activity. As stated previously, electromagnetic energy is not analyzed for impacts on marine birds because the electromagnetic energy generated for this testing activity is confined to the ship and will not impact marine birds.

Seabirds and other migratory birds are known to use the Earth's magnetic field as a navigational cue during seasonal migrations (Akesson and Hedenstrom 2007, Fisher 1971, Wiltschko and Wiltschko 2003). Birds use numerous other orientation cues to navigate in addition to magnetic fields. These include position of the sun, celestial cues, visual cues, wind direction, and scent (Akesson and Hedenstrom 2007, Fisher 1971, Haftorn et al. 1988, Wiltschko and Wiltschko 2003). It is believed that by using a combination of these cues birds are able to successfully navigate long distances. A magnetite-based (magnetic mineral) receptor mechanism in the upper beak of birds provides information on position and compass direction (Wiltschko and Wiltschko 2003). Electromagnetic devices send out electromagnetic signals into the environment to which birds are able to detect and respond.

Some electromagnetic devices such as a vessel radar and radio are devices that could impact birds above the water. Towed electromagnetic device impacts on birds would only occur underwater and would only impact diving species or species on the surface in the immediate area where the device is deployed. There is no information available on how birds react to electromagnetic fields underwater.

Studies conducted on electromagnetic sensitivity in birds have typically been associated with land, and little information exists specifically on seabird response to electromagnetic changes at sea. Results from a study conducted by Larkin and Sutherland (1977) showed that during nocturnal flights, birds were capable of sensing electromagnetic fields emitted from an antenna in Wisconsin used for the Navy's Project Seafarer. This study suggests that birds reacted to low intensity electromagnetic fields and changed their flight altitudes more frequently when the antenna was operational. Another study on the effects of extremely low-frequency electromagnetic fields on breeding and migrating birds around the Navy's extra-low-frequency communication system antenna in Wisconsin found no evidence that bird distribution or abundance was impacted by electromagnetic fields produced by the antenna (Hanowski et al. 1993).

Possible impacts on birds from electromagnetic fields above water include behavioral responses such as temporary disorientation and change in flight direction (Larkin and Sutherland 1977, Wiltschko and Wiltschko 2003) and flight altitude (Larkin and Sutherland 1977). Many bird species return to the same stopover, wintering, and breeding areas every year and often follow the exact same or very similar migration routes (Akesson and Hedenstrom 2007). However, ample evidence exists that displaced birds can successfully reorient and find their way when one or more cues are removed (Haftorn et al. 1988). For example, Haftorn et al. (1988) found that after removal from their nests and release into a different area, snow petrels (*Pagodrama nivea*) were able to successfully navigate back to their nests even when their ability to smell was removed. Furthermore, Wiltschko and Wiltschko (2003) report that electromagnetic pulses administered to birds during an experimental study on orientation do not deactivate the magnetite-based receptor mechanism in the upper beak altogether but instead cause the receptors to provide altered information, which in turn causes birds to orient in different directions. However, these impacts were temporary, and the ability of the birds to correctly orient themselves eventually returned.

3.6.3.2.1.1 No Action Alternative

Training Activities

Under the No Action Alternative, there are no training activities that involve the use of electromagnetic devices.

Testing Activities

Under the No Action Alternative, there are no testing activities that involve the use of electromagnetic devices.

3.6.3.2.1.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), training activities involving electromagnetic devices under Alternative 1 occur up to five times annually as part of Mine Countermeasure Exercise – Towed Sonar exercises and Civilian Port Defense activities. Table 2.8-1 lists the number and location of training activities that use electromagnetic devices. Exposure of birds would be limited to those foraging at or below the surface (e.g., terns, cormorants, loons, petrels, or grebes) because that is where the devices are used. Birds that forage inshore or located at FDM or other rookery locations in the Mariana archipelago would not be exposed to these electromagnetic stressors because electromagnetic devices are not used in areas close to shore and are used only underwater. Also, the electromagnetic fields generated would be distributed over time and location, and any influence on the surrounding environment would be temporary and localized. More importantly, the electromagnetic devices used are typically towed by a helicopter, and it is likely that any birds in the vicinity of the approaching helicopter would be dispersed by the sound and disturbance generated by the helicopter (Section 3.6.3.1.3, Impacts from Aircraft and Vessel Noise) and move away from the device before any exposure could occur.

In the unlikely event that a bird is temporarily disoriented by an electromagnetic device, it would still be able to re-orient using their internal magnetic compass to aid in navigation (Wiltschko et al. 2011). Therefore, any temporary disorientation experienced by birds from electromagnetic changes caused by training activities in the Study Area may be considered a short-term impact and would not hinder bird navigation abilities. Impacts on birds from potential exposure to electromagnetic fields would be temporary and inconsequential based on:

- Relatively low intensity of the magnetic fields generated (0.2 microtesla at 656 ft. [200 m] from the source)
- Very localized potential impact area
- Temporary duration of the activities (hours)
- Occurring only underwater

Short-tailed albatrosses, Hawaiian petrels, and Newell’s shearwaters are rare vagrants in the MITT Study Area. The southern portion of the short-tailed albatross range is likely the northern edge of the North Equatorial Current, which overlaps with the MITT Study Area. The ranges of the Hawaiian petrel and Newell’s shearwater overlap with MITT Study Area outside of these species’ breeding seasons, are rare vagrant migrants that forage in offshore, open ocean waters.

Vessels and aircraft which deploy devices that generate electromagnetic fields may intersect with transiting short-tailed albatrosses through training areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for proximity to ships generating electromagnetic fields. As discussed in Section 3.0.5.3.2.1, most electromagnetic fields are shielded and contained within the ship. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell’s shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). Electromagnetic devices would have no effect on ESA-listed seabird species. This conclusion is based on the rare occurrence of these species within the Study Area, and absence from breeding grounds and rookery sites located within the Study Area, particularly at FDM. This conclusion is consistent with the 2010 Biological Opinion issued by the USFWS Pacific Island Field Office for training within the MIRC.

Pursuant to the ESA, the use of electromagnetic devices during training activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during training activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Mission package testing for new ship systems includes the use of electromagnetic devices (e.g., magnetic fields generated underwater to detect mines). Under Alternative 1, the Naval Sea Systems Command would engage in up to 32 MCM mission package testing activities. As discussed previously, seabirds may experience temporary behavioral changes (e.g., changes in altitude, orientation shifts) when they enter an electromagnetic field; however, normal behavior is expected to resume when the energy source reduces in power or is turned off, or simply when the bird leaves the area. These events are expected to occur within the at-sea portions of the Study Area, which does not overlap with the normal range of the Hawaiian petrels or Newell's shearwater (see Figure 3.6-9).

There is some overlap of the short-tailed albatross range with the Study Area; however, due to the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with testing activities would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for proximity to ships generating electromagnetic fields. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the testing activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species.

Pursuant to the ESA, the use of electromagnetic devices during testing activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during testing activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.2.1.3 Alternative 2

Training Activities

As indicated in Section 3.0.5.3.2.1 (Electromagnetic Devices), training activities involving electromagnetic devices under Alternative 2 occur up to five times annually as part of Mine Countermeasure – Towed Sonar and Civilian Port Defense activities. Table 2.8-1 lists the number and location of training activities that use electromagnetic devices. The location and number of electronic warfare exercises under Alternative 2 are the same as Alternative 1; therefore, the conclusions for Alternative 2 are the same as for Alternative 1.

Pursuant to the ESA, the use of electromagnetic devices during training activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during training activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

The Naval Sea Systems Command would engage in up to 36 MCM mission package testing activities under Alternative 2. Marine birds that co-occur with these activities would have the potential to be exposed to the electromagnetic fields. Although there is a slight increase in the use of electromagnetic devices, the use of electromagnetic devices is not expected to cause more than a short-term behavioral disturbance to seabirds or have any population-level effects.

Mission package testing for new ship systems includes the use of electromagnetic devices (e.g., magnetic fields generated underwater to detect mines). As with Alternative 1, these events under Alternative 2 are expected to occur within the at-sea portions of the Study Area, which does not overlap with the normal range of the Hawaiian petrels or Newell's shearwater (see Figure 3.6-9). There is some overlap of the short-tailed albatross range with the Study Area; however, due to the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with testing activities would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for proximity to ships generating electromagnetic fields. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the testing activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species. Birds that roost or breed within the Study Area would only be exposed when these birds are foraging or transiting through an area where testing is occurring. Despite the slight increase in the use of electromagnetic devices under Alternative 2, the use of electromagnetic devices is not expected to cause more than a short-term behavioral disturbance to the masked booby, great frigatebird, and any other seabird or shorebird that visits, roosts, or breeds within the Study Area.

Pursuant to the ESA, the use of electromagnetic devices during testing activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of electromagnetic devices during testing activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.3 Physical Disturbance and Strike Stressors

This section describes the potential impacts on birds by aircraft and aerial target strikes, vessels (disturbance and strike), military expended material strike, ground disturbance, and wild fires at FDM. For a list of Navy activities that involve this stressor refer to Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). Aircraft include fixed-wing and rotary-wing aircraft; vessels include various sizes and classes of ships, submarines, and other boats; towed devices, unmanned surface vehicles, and unmanned underwater vehicles; military expended material includes non-explosive practice munitions, target fragments, decelerators or parachutes, and other objects.

Physical disturbance and strike risks, primarily from aircraft, have the potential to impact all taxonomic groups found within the Study Area (Table 3.6-3) if birds are in the same area with aircraft, vessels, and military expended material. Impacts of physical disturbance include behavioral responses such as temporary disorientation, change in flight direction, and avoidance response behavior. Physical disturbances (discussed in Section 3.6.3.1.3, Impacts from Aircraft and Vessel Noise) may elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, and a temporary increase in heart rate. These disturbances can also result in abnormal behavioral, growth, or reproductive impacts in nesting birds and can cause foraging and nesting birds to flush from or abandon their habitats or nests. Aircraft strikes often result in bird mortalities or injuries.

Although birds likely hear and see approaching vessels and aircraft, they cannot avoid all collisions. Nighttime lighting on vessels, specifically high-powered searchlights used for navigation in icy waters off of Greenland has caused birds to become confused and collide with Navy vessels, cargo vessels, and trawlers (Merkel and Johansen 2011). Birds are known to be attracted to lights which can lead to collisions (Gehring et al. 2009, Poot et al. 2008). High-speed collisions with large objects can be fatal to birds. Training and testing activities around concentrated numbers of birds would cause greater disturbance and increase the potential for strikes.

3.6.3.3.1 Impacts from Aircraft and Aerial Targets

Aircraft and aerial target strikes could occur during training and testing activities that use aircraft, particularly in nearshore areas, where birds are more concentrated in the Study Area. Training and testing activities where aircraft are used typically occur further offshore.

Wildlife aircraft strikes are a serious concern for the Navy because these incidents can harm aircrews as well as damage equipment and injure or kill wildlife (Bies et al. 2006). Since 1981, Naval Aviators reported 16,550 bird strikes at a cost of $350 million. About 90 percent of wildlife/aircraft collisions involve large birds or large flocks of smaller birds (Federal Aviation Administration 2003), and more than 70 percent involve gulls, waterfowl, or raptors.

Part of aviation safety during training and testing activities is the implementation of the Bird/Animal Aircraft Strike Hazard program. The Bird/Animal Aircraft Strike Hazard program manages risk by addressing specific aviation safety hazards associated with wildlife near airfields through coordination among all the entities supporting the aviation mission (U.S. Department of Defense 2012). The Bird/Animal Aircraft Strike Hazard program consists of, among other things, identifying the bird/animal species involved and the location of the strikes to understand why the species is attracted to a particular area of the airfield or training route. By knowing the species involved, managers can understand the habitat and food habits of the species. A Wildlife Hazard Assessment identifies the areas of the airfield that are attractive to the wildlife and provides recommendations to remove or modify the attractive feature. Recommendations may include the removal of unused airfield equipment to eliminate perch sites, placement of anti-perching devices, wiring of streams and ponds, removal of brush/trees, use of pyrotechnics, and modification of the grass mowing program (U.S. Department of Defense 2012).

Air Force Instruction 91-202 requires Andersen Air Force Base to implement a Bird/Animal Aircraft Strike Hazard Plan. The Andersen Air Force Base Bird/Animal Aircraft Strike Hazard plan provides guidance for reducing the incidents of bird strikes in and around areas where flying training is being conducted. At Andersen Air Force Base, the only regular location of fixed wing take offs and landings, a sound cannon is deployed on the runway to discourage birds from accumulating on or near the runway. The plan is reviewed annually and updated as needed. Bird/Animal Aircraft Strike Hazard plans are not required around Northwest Field and Orote Air Field on Guam, and North Field on Tinian.

Though bird strikes can occur anywhere aircraft are operated, Navy and Air Force data indicate they occur more often over land (Air Force Safety Center 2007, Navy Safety Center 2009, U.S. Department of Defense 2012). Bird strike potential is greatest in foraging or resting areas, in migration corridors, and at low altitudes. For example, birds can be attracted to airports because they often provide foraging and nesting resources (Federal Aviation Administration 2003, U.S. Department of Defense 2012).

For the majority of fixed-wing activities, flight altitudes would be above 3,000 ft. (914 m), with the exception of sorties associated with air-to-surface bombing exercises and sonobuoy drops. Typical flight altitudes during air-to-surface bombing exercises are from 500 to 5,000 ft. (152 to 1,524 m) above ground level. Most fixed-wing aircraft flight hours (greater than 90 percent) occur at distances greater than 12 nm offshore.

Helicopter flights would occur closer to the shoreline where sheltering, roosting, and foraging of birds occur. Helicopters can hover and fly low and would be used to tow electromagnetic devices as well as for other military activities at sea. This combination would make a potential helicopter strike to a bird possible. Additional details on typical altitudes and characteristics of aircraft used in the Study Area are provided in Section 3.0.5.3.1.6 (Aircraft Overflight Noise) and in Appendix A (Training and Testing Activities Descriptions).

In addition to manned aircraft, aerial targets such as unmanned drones and expendable rocket powered missiles, could also incur a bird strike but the probability is low. No data about bird strikes to drones or expendable rocket-powered missiles are available.

Approximately 95 percent of bird flight during migration occurs below 10,000 ft. (3,048 m), with the majority below 3,000 ft. (914 m) (Air Force Safety Center 2007, Navy Safety Center 2009, U.S. Department of Defense 2012). Bird and aircraft encounters are more likely to occur during aircraft takeoffs and landings than when the aircraft is engaged in level flight. In a study that examined 38,961 bird and aircraft collisions, Dolbeer (2006) found that the majority (74 percent) of collisions occurred below 500 ft. (152 m). Air Force data support this statistic, showing that approximately 70 percent of collisions at Air Force-administered airfields occur below 500 ft. (152 m) (U.S. Department of Defense 2012). Collisions, however, have been recorded at elevations as high as 12,139 ft. (3,700 m) (Dove and Goodroe 2008).

The potential for bird strikes to occur in offshore areas is relatively low because activities are widely dispersed and occur at relatively high altitudes (above 3,000 ft. [914 m] for fixed-wing aircraft) where seabird occurrences are generally low.

In general, bird populations consist of hundreds or thousands, ranging across a large geographical area. In this context, the loss of several or even dozens of birds due to physical strikes may not constitute a population-level effect, although some species gather in large flocks. Bird exposure to strike potential would be relatively brief as an aircraft quickly passes overhead. Seabirds actively avoid interaction with aircraft; however, disturbances of various seabird species may occur from aviation operations on a site-specific basis. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the safety risk involved with a potential bird strike.

3.6.3.3.1.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights. Certain portions of the Study Area, such as areas near Navy and Air Force airfields, installations, and ranges are used more heavily by Navy and Air Force aircraft than other portions as described in further detail in Table 2.8-1 in Chapter 2 (Description of Proposed Action and Alternatives).

Bird exposure to strike potential would be relatively brief as an aircraft quickly passes. Birds actively avoid interaction with aircraft; however, disturbances or strike of various bird species may occur from aircraft on a site-specific basis. At FDM, close air support training and other aircraft training would occur at low altitudes, and helicopter and fixed wing overflights may occur over rookery locations at Apra Harbor and Andersen AFB on Guam. Low altitude aircraft overflights would not occur over any other rookery location within the Mariana Islands. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the personnel safety risk involved with a potential bird strike. Some bird and aircraft strikes and associated bird mortalities or injuries could occur in the Study Area under the No Action Alternative; however, no long-term or population-level impacts are expected. It should be noted that low level helicopter flights at FDM occur on a quarterly basis since 2010 and on a monthly basis between 1997 and 2009 for seabird monitoring surveys. These surveys have never recorded a strike of a bird from an aircraft. Further, there has never been a reported aircraft strike of a bird during training activities over FDM, which involve more tactical maneuvers and relatively faster flight speeds. Although there is limited potential for a strike of a seabird by an aircraft over rookery locations (particularly at FDM) the injury or mortality of a single individual seabird would not adversely impact populations of the masked booby, great frigatebird, or other marine bird species that visit, roost, or breed within the Study Area.

Aircraft flight lines at sea may overlay transiting short-tailed albatrosses through training areas; however, due to the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. Further, the altitude of aircraft at sea is likely much higher than a transiting or foraging albatross. Birds of this family follow wakes of ships, slightly increasing the potential for proximity to ships generating electromagnetic fields. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species. Because the highest risk for bird strike is during take offs and landings, there would be no risk to short-tailed albatross because this species does not approach land areas.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur with aircraft and aerial target training activities within the MITT Study Area is extremely low.

Pursuant to the ESA, the use of aircraft and aerial targets during training activities under the No Action Alternative would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during training activities under the No Action Alternative would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

As described in Table 2.4-4, the No Action Alternative includes one annual testing event conducted by the Office of Naval Research, which is a continuation of a series of experiments for the North Pacific Acoustic Laboratory Philippine Sea Experiment. The intent of these experiments is to study deep-water acoustic propagation and ambient noise in the northern Philippine Sea. Completion of these experiments involves the use of surface and subsurface vessels. No testing activities involving aircraft or aerial targets are included in the No Action Alternative.

3.6.3.3.1.2 Alternative 1

Training Activities

Training activities under Alternative 1 include an increase in aircraft flight hours from the No Action Alternative in the same areas. By way of example, the number of sorties leaving Andersen Air Force Base and carriers at sea would increase less than 300 percent relative to the No Action Alternative, as part of strike warfare (air to ground) training at FDM. The types of activities, locations, and types of aircraft would not differ from the No Action Alternative.

For reasons stated in Section 3.6.3.3.1.1 (No Action Alternative), disturbance or strike from aircraft or aerial targets are not expected to have lasting impacts on the survival, growth, recruitment, or reproduction of bird populations.

Aircraft flight lines at sea under Alternative 1 may overlay transiting short-tailed albatrosses through training areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. Further, the altitude of aircraft at sea is likely much higher than a transiting or foraging albatross. Birds of this family follow wakes of ships, slightly increasing the potential for proximity to ships from which aircraft and aerial targets are launched. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species. Because the highest risk for bird strike is during take offs and landings, there would be no risk to short-tailed albatross because this species does not approach land areas in the Mariana Islands.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur with aircraft and aerial target training activities within the MITT Study Area is extremely low.

Pursuant to the ESA, the use of aircraft and aerial targets during training activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during training activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Testing activities under Alternative 1 would introduce rotary wing aircraft and fixed wing aircraft. Under Alternative 1, 320 activities involving aircraft movements are proposed, compared to zero events under the No Action Alternative. The types of activities, locations, and types of aircraft would not differ from training activities. These activities would not occur over FDM or other important rookery locations in the Mariana Islands.

For reasons stated in Section 3.6.3.3.1.1 (No Action Alternative), disturbance or strike from aircraft or aerial targets are not expected to have lasting impacts on the survival, growth, recruitment, or reproduction of bird populations.

Aircraft flight lines at sea under Alternative 1 may overlay transiting short-tailed albatrosses through training areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with testing exercises would be extremely low. Further, the altitude of aircraft at sea is likely much higher than a transiting or foraging albatross. Birds of this family follow wakes of ships, slightly increasing the potential for proximity to ships as the ship move through an area. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the testing activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect impact would occur to this species. Because the highest risk for bird strike is during take offs and landings, there would be no risk to short-tailed albatross because this species does not approach land areas in the Marianas.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur with aircraft and aerial target training activities within the MITT Study Area is extremely low.

Pursuant to the ESA, the use of aircraft and aerial targets during testing activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during testing activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.3.1.3 Alternative 2

Training Activities

Training activities under Alternative 2 include an increase in aircraft flight hours from the No Action Alternative in the same areas. By way of example, the number of sorties leaving Andersen Air Force Base and carriers at sea would increase by slightly more than 300 percent relative to the No Action Alternative, as part of strike warfare (air to ground) training at FDM. The types of activities, locations, and types of aircraft would not differ from the No Action Alternative.

For reasons stated in Section 3.6.3.3.1.1 (No Action Alternative), disturbance or strike from aircraft or aerial targets are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations.

Aircraft flight lines at sea under Alternative 2 may overlay transiting short-tailed albatrosses through training areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. Further, the altitude of aircraft at sea is likely much higher than a transiting or foraging albatross. Birds of this family follow wakes of ships, slightly increasing the potential for proximity to ships from which aircraft and aerial targets are launched. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect effect would occur to this species. Because the highest risk for bird strike is during take offs and landings, there would be no risk to short-tailed albatross because this species does not approach land areas in the Marianas.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur with aircraft and aerial target training activities within the MITT Study Area is extremely low.

Pursuant to the ESA, the use of aircraft and aerial targets during training activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during training activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Under Alternative 2, 362 activities involving aircraft movements are proposed, compared to zero events under the No Action Alternative. Compared to Alternative 1, Alternative 2 would include 42 additional activities involving aircraft movements. The types and number of testing activities involving aircraft in Alternative 2 are similar to Alternative 1. Therefore, the conclusions for Alternative 2 are the same as for Alternative 1.

Pursuant to the ESA, the use of aircraft and aerial targets during testing activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of aircraft and aerial targets during testing activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.3.2 Impacts from Vessels and In-Water Devices

The majority of the training and testing activities under all the alternatives involve vessels and a few of the activities involve the use of in-water devices.

Direct collisions with most Navy vessels are unlikely but do occur, especially at night. Other impacts would be the visual and behavioral disturbance from a vessel. Birds respond to moving vessels in various ways. Some birds, including certain species of gulls, storm petrels, and albatrosses, commonly follow vessels (Hyrenbach 2001, 2006); while other species such as frigatebirds and sooty terns seem to avoid vessels (Hyrenbach 2006). There could be a slightly increased risk of impacts during the winter, or fall/spring migrations when migratory birds are concentrated in coastal areas. However, despite this concentration, most birds would still be able to avoid collision with a vessel. Vessel movements could elicit short-term behavioral or physiological responses (e.g., alert response, startle response, fleeing the immediate area, temporary increase in heart rate). However, the general health of individual birds would not be compromised.

The possibility of collision with an aircraft carrier or surface combatant vessels (or a vessel's rigging, cables, poles, or masts) could increase at night, especially during inclement weather. Birds can become disoriented at night in the presence of artificial light, and lighting on vessels may attract some birds (U.S. Fish and Wildlife Service 2005, 2011a), increasing the potential for harmful encounters. Lighting on boats and vessels have also contributed to bird fatalities in open-ocean environments when birds are attracted to these lights, usually in inclement weather conditions (Merkel and Johansen 2011). This could be a scenario that Navy vessels could face, especially during the migration season when migrating birds are using celestial clues during night time flight. Other harmful seabird-vessel interactions are commonly associated with commercial fishing vessels because seabirds are attracted to concentrated food sources around these vessels (Melvin and Parrish 1999, Melvin et al. 2001). However, these concentrated food sources are not associated with Navy vessels.

Navy aircraft carriers, surface combatant vessels, and amphibious warfare ships are minimally lighted for tactical purposes. Under normal cruising conditions, vessels that are 50 m (164 ft.) in length or greater typically exhibit a masthead light (visible out to 6 nm), sidelights and aft lights (both visible out to 3 nm). Vessels that are 12–50 m (39–164 ft.) in length typically exhibit a masthead light (visible out to 5 nm), and sidelights and aft lights (visible out to 2 nm). These lighting regulations are in accordance with Rule 22, Part C, Section III of the International Regulations for Preventing Collisions at Sea. Solid white lighting appears more problematic for birds, especially nocturnal migrants (Gehring et al. 2009, Poot et al. 2008). Navy vessel lights are mostly solid, but sometimes may not appear solid because of the constant movement of the vessel (wave action), making vessel lighting potentially less problematic for birds in some situations.

Procrocellariiformes, in particular, Newell's shearwater and Hawaiian petrel fledglings are particularly susceptible to light attraction, which can cause exhaustion and increase potential for collision with land-based structures (Reed et al. 1985). The collision may cause mortality or injury which increases potential for predation. These two species are considered rare vagrants in the Study Area. Further, because nesting for these species only occurs in the Hawaiian Islands, fledglings would not be found within the Study Area.

In addition to vessels, towed devices and unmanned vehicles are also used; however, no documented instances of birds being struck by in-water devices exist. It would be anticipated that most bird species would move away from an unmanned vehicle or a towed device.

The other type of vessel movements in the Study Area with the potential to strike a bird is those used during amphibious landings. These amphibious warfare vessels have the potential to impact shorebirds and seabirds by disturbing or striking individual animals. Amphibious vessel movements could elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, nest abandonment, and a temporary increase in heart rate. Amphibious vessels have the potential to disturb foraging shorebirds, seabird nesting on landing beaches is not expected to occur primarily because of predation by introduced brown treesnakes (on Guam). However, the general health of individual birds would not be compromised, unless a direct strike occurred. It is highly unlikely that a shorebird/seabird would be struck in this scenario because most foraging shorebirds in the vicinity of the approaching amphibious vessel would likely be dispersed by the sound of the approaching vessel before it could come close enough to strike a shorebird/seabird (Section 3.6.3.1.3, Impacts from Aircraft and Vessel Noise).

3.6.3.3.2.1 No Action Alternative, Alternative 1, and Alternative 2

Training Activities

As indicated in Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors), the majority of the training activities under all alternatives involve vessels. See Table 3.0-15 for a representative list of Navy vessel sizes and speeds. Vessel activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers and range areas. There would be a higher likelihood of seabird and vessel interactions over nearshore than in the open ocean portions of the Study Area because of the concentration of vessel movements in those areas. The number of Navy ships operating in the Study Area varies based on training schedules and can range up to 10 ships at any given time. The probability of vessel and seabird interactions occurring in the Study Area depends on several factors, including the presence and density of seabirds; numbers, types, and speeds of vessels; duration and spatial extent of activities; and protective measures implemented by the Navy.

Birds would not be exposed to unmanned underwater vehicles or remotely operated vehicles because they are typically used on the seafloor or in the water column deeper than the areas commonly used by birds during foraging. The other in-water devices used are typically towed by a helicopter. As discussed for electromagnetic devices (Section 3.6.3.2.1, Electromagnetic Devices), it is likely that any birds in the vicinity of the approaching helicopter would be dispersed by the sound of the helicopter (Section 3.6.3.1.3, Impacts from Aircraft and Vessel Noise) and move away from the in-water device before any exposure could occur.

Vessels and in-water devices under Alternative 2 may coincide with transiting short-tailed albatrosses through training areas; however, due to the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for interactions with vessels and in-water devices. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect effect would occur to this species.

Amphibious landings under the No Action Alternative, Alternative 1, and Alternative 2 would occur within landing locations at Naval Base Guam Apra Harbor on Guam and Tinian landing beaches. None of the known breeding locations for seabirds within the Naval Base Guam Apra Harbor (rocky islets off of Orote Island and Orote Peninsula, Neye Island, and Apaoa Point) are used as amphibious landing areas. Unai Chulu and Unai Dankulo may be used for landing craft air cushion training. Historically, only Unai Chulu has been used for landing craft air cushion training; however, additional use of this beach would require beach repairs. Unai Babui is a rocky beach and may be used for amphibious assault vehicle training. Unai Dankulo is also a known breeding location for Pacific reef herons. The other known rookery locations on Tinian, Puntan Masalok (which supports breeding areas for the black noddy, brown noddy, and boobies) and Puntan Lamanibot (another location for Pacific reef herons) are not used for amphibious landings. As stated previously, vessel collision with a foraging seabird is unlikely because the noise generated by the amphibious assault vehicle would likely drive the seabird away from the area. Pacific reef herons nest in trees, so an amphibious assault vehicle maneuvering on the beach area would not likely physically disturb a nest. Amphibious landings do not occur on FDM.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell’s shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur with vessel movements or in-water devices within the MITT Study Area is extremely low.

Pursuant to the ESA, the use of vessels and in-water devices during training activities under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of vessels and in-water devices during training activities under the No Action Alternative, Alternative 1, or Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

As indicated in Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors), the majority of the testing activities under all alternatives involve vessels. See Table 3.0-15 for a representative list of Navy vessel sizes and speeds. Under the No Action Alternative, there are no testing activities that specifically require vessel movements, whereas Alternative 1 would require 300 events and Alternative 2 would require 362 events. Vessel activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers, and range areas. There would be a higher likelihood of seabird and vessel interactions over nearshore than in the open ocean portions of the Study Area because of the concentration of vessel movements in those areas.

Birds would not be exposed to unmanned underwater vehicles or remotely operated vehicles because they are typically used on the seafloor or in the water column. The other in-water devices used are typically towed by a helicopter. As discussed for training activities using electromagnetic devices (Section 3.6.3.2.1, Electromagnetic Devices), it is likely that any birds in the vicinity of the approaching helicopter would be dispersed by the sound of the helicopter (Section 3.6.3.1.3, Impacts from Aircraft and Vessel Noise) and move away from the in-water device before any exposure could occur. Under the No Action Alternative, one annual event would require the use of towed in-water devices. Alternative 1 would require 300 events, and Alternative 2 would require 338 events.

Vessels and in-water devices under the No Action Alternative, Alternative 1, and Alternative 2 may coincide with transiting short-tailed albatrosses throughout the MITT Study Area; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with testing exercises would be extremely low. Birds of this family follow wakes of ships, slightly increasing the potential for interactions with vessels and in-water devices. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the testing activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect effect would occur to this species.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles(U.S. Department of the Navy 2007). The potential for these two species to co-occur with vessel movements or in-water devices within the MITT Study Area is extremely low.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of vessels and in-water devices during testing activities under the No Action Alternative, Alternative 1, or Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.3.3 Impacts from Military Expended Materials

This section analyzes the strike potential to birds of the following categories of military expended materials: (1) non-explosive practice munitions; (2) fragments from high-explosive munitions; and (3) expended materials other than ordnance, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each Alternative, see Section 3.0.5.3.3.4 (Military Expended Materials).

Exposure of birds to military expended materials during Navy training and testing activities could result in physical injury or behavioral disturbances to birds in air, at the surface, or underwater during foraging dives. Although a quantitative analysis is not possible due to the absence of bird density information in the Study Area, an assessment of the likelihood of exposure to military expended materials was conducted based on general bird distributions in the Study Area.

The number of large-caliber projectiles and other large munitions (e.g., bombs, rockets, missiles) that would be expended in the Study Area annually at sea, coupled with the often patchy pelagic distribution of seabirds (Fauchald et al. 2002, Haney 1986), suggest that the likelihood of this type of strike for a seabird would be extremely low at sea. The number of small-caliber projectiles that would be expended annually during gunnery exercises is much higher than the number of large-caliber projectiles. However, the total number of rounds expended is not a good indicator of strike probability during gunnery exercises because multiple rounds are fired at individual targets.

Human activity such as vessel or boat movement, aircraft overflights, and target setting, could cause birds to flee a target area before the onset of firing, thus avoiding harm. If birds were in the target area, they would likely flee the area prior to the release of military expended materials or just after the initial rounds strike the target area. Additionally, the force of military expended material fragments dissipates quickly once the pieces hit the water, so direct strikes on birds foraging below the surface would not be likely. Also, munitions would not be used in shallow/nearshore areas. Individual birds may be impacted, but ordnance strikes would likely have no impact on bird populations.

At FDM, there is a higher probability for bird strike by military expended materials. FDM supports several rookeries, and therefore concentrations of birds at different times of year are likely to co-occur with training exercises. FDM is the only rookery location where military expended materials are deposited. On FDM, the range area where ordnance is restricted to inert munitions, vegetation is recovering in vertical structure and surface cover, relative to range areas on FDM where explosive ordnance is permitted (U.S. Department of the Navy 2008, 2013a).

3.6.3.3.3.1 No Action Alternative

Training Activities

Tables located in Section 3.0.4.5.3.4 (Military Expended Materials) list the activities that involve military expended materials, most of which are small- and medium-caliber projectiles.

Live fire events do occur within nearshore waters of Guam in defined surface danger zones, explosive ordnance disposal exclusion zones, and extended surface danger zones. Small- and medium-caliber projectiles would also be expended within the Small Arms Firing Area. These areas include a nearshore environment of Guam that is likely a primary foraging habitat for seabird species that roost and breed on the island and offshore islets. Figure 2.7-1 shows the location of these areas. The training activity areas do not include fish aggregating devices, artificial reefs, shipwrecks, abandoned vessels, and or buoys (e.g., navigational buoys, meteorological buoys) that attract seabird prey species and offer perch sites. Section 3.11 (Cultural Resources) discusses shipwrecks other submerged resources that may also serve to aggregate fish and therefore seabirds. The Navy routinely avoids locations of known obstructions which include submerged cultural resources such as historic shipwrecks. These avoidance measures prevent damage to sensitive Navy equipment and vessels, ensure the accuracy of training and testing exercises, and limit the possibility of large numbers of seabirds to be exposed to a training exercise. By avoiding areas where higher numbers of seabirds may congregate, risk of striking seabirds is minimized.

At FDM, there is an increased potential for bird strike by military expended materials. While increased ordnance use may increase exposure to direct strike, percussive force, and the direct and indirect effects of wild land fire, limiting increased ordnance use to existing impact areas will minimize effects on seabird nesting habitats on FDM. Impacts on the great frigatebird population and the masked booby population, may be avoided by not targeting known rookery locations and through the concentration of ordnance to designated range areas on the interior of the island. All these factors serve to minimize the risk of harming seabirds. FDM habitats and wildlife have been subject to perturbations associated with explosive ordnance training, yet utilization of FDM by seabirds has continued. The increase in the number of rounds deployed per year under the No Action Alternative is unlikely to endanger breeding activity of the seven seabird species known to breed at FDM (black noddies, brown noddies, brown boobies, masked boobies, red-footed boobies, white terns, and great frigatebirds) (Reichel 1991, Lusk et al. 2000, U.S. Department of the Navy 2013a). The Navy has reached this conclusion based on (1) population index surveys conducted since 1997 that show populations are relatively stable despite periodic oscillations, and (2) existing conservation measures and targeting restrictions that have minimized the potential impact associated with ordnance use. Further, the Navy will continue to conduct seabird surveys on FDM, as appropriate. FDM is the only land-based live fire range in the Mariana Islands, and live fire training does not occur near other important rookery locations within the archipelago.

Expending of military materials may coincide with transiting short-tailed albatrosses through training areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect effect would occur to this species.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur with activities that use military expended materials within the MITT Study Area is extremely low.

Pursuant to the ESA, the use of military expended materials during training activities under the No Action Alternative would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of military expended materials during training activities under the No Action Alternative would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Under the No Action Alternative, there are no testing activities that involve the use of military expended materials.

3.6.3.3.3.2 Alternative 1 and Alternative 2

Training Activities

For training activities at sea, the majority of military expended materials (bombs, medium- and large-caliber projectiles, missiles and decelerators/parachutes) are all used in areas of the MITT Study Area greater than 3 nm from shorelines, and the larger of these (bombs, missiles, large-caliber projectiles) are restricted to use in areas greater than 12 nm from shore. Small caliber projectiles would be used throughout the MITT Study Area. As indicated in Section 3.0.5.3.3.4 (Military Expended Materials), under Alternative 1 and Alternative 2, the total amount of military expended materials is more than twice the amount expended in the No Action Alternative. The activities and type of military expended materials under Alternative 1 and Alternative 2 would be expended in the same geographic locations as the No Action Alternative.

As with the No Action Alternative, live fire training events would continue under Alternative 1 and Alternative 2 within nearshore waters of Guam in defined surface danger zones, explosive ordnance disposal exclusion zones, and extended surface danger zones. Small- and medium-caliber projectiles would also be expended within the Small Arms Firing Area. The training activity areas do not include fish aggregating devices, artificial reefs, known shipwrecks and abandoned vessels, and or buoys (e.g., navigational buoys, meteorological buoys) that attract seabird prey species and offer perch sites. Section 3.11 (Cultural Resources) discusses shipwrecks and other submerged resources that may also serve to aggregate fish and therefore seabirds. The Navy routinely avoids locations of known obstructions which include submerged cultural resources such as historic shipwrecks. These avoidance measures prevent damage to sensitive Navy equipment and vessels, ensure the accuracy of training and testing exercises, and limit the possibility of large numbers of seabirds to be exposed to a training exercise. By avoiding areas where higher numbers of seabirds may congregate, risk of striking seabirds is minimized for training activities under Alternative 1 and Alternative 2.

Specifically at FDM, the number of bombs, projectiles, missiles, and rockets targeting range portions of the island would increase by a factor of three. Although increases in ordnance use are proposed, only existing impact areas (totaling 34 acres [ac.] [13.8 hectares {ha}]) would be used. While increased ordnance use may increase exposure to direct strike, percussive force, and the direct and indirect effects of wild land fire, limiting increased ordnance use to existing impact areas will minimize effects on seabird nesting habitats on FDM. Impacts on any nesting great frigatebirds (believed to nest on the island periodically) and the masked booby population (a species that uses FDM as a large colonial rookery) may be avoided by not targeting known rookery locations and through the concentration of ordnance to designated range areas on the interior of the island. All these factors serve to minimize the risk of harming seabirds, even with the projected increase in training activities utilizing explosive ordnance, relative to the No Action Alternative.

Direct strike from inert munitions and other military expended materials is far less likely to impact seabirds than the potential for blast effects associated with explosive munitions, especially heavy weight munitions. By way of example, a single MK 84 (2,000 lb. explosive bomb) has a hazardous fragment distance of over 300 yards (yd.) (274 m) (U.S. Department of Defense 2004a). For a single MK 48 (25 lb. non-explosive practice bomb), seabird would need to be directly struck by, or in very close proximity to the area of impact. If the injury zone is conservatively estimated to be a 1 yd. radius, the resultant area would be just over 3 square yards (yd.^{2}) (2.5 square meters [m^2]. For a 20 mm (3.5-ounce [oz.]) projectile, the zone would be smaller still, likely less than 0.5 yd.^{2} (0.42 m^2). Hundreds of thousands of 20 mm projectiles would need to be expended at a single time, and evenly distributed over a given area to equal the impact footprint of a single MK 84 heavyweight bomb.

FDM has been subject to perturbations associated with live-fire weapons training, yet utilization of FDM by seabirds has continued. As discussed previously, the best available data for measuring the impacts of military activities on seabird populations on FDM comes from the helicopter-based surveys for masked booby, red-footed booby, and brown booby. The population trends (shown in

Figure 3.6-6, Figure 3.6-7, and Figure 3.6-8) show annual and seasonal fluctuations, but relatively stable populations and breeding success for the three booby species over the long-term (since 1997 when surveys began). Despite the likely injury and mortality to individual seabirds and eggs, and habitat degradation within the impact areas caused by the continued military use of FDM, the island continues to be a valuable, important, and productive rookery location in the Mariana archipelago (U.S. Fish and Wildlife Service 2005, Lusk et al. 2000, Reichel 1991).

Other factors associated with the military use of the island may benefit seabirds, such as restricting access to the island and nearshore areas surrounding FDM. Excluding access to land prevents poaching of eggs, a major threat to seabirds identified in the USFWS Pacific Islands Seabird Conservation Plan (U.S. Fish and Wildlife Service 2005). Further, restricting availability of waters from the nearshore of FDM through the issuance of NTMs may decrease fishing pressure and provide refugia for seabird prey species, thereby increasing the availability and ease for seabirds to capture prey near FDM.

The increase in the number of rounds deployed per year under Alternative 1 and Alternative 2 is unlikely to endanger breeding activity at FDM for the seven species of seabirds known to nest on the island (black noddies, brown noddies, brown boobies, masked boobies, red-footed boobies, white terns, and great frigatebirds). The Navy has reached this conclusion based on (1) population index surveys conducted since 1997 that show populations are relatively stable despite periodic oscillations, (2) existing conservation measures and targeting restrictions that have minimized the potential impact associated with ordnance use, and (3) the fact that no new areas of FDM will be targeted; therefore, the increases in munitions use at FDM would occur in areas already impacted by existing munitions use. Further, the Navy will conduct periodic seabird surveys on FDM to track population trends. The increases in munitions as proposed under Alternative 1 or Alternative 2 may increase potential for disturbance, injury, and mortality events; however, after analyzing the effects of such activities within the Study Area and population data on FDM, the likelihood of Alternative 1 or Alternative 2 diminishing the ability of a species to maintain genetic diversity, to reproduce, and function effectively in its native ecosystem is remote.

Expending of military materials may coincide with transiting short-tailed albatrosses through training areas; however, due to the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training exercises would be extremely low. The spatial and temporal variability of both the occurrence of a short-tailed albatross and the training activities conducted within offshore locations near foraging areas presents an improbable chance that a direct or indirect effect would occur to this species.

As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur with activities that use military expended materials within the MITT Study Area is extremely low.

Pursuant to the ESA, the use of military expended materials during training activities under Alternative 1 or Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of military expended materials during training activities under Alternative 1 or Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Tables in Section 3.0.5.3.3.4 (Military Expended Materials) list the activities that involve military expended materials (e.g., medium-caliber projectiles, missiles, and rockets), most of which are large-caliber projectiles associated with kinetic energy weapon testing. As indicated in Section 3.0.5.3.3.4 (Military Expended Materials), under Alternative 2, the total amount of military expended materials is slightly higher than the amount expended under Alternative 1. The activities and type of military expended materials under Alternative 1 and Alternative 2 would be expended in the same geographic locations.

Testing activities under Alternative 1 and Alternative 2 would occur within nearshore waters of Guam in defined surface danger zones, explosive ordnance disposal exclusion zones, and extended surface danger zones. Small- and medium-caliber projectiles would also be expended within the Small Arms Firing Area. These activity areas do not include fish aggregating devices, artificial reefs, known shipwrecks and abandoned vessels, and or buoys (e.g., navigational buoys, meteorological buoys) that attract seabird prey species and offer perch sites. Section 3.11 (Cultural Resources) discusses shipwrecks and other submerged resources that may also serve to aggregate fish and therefore seabirds. The Navy routinely avoids locations of known obstructions which include submerged cultural resources such as historic shipwrecks. These avoidance measures prevent damage to sensitive Navy equipment and vessels, ensure the accuracy of training and testing exercises, and limit the possibility of exposing large numbers of seabirds to military expended materials. By avoiding areas where higher numbers of seabirds may congregate, risk of striking seabirds is minimized for testing activities under Alternative 1 and Alternative 2.

Alternative 1 and Alternative 2 do not contain any testing activities that target FDM; therefore, Alternative 1 and Alternative 2 would not impact nesting and breeding activities on the island.

Pursuant to the ESA, the use of military expended materials during testing activities under Alternative 1 or Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of military expended materials during testing activities under Alternative 1 or Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.3.4 Impacts from Ground Disturbance

Amphibious landings are conducted to transport troops and equipment from ship to shore for subsequent inland maneuvers. Subsequently, these activities may disturb seabird nesting areas and foraging grounds for shorebirds. Concerns associated with amphibious landing activities in the Mariana Islands include potential impacts on coral reefs and impacts on natural and cultural resources in nearby inland areas since disembarked personnel and equipment must often traverse such areas in order to exit and enter a landing beach.

In a previous study of the impact of amphibious landings on corals at Unai Chulu in Tinian during Tandem Thrust 1999, it was observed that sediment plumes were generated in the track of the amphibious vehicles. The plumes remained localized in the track area, dissipated within minutes, and were not qualitatively different from episodes of sediment resuspension during periods of storm-generated waves that occur routinely on Tinian (Marine Research Consultants 1999). Because of the rapid dissipation and temporary nature of turbidity due to amphibious vehicles, it is unlikely that these activities would impact seabird or shorebird foraging grounds.

As described in Section 3.6.3.1.3 (Impacts from Aircraft and Vessel Noise), birds are likely to move away from an area in response to visual or sound stimuli. Therefore, it is highly unlikely that shorebirds would be directly impacted by ground disturbing activities associated with amphibious training.

Military use of FDM may contribute to ongoing soil disturbance and erosion from natural causes. FDM is comprised of highly weathered limestone overlain by a thin layer of clay soil (U.S. Department of the Navy 2013a). Ordnance use, particularly within Impact Areas 2 and 3 (where explosive ordnance use is permitted), would dislodge sediments that may potentially wash into nearshore waters of FDM. In addition to natural wind and water erosion (including high-energy typhoon events), erosion caused by ordnance use would contribute to increased turbidity and siltation of habitats used by marine bird prey species.

3.6.3.3.4.1 No Action Alternative, Alternative 1, and Alternative 2

Training Activities

Table 2.8-1 lists amphibious training activities that may disturb foraging grounds for shorebirds for the No Action Alternative, Alternative 1, and Alternative 2. As stated previously, amphibious landings under the No Action Alternative, Alternative 1, and Alternative 2 would occur within landing locations at Naval Base Guam Apra Harbor on Guam and Tinian landing beaches. None of the known breeding locations for seabirds within the Naval Base Guam Apra Harbor (rocky islets off of Orote Island and Orote Peninsula, Neye Island, And Apaoa Point) are used as amphibious landing areas. On Tinian, the only potential landing beach known to support a breeding colony is located at Unai Dankulo, a known breeding location for Pacific reef herons. Pacific reef herons nest in trees, so an amphibious assault vehicle maneuvering on the beach area would not likely physically disturb a nest. The other known rookery locations on Tinian, Puntan Masalok (which supports breeding areas for the black noddy, brown noddy, and boobies) and Puntan Lamanibot (another location for Pacific reef herons) are not used for amphibious landings. Amphibious landings do not occur on FDM, and are not proposed under the No Action Alternative, Alternative 1, or Alternative 2 (access to FDM is by helicopter only).

Shorebirds, however, likely forage in the intertidal zone where amphibious vehicles and personnel maneuver. Under the No Action Alternative, Alternative 1, and Alternative 2, foraging would be temporarily hindered by turbidity and sediment plumes created by amphibious vehicle contact with the beach along with the overall presence of vehicles and human activity. This impact is expected to be temporary, and coincide with the actual presence of the activity. The duration of these activities may range for a few minutes to 3 or 4 hours of time on the beach.

On FDM, the Navy restricts the target area extents and types of ordnance used by establishing impact areas, which minimizes mass wasting, sediment plumes, and siltation of nearshore foraging habitats. Because of the rapid dissipation and temporary nature of turbidity, it is unlikely that these activities would impact seabird or shorebird foraging grounds above effects associated with natural weathering processes on FDM.

The short-tailed albatross, Newell’s shearwater, and Hawaiian petrel do not occur on lands within the Mariana Islands. These species would not be affected by ground disturbing training activities under the No Action Alternative, Alternative 1, or Alternative 2. Nesting locations for the great frigatebird, masked booby, and other species of birds that are known to roost or breed within the Study Area would not be disturbed by amphibious warfare training activities.

Pursuant to the ESA, ground disturbing activities resulting from amphibious training activities and military use of FDM under the No Action Alternative, Alternative 1 or Alternative 2 would have no effect on the Hawaiian petrel, Newell’s shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), ground disturbing activities resulting from amphibious training activities and military use of FDM under the No Action Alternative, Alternative 1, or Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

There are no testing activities under the No Action Alternative, Alternative 1, or Alternative 2 that require ground disturbance in seabird or shorebird terrestrial habitats.

3.6.3.3.5 Impacts from Wildfires

This section assesses impacts from wildfires on seabirds and shorebirds that visit or breed on FDM. As the only land-based training area within the MITT Study Area subject to ordnance drops and live fire, FDM is the only site within the Study Area where training could cause uncontrolled wildland fires. See Section 3.10 (Terrestrial Species and Habitats) for a more detailed analysis of habitat degradation at FDM associated with ordnance use. Fires do occur on other DoD-owned and leased lands within the MIRC; however, these fires are sourced from properties offsite outside the DoD use boundary. Live fire on small arms ranges that include simulated training devices (including pyrotechnics) have been actively used on Guam for over 10 years, along with explosive ordnance demolition training. Range controls and fire response protocols have limited brush fires to very small areas (limited to a few square meters), which are immediately controlled and extinguished. Because range controls, fire response protocols, and long-term fire management plans have resulted in no uncontrolled wildfires, only wildfire potential on FDM is included for analysis.

Fires could occur on FDM in any month of the year; however, fuel loading (the amount of flammable vegetation) and ignition potential would increase during the dry season. Fire danger increases during the dry season (February through April) and decreases in the wet season (July through October). Wildland fires can set back succession within vegetation communities and facilitate establishment of fire-tolerant species, which may alter the composition and structure of vegetation communities. Fires may cause direct mortality of birds and nests in vegetated areas with fuel loadings sufficient to carry fire, and indirect mortality through exposure to smoke or displacement of nest predators into nesting habitats.

Fire can indirectly affect seabirds and shorebirds at FDM by changing the physical and biological characteristics of the area, which can subsequently degrade nesting habitat. Seabirds forage at sea, so wildfires would not affect the forage base; however, shorebirds that visit the island may forage on invertebrates in the impacted vegetation communities. Light levels, temperatures, and wind speeds will increase with destruction of canopy plants, and relative humidity will decrease (Hoffmann et al. 2003). Because vegetation cover affects erosion rate, soil erosion may occur after fire except where rapid establishment of non-native invasive grasses are prevalent. Grass, vine, or other herbaceous vegetation may invade following removal of shrub and tree canopy (D'Antonio and Vitousek 1992; Tunison et al. 2001).

Fire history on FDM is not well documented, but the replacement of at least patchy forest communities and with lower stature vegetation is evidenced in historical aerial imagery (see Figure 3.10-2). The potential for military bombardment of FDM to alter vegetation composition and structure was noted during post-bombardment surveys conducted in August 1997. These surveys revealed 25–50 fresh bomb craters and a large section of the island burned to bare earth (Lusk et al. 2000).

Based on surveys conducted in 1974 (as discussed in Section 3.10.2.1.5, Farallon de Medinilla), recent assessments in 2000 (Lusk et al. 2000), and current surveys of FDM's avifauna and knowledge of FDM's vegetation community status (U.S. Department of the Navy 2013a), the vegetation and avian communities have changed significantly since 1974. Prior to intensive military use of the island, the presence of more trees with a higher canopy resulted in a higher number of tree nesting seabirds (Lusk et al. 2000).

3.6.3.3.5.1 No Action Alternative, Alternative 1, and Alternative 2

Training Activities

Training activities that involve explosive detonations on FDM introduce the potential for wildfires on the island. The number of training activities using explosives at FDM is presented in Table 2.8-1 of Chapter 2 (Description of the Proposed Action and Alternatives). Although the numbers of ordnance with explosives increases from the No Action Alternative to Alternative 1, and from the No Action Alternative to Alternative 2, the potential for wildfire does not vary among alternatives.

On FDM, the impact areas total approximately 34 ac. (13.8 ha), which accounts for 20 percent of the island's area. FDM use restrictions were designed to minimize wildland fire danger to FDM's avifauna and to limit the indirect impacts associated with fire tolerant invasive species encroachment into non-impact areas. Live-fire weapons are restricted in that cluster bombs, live cluster weapons, live scatterable munitions, fuel-air explosives, incendiary devices, and bombs greater than 2,000 lb. (907.2 kg) are prohibited. The live-fire weapons allowed are used only in two specific areas and targets are placed to reduce the potential for wildfire. The areas for target placement support only low-growing vegetation due to long-term training with explosives. Due to the lack of fuels in the area, explosions are unlikely to result in wildfires. Dense vegetation grows on the northern portion of the island within the "No Drop Zone" which could create a wildfire if weapons are misfired.

The short-tailed albatross, Newell's shearwater, and Hawaiian petrel do not occur on lands within the Mariana Islands. These species would not be affected by wildfires on FDM under the No Action Alternative, Alternative 1, or Alternative 2.

The great frigatebird utilizes shrubs and trees for nesting, and the loss of higher stature forests in the interior portion of the FDM may represent a loss of nesting habitat for this species and other tree nesting seabird species. The great frigatebird, however, likely never occurred in the Mariana Islands in great numbers (Reichel 1991), and the colony on Maug (the only other known location of great frigatebird nesting in the archipelago), which is not subject to stressors of military training activities, has remained small (Reichel 1991, Lusk et al. 2000, U.S. Fish and Wildlife Service 2005, 2011b). Although wildfires may destroy nests, reduce nesting habitat, and directly and indirectly impact individual birds, these effects do not adversely affect the population of great frigatebirds.

Masked boobies may also experience direct effects of fire, but likely limited to smoke exposure because of nesting habitat and rookery locations. These birds prefer to nest on bare or rocky ground without fuel loading to carry a fire through the rookery locations, and Lusk et al. (2000) speculated that the military use of FDM in the interior portions of the island has created additional suitable nesting habitat for this species. Despite the risks associated with wildfires at FDM, the masked booby numbers at FDM have remained relatively stable since 1997 when systematic monitoring began.

Pursuant to the ESA, potential wildfires at FDM due to training activities under the No Action Alternative, Alternative 1 or Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), potential wildfires at FDM during training activities under the No Action Alternative, Alternative 1, or Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

There are no testing activities that involve expending ordnance on FDM that would potentially ignite a wildfire.

3.6.3.4 Ingestion Stressors

This section analyzes the potential impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. The activities that expend these items and their general distribution are detailed in Section 3.0.5.3.5 (Ingestion Stressors), and aspects of ingestion stressors that are applicable to marine organisms in general are presented in Appendix H.6 (Conceptual Framework for Assessing Effects from Ingestion).

Birds could potentially ingest expended materials used by the Navy during training and testing activities within the Study Area. The Navy expends the following types of materials that could become ingestion stressors for birds during training and testing in the Study Area: chaff and flare endcaps/pistons. Ingestion of expended materials by birds could occur in all large marine ecosystems and open ocean areas and would occur either at the surface or just below the surface portion of the water column, depending on the size and buoyancy of the expended object and the feeding behavior of the birds. Floating material of ingestible size could be eaten by birds that feed at or near the water surface, while materials that sink pose a potential risk to diving birds that feed just below the water's surface.

Foraging depths of most diving birds are generally restricted to shallow depths, so it is highly unlikely that benthic, nearshore, or intertidal foraging would occur in areas of munitions use, and these birds would not encounter any type of munitions or fragments from munitions in nearshore or intertidal areas. Ingestion of military expended material from munitions is not expected to occur because the solid metal and heavy plastic objects from these ordnances sink rapidly to the seafloor, beyond the foraging depth range of most birds. Therefore, no impact of ingestion of military expended material from munitions would result for birds. As a result, the analysis in this section includes the potential ingestion of military expended materials other than munitions, all of which are expended away from nearshore habitats and close to the water surface.

A variety of ingestible materials may be released into the marine environment by Navy training and testing activities. Birds of all sizes and species are known to ingest a wide variety of items, which they might mistake for prey. For example, 21 of 38 seabird species (55 percent) collected off the coast of North Carolina from 1975 to 1989 contained plastic particles (Moser and Lee 1992). The mean particle sizes of ingested plastic were positively correlated with the birds' size though the mean mass of plastic found in the stomachs and gizzards of 21 species was below 3 grams (g) (0.11 oz.).

Plastic is often mistaken for prey, and the incidence of plastic ingestion appears to be related to a bird's feeding mode and diet. Seabirds that feed by pursuit-diving, surface-seizing, and dipping tend to ingest plastic, while those that feed by plunging or piracy typically do not ingest plastic (Azzarello and Van Vleet 1987). Birds of the order Procellariiformes, which include petrels and shearwaters, tend to accumulate more plastic than other species (Azzarello and Van Vleet 1987, Moser et al. 2000). Some birds, including gulls and terns, commonly regurgitate indigestible parts of their food items such as shell and fish bones. However, the structure of the digestive systems of most Procellariiformes makes it difficult to regurgitate solid material such as plastic (Azzarello and Van Vleet 1987, Moser et al. 2000).

Moser and Lee (1992) found no evidence that seabird health was impacted by the presence of plastic, but other studies have documented negative consequences of plastic ingestion. As summarized by Pierce et al. (2004), Auman et al. (1997), and Azzarello and Van Vleet (1987), the consequences of plastic ingestion by seabirds that have been documented include blockage of the intestines and ulceration of the stomach, reduction in the functional volume of the gizzard leading to a reduction of digestive capability, and distention of the gizzard leading to a reduction in hunger. Dehydration has also been documented in seabirds that have ingested plastic (Sievert and Sileo 1993). Studies have also found negative correlations between body weight and plastic load, as well as between body fat (a measure of energy reserves), and the number of pieces of plastic in a seabird's stomach. Pierce et al. (2004) described two cases where plastic ingestion caused seabird mortality from starvation. The examination of a deceased adult northern gannet revealed that a 1.5 in. (3.8-centimeter [cm]) diameter plastic bottle cap lodged in its gizzard blocked the passage of food into the small intestine, which resulted in its death from starvation. Northern gannets are larger, and dive deeper than the ESA-listed birds in the Study

Area. Also, since gannets typically utilize flotsam in nest-building, they may be more susceptible to ingesting marine debris than other species as it gathers that material. Dissection of an adult greater shearwater's gizzard revealed that a 1.5 in. by 0.5 in. (3.8 cm by 1.3 cm) fragment of plastic blocked the passage of food in the digestive system, which also resulted in death from starvation.

Species such as storm-petrels, albatrosses, shearwaters, fulmars, and noddies that forage by picking prey from the surface may have a greater potential to ingest any floating plastic debris. Ingestion of plastic military expended material by any species from the taxonomic groups found within the Study Area (Table 3.6-3) has the potential to impact individual birds.

Items of concern are those of ingestible size that remain floating at the surface, including lighter items such as plastic end caps from chaff and flares, pistons, and chaff, that may be caught in currents and gyres or snared in floating algal mats before sinking.

3.6.3.4.1 Impacts from Military Expended Materials other than Munitions

3.6.3.4.1.1 Chaff

A general discussion of chaff and chaff end caps as an ingestion stressor is presented in Section 3.0.5.3.5.3 (Military Expended Materials Other than Munitions). It is unlikely that chaff would be selectively ingested (U.S. Department of the Air Force 1997). Ingestion of chaff fibers is not expected to cause substantial damage to a bird's digestive tract based on the fibers' small size (ranging in lengths of 0.25 to 3 in. [0.63 to 7.6 cm] with a diameter of about 0.0015 in.) and flexible nature, as well as the small quantity that could reasonably be ingested. In addition, concentrations of chaff fibers that could reasonably be ingested are not expected to be toxic to birds. Scheuhammer (1987) reviewed the metabolism and toxicology of aluminum in birds and mammals. Intestinal adsorption of orally ingested aluminum salts was very poor, and the small amount adsorbed was almost completely removed from the body by excretion. Dietary aluminum normally has small effects on healthy birds and mammals and often high concentrations (> 1,000 milligrams [mg] per kg) are needed to induce effects such as impaired bone development, reduced growth, and anemia (Arfsten et al. 2002, Spargo 1999). A bird weighing 2.2 lb. (1 kg) would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 mg per kg; this analysis was based on chaff consisting of 40 percent aluminum by weight and a 5 oz. (141.7 g) chaff canister containing 5 million fibers. As an example, a masked booby weighs about 2.6 to 5.2 lb. (1.2 to 2.4 kg). It is highly unlikely that a bird would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (i.e., 1.8 fibers per square foot for an unrealistic, worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

3.6.3.4.1.2 Flares

A general discussion of flares as an ingestion stressor is presented in Section 3.0.5.3.5.3 (Military Expended Materials Other than Munitions). Ingestion of flare end caps 1.3 in. (3.3 cm) in diameter and 0.13 in. (0.33 cm) thick (U.S. Air Force 1994, 1997) by birds may result in gastrointestinal obstruction or reproductive complications. Based on the information presented above, if a seabird were to ingest a plastic end-cap or piston, the response would vary based on the species and individual bird. The responses could range from none, to sublethal (reduced energy reserves), to lethal (digestive tract blockage leading to starvation). Ingestion of end caps and pistons by species that regularly regurgitate indigestible items would likely have no adverse effects. However, end caps and pistons are similar in size to those plastic pieces described above that caused digestive tract blockages and eventual starvation. Therefore, ingestion of plastic end caps and pistons could be lethal to some individuals of some species of seabirds. Species with small gizzards and anatomical constrictions that make it difficult to regurgitate solid material would likely be most susceptible to blockage (such as Procellariiformes). Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual birds.

3.6.3.4.1.3 No Action Alternative

Training Activities

Although chaff fibers are too small for birds to confuse with prey, there is some potential for chaff to be incidentally ingested along with other prey items. If ingested, chaff is not expected to impact birds, due to the low concentration that would be ingested and the small size of the fibers.

The plastic materials associated with flare end caps and pistons sink in saltwater (Spargo 1999), which reduces the likelihood of ingestion by seabirds. However, some of the material could remain at or near the surface if it were to fall directly on a dense algal mat or flotsam. Actual environmental concentrations would vary based on actual release points and dispersion by wind and water currents. The number of end caps and pistons that would remain at the surface and would potentially be available to seabirds is unknown but is expected to be an extremely small percentage of the total.

Birds would have the potential to ingest military expended material. However, the concentration of military expended material in the Study Area is low, and seabirds are patchily distributed (Haney 1986). The overall likelihood that birds would be impacted by ingestion of military expended material in the Study Area under the No Action Alternative is very low.

If foraging in an area where military expended materials are present on the sea surface, the short-tailed albatross, Hawaiian petrel, and Newell's shearwater could be impacted by ingestion of military expended material. Expended materials may be deposited in areas transited by short-tailed albatrosses; however, due to the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with military expended materials would be extremely low. As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur with activities that expend ingestible materials before sinking within the MITT Study Area is extremely low.

Pursuant to the ESA, potentially ingestible materials used during training activities under the No Action Alternative would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), potentially ingestible materials used during training activities under the No Action Alternative would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Under the No Action Alternative, there are no testing activities that involve the use of ingestible materials.

3.6.3.4.1.4 Alternative 1

Training Activities

As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other than Munitions), under Alternative 1 the number of expended decelerators/parachutes is approximately 35 percent higher than that of the No Action Alternative (from approximately 8,000 parachutes under the No Action Alternative to less than 11,000 decelerators/parachutes under Alternative 1). In addition to the geographic locations identified in the No Action Alternative, decelerators/parachutes would also be expended anywhere in the Study Area, outside the Study Area while vessels are in transit. As indicated in Sections 3.0.5.3.5.3 (Military Expended Materials Other than Munitions), under Alternative 1, the numbers of chaff canisters and flares increase by approximately 300 percent, relative to the No Action Alternative. The activities using chaff under Alternative 1 would occur in the same geographic locations as the No Action Alternative.

If foraging in an area where military expended materials are present on the sea surface, the short-tailed albatross, Hawaiian petrel, and Newell's shearwater could be impacted by ingestion of military expended material. Expended materials may be deposited in areas transited by short-tailed albatrosses; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with military expended materials would be extremely low. As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007). The potential for these two species to co-occur activities that expend ingestible materials before sinking within the MITT Study Area is extremely low.

Pursuant to the ESA, potentially ingestible materials used during training activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), potentially ingestible materials used during training activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Alternative 1 testing activities would introduce 1,727 decelerators/parachutes within the Study Area. The decelerators or parachutes would be expended widely across the Study Area and would not be expended over land. Decelerators/parachutes would not be expended over important rookeries or the nearshore foraging areas adjacent to these rookery areas. The likelihood of foraging seabirds encountering and ingesting decelerators or parachutes is extremely low.

Pursuant to the ESA, potentially ingestible materials used during testing activities under Alternative 1 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), potentially ingestible materials used during testing activities under Alternative 1 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.4.1.5 Alternative 2

Training Activities

The number and type of materials that seabirds may ingest are the same under Alternative 2 as they are for Alternative 1. Therefore, the conclusions for Alternative 2 are the same as Alternative 1.

Pursuant to the ESA, potentially ingestible materials used during training activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), potentially ingestible materials used during training activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

Testing Activities

Under Alternative 2, testing activities would introduce 1,912 decelerators/parachutes within the Study Area, which is an 11 percent increase over Alternative 1. The decelerators/parachutes would be expended widely across the Study Area, and would not be expended over land. Decelerators/parachutes would not be expended over important rookeries or the nearshore foraging areas adjacent to these rookery areas. The likelihood of foraging seabirds encountering and ingesting flares or decelerators/parachutes is extremely low.

Pursuant to the ESA, potentially ingestible materials used during testing activities under Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), potentially ingestible materials used during testing activities under Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.3.5 Secondary Stressors

The potential of sediments, water quality, and air quality stressors associated with training and testing activities to indirectly affect birds, as a secondary stressor, was analyzed. The assessment of potential water, sediment, and air quality stressors refers to Section 3.1 (Sediments and Water Quality) and Section 3.2 (Air Quality); the assessment addresses specific activities in local environments that may affect seabird habitats. At-sea activities that may impact water and air include general emissions.

Amphibious warfare training on Guam and Tinian, as well as military use of FDM, may affect water quality in nearshore foraging environments for seabirds and migrating shorebirds. Amphibious training activities on landing beaches on Guam and Tinian would likely disturb unconsolidated sediments in the intertidal and subtidal zones; however, these effects (such as changes in turbidity in nearshore waters) would be similar to changes caused by normal wave action during stormy conditions. Similarly, sediments dislodged from ordnance strikes on FDM that wash into FDM's nearshore environments would cause temporary water quality impacts in seabird and shorebird foraging areas. FDM is highly susceptible to natural causes of erosion because it is comprised of highly weathered limestone overlain by a thin layer of clay soil. The Navy minimizes the potential for military use of FDM to contribute to naturally induced water quality impacts by limiting the location and extent of target areas, along with the types of ordnance allowed within specific impact areas.

In accordance with DoD Directive 4715.11, *Environmental and Explosives Safety Management on Operational Ranges within the United States* (U.S. Department of Defense 2004b), the Navy has in place an Operational Range Clearance Plan for FDM (U.S. Department of the Navy 2013c). The Operational Range Clearance Program on FDM includes range clearance, inspection, certification, demilitarization, and recycling or disposal procedures. The plan requires range surfaces at FDM to be cleared of all ordnance, inert ordnance debris, inert munitions, and other material that may potentially present an explosive hazard. Materials greater than 2 ft. (0.6 m) in size are removed from impact areas on FDM. Range clearance on FDM occurs every 2 to 4 years, which reduces the potential for soil contamination and contamination of nearshore habitats receiving surface runoff.

As noted in Section 3.1 (Sediments and Water Quality) and Section 3.2 (Air Quality), implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not adversely affect sediments, water, or air quality and therefore would not indirectly impact seabirds as secondary stressors. Any physical impacts on seabird habitats would be temporary and local because training activities would occur infrequently. Impacts from activities would not be expected to adversely impact seabirds or seabird habitats.

There is no overlap of activities that could potentially impact sediments, water, or air quality with nesting or breeding locations of short-tailed albatross, Hawaiian petrel, and Newell's shearwater. These locations are found outside of the MITT Study Area. Further, these species would be expected to forage in pelagic areas of the study area, far from shore; therefore, only water quality and air quality impacts would potentially impact ESA-listed seabird species. Short-tailed albatrosses may transit through training and testing areas; however, the rarity of this species in general and the lack of frequent sightings, chances for its potential interactions with training and testing exercises would be extremely low. As shown in Figure 3.6-9, the known ranges of Hawaiian petrels and Newell's shearwaters may overlap with the transit corridor and do not overlap with land training areas or surrounding coastal areas. They were observed in 2007 during cruise surveys in pelagic areas for marine mammals and sea turtles (U.S. Department of the Navy 2007).

Indirect impacts on water or air quality under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on ESA-listed bird species due to (1) the temporary nature of impacts on water or air quality, (2) the distribution of temporary water or air quality impacts, (3) the wide distribution of birds in the Study Area, and (4) the dispersed spatial and temporal nature of the training and testing activities that may have temporary water, or air quality impacts. No long-term or population-level impacts are expected.

Pursuant to the ESA, secondary stressors associated with training or testing activities under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on the Hawaiian petrel, Newell's shearwater, or short-tailed albatross.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), secondary stressors associated with training or testing activities under the No Action Alternative, Alternative 1, or Alternative 2 would not result in a significant adverse effect on populations of the great frigatebird, masked booby, or other marine bird populations.

3.6.4 SUMMARY OF POTENTIAL IMPACTS ON MARINE BIRDS

3.6.4.1 Combined Impacts of All Stressors

As described in Section 3.0.5 (Overall Approach to Analysis), this section evaluates the potential for combined impacts of all the stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the analyses of each stressor in the sections above and summarized in Section 3.6.4.2 (Endangered Species Act Determinations).

There are generally two ways that a bird could be exposed to multiple stressors. The first would be if a bird were exposed to multiple sources of stress from a single activity or activities (e.g., an amphibious landing activity may include an amphibious vessel that would introduce potential acoustic and physical strike stressors). The potential for a combination of these impacts from a single activity would depend on the range of effects for each of the stressors and the response or lack of response to that stressor. Most of the activities as described in the Proposed Action involve multiple stressors; therefore, it is likely that if a bird were within the potential impact range of those activities, they may be impacted by multiple stressors simultaneously. This would be more likely to occur during large-scale exercises or activities that span a period of days or weeks (such as a sinking exercise or composite training unit exercise).

Secondly, an individual bird could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where training and testing activities are more concentrated (e.g., near ports, training ranges, and routine activity locations) and in areas that individual birds frequent because it is within the animal's home range, migratory route, breeding area, or foraging area. Except for in the few concentrated areas mentioned above, combinations are unlikely to occur because training and testing activities are generally separated in space and time in such a way that it would be very unlikely that any individual birds would be exposed to stressors from multiple activities. However, animals with a small home range intersecting an area of concentrated Navy activity have elevated exposure risks relative to animals that simply transit the area through a migratory route. The majority of the proposed training and testing activities occur over a small spatial scale relative to the entire Study Area, have few participants, and are of a short duration (the order of a few hours or less).

Multiple stressors may also have synergistic effects. For example, birds that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Birds that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic impacts from the combination of Navy stressors on birds are difficult to predict.

Although potential impacts on certain bird species from the Proposed Action could include injury or mortality, impacts are not expected to decrease the overall fitness or result in long-term population-level impacts of any given population. In cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The potential impacts anticipated from the Proposed Action are summarized in Sections 3.6.4.2 (Endangered Species Act Determinations) and 3.6.4.3 (Migratory Bird Act Determinations) with respect to each regulation applicable to birds.

3.6.4.2 Endangered Species Act Determinations

Table 3.6-7 summarizes the ESA determinations for each substressor analyzed. There are no critical habitat designations for ESA-listed marine bird species within the MITT Study Area. In 2010, the USFWS Pacific Islands Fish and Wildlife Office issued a Biological Opinion, pursuant with Section 7 of the ESA, on proposed training activities within the MIRC. In early 2015, the Navy completed Section 7 ESA consultation for activities proposed in this EIS/OEIS with the issuance of a new Biological Opinion. The

Biological Opinion concurred with the Navy's determination that training activities within the MITT Study Area would have no effect on the short-tailed albatross, Hawaiian petrel, or Newell's shearwater. These no effect determinations were primarily based on the rare occurrence of these species within the MITT Study Area, and absence from breeding grounds and rookery sites located within the Study Area, particularly at FDM. Because training and testing activities described in this EIS/OEIS do not introduce additional stressors to ESA-listed seabird species, the Navy concludes that implementation of the No Action Alternative, Alternative 1 or Alternative 2 would have no effect on the short-tailed albatross, Hawaiian petrel, or Newell's shearwater.

Table 3.6-7: Summary of Endangered Species Act Effects Determinations for Seabirds for the Preferred Alternative

Navy Activities and Stressors		Short-Tailed Albatross	Hawaiian Petrel	Newell's Shearwater
Acoustic Stressors				
Sonar and other Active Acoustic Sources	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect
Explosives[1]	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect
Aircraft Noise and Vessel Noise	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect
Energy Stressors				
Electromagnetic devices	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect
Physical Disturbance and Strike Stressors				
Aircraft strike	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect
Vessels and in-water devices	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect

Table 3.6-7: Summary of Endangered Species Act Effects Determinations for Seabirds and Shorebirds for the Preferred Alternative (continued)

Navy Activities and Stressors		Short-Tailed Albatross	Hawaiian Petrel	Newell's Shearwater
Physical Disturbance and Strike Stressors (continued)				
Military expended materials	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect
Ground Disturbance	Training Activities	No effect	No effect	No effect
	Testing Activities	Not applicable	Not applicable	Not applicable
Wildfires	Training Activities	No effect	No effect	No effect
	Testing Activities	Not applicable	Not applicable	Not applicable
Ingestion Stressors				
Military expended materials other than munitions	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect
Secondary Stressors				
Secondary Stressors	Training Activities	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect

[1] The explosives substressor includes other impulsive sound sources, such as swimmer defense airguns, weapons firing, launch, and impact noise.

Notes: The scientific names of the listed species are as follows: Short-tailed albatross (*Phoebastria albatrus*), Hawaiian petrel (*Pterodroma sandwichensis*), and Newell's shearwater (*Puffinus newelli*).

3.6.4.3 Migratory Bird Treaty Act Determinations

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations. While this determination is applicable to all seabirds and shorebirds that occur in the Study Area, the Navy carried out a focused analysis for seabirds known to breed within the Study Area, particularly for breeding seabirds on FDM. The Navy identified two birds in particular that have a heightened concern with regards to 50 C.F.R. Part 21—the great frigatebird and the masked booby. FDM is an important breeding ground for these two species.

The Navy assessed the significance of injury and mortality of individual masked boobies and great frigatebirds relative to the viability of these species' populations. The populations of the masked booby and great frigatebird were defined based on (1) the distribution of subspecies *S. d. personata* and *F. m. palmerstoni*, (2) the colony locations within these distributions, and (3) the number of individual birds associated with these colonies. The Navy then compared the number of masked boobies and great frigatebirds that are found within the colonies within the Marianas (particularly FDM) to that of the regional population within the western and central Pacific.

The great frigatebird may occasionally nest on FDM, which is one of only two small breeding colonies known to exist within the Mariana Islands (the other is located on Maug in the northern portion of the archipelago). FDM does not appear to be a temporally or spatially stable rookery location. Compared to the numbers of great frigatebirds estimated throughout central and western Pacific (10,000 pairs in the Hawaiian Islands, with other colonies on Howland, Baker, Jarvis, Johnston Atoll, and Christmas Island [U.S. Fish and Wildlife Service 2005, Reichel 1991, Schreiber and Schreiber 1988]), and the apparent low numbers of great frigatebirds from historic times through the present within the Mariana archipelago, the direct and indirect effects on effects of military activities on FDM would not represent a significant adverse impact on the population of the great frigatebird.

For the masked booby, FDM is the largest breeding colony in Mariana Islands. The colony numbers recorded by the Navy appear to be stable, and the data do not suggest any significant changes of masked booby numbers. Although the masked booby may be subject to short- and long-term impacts of military use of FDM and individuals likely suffer injury and mortality from some activities (e.g., explosives), FDM continues to support a relatively stable rookery. In the central and western Pacific, 2,500 pairs are estimated within the Northwestern Hawaiian Islands, Jarvis (up to 1,200 pairs), Barker Island (over 1,500 pairs), and smaller colonies in American Samoa, Palmyra, Johnson Atoll, and northern islands in the Mariana archipelago (Maug, Uracas, Guguan, and FDM). Based on the long-term use and stability of the masked booby breeding population on FDM and the wide geographic range and abundance of the masked booby throughout the Pacific, the effects of military use of FDM would not represent a significant adverse impact on the population of the masked booby.

Pursuant with the DoD’s obligations under 50 C.F.R. Part 21, the DoD will continue to implement training restrictions on FDM (see Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring), monitoring of bird populations on FDM, and other natural resource projects described in the Joint Region Marianas Integrated Natural Resources Management Plan (U.S. Department of the Navy 2013a).

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3.7 Marine Vegetation

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3.7 MARINE VEGETATION

MARINE VEGETATION SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following have been analyzed for marine vegetation:

- Acoustic (underwater explosives)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, and seafloor devices)
- Secondary (impacts associated with sediments and water quality)

Preferred Alternative (Alternative 1)

- No Endangered Species Act-listed marine vegetation species are found in the Mariana Islands Training and Testing Study Area.
- Acoustic: Underwater explosives could affect marine vegetation by destroying individual plants or damaging parts of plants. The impacts of these stressors are not expected to result in detectable changes in survival or propagation, and are not expected to result in population-level impacts on marine plant species.
- Physical Disturbance and Strike: Physical disturbance and strikes could affect marine vegetation by destroying individual plants or damaging parts of plants. The impacts of these stressors are not expected to result in population-level impacts on marine plant species.
- Secondary: Secondary stressors are not expected to result in detectable changes in growth, survival, propagation, or population-level impacts because changes in sediment and water quality are not likely to be detectable.
- Pursuant to the Essential Fish Habitat (EFH) requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives and other impulsive sources, vessel movement, in-water devices, military expended materials, and seafloor devices during training and testing activities may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or Habitat Areas of Particular Concern.

3.7.1 INTRODUCTION

This section analyzes potential impacts to marine vegetation found in the Mariana Islands Training and Testing (MITT) Study Area (Study Area). The species and taxonomic groups that occur in the Study Area are discussed in this section and the baseline affected environment is discussed in Section 3.7.2 (Affected Environment). The analysis of environmental consequences is presented in Section 3.7.3 (Environmental Consequences), and the potential impacts of the Proposed Action are summarized in Section 3.7.4 (Summary of Potential Impacts [Combined Impacts of All Stressor] on Marine Vegetation).

For this Environmental Impact Statement (EIS)/Overseas EIS (OEIS), marine vegetation is evaluated as groups of species characterized by their distribution. Training and testing activities of the United States (U.S.) Department of the Navy (Navy) are evaluated for their potential impacts on six major taxonomic groups of marine vegetation as appropriate (Table 3.7-1). Marine vegetation, including marine algae and flowering plants, are found throughout the Study Area. Marine vegetation species included as components of habitats that are designated as EFH under the Magnuson-Stevens Fishery Conservation and Management Act are described in the Essential Fish Habitat Assessment (EFHA), and conclusions from the EFHA are summarized in each substressor section. The EFHA for the MITT Study Area is a supporting technical document (U.S. Department of the Navy 2014), and the U.S. Navy has consulted with the National Marine Fisheries Service on the EFHA (refer to Appendix C, Agency Correspondence). No Endangered Species Act (ESA)-listed species are found in the MITT Study Area.

The distribution and condition of abiotic (non-living) substrate associated with attached macroalgae and the impact of stressors are described in Section 3.3 (Marine Habitats). Additional information on the biology, life history, and conservation of marine vegetation can be found on the websites of the following agencies and groups:

- National Marine Fisheries Service (NMFS), Office of Protected Resources (including ESA-listed species distribution maps)
- Conservation International
- Algaebase
- National Resources Conservation Service
- National Museum of Natural History

To cover all marine vegetation types represented in the Study Area, the major groups are discussed in Section 3.7.2 (Affected Environment). The major taxonomic groups include five groups of marine algae and one group of flowering plants (Table 3.7-1).

Table 3.7-1: Major Groups of Marine Vegetation in the Mariana Islands Training and Testing Study Area

Marine Vegetation Groups[1]		Presence in Study Area	
Phylum (Common Name)	Description	Open Ocean	Coastal Waters
Phylum Dinophyta (Dinoflagellates)	Most are photosynthetic single-celled algae that have two whip-like appendages (flagella); Some live inside other organisms. Some produce toxins that can result in red tides or ciguatera poisoning.	Euphotic Zone[2]	Euphotic Zone
Phylum Cyanobacteria (Blue green algae)	These organisms may form mats that attach to reefs and produce nutrients for other marine species through nitrogen fixation.	Euphotic Zone	Euphotic Zone, seafloor
Phylum Chlorophyta (Green algae)	Marine species occur as unicellular algae, filaments, and large seaweeds; some form calcium deposits.	Euphotic Zone	Euphotic Zone, seafloor
Phylum Heterokontophyta (Diatoms, brown and golden-brown algae)	Diatoms are single-celled algae that form the base of the marine food web; brown and golden-brown algae are large multi-celled seaweeds that may form extensive canopies, providing habitat and food for many marine species.	Euphotic Zone	Euphotic Zone, seafloor
Phylum Rhodophyta (Red algae)	Single-celled algae and multi-celled large seaweeds; some form calcium deposits.	Euphotic Zone	Seafloor
Phylum Spermatophyta (Flowering Plants)	Flowering plants in the Study Area (i.e., seagrasses and mangroves) are adapted to salty marine environments in mudflats and marshes, providing habitat and food for many marine species.	None	Seafloor, Intertidal subtidal

[1] Taxonomic groups are based on the Catalogue of Life (Bisby et al. 2010).
[2] Euphotic zone is the portion of the water column where sunlight can penetrate and photosynthesis can occur.

3.7.2 Affected Environment

Features that influence the distribution and abundance of marine vegetation in the coastal waters and open ocean areas of the Study Area are the availability of light, water quality, water clarity, salinity level, seafloor type (important for rooted or attached vegetation), artificial substrates, currents, tidal schedule, and temperature (Green and Short 2003). Marine ecosystems depend almost entirely on the energy produced by marine vegetation through photosynthesis (Castro and Huber 2000), which is the transformation of the sun's energy into chemical energy. In the lighted surface waters of the open ocean and coastal waters, marine algae and flowering plants provide oxygen, food, and habitat for many organisms in addition to forming the base of the marine food web (Dawes 1998).

Of the known major groups found in the Mariana Islands, there are approximately 26 species of blue green algae, 109 species of red algae, 31 species of brown algae, 71 species of green algae, 10 species of seagrasses, 10 species of mangroves (Ellison 2008, Gilman et al. 2006, Lobban and Tsuda 2003), and an estimated 1,200 species of dinoflagellates (Castro and Huber 2000).

The marine vegetation species in the group of seagrasses and mangroves has more limited distributions; all of these occur in shallow (less than 85 feet [ft.] [25.9 meters {m}]) water. The relative distribution of seagrass is influenced by the availability of suitable soft substrates, such as sand or mud, in low-wave-energy areas at depths that allow sufficient light exposure (Spalding et al. 2003), and fresh water input (Houk and van Woesik 2008).

The baseline description for marine vegetation in the Study Area (see Section 3.7.2, Affected Environment), is based on references from scientific research and information published by regulatory agencies. In Section 3.7.3 (Environmental Consequences), the alternatives were evaluated based on the potential and the degree to which exposure to training and testing activities could impact marine vegetation.

3.7.2.1 General Threats

Environmental stressors on marine vegetation are products of human activities (industrial, residential, and recreational) and natural occurrences. The impacts of these environmental stressors on marine vegetation and the existing conditions of this resource are important to consider in determining if Navy training and testing activities contribute to these stressors. Species-specific information is discussed where applicable. Physical disturbance and strike stressors, secondary stressors (addressed in Sections 3.7.3.2 and 3.7.3.3, respectively), and the cumulative impacts of these threats are analyzed in Chapter 4 (Cumulative Impacts).

Human-made stressors that act on marine vegetation include excessive nutrient input (pollutants, such as fertilizers), siltation (the addition of fine particles to the ocean), pollution (oil, sewage), climate change, overfishing (Ellison 2008, Mitsch et al. 2009, Steneck et al. 2002), and the introduction of invasive species, such as other types of non-native vegetation or herbivorous species (Hemminga and Duarte 2000, Spalding et al. 2003). The seagrass and mangrove group is more sensitive to stressors compared to the algal taxonomic groups. The great diversity of algae makes it difficult to generalize but, overall, they are resilient and are able to colonize disturbed environments created by stressors (Levinton 2009b).

Seagrasses and mangroves are all susceptible to the human-induced stressors on marine vegetation, and their presence in the Study Area has decreased as a result (Food and Agriculture Organization of the United Nations 2007, Gilman et al. 2006, Spalding et al. 2003). Seagrasses can be uprooted by dredging and scarred by boat propellers (Hemminga and Duarte 2000, Spalding et al. 2003) and uprooted and broken by anchors (Francour et al. 1999). Seagrass that is scarred from boat propellers can take years to recover (Dawes et al. 1997). Likewise, the global mangrove resource has decreased over the last 50 years to about two-thirds of what it used to be due to aquaculture, changes in hydrology (water movement and distribution), and sea level rise (Feller et al. 2010). Although not occurring in the Study Area, a main threat to mangroves worldwide is removal of mangrove for the establishment of shrimp aquaculture ponds. Shrimp aquaculture accounts for the loss of 20 to 50 percent of mangroves worldwide (McLeod and Salm 2006).

A stressor of particular concern for marine vegetation is pollution. Runoff from land-based sources, natural seeps, and accidental spills (e.g., oil tanker spills) are some of the major sources of pollution in the marine environment (Levinton 2009a). The types and amounts of contaminant spilled, weather conditions, season, location, oceanographic conditions, and the method used to remove the contaminant (containment or chemical dispersants) are some of the factors that determine the severity of the impacts. Sensitivity to contaminants varies among marine vegetation species and within species, depending on the life stage; generally, early-life stages are more sensitive than adult stages (Hayes et al. 1992). Additionally, those species that are completely submerged are less susceptible to contaminants which remain on the surface, such as oil, since they largely escape direct contact with the pollutant. In the Study Area, mangroves would be the most susceptible marine vegetation species because contact with oil can cause death, leaf loss, and germination failure (Hoff 2002).

The discussion above represents general threats to marine vegetation. Additional threats to individual species within the Study Area are described below in the accounts of those species.

3.7.2.2 Marine Vegetation Groups

3.7.2.2.1 Phylum Cyanobacteria (Blue-Green Algae)

Blue-green algae are single-celled and filamentous (fine threads) forms of photosynthetic (using the sun's energy to produce food) bacteria that inhabit the lighted surface waters and seafloors of the world's oceans (Bisby et al. 2010). Blue-green algae are key primary producers in the marine environment, and provide valuable ecosystem services such as producing oxygen and nitrogen. The blue-green algae *Prochlorococcus* is responsible for a large part of the oxygen produced globally by photosynthetic organisms. Other species of blue-green algae have specialized cells that convert nitrogen gas into a form that can be used by other marine plants and animals (nitrogen fixation) (Hayes et al. 2007, Whitton and Potts 2008). In nutrient-poor waters of the Study Area where coral reef ecosystems are present, blue-green algae may be a source of food for herbivorous marine life Areas lacking herbivorous fish, or other animals which feed on blue-green algae, are likely to have a higher abundance of highly productive and invasive blue-green algae (Cheroske et al. 2000).

3.7.2.2.2 Phylum Dinophyta (Dinoflagellates)

Dinoflagellates are single-celled organisms with two flagella (whiplike structures used for locomotion) in the phylum Dinophyta (Bisby et al. 2010). Dinoflagellates are a marine algae, with an estimated 1,200 species living in surface waters of the ocean worldwide (Castro and Huber 2000). Most dinoflagellates use the sun's energy to produce food through photosynthesis; some species also ingest small food particles or do both. Photosynthetic dinoflagellates are important primary producers in coastal waters (Waggoner and Speer 1998). Organisms such as zooplankton, small organisms with an external supportive covering (exoskeleton), feed on dinoflagellates.

Dinoflagellates are also valuable for their close relationship with reef-building corals. Some species of dinoflagellates, the zooxanthellae, live inside corals. This mutually beneficial relationship provides shelter and food (in the form of coral waste products) for the dinoflagellates; in turn, the corals receive essential nutrients produced by dinoflagellates (Spalding et al. 2001). Dinoflagellates are responsible for some types of algal blooms, which can be harmful to invertebrates, fish, birds, marine mammals, and humans. These algal blooms usually result from sudden increases in nutrients (e.g., terrestrial runoff of fertilizers), temperature changes, and increase in algal productivity due to sunlight (Levinton 2009c). Additional information on harmful algal blooms can be accessed on the Centers for Disease Control and the National Oceanic and Atmospheric Administration (NOAA) websites.

3.7.2.2.3 Phylum Chlorophyta (Green Algae)

Green algae are single-celled and multi-cellular plants in the phylum Chlorophyta that may form large colonies of individual cells (Bisby et al. 2010). Green algae are predominately found in freshwater, with only 10 percent of the estimated 7,000 species living in the marine environment (Castro and Huber 2000). These species are important primary producers that play a key role at the base of the marine food web. Green algae are found in areas with a wide range of salinity, such as bays and estuaries, and are eaten by various organisms, including zooplankton (small animals that float in the water), snails, and herbivorous fish. In the Study Area, the green algae, *Caulerpa racemosa* and *Caulerpa lentillifera,* are harvested for human consumption.

3.7.2.2.4 Phylum Heterokontophyta (Brown Algae)

Brown and golden-brown algae are single-celled (diatoms) and large multi-celled marine species with structures varying from fine filaments to thick leathery forms (Castro and Huber 2000). In the Study Area there are 31 species of brown algae (Lobban and Tsuda 2003). Most species are attached to the seafloor in coastal waters, and include species such as *Sargassum ilicifolium, Sargassum obtusifolium,* and *Sargassum polycystum* (Lobban and Tsuda 2003). Additionally, several species of diatoms occur in the Study Area such as *Nitzschia martiana* (Lobban and Tsuda 2003).

3.7.2.2.5 Phylum Rhodophyta (Red Algae)

Red algae are predominately marine algae, with approximately 4,000 species worldwide (Castro and Huber 2000). Red algal species exist in a range of forms, including single and multicellular forms (Bisby et al. 2010), from fine filaments to species with thick calcium carbonate crusts. Within the Study Area, they occur in coastal waters, primarily in reef environments and intertidal zones. Some species of red algae that occur in the Study Area include *Erythrotrichia carnea* and *Yamadaella caenomyce* (Lobban and Tsuda 2003). In the Study Area, the species *Gracilaria tsudae* had previously been harvested for human consumption until being implicated in the deaths of three individuals in 1991 (Tsuda 2009).

Many Rhodophyta species support coral reefs by trapping loose sediments, and cementing coral fragments to provide the base structures for coral growth and a living protective cover (Castro and Huber 2000). Coralline algae secrete calcium carbonate to build a hard shell around its cell walls. There are both encrusting forms, which grow as a crust over hard structures such as rocks and the shells of organisms like clams and snails, and upright forms of coralline algae (Kennedy 2012). Some species of red crustose coralline algae in the Study Area include *Hydrolithon onkodes, Lithophyllum pygmaeum,* and *Pneophyllum conicum* (Minton et al. 2009).The percentage cover of red coralline algae is estimated from surveys to be less than 20 percent for Guam and Tinian and increases to approximately 31 to 50 percent on portions of the southwestern side of Saipan (Minton et al. 2009).

3.7.2.2.6 Phylum Spermatophyta (Flowering Plants)

Seagrasses and mangroves are flowering marine plants in the phylum Spermatophyta (Bisby et al. 2010). These marine flowering plants create important habitat, and are a food source for many marine species.

3.7.2.2.6.1 Seagrasses

Seagrasses are unique among flowering plants in their ability to grow submerged in shallow marine environments. Except for some species that inhabit the rocky intertidal zone, seagrasses grow in shallow, subtidal, or intertidal sediments, and can extend over a large area to form seagrass beds (Garrison 2004, Phillips and Meñez 1988). They provide suitable nursery habitat for commercially important organisms (e.g., crustaceans, fish, and shellfish) and also are a food source for some protected species (e.g., sea turtles) (Heck et al. 2003). The structure of seagrass beds can prevent coastal erosion, promotes nutrient cycling through the breakdown of detritus (Dawes 1998), and improves water quality. Seagrasses also contribute a high level of primary production to the marine environment, which supports high species diversity and biomass (Spalding et al. 2003).

Seagrass beds are distributed within the Study Area (see Figures 3.3-1 to 3.3-4). Seagrasses that occur in the coastal areas of the Study Area from the southern Mariana Islands include *Enhalus acoroides, Halodule uninervis,* and *Halophila minor* (Tsuda et al. 1977). Both Guam and Saipan have extensive seagrass meadows surrounding the coastlines (National Centers for Coastal Ocean Science and National Oceanic and Atmospheric Administration 2005), including extensive beds in Agat Bay (including the Agat Unit of the War in the Pacific National Historical Park) (Daniel and Minton 2004), south of Apra Harbor, Agana Bay, and Cocos Lagoon on Guam (Daniel and Minton 2004, Eldredge et al. 1977) (Figure 3.7-1). According to NOAA satellite surveys, there are no seagrass beds in Apra Harbor (Figure 3.7-2); however, smaller beds of seagrasses may be present in this area. The NOAA satellite surveys do not show seagrass beds around Tinian (Figure 3.7-3). However, a literature review provided information that Tinian possesses seagrass beds along the northeastern, eastern, the southwestern, and northwestern coastlines (Kolinski 2001, U.S. Department of the Navy 2003), and that seagrasses were largely absent from Tinian's north and south coasts (Kolinski 2001). Seagrasses are more scattered on the island of Saipan (Figure 3.7-4), with seagrass beds reported along Tanapag Beach (along the northwest coast) and in Puerto Rico Mudflats (northwest shoreline, north of Tanapag Beach) (Scott 1993, Tsuda et al. 1977). There is no record of seagrasses for the islands north of Saipan (Tsuda 2009), which is also documented in the NOAA satellite surveys for FDM (Figure 3.7-5).

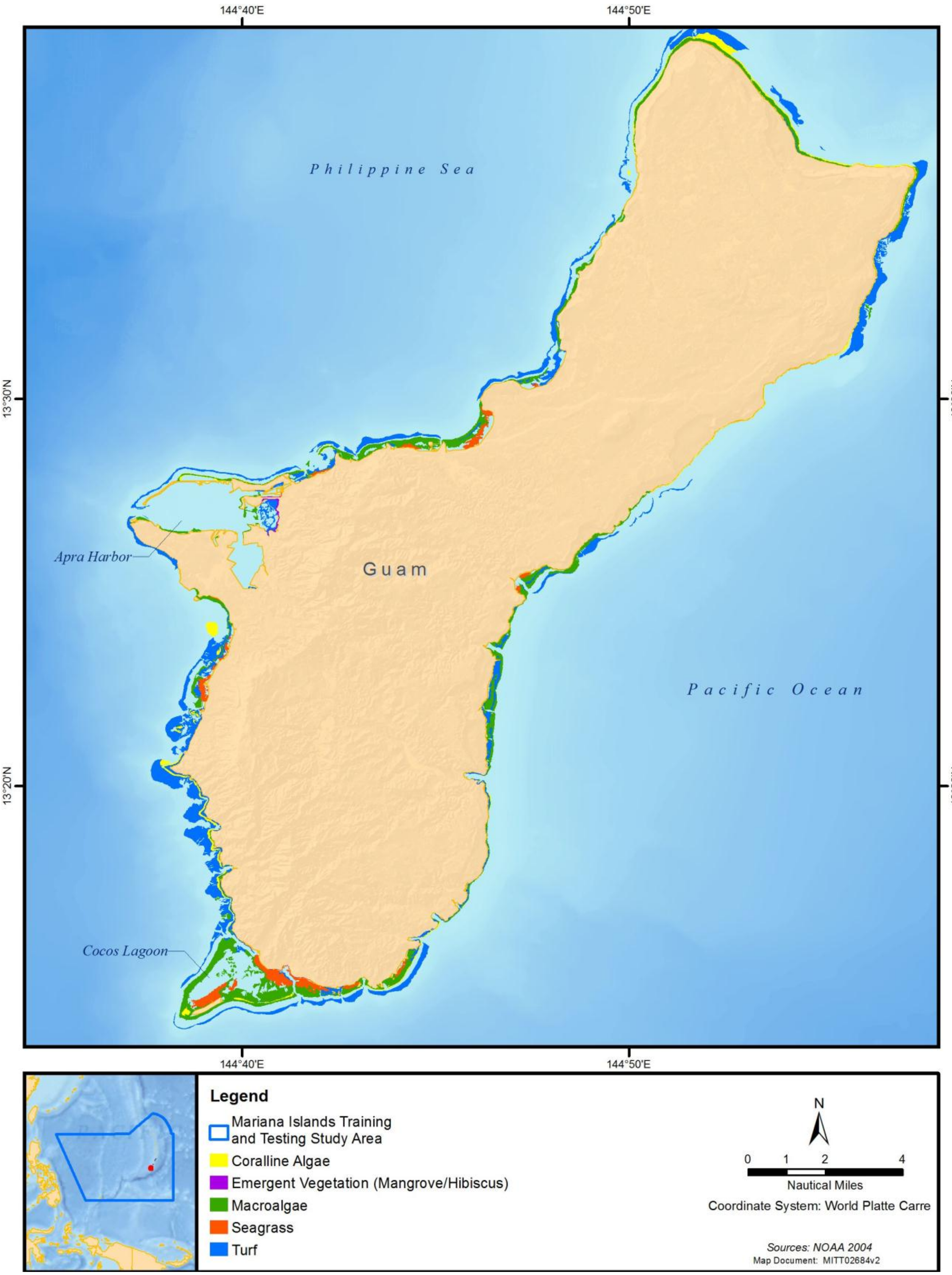

Figure 3.7-1: Marine Vegetation Surrounding Guam

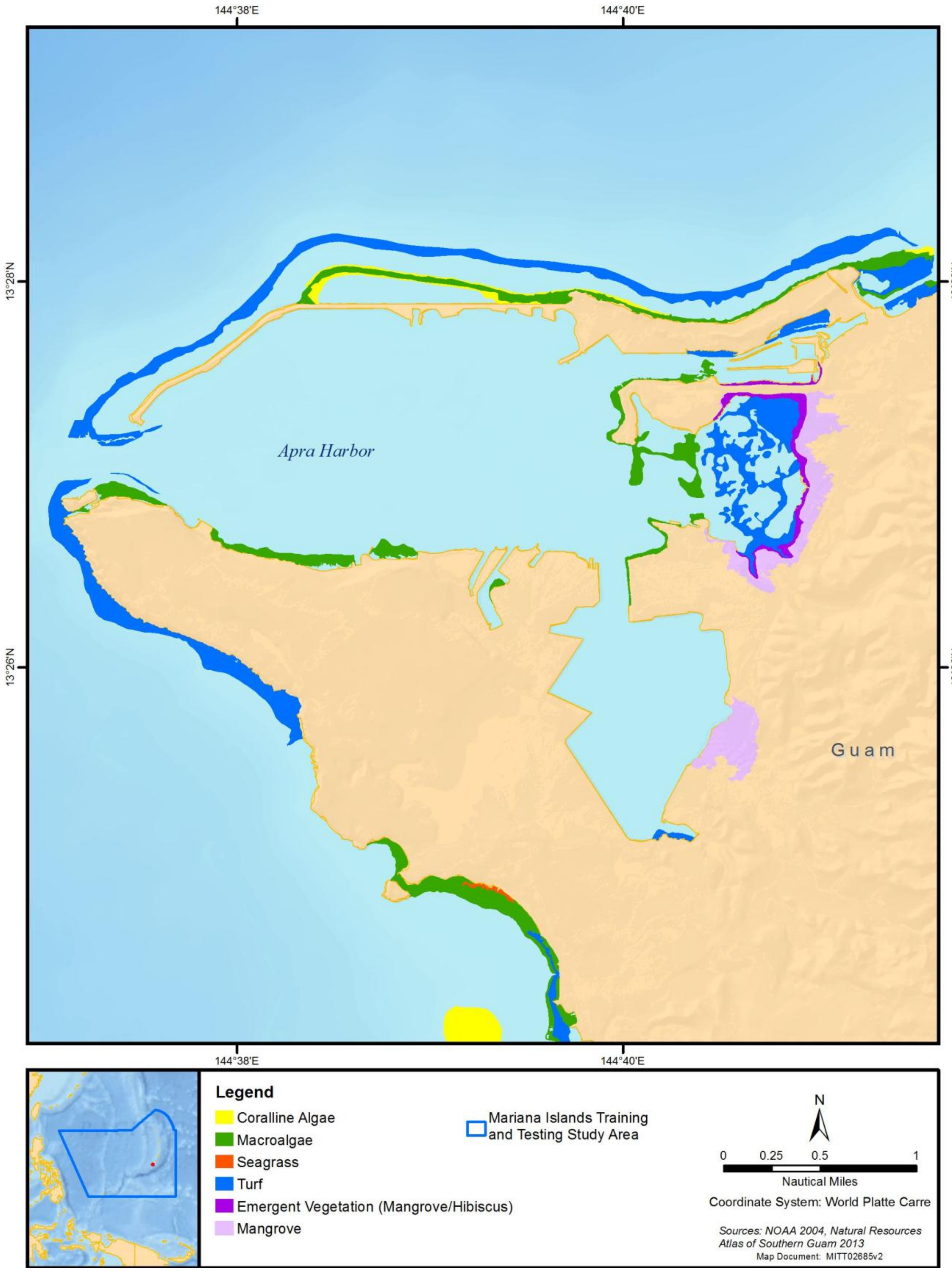

Figure 3.7-2: Marine Vegetation in the Vicinity of Apra Harbor

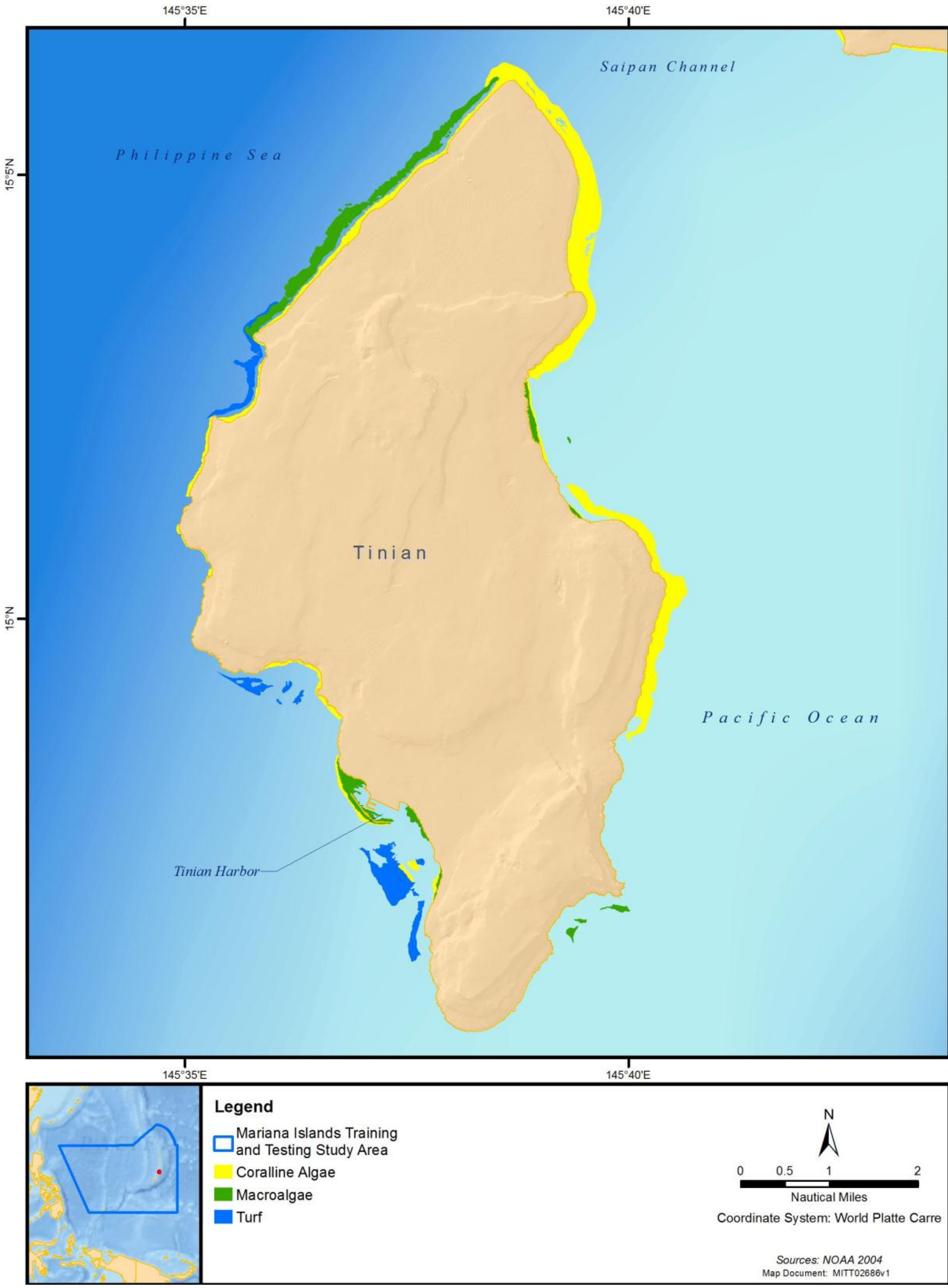

Figure 3.7-3: Marine Vegetation Surrounding Tinian

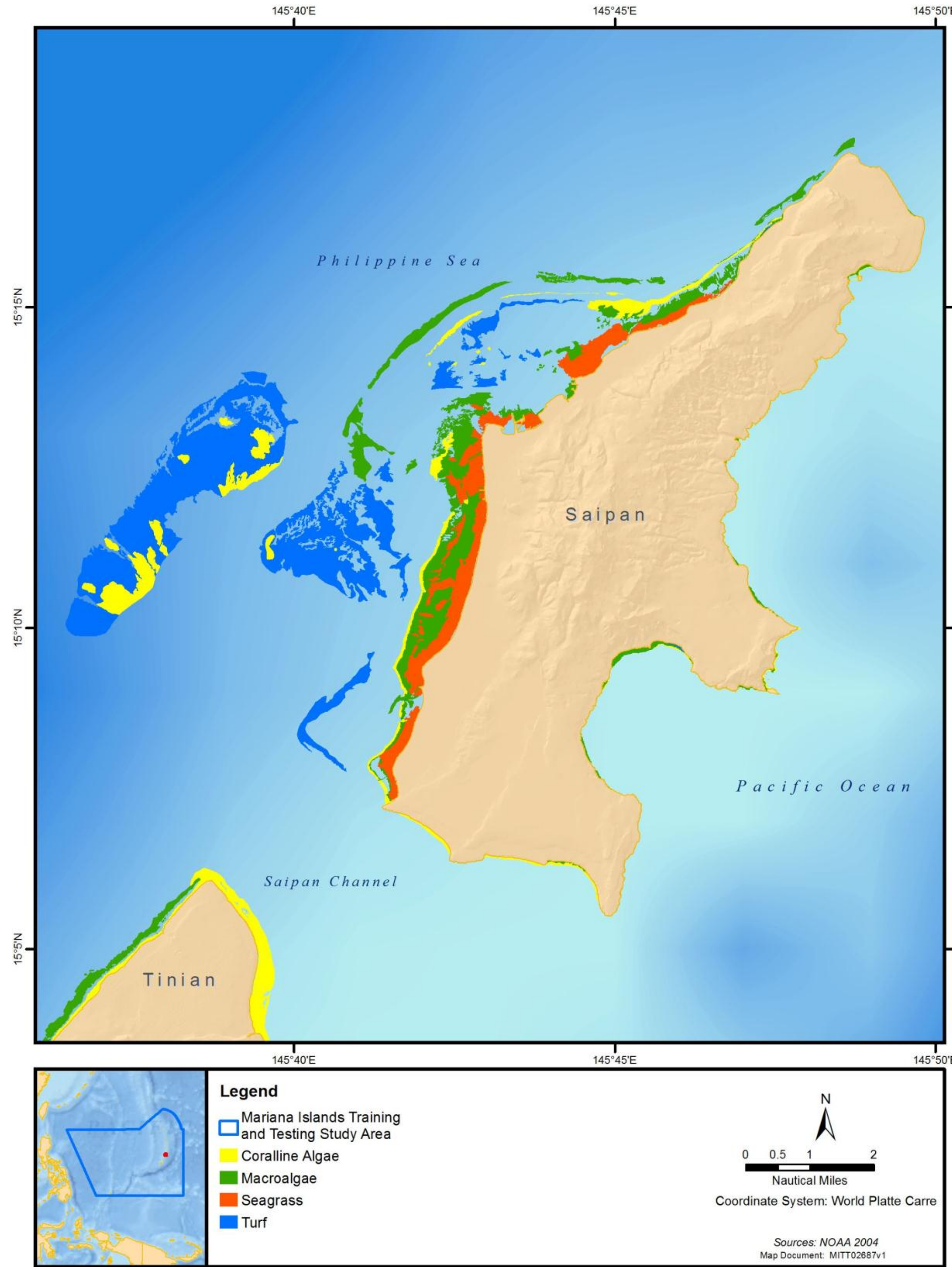

Figure 3.7-4: Marine Vegetation Surrounding Saipan

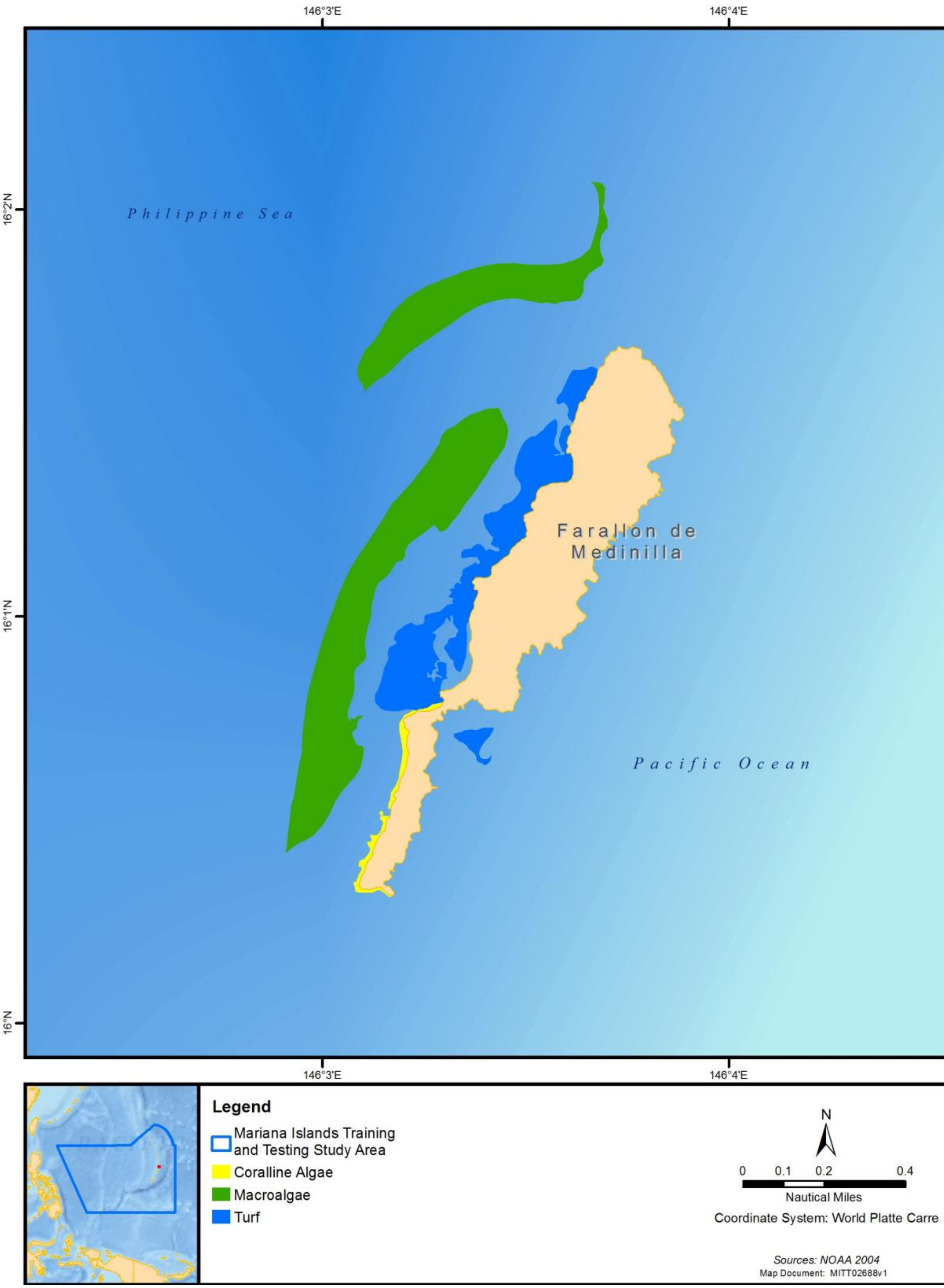

Figure 3.7-5: Marine Vegetation Surrounding Farallon de Medinilla

3.7.2.2.6.2 Mangroves

Mangroves are a group of woody plants that have adapted to brackish water environments in the tropics and subtropics (Ruwa 1996). Mangroves provide critical ecosystem services in their role as primary producers, including contributions to the decomposition of matter (Bouillon 2009), sediment stabilization (Ruwa 1996), nursery habitat (Mitsch et al. 2009), and providers of habitat for commercially important species (e.g., fish, shrimp, and crabs) (Aburto-Oropeza et al. 2008, Hogarth 1999). Nearshore fisheries associated with mangroves are generally more productive than those not associated with mangroves due to the nutrient storage in the plants and the physical complexity of the habitat that mangroves provide for fish and their prey (Ruwa 1996).

Mangroves provide important nursery habitat for many species of fish and invertebrates. Conservation of mangrove habitats is important due to the use of these areas as nurseries for commercial fish species and coral reef fish species (Laegdsgaard and Johnson 1995). Additionally, researchers have found that coral reef fish were twice as abundant on reefs adjacent to mangrove forests compared to reefs without mangroves (Roach 2004).

Mangrove forest are native to the Study Area; however, they are only present on the islands of Guam and Saipan, with the mangroves of Guam being the most extensive and diverse totaling approximately 170 ac. (68 hectares [ha]) (Scott 1993). However, a recent survey documented only 84.5 ac. (34.2 ha) (Bhattarai and Giri 2011). Guam has 10 species of mangroves including *Rhizophora mucronata, Rhizophora apiculata, Avicennia marina*, *Bruguiera gymnorhiz, Lumnitzera littorea, Nypa fructicans, Xylocarpus moluccensis, Heritiera littoralis, Heritiera tiliaceus,* and *Acrostichum aureum* (Guam Department of Agriculture 2005). The mangrove forest on Saipan is dominated by a single species, *Bruguiera gymnorhiza.*

3.7.3 Environmental Consequences

This section presents the analysis of potential impacts on marine vegetation, from implementation of the project alternatives, including the No Action Alternative, Alternative 1, and Alternative 2. General characteristics of all stressors were introduced in Section 3.0.5.2 (Identification of Stressors for Analysis), and living resources' general susceptibilities to stressors are discussed in Appendix H (Biological Resource Methods). Each marine vegetation stressor is introduced, analyzed by alternative, and analyzed for training activities and testing activities.

The stressors vary in intensity, frequency, duration, and location within the Study Area. Because marine vegetation is not susceptible to energy, entanglement, or ingestion stressors, those stressors will not be assessed. Only the training and testing activity stressors and their components that occur in the same geographic location as marine vegetation are analyzed in this section. Based on the general threats to marine vegetation discussed in Section 3.7.2 (Affected Environment), the stressors applicable to marine vegetation are:

- Acoustic (underwater explosives)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, and seafloor devices)
- Secondary (impacts associated with sediments and water quality)

Details of all training and testing activities, stressors, components that cause the stressor, and geographic occurrence within the Study Area, are summarized in Section 3.0.5.2 (Identification of Stressors for Analysis) and detailed in Appendix A (Training and Testing Activities Descriptions).

3.7.3.1 Acoustic Stressors

This section analyzes the potential impacts of acoustic stressors that may occur during training and testing activities on marine vegetation within the Study Area. The acoustic stressors that may impact marine vegetation include explosives that are detonated on or near the surface of the water, or underwater; therefore, only these types of explosions are discussed in this section.

3.7.3.1.1 Impacts from Explosives

This section analyzes the potential impacts of training and testing activities conducted by the military that involve underwater explosions in the water column and on the seafloor in the Study Area. Various types of explosives are used during training and testing activities. The type, number, and location of activities that use explosives under each alternative are discussed in Section 3.0.5.2.1.2 (Explosives). Explosive sources are the only acoustic stressor applicable to this resource because of the potential for explosives to result in physical damage to marine vegetation.

The potential for an explosion to injure or destroy marine vegetation would depend on the amount of vegetation present, the number of munitions used, and their net explosive weight (NEW). In areas where marine vegetation and locations for explosions overlap, vegetation on the surface of the water, in the water column, or rooted in the seafloor may be impacted. Seafloor macroalgae and single-celled algae may overlap with underwater and sea surface explosion locations. If these vegetation types are near an explosion, only a small number of them are likely to be impacted relative to their total population level. The low number of explosions relative to the amount of seafloor macroalgae and single-celled algae in the Study Area also decreases the potential for impacts on these vegetation types. Based on these factors, the impact on these types of marine vegetation would not be detectable, and they will not be discussed further. In addition, some seafloor macroalgae are resilient to high levels of wave action (Mach et al. 2007), which may aid in their ability to withstand underwater explosions that occur near them. Underwater explosions also may temporarily increase the turbidity (sediment suspended in the water) of nearby waters, incrementally reducing the amount of light available to marine vegetation. Reducing light availability will decrease, albeit temporarily, the photosynthetic ability of marine vegetation.

Seagrasses may potentially be uprooted or damaged by sea surface or underwater explosions. Re-growth of seagrasses after uprooting can take up to 10 years (Dawes et al. 1997). Explosions may also temporarily increase the turbidity (sediment suspended in the water) of nearby waters, but the sediment would settle to pre-explosion conditions within a number of days. Sustained high levels of turbidity may reduce the amount of light that reaches vegetation which it needs to survive. This scenario is not likely given the low number of explosions planned in areas with seagrass. It should be noted that seagrasses generally grow in waters that are sheltered from wave action, such as estuaries, lagoons, and bays (Phillips and Meñez 1988) where most activities are not conducted. Detonations are unlikely to occur in areas with mangroves or seagrasses. Detonations in the Study Area, at the underwater detonation (UNDET) sites (Figure 3.7-2) would occur in previously disturbed areas over unvegetated seafloor.

3.7.3.1.1.1 No Action Alternative

<u>Training Activities</u>

Under the No Action Alternative, mine neutralization systems that use explosive ordnance disposal divers and remotely operated vehicles may involve explosions on the seafloor. Table 3.7-2 lists training and testing activities that include seafloor explosions, along with the location of the activity and the associated explosives charges. These activities may impact seafloor vegetation. Within the coastal waters of the Study Area, 50 mine neutralization training activities with explosive ordnance would occur every year, using a total of 50 explosive charges, with each charge ranging from 1 to 10 pounds (lb.) (0.5 to 4.5 kilograms [kg]) NEW. These activities would occur in areas that have been previously disturbed and are unlikely to support marine vegetation.

If marine vegetation (not including seagrasses) did occur within blast zones, the vegetation may have a clearly detectable response (e.g., algal mats dispersing, rupture of individual plant cells), followed by a recovery period lasting weeks to months after exposure. Although marine vegetation growth in the immediate area of explosions would be inhibited, long-term survival, annual reproductive success, or lifetime reproductive success of the population would not be impacted since recovery is likely.

Some seafloor macroalgae in coastal areas are adapted to natural disturbances such as storms and wave action that can exceed 33 ft. (10.1 m) per second (Mach et al. 2007), and would be expected to quickly recover from local UNDETs. It is reasonable to assume that training activities involving stressors that result in impacts similar to natural events would be followed by a similar recovery period. Impacts from explosions that exceed natural disturbance intensity or frequency may include uprooting of plants and substrate damage, which would prolong recovery times. However, the military further reduces impacts on overall vegetation communities by using unvegetated areas that are already disturbed.

Table 3.7-2: Annual Training and Testing Activities that Include Seafloor Explosions

Activity	Explosive Charge (NEW)[1]	Underwater Detonations			Location
		No Action[1]	Alternative 1	Alternative 2	
Training					
Mine Neutralization (Explosive Ordnance Disposal)	1–20 lb.	20	20	20	Agat Bay Mine Neutralization Site Piti Point Mine Neutralization Site Outer Apra Harbor Underwater Detonation Site
Underwater Demolition Qualification/ Certification	1–20 lb.	30	30	30	
Testing					
Mine Countermeasure Mission Package Testing	5 lb.	0	24	28	Study Area

[1] Under the No Action Alternative, the NEW would not exceed 10 lb. Under Alternatives 1 and 2 only Agat Bay Mine Neutralization Site NEW would increase to a maximum of 20 lb.
Notes: lb. = pound(s), MIRC = Mariana Islands Range Complex, NEW = net explosive weight

There are no seagrass beds or mangroves located in the vicinity of the UNDET area in Apra Harbor or in the open ocean locations (Figures 2.7-1 and 3.7-1). Underwater and surface explosions conducted for training activities are not expected to cause any risk to marine algae or seagrass because: (1) the relative coverage of marine vegetation in these areas is low, (2) the impact area of underwater explosions is very small relative to marine vegetation distribution (see Section 3.3.3.1, Acoustic Stressors [Explosives], in Section 3.3, Marine Habitats), and (3) seagrass does not overlap with areas where the stressor occurs. Based on these factors, potential impacts on multi-cellular marine algae from underwater and surface explosions are not expected to impact the long-term survival, annual reproductive success, and lifetime reproductive success, and are not expected to result in population level impacts; and there are no potential impacts on seagrass species.

Testing Activities

Under the No Action Alternative, there are no testing activities that include the use of explosives that would have an acoustic impact on marine vegetation.

3.7.3.1.1.2 Alternative 1

Training Activities

Under Alternative 1, there is a proposed increase in UNDETs from 10 lb. NEW to 20 lb. NEW at the Agat Bay Mine Neutralization Site. Underwater detonations at the Piti Point Mine Neutralization and Outer Apra Harbor UNDET sites would remain at 10 lb. NEW. Under Alternative 1, about 50 mine neutralization training activities with explosive ordnance would occur every year. These activities would occur in areas that have been previously disturbed and are unlikely to support marine vegetation. In addition, a shock wave generator would be used, however, based on the small amount of explosives (0.033 lb. [0.015 kg]) used in a shock wave generator; no impacts to marine vegetation are expected.

Under Alternative 1, underwater explosions conducted for training activities may injure or kill individual marine vegetation; however, exposure to these detonations would be limited to the vicinity of the explosions. The UNDET area in Apra Harbor is located in a sandy habitat where there are no seagrass beds or other marine vegetation located (Figures 2.7-1, 3.3-2, and 3.7-2). The offshore underwater mine neutralization sites are located in areas with water depths that are unlikely for marine vegetation to occur in (Figure 2.7-1). Despite the increase in underwater and surface explosions, the potential impacts on exposed marine algae are expected to be the same as under the No Action Alternative because the overlap with the resource is limited. Underwater and surface explosions conducted for training activities are not expected to pose a risk to seagrass because: (1) the impact area of underwater explosions is very small relative to seagrass distribution and (2) the low number of charges reduces the potential for impacts. For the same reasons as stated in Section 3.7.3.1.1.1 (No Action Alternative) for marine algae and here for seagrass, the use of surface and underwater explosions is not expected to impact the long-term survival, annual reproductive success, and lifetime reproductive success of marine vegetation, and is therefore not expected to result in population-level impacts.

Testing Activities

Alternative 1 would introduce testing activities that would involve the use of 6,012 explosives. As presented in Tables 2.8-2 to 2.8-4, these testing activities occur in waters between 3 and 12 nautical miles (nm) from shore within the Study Area, which are not likely to support marine vegetation such as attached macro algae or seagrasses. However, there would be 24 UNDETs (explosive neutralizers) used during mine countermeasure mission package testing activities. The maximum NEW of each detonation would be 5 lb. which could impact an area of 145 square feet (ft.^{2}) (13 square meters [m^2]). Underwater explosions associated with testing activities under Alternative 1 would disturb approximately 3,480 ft.^{2} (310 m^2) per year of substrate in the Study Area (Table 3.3-4).

Under Alternative 1, underwater explosions conducted for testing activities may injure or kill individual marine plants; however, exposure to these detonations would be limited to the vicinity of the explosions and would not pose a risk to marine vegetation communities. Marine vegetation within blast zones could have a clearly detectable response (e.g., algal mats dispersing, rupture of individual plant cells), followed by a recovery period lasting weeks to months. The long-term survival, annual reproductive success, and lifetime reproductive success of marine vegetation would not be impacted. The explosions occur in open water and in the outer part of Apra Harbor. Some seafloor macroalgae in coastal areas are adapted to natural disturbances such as storms and wave action that can exceed 33 ft. (10.1 m) per second (Mach et al. 2007), and would be expected to quickly recover from local UNDETs. These activities would be on a small spatial scale relative to its distribution in marine ecosystems. This analysis assumes that testing activities under Alternative 1 involving stressors that result in impacts similar to natural events would be followed by a similar recovery period. Impacts of explosions that exceed natural disturbance intensities may uproot plants and damage substrates, which would delay recovery. The military further reduces impacts on overall vegetation communities by using already disturbed areas.

3.7.3.1.1.3 Alternative 2

Training Activities

Under Alternative 2, the number of mine neutralization (explosive ordnance disposal) training activities in the Study Area would remain the same as under Alternative 1.

Under Alternative 2, underwater explosions conducted for training activities may injure or kill individual marine plants; however, exposure to these detonations would be limited to the vicinity of the explosions and would not pose a risk to marine vegetation communities. Marine vegetation within blast zones could have a clearly detectable response (e.g., algal mats dispersing, rupture of individual plant cells). The long-term survival, annual reproductive success, and lifetime reproductive success of marine vegetation would not be impacted. The UNDET area in Apra Harbor is located in a sandy habitat where no seagrass beds or other marine vegetation are located (Figures 2.7-1, 3.3-2, and Figure 3.7-2). The offshore underwater mine neutralization sites are located in areas with water depths that are unlikely for marine vegetation to occur in (Figure 2.7-1). Despite the increase in underwater and surface explosions, the potential impacts on exposed marine algae are expected to be the same as under the No Action Alternative because the overlap with the resource is limited. Underwater and surface explosions conducted for training activities are not expected to pose a risk to seagrass because: (1) the impact area of underwater explosions is very small relative to seagrass distribution, and (2) the low number of charges reduces the potential for impacts. For the same reasons as stated in Section 3.7.3.1.1.1 (No Action Alternative) for marine algae and here for seagrass, the use of surface and underwater explosions is not expected to impact the long-term survival, annual reproductive success, and lifetime reproductive success of marine vegetation, and is therefore not expected to result in population-level impacts.

Testing Activities

Alternative 2 would introduce testing activities that would involve the use of 7,451 explosives, all of which could occur throughout the Study Area, although the majority occurs in waters greater than 3 nm from shore. Because these detonations occur in deeper waters near the water surface, most marine vegetation would not experience intense shock wave impacts. However, there would be 28 UNDETs (explosive neutralizers) used during mine countermeasure mission package testing activities, which may impact marine vegetation. The maximum NEW of each detonation would be 5 lb., which could impact an area of 145 $ft.^2$ (13 m^2). Underwater explosions associated with testing activities under Alternative 2 would disturb approximately 4,060 $ft.^2$ (365 m^2) per year of substrate in the Study Area (see Table 3.3-4).

Under Alternative 2, underwater explosions conducted for testing activities may injure or kill individual marine plants; however, exposure to these detonations would be limited to the vicinity of the explosions and would not pose a risk to marine vegetation communities. Marine vegetation within blast zones could have a clearly detectable response (e.g., algal mats dispersing, rupture of individual plant cells), followed by a recovery period lasting weeks to months. The long-term survival, annual reproductive success, and lifetime reproductive success of marine vegetation would not be impacted. The explosions occur in open water and in the outer part of Apra Harbor. Some seafloor macroalgae in coastal areas are adapted to natural disturbances such as storms and wave action that can exceed 33 ft. (10.1 m) per second (Mach et al. 2007), and would be expected to quickly recover from local UNDETs. These activities would be on a small spatial scale relative to the distribution of vegetative communities in marine ecosystems. This analysis assumes that testing activities under Alternative 2 involving stressors that result in impacts similar to natural events would be followed by a similar recovery period. Impacts of explosions that exceed natural disturbance intensities may uproot plants and damage substrates, which would delay recovery. The military further reduces impacts on overall vegetation communities by using already disturbed areas.

3.7.3.1.2 Substressor Impact on Marine Vegetation as Essential Fish Habitat from Explosives (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during training and testing activities may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that is part of a habitat that is defined as EFH or a Habitat Area of Particular Concern. The MITT EFHA report states that the impact on attached macroalgae is determined to be minimal and temporary to short term throughout the Study Area. Given the available information, the impact on submerged rooted vegetation beds is determined to be minimal and long term.

3.7.3.2 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts of the various physical disturbance and strike stressors used during training and testing activities within the Study Area. The physical disturbance and strike stressors that may impact marine vegetation include (1) vessels, in-water devices, and towed in-water devices; (2) military expended materials; and (3) seafloor devices.

The evaluation of impacts to marine vegetation from physical disturbance and strike stressors focuses on proposed activities that may cause vegetation to be damaged by an object that is moving through the water (e.g., vessels and in-water devices), dropped into the water (e.g., military expended materials), or deployed on the seafloor (e.g., anchors). Not all activities are proposed throughout the Study Area. Wherever appropriate, specific geographic areas of potential impact are identified.

Single-celled algae may overlap with physical disturbance or strike stressors, but the impact would be minimal relative to their total population level; therefore, they will not be discussed further. Seagrasses and macroalgae on the seafloor are the only types of marine vegetation that occur in locations where physical disturbance or strike stressors may be encountered. Therefore, only seagrasses and macroalgae are analyzed further for potential impacts of physical disturbance or strike stressors. Since the occurrence of marine algae is an indicator of marine mammal and sea turtle presence, some mitigation measures designed to reduce impacts on these resources may indirectly reduce impacts on marine algae; see Section 5.3.2.2 (Physical Disturbance and Strike).

3.7.3.2.1 Impacts from Vessels and In-Water Devices

Several different types of vessels (ships, submarines, boats, amphibious vehicles) and in-water devices (towed devices, unmanned underwater vehicles) are used during training and testing activities throughout the Study Area, as described in Chapter 2 (Description of Proposed Action and Alternatives). Vessel movements occur intermittently, are variable in duration, ranging from a few hours to a few weeks, and are dispersed throughout the Study Area. Events involving large vessels are widely spread over offshore areas, while smaller vessels are more active in nearshore areas.

The potential impacts of military vessels and in-water devices used during training and testing activities on marine vegetation are based on the vertical distribution of the vegetation. Surface vessels include ships, boats, and amphibious vehicles; and seafloor vessels include unmanned underwater vehicles and autonomous underwater vehicles. Vessels may impact vegetation by striking or disturbing vegetation on the sea surface or seafloor (Spalding et al. 2003).

Vegetation on the seafloor such as seagrasses and macroalgae may be disturbed by amphibious combat vehicles. Seagrasses are susceptible to vessel propeller scarring (Sargent et al. 1995). Seagrasses could take up to 10 years to fully regrow and recover from propeller scars (Dawes et al. 1997). Seagrasses may also be susceptible to increases in turbidity; however, short-term or seasonal increases have not been found to impact survivorship (Moore et al. 1997). Seafloor macroalgae may be present in locations where these vessels and in-water devices occur, but the impacts would be minimal because of their resilience, distribution, and biomass. Because some seafloor macroalgae in coastal areas are adapted to natural disturbances, such as storms and wave action that can exceed 33 ft. (10 m) per second (Mach et al. 2007), macroalgae will quickly recover from vessel and in-water device movements. However, if the disturbance caused by vessels and in-water device movement exceeds the natural disturbance level for a particular area of marine vegetation then the recovery time would be longer.

Towed in-water devices include towed targets that are used during activities such as Missile Exercises and Gun Exercises. These devices are operated at low speeds either on the sea surface or below it. The analysis of in-water devices will focus on towed surface targets because of the potential for impacts on marine algae. Unmanned underwater vehicles and autonomous underwater vehicles are used in training and testing activities in the Study Area. They are typically propeller-driven, and operate within the water column or crawl along the seafloor. The propellers of these devices are encased, eliminating the potential for seagrass propeller scarring. Algae on the seafloor could be disturbed by these devices although, for the same reasons given for vessel disturbance, unmanned underwater vehicles are not expected to compromise the health or condition of algae.

3.7.3.2.1.1 No Action Alternative

Training Activities

Estimates of relative vessel use and location for the No Action Alternative are provided in Section 3.0 (Introduction to Affected Environment and Environmental Consequences). While these estimates provide a prediction of use, actual military vessel use depends upon military training requirements, deployment schedules, annual budgets, and other unpredictable factors. Testing and training concentrations are most dependent upon locations of military shore installations and established testing and training areas. Under the No Action Alternative the concentration of use and the manner in which the military tests and trains would remain consistent with the range of variability observed over the last decade.

A variety of vessels, in-water devices, and towed in-water devices would be used throughout the Study Area during training activities, as described in Chapter 2 (Description of Proposed Action and Alternatives). Most activities would involve one vessel, but activities may occasionally use two vessels. Unlike most vessels used in offshore training activities that occur in deep water, amphibious vehicles are designed to move personnel and equipment from ship to shore in shallow water.

Disturbances to marine vegetation caused by training activities may result in opportunities for invasive or nuisance species to colonize these areas. Per Chief of Naval Operations Instruction (OPNAVINST)

5090.1D, the Navy would prevent their introductions if possible, respond rapidly to control these species, monitor their populations, and restore the native species and habitats.

Marine vegetation in the path of moving vessels or in-water devices may have a clearly detectable response (e.g., rupture of individual plant cells), followed by a recovery period lasting weeks to months. Although marine vegetation growth near vessels or in-water devices used for training activities under the No Action Alternative would be inhibited during recovery, long-term survival, reproductive success, or lifetime reproductive success would not be impacted.

Amphibious landings would be associated with amphibious warfare training activities, which would include amphibious assault, amphibious assault-battalion landing, and amphibious raid training activities and could occur 10 times under the No Action Alternative. Boats and vessels (including MK V Special Operations Craft, Mechanized and Utility Landing Craft, Air Cushioned Landing Craft) may transport personnel or equipment to the shore or beach in the Study Area. This beaching activity could affect marine habitats, as the boat contacts and disturbs the sediment where it lands. Amphibious Assault and Amphibious Raid training could be conducted in the nearshore area, including the surf zone up to the high tide line at Unai Chulu, Unai Babui, and Unai Dankulo, Tinian, as well as Dry Dock Island in Apra Harbor and Dadi Beach on Guam. Amphibious Raid activities could also be conducted on Rota, but they are restricted to approaches via boat docks (no beach landings).

Amphibious vessels would approach the shore and could beach, which would disturb sediments and increase turbidity. However, amphibious landing activities would be scheduled at high tide, which would reduce the potential for the vessels to disturb sediments or marine vegetation. The impact of vessels on marine vegetation in the surf zone would be minor because of the dispersed nature of the amphibious landings and the surf and tidal disturbance to which the vegetation in these areas are accustomed. Additionally, prior to amphibious landings the area is surveyed to determine the best location for the landing to minimize the potential for impacts to marine vegetation.

Under the No Action Alternative, the impacts of vessel, in-water device, and towed in-water device physical disturbances and strikes during training activities would be minimal disturbances of seaweeds. Seagrass bed damage is not likely but, if it occurs, the impacts would be minor, such as short-term turbidity increases.

The net impact of vessel, in-water device, and towed in-water device physical disturbances and strikes on marine vegetation is expected to be negligible under the No Action Alternative, based on: (1) the quick recovery of most vegetation types; (2) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increase in suspended sediment in shallow areas; and (3) the deployment of in-water devices at depths where they would not likely come in contact with marine vegetation.

Testing Activities

Under the No Action Alternative, the Office of Naval Research will conduct one testing activity involving vessels, vehicles, and in-water devices at the North Pacific Acoustic Lab Philippine Sea Experiment site. No new ship systems are proposed under the No Action Alternative; rather, these systems are analyzed under Alternative 1 testing activities.

Marine vegetation within the path of moving vessels or in-water devices could have a clearly detectable response (e.g., rupture of individual plant cells), followed by a recovery period lasting weeks to months after exposure. Under the No Action Alternative, in-water device physical disturbance or strike from testing activities would not pose a risk to seagrass since the area of action and seagrasses do not overlap.

3.7.3.2.1.2 Alternative 1

Training Activities

Alternative 1 proposes to introduce new vessels (not replacement class vessel for existing vessels). The Littoral Combat Ship and the Joint High Speed Vessel are fast vessels that may operate in near shore waters, but would not be expected to contact marine vegetation on the seafloor. The military would introduce unmanned undersea in-water devices and surface systems under Alternative 1, which may contact marine vegetation on the seafloor. The number of amphibious warfare training activities with amphibious landings would increase by approximately 30 percent compared to the No Action Alternative.

Under Alternative 1, the number of vessels with potential impacts on marine vegetation would increase compared with the No Action Alternative mainly due to the addition of the unmanned undersea and surface systems, but the concentration of use and the manner in which the military trains would remain consistent with that described under the No Action Alternative. The types of vegetation that would overlap with the vessels and the potential impacts of vessel operations would be the same as under the No Action Alternative. Marine vegetation within the path of moving vessels or in-water devices could have a clearly detectable response (e.g., rupture of individual plant cells), followed by a recovery period lasting weeks to months after exposure.

Amphibious landings would be associated with amphibious warfare training activities, which would include amphibious assault, amphibious assault – battalion landing, and amphibious raid training activities. These training activities would occur at Unai Chulu, Unai Babui, and Unai Dankulo on the northern portion of Tinian. Amphibious vessels would approach the shore and could beach, which would disturb sediments and increase turbidity. However, amphibious landing activities would be scheduled at high tide, which would reduce the potential for the vessels to disturb sediments or marine vegetation. The impact of vessels on marine vegetation in the surf zone would be minor because of the dispersed nature of the amphibious landings and the surf and tidal disturbance which the vegetation in these areas are accustomed. Additionally, prior to amphibious landings the area is surveyed to determine the best location for the landing to minimize the potential for impacts to marine vegetation.

Disturbances to marine vegetation caused by training activities may result in opportunities for invasive or nuisance species to colonize these areas. Per OPNAVINST 5090.1D, the Navy will would prevent their introductions if possible, respond rapidly to control these species, monitor their populations, and restore the native species and habitats.

Under Alternative 1, the impacts of vessel, in-water device, and towed in-water device physical disturbances and strikes during training activities would result in minimal disturbances of seaweeds. Seagrass bed damage is not likely but, if it occurs, the impacts would be minor, such as short-term turbidity increases.

The net impact of vessel, in-water device, and towed in-water device physical disturbances and strikes on marine vegetation is expected to be negligible under Alternative 1, based on: (1) the quick recovery of most vegetation types; (2) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increase in suspended sediment in shallow areas; and (3) the deployment of in-water devices at depths where they would not likely come in contact with marine vegetation.

Testing Activities

Under Alternative 1, events using vessels and in-water devices would increase from 1 under the No Action Alternative to 479. Marine vegetation within the path of moving vessels or in-water devices could have a clearly detectable response (e.g., rupture of individual plant cells), followed by a recovery period lasting weeks to months after exposure.

Disturbances to marine vegetation caused by testing activities may result in opportunities for invasive or nuisance species to colonize these areas. Per OPNAVINST 5090.1D, the Navy will would prevent their introductions if possible, respond rapidly to control these species, monitor their populations, and restore the native species and habitats.

Alternative 1 also proposes to introduce new vessels (not replacement class vessel for existing vessels) which are described in Section 2.7.3.2 (Ships). Some of the new vessels may operate in nearshore waters. Because these areas typically support marine vegetation at the surface and on the seafloor, the potential for marine vegetation disturbance in nearshore environments would increase under Alternative 1. Despite this increased disturbance of marine vegetation, the areas where new ship systems would be tested are areas where existing ship maneuvers and training already occur.

In addition to manned ships, the military also proposes to use unmanned undersea and surface systems under testing activities. All of the vehicles described in Section 2.7.3.3 (Unmanned Vehicles and Systems) use advanced propeller systems with encased propellers would prevent damage to seabeds (including seafloor flora). Under Alternative 1, vessel and in-water device use during training activities would not pose a risk of physical disturbance or strike to seagrass, since these activities do not overlap with known seagrass beds.

3.7.3.2.1.3 Alternative 2

Training Activities

Under Alternative 2, the number of events utilizing vessels with potential impacts on marine vegetation would increase to 2,800 events compared with 786 events under the No Action Alternative, but the concentration of use and the manner in which the military trains would remain consistent with that described under the No Action Alternative. The types of vegetation that would overlap with the vessels and the potential impacts of vessel operations would be the same as under the No Action Alternative. In nearshore environments, the number of amphibious assault training activities in amphibious warfare training areas would be the same as under the No Action Alternative. Impacts on marine vegetation in shallow water, including the surf zones, would not increase under Alternative 2. Under Alternative 2, increased vessel and in-water device use during training activities would not pose a risk of physical disturbance or strike to seagrass.

Testing Activities

Under Alternative 2, events using vessels and in-water devices would increase from 1 under the No Action Alternative to 537. Marine vegetation within the path of moving vessels or in-water devices could have a clearly detectable response (e.g., rupture of individual plant cells), followed by a recovery period lasting weeks to months after exposure.

Disturbances to marine vegetation caused by testing activities may result in opportunities for invasive or nuisance species to colonize these areas. Per OPNAVINST 5090.1D the Navy will would prevent their introductions if possible, respond rapidly to control these species, monitor their populations, and restore the native species and habitats.

3.7.3.2.1.4 Substressor Impact on Marine Vegetation as Essential Fish Habitat from Vessels and In-Water Devices (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training and testing activities would have no impact on attached macroalgae or submerged rooted vegetation that is part of a habitat that is defined as EFH or a Habitat Area of Particular Concern. The MITT EFHA report states that any impacts on marine vegetation incurred by vessel movements and in-water devices would be minimal and short term.

3.7.3.2.2 Impacts from Military Expended Materials

This section analyzes the strike potential to marine vegetation of the following categories of military expended materials: (1) non-explosive practice munitions; (2) fragments from explosive munitions; and (3) expended materials other than ordnance, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.2.3 (Physical Disturbance and Strike Stressors) and Chapter 2 (Description of Proposed Action and Alternatives).

In areas where marine vegetation and locations for military expended materials overlap, vegetation that occurs in the water column, or rooted in the seafloor may be impacted. If these vegetation types are in the immediate vicinity of military expended material, only a small number of them are likely to be impacted relative to their total population level. The low number of military expended materials relative to the total amount of seafloor macroalgae and single-celled algae in the Study Area also decreases the potential for impacts to these vegetation types.

Military expended materials can impact seagrass and other types of algae on the seafloor in coastal areas. Most types of military expended materials are deployed in the open ocean. In coastal water training areas, only projectiles (small and medium), target fragments, and countermeasures could be introduced into areas where shallow water vegetation such as seagrass and algae may be impacted.

Military expended materials can potentially impact seagrass on the seafloor by disturbing, crushing, or shading, which may interfere with photosynthesis. In the event that seagrass is not able to photosynthesize its ability to produce energy is compromised. However, the intersection of seagrasses and military expended materials is limited. Otherwise, seagrasses generally grow in waters that are sheltered from wave action such as estuaries, lagoons and bays (Phillips and Meñez 1988). Locations for the majority of training and testing activities where military materials are expended do not provide this type of habitat. The potential for detectable impacts on seagrasses from expended materials would be low given the small size (e.g., countermeasures) of the majority of the materials, low velocity at deployment (e.g., countermeasures), and the decrease in speed as they hit the sea surface. Falling materials could cause sediment, the surface that seagrasses need to grow, to be suspended. The resuspension of the sediment could impact water quality and decrease light exposure but since it would be short-term (hours), stressors from expended materials would not likely impact the general health of seagrasses.

The following are descriptions of the types of military expended materials that can potentially impact seagrass.

Small-, Medium-, and Large-Caliber Projectiles. Small-, medium-, and large-caliber non-explosive practice munitions, or fragments from explosive projectiles expended during training and testing activities rapidly sink to the seafloor. Due to the small size of projectiles and their casings, damage to marine vegetation is unlikely. Large-caliber projectiles are primarily used in the offshore (at depths greater than 85.3 ft. [26 m]) while small and medium projectiles may be expended in both offshore and coastal areas (at depths less than 85.3 ft. [26 m]). Seagrasses generally do not occur where these materials are expended because these activities do not normally occur in water that is shallow enough for seagrass to grow (85.3 ft. [26 m]).

Bombs, Missiles, and Rockets. Bombs, missiles, and rockets, or their fragments (if explosive) are expended offshore (at depths greater than 85.3 ft. [26 m]) during training and testing activities, and rapidly sink to the seafloor. Seagrass generally does not occur where these materials are expended because of water depth limitations for activities that expend these materials.

Decelerators/Parachutes. Decelerators/parachutes of varying sizes are used during training and testing activities. The types of activities that use decelerators/parachutes, the physical characteristics of these expended materials, where they are used, and the number of activities that would occur under each alternative are discussed in Chapter 2 (Description of Proposed Action and Alternatives) and Section 3.0 (Affected Environment and Environmental Consequences).

Targets. Many training and testing activities use targets. Targets that are hit by munitions could break into fragments. Target fragments vary in size and type, but most fragments are expected to sink. Pieces of targets that are designed to float are recovered when possible. Target fragments would be spread out over large areas in water too deep to support the existence of seagrasses. Seagrass could not occur where these materials are expended.

Vessel Hulk. Vessel hulks are a notable type of military expended material because of their size. Vessel hulks are expended at sea during sinking exercises (SINKEX). Sinking exercises use a target (vessel hulk) against which live explosive or non-explosive munitions are fired; the SINKEX is conducted in a manner that results in the sinking of the target. This activity would only be conducted in designated areas (SINKEX box) with bottom depths greater than 9,842.7 ft. (3,000 m). Seagrass could not occur where these materials are expended.

Countermeasures. Defensive countermeasures such as chaff and flares are used to protect against missile and torpedo attack. Chaff is made of aluminum-coated glass fibers and flares are pyrotechnic devices. Chaff, chaff canisters, and flare end caps are expendable materials. Chaff and flares are dispensed from aircraft or fired from ships. Seagrass could not occur where these materials are expended.

3.7.3.2.2.1 No Action Alternative

Training Activities

Under the No Action Alternative, the majority of military expended material would be used in open ocean areas, where marine vegetation would not be expected to occur. Table 3.3-6 provides numbers and impact radius for all military expended materials used for training activities under the No Action Alternative. Explosive military expended materials would typically fragment into small pieces. Ordnance that fails to function as designed and inert munitions would result in larger pieces of military expended material settling to the seafloor.

Military expended materials in the coastal portions of the Study Area would be limited to small-caliber projectiles, flares, and target fragments. These materials would be small and would typically be colonized with marine vegetation. The small size of these military expended materials would not be expected to impact marine vegetation. In heavily used coastal areas around Farallon de Medinilla (FDM), monitoring since 1999 has determined that impacts to the marine habitats from military expended materials have been insignificant. This was based on few areas of disturbance detected during monitoring; most of the observed disturbance areas have been located in natural rubble environments, the size of disturbed areas was less than 2 m^2, and substantial or complete recovery was observed within one year (Smith et al. 2013). Additionally, marine plant species found in shallow waters off the coasts of the Mariana Islands are adapted to natural disturbance, and recover quickly from storms, as well as to high-energy wave action and tidal surges in oceanside areas. As noted previously, seagrass beds and mangroves in coastal areas would require longer recovery periods. Military expended material strikes would have little impact and would not likely result in the mortality of algae or population level impacts.

Military expended materials used for training activities are not expected to pose a risk to marine algae or seagrass because: (1) the relative coverage of marine algae in the Study Area is low, (2) new growth may result from marine algae exposure to military expended materials, (3) the impact area of military expended materials is very small relative to marine algae distribution, and (4) seagrass overlap with areas where the stressor occurs is very limited. Based on these factors, potential impacts on marine algae and seagrass from military expended materials are not expected to result in detectable changes in their growth, survival, or propagation, and are not expected to result in population-level impacts.

Testing Activities

Under the No Action Alternative, testing activities would not expend materials in shallow-water habitats.

3.7.3.2.2.2 Alternative 1

Training Activities

Under Alternative 1, the number of military expended materials would increase by 225 percent over the No Action Alternative. The majority of military expended material would be used in open ocean areas, where marine vegetation would not be expected to occur. Table 3.3-7 provides numbers and impact radius for all military expended materials used for training activities under the Alternative 1. Explosive military expended materials would typically fragment into small pieces. Ordnance that fails to function as designed and inert munitions would result in larger pieces of military expended material settling to the seafloor.

Military expended materials in the coastal portions of the Study Area would be limited to small-caliber projectiles, flares, and target fragments. Despite the increase in expended materials over the No Action Alternative, the small size of these military expended materials still would not be expected to impact marine vegetation. In heavily used coastal areas around FDM, monitoring conducted since 1999 has determined that impacts to the marine habitats from military expended materials have been insignificant. Additionally, marine plant species found in shallow waters off the coasts of the Mariana Islands are adapted to natural disturbance, and recover quickly from storms, as well as to high-energy wave action and tidal surges in oceanside areas. As noted previously, seagrass beds and mangroves in coastal areas would require longer recovery periods. Strikes would have little impact and would not likely result in the mortality of algae or population level impacts.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may increase the risk to marine algae and seagrass of exposure to military expended materials. Despite the increase in the number of military expended materials, the potential impacts on seagrass are expected to be the same as under the No Action Alternative because overlap with the resources is limited. For the same reasons as stated in Section 3.7.3.2.2.1 (No Action Alternative), the use of military expended materials is not expected to result in detectable changes in marine algae or seagrass growth, survival, or propagation, and are not expected to result in population-level impacts.

Testing Activities

Under the Alternative 1, testing activities would not expend materials in shallow-water habitats.

3.7.3.2.2.3 Alternative 2

Training Activities

Under Alternative 2, the number of military expended materials would increase by 230 percent over the No Action Alternative. The majority of military expended material would be used in open ocean areas, where marine vegetation would not be expected to occur. Table 3.3-7 provides numbers and impact radius for all military expended materials used for training activities under the Alternative 2. Explosive military expended materials would typically fragment into small pieces. Ordnance that fails to function as designed and inert munitions would result in larger pieces of military expended material settling to the seafloor.

Military expended material in the coastal portions of the Study Area would be limited to small-caliber projectiles, flares, and target fragments. Despite the increase over the No Action Alternative, the small size of these military expended materials still would not be expected to impact marine vegetation. In heavily used coastal areas around FDM, monitoring since 1999 has determined that impacts to the marine habitats from military expended materials have been insignificant. Additionally, marine plant species found in shallow waters off the coasts of the Mariana Islands are adapted to natural disturbance, and recover quickly from storms, as well as to high-energy wave action and tidal surges in oceanside areas. As noted previously, seagrass beds and mangroves in coastal areas would require longer recovery periods.

In comparison to the No Action Alternative, the overall increase in activities presented in Alternative 2 may increase the risk of marine algae and seagrass exposure to military expended materials. However, the differences in species overlap and potential impacts of surface explosions on marine algae and seagrass during testing activities would not be discernible from those described in Section 3.7.3.2.2.1 (No Action Alternative). For the same reasons as stated in Section 3.7.3.2.2.1 (No Action Alternative) for marine algae and seagrass, the use of military expended materials is not expected to result in detectable changes to marine algae or seagrass growth, survival, or propagation, and is not expected to result in population-level impacts.

Testing Activities

Under the Alternative 2, testing activities would not expend materials in shallow-water habitats.

3.7.3.2.2.4 Substressor Impact on Marine Vegetation as Essential Fish Habitat from Military Expended Materials (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, military expended materials used for training and testing activities may adversely affect EFH by reducing the quality and quantity of marine vegetation that is part of a habitat that is defined as EFH or a Habitat Area of Particular Concern. The MITT EFHA states that any impacts of military expended materials on attached macroalgae or submerged rooted vegetation would be minimal and long term.

3.7.3.2.3 Impacts from Seafloor Devices

Marine vegetation on the seafloor may be impacted by seafloor devices. Seagrasses and seafloor algae in the Study Area may be impacted by activities involving seafloor devices.

Seafloor device operation, installation, or removal could impact seagrass by physically removing vegetation (e.g., uprooting), crushing, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass which may interfere with photosynthesis. If seagrass is not able to photosynthesize, its ability to produce energy is compromised. However, the intersection of seagrasses and seafloor devices is limited, and suspended sediments would settle in a few days.

Precision anchoring training exercises involve releasing anchors at established anchorages throughout the Study Area. The intent of these training exercises is to practice anchoring a vessel within 100 yards (91.4 m) of the planned anchorage location. These training activities typically occur within predetermined shallow water anchorage locations near ports. In these locations, the seafloors consist of unconsolidated sediments and are devoid of marine vegetation. The level of impact would depend on the size of the anchor used, which would vary according to vessel type.

3.7.3.2.3.1 No Action Alternative

<u>Training Activities</u>

Under the No Action Alternative, 480 mine shapes would be used during mine laying training activities. Mine shapes would be used primarily in Warning Area 517, which is located over predominately soft bottom habitat in the open ocean offshore area (Figure 2.1-2). Based on the small area affected by mine shapes (approximately 8–15 $ft.^2$ [0.7–1.4 m^2]), and the lack of marine vegetation in the areas which mine shapes are used, the use of mine shapes during training activities would not be expected to affect marine vegetation. Additionally, the Portable Underwater Tracking Range (PUTR) would be deployed under the No Action Alternative. This would involve anchoring of approximately seven transponders normally in waters of depths greater than approximately 5,900 ft. (1,798 m). These locations would include seafloors consisting of soft bottom habitat of unconsolidated sediments and would likely not support marine vegetation. Based on the use of areas that have been previously disturbed and are unlikely to support marine vegetation, the PUTR anchoring activities would not be expected to affect marine vegetation.

Seafloor device installation in shallow water habitats under the No Action Alternative training activities would pose a negligible risk to marine vegetation. Any damage from seafloor devices would be followed by a recovery period lasting weeks to months. Although marine vegetation growth near seafloor devices installed during training activities under the No Action Alternative would be inhibited during recovery, population-level impacts are unlikely because of the small, local impact areas, the frequency of training activities, and the wider geographic distribution of seagrasses in and adjacent to training areas.

Testing Activities

Under the No Action Alternative, seafloor devices are only utilized during testing activities at the North Pacific Acoustic Lab's Deep Water site. The deep water experimental site consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment (depths greater than 3,280 ft. [1,000 m]) of the northwestern Philippine Sea. The impact of seafloor devices on marine vegetation is unlikely based on the depth of these activities and the lack of vegetation present.

3.7.3.2.3.2 Alternative 1

Training Activities

Under Alternative 1, 480 mine shapes would be used during mine laying training activities. Mine shapes would be used primarily in Warning Area 517, which is located over predominately soft bottom habitat in the open ocean offshore area (Figure 2.1-2). Based on the small area affected by mine shapes (approximately 8–15 $ft.^2$ [0.7–1.4 m^2]), and the lack of vegetation present in these areas, the use of mine shapes during training activities would not be expected to affect marine vegetation. Additionally there would be 18 precision anchoring activities which would occur within predetermined shallow water anchorage locations near ports. These locations would include seafloors consisting of soft bottom habitat of unconsolidated sediments and would likely not support marine vegetation. The level of impact on the marine vegetation would depend on the size of the anchor used, which would vary according to vessel type. However, based on the use of areas that have been previously disturbed and are unlikely to support marine vegetation, precision-anchoring activities would not be expected to affect marine vegetation.

Seafloor devices installed in shallow-water habitats under Alternative 1 training activities would pose a negligible risk to marine vegetation. Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth near seafloor devices installed for training activities under Alternative 1 would be inhibited during recovery, the long-term survival, reproductive success, and lifetime reproductive success would not be impacted.

Testing Activities

Under Alternative 1, seafloor devices are utilized during pierside integrated swimmer defense activities, testing activities at the North Pacific Acoustic Lab's Deep Water site, and during the mine countermeasure mission package testing. The deep water experimental site consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment (depths greater than 3,280 ft. [1,000 m]) of the northwestern Philippine Sea, which is at a depth unlikely to support marine vegetation. Seafloor devices installed in shallow-water habitats under Alternative 1 testing activities would pose a negligible risk to marine vegetation. Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth near seafloor devices installed for testing activities under Alternative 1 would be inhibited during recovery, the long-term survival, reproductive success, and lifetime reproductive success would not be impacted.

3.7.3.2.3.3 Alternative 2

Training Activities

Under Alternative 2, no additional seafloor devices would be used or implemented. Therefore, seafloor devices under Alternative 2 would have the same impacts on marine vegetation as under Alternative 1.

Testing Activities

Under Alternative 2, seafloor devices are utilized during pierside integrated swimmer defense activities and testing activities at the North Pacific Acoustic Lab's Deep Water site and during the mine countermeasure mission package testing. The deep water experimental site consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment (depths greater than 3,280 ft. [1,000 m]) of the northwestern Philippine Sea, which is at a depth unlikely to support marine vegetation. Seafloor devices installed in shallow-water habitats under Alternative 2 testing activities would pose a negligible risk to marine vegetation. Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth near seafloor devices installed for testing activities under Alternative 2 would be inhibited during recovery, the long-term survival, reproductive success, and lifetime reproductive success would not be impacted.

3.7.3.2.3.4 Substressor Impact on Marine Vegetation as Essential Fish Habitat from Seafloor Devices (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training and testing activities may adversely affect EFH by reducing the quality and quantity of marine vegetation that is part of a habitat that is defined as EFH or a Habitat Area of Particular Concern. The MITT EFHA report states that any impacts of seafloor devices on attached macroalgae or submerged rooted vegetation would be minimal and short term.

3.7.3.3 Secondary Stressors

This section analyzes potential impacts on marine vegetation exposed to stressors indirectly through changes in sediments and water quality. Section 3.1 (Sediments and Water Quality) considered the impacts on marine sediments and water quality from explosives and explosive byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). One example of a localized impact associated with water quality impacts could be the increase of cyanobacteria associated with munitions deposits in marine sediments. Cyanobacteria may proliferate when iron is introduced to the marine environment, and this proliferation can negatively affect surrounding habitats by releasing toxins, or stimulating the growth of nuisance species (Schils 2012). Introducing iron into the marine environment from munitions or infrastructure is not associated with red tide events; rather, these harmful events are more associated with natural causes (e.g., upwellings) and the effects of human activities (e.g., agricultural runoff and other coastal pollution) (Hayes et al. 2007; Whitton and Potts 2008).

Strike warfare activities such as BOMBEX (Land) and MISSILEX involve the use of live munitions by aircrews that practice on ground targets on FDM. These warfare training activities occur on the FDM land mass and are limited to the designated impact zones along the central corridor of the island. Explosives that detonate on land could loosen soils and subsequently get transported into surface drainage areas or nearshore waters. It should be noted that FDM is highly susceptible to natural causes of erosion because it is comprised of highly weathered limestone overlain by a thin layer of clay soil.

Sediments entering the nearshore environment as a result of natural processes or explosives could cause temporary water quality impacts, some of which may be in foraging areas used by marine organisms. By limiting the location and extent of target areas, along with the types of ordnance allowed within specific impact areas, the military minimizes the potential for soil transport and, thus, water quality impacts.

Erosion as a result of training activities at FDM may contribute to deposition of soils into the nearshore areas of FDM, causing increased turbidity. Turbidity can impact vegetation communities by reducing the amount of light that reaches these organisms. However, as listed in the High-Order Explosions at FDM and Explosive Byproducts subsection of Section 3.1.3.6.1 (No Action Alternative), the impacts of explosive byproducts on sediment and water quality would be indirect, short term, local, and negative. Explosive ordnance could loosen the soil on FDM and runoff from surface drainage areas containing soil and explosive byproducts could contaminate sediments and the surrounding ocean water. However, chemical, physical, or biological changes in sediment or water quality would not be detectable. Therefore, impacts on marine vegetation from erosion or sedimentation are not anticipated.

As described in Section 3.1.3.1.5.3 (Farallon de Medinilla Specific Impacts), the Navy has conducted annual marine dive surveys in waters surrounding FDM from 1999 to 2010. Throughout all dive surveys, the coral fauna at FDM was observed to be healthy and robust. The nearshore physical environment and basic habitat types at FDM have remained unchanged over the 13 years of survey activity. These conclusions are based on (1) a limited amount of physical damage, (2) very low levels of partial mortality and disease (less than 1 percent of all species observed), (3) absence of excessive mucus production, (4) good coral recruitment, (5) complete recovery by 2012 of the 2007 bleaching event, and (6) a limited number of macrobioeroders and an absence of invasive crown of thorns starfish (Acanthaster planci). These factors suggest that sedimentation that may result from military use of FDM is not sufficient as to adversely impact water quality, and as such, marine habitats.

The analysis included in Section 3.1 (Sediments and Water Quality) determined that neither state or federal standards or guidelines for sediments or water quality would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because of these conditions, population-level impacts on marine vegetation are likely to be inconsequential and not detectable. Therefore, because these standards and guidelines are structured to protect human health and the environment, and the proposed activities do not violate them, no indirect impacts are anticipated on marine vegetation from the training and testing activities proposed by the No Action Alternative, Alternative 1, or Alternative 2.

3.7.4 Summary of Potential Impacts (Combined Impacts of All Stressors) on Marine Vegetation

3.7.4.1 Combined Impacts of All Stressors

Activities described in this EIS/OEIS that have potential impacts on vegetation are widely dispersed, and not all stressors would occur simultaneously in a given location. The stressors that have potential impacts on marine vegetation include acoustic (explosions) and physical disturbance or strike (vessel and in-water devices, military expended materials, and seafloor devices). Unlike mobile organisms, vegetation cannot flee from stressors once exposed. Marine algae are the vegetation most likely to be exposed to multiple stressors in combination because they occur in large expanses. Discrete areas of the Study Area (mainly within offshore areas with depths greater than 85.3 ft. [26 m]) could experience higher levels of activity involving multiple stressors, which could result in a higher potential risk for impacts on marine algae within those areas.

The potential for exposure of seagrasses and attached macroalgae to multiple stressors would be less because activities are not concentrated in coastal (areas with depths less than 85.3 ft. [26 m]) distributions of these species. The combined impacts of all stressors would not be expected to affect marine vegetation populations because: (1) activities involving more than one stressor are generally short in duration, (2) such activities are dispersed throughout the Study Area, and (3) activities are generally scheduled where previous activities have occurred. The aggregate effect on marine vegetation would not observably differ from existing conditions.

3.7.4.1.1 Essential Fish Habitat Determinations

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of metal, chemical, and other material contaminants during training and testing activities would have no adverse impact on marine vegetation that is part of a habitat that is defined as EFH or a Habitat Area of Particular Concern. The use of explosives and other impulsive sources, vessel movement, in-water devices, military expended materials, and seafloor devices during training and testing activities may adversely affect EFH by reducing the quality and quantity of marine vegetation that is part of a habitat that is defined as EFH or a Habitat Area of Particular Concern. The MITT EFHA states that individual stressor impacts on marine vegetation were either no effect or minimal and ranged in duration from temporary to long term, depending on the habitat impacted. As a result of consultation with NMFS for EFH, the Navy will not increase the amount of explosive used at the Outer Apra Harbor UNDET site from 10 lb. NEW to 20 lb. NEW. If the proposed increase becomes necessary at a later date, the Navy will conduct the appropriate level of analysis to assess potential effects on nearby EFH. The MITT EFHA report is available on the MITT project website (www.mitt-eis.com), and Appendix C (Agency Correspondence) provides agency correspondence and supporting documentation.

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3.8 Marine Invertebrates

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3.8 Marine Invertebrates

MARINE INVERTEBRATES SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following have been analyzed for marine invertebrates:

- Acoustic (sonar and other active acoustic sources; underwater explosives; swimmer defense airguns; weapons firing, launch and impact noise; aircraft noise; and vessel noise)
- Energy (electromagnetic devices)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, and seafloor devices)
- Entanglement (fiber optic cables and guidance wires, and decelerators/parachutes)
- Ingestion (military expended materials)
- Secondary (impacts associated with sediments and water quality)

Preferred Alternative (Alternative 1)

- Acoustic: Pursuant to the Endangered Species Act (ESA), the use of sonar and other active acoustic sources; underwater explosives; swimmer defense airguns weapons firing, launch and impact noise; aircraft noise; and vessel noise may affect ESA-listed coral species.
- Energy: Pursuant to the ESA, the use of electromagnetic devices would have no effect on ESA-listed coral species.
- Physical Disturbance and Strike: Pursuant to the ESA, the use of vessels, in-water devices, and military expended materials may affect ESA-listed coral species. The use of military expended materials on FDM may affect ESA-listed coral species as a result of direct strikes from off island munitions. The use of seafloor devices would have no effect on ESA-listed coral species.
- Entanglement: Pursuant to the ESA, the use of fiber optic cables and guidance wires as well as decelerators/parachutes would have no effect on ESA-listed coral species.
- Ingestion: Pursuant to the ESA, the use of military expended materials would have no effect on ESA-listed coral species.
- Secondary: Pursuant to the ESA, secondary stressors would have no effect on ESA-listed coral species.
- There is no marine invertebrate critical habitat in the Study Area.
- Pursuant to the Essential Fish Habitat (EFH) requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other acoustic sources, vessel noise, swimmer defense airguns, weapons firing noise, electromagnetic sources, vessel movement, in-water devices, and metal, chemical, or other material byproducts will have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The use of electromagnetic sources will have minimal and temporary adverse impact to invertebrates occupying water column EFH or Habitat Areas of Particular Concern. The use of explosives, military expended materials, seafloor devices, and explosives and explosive byproducts may have an adverse effect on EFH by reducing the quality and quantity of sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern.

3.8.1 INTRODUCTION

In this Environmental Impact Statement (EIS)/Overseas EIS (OEIS), marine invertebrates are evaluated based on their distribution and life history relative to the stressor or activity being considered. Activities are analyzed for their potential impact on marine invertebrates in general, on taxonomic groupings of marine invertebrates as appropriate, and on species listed under the Endangered Species Act (ESA) in the Mariana Islands Training and Testing (MITT) Study Area.

Invertebrates are animals without backbones, and marine invertebrates are a large and diverse group. Many of these species are important to humans ecologically and economically, providing essential ecosystem services (coastal protection) and income from commercial and recreational fisheries (Spalding et al. 2001). Because marine invertebrates occur in all habitats, activities that interact with the water column or the seafloor could impact countless zooplankton (e.g., copepods, fish eggs, larvae, and jellyfish), larger invertebrates living in water column (e.g., squid), and benthic invertebrates that live on or in the seafloor (e.g., clams, crabs).

The following subsections provide brief introductions to major taxonomic groups and federally listed species of marine invertebrates that occur in the Study Area. Profiles of these species, along with major taxonomic groups in the Study Area (as defined in Paulay 2003a), are described in this section. The National Oceanic and Atmospheric Administration (NOAA) Office of Protected Resources maintains a website that provides additional information on the biology, life history, species distribution (including maps), and conservation of listed, proposed, or candidate invertebrate species.

Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act will be described in the Essential Fish Habitat Assessment (EFHA), and conclusions from the EFHA will be summarized in each substressor section.

3.8.1.1 Endangered Species Act – Listed Species

In response to a petition from the Center for Biological Diversity to list under the ESA and designate critical habitat for species of coral, National Marine Fisheries Service (NMFS) reviewed the status of 82 “candidate species” of corals. Candidate species are those petitioned species that are actively being considered for listing as endangered or threatened under the ESA, as well as those species for which NMFS has initiated an ESA status review that it has announced in the Federal Register (FR). In April 2012, NMFS completed a status review report and draft Management Report of the candidate species of corals. On 20 September 2013, an extension of the final determination on corals to be listed under the ESA was announced by NMFS (78 FR 57835).

Fifty-two species of coral found in the Study Area were potential candidates for listing under the ESA (National Oceanic and Atmospheric Administration 2010a; National Oceanic and Atmospheric Administration and U.S. Department of Commerce 2010). The presence or possible presence of these species in the Study Area has been noted by Randall (2003), Center for Biological Diversity (2009), and the International Union for Conservation of Nature.

On 7 December 2012, the NMFS published a proposed rule with the determination that 66 species of coral warranted listing under the ESA as either threatened or endangered (77 FR 73220–73252). Of these 66 species, 43 potentially occur within the Study Area (Table 3.8-1) based on their life histories (Brainard et al. 2011) and recent surveys (National Marine Fisheries Service 2012), which are described below (note that 44 species are presented in Table 3.8-1; *Montipora turgescens* was not proposed for listing but is part of the clade that was proposed for listing under the ESA). On 20 September 2013, an extension of the final determination on corals to be listed under the ESA was announced by the National Marine Fisheries Service (78 FR 57835), and on 25 October 2013 the National Marine Fisheries Service added three additional coral species to the list of candidate species being considered for listing under the ESA. These species, none of which occur in the Study Area, are *Cantharellus noumeae, Siderastrea glynni, and Tubastraea floreana*. Additional information regarding each coral species, including the Petition to List 82 Coral Species Under the ESA by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources.

On September 10, 2014, NMFS published a Final Rule (79 FR 53851) presenting the final listing determinations for the 66 species of coral. In total, 22 species of coral are now protected under the Endangered Species Act, including the two corals (elkhorn and staghorn) listed as threatened in 2006. NMFS also determined that the remainder of the proposed species do not warrant listing as endangered or threatened species, and three proposed species (proposed October 2013) are not determinable under the ESA. Listed species that could occur in the MITT Study Area are highlighted in Table 3.8-1 and detailed below.

Table 3.8-1: Endangered Species Act Listing Determinations for Species Potentially within the Mariana Islands Training and Testing Study Area

Species Names				
Family	**Common Name**	**Scientific Name**	**Threatened/ Endangered[3]**	**Occurrence[4]**
Acroporidae	Bottlebrush staghorn	*Acropora aculeus*[1,2]		Common
	Fuzzy table coral	*Acropora paniculata*[2]		Rare
	Blue-tipped staghorn	*Acropora acuminata*[1,2]		Uncommon
	Staghorn coral	*Acropora aspera*[1,2]		Common
		***Acropora globiceps*[2]**	Threatened	Common
		Acropora listeri[2]		Uncommon
		Acropora microclados		Uncommon
		Acropora palmerae[1,2]		Uncommon
		Acropora paniculata[2]		Rare
		Acropora polystoma		Uncommon
		Acropora retusa	Threatened	Rare[5]
		Acropora striata[1,2]		Rare
		***Acropora tenella*[2]**	Threatened	Common
		Acropora vaughani[1,2]		Uncommon
		Acropora verweyi[1,2]		Common/Locally abundant
		Anacropora puertogalerae[2]		Uncommon
		Astreopora cucullata		Rare[5]
		Isopora cuneata[1,2]		Common
	Pore coral	*Montipora caliculata*[1,2]		Uncommon
		Montipora lobulata[1,2]		Rare
		Montipora patula		Rare
		Montipora turgescens		Rare[5]

Table 3.8-1: Endangered Species Act Listing Determinations for Species Potentially within the Mariana Islands Training and Testing Study Area (continued)

Species Names				
Family	**Common Name**	**Scientific Name**	**Proposed Threatened/ Endangered**	**Occurrence**
Agariciidae	Rugosa coral	*Pachyseris rugosa*[2]		Common
Euphyllidae	Grape coral	*Euphyllia cristata*[1,2]		Uncommon
		Euphyllia paraancora[2]		Uncommon
		Physogyra lichtensteini[2]		Common
Faviidae	Faviid coral	*Barabattoia laddi*[2]		Rare
Milleporidae	Fire coral	*Millepora foveolata*[1]		Rare
		Millepora tuberosa[1,2]		Rare
Mussidae	Starry cup coral	*Acanthastrea brevis*[2]		Uncommon
		Acanthastrea ishigakiensis[2]		Uncommon
		Acanthastrea regularis[2]		Uncommon
Pectinidae	Lettuce coral	*Pectinia alcicornis*[2]		Uncommon
Pocilloporidae	Cauliflower coral	*Pocillopora danae*[1]		Uncommon
		Pocillopora elegans (Indo-Pacific)[1,2]		Common
	Bird nest coral	***Seriatopora aculeata*[1,2]**	Threatened	Uncommon
Poritidae	Net coral	*Alveopora allingi*[1,2]		Uncommon
		Alveopora fenestrata[1,2]		Uncommon
		Alveopora verrilliana[1,2]		Uncommon
	Hump coral	*Porites horizontalata*[1,2]		Common
		Porites nigrescens[2]		Common

[1] Randall 2003
[2] Center for Biological Diversity 2009
[3] Threatened/Endangered listings were based on the final listing determination in 79 FR 53851.
[4] Brainard et al. 2011; Occurrence is based on a relative abundance scale that ranges from Dominant, Common, Occasional or Uncommon, to Rare, with the largest abundance present on the dominant side of the scale and least abundance present on the rare side of the scale.
[5] National Marine Fisheries Service 2012.
[6] The coral *Montipora turgescens* itself is not a petitioned species, but was proposed as a threatened coral clade, *M. dilatata/flabellata/turgescens*.
[7] *Pocillipora elegans* is treated as two regional populations in the proposed listing: *P. elegans* (Indo-Pacific) and *P. elegans* (Eastern Pacific). Only the Indo-Pacific regional population is proposed as "threatened."

3.8.1.1.1 *Acropora globiceps* (Staghorn Coral)

3.8.1.1.1.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Acropora globiceps*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species warranted listing as threatened under the ESA. NMFS is currently soliciting information that may be relevant to the designation of critical habitat for this species.

3.8.1.1.1.2 Habitat and Geographic Range

Acropora globiceps has been reported from the central Indo-Pacific, the oceanic west Pacific, and the central Pacific (Richards et al. 2008a). It has been reported as common and relatively widespread longitudinally but restricted latitudinally and has a narrow depth range. *Acropora globiceps* has been reported from intertidal, upper reef slopes, and reef flats (Australian Institute of Marine Science 2010) and has been reported in water depths ranging from 0 to 8 m (0 to 26.2 ft.).

3.8.1.1.1.3 Population and Abundance

Within its range, *Acropora globiceps* has been reported as common (Australian Institute of Marine Science 2010).

3.8.1.1.1.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora globiceps*. However, most acroporid corals are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci*) and by corallivorous snails.

3.8.1.1.1.5 Species-Specific Threats

Acroporia globiceps is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population’s demographic, spatial structure, and vulnerability factors (77 FR 73220–73262). Elements that contributed to *A. globiceps* threatened status were high vulnerability to ocean warming, moderate vulnerability to disease and acidification, trophic effects of fishing, nutrients, and predation as well as narrow overall distribution (based on shallow depth distribution (79 FR 53851).

3.8.1.1.2 *Acropora retusa* (Staghorn Coral)

3.8.1.1.2.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Acropora retusa*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species warranted listing as threatened under the ESA. NMFS is currently soliciting information that may be relevant to the designation of critical habitat for this species.

3.8.1.1.2.2 Habitat and Geographic Range

Acropora retusa has been reported in the southwest and northern Indian Ocean, the central Indo-Pacific, the Solomons, the oceanic west Pacific, and the central Pacific (Richards et al. 2008e). *A. retusa* has been reported to occur in shallow, tropical reef environments and on upper reef slopes and in tidal pools from 1 to 5 m (3.3 to 16.4 ft.). *A. retusa* has a widespread distribution longitudinally but is restricted latitudinally (Brainard et al. 2011). This species is not known to occur in waters off Guam and the CNMI (Brainard et al. 2011).

3.8.1.1.2.3 Population and Abundance

Acropora retusa has only been reported in the waters off Guam and is rare in the Study Area (HDR 2011).

3.8.1.1.2.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora retusa.* However, most acroporid corals are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci)* and by corallivorous snails.

3.8.1.1.2.5 Species-Specific Threats

Acroporia retusa is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262). In the proposed rule using the listing determination tool approach, *A. retusa* was proposed for listing as threatened because of high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms. In the final listing (79 FR 53851), NMFS determined that the species warranted listing as threatened because *A. retusa* is highly susceptible to ocean warming; disease; ocean acidification; trophic effects of fishing, predation, and nutrients; a shallow habitat restriction; and overall rare abundance.

3.8.1.1.3 *Acropora tenella* (Staghorn Coral)

3.8.1.1.3.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Acropora tenella*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species warranted listing as threatened under the ESA. NMFS is currently soliciting information that may be relevant to the designation of critical habitat for this species.

3.8.1.1.3.2 Habitat and Geographic Range

Acropora tenella has been reported to have a moderately broad range overall, from the central Indo-Pacific, Japan, the East China Sea, and Southeast Asia, and includes the Mariana Islands (Aeby et al. 2008).

Acropora tenella has been reported to occupy lower slopes below 40 m (131.2 ft.), protected slopes and shelves as deep as 70 m (229.7 ft.), apparently specialized to calm, deep conditions in water depths ranging from 25 to 70 m (82.0 to 229.7 ft.). *Acropora tenella* is known primarily from mesophotic habitats, suggesting the potential for deep refugia.

3.8.1.1.3.3 Population and Abundance

Abundance of *Acropora tenella* has been reported as locally common in some locations (Australian Institute of Marine Science 2010).

3.8.1.1.3.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora tenella*. Most Acropora are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci*) and by corallivorous snails.

3.8.1.1.3.5 Species-Specific Threats

Acroporia tenella is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that contributed to *A. tenella* proposed threatened status. These were a high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, wide overall distribution (based on moderate geographic distribution and wide depth distribution), and inadequacy of existing regulatory mechanisms. In the final listing (79 FR 53851), NMFS determined that the species warranted listing as threatened because *A. tenella* is highly susceptible to ocean warming; disease; ocean acidification; trophic effects of fishing, predation, and nutrients; geographic restriction; and overall population size.

3.8.1.1.4 *Seriatopora aculeata* (Bird Nest Coral)

3.8.1.1.4.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the bird nest coral (*Seriatopora aculeata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species warranted listing as threatened under the ESA. NMFS is currently soliciting information that may be relevant to the designation of critical habitat for this species.

3.8.1.1.4.2 Habitat and Geographic Range

Seriatopora aculeata has a relatively confined distribution. It has been reported primarily from the Indo-Pacific, including Australia, Fiji, Indonesia, Japan, and Papua New Guinea. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Seriatopora aculeata* has been recorded in the Northern Mariana Islands (Hoeksema et al. 2008e).

Seriatopora aculeata has been reported to occupy shallow reef environments in water depths ranging from 3 to 40 m (9.8 to 131.2 ft.).

3.8.1.1.4.3 Population and Abundance

Abundance of *Seriatopora aculeata* has been reported as uncommon (Australian Institute of Marine Science 2010).

3.8.1.1.4.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Seriatopora aculeata*. The genus Seriatopora is known to be susceptible to predation by snails and the crown-of-thorns seastar (*Acanthaster planci*).

3.8.1.1.4.5 Species-Specific Threats

Seriatopora aculeata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that contributed to the proposed listing status of *Seriatopora aculeata*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on moderate geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms. In the final listing (79 FR 53851), NMFS determined that the species warranted listing as threatened because *S. aculeata* is highly susceptible to ocean warming; disease; ocean acidification; trophic effects of fishing, nutrients, and collection and trade; inadequate regulatory mechanisms; and geographic restriction.

3.8.1.1.4.6 Taxonomic Groups

All marine invertebrate species groups are represented in the Study Area. Paulay (2003a) presents an overview of the marine biodiversity of Guam, which has the best documented marine biota in Micronesia. Of all the species noted in the marine biodiversity survey of Guam (which included chordates, protists [mostly unicellular organisms], and algae species), it was found that seven major invertebrate species groups (Table 3.8-2) comprise approximately 65 percent of the species observed (Paulay 2003a) (Figure 3.8-1). Throughout the marine invertebrate section, organisms will often be referred to by their phylum name, or more generally, as marine invertebrates.

Table 3.8-2: Major Taxonomic Groups of Marine Invertebrates in the Mariana Islands Training and Testing Study Area

Major Invertebrate Groups[1]		Presence in Study Area	
Common Name (Phylum)	**Description**	**Open Ocean**	**Coastal Waters**
Cephalopods, bivalves, sea snails, chitons (Mollusca)	Benthic and planktonic predators, filter feeders, and grazers, with a muscular foot and in some groups a ribbon-like band of teeth used to scrape food off rocks	Water column, seafloor	Water column, seafloor
Shrimp, crabs, lobsters, barnacles, copepods (Arthropoda Subphylum Crustacea)	Benthic and planktonic predators, filter feeders with segmented bodies and external skeletons with jointed appendages	Water column, seafloor	Water column, seafloor
Corals, hydroids, jellyfish (Cnidaria)	Benthic and planktonic animals with stinging cells; sessile corals are main builders of coral reef frameworks	Water column, seafloor	Water column, seafloor
Sea stars, sea urchins, sea cucumbers (Echinodermata)	Benthic and planktonic (during larval phase) predators, filter feeders with tube feet.	Seafloor	Seafloor
Segmented worms (Annelida)	Mostly benthic, highly mobile marine worms, many tube-dwelling species	Seafloor	Seafloor
Sponges (Porifera)	Mostly benthic animals; sessile filter feeders, large species have calcium carbonate or silica spicules or bodies embedded in cells to provide structural support	Water column, seafloor	Water column, seafloor

Table 3.8-2: Major Taxonomic Groups of Marine Invertebrates in the Mariana Islands Training and Testing Study Area (continued)

Major Invertebrate Groups[1]		Presence in Study Area	
Common Name (Phylum)	**Description**	**Open Ocean**	**Coastal Waters**
Flatworms (Platyhelminthes)	Mostly benthic, simplest form of marine worm with a flattened body	Water column, seafloor	Water column, seafloor
Ribbon worms (Nemertea)	Benthic marine worms with long extension (proboscis) from the mouth that helps capture food	Water column, seafloor	Seafloor
Round worms (Nematoda)	Small benthic marine worms, many live in close association with other animals (parasitic)	Water column, seafloor	Water column, seafloor
Foraminifera, radiolarians, ciliates (Kingdom Protozoa)	Benthic and planktonic single-celled organisms; shells typically made of calcium carbonate or silica	Water column, seafloor	Water column, seafloor

[1] Major invertebrate groups are based on Marine Diversity of Guam (Paulay 2003a) and Catalogue of Life (Bisby et al. 2010).
[2] Other invertebrate groups are represented in the "Other Taxa" category of Paulay (2003a).
Notes: Benthic = A bottom-dwelling organism, Planktonic = An organism (or life stage of an organism) that drifts in open ocean environments.

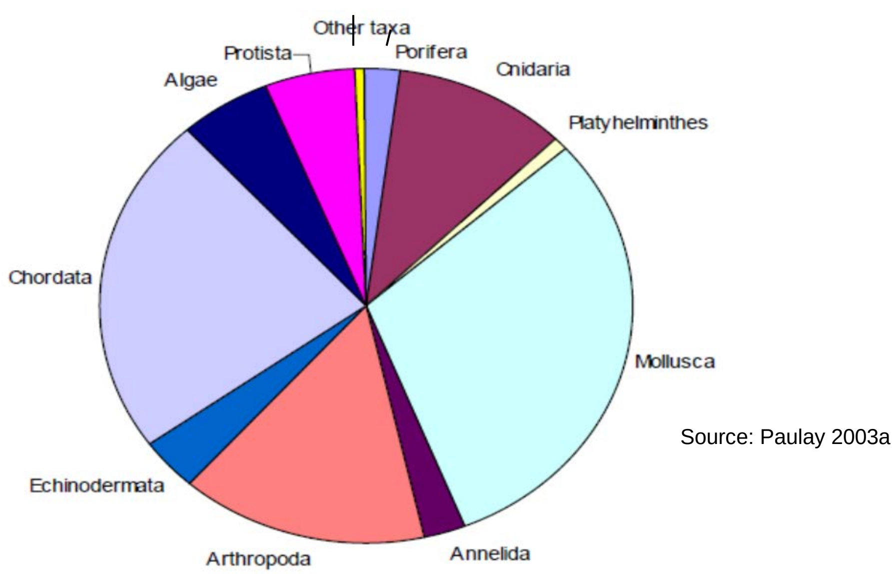


Figure 3.8-1: Diversity of Phylogenetic Groups in the Mariana Islands

3.8.2 AFFECTED ENVIRONMENT

Marine invertebrates live in the world's oceans, from warm-shallow waters to cold-deep waters. They inhabit the seafloor and water column in all of the large marine ecosystems and open-ocean areas in the Study Area. Marine invertebrate distribution in the Study Area is influenced by habitat, ocean currents, physical and water chemistry factors such as temperature, salinity and nutrient content (Levinton 2009). The distribution of invertebrates is also influenced by their distance from the equator (latitude); in general, the number of marine invertebrate species increases toward the equator (Macpherson 2002). The higher number of species (diversity) and abundance of marine invertebrates in coastal habitats, compared with the open ocean, is a result of the food and protection that coastal habitats provide (Levinton 2009).

The Mariana nearshore environment is characterized by extensive coral bottom and coral reef areas. The Mariana coral reefs differ between the northern and southern island groups, northern islands having lower coral diversity and colony surface area than southern islands; however, coral densities are similar between the groups (Randall 2003; Abraham et al. 2004; Chin et al. 2011). There is also a greater species diversity of fishes and molluscs (invertebrates) in waters around the southern islands than around the northern islands. For example, Guam has diverse invertebrate assemblages, known species include 59 flatworms, 1,722 molluscs, 104 polychaetes, 840 arthropods, and 196 echinoderm species (Abraham et al. 2004; Burdick et al. 2008).

In general, the coral reefs of the Marianas have a lower coral diversity compared to other reefs in the northwestern Pacific (e.g., Palau, Philippines, Australian Great Barrier Reef, southern Japan, and Marshall Islands) but a higher diversity than the reefs of Hawaii. Corals reported in Guam are typically found on shallow reefs and upper forereefs (or outer portion of the reef, closest to open ocean) at depths less than 245 feet (ft.) (74.7 meters [m]), and deeper forereef habitats within the photic zone that allows for coral growth (greater than 245 ft. [greater than 74.7 m] water depth) (Randall 2003).

On the island of Guam, most northern shorelines are karstic (layer or layers of soluble bedrock, usually carbonate rock such as limestone or dolomite) and bordered by limestone cliffs. In a few areas, the shorelines consist of volcanic substrates. On windward shores, reefs are narrow and have steep forereefs. Narrow reef flats or shallow fringing reefs (approximately 325–3,250 ft. [99.06–990.6 m] wide) are characteristic of leeward and more protected coastlines. Reefs also occur in lagoonal habitats in Apra Harbor and Cocos Lagoon. Reef organisms also occur on eroded limestone substrates including submerged caves and crevices, and large limestone blocks fallen from shoreline cliffs (Paulay 2003b).

3.8.2.1 Invertebrate Hearing and Vocalization

Very little is known about sound detection and use of sound by aquatic invertebrates (Budelmann 2010; Montgomery et al. 2006; Popper et al. 2001). Organisms may detect sound by sensing either the particle motion or pressure component of sound, or both. Aquatic invertebrates probably do not detect pressure since many are generally the same density as water and few, if any, have air cavities that would function like the fish swim bladder in responding to pressure (Budelmann 2010; Popper et al. 2001). Many aquatic invertebrates, however, have ciliated “hair” cells that may be sensitive to water movements, such as those caused by currents or water particle motion very close to a sound source (Budelmann 2010; Mackie and Singla 2003). These cilia may allow invertebrates to sense nearby prey or predators or help with local navigation.

Aquatic invertebrates that can sense local water movements with ciliated cells include cnidarians, flatworms, segmented worms, urochordates (tunicates), molluscs, and arthropods (Budelmann 2010; Popper et al. 2001). The sensory capabilities of corals are largely limited to detecting water movement using receptors on their tentacles (Gochfeld 2004), and the exterior cilia of coral larvae likely help them detect nearby water movements (Vermeij et al. 2010). Some aquatic invertebrates have specialized organs called statocysts for the determination of equilibrium and, in some cases, linear or angular acceleration. Statocysts allow an animal to sense movement, and may enable some species, such as cephalopods and crustaceans, to be sensitive to water particle movements associated with sound (Hu et al. 2009; Kaifu et al. 2008; Montgomery et al. 2006; Popper et al. 2001). Because any acoustic sensory capabilities, if present at all, are limited to detecting water motion, and water particle motion near a sound source falls off rapidly with distance, aquatic invertebrates are probably limited to detecting nearby sound sources rather than sound caused by pressure waves from distant sources.

Both behavioral and auditory brainstem response studies suggest that crustaceans may sense sounds up to 3 kilohertz (kHz), but best sensitivity is likely below 200 Hertz (Hz) (Lovell et al. 2005; Lovell et al. 2006). Most cephalopods (e.g., octopus and squid) likely sense low-frequency sound below 1,000 Hz, with best sensitivities at lower frequencies (Budelmann 2010; Mooney et al. 2010; Packard et al. 1990). A few cephalopods may sense higher frequencies up to 1,500 Hz (Hu et al. 2009). Squid did not respond to toothed whale ultrasonic echolocation clicks at peak sound pressure levels ranging from 199 to 226 decibels (dB) referenced to (re) 1 micropascal (μPa), likely because these clicks were outside of squid hearing range (Wilson et al. 2007). However, squid exhibited alarm responses when exposed to broadband sound from an approaching seismic airgun with received levels exceeding 145 to 150 dB re 1 micropascal squared second (μPa^2-s) root mean square (McCauley et al. 2000b). Four species of cephalopods showed damage to statocysts following exposure to a swept sine waveform (50 to 400 Hz) repeated every second for 2 hours with a peak of 175 dB re 1 μPa (Andre et al. 2011).

Aquatic invertebrates may produce and use sound in territorial behavior, to deter predators, to find a mate, and to pursue courtship (Popper et al. 2001). Some crustaceans, such as lobsters and snapping shrimp, produce sound by rubbing or closing hard body parts together (Latha et al. 2005; Patek and Caldwell 2006). The snapping shrimp chorus makes up a significant portion of the ambient noise budget in many locales (Cato and Bell 1992). Each click is up to 215 dB re 1 μPa, with a peak around 2 to 5 kHz (Heberholz and Schmitz 2001). Other crustaceans make low-frequency rasping or rumbling noises, perhaps used in defense or territorial display, that are often obscured by ambient noise (Patek and Caldwell 2006; Patek et al. 2009).

Reef noises, such as fish pops and grunts, sea urchin and parrotfish grazing (around 1.0 kHz to 1.2 kHz), and snapping shrimp noises (around 5 kHz) (Radford et al. 2010), may be used as a cue by some aquatic invertebrates. Nearby reef noises were observed to affect movements and settlement behavior of coral and crab larvae (Jeffs et al. 2003; Radford et al. 2007; Stanley et al. 2010; Vermeij et al. 2010). Larvae of other crustacean species, including pelagic and nocturnally emergent species that benefit from avoiding coral reef predators, appear to avoid reef noises (Simpson et al. 2011). Detection of reef noises is likely limited to short distances (less than 330 ft. [100 m]) (Vermeij et al. 2010).

3.8.2.2 General Threats

The health and abundance of marine invertebrates are vital to the marine ecosystem and the sustainability of the world’s fisheries (Pauly et al. 2002). Coral reefs can be stressed or damaged by coastal development (Risk 2009), impacts from inland pollution and erosion (Cortes and Risk 1985), overexploitation and destructive fishing practices (Jackson et al. 2001, Pandolfi et al. 2003), global climate change and acidification (Hughes et al. 2003), disease (Porter et al. 2001), predation, harvesting by the aquarium trade (Caribbean Fishery Management Council 1994), anchors (Burke and Maidens 2004), invasive species (Bryant et al. 1998; Galloway et al. 2009, National Marine Fisheries Service 2010a; Wilkinson 2002), ship groundings (National Oceanic and Atmospheric Administration 2010b), oil spills (National Oceanic and Atmospheric Administration 2010b), and possibly human-made noise (Brainard et al. 2011, Vermeij et al. 2010).

The reefs near populated areas Guam, Saipan, Tinian, and Rota receive most of the human impacts from coastal development, population growth, fishing, and tourism. These threats can result in coral death from coastal runoff (Downs et al. 2009), reduced growth rates caused by a decrease in the pH of the ocean from pollution (Cohen et al. 2009), reduced tolerance to global climate change (Carilli et al. 2010), and increased susceptibility to bleaching (which are often tied to atypically high sea temperatures [Brown 1997; Glynn 1993; van Oppen and Lough 2009]). Human-made noise may impact coral larvae by masking the natural sounds that serve as cues to orient them towards suitable settlement sites (Vermeij et al. 2010).

Exposure to runoff from land from development projects can also affect local reef communities. Erosion rates in the Ugum Watershed on Guam doubled from 1975 to 1993 as a result of road construction and development projects. The discharge of cleaning chemicals has also occurred, with subsequent impacts on local coral populations (Wilkinson 2002). Exposure to oil runoff from land, and natural seepage is another threat to marine invertebrates. Additional information on the biology, life history, and conservation of marine invertebrates (ESA-listed species, species of concern, and candidate species) can be found on the website maintained by the National Marine Fisheries Service.

The discussion above represents general threats to marine invertebrates. Additional threats to individual species within the Study Area are described below in the accounts of those species. The following sections include descriptions of species not warranted to be listed as threatened or endangered under the ESA, and descriptions of the major marine invertebrate taxonomic groups in the Study Area. The species-specific information emphasizes the ESA-listed and candidate species because any threats to or potential impacts on those species are subject to consultation with regulatory agencies.

The ESA process for the 66 species of reef-building corals proposed for listing (originally petitioned by the Center for Biological Diversity [Sakashita and Wolf 2009]) is the broadest and most complex listing process undertaken by NMFS (Brainard et al. 2011). A rigorous threat evaluation was developed for these corals, and 19 key threats were selected as the most important factors influencing the potential extinction of candidate coral species before the year 2100 (Table 3.8-3). Because most of these threats are also known to generally affect marine invertebrate groups, the information is presented here in General Threats rather than within a subsequent subsection.

Table 3.8-3: Summary of Proximate Threats to Coral Species

Proximate Threat[1]	Importance	Used in Coral ESA Determinations
Ocean Warming	High	Yes
Disease	High	Yes
Ocean Acidification	Med-High	Yes
Reef Fishing – Trophic Effects	Medium	Yes
Sedimentation	Low-Medium	Yes
Nutrients	Low-Medium	Yes
Sea-Level Rise	Low-Medium	Yes
Toxins	Low	No
Changing Ocean Circulation	Low	No
Changing Storm Tracks/Intensities	Low	No
Predation	Low	Yes
Reef Fishing – Habitat Impacts/Destructive Fishing Practices	Low	No
Ornamental Trade	Low	Yes
Natural Physical Damage	Low	No
Human-induced Physical Damage	Negligible-Low	No
Aquatic Invasive Species	Negligible-Low	No

Table 3.8-3: summary of Proximate Threats to Coral Species (continued)

Proximate Threat[1]	Importance	Used in Coral ESA Determinations
Salinity	Negligible	No
African/Asian Dust	Negligible	No
Changes in Insolation	Probably Negligible	No

[1] As summarized by Brainard et al. (2011). The authors note that, accepting "natural physical damage" and "changes in insolation," the ultimate factor for all of the proximate threats is growth in human population and consumption of natural resources.

Note: ESA = Endangered Species Act

3.8.2.3 Coral Species Not Warranting ESA Listing

3.8.2.3.1 *Acropora aculeus* (Bottlebrush Coral)

3.8.2.3.1.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for bottlebrush coral (*Acropora aculeus*) as threatened (77 FR 73220–73262). The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.1.2 Habitat and Geographic Range

Acroporid corals (the largest group of stony corals) are typically found in shallow, warm, nutrient-poor waters that allow sufficient sunlight penetration to support photosynthesis by zooxanthellae, single-cell algae hosted by the coral. Throughout its range, Acroporid corals can be found on any stretch of reef and is often the dominant coral, especially along the reef front. Staghorn and plate forms flourish in sheltered areas, whereas clusters and semi-massive types can withstand more exposed conditions.

Acropora aculeus has a broad depth range. It is particularly abundant in shallow lagoons and is common in most habitats where it is protected from direct wave action. *Acropora aculeus* has been reported in water depths ranging from low tide to at least 20 m (65.6 ft.) (Brainard et al. 2011).

Acropora aculeus has a relatively broad range, extending from east Africa, the Comorros, and Seychelles in the Indian Ocean all the way to Pitcairn Island in the southeastern Pacific Ocean. Latitudinally, it has been reported from Japanese waters in the northern hemisphere across the southern Great Barrier Reef and Mozambique in the southern hemisphere. According to both the International Union for Conservation of Nature and Natural Resources Species Account and the Convention on International Trade in Endangered Species database, *Acropora aculeus* occurs in American Samoa, the Northern Mariana Islands, and the United States (U.S.) minor outlying islands (Brainard et al. 2011).

3.8.2.3.1.3 Population and Abundance

Abundance of *Acropora aculeus* has been reported as generally common and locally abundant, especially in the central Indo-Pacific (Australian Institute of Marine Science 2010).

3.8.2.3.1.4 Predator-Prey Interactions

Most species from the Acroporidae family are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci*) and by corallivorous snails.

3.8.2.3.1.5 Species-Specific Threats

Bottlebrush coral has no species-specific threats. It is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors and identified elements that threaten *Acropora aculeus.* These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.2 *Acropora paniculata* (Fuzzy Table Coral)

3.8.2.3.2.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for fuzzy table coral (*Acropora paniculata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports. Additional information regarding this coral species, including the Petition to List 82 Coral Species Under the ESA by the Center for Biological Diversity (Sakashita and Wolf 2009), can be accessed at the website maintained by the NMFS Office of Protected Resources. NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.2.2 Habitat and Geographic Range

Acropora paniculata has been reported to occupy upper reef slopes, just subtidal, reef edges, and sheltered lagoons in water depths ranging from 10 to 35 m (32.8 to 114.8 ft.) (Brainard et al. 2011).

Acropora paniculata has been reported across a wide distribution ranging from the Red Sea and Indian Ocean to the west and central Pacific.

3.8.2.3.2.3 Population and Abundance

Abundance of *Acropora paniculata* has been reported as uncommon to rare on most reefs; however, the fuzzy table coral is common in Papua New Guinea (Australian Institute of Marine Science 2010, Wallace 1999, Brainard et al. 2011).

3.8.2.3.2.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora paniculata*. Most species from the Acroporidae family are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci*) and by corallivorous snails.

3.8.2.3.2.5 Species-Specific Threats

Acropora paniculata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that threaten *Acropora paniculata.* These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.3 *Acropora acuminata* (Blue-Tipped Staghorn Coral)

3.8.2.3.3.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for blue-tipped staghorn coral (*Acropora acuminata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.3.2 Habitat and Geographic Range

Acropora acuminata has a very broad range, extending longitudinally from the Red Sea all the way to Pitcairn Island in the southeastern Pacific. It extends latitudinally from Taiwan in the northern hemisphere across the Great Barrier Reef in the southern hemisphere. It can be very common in the center of its range (e.g., Indonesia), but it can be uncommon in the outer parts of its range. Throughout its range, Acroporid corals can be found on any stretch of reef and is often the dominant coral, especially along the reef front where it has been reported in waters ranging from 15 to 20 m (49.2 to 65.6 ft.). Staghorn and plate forms flourish in sheltered areas, whereas clusters and semi-massive types can withstand more exposed conditions.

3.8.2.3.3.3 Population and Abundance

Acropora acuminata has been reported to occasionally live in extensive clumps with dimensions of several meters (Wallace 1999; Brainard et al. 2011).

3.8.2.3.3.4 Predator-Prey Interactions

Acropora acuminata is the only acroporid known to not be preferred as prey by the crown-of-thorns seastar. The crown-of-thorns seastar will eat *Acropora acuminata* if there are no other corals to prey on, but *Acropora acuminata are* among the last to be preyed upon.

3.8.2.3.3.5 Species-Specific Threats

Acropora acuminata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that threaten *Acropora acuminata*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.4 *Acropora aspera* (Staghorn Coral)

3.8.2.3.4.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the staghorn coral (*Acropora aspera*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.4.2 Habitat and Geographic Range

Acropora aspera has been reported to occupy a broad range of habitats and its colony structure varies substantially with habitat and has been reported in water depths ranging from low tide to at least 10 m (32.8 ft.).

Acropora aspera has a relatively broad range, extending longitudinally from the Red Sea and Oman to Samoa (east central Pacific Ocean). It extends latitudinally from Japanese waters in the northern hemisphere across the Great Barrier Reef in the southern hemisphere. According to both the International Union for Conservation of Nature and Natural Resources Species Account and the Convention on International Trade in Endangered Species of Wild Fauna and Flora species database, *Acropora aspera* occurs in American Samoa, the Northern Mariana Islands, and the U.S. minor outlying islands.

3.8.2.3.4.3 Population and Abundance

Abundance of *Acropora aspera* has been reported as sometimes locally common (Australian Institute of Marine Science 2010). *Acropora aspera* can occasionally live in extensive clumps with dimensions of several meters.

3.8.2.3.4.4 Predator-Prey Interactions

Most Acropora are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci*) and by corallivorous snails. *Acropora aspera* is a preferred prey of *Acanthaster planci* and, when killed, is rapidly overgrown by algae.

3.8.2.3.4.5 Species-Specific Threats

Acroporia aspera is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population’s demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that threaten *Acropora aspera*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, narrow overall distribution (based on moderate geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.5 *Acropora listeri* (Staghorn Coral)

3.8.2.3.5.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Acropora listeri*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.5.2 Habitat and Geographic Range

Acropora listeri has been reported from the Red Sea, the northern Indian Ocean, the central Indo-Pacific, east and west coasts of Australia, Southeast Asia, Japan and the East China Sea, the oceanic west Pacific, and the central Pacific (Richards et al. 2008b). *Acropora listeri* has been reported from subtidal shallow reef edges, upper reef slopes, and in strong wave action in water depths ranging from near the surface to 15 m (49.2 ft.).

3.8.2.3.5.3 Population and Abundance

Abundance of *Acropora listeri* has been reported as uncommon (Australian Institute of Marine Science 2010).

3.8.2.3.5.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora listeri*. However, most acroporid corals are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci)* and by corallivorous snails.

3.8.2.3.5.5 Species-Specific Threats

Acroporia listeri is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that threaten *Acropora listeri*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, overall moderate distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.6 *Acropora microclados* (Staghorn Coral)

3.8.2.3.6.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Acropora microclados*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.6.2 Habitat and Geographic Range

Acropora microclados has been reported from the Red Sea and the Gulf of Aden, the northern Indian Ocean, the central Indo-Pacific, Australia, Southeast Asia, Japan and the East China Sea, and the oceanic west Pacific (Richards et al. 2008c). *A. microclados* has been reported from upper reef slopes and subtidally at reef edges in water depths ranging from 5 to 20 m (16.4 to 65.6 ft.).

3.8.2.3.6.3 Population and Abundance

Abundance of *Acropora microclados* has been reported as uncommon (Australian Institute of Marine Science 2010; Veron and Wallace 1984).

3.8.2.3.6.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora microclados*. However, most acroporid corals are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci)* and by corallivorous snails.

3.8.2.3.6.5 Species-Specific Threats

Acroporia microclados is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acropora microclados*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.7 *Acropora palmerae* (Staghorn Coral)

3.8.2.3.7.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the staghorn coral (*Acropora palmerae*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.7.2 Habitat and Geographic Range

Acropora palmerae has been reported from the northern Indian Ocean, central Indo-Pacific, west and east coasts of Australia, Southeast Asia, Japan and the East China Sea, and the oceanic west Pacific.

Acropora palmerae has been reported to occupy reef flats exposed to strong wave action and lagoons and intertidal, subtidal, shallow, reef tops, reef flats, and reef edges in water depths ranging from 5 to 20 m (16.4 to 65.6 ft.).

3.8.2.3.7.3 Population and Abundance

Abundance of *Acropora palmerae* has been reported as uncommon (Australian Institute of Marine Science 2010; Carpenter et al. 2008).

3.8.2.3.7.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora palmerae*. However, most acroporid corals are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci*) and by corallivorous snails.

3.8.2.3.7.5 Species-Specific Threats

Acroporia palmerae is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acropora palmerae*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on moderate geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.8 *Acropora polystoma* (Staghorn Coral)

3.8.2.3.8.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Acropora polystoma*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.8.2 Habitat and Geographic Range

Acropora polystoma has been reported from the Red Sea and the Gulf of Aden, the south-west and northern Indian Ocean, the central Indo-Pacific, Australia, Southeast Asia, and the oceanic west Pacific (Richards et al. 2008d). *A. polystoma* has been reported from shallow, tropical reef environments. It is found on upper reef slopes exposed to strong wave action in water depths ranging from 3 to 10 m (9.8 to 32.8 ft.).

3.8.2.3.8.3 Population and Abundance

Abundance of *Acropora polystoma* has been reported as uncommon (Australian Institute of Marine Science 2010; Carpenter et al. 2008).

3.8.2.3.8.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora polystoma*. However, most acroporid corals are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci)* and by corallivorous snails.

3.8.2.3.8.5 Species-Specific Threats

Acroporia polystoma is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acropora polystoma*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.9 *Acropora striata* (Staghorn Coral)

3.8.2.3.9.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Acropora striata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.9.2 Habitat and Geographic Range

Acropora striata has been reported to have a moderately broad range overall. A search of published and unpublished records of occurrence in U.S. waters indicates *Acropora striata* has been reported from Ofu Lagoon in American Samoa, Guam (Randall 2003), Commonwealth of the Northern Mariana Islands, and Kingman Reef.

Acropora striata has been reported to occupy shallow rocky foreshores and shallow reef in water depths ranging from 10 to 25 m (32.8 to 82.0 ft.).

3.8.2.3.9.3 Population and Abundance

Abundance of *Acropora striata* has been reported as rare overall but may be locally dominant in some areas in Japan (Australian Institute of Marine Science 2010).

3.8.2.3.9.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora striata*. Most Acropora are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci*) and by corallivorous snails.

3.8.2.3.9.5 Species-Specific Threats

Acroporia striata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acropora striata*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on moderate geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.10 *Acropora vaughani* (Staghorn Coral)

3.8.2.3.10.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the staghorn coral (*Acropora vaughani*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.10.2 Habitat and Geographic Range

Reported ranges of *Acropora vaughani* have been somewhat disjunct, with reports from Australia, the Red Sea, and southwest Indian Ocean. *Acropora v*aughani occurs in American Samoa and U.S. minor outlying islands, and also in the Northern Mariana Islands (Richards et al. 2008f).

Acropora vaughani has been reported to occupy fringing reefs with turbid water, protected lagoons and sandy slopes, or protected subtidal waters in water depths ranging from low tide levels to 30 m (98.4 ft.).

3.8.2.3.10.3 Population and Abundance

Abundance of *Acropora vaughani* has been reported as uncommon (Australian Institute of Marine Science 2010).

3.8.2.3.10.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora vaughani*. Most Acropora are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci*) and by corallivorous snails.

3.8.2.3.10.5 Species-Specific Threats

Acroporia vaughani is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acropora vaughani*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, moderate overall distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.11 *Acropora verweyi* (Staghorn Coral)

3.8.2.3.11.1 Status and Management

As In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the staghorn coral (*Acropora verweyi*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.11.2 Habitat and Geographic Range

Acropora verweyi has been reported to have a relatively broad range, extending from east Africa, the Comorros and Seychelles in the Indian Ocean all the way to Pitcairn Island in the southeastern Pacific Ocean which includes American Samoa and the Northern Mariana Islands (Richards et al. 2008g).

Acropora verweyi lives on upper reef slopes or other parts of the reef where circulation is good and has been reported to be an exclusively shallow-water species (Wallace 1999), living in depths ranging from low tide to at least 10 m (32.8 ft.).

3.8.2.3.11.3 Population and Abundance

Abundance of *Acropora verweyi* has been reported as generally common but can be locally abundant, especially in the western Indian Ocean (Australian Institute of Marine Science 2010).

3.8.2.3.11.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *Acropora verweyi*. Most Acropora are preferentially consumed by crown-of-thorns seastars (*Acanthaster planci)* and by corallivorous snails.

3.8.2.3.11.5 Species-Specific Threats

Acroporia verweyi is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acropora verweyi*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification; common generalized rangewide abundance, moderate overall distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.12 *Anacropora puertogalerae* (Staghorn Coral)

3.8.2.3.12.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the staghorn coral (*Anacropora puertogalerae*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.12.2 Habitat and Geographic Range

Anacropora puertogalerae has been reported throughout the Indo-Pacific, on the Great Barrier Reef in Australia, Fiji, Indonesia, Japan, and other areas. *Anacropora puertogalerae* has been reported to occur in the Northern Mariana Islands (Richards et al. 2008h).

Anacropora puertogalerae has been reported to occupy shallow reef environments in water depths ranging from 5 to 20 m (16.4 to 65.6 ft.), though it has also been found separated from reefs.

3.8.2.3.12.3 Population and Abundance

Abundance of *Anacropora puertogalerae* has been reported as uncommon but can form large thickets in the Philippines (Australian Institute of Marine Science 2010; International Union for Conservation of Nature 2013a).

3.8.2.3.12.4 Predator-Prey Interactions

Anacropora puertogalerae have been reported to be preyed on by wrasses, in proportion to availability. However, population-level effects remain unknown.

3.8.2.3.12.5 Species-Specific Threats

Anacropora puertogalerae is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Anacropora puertogalerae*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on moderate geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.13 *Astreopora cucullata* (Staghorn Coral)

3.8.2.3.13.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Astreopora cucullata*) as endangered (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.13.2 Habitat and Geographic Range

Astreopora culcullata has been reported primarily in the Red Sea and Gulf of Aden, central Indo-Pacific, Southeast Asia, Eastern Australia, and oceanic west Pacific (Bass et al. 2008). *Astreopora cucullata* has been reported in protected reef environments in water depths ranging from 5 to 15 m.

3.8.2.3.13.3 Population and Abundance

Abundance of *Astreopora cucullata* has been reported as rare (Brainard et al. 2011) and has only been observed in waters off Guam (HDR 2011). Note that Brainard et al. (2011) does not list this species as occurring in waters off Guam and the CNMI.

3.8.2.3.13.4 Predator-Prey Interactions

The specific effects of predation are poorly known for *A. cucullata.*

3.8.2.3.13.5 Species-Specific Threats

Astreopora cucullata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Astreopora cucullata*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.14 *Isopora cuneata* (Staghorn Coral)

3.8.2.3.14.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the staghorn coral (*Isopora cuneata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.14.2 Habitat and Geographic Range

The International Union for Conservation of Nature and Natural Resources and Veron (2000) consider *Isopora cuneata* to be found from the coast of eastern Africa to the central Pacific. According to both the International Union for Conservation of Nature and Natural Resources Species Account and the Convention on International Trade in Endangered Species of Wild Fauna and Flora species database, *Isopora cuneata* occurs in American Samoa and the Northern Mariana Islands. This database also lists it for the U.S. minor outlying islands.

Isopora cuneata is found most commonly in shallow, high-wave energy environments. Although it is occasionally found on sheltered reef slopes and backreef lagoons, it is more typical of reef crests and inner reef flats in water depths ranging from low tide to 15 m (49.2 ft.).

3.8.2.3.14.3 Population and Abundance

Abundance of *Isopora cuneata* has been reported as generally common and occasionally locally abundant (Australian Institute of Marine Science 2010).

3.8.2.3.14.4 Predator-Prey Interactions

Susceptibility of the family Acroporidae to predation stems from reports that most Acropora spp. have been preferentially consumed by crown-of-thorns seastars. In addition, Acropora spp. have been reported to be favored prey of the gastropods Drupella spp. and other corallivorous snails.

3.8.2.3.14.5 Species-Specific Threats

Isopora cuneata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Isopora cuneata*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, moderate overall distribution (based on moderate geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.15 *Montipora caliculata* (Pore Coral)

3.8.2.3.15.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the pore coral (*Montipora caliculata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.15.2 Habitat and Geographic Range

Montipora caliculata has a wide distribution from western Sumatra through the Pitcairn Islands. It also has fairly wide latitudinal range from Taiwan to mid-Australia. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Montipora caliculata* occurs in American Samoa, Northern Mariana Islands, and also the U.S. minor outlying islands (DeVantier et al. 2008a).

Montipora caliculata are found in most reef environments at depths of up to 20 m (65.6 ft.).

3.8.2.3.15.3 Population and Abundance

Montipora caliculata are most often reported to be uncommon (Australian Institute of Marine Science 2010).

3.8.2.3.15.4 Predator-Prey Interactions

Montipora spp. are preferred prey of crown-of-thorns seastar.

3.8.2.3.15.5 Species-Specific Threats

Montipora caliculata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population’s demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Montipora caliculata*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.16 *Montipora lobulata* (Pore Coral)

3.8.2.3.16.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the pore coral (*Montipora lobulata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.16.2 Habitat and Geographic Range

Montipora lobulata has a disjoint distribution, with occurrence in the western and central Indian Ocean and the central Pacific. According to the International Union for Conservation of Nature and Natural

Resources Species, *Montipora lobulata* occurs in American Samoa and the Northern Mariana Islands. The species account also lists its occurrence in the U.S. minor outlying islands (DeVantier et al. 2008b).

Montipora lobulata has been reported to inhabit shallow reef environments at depths of up to 20 m (65.6 ft.).

3.8.2.3.16.3 Population and Abundance

Abundance of *Montipora lobulata* has been reported as rare (Australian Institute of Marine Science 2010).

3.8.2.3.16.4 Predator-Prey Interactions

Montipora spp. are preferred prey of crown-of-thorns seastar.

3.8.2.3.16.5 Species-Specific Threats

Montipora lobulata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Montipora lobulata*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, overall wide distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.17 *Montipora patula* (Pore Coral)

3.8.2.3.17.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the pore coral (*Montipora patula*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). This species is proposed for listing as a combined group with *Montipora verrilli* (*Montipora patula/verrilli*). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.17.2 Habitat and Geographic Range

Montipora patula has occurs in the Indo-West Pacific. The International Union for Conservation of Nature and Natural Resources Species Account also lists its occurrence in the U.S. minor outlying islands (DeVantier et al. 2008c).

Montipora patula has been reported to inhabit shallow reef environments at depths of up to at least 10 m (32.8 ft.).

3.8.2.3.17.3 Population and Abundance

Abundance of *Montipora patula* has been reported as rare. *M. verrilli*, the other species in the combined group, is considered uncommon in the CNMI and Guam (International Union for Conservation of Nature 2013b)

3.8.2.3.17.4 Predator-Prey Interactions

Montipora spp. are preferred prey of crown-of-thorns seastar.

3.8.2.3.17.5 Species-Specific Threats

Montipora patula is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Montipora patula*. These elements included high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, overall wide distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.18 *Montipora turgescens* (Pore Coral)

3.8.2.3.18.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the pore coral (*Montipora turgescens*) as threatened (77 FR 73220–73262). It is important to note that *Montipora turgescens* itself was not petitioned for listing; rather, it was included as a combined clade in the proposed listing as *Montipora dilatata/flabellate/turgescens* due to taxonomic similarities. NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.18.2 Habitat and Geographic Range

Montipora turgescens occurs in the in the Red Sea and the Gulf of Aden, the southwest and northern Indian Ocean, the central Indo-Pacific, Australia, Southeast Asia, Japan and the East China Sea, the oceanic West Pacific, the Central Pacific, the Hawaiian Islands, and Johnston Atoll (DeVantier et al. 2008d). *Montipora turgescens* has been reported to inhabit shallow reef environments at depths of up to at least 30 m (98.4 ft.).

3.8.2.3.18.3 Population and Abundance

Montipora turgescens has been reported as rare in the Study Area, but has been observed in the waters of Guam (HDR 2011). Note that Brainard et al. (2011) does not list this species as occurring in waters off Guam and the CNMI.

3.8.2.3.18.4 Predator-Prey Interactions

Montipora spp. are preferred prey of crown-of-thorns seastar.

3.8.2.3.18.5 Species-Specific Threats

Montipora turgescens is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Montipora turgescens*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, overall wide distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.19 *Pachyseris rugosa* (Rugosa Coral)

3.8.2.3.19.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the rugosa coral (*Pachyseris rugosa*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.19.2 Habitat and Geographic Range

Pachyseris rugosa has a very widespread distribution, stretching from the western Indian Ocean into the Pacific. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Pachyseris rugosa* occurs in American Samoa and the Northern Mariana Islands (Hoeksema et al. 2008b).

Pachyseris rugosa may develop into large mound-shaped colonies in shallow water in water depths ranging from 5 to 20 m (16.4 to 65.6 ft.). Smaller colonies occur in a wide range of habitats, including those exposed to strong wave action.

3.8.2.3.19.3 Population and Abundance

Abundance of *Pachyseris rugosa* has been reported as common (Australian Institute of Marine Science 2010).

3.8.2.3.19.4 Predator-Prey Interactions

Mass mortality of this species on the Great Barrier Reef has been attributed to *Acanthaster planci*, although predation was not observed directly.

3.8.2.3.19.5 Species-Specific Threats

Pachyseris rugosa is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population’s demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Pachyseris rugosa*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.20 *Euphyllia cristata* (Grape Coral)

3.8.2.3.20.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the grape coral (*Euphyllia cristata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.20.2 Habitat and Geographic Range

Euphyllia cristata has a moderately wide range, including higher latitude areas in the Ryukus (Japan) and along both coasts of Australia. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Euphyllia cristata* occurs in American Samoa and the Northern Mariana Islands (Turak et al. 2008a).

Euphyllia cristata inhabits shallow reef habitats; the International Union for Conservation of Nature and Natural Resources account includes a wide depth range of 1 to 35 m (3.3 to 114.8 ft.).

3.8.2.3.20.3 Population and Abundance

Abundance of *Euphyllia cristata* has been reported to range from common to uncommon but conspicuous (Australian Institute of Marine Science 2010; Carpenter et al. 2008).

3.8.2.3.20.4 Predator-Prey Interactions

Unknown for *Euphyllia cristata.*

3.8.2.3.20.5 Species-Specific Threats

Euphyllia cristata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Euphyllia cristata. These elements include* high vulnerability to ocean warming, moderate vulnerability to disease and acidification; uncommon generalized rangewide abundance, moderate overall distribution (based on moderate geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.21 *Euphyllia panaacora* (Grape Coral)

3.8.2.3.21.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the grape coral (*Euphyllia panaacora*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.21.2 Habitat and Geographic Range

Euphyllia paraancora has a restricted range, both longitudinally and latitudinally. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Euphyllia* *paraancora* occurs in the Northern Mariana Islands (Turak et al. 2008b). The Convention on International Trade in Endangered Species of Wild Fauna and Flora database does not list its occurrence in U.S. waters.

Euphyllia paraancora has been reported from shallow and deep reef environments protected from wave action in water depths ranging from 3 to 30 m (9.8 to 98.4 ft.).

3.8.2.3.21.3 Population and Abundance

Abundance of *Euphyllia paraancora* has been reported to be uncommon (Turak et al. 2008b).

3.8.2.3.21.4 Predator-Prey Interactions

Unknown for *Euphyllia paraancora.*

3.8.2.3.21.5 Species-Specific Threats

Euphyllia paraacora is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Euphyllia paraancora*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, wide overall distribution (based on moderate geographic distribution and wide depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.22 *Physogyra lichtensteini* (Grape Coral)

3.8.2.3.22.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the grape coral (*Physogyra lichtensteini*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.22.2 Habitat and Geographic Range

Physogyra lichtensteini has a relatively broad distribution. It is found in Australia, Indonesia, Japan, Kenya, Madagascar, the Seychelles, the Red Sea, the Arabian Sea, India, the Philippines, and other areas in the west Pacific. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Physogyra lichtensteini* occurs in the Northern Mariana Islands (Turak et al. 2008c).

Physogyra lichtensteini has been reported to occupy turbid reef environments (Australian Institute of Marine Science 2010). The species is common in protected habitats (crevices and overhangs), especially in turbid water with tidal currents in water depths ranging from 1 to 20 m (3.3 to 65.6 ft.).

3.8.2.3.22.3 Population and Abundance

Abundance of *Physogyra lichtensteini* has been reported to be common in protected habitats such as crevices and overhangs, especially in turbid water with tidal currents (Australian Institute of Marine Science 2010).

3.8.2.3.22.4 Predator-Prey Interactions

Population-level effects of predation are unknown for *Physogyra lichtensteini*, although it is preyed upon on by butterflyfish in Indonesia.

3.8.2.3.22.5 Species-Specific Threats

Physogyra lichtensteini is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population’s demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Physogyra lichtensteini*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.23 *Barabattoia laddi* (Faviid Coral)

3.8.2.3.23.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species including a proposed listing for the faviid coral (*Barabattoia laddi*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing is based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.23.2 Habitat and Geographic Range

The range of *Barabattoia laddi* is somewhat restricted, latitudinally. It is highly centered in the Coral Triangle but also found around some of the islands in the western Pacific, central South Pacific, and Australia’s Great Barrier Reef. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Barabattoia laddi* occurs in the Northern Mariana Islands (DeVantier et al. 2008e).

Barabattoia laddi has been recorded only from shallow lagoons in water depths ranging from 0 to 10 m (0 to 32.8 ft.).

3.8.2.3.23.3 Population and Abundance

Abundance of *Barabattoia laddi* has been reported to be rare (Australian Institute of Marine Science 2010).

3.8.2.3.23.4 Predator-Prey Interactions

Susceptibility to predation is unknown for *Barabattoia laddi*.

3.8.2.3.23.5 Species-Specific Threats

Barabattoia laddi is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Barabattoia laddi*. These elements include moderate vulnerability to ocean warming, disease, and acidification; uncommon generalized rangewide abundance; narrow overall distribution (based on moderate geographic distribution and shallow depth distribution); and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.24 *Millepora foveolata* (Fire Coral)

3.8.2.3.24.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the fire coral (*Millepora foveolata*) as endangered (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.24.2 Habitat and Geographic Range

Millepora foveolata has been reported on the southern coast of Taiwan, the Philippines, the Northern Marianas (but not the Southern Marianas, which include Guam, Rota, Tinian, Saipan); and the Great Barrier Reef in Australia (Brainard et al. 2011). According to the International Union for Conservation of Nature and Natural Resources Species Account, *Millepora foveolata* occurs in American Samoa (Obura et al. 2008).

Specimens of *Millepora foveolata* have been collected from the forefront reef slope on the upper surface of buttress ridges and have been reported in water depths ranging from at least 1 to 8 m (3.3 to 26.2 ft.).

3.8.2.3.24.3 Population and Abundance

Abundance of *Millepora foveolata* has been reported mostly as occasional (Brainard et al. 2011).

3.8.2.3.24.4 Predator-Prey Interactions

Species of the Milleporidae family are known to be preyed on by the crown-of-thorns seastar, although they are less preferred prey than members of the Acroporidae family. Milleporids are also susceptible to predation by the polychaete *Hermodice carunculata*, the nudibranch mollusk *Phyllidia*, and filefish of the genera *Alutera* and *Cantherhines.*

3.8.2.3.24.5 Species-Specific Threats

Millepora foveolata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Millepora foveolata*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, narrow overall distribution (based on narrow geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.25 *Millepora tuberosa* (Fire Coral)

3.8.2.3.25.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the fire coral (*Millepora tuberosa*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.25.2 Habitat and Geographic Range

Millepora tuberosa is occasionally common in portions of the western Pacific (Taiwan, Mariana lslands, Caroline Islands) and is found in American Samoa.

Millepora tuberosa has been reported to occupy a variety of habitats, including the forest reef and lagoonal areas in water depths ranging from at least 1 to 12 m (3.3 to 39.4 ft.).

3.8.2.3.25.3 Population and Abundance

Abundance of *Millepora tuberosa* has most often been reported as occasional, but it has been observed as predominant in an area of lagoonal reef in southwest Guam near the Agat Boat Harbor (Brainard et al. 2011).

3.8.2.3.25.4 Predator-Prey Interactions

Species of the Milleporidae family are known to be preyed on by the crown-of-thorns seastar, although they are less preferred prey than members of the Acroporidae family. Milleporids are also susceptible to predation by the polychaete *Hermodice carunculata*, the nudibranch mollusk *Phyllidia*, and filefish of the genera *Alutera* and *Cantherhines.*

3.8.2.3.25.5 Species-Specific Threats

Millepora tuberosa is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population’s demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Millepora tuberosa.* These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, narrow overall distribution (based on narrow geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.26 *Acanthastrea brevis* (Starry Cup Coral)

3.8.2.3.26.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the starry cup coral (*Acanthastrea brevis*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.26.2 Habitat and Geographic Range

Acanthastrea brevis has wide distribution ranging from the Red Sea, Gulf of Aden, southwest Indian Ocean, and northern Indian Ocean to central Indo-Pacific, west Pacific, Great Barrier Reef, and Fiji. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Acanthastrea brevis* occurs in American Samoa and in the northern Mariana Islands (Turak et al. 2008d). No supporting reference is given in the species account for the stated record of occurrence in the Northern Mariana Islands.

Acanthastrea brevis has been reported to occupy shallow reef environments (Australian Institute of Marine Science 2010) and all types of reef habitats. *Acanthastrea brevis* has been reported at water depths ranging from 1 to 20 m (3.3 to 65.6 ft.).

3.8.2.3.26.3 Population and Abundance

Abundance of *Acanthastrea brevis* has been reported as uncommon but conspicuous (Australian Institute of Marine Science 2010).

3.8.2.3.26.4 Predator-Prey Interactions

The specific predation threats upon members of the Family Mussidae (*Acanthastrea* sp.) found in the MITT Study Area are unknown (Brainard et al. 2011).

3.8.2.3.26.5 Species-Specific Threats

Acanthastrea brevis is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acanthastrea brevis*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, wide overall distribution (based on wide geographic range and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.27 *Acanthastrea ishigakiensis* (Starry Cup Coral)

3.8.2.3.27.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the starry cup coral (*Acanthastrea ishigakiensis*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.27.2 Habitat and Geographic Range

Acanthastrea ishigakiensis has a broad range; it stretches from the Red Sea, Gulf of Aden, and southern Africa to the central Pacific Ocean as far as Samoa but not including Australia. According to the

International Union for Conservation of Nature and Natural Resources Species Account, *Acanthastrea ishigakiensis* occurs in American Samoa and the Northern Mariana Islands, but no supporting reference is given for the record of occurrence in either of these areas in the species account.

Acanthastrea ishigakiensis has been reported to occupy shallow protected reef environments in water depths ranging from 1 to 15 m (3.3 to 49.2 ft.).

3.8.2.3.27.3 Population and Abundance

Abundance of *Acanthastrea ishigakiensis* has been reported as uncommon but conspicuous (Australian Institute of Marine Science 2010).

3.8.2.3.27.4 Predator-Prey Interactions

The specific predation threats upon members of the Family Mussidae (*Acanthastrea* sp.) found in the MITT Study Area are unknown (Brainard et al. 2011).

3.8.2.3.27.5 Species-Specific Threats

Acanthastrea ishigakiensis is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acanthastrea ishigakiensis*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.28 *Acanthastrea regularis* (Starry Cup Coral)

3.8.2.3.28.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the starry cup coral (*Acanthastrea regularis*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.28.2 Habitat and Geographic Range

Distribution is fairly restricted both longitudinally as latitudinally. It is highly centered in the Coral Triangle but also found around some of the islands in the west Pacific and Australia's Great Barrier Reef. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Acanthastrea regularis* occurs in the Northern Mariana Islands, but no supporting reference is given.

Acanthastrea regularis has been reported to occupy shallow reef environments in water depths ranging from 2 to 20 m (6.6 to 65.6 ft.).

3.8.2.3.28.3 Population and Abundance

Abundance of *Acanthastrea regularis* has been reported as uncommon (Australian Institute of Marine Science 2010).

3.8.2.3.28.4 Predator-Prey Interactions

The specific predation threats upon members of the Family Mussidae (Acanthastrea sp.) found in the MITT Study Area are unknown (Brainard et al. 2011).

3.8.2.3.28.5 Species-Specific Threats

Acanthastrea regularis is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Acanthastrea regularis*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on moderate geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.29 *Pectinia alcicornis* (Lettuce Coral)

3.8.2.3.29.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the lettuce coral (*Pectinia alcicornis*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.29.2 Habitat and Geographic Range

Pectinia alcicornis is broadly distributed in the Indo-Pacific, including Australia, Fiji, Indonesia, Japan, the Philippines, and India. U.S.-affiliated waters within the Indo-West Pacific range include American Samoa, the Marshall Islands, Micronesia, the Northern Mariana Islands, Palau, and unspecified U.S. minor outlying islands.

Pectinid corals can be found in turbid, horizontal reef environments to approximately 25 m (82.0 ft.) deep.

3.8.2.3.29.3 Population and Abundance

Abundance of *Pectinia alcicornis* has been reported as usually uncommon (Australian Institute of Marine Science 2010).

3.8.2.3.29.4 Predator-Prey Interactions

Members of the Pectinidae family are highly susceptible to crown-of-thorns seastar. However, little is known about the potential population-level impacts for *Pectinia alcicornis*.

3.8.2.3.29.5 Species-Specific Threats

Pectina alcicornis is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Pectinia alcicornis*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, wide overall distribution (based on wide geographic range and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.30 *Pocillopora danae* (Cauliflower Coral)

3.8.2.3.30.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the cauliflower coral (*Pocillopora danae*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.30.2 Habitat and Geographic Range

Pocillopora danae has a somewhat broad longitudinal and latitudinal range. It has been reported throughout the western Pacific and a small part of the central Pacific, the Great Barrier Reef, and around Sri Lanka. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Pocillopora danae* has been recorded in the Northern Mariana Islands (Hoeksema et al. 2008c).

Pocillopora danae has been reported on partly protected reef slopes in water depths ranging from 1 to 15 m (49.2 ft.).

3.8.2.3.30.3 Population and Abundance

Abundance of *Pocillopora Danae* has usually been reported to be uncommon (Carpenter et al. 2008; Australian Institute of Marine Science 2010).

3.8.2.3.30.4 Predator-Prey Interactions

Species of the Pocilloporidae family are among the most commonly consumed coral genera by crown-of-thorns seastar (*Acanthaster planci*) (Glynn 1976). However, Pocillopora are defended from Acanthaster predation by two mutualistic crustacean symbionts: a crab and a snapping shrimp, which often form protective barriers around unprotected species (Glynn 1976). Because smaller colonies lack these symbionts, Acanthaster often target young colonies, potentially reducing recruit success. Additionally, Pocillopora has been identified as preferred prey for corallivorous invertebrates such as the asteroid *Culcita novaeguineae* (Brainard et al. 2011), the gastropod *Jenneria pustulata* (Glynn 1976), and corallivorous fishes.

3.8.2.3.30.5 Species-Specific Threats

Pocillopora danae is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Pocillopora danae*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon generalized rangewide abundance, moderate overall distribution (based on moderate geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.31 *Pocillopora elegans*, Indo-Pacific (Cauliflower Coral)

3.8.2.3.31.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the cauliflower coral (*Pocillopora elegans*) as threatened (77 FR 73220–73262). *Pocillipora elegans* is treated as two regional populations in the proposed listing: *P. elegans* (Indo-Pacific) and *P. elegans* (Eastern Pacific). Only the Indo-Pacific regional population is proposed as "threatened." NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.31.2 Habitat and Geographic Range

The global distribution of both the Indo-Pacific and Eastern Pacific populations of *Pocillopora elegans* is rather fragmented; it is found in the central Indo-Pacific, the Marianas and central Pacific, and along the coastline of the eastern tropical Pacific and the Galapagos Islands. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Pocillopora elegans* has been recorded in American Samoa and the Northern Mariana Islands (Hoeksema et al. 2008d). The species account also lists its occurrence in the U.S. minor outlying islands.

Pocillipora elegans has been reported from shallow reef in water depths ranging from 1 to 20 m (3.3 to 65.6 ft.). However, it has been found at a depth of 60 m (196.9 ft.), suggesting the potential for deep refugia.

3.8.2.3.31.3 Population and Abundance

Abundance of *Pocillipora elegans* has been reported to be locally common in some regions of the central Indo-Pacific and the far eastern Pacific (Carpenter et al. 2008; Australian Institute of Marine Science 2010).

3.8.2.3.31.4 Predator-Prey Interactions

Species of the Pocilloporidae family are among the most commonly consumed coral genera by crown-of-thorns seastar (*Acanthaster planci*). Additionally, Pocillopora has been identified as preferred prey for corallivorous invertebrates such as the asteroid *Culcita novaeguineae* (Brainard et al. 2011), the gastropod *Jenneria pustulata* (Glynn 1976), and corallivorous fishes.

3.8.2.3.31.5 Species-Specific Threats

Pocillopora elegans is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Pocillopora elegans*' (Indo-Pacific). These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized range-wide abundance, wide overall distribution (based on wide geographic distribution and wide depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.32 *Alveopora allingi* (Net Coral)

3.8.2.3.32.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the net coral (*Alveopora allingi*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.32.2 Habitat and Geographic Range

Alveopora allingi has a very broad range, extending from the Red Sea and East Africa to the central Pacific. It extends latitudinally from the Japanese Ryukyu Islands and Red Sea in the northern hemisphere across the Great Barrier Reef and down both coastlines of Australia and South Africa in the southern hemisphere. According to both the International Union for Conservation of Nature and Natural Resources Species Account, *Alveopora allingi* occurs in American Samoa, the Northern Mariana Islands and U.S. minor outlying islands (Sheppard et al. 2008a).

Alveopora allingi has been reported to occupy protected reef environments in water depths ranging from 5 to 10 m (16.4 to 32.8 ft.).

3.8.2.3.32.3 Population and Abundance

Abundance of *Alveopora allingi* has been reported as usually uncommon (Australian Institute of Marine Science 2010).

3.8.2.3.32.4 Predator-Prey Interactions

The specific predation threats upon Alveopora allingi are unknown (Brainard et al. 2011). However, species of the Portidae family (e.g., *Porites, Alveopora* spp.) are susceptible to crown-of-thorns seastar and corallivorous snail predation. Porites are susceptible, but are not a preferred prey, of the predatory asteroid *Culcita novaeguineae* and the butterflyfish *Chaetodon unimaculatus*.

3.8.2.3.32.5 Species-Specific Threats

Alveopora allingi is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Alveopora allingi*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon relative rangewide abundance, moderate overall distribution (based on wide geographic distribution and shallow depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.33 *Alveopora fenestrata* (Net Coral)

3.8.2.3.33.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the net coral (*Alveopora fenestrata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.33.2 Habitat and Geographic Range

Alveopora fenestrata has a relatively broad range. Longitudally it stretches from the Red Sea to the oceanic west Pacific and latitudinally from the Red Sea and the Northern Mariana Islands on the northern hemisphere to southern Africa and across both coasts of Australia in the Southern hemisphere. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Alveopora fenestrata* occurs in the Northern Mariana Islands (Sheppard et al. 2008b).

Alveopora fenestrata has been reported to occupy shallow reef environments in water depths ranging from 3 to 30 m (9.8 to 98.4 ft.).

3.8.2.3.33.3 Population and Abundance

Abundance of *Alveopora fenestrata* has been reported as uncommon (Australian Institute of Marine Science 2010).

3.8.2.3.33.4 Predator-Prey Interactions

The specific predation threats upon *Alveopora fenestrata* are unknown (Brainard et al. 2011). However, species of the Portidae family (e.g., *Porites, Alveopora* spp.) are susceptible to crown-of-thorns seastar and corallivorous snail predation. Porites are susceptible, but are not a preferred prey, of the predatory asteroid *Culcita novaeguineae* and the butterflyfish *Chaetodon unimaculatus*.

3.8.2.3.33.5 Species-Specific Threats

Alveopora fenestrata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Alveopora fenestrata*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon relative range-wide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.34 *Alveopora verrilliana* (Net Coral)

3.8.2.3.34.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the net coral (*Alveopora verrilliana*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.34.2 Habitat and Geographic Range

Alveopora verrilliana has a broad range. It stretches from the Red Sea to the central Pacific Ocean longitudinally and latitudinally from the Japanese Ryukyu Islands in the northern hemisphere and midway along both Australian coasts in the southern hemisphere. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Alveopora verrilliana* occurs in American Samoa, the Northern Mariana Islands, and minor outlying islands (Sheppard et al. 2008c).

Alveopora verrilliana has been reported to occupy shallow reef environments in water depths ranging from 3 to 40 m (9.8 to 131.2 ft.). It has also been reported on outer steep slopes from 20 to 80 m (65.6 to 262.5 ft.) deep in the Red Sea, suggesting the potential for deep refugia.

3.8.2.3.34.3 Population and Abundance

Abundance of *Alveopora verrilliana* has been reported to be uncommon (Australian Institute of Marine Science 2010).

3.8.2.3.34.4 Predator-Prey Interactions

The specific predation threats upon *Alveopora verrilliana* are unknown (Brainard et al. 2011). However, species of the Portidae family (e.g., Porites, *Alveopora* spp.) are susceptible to crown-of-thorns seastar and corallivorous snail predation. Porites are susceptible, but are not a preferred prey, of the predatory asteroid *Culcita novaeguineae* and the butterflyfish *Chaetodon unimaculatus*.

3.8.2.3.34.5 Species-Specific Threats

Alveopora verrilliana is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Alveopora verrilliana*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, uncommon relative rangewide abundance, wide overall distribution (based on wide geographic distribution and wide depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.35 *Porites horizontalata* (Hump Coral)

3.8.2.3.35.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the hump coral (*Porites horizontalata*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September

2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.35.2 Habitat and Geographic Range

The range of *Porites horizontalata* is somewhat restricted longitudinally from the Maldives in the west to the central Pacific in the east and latitudinally from south of Japan in the northern hemisphere to New Caledonia in the southern hemisphere. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Porites horizontalata* has been recorded in American Samoa and the Northern Mariana Islands (Sheppard et al. 2008d). The species account also lists this species in the U.S. minor outlying islands.

Porites horizontalata has been reported to occupy shallow reef environments in water depths ranging from 5 to 20 m (16.4 to 65.6 ft.). It is also known to range in depth from moderate to deep water in American Samoa and in New Caledonia.

3.8.2.3.35.3 Population and Abundance

Abundance of *Porites horizontalata* has been reported as sometimes common (Carpenter et al. 2008; Australian Institute of Marine Science 2010).

3.8.2.3.35.4 Predator-Prey Interactions

Porites is susceptible to crown-of-thorns seastar (*Acanthaster planci*) and corallivorous snail predation including predation of *Coralliphilia violacea* on both massive and branching forms. Massive Porites are susceptible, but not a preferred prey, of the predatory asteroid *Culcita novaeguineae* and the butterflyfish *Chaetodon unimaculatus*.

3.8.2.3.35.5 Species-Specific Threats

Porites horizontalata is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Porites horizontilata*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.3.36 *Porites nigrescens* (Hump Coral)

3.8.2.3.36.1 Status and Management

In December 2012, NMFS issued a proposed rule for reef-building coral species, including a proposed listing for the hump coral (*Porites nigrescens*) as threatened (77 FR 73220–73262). NMFS has not proposed a critical habitat designation. The proposed listing was based on a comprehensive status review (Brainard et al. 2011), a summary of management and conservation measures, and a supplemental information report addressing new information and public comment to both status and management reports (National Marine Fisheries Service 2012). NMFS reviewed the status of this species and efforts being made to protect the species, as well as public comments received on the proposed rule, and made determinations based on the best scientific and commercial data available. In September 2014, NMFS published a Final Rule (79 FR 53851), which concluded that this species did not warrant listing as endangered or threatened under the ESA.

3.8.2.3.36.2 Habitat and Geographic Range

The distribution is broad longitudinally, ranging from the east coast of Africa to the central Pacific and broad latitudinally ranging from the Red Sea and south of Japan in the northern hemisphere to halfway down both coastlines of Australia in the southern hemisphere. According to the International Union for Conservation of Nature and Natural Resources Species Account, *Porites nigrescens* has been recorded in American Samoa (Sheppard et al. 2008f). The species account also lists this species in the Northern Mariana Islands and the U.S. minor outlying islands.

Porites nigrescens has been reported to occupy lower reef slopes and lagoons protected from wave action at moderate depths ranging from 0.5 to 20 m (1.6 to 65.6 ft.).

3.8.2.3.36.3 Population and Abundance

Porites nigrescens has been reported as sometimes common. Where found, it can be a part of a locally abundant branching Poritiid assemblage (Australian Institute of Marine Science 2010; Phongsuwan and Brown 2007).

3.8.2.3.36.4 Predator-Prey Interactions

Porites is susceptible to crown-of-thorns seastar (*Acanthaster planci*) and corallivorous snail predation including predation of *Coralliphilia violacea* on both massive and branching forms. Massive Porites are susceptible, but not a preferred prey, of the predatory asteroid *Culcita novaeguineae*, and the butterflyfish *Chaetodon unimaculatus*.

3.8.2.3.36.5 Species-Specific Threats

Porites nigrescens is susceptible to the same suite of stressors that generally threaten corals. NMFS evaluated the population's demographic, spatial structure, and vulnerability factors (77 FR 73220–73262) and identified elements that may threaten *Porites nigrescens*. These elements include high vulnerability to ocean warming, moderate vulnerability to disease and acidification, common generalized rangewide abundance, wide overall distribution (based on wide geographic distribution and moderate depth distribution), and inadequacy of existing regulatory mechanisms (79 FR 53851).

3.8.2.4 Taxonomic Group Descriptions

3.8.2.4.1 Phylum Cnidaria (e.g., Corals, Hydroids, Jellyfish)

There are over 10,000 marine species of corals, hydroids, and jellyfish worldwide (Appeltans et al. 2010). Members of this group are found throughout the Study Area at all depths. Hydroids are colonial animals that can have both flexible and rigid skeletons, but are not considered to be habitat-forming as corals are in creating reefs (Colin and Arneson 1995a; Gulko 1998). Jellyfish are motile as larvae, sessile as an intermediate colonial polyp stage, and motile as adults (Brusca and Brusca 2003). They are predatory at all stages and, like all Cnidaria, use tentacles equipped with stinging cells to capture prey (Castro and Huber 2000; University of California at Berkeley 2010a). Jellyfish are an important prey species to a range of organisms, including some sea turtles and some ocean sunfish (*Mola mola*) (Heithaus et al. 2002; James and Herman 2001).

The class Anthozoa includes anemones and corals (hard and soft). The individual unit of corals is a polyp, and most species occur as colonies of polyps. Corals can feed on plankton, which are small organisms that float with the currents, as well as other small organisms. Corals capture prey with tentacles that surround their mouth and are armed with stinging cells (Brusca and Brusca 2003). Reef-building corals occur in the photic zone (defined by the depth of light penetration) of coastal waters, typically shallower than approximately 650 ft. (200 m), and usually host symbiotic algae called zooxanthellae that provide nutrition to the corals as byproducts from photosynthesis (Veron and Stafford-Smith 2011; Castro and Huber 2000) and give the coral its color. The zooxanthellae receive shelter from the coral as well as carbon dioxide needed for photosynthesis. All corals feed on small planktonic organisms or dissolved organic matter, although some shallow-water corals derive most of their energy from their symbiotic algae (Dubinsky and Berman-Frank 2001). Most hard corals and some soft corals are habitat-forming (i.e., they form coral reefs) (Freiwald et al. 2004; Spalding et al. 2001; South Atlantic Fishery Management Council 1998). See Figure 3.8-2 through Figure 3.8-6 for information on the distribution and percent cover of corals surrounding Guam (and within Apra Harbor), Tinian, Saipan, and Farallon de Medinilla (FDM), as derived by satellite imagery by NOAA, near Guam, Apra Harbor, Saipan, and Tinian, respectively.

Many corals can reproduce either sexually or asexually. Some are hermaphrodites, meaning that they possess both male and female reproductive organs. Most species reproduce sexually by releasing eggs and sperm into the water (spawning), where fertilization occurs and larvae begin to develop. After larvae settle on an appropriate surface, the colony begins to grow (Boulon et al. 2005). Fragmentation is a common form of asexual reproduction in species with thin branches. During a storm, thin branches typically break off from a colony and form new colonies by attaching to a suitable surface (Richmond 1997). Although fragmentation helps maintain high growth rates, it reduces the reproductive potential of some coral species by delaying the production of eggs and sperm for years following the damage (Lirman 2000).

Predation on some coral genera, especially *Acropora, Montipora, Pocillopora*, and *Porites* in the Pacific, by many species of fish and invertebrates is a consistent threat to corals and has been identified for most coral life stages (Brainard et al. 2011). So far, 128 species of fish spread across 11 families have been found to prey on corals, with a third of the species relying on corals for more than 80 percent of their diet. Several experimental field studies have demonstrated that the distribution of corals was directly limited by predation of corallivorous fishes and invertebrates. Predation of corals by fishes and invertebrates is normally considered negative, but triggerfish and pufferfish have been shown to disperse coral fragments during feeding, potentially helping corals spread by asexual reproduction. Some predators also affect the distribution of corals by preferentially consuming coral species or forms that are the faster-growing and thereby superior competitors for space (e.g., *Acropora, Montipora, Pocillopora*, and branching *Porites*). For example, one study found that by reducing the growth of the superior competitor (e.g., *Montipora capitata*), predators allow the more slowly growing coral (*Porites compressa*) to prevail (Cox 1986).

Apart from a few exceptions, coral reefs in the Pacific Ocean are confined to the warm tropical and subtropical waters between 30 degrees (°) North (N) and 30° South (S). Over 400 scleractinian (stony corals) and hydrozoan coral species (hydrocorals), representing 22 families and 108 genera have, been identified from Guam and the Mariana Islands (Randall 2003). Of this total number, 377 are scleractinian species that occur within 20 families and 99 genera and 26 are hydrozoan species that occur within 2 families and 9 genera. About 70 percent of the coral fauna (281 species) contain zooxanthellae in their tissues and about 30 percent (122 species) are azooxanthellate, although several genera (contain both azooxanthellate and zooxanthellae species) (Randall 2003). Azooxanthellate obtain energy from detritus, zooplankton, and nekton they capture from the surrounding water. Since azooxanthellate corals do not depend on sunlight or a symbiotic existence with zooxanthellae, they can be found in deeper waters (National Marine Fisheries Service 2010b).

Deep-sea coral communities are prevalent throughout the Mariana Islands chain, and often form offshore reefs. Much like shallow-water corals, deep-sea corals are fragile, slow growing, and can survive for hundreds of years. In the Mariana Islands, gorgonians, while occurring at all depths, are the most commonly found corals in deep-sea communities. Gorgonian diversity and abundance increase below 30 m (98.4 ft.), especially in steep, cavernous, and current-swept areas, so that about 20 species are known between 30 and 60 m (98.4 and 196.9 ft.) (Paulay et al. 2003). Several of the gorgonian species listed have been encountered at diving depths only in caverns along the southern Orote Peninsula of Guam, especially the Blue Hole; these species are otherwise restricted to deeper water. In contrast, the much richer deep-water fauna remains poorly known. Gorgonians, the soft coral genera *Siphonogorgia* and *Dendronephthya*, and black corals become much more diverse and abundant below 60 m (196.9 ft.). Dredging and tangle net surveys (Eldredge 2003) have already revealed about 70 species of arborescent octocorals at 60 to 400 m (196.9 to 1,312.3 ft.) and many others surely remain to be collected.

There is evidence that overall coral reef habitat has declined in the Study Area, and this is used as a proxy for population decline in many species. Species that are particularly susceptible to bleaching, disease, and other threats are more susceptible to further decline; therefore, population decline is based on both the percentage of destroyed reefs and the percentage of critical reefs that are likely to be destroyed within 20 years (Wilkinson 2004).

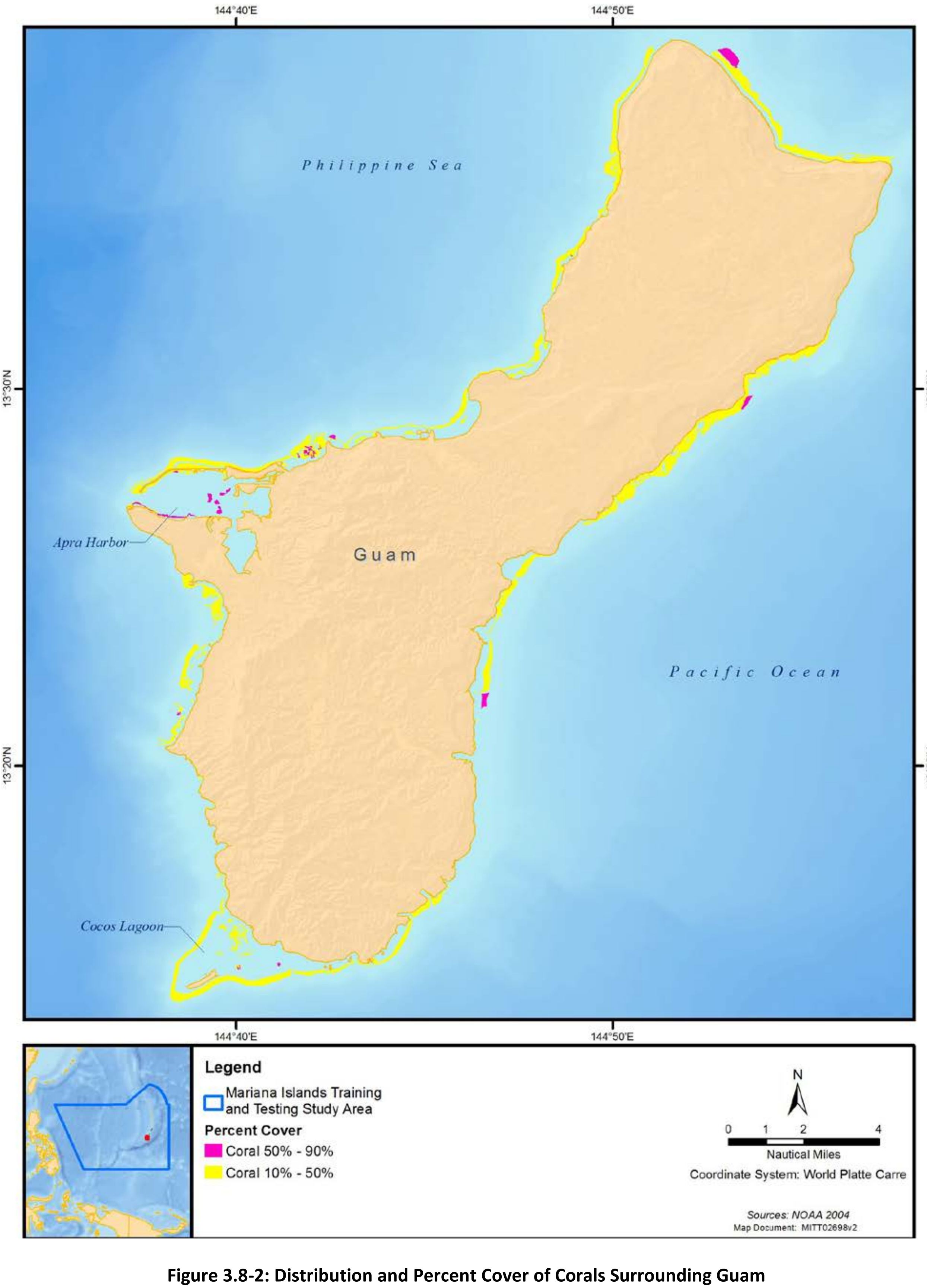


Figure 3.8-2: Distribution and Percent Cover of Corals Surrounding Guam

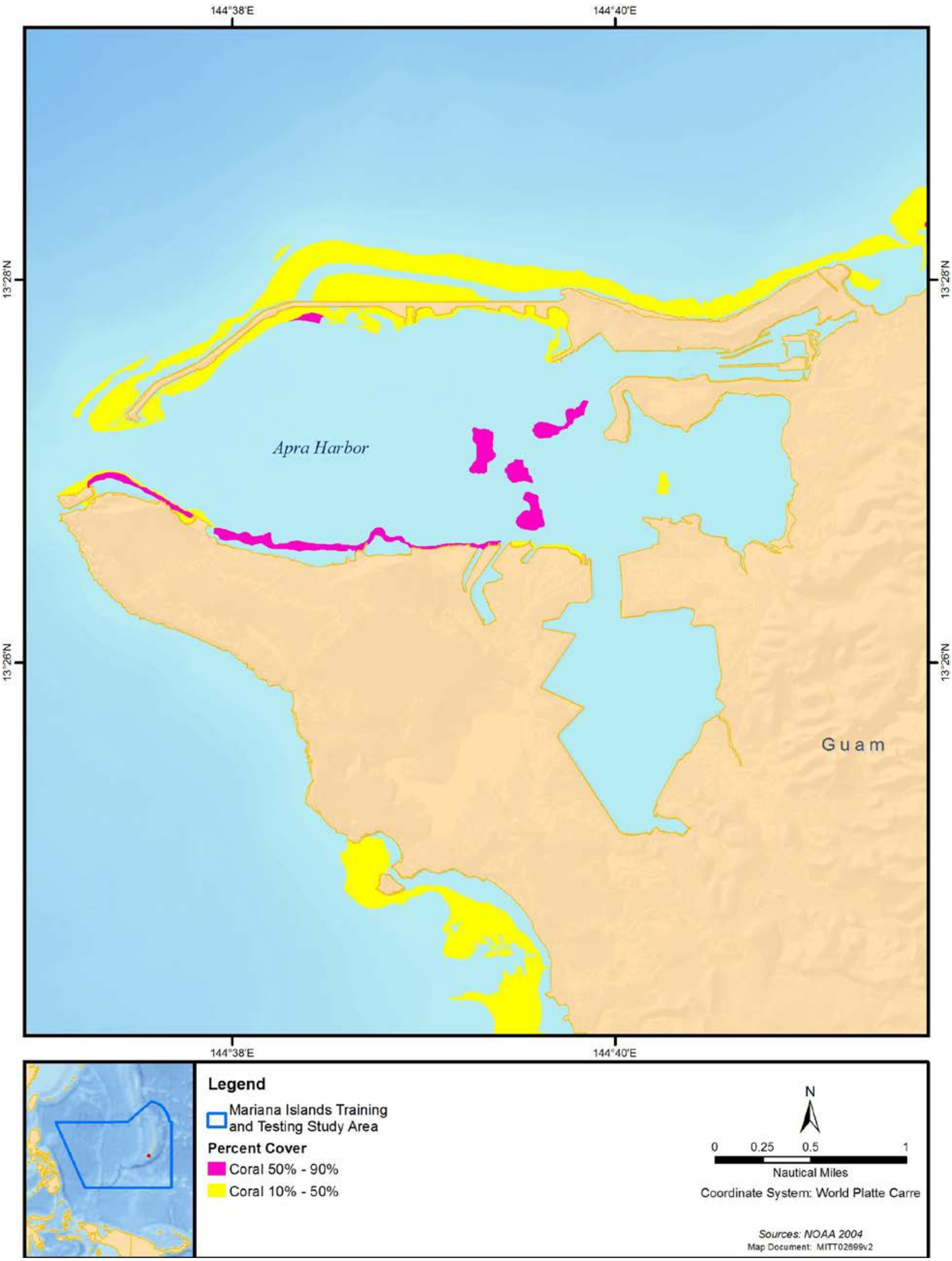


Figure 3.8-3: Distribution and Percent Cover of Corals Within Apra Harbor

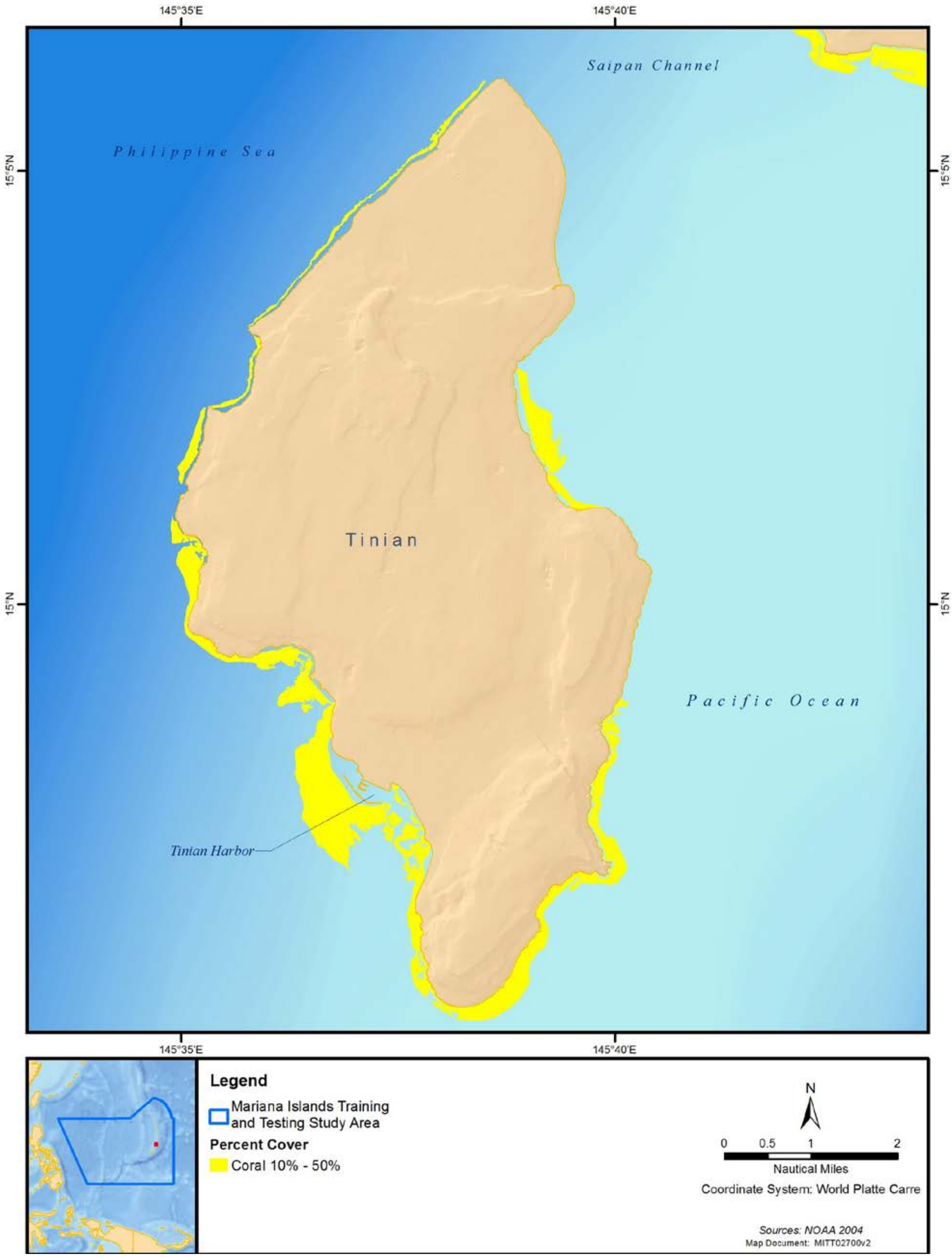


Figure 3.8-4: Distribution and Percent Cover of Corals Surrounding Tinian

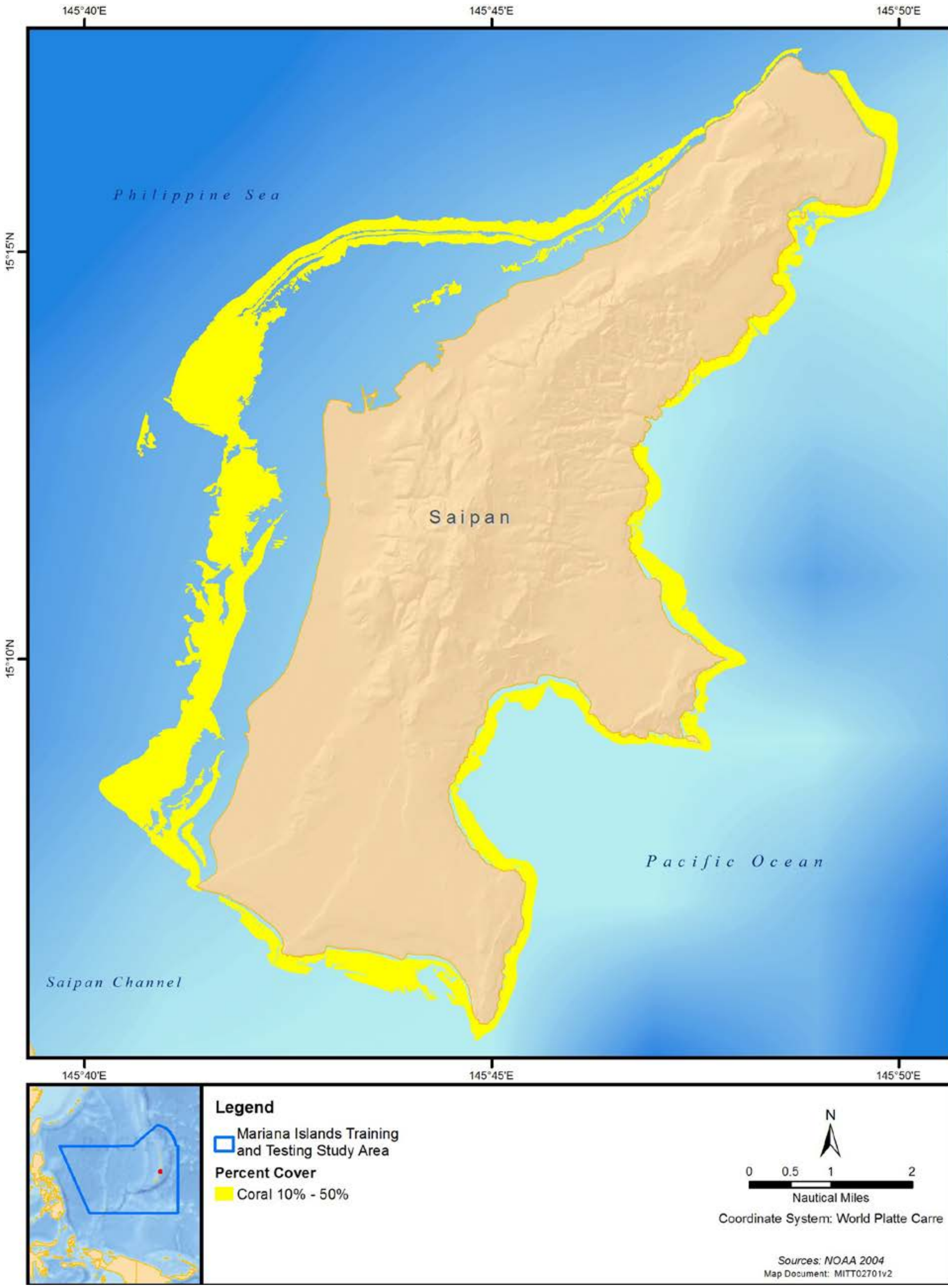


Figure 3.8-5: Distribution and Percent Cover of Corals Surrounding Saipan

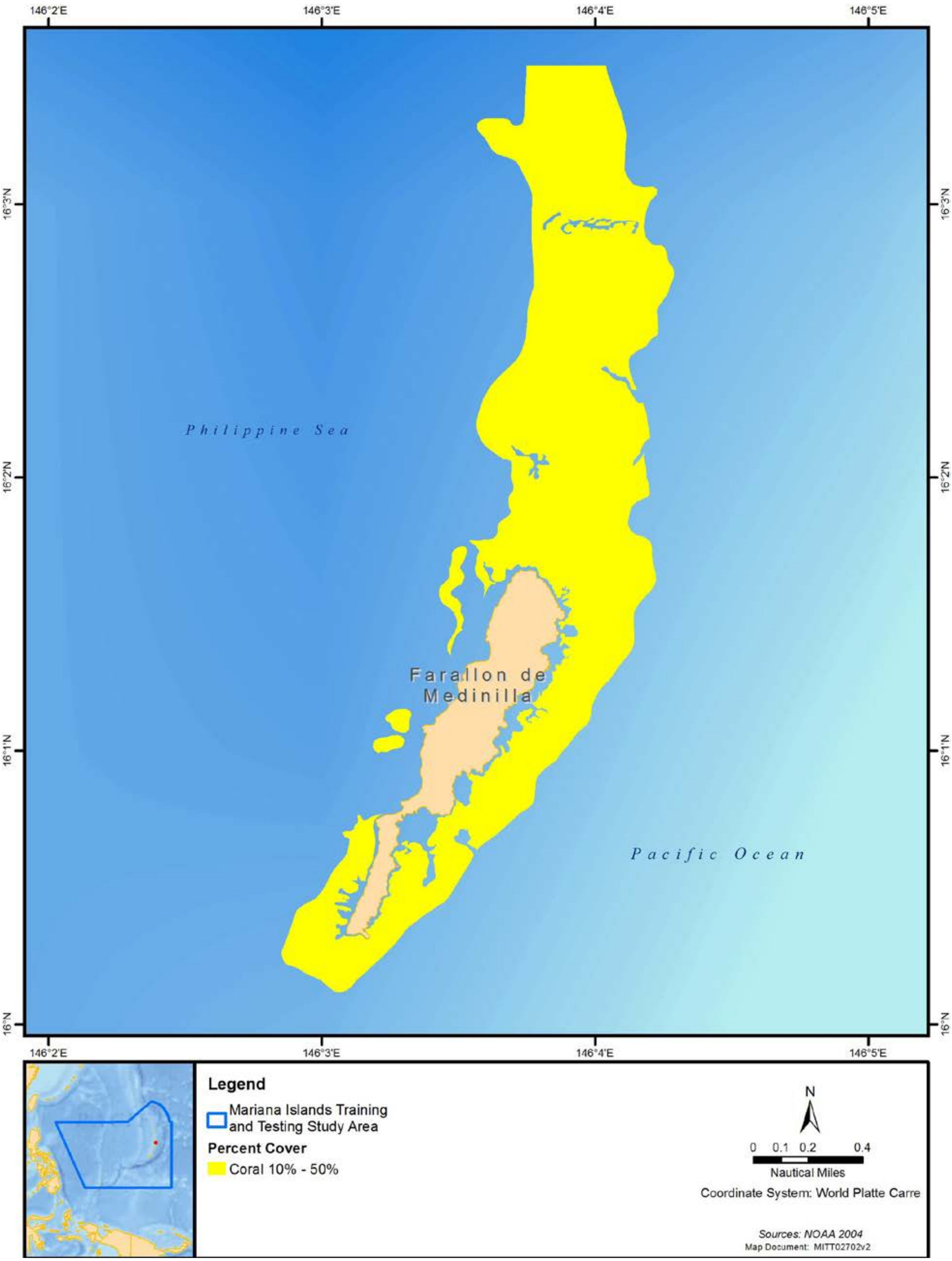


Figure 3.8-6: Distribution and Percent Cover of Corals Surrounding FDM

3.8.2.4.2 Phylum Platyhelminthes (Flatworms)

Flatworms include between 8,000 and 20,000 marine species worldwide (Appeltans et al. 2010; Castro and Huber 2000) and are the simplest form of marine worm (Castro and Huber 2000). The largest single group of flatworms are parasites commonly found in fishes, seabirds, and whales (Castro and Huber 2000; University of California Berkeley 2010b). The life history of parasitic flatworms plays a role in the regulation of populations for the marine vertebrates they inhabit. Ingestion by the host organism is the primary dispersal method for parasitic flatworms. As parasites, they are not typically found in the water column, outside of a host organism. The remaining groups are non-parasitic carnivores, living without a host. Flatworms are found throughout the Study Area living on rocks in tidepools and reefs, within the top layer of sandy areas, or planktonic. Eighty-eight species of flatworms have been identified from surveys and from literature records in and around Guam (Newman et al. 2003); however, due to the difficulty in taxonomic determinations, the authors believe there may be in excess of 100 species.

3.8.2.4.3 Phylum Nemertea (Ribbon Worms)

Ribbon worms include approximately 1,000 marine species worldwide (Appeltans et al. 2010). Ribbon worms, with their distinct gut and mouth parts, are more complex than flatworms (Castro and Huber 2000). Organisms in this phylum are bottom-dwelling, predatory marine worms that are equipped with a long extension from the mouth (i.e., a proboscis) that helps them capture food (Castro and Huber 2000). Some species are also equipped with a sharp needle-like structure that delivers poison to kill prey. Ribbon worms occupy an important place in the marine food web as prey for a variety of fish and invertebrates and as a predator of other bottom-dwelling organisms, such as worms and crustaceans (Castro and Huber 2000). Some ribbon worms occupy the inside of the mantle of molluscs where they feed on the waste products of their host (Castro and Huber 2000). Eight species of ribbon worms have been found within the Study Area (Paulay 2003a).

3.8.2.4.4 Phylum Nematoda (Round Worms)

Round worms include over 5,000 marine species, though this number may be significantly underestimated (Appeltans et al. 2010). Round worms are small and cylindrical, and are abundant in sediments and can also be found in host organisms as parasites (Castro and Huber 2000). Round worms are one of the most widespread marine invertebrates, with population densities of up to one million organisms per 11 square feet ($ft.^2$) (1.02 square meters [m^2]) of mud (Levinton 2009). This group has a variety of food preferences, including algae, small invertebrates, annelid worms, and organic material from sediment. Like parasitic flatworms, parasitic nematodes provide important ecosystem services by regulating populations of other marine organisms by causing illness or mortality in less viable organisms. Species in the family Anisakidae infect marine fish, and may cause illness in humans if fish are consumed raw without proper precautions. Round worms are found throughout the Study Area.

3.8.2.4.5 Phylum Annelida (Segmented Worms)

Segmented worms include approximately 12,000 marine species worldwide in the phylum Annelida, although most marine forms are in the class Polychaeta (Appeltans et al. 2010). Segmented worms are the most physiologically complex group of marine worms with a well-developed respiratory and gastrointestinal system (Castro and Huber 2000). Different species of segmented worms may be highly mobile or burrow in the seafloor (Castro and Huber 2000). Most segmented worms are predators; others are scavengers, deposit feeders, filter feeders, or suspension feeders of sand, sediment, and water (Hoover 1998c). The variety of feeding strategies and close connection to the seafloor make Annelids an integral part of the marine food web (Levinton 2009). Burrowing in the seafloor and agitating the sediment increases the oxygen content of seafloor sediments and makes important buried nutrients available to other organisms. This ecosystem service allows bacteria and other organisms, which are also an important part of the food web, to flourish on the seafloor. Segmented worms are found throughout the Study Area inhabiting rocky, sandy, and muddy areas of the seafloor. These worms also colonize on corals, vessel hulls, docks, and floating debris.

3.8.2.4.6 Phylum Mollusca (e.g., Squid, Bivalves, Sea Snails, Chitons)

There are approximately 27,000 marine species that are classified in the Phylum Mollusca worldwide (Appeltans et al. 2010). Gastropods (e.g., sea snails), bivalves (e.g., mussels), cephalopods (e.g., squid), and chitons (polyplacophorans) are marine invertebrates that possess a muscular organ called a foot, which is used for mobility (Castro and Huber 2000). Sea snails and slugs eat fleshy algae and a variety of invertebrates, including hydroids, sponges, sea urchins, worms, other snails, and small crustaceans, as well as detritus (Castro and Huber 2000; Colin and Arneson 1995c). Clams, mussels, and other bivalves feed on suspended food particles (e.g., phytoplankton, detritus) (Castro and Huber 2000). Chitons, sea snails, and slugs use rasping tongues, known as radula, to scrape food (e.g., algae) off rocks (Castro and Huber 2000; Colin and Arneson 1995c). Squid and octopus are active swimmers at all depths and use a beak to prey on a variety of organisms, including fish, shrimp, and other invertebrates (Castro and Huber 2000; Hoover 1998c; Western Pacific Regional Fishery Management Council 2001). Octopuses mostly prey on fish, shrimp, eels, and crabs (Wood and Day 2005).

Creel surveys (estimates of local fisheries catch data) have shown that the main species collected within the shore-based harvesting are octopus (*Octopus cyanea, O. ornatus*) and topsnail (*Tectus niloticus*). Important species of Mollusca, as indicated by creel surveys of boat-based harvesting show that the highest catches are of octopus (*Octopus cyanea*, *O. ornatus*, and *O. teuthoides*), topsnail (*Trochus niloticus*), giant spider conch (*Lambis truncata*), and bigfin reef squid (*Sepioteuthis lessoniana*) (Burdick et al. 2008).

3.8.2.4.7 Phylum Arthropoda (e.g., Shrimp, Crab, Lobster, Barnacles, Copepods)

Shrimp, crabs, lobsters, barnacles, and copepods are animals with skeletons on the outside of their body (exoskeleton) (Castro and Huber 2000), and are classified as crustaceans in the Phylum Arthropoda, which also includes insects and arachnids. Shrimp, crabs, and lobsters are typically carnivores, omnivorous predators, or scavengers, preying on molluscs (primarily gastropods), other crustaceans, echinoderms, small fish, algae, and sea grass (Waikiki Aquarium 2009a, b, c; Western Pacific Regional Fishery Management Council 2009). Barnacles and copepods filter algae and other small organisms from the water (Levinton 2009).

Important recreational species of Crustacea, as indicated by creel surveys of the shore-based fishery, are lobster (*Panulirus penicillatus*), slipper lobster (*Parribacus antarticus*) and crab (*Scylla serrate*). The important harvested species of the boat-based fishery are lobster (*Panulirus penicillatus, P. versicolor*), and slipper lobster (*Parribacus antarticus*) (Burdick et al. 2008).

3.8.2.4.8 Phylum Echinodermata (e.g., Sea Stars, Sea Urchins, Sea Cucumbers)

Organisms in this phylum include over 6,000 marine species, such as sea stars, sea urchins, and sea cucumbers (Appeltans et al. 2010). Asteroids (e.g., sea stars), sechinoids (e.g., sea urchins), holothuroids (e.g., sea cucumbers), ophuiroids (e.g., brittle stars and basket stars), and crinoids (e.g., feather stars and sea lilies) are symmetrical around the center axis of the body (Castro and Huber 2000). Echinoderms occur at all depth ranges from the intertidal zone to the abyssal zone and are almost exclusively benthic (living on the sea floor). Most echinoderms have separate sexes, but unisexual forms occur among the sea stars, sea cucumbers, and brittle stars. Many species have external fertilization, producing planktonic larvae, but some brood their eggs, never releasing free-swimming larvae (Colin and Arneson

1995b). Many echinoderms are either scavengers or predators on organisms that do not move, such as algae, stony corals, sponges, clams, and oysters (Hoover 1998b), although some also predate on other species of seastars. Some species, however, filter food particles from sand, mud, or water.

Important commercial, ecological, and recreational species in the shore-based fishery of Guam are the sea urchins (*Tripneustes gratilla* and *Toxipneustes pilolus*) (Burdick et al. 2008) and sea cucumbers (Kinch et al. 2008).

3.8.2.4.9 Phylum Porifera (Sponges)

Sponges include over 8,000 marine species worldwide, and are classified in the Phylum Porifera (Appeltans et al. 2010). Sponges are bottom-dwelling, multi-cellular animals that can be best described as an aggregation of cells that perform different functions. Sponges are largely sessile (not mobile), except for their larval stages, and are common throughout the Study Area at all depths. This filtering process is an important coupler of pelagic and benthic processes (Perea-Blázquez et al. 2012). Sponges reproduce both sexually and asexually. Water flowing through the sponge provides food and oxygen and removes wastes (Castro and Huber 2000; Collins and Waggoner 2006). Many sponges form calcium carbonate or silica spicules or bodies embedded in cells to provide structural support (Castro and Huber 2000). Sponges provide homes for a variety of animals, including shrimp, crabs, barnacles, worms, brittle stars, holothurians, and other sponges (Colin and Arneson 1995d). Over 100 species of siliceous sponges (Class Demospongiae) and 4 species of the calcareous sponges (Class Calcarea) have been identified from the marine waters of the Mariana Islands (Kelly et al. 2003).

3.8.2.4.9.1 Kingdom Protozoa (e.g., Foraminifera, Radiolarians, Ciliates)

Foraminifera, radiolarians, and ciliates are minute singled-celled organisms, sometimes forming colonies of cells, belonging to the Kingdom Protozoa (Castro and Huber 2000). They are found in the water column and seafloor of the world's oceans. Forminifera form diverse and intricate shells out of calcium carbonate (Wetmore 2006). The shells of formanifera that live in the water column eventually sink to the deep seafloor, forming sediments known as formaminiferan ooze. Four new species of foraminifera were recently discovered in the Challenger Deep at a depth of over 10,800 m (35,400 ft.) in the Marianas Trench (Gooday et al. 2008). Foraminifera feed on diatoms and other small organisms. Their predators include copepods and other zooplankton. Radiolarians are microscopic organisms that form shells made of silica. Radiolarian ooze covers large areas of the ocean floor (Castro and Huber 2000; Wetmore 2006). Ciliates are protozoans with small hair-like extensions that are used to feed and move around. Over 300 species of the clade Foraminifera occur in the substrate and marine waters surrounding Guam (Richardson and Clayshulte 2003). However, while species of protozoans have been identified within the MITT Study Area, direct measurements of abundance are not readily available.

3.8.3 Environmental Consequences

This section presents the analysis of potential impacts on marine invertebrates, from implementation of the project alternatives, including the No Action Alternative, Alternative 1, and Alternative 2. U.S. Department of the Navy (Navy) training and testing activities are evaluated for their potential impact on marine invertebrates in general, by taxonomic groups, and in detail for species listed under the ESA (Section 3.8.2, Affected Environment).

The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to marine invertebrates in the study area and analyzed below include the following:

- Acoustic (sonar and other active acoustic sources; underwater explosives; swimmer defense airguns; weapons firing, launch and impact noise; aircraft noise; and vessel noise)
- Energy Stressors (electromagnetic devices)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, and seafloor devices)
- Entanglement (Fiber optic cables and guidance wires, and decelerators/parachutes)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary (impacts associated with sediments and water quality)

The specific analysis of the training and testing activities presented in this section considers the relevant components and associated data within the geographic location of the activity (see Tables 2.8-1 through 2.8-4) and the resource.

3.8.3.1 Acoustic Stressors

Assessing whether sounds may disturb or injure an animal involves understanding the characteristics of the acoustic sources, the animals that may be near the sound, and the effects that sound may have on the physiology and behavior of those animals. The methods used to predict acoustic effects on invertebrates build upon the conceptual framework for assessing effects from sound-producing activities (Appendix H.1, Conceptual Framework for Assessing Effects from Sound-Producing Activities). Categories of potential impacts are direct trauma, hearing loss, auditory masking, behavioral reactions, and physiological stress. Little information is available on the potential impacts on marine invertebrates' exposure to sonar, explosions, and other sound-producing activities. Most studies focus on squid or crustaceans, and the consequences of exposures to broadband impulse air guns typically used for seismic exploration, rather than on sonar or explosions.

Direct trauma and mortality may occur due to the rapid pressure changes associated with an explosion. Most invertebrates lack air cavities that would respond to pressure waves, which typically causes the most damage in fish or marine mammals. Marine invertebrates could also be displaced, or in the case of delicate coral polyps or structures, damaged, by a shock wave.

To experience hearing impacts, masking, behavioral reactions, or physiological stress, a marine invertebrate must be able to sense sound. Marine invertebrates are likely only sensitive to water particle motion caused by nearby low-frequency sources, and likely do not hear or feel distant or mid- and high-frequency sounds. Lovel et al. (2005) determined hearing sensitivity in prawns to sounds between 100 Hz and 3 kHz (though the threshold levels were all above 100 dB re 1 μPa). No damage to statocysts (a sensory receptor in some aquatic invertebrates) and no impacts on crustacean balance (a function of the statocyst) were observed in crustaceans repeatedly exposed to high-intensity airgun firings (Christian et al. 2003; Payne et al. 2007). The limited information suggests that marine invertebrate statocysts may be resistant to impulse sound impacts, but that the impact of long-term or non-impulse sound exposures is undetermined.

Masking occurs when a sound interferes with an animal's ability to detect other biologically relevant sounds in its environment. Little is known about how marine invertebrates use sound in their environment. Some studies have shown that crab and coral larvae and post-larvae may use nearby reef sounds when in their settlement phase (Jeffs et al. 2003; Radford et al. 2007; Stanley et al. 2010; Vermeij et al. 2010), although it is unknown what component of reef noise is used. Larvae likely sense particle motion of nearby sounds, limiting their reef noise detection range (less than 328 ft. [100.01 m]) (Vermeij et al. 2010). Anthropogenic sounds could mask important acoustic cues, affecting detection of settlement cues or predators, potentially affecting larval settlement patterns or survivability in highly modified acoustic environments (Simpson et al. 2011). Low-frequency sounds could interfere with perception of low-frequency rasps or rumbles among crustaceans, although these are often already obscured by ambient noise (Patek et al. 2009). Sonar is not used in areas where ESA-listed coral species are known to occur.

Studies of invertebrate behavioral responses to sound have focused on responses to impulse sound. Some caged squid showed strong startle responses, including inking, when exposed to the first shot of broadband sound from a nearby seismic airgun (sound exposure level of 163 dB re 1 μPa^2-s), but strong startle responses were not seen when sounds were gradually increased (McCauley et al. 2000a, b). Slight increases in behavioral responses, such as jetting away or changes in swim speed, were observed at received levels exceeding 145 dB re 1 μPa^2-s (McCauley et al. 2000a, b). Other studies have shown no observable response by marine invertebrates to sounds. Snow crabs did not react to repeated firings of a seismic airgun (peak received sound level was 201 dB re 1 µPa) (Christian et al. 2003) and squid did not respond to killer whale echolocation clicks (higher frequency signals ranging from 199 to 226 dB re 1 µPa) (Wilson et al. 2007). Krill did not respond to a research vessel approaching at 2.7 knots (source level below 150 dB re 1 µPa) (Brierley et al. 2003). Distraction may be a consequence of some sound exposures. Hermit crabs were shown to delay reaction to an approaching visual threat when exposed to continuous noise, putting them at increased risk of predation (Chan et al. 2010).

There is some evidence of possible stress effects on invertebrates from long-term or intense sound exposure. Captive sand shrimp exposed to low-frequency noise (30 to 40 dB above ambient) continuously for 3 months demonstrated decreases in both growth rate and reproductive rate (Lagardère 1982). Sand shrimp showed lower rates of metabolism when kept in quiet, soundproofed tanks than when kept in tanks with typical ambient noise (Lagardère and Régnault 1980). The effect of long-term (multiple years), intermittent sound exposure was examined in a statistical analysis of recorded catch rate of rock lobster and seismic airgun activity (Parry and Gason 2006). No correlation was found between catch rate and seismic airgun activity, implying no long-term population impacts from intermittent anthropogenic sound exposure over long periods.

Because research on the consequences of exposing marine invertebrates to anthropogenic sounds is limited, qualitative analyses described below were conducted to determine the effects of the following acoustic stressors on marine invertebrates within the Study Area: non-impulse sources (including sonar other active acoustic sources) and impulse acoustic sources (including explosives, swimmer defense airguns, and weapons firing).

3.8.3.1.1 Impacts from Sonar and Other Active Acoustic Sources

Sources of non-impulse underwater sound during testing and training activities include vessel noise (including surface ships and small boats), aircraft overflight noise (i.e., fixed-wing and rotary-wing aircraft), and sonar, and other active acoustic sources.

Many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels). Activities involving vessel movements occur intermittently, and are variable in duration, ranging from a few hours up to two weeks. Navy traffic is heaviest near the Navy port facilities and training areas within the Mariana Islands Range Complex (MIRC). Additionally, a variety of smaller craft could be operated within the Study Area. Surface combatant ships and submarines are designed to be quiet to evade enemy detection. Other Navy ships and small craft have higher source levels, similar to equivalently sized commercial ships and private vessels. Ship noise tends to be low-frequency and broadband.

Fixed and rotary-wing aircraft are used for a variety of training and testing activities throughout the Study Area. Airborne broadband noise from aircraft can be transmitted through the air-water interface, though much of energy is lost at the sea-air interface. Underwater sounds from aircraft are strongest just below the surface and directly under the aircraft. Sonar and other active acoustic sources emit sound waves into the water to detect objects, safely navigate, and communicate. These sources may emit low-, mid-, high-, or very-high-frequency sounds at various sound pressure levels.

Most marine invertebrates do not have the capability to sense sound; however, some may be sensitive to nearby low-frequency and possibly lower-mid-frequency sounds, such as some active acoustic sources or vessel noise. As described in Section 3.8.2.1 (Invertebrate Hearing and Vocalization), invertebrate species detect sounds through particle motion, which diminishes rapidly from the sound source. Most activities using sonar or other active acoustic sources would be conducted in deepwater, offshore areas of the Study Area and are not likely to affect most invertebrate species, including ESA-listed coral species. Furthermore, invertebrate species have their best hearing sensitivity below 1 kHz and would not be capable of detecting the majority of sonars and other acoustic sources used in the Study Area.

The relatively low sound pressure level beneath the water surface caused by aircraft overflights is likely not detectable by most marine invertebrates. For example, the sound pressure level from an H-60 helicopter hovering at 50 ft. is estimated to be about 125 dB re 1 µPa at 1 m below the surface, a sound pressure lower than other sounds to which marine invertebrates have shown no reaction (see Section 3.8.3.1, Acoustic Stressors). Therefore, impacts due to aircraft overflight noise are not expected.

3.8.3.1.1.1 No Action Alternative

Training Activities

Under the No Action Alternative, marine invertebrates would be exposed to low-, mid-, and high-frequency sonar; vessel noise; and aircraft overflight noise during training activities. These activities could occur throughout the open ocean areas of the Study Area. Certain portions of the Study Area, such as areas near Navy ports and airfields, installations, and training ranges, are used more heavily by vessels and aircraft than other portions of the Study Area. A more detailed description of these activities, the number of activities, and their proposed locations is provided in Table 2.8-1.

Species that do not occur within these specified areas would not be exposed to low-, mid-, and high-frequency sonar; vessel noise; and aircraft overflight noise during training activities. Species that do occur within the areas listed above—including ESA-listed coral species—would have the potential to be exposed to sonar, vessel, and aircraft noise. Human-induced physical damage was considered by NMFS to be a “negligible to low-importance” threat to coral species and was not cited as a factor when considering the ESA listing of coral species.

Corals throughout the Study Area may be exposed to non-impulse sounds generated by sonar and other active acoustic sources, vessels, and aircraft during training. Most underwater acoustic sources would not be used in the shallow waters (less than 100 ft. [30 m]) where ESA-listed coral species are known to exist. There is no evidence that corals or coral larvae are sensitive to distant non-impulse sounds, although larvae may sense particle motion from close sounds. Sound from training activities is intermittent or transient, or both, and will not commonly occur close enough to reefs to interfere with larval perception of reef noise.

Most marine invertebrates will not sense mid- or high-frequency sounds, but some individual marine invertebrates may sense nearby low-frequency sounds such as vessel noise, aircraft overflight noise (transmitted through the air-water interface), and lower-frequency sonar. Because most non-impulse sound sources are transient or intermittent, or both, any responses are likely to be short-term behavioral responses or brief masking. Non-impulse sounds may impact individual marine invertebrates and groups of marine invertebrates close to a sound source, but they are unlikely to impact populations or subpopulations.

Pursuant to the ESA, sonar and other active acoustic sources associated with training activities as described under the No Action Alternative may affect ESA-listed coral species.

Testing Activities

Under the No Action Alternative, marine invertebrates could be exposed to low-, mid-, and high-frequency acoustic sources used during testing activities. Testing activities potentially using non-impulse acoustic sources under the No Action Alternative include the North Pacific Acoustic Lab Philippine Sea Experiment (Table 2.4-4). In 2018, research vessels, acoustic test sources, side scan sonar, ocean gliders, the existing moored acoustic tomographic array and distributed vertical line array, and other oceanographic data collection equipment will be used to collect information on the ocean environment and sound propagation.

ESA-listed coral species are not expected to be present in the portion of the Study Area where the Philippine Sea Experiment is conducted. Underwater acoustic sources would not be used in the shallow waters (less than 100 ft. [30 m]) where ESA-listed coral species are known to exist. There is no evidence that corals or coral larvae are sensitive to distant non-impulse sounds. Sound from testing activities is intermittent or transient, or both, and will not commonly occur close enough to reefs to interfere with larval perception of reef noise.

Pursuant to the ESA, sonar and other active acoustic sources associated with testing activities as described under the No Action Alternative may affect ESA-listed coral species.

3.8.3.1.1.2 Alternative 1

Training Activities

Under Alternative 1, marine invertebrates would be exposed to low-, mid-, and high-frequency sonar and other acoustic sources, vessel noise, and aircraft overflight noise during training activities. The number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 1 would increase as indicated in Table 3.0-8 of Chapter 3 (Affected Environment and Environmental Consequences), over the No Action Alternative. However, the vast majority of activities that produce non-impulse sound occur greater than 3 nautical miles (nm) from shore within the Study Area. As the depth of the water drops quickly as you move away from the inshore reefs, the density of benthic invertebrates drops. Invertebrates that are in these locations could be exposed to non-impulse acoustic sources. However, because most non-impulse sound sources would be transient or intermittent, or both, any responses would likely be short-term behavioral responses or brief masking. Non-impulse sounds could impact individual marine invertebrates and groups of marine invertebrates close to a sound source, but they are unlikely to impact populations or subpopulations.

Corals throughout the Study Area may be exposed to non-impulse sounds generated by sonar and other acoustic sources, vessels, and aircraft during training under Alternative 1. However, the vast majority of underwater acoustic sources would not be used in the shallow waters (less than 100 ft. [30 m]) where the majority of ESA-listed coral species are known to exist. The ESA-listed coral species that are found in deeper waters may be exposed to non-impulsive sounds, which could impact individual marine invertebrates and groups of marine invertebrates close to the sound source, but they are unlikely to impact populations or subpopulations. Sound from training activities is intermittent or transient, or both, and will not commonly occur close enough to reefs or ESA-listed coral species to interfere with larval perception of reef noise. Continuous noise from training activities (e.g., vessel noise) could mask reef noise. If this noise source overlapped with the larval settlement period, recruitment of larvae onto a reef habitat may be altered.

Pursuant to the ESA, sonar and other active acoustic sources associated with training activities as described under Alternative 1 may affect ESA-listed coral species.

Testing Activities

Under Alternative 1, marine invertebrates could be exposed to low-, mid-, and high-frequency sonar and other active acoustic sources, vessel noise, and aircraft overflight noise during testing activities. The number of testing activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 1 would increase from the No Action Alternative. A detailed description of these activities, the number of activities, and their proposed locations in the Study Area are presented in Tables 2.8-2 through 2.8-4 of Chapter 2 (Description of Proposed Action and Alternatives). Testing activities using sonar and other active acoustic sources include:

- Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft (Sonobuoys)
- Anti-Submarine Warfare Torpedo Test (Maritime Patrol Aircraft)
- Ship Signature Testing
- Torpedo Testing
- Countermeasure Testing
- At-Sea Sonar Testing
- Pierside Integrated Swimmer Defense
- ASW Mission Package Testing
- Mine Countermeasure (MCM) Mission Package Testing
- North Pacific Acoustic Lab Philippine Sea 2018–19 Experiment (Deep Water)

Annual testing activities that produce in-water sound from the use of sonar and other active acoustic sources under Alternative 1 would increase as indicated in Tables 2.8-2 through 2.8-4 and Table 3.0-8 of Chapter 3 (Affected Environment and Environmental Consequences), over no usage under the No Action Alternative. Similarly, aircraft events increase (from 0 under the No Action Alternative, to 320 under Alternative 1 [Table 3.0-14]) as do activities involving vessels. However, the vast majority of activities that produce non-impulse sound occur farther than 3 nm from shore within the Study Area. Water depth decreases abruptly a relatively short distance from shore; correspondingly, the density of benthic invertebrates decreases with the increasing water depth. Invertebrates that are in these locations could be exposed to non-impulse acoustic sources. However, because most non-impulse sound sources would be transient or intermittent, or both, any responses would likely be short-term behavioral responses or brief masking. Non-impulse sounds could impact individual marine invertebrates and groups of marine invertebrates close to a sound source, but they are unlikely to impact populations or subpopulations.

Corals throughout the Study Area could be exposed to non-impulse sounds generated by sonar and other acoustic sources, vessels, and aircraft during testing. There is no evidence that corals or coral larvae are sensitive to distant non-impulse sounds, although larvae may sense particle motion from close sounds. Sound from testing activities would be intermittent or transient, or both, and would not commonly occur close enough to reefs to interfere with larval perception of reef noise. Non-intermittent noise from testing activities (e.g., vessel noise) could mask reef noise. If non-intermittent noise sources overlap in time with the larval settlement period, recruitment of larvae onto a reef habitat may be affected.

Pursuant to the ESA, sonar and other active acoustic sources associated with testing activities as described under Alternative 1 may affect ESA-listed coral species.

3.8.3.1.1.3 Alternative 2

Training Activities

Under Alternative 2, marine invertebrates would be exposed to low-, mid-, and high-frequency sonar and other acoustic sources, vessel noise, and aircraft overflight noise during training activities. The number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 2 would as indicated in Table 3.0-8 of Chapter 3 (Affected Environment and Environmental Consequences), over Alternative 1. However, the vast majority of activities that produce non-impulse sound occur greater than 3 nm from shore within the Study Area. As the depth of the water drops quickly as you move away from the inshore reefs, the density of benthic invertebrates drops. Invertebrates that are in these locations could be exposed to non-impulse acoustic sources. However, because most non-impulse sound sources would be transient or intermittent, or both, any responses would likely to be short-term behavioral responses or brief masking. Non-impulse sounds could impact individual marine invertebrates and groups of marine invertebrates close to a sound source, but they are unlikely to impact populations or subpopulations. Continuous noise from training activities (e.g., vessel noise) could mask reef noise. If this noise source overlapped with the larval settlement period, recruitment of larvae onto a reef habitat may be altered.

Corals throughout the Study Area may be exposed to non-impulse sounds generated by sonar and other acoustic sources, vessels, and aircraft during training under Alternative 2. However, the vast majority of underwater acoustic sources would not be used in the shallow waters (less than 100 ft. [30 m]) where the majority of the ESA-listed coral species are known to exist. The ESA-listed coral species that are found in deeper waters may be exposed to non-impulsive sounds that could impact individual marine invertebrates and groups of marine invertebrates close to the sound source, but they are unlikely to impact populations or subpopulations. Sound from training activities is intermittent or transient, or both, and will not commonly occur close enough to reefs or ESA-listed coral species to interfere with larval perception of reef noise.

Pursuant to the ESA, sonar and other active acoustic sources associated with training activities as described under Alternative 2 may affect ESA-listed coral species.

Testing Activities

Under Alternative 2, marine invertebrates would be exposed to low-, mid-, and high-frequency sonar and other acoustic sources, vessel noise, and aircraft overflight noise during testing activities. The number of testing activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 2 would increase from the No Action Alternative. A detailed description of these activities, the number of activities, and their proposed locations are presented in Tables 2.8-2 through 2.8-4 of Chapter 2 (Description of Proposed Action and Alternatives). Testing activities using sonar and other active acoustic sources include:

- Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft (Sonobuoys)
- Anti-Submarine Warfare Torpedo Test (Maritime Patrol Aircraft)
- Ship Signature Testing

- Torpedo Testing
- Countermeasure Testing
- At-Sea Sonar Testing
- Pierside Integrated Swimmer Defense
- ASW Mission Package Testing
- Mine Countermeasure (MCM) Mission Package Testing
- North Pacific Acoustic Lab Philippine Sea 2018–19 Experiment (Deep Water)

Annual testing activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 2 would increase as indicated in Table 2.8-2 through 2.8-4 and Table 3.0-8 of Chapter 3 (Affected Environment and Environmental Consequences), over no usage under the No Action Alternative. Similarly, aircraft events increase (from 0 under the No Action Alternative, to 362 under Alternative 2 [Table 3.0-14]) as do activities involving vessels. However, the vast majority of activities that produce non-impulse sound occur farther than 3 nm from shore within the Study Area. Water depth decreases abruptly a relatively short distance from shore; correspondingly, the density of benthic invertebrates decreases with the increasing water depth. Invertebrates that are in these locations could be exposed to non-impulse acoustic sources. However, because most non-impulse sound sources would be transient or intermittent, or both, any responses would likely be short-term behavioral responses or brief masking. Non-impulse sounds could impact individual marine invertebrates and groups of marine invertebrates close to a sound source, but they are unlikely to impact populations or subpopulations.

Corals throughout the Study Area could be exposed to non-impulse sounds generated by sonar and other acoustic sources, vessels, and aircraft during testing. There is no evidence that corals or coral larvae are sensitive to distant non-impulse sounds, although larvae may sense particle motion from close sounds. Sound from testing activities would be intermittent or transient, or both, and would not commonly occur close enough to reefs to interfere with larval perception of reef noise. Non-intermittent noise from testing activities (e.g., vessel noise) could mask reef noise. If this noise source overlapped with the larval settlement period, recruitment of larvae onto a reef habitat may be altered.

Pursuant to the ESA, sonar and other active acoustic sources associated with testing activities as described under Alternative 2 may affect ESA-listed coral species.

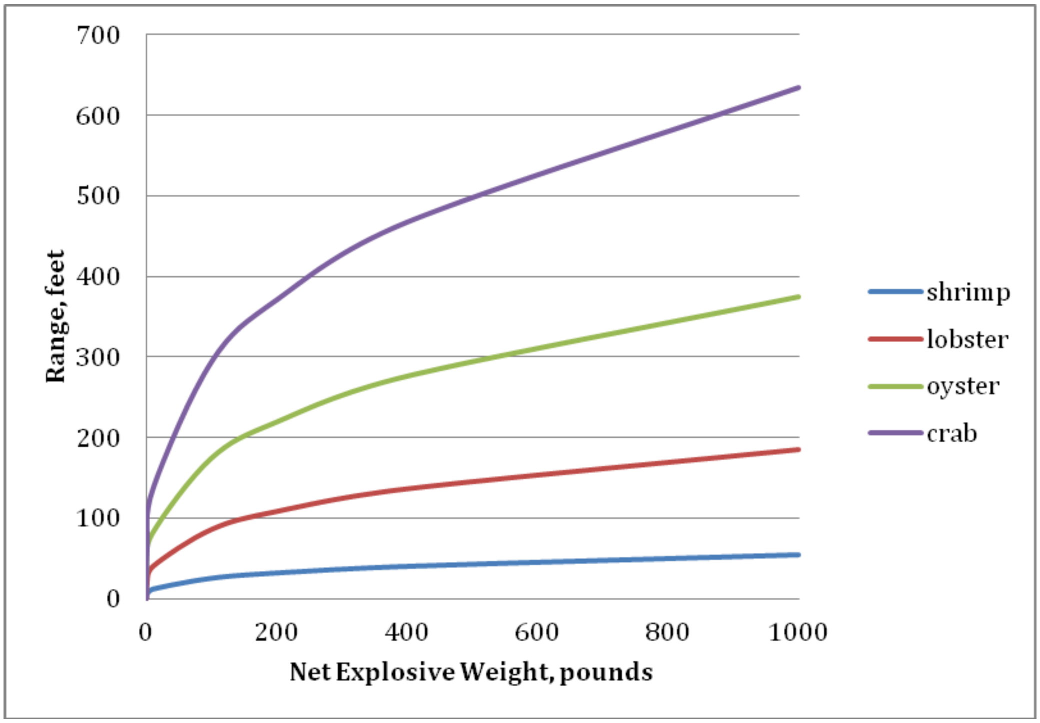
3.8.3.1.1.4 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other active acoustic sources during training and testing activities will have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern within the Study Area.

3.8.3.1.2 Impacts from Explosives and Other Impulsive Sources

Explosives, weapons firing, launch, and subsequent impact of ordnance on the water’s surface, and swimmer defense airguns introduce loud, impulse, broadband sounds into the marine environment. Impulse sources are characterized by rapid pressure rise times and high peak pressures. Explosions produce high-pressure shock waves that could cause injury or physical disturbance due to rapid pressure changes. Some other impulse sources, such as swimmer defense airguns, also produce shock waves, but of lower intensity. Impulse sounds are usually brief, but the associated rapid pressure changes can injure or startle marine invertebrates.

The few studies of marine invertebrates (crustaceans and molluscs) exposed to explosions show a range of impacts, from mortality close to the source to no observable effects. Limited studies of crustaceans have examined mortality rates at various distances from detonations in shallow water (Chesapeake Biological Laboratory 1948; Gaspin et al. 1976). Similar studies of molluscs have shown them to be more resistant than crustaceans to explosive impacts (Chesapeake Biological Laboratory 1948; Gaspin et al. 1976). Other invertebrates found in association with molluscs, such as sea anemones, polychaete worms, isopods, and amphipods, were observed to be undamaged in areas near detonations (Gaspin et al. 1976). Using data from these experiments, Young (1991) developed curves that estimate the distance from an explosion beyond which at least 90 percent of certain marine invertebrates would survive, depending on the weight of the explosive (Figure 3.8-7). For example, 90 percent of crabs would survive a 200-pound explosion if they are greater than 350 ft. away from the source.



Source: Young 1991

Figure 3.8-7: Prediction of Distance to 90 Percent Survivability of Marine Invertebrates Exposed to an Underwater Explosion

In deeper waters (most detonations would occur near the water surface), most benthic marine invertebrates would be beyond the 90 percent survivability ranges shown above, even for larger quantities of explosives. Some charges detonated in shallow water or near the seafloor could kill and injure marine invertebrates on or near the seafloor depending on the species and the distance to the underwater explosion. A blast in the vicinity of hard corals could cause direct impact to coral polyps or early life-stages of pre-settlement corals, or fragmentation and siltation of the corals; in one study, recovery from a single small blast directly on a reef took 5 to 10 years (Fox and Caldwell 2006). A blast near the bottom could also disturb hard substrate suitable for colonization.

Marine invertebrate mortalities and direct traumas caused by underwater and surface explosions are more likely to occur in the water column than on the bottom in deeper waters because most detonations would occur at or near the water surface. The number of organisms affected would depend on the size of the explosive, the distance from the explosion, the exact geographic location in the Study Area, and the presence invertebrates. In addition to trauma caused by a shock wave, organisms could be killed in an area of cavitation that forms near the surface above a large underwater detonation. Cavitation is where the reflected shock wave creates a region of negative pressure followed by a collapse, or water hammer.

Airguns have slower rise times and lower peak pressures than many explosives. Studies of airgun impacts on marine invertebrates have used seismic airguns, which are more powerful than any swimmer defense airguns proposed for use during Navy testing. Studies of crustaceans have shown that adult crustaceans were not noticeably physically affected by exposures to intense seismic airgun use (Christian et al. 2003; Payne et al. 2007). Snow crab eggs repeatedly exposed to airgun firings had slightly increased mortality and apparent delayed development (Christian et al. 2003), but Dungeness crab (*Metacarcinus magister*) zoeae were not affected by repeated exposures (Pearson et al. 1993). Some squid showed strong startle responses, including inking, when exposed to the first shot of broadband sound from a nearby seismic airgun (sound exposure level of 163 dB re 1 μPa^2-s), but strong startle responses were not seen when sounds were gradually increased (McCauley et al. 2000a, b). Airguns used during testing of swimmer defense systems are intended to be nonlethal swimmer deterrents, and are substantially less powerful than those used in seismic studies. It is unlikely that they would injure marine invertebrates as the swimmer defense airguns would be used only in Navy ports (Inner Apra Harbor), which does not support large marine invertebrate communities and as such, are not carried forward in the analysis.

Firing weapons on a ship generates sound from firing the gun (muzzle blast), from the shell flying through the air, and from the blast vibrating through the ship’s hull. A blast wave from a gun fired above the surface of the water propagates away from the gun muzzle into the water. In addition, larger non-explosive munitions and targets could produce loud impulsive noise when hitting the water, depending on the size, weight, and speed of the object at impact. Small- and medium-caliber munitions are not expected to produce substantial impact noise.

Based on studies with airguns, some marine invertebrates exposed to impulsive sounds from swimmer defense airguns and weapons firing may exhibit startle reactions, such as inking by a squid or changes in swim speed. Similarly, marine invertebrates beyond the range to any injurious effects from exposure to explosions may also exhibit startle reactions. Repetitive impulses during multiple explosions, such as during a firing exercise, may be more likely to have injurious effects or cause avoidance reactions. However, impulsive sounds produced in water during testing and training are single impulses or multiple impulses over a limited duration (e.g., gun firing or driving a pile). Any auditory masking, in which the sound of an impulse could prevent detection of other biologically relevant sounds, would be very brief.

At a distance, impulses lose their high pressure peak and take on characteristics of non-impulsive acoustic waves. Similar to the impacts expected for non-impulsive sounds discussed previously, it is expected these exposures would cause no more than brief startle reactions in some marine invertebrates.

3.8.3.1.2.1 No Action Alternative

Training Activities

Under the No Action Alternative, marine invertebrates would be exposed to explosions and underwater impulse sounds from weapons firing, launch, and non-explosive impacts during training activities. Weapons firing, launch, and non-explosive impacts would be spread throughout the Study Area; explosions would occur during naval gunnery, missile exercises, bombing exercises, sinking exercises, tracking exercises, and mine warfare. The largest source class used during training under the No Action Alternative would be E12 (650 to 1,000 pounds [lb.] net explosive weight [NEW] [295 to 454 kilograms {kg} NEW]) (Table 3.0-9). However, of all explosives used for training under the No Action Alternative (1,594), only four are in this source class, and this source class is only used in the Study Area at distances greater than 50 nm from shore. Other than explosives used at the bombing range on FDM and discrete underwater detonation sites (e.g., in Apra Harbor) in nearshore areas (see Chapter 2, Description of Proposed Action and Alternatives), the vast majority of all explosives used under the No Action Alternative (approximately 84 percent) occur in offshore areas greater than 3 nm from shore.

Under the No Action Alternative, training activities using explosions that could occur anywhere in the Study Area, including within the Mariana littoral zones (nearshore shallow areas below the high tide line), are restricted to 50 detonations annually, all of them less than at or below the E5 source class (5–10 lb. [2.3–4.5 kg] NEW). Based on Young (1991), some charges detonated in shallow water or near the seafloor associated with mine neutralization activities could kill and injure marine invertebrates on or near the seafloor in the immediate vicinity of the detonation, though due to the low source class used, the zone of potential impact would be quite small. A blast in the vicinity of hard corals could cause fragmentation and siltation of the corals; in one study, recovery from a single small blast directly on a reef took 5 to 10 years (Fox and Caldwell 2006). It is reasonable to assume a proportion of eggs, sperm, early embryonic stages, and planula larvae of corals subjected to explosive shock and pressure waves will be deformed, die, or experience a decreased likelihood of fertilization. Mortality and lack of successful fertilization in broadcast spawning organisms are not rare, and a majority of the reproductive effort in corals fails naturally. While explosives will likely result in death of developmental stages of ESA-listed coral species, they likely have little impact on their reproductive output at the population level. A blast near the bottom could also disturb hard substrate suitable for colonization. However, as described in Section 3.3 (Marine Habitats), coral reefs and associated higher productivity areas do not overlap with the mine neutralization areas. It is not expected that a large number of pelagic invertebrates would be present in the area of these activities.

In general, explosive activities would consist of a single explosion or a few smaller explosions over a short period. Some marine invertebrates close to a detonation would likely be killed or injured. Weapons firing, launch, and non-explosive impacts would consist of a single pulse or several impulses over a short period. In general, marine invertebrates are unlikely to respond to sounds from detonations or weapons firing, launch, or impact noise unless they are very close to the sound source. Some marine invertebrates may be sensitive to the low-frequency component of impulse sound, and they may exhibit startle reactions or temporary changes in swim speed. Because the exposures are brief, limited in number, and spread over a large area, no long-term impacts are expected. Explosives and impulse sounds may impact individual marine invertebrates and groups of marine invertebrates, but they are unlikely to impact populations or subpopulations.

The vast majority of all explosives used under the No Action Alternative occur in offshore areas greater than 3 nm from shore, which are not known to support ESA-listed coral species. Additionally, air-to-ground explosives are only used at FDM. Although the island is the target, there are known instances where explosive ordnance has missed the island, falling into nearshore waters. If corals are present in areas overlapping with training activities using explosives, sessile (planula larvae that have settled out of the water column and have metamorphosed into coral polyps) shallow-water, hardbottom, and deep-water corals, as well as eggs, sperm, early embryonic stages, and planula larvae of corals could be impacted by explosions. Explosive impacts on the benthic invertebrates are more likely when an explosive is large compared to the water depth or when an explosive is detonated at or near the bottom and would include fragmentation and/or siltation. Consequences of exposure to an explosive shock wave could include breakage, injury, or mortality. Many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable. Many of these organisms grow slowly, and could require decades to recover (Precht et al. 2001). Because most detonations occur in deeper waters near the water surface, most corals and other benthic invertebrates would not experience intense shock wave impacts.

The large number of possible explosions could alter the benthic community as mortality on hard corals could be substantial, and with continued exercises there would be no time for recovery. This would have impacts at sites where explosions are conducted in nearshore areas. Training activities that include bottom-laid underwater explosions are infrequent (only about 50 explosions per year). As presented in Chapter 3.3 (Marine Habitats), detonations on the seafloor would result in a maximum of approximately 11,500 $ft.^2$ (1,050 m^2) of disturbed substrate per year in the Study Area (Table 3.3-4), which represents less than 1 percent of the total Study Area. Additionally, detonations occur in the same area, Agat Bay Mine Neutralization Site and Outer Apra Harbor Underwater Detonation (UNDET) sites, which are located in waters that previously disturbed and are not known to support large invertebrate communities, which further reduces the potential for population level impacts.

Pursuant to the ESA, the use of explosives during training activities as described under the No Action Alternative may affect ESA-listed coral species.

Testing Activities

Under the No Action Alternative, there are no testing activities that involve explosive detonations or other impulse sources.

3.8.3.1.2.2 Alternative 1

Training Activities

Under Alternative 1, the number of explosives used during training activities would rise to 10,006 per year. Similar to the No Action Alternative, marine invertebrates would be exposed to explosions and underwater impulse sounds from weapons firing, launch, and non-explosive impacts during training activities. Weapons firing, launch, and non-explosive impacts would be spread throughout the Study Area; explosions would occur during naval gunnery, missile exercise, bombing exercise, sinking exercise, tracking exercises, and mine warfare. Approximately 94 percent of the explosions would occur in areas greater than 12 nm from shore.

The total number of explosive detonations that could occur in the shallow portions of the Study Area where corals and high productivity areas exist would increase from 50 to 94. Similar to the No Action Alternative, the source class for these activities is E5 (5 to 10 lb. [2.3 to 4.5 kg] NEW) or less. The additional detonations (either E2 [> 0.26 to 0.5 lb. {> 0.12 to 0.23 kg} NEW] or E5) in all training areas (but potentially in shallow waters) would increase the disturbance of benthic invertebrates, relative to the No Action Alternative. Shallow-water, hardbottom, and deep-water corals, as well as eggs, sperm, early embryonic stages, and planula larvae of corals could be impacted by explosions. No explosions would occur in areas known to support coral species proposed for listing.

Other than explosives used at the bombing range on FDM and discrete underwater detonation sites (e.g., in Apra Harbor) in nearshore areas (see Chapter 2, Description of Proposed Action and Alternatives) the vast majority of explosives used under Alternative 1 occur in areas greater than 3 nm from shore. These areas are not known to support coral species proposed for listing. However, if sessile shallow-water, hardbottom, and deep-water corals, as well as eggs, sperm, early embryonic stages, and planula larvae of corals are present in areas overlapping with training activities using explosives, shallow-water, hardbottom, and deep-water corals could be impacted by explosions. Under Alternative

1, Agat Bay Mine Neutralization Site changes the size of underwater detonations from 10 lb. to 20 lb. NEW. The Outer Apra Harbor UNDET and Piti Point Mine Neutralization sites remain at 10 lb. NEW. Consequences of exposure to an explosive shock wave could include breakage, injury, or mortality. Many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable. Many of these organisms grow slowly and could require decades to recover (Precht et al. 2001). If the sites of the explosions are the same for the nearshore exercises, this could over time (years) alter the benthic composition of especially sessile invertebrates (e.g., coral). Population-level impacts in the nearshore areas could be possible depending on the size of the impacted areas. Training activities that include bottom-laid underwater explosions are infrequent (only about 50 explosions per year). As presented in Chapter 3.3 (Marine Habitats), detonations on the seafloor would result in a maximum of approximately 18,300 $ft.^2$ (1,700 m^2) of disturbed substrate per year in the Study Area (Table 3.3-4), which represents less than 1 percent of the total Study Area. Additionally, underwater detonations occur in the same areas, Agat Bay Mine Neutralization Site, Piti Floating Mine Neutralization Site, and Outer Apra Harbor underwater detonation site, which are located in waters that have previously been disturbed, and are not known to support large invertebrate communities, which further reduces the potential for population level impacts.

The remaining activities conducted under Alternative 1 utilizing explosive detonations would be restricted to portions of the Study Area that are greater than 12 nm from the shore. Additionally, air-to-ground explosives are only used at FDM. Although the island is the target, there are known instances where bombs have missed the island or rolled down into the water after impact. If corals are present in areas overlapping with training activities using explosives, sessile shallow-water, hardbottom, and deep-water corals, as well as eggs, sperm, early embryonic stages, and planula larvae of corals could be impacted by explosions. Based on Young (1991), some charges could kill and injure marine invertebrates in the immediate vicinity of the detonation, though due to the low source class used, the zone of potential impact would be quite small. Given the large area where training activities occur, and the lack of shallow water habitat greater than 2 nm away from shorelines, explosives and impulse sounds may impact individual marine invertebrates and groups of marine invertebrates, but they are unlikely to impact populations or subpopulations.

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 1 may affect ESA-listed coral species.

Testing Activities

Alternative 1 would introduce testing activities that would involve the use of 6,805 high-explosives. As presented in Tables 2.8-2 through Table 2.8-4, these testing activities occur in waters greater than 3 nm from shore within the MIRC, which are not known to support ESA-listed coral species. However, if corals are present in areas overlapping with testing activities using explosives, sessile shallow-water corals, hardbottom, and deep-water corals, as well as eggs, sperm, early embryonic stages, and planula larvae of corals could be impacted by explosions. Consequences of exposure to an explosive shock wave could include breakage, injury, or mortality. Many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable. Many of these organisms grow slowly and could require decades to recover (Precht et al. 2001).

Based on Young (1991), some explosives could kill or injure marine invertebrates in the immediate vicinity of the detonation. Some marine invertebrates may be sensitive to the low-frequency component of impulse sound, and they may exhibit startle reactions or temporary changes in swim speed. However, because the exposures are brief, limited in number, and spread over a large area, no long-term impacts are expected. Explosives may impact individual marine invertebrates and groups of marine invertebrates, but they are unlikely to impact populations or subpopulations. Other less intense impulsive sounds (e.g., swimmer defense airguns) are not expected to affect marine invertebrates as discussed in Section 3.8.3.1.2 (Impacts from Explosives and Other Impulsive Sources).

Pursuant to the ESA, the use of explosives during testing activities as described under Alternative 1 may affect ESA-listed coral species.

3.8.3.1.2.3 Alternative 2

Training Activities

Under Alternative 2, the number of explosives used during training activities would rise from 1,594 to 10,284 per year, as compared to the No Action Alternative. Similar to the No Action Alternative, marine invertebrates would be exposed to explosions and underwater impulse sounds from weapons firing, launch, and non-explosive impacts during training activities. Weapons firing, launch, and non-explosive impacts would be spread throughout the Study Area; explosions would occur during naval gunnery, missile exercises, bombing exercises, sinking exercises, tracking exercises, and mine warfare.

The vast majority (approximately 94 percent) of all explosives used under Alternative 2 occur in areas greater than 3 nm from shore, which are not known to support listed coral species. Additionally, air-to-ground explosives are only used at FDM. Although the island is the target, there are known instances where bombs have missed the island or rolled down into the water after impact. If corals are present in areas overlapping with training activities using explosives, sessile shallow-water corals, hardbottom, and deep-water corals, as well as eggs, sperm, early embryonic stages, and planula larvae of corals could be impacted by explosions. Under Alternative 2, Agat Bay Mine Neutralization Site changes the size of underwater detonations from 10 lb. to 20 lb. NEW. The Outer Apra Harbor UNDET and Piti Point Mine Neutralization sites remain at 10 lb. NEW. Consequences of exposure to an explosive shock wave could include breakage, injury, or mortality.

The total number of explosive detonations that could occur in the shallow portions of the Study Area where corals and high productivity areas exist would increase. Similar to the No Action Alternative, the source class for these activities is E5 (5 to 10 lb. [2.3 to 4.5 kg] NEW) or less. The additional detonations (either E2 [> 0.26 to 0.5 lb. {> 0.12 to 0.23 kg} NEW] or E5) in all training areas (but potentially in shallow waters) would increase the disturbance of benthic invertebrates, relative to the No Action Alternative.

If an ESA-listed coral species of any life stage (or any other coral species) were to occur in areas used during training activities, consequences of exposure to an explosive shock wave could include breakage, injury, or mortality. Many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable. Many of these organisms grow slowly and could require decades to recover (Precht et al. 2001). If the sites of the explosions are the same for the nearshore exercises, this could over time (years) alter the benthic composition of especially sessile invertebrates (e.g., coral). Population-level impacts in the nearshore areas could be possible depending on the size of the impacted areas. However, training activities that include bottom-laid underwater explosions are infrequent (only about 50 explosions per year), and the percentage of training area affected is small (less than 1 percent of the total Study Area). Additionally, detonations occur in the same area, Agat Bay Mine Neutralization Site and Outer Apra Harbor UNDET sites, which are located in waters that are previously disturbed and not known to support large invertebrate communities, which further reduces the potential for population level impacts. It is reasonable to assume a proportion of eggs, sperm, early embryonic stages, and planula larvae of ESA-listed corals subjected to explosive shock and pressure waves will be deformed, die, or experience a decreased likelihood of fertilization. Mortality and lack of successful fertilization in broadcast spawning organisms are not rare, and a majority of the reproductive effort in ESA-listed coral species likely fails naturally. While explosives will likely result in death of developmental stages of ESA-listed coral species, they likely have little impact on their reproductive output at the population level.

The remaining activities conducted under Alternative 2 utilizing explosive detonations would be restricted to portions of the Study Area that are greater than 12 nm from the shore. Over 9,710 detonations could occur, and 98 percent of these detonations would be restricted to source class E6 (> 10 to 20 lb. [> 4.5 to 9.1 kg] NEW) or less (Table 3.0-9). Based on Young (1991), some charges could kill and injure marine invertebrates in the immediate vicinity of the detonation, though due to the low source class used, the zone of potential impact would be quite small. Given the large area where training activities occur, and the lack of shallow water habitat greater than 2 nm away from shorelines, explosives and impulse sounds may impact individual marine invertebrates and groups of marine invertebrates (including pelagic larvae).

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 1 may affect ESA-listed coral species.

Testing Activities

Alternative 2 would introduce testing activities that would involve the use of 8,335 high-explosives, all of which could occur throughout the Study Area, although the majority occur in waters greater than 3 nm from shore within the MIRC. Because these detonations occur in deeper waters near the water surface, most corals and other benthic invertebrates would not experience intense shock wave impacts. If an ESA-listed coral species of any life stage (or any other coral species) were to occur in areas used during testing activities, consequences of exposure to an explosive shock wave could include breakage, injury, or mortality. Many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable. Many of these organisms grow slowly, and could require decades to recover (Precht et al. 2001).

Based on Young (1991), some explosive charges could kill and injure marine invertebrates in the immediate vicinity of the detonation. Some marine invertebrates may be sensitive to the low-frequency component of impulse sound, and they may exhibit startle reactions or temporary changes in swim speed. However, because the exposures are brief, limited in number, and spread over a large area, no long-term impacts are expected. Explosives and impulsive sounds may impact individual marine invertebrates and groups of marine invertebrates, but they are unlikely to impact populations or subpopulations. Other less intense impulsive sounds (e.g., swimmer defense airguns) are not expected to affect marine invertebrates as discussed in Section 3.8.3.1.2 (Impacts from Explosives and Other Impulsive Sources).

Pursuant to the ESA, the use of explosives during training activities as described under Alternative 1 may affect ESA-listed coral species.

3.8.3.1.2.4 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives and other impulsive sources during training and testing activities may have an adverse effect on EFH by reducing the quality or quantity of sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The use of other impulsive sources (swimmer defense airguns; and weapons firing, launch, and impact noise) during training and testing activities will not have an adverse effect on EFH by reducing the quality or quantity of sedentary invertebrate beds or offshore reefs that constitute EFH or Habitat Areas of Particular Concern within the Study Area.

3.8.3.1.3 Summary of Impacts from Acoustic Stressors

Most testing and training activities would generate underwater impulse or non-impulse sounds from some combination of several sources, including sonar, other active acoustic sources, vessels, aircraft, explosions, airguns, weapons firing, weapons launches, or non-explosive impacts. Both pelagic and benthic marine invertebrates could be impacted by these stressors. In most cases, marine invertebrates would not respond to impulse and non-impulse sounds, although they may detect and briefly respond to nearby low-frequency sounds. These short-term responses would likely be inconsequential. Explosions would likely kill or injure nearby marine invertebrates. Explosions near the seafloor and very large explosions in the water column may impact shallow water corals of any life stage, hardbottom habitat and associated marine invertebrates, and deep-water corals, including physical disturbance, fragmentation, or mortality (both to sessile organisms and pelagic larvae). Most explosions at the water surface would not injure benthic marine invertebrates because the explosive weights would be small compared to the water depth. Additionally, the vast majority of explosions occur at distances greater than 3 nm from shore, in water depths greater than those for shallow water coral species.

3.8.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from electromagnetic devices.

3.8.3.2.1 Impacts from Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities. For a discussion of the types of activities that use electromagnetic devices, where they are used, and how many activities would occur under each alternative, please see Section 3.0.5.2.2.1 (Electromagnetic Devices). Aspects of electromagnetic stressors that are applicable to marine organisms in general are presented in Appendix H, Section H.3 (Conceptual Framework for Assessing Effects from Energy-Producing Activities).

Little information exists about marine invertebrates’ susceptibility to electromagnetic fields. Most corals are thought to use water temperature, day length, lunar cycles, and tidal fluctuations as cues for spawning. Magnetic fields are not known to control coral spawning release or larval settlement. Some arthropods (e.g., spiny lobster and American lobster) can sense magnetic fields, and this ability is thought to assist the animal with navigation and orientation (Lohmann et al. 1995; Normandeau et al. 2011). These animals travel relatively long distances during their lives, and magnetic field sensation may exist in other invertebrates that travel long distances. Marine invertebrates, including several commercially important species and federally managed species, could use magnetic cues (Normandeau et al. 2011). Susceptibility experiments have focused on arthropods, but several mollusks and echinoderms are also susceptible. However, because susceptibility is variable within taxonomic groups it is not possible to make generalized predictions for groups of marine invertebrates. Sensitivity thresholds vary by species ranging from 0.3 to 30 milliteslas, and responses included non-lethal physiological and behavioral changes (Normandeau et al. 2011). The primary use of magnetic cues seems to be navigation and orientation. Human-introduced electromagnetic fields could disrupt these cues and interfere with navigation, orientation, or migration. Because electromagnetic fields weaken exponentially with increasing distance from their source, large and sustained magnetic fields present greater exposure risks than small and transient fields, even if the small field is many times stronger than the earth’s magnetic field (Normandeau et al. 2011). Transient or moving electromagnetic fields may cause temporary disturbance to susceptible organisms’ navigation and orientation.

3.8.3.2.1.1 No Action Alternative

Training Activities

Under the No Action Alternative, there are no training activities that involve the use of electromagnetic devices.

Testing Activities

Under the No Action Alternative, there are no testing activities that involve the use of electromagnetic devices.

3.8.3.2.1.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.2.2.1 (Electromagnetic Devices), training activities involving electromagnetic devices under Alternative 1 occur up to five times annually as part of MCM (towed mine detection) and Civilian Port Defense activities. Table 2.8-1 lists the number and location of training activities that use electromagnetic devices. Little information exists about marine invertebrates' susceptibility to electromagnetic fields. Most corals are thought to use water temperature, day length, lunar cycles, and tidal fluctuations as cues for spawning. Magnetic fields are not known to influence coral spawning or larval settlement.

The impact of electromagnetic fields on marine invertebrates, including ESA-listed coral species, would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges; (2) the number of activities involving the stressor is low; (3) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (4) even for invertebrates that may be susceptible (e.g., some species of arthropods, mollusks, and echinoderms) the consequences of exposure would be limited to temporary disruptions to navigation and orientation.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 1 would have no effect on ESA-listed coral species.

Testing Activities

Mine countermeasure mission package testing includes the use of electromagnetic devices that generate electromagnetic fields underwater to detect mines. Under Alternative 1, the Naval Sea Systems Command will engage in up to 32 MCM mission package testing activities annually.

The impact of electromagnetic fields on marine invertebrates, including ESA-listed coral species, would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges; (2) the number of activities involving the stressor is low; (3) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (4) even for invertebrates that may be susceptible (e.g., some species of arthropods, mollusks, and echinoderms) the consequences of exposure are limited to temporary disruptions to navigation and orientation.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 1 would have no effect on ESA-listed coral species.

3.8.3.2.1.3 Alternative 2

Training Activities

As indicated in Section 3.0.5.2.2.1 (Electromagnetic Devices), training activities involving electromagnetic devices under Alternative 2 occur up to five times annually as part of MCM (towed mine detection) and Civilian Port Defense activities. Table 2.8-1 lists the number and location of training activities that use electromagnetic devices.

The impact of electromagnetic fields on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges; (2) the number of activities involving the stressor is low; (3) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (4) even for susceptible organisms invertebrates (e.g., some species of arthropods, mollusks, and echinoderms) the consequences of exposure are limited to temporary disruptions to navigation and orientation.

Pursuant to the ESA, the use of electromagnetic devices during training activities as described under Alternative 2 would have no effect on ESA-listed coral species.

Testing Activities

Mine countermeasure mission package testing includes the use of electromagnetic devices that generate electromagnetic fields underwater to detect mines. Under Alternative 2, the Naval Sea Systems Command will engage in up to 36 MCM mission package testing activities annually.

The impact of electromagnetic fields on marine invertebrates, including ESA-listed coral species, would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges; (2) the number of activities involving the stressor is low; (3) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (4) even for susceptible organisms invertebrates (e.g., some species of arthropods, mollusks, and echinoderms) the consequences of exposure are limited to temporary disruptions to navigation and orientation.

Pursuant to the ESA, the use of electromagnetic devices during testing activities as described under Alternative 2 would have no effect on ESA-listed coral species.

3.8.3.2.1.4 Substressor Impacts on Sedentary Invertebrate Beds or Reefs as Essential Fish Habitat

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of electromagnetic devices during training and testing activities will have minimal and temporary adverse effects on invertebrates that occupy water column EFH or Habitat Areas of Particular Concern, and will have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern within the Study Area.

3.8.3.3 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts of the various types of physical disturbance and strike stressors caused by Navy training and testing activities within the Study Area. For a list of locations and numbers of activities that may cause physical disturbance and strikes refer to Section 3.3.3.2 (Physical Disturbance and Strike Stressors) as well as Appendix A for details regarding Amphibious Assaults/Amphibious Raids. The physical disturbance and strike stressors that may impact marine invertebrates include (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices.

Most marine invertebrate populations extend across wide areas containing hundreds or thousands of discrete patches of suitable habitat. Sessile (attached to the seafloor or other surface) invertebrate populations may be maintained by complex currents that carry adults and young from place to place. Such widespread populations are difficult to evaluate in terms of Navy training and testing activities that occur intermittently and in relatively small patches in the Study Area. Even invertebrate populations that are somewhat restricted in range, such as coral reefs, cover enormous areas (see Section 3.3, Marine Habitats, for quantitative assessments). In this context, a physical strike or disturbance would impact individual organisms directly or indirectly.

With few exceptions, activities involving vessels and in-water devices are not intended to contact the seafloor. Except for amphibious activities and bottom-crawling unmanned underwater vehicles, there is minimal potential strike impact and limited potential disturbance impact on benthic or habitat-forming marine invertebrates. For environmental and safety- reasons amphibious landings and other nearshore activities would avoid areas where corals are known to occur.

With the exception of corals and other sessile benthic invertebrates, most mobile invertebrate populations recover quickly from non-extractive disturbance. Other invertebrates, such as the small soft-bodied organisms that live in the bottom sediment, are thought to be well-adapted to natural physical disturbances, although recovery from human-induced disturbance is delayed by decades or more (Kaiser et al. 2002; Lindholm et al. 2011). Biogenic habitats such as coral reefs, deep coral, and sponge communities may take decades to re-grow following a strike or disturbance (Jennings and Kaiser 1998; Precht et al. 2001). If the sites of the activities are the same for repeated exercises, this could over time (years) alter the benthic composition, especially sessile invertebrates (e.g., coral).

3.8.3.3.1 Impacts from Vessels and In-Water Devices

The majority of the training and testing activities under all the alternatives involve vessels, and a few of the activities involve the use of in-water devices (such as remotely operated vehicles, unmanned surface vehicles and unmanned undersea vehicles, and towed devices). Vessels and in-water devices could impact marine invertebrates by disturbing the water column or sediments, or directly striking organisms (Bishop 2008). The propeller wash (water displaced by propellers used for propulsion) from vessel movement and water displaced from vessel hulls could disturb marine invertebrates in the water column, and is a likely cause of zooplankton mortality (Bickel et al. 2011). This local and short-term exposure to vessel and propeller movements could displace, injure, or kill zooplankton, invertebrate eggs or larvae, and macro-invertebrates in the upper portions of the water column.

Few sources of information are available on the impact of non-lethal chronic disturbance on marine invertebrates. One study of seagrass-associated marine invertebrates found that chronic disturbance from vessel wakes resulted in the long-term displacement of some marine invertebrates from the impacted shallow-water area (Bishop 2008). Impacts of this type resulting from repeated exposure in shallow water are not likely to result from Navy training and testing activities because (1) most vessel movements occur in relatively deep water, and (2) vessel movements are concentrated in well-established port facilities and associated channels (Mintz and Parker 2006).

Vessels and towed in-water devices do not normally collide with invertebrates that inhabit the seafloor because Navy vessels are operated in relatively deep waters and have navigational capabilities to avoid contact with these habitats. A consequence of vessel operation in shallow water is increased turbidity from stirring-up bottom sediments. Turbidity can impact corals and invertebrate communities on hardbottom areas by reducing the amount of light that reaches these organisms and by increasing the energy the organism expends on sediment removal (Riegl and Branch 1995). Reef-building corals are sensitive to water clarity because of their symbiotic algae (i.e., zooxanthellae) that require sunlight to live. Encrusting organisms residing on hardbottom can be impacted by persistent silting from increased turbidity. In addition, propeller wash and physical contact with coral and hardbottom areas can cause structural damage to the substrate, as well as mortality to encrusting organisms. While information on the frequency of vessel operations in shallow water is not adequate to support a specific risk assessment, typical navigational procedures minimize the likelihood of contacting the seafloor, and most Navy vessel movements in nearshore waters are confined to established channels and ports, or predictable transit lanes to adjoining training areas through deep water.

The Navy would also conduct activities that use unmanned undersea systems and unmanned surface systems. These systems can operate anywhere from the water's surface to the benthic zone. Certain devices do not have a realistic potential to strike living marine resources because they either move slowly through the water column (e.g., most unmanned undersurface vehicles) or are closely monitored by observers manning the towing platform (e.g., most towed devices). Additionally, most of the vehicles use advanced propeller systems with encased propellers to prevent damage to sea beds (seafloor fauna such as corals). Even at low speeds, however, coral larvae in the water column could be displaced, injured, or killed by unmanned underwater vehicle movements. However, the number of individual larvae exposed would be quite small in comparison to the total number of coral larvae that are produced by reproduction, and impacts to coral populations from unmanned underwater vehicles are expected to be inconsequential. Zooplankton, invertebrate eggs or larvae, and macro-invertebrates in the water column could be displaced, injured, or killed by unmanned underwater vehicle movements.

3.8.3.3.1.1 No Action Alternative

Training Activities

As indicated above, the majority of the training activities under all alternatives involve vessels, and a few of the activities involve the use of in-water devices. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers, and range areas. Large, slow vessels would pose little risk to marine invertebrates in the open ocean although, in coastal waters, currents from large vessels may cause resuspension and settlement of sediment onto sensitive invertebrate communities. Fast boats would generally pose more of a risk through propeller action in shallow waters. This action may affect a proportion of eggs, sperm, early embryonic stages, and planula larvae of ESA-listed coral species subjected to the shearing forces of turbulent waters from the hulls, propellers, or jets of vessels. Mortality and lack of successful fertilization in broadcast spawning organisms are not rare, and a majority of the reproductive effort of broadcast spawning organisms fails naturally. While vessel movement may affect the developmental life stages of ESA-listed coral species, it likely has little impact on their reproductive output at the population level.

Exposure of marine invertebrates to vessel disturbance and strikes would be limited to organisms in the water column, and primarily in the uppermost portions of the water column. Most pelagic marine invertebrates are disturbed as the water flows around the vessel, towed in-water device, or autonomous vehicle. Injury or mortality caused directly or indirectly by propellers is possible, but the scale of impacts would be limited, and population-level impacts are unlikely. Under the No Action Alternative, these shallow-water vessels would continue to operate in defined boat lanes with sufficient depths to avoid propeller or hull strikes of benthic invertebrates on the seafloor, thereby minimizing impacts to invertebrate populations.

Amphibious Assault and Amphibious Raids could occur up to four and two times annually, respectively. These could occur at beaches at Una Babui, Una Chulu, and Unai Dankulo on Tinian and can also occur at Dry Dock Island in Apra Harbor, Dadi Beach on Guam. Benthic invertebrates of the reef crest or flat, such as crabs, clams, and polychaete worms, within the disturbed area could be displaced, injured, or killed during amphibious operations. As is current practice, exposure of coral and other hard bottom habitats would be avoided in the No Action Alternative. Prior to any amphibious over-the-beach training activity conducted with larger amphibious vehicles such as Landing Craft Air Cushions (LCACs) or Amphibious

Assault Vehicles (AAVs) (e.g., Amphibious Assaults), a hydrographic survey and a beach survey would be required. The surveys would be conducted to identify and designate boat lanes and beach landing areas that are clear of coral, hard bottom substrate, and obstructions. LCAC landing and departure activities would be scheduled at high tide. In addition, LCACs would stay fully on cushion or hover when over shallow reef to avoid corals and hard bottom substrate. This is a standard operating procedure for safe operation of LCACs. Over-the-beach amphibious activity would only occur within designated areas based on the hydrographic and beach surveys. Similarly, AAV activities would only be scheduled within designated boat lanes and beach landing areas and would conduct their beach landings and departures at high tide one vehicle at a time within their designated boat lane (Commander, US. Naval Forces Marianas Instruction [COMNAVMARINST] 3500.4A). Based on the surveys, if the beach landing area and boat lane is clear, the activity could be conducted, and crews would follow procedures to avoid obstructions to navigation, including coral reefs; however, if there is any potential for impacts to occur on corals or hard bottom substrate, the Navy will coordinate with applicable resource agencies before conducting the activity. Hydrographic and beach surveys would not be necessary for beach landings with small boats, such as Rigid Hull Inflatable Boats (RHIBs).

Benthic invertebrates within the disturbed area, such as crabs, clams, and polychaete worms, could be displaced, injured, or killed during amphibious operations. Benthic invertebrates inhabiting these areas are adapted to a highly variable environment and are expected to rapidly re-colonize disturbed areas by immigration and larval recruitment. Studies indicate that benthic communities of high-energy sandy beaches recover relatively quickly (typically within 2 to 7 months) following beach nourishment (U.S. Army Corps of Engineers 2001). Schoeman et al. (2000) found that the macrobenthic (visible organisms on the seafloor) community required between 7 and 16 days to recover following excavation and removal of sand from a 2,153 $ft.^2$ (200 m^2) quadrant in the mid-intertidal zone of a sandy beach.

Exposure of marine invertebrates to vessel disturbance and strikes would be limited to organisms in the water column (primarily in the uppermost portions of the water column) and organisms occupying shallow water habitats. Most pelagic marine invertebrates are disturbed as the water flows around the vessel, towed in-water device, or autonomous vehicle. A consequence of vessel operation in shallow water is increased turbidity from stirring-up bottom sediments as well as the potential for running aground. Turbidity can impact corals and invertebrate communities in shallow water areas by reducing the amount of light that reaches these organisms and by increasing the effort the organism expends on sediment removal (Riegl and Branch 1995). Reef-building corals are sensitive to water clarity because of their symbiotic algae (i.e., zooxanthellae) that require sunlight to live. Encrusting organisms residing on hardbottom can be impacted by persistent silting from increased turbidity. In addition, propeller wash and physical contact with coral and hardbottom areas can cause structural damage to the substrate, as well as mortality to encrusting organisms. Injury or mortality caused directly or indirectly by propellers or vessels is possible, but the scale of impacts would be limited, and population-level impacts are unlikely.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel’s and in-water device’s footprint, and is extremely small relative to most marine invertebrates’ ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, vessel or in-water device strikes or physical disturbance from training activities as described under the No Action Alternative may affect ESA-listed coral species.

Testing Activities

Under the No Action Alternative, there are no testing activities except for vessels transiting to the North Pacific Acoustic Lab Philippine Sea Experiment site. This action may affect a proportion of eggs, sperm, early embryonic stages, and planula larvae of ESA-listed coral species subjected to the shearing forces of turbulent waters from the hulls, propellers, or jets of vessels. Mortality and lack of successful fertilization in broadcast spawning organisms are not rare, and a majority of the reproductive effort of broadcast spawning organisms fails naturally. While vessel movement may affect the developmental life stages of ESA-listed corals, it likely has little impact on their reproductive output at the population level.

The impact of vessels on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level

Pursuant to the ESA, vessel or in-water device strikes or physical disturbance from testing activities as described under the No Action Alternative may affect ESA-listed coral species.

3.8.3.3.1.2 Alternative 1

Training Activities

As described in Section 2.7.3.2 (Ships), additional ships are proposed under Alternative 1 as well as increase in overall vessel use in the Study Area. The replacement of the Nimitz Class aircraft carriers would introduce new aircraft carriers into the activities described in this EIS/OEIS. The first replacement Gerald Ford Class aircraft carrier is expected to be operational within the MITT Study Area in 2015. The replacement of Nimitz Class aircraft carriers would not increase the potential for marine invertebrate disturbance because there would be no net increase of aircraft carriers within the Study Area, the operational differences between Nimitz and Gerald Ford Classes are minor, and no new training activities would result from the introduction of Gerald Ford Class aircraft carriers.

Under Alternative 1, the Navy plans to introduce a new class of destroyers (Zumwalt Class, Multi-Mission Destroyers), which would require increased training exercises relative to existing destroyer class ships. Although the increase in training would increase the potential for disturbance of marine invertebrates, the impacts of the Zumwalt Class destroyers during training and testing activities would not differ from those of existing destroyers. Therefore, the likelihood of disturbance would increase not because of the new destroyer class, but because of increased vessel movements under Alternative 1. However, as described above, vessels do not normally collide with invertebrates because Navy vessels are operated in relatively deep waters and also have navigational capabilities to avoid contact with benthic habitats.

Alternative 1 also proposes to introduce new vessels (not replacement class vessel for existing vessels). The Littoral Combat Ship, the Joint High Speed Vessel, and the Expeditionary Fighting Vehicle are all fast vessels that may operate in nearshore waters. These areas typically support marine invertebrates within the water column and benthic habitats, so the potential for disturbance or strike of marine invertebrates in nearshore waters would increase.

In addition to manned ships, the Navy also proposes to introduce unmanned undersea and surface systems under Alternative 1. These devices can operate anywhere from the water surface to the benthic zone. Certain devices do not have a realistic potential to strike living marine resources because they either move slowly through the water column (e.g., most unmanned undersurface vehicles) or are closely monitored by observers manning the towing platform (e.g., most towed devices). Even at low speeds, however, zooplankton, invertebrate eggs or larvae, corals, and macro-invertebrates in the water column could be displaced, injured, or killed by unmanned underwater vehicle movements. Consequences of exposure of corals to an unmanned undersea and surface system could include breakage, injury, or mortality. As described above, while vessels may affect the developmental stages of ESA-listed coral species, they likely have little impact on their reproductive output at the population level.

Because of their size and potential operating speed, in-water devices that operate in a manner with the potential to strike living marine resources are the Unmanned Surface Vehicles. All of the vehicles described in Section 2.7.3.3 (Unmanned Vehicles and Systems) use advanced propeller systems with encased propellers to prevent damage to sea beds (seafloor fauna, such as corals and other invertebrate species). The Sea Maverick Unmanned Surface System operates in harbors and bays; therefore, it could increase the risk of interactions with marine invertebrates. A consequence of vessel operation in shallow water is increased turbidity from stirring-up bottom sediments. Bottom sediments would be disturbed, and localized increases in turbidity would occur when an in-water device makes contact with the seafloor, but turbidity would quickly dissipate (i.e., time scales of minutes to hours) following the exercise. Training activities that involve the use of unmanned surface or underwater activities include Amphibious Raid activities (Table 2.8-1), which occur six times a year.

Amphibious Assault and Amphibious Raids could occur up to six times each annually. These could occur at beaches at Una Babui, Una Chulu, and Unai Dankulo on Tinian and can also occur at Dry Dock Island in Apra Harbor, Dadi Beach on Guam. Benthic invertebrates of the reef crest or flat, such as crabs, clams, and polychaete worms, within the disturbed area could be displaced, injured, or killed during amphibious operations. As is current practice, exposure of coral and other hard bottom habitats would continue to be avoided in the Proposed Action.

Prior to any amphibious over-the-beach training activity conducted with larger amphibious vehicles such as LCACs or AAVs (e.g., Amphibious Assaults), a hydrographic survey and a beach survey would be required. The surveys would be conducted to identify and designate boat lanes and beach landing areas that are clear of coral, hard bottom substrate, and obstructions. LCAC landing and departure activities would be scheduled at high tide. In addition, LCACs would stay fully on cushion or hover when over shallow reef to avoid corals and hard bottom substrate. This is a standard operating procedure for safe operation of LCACs. Over-the-beach amphibious activity would only occur within designated areas based on the hydrographic and beach surveys. Similarly, AAV activities would only be scheduled within designated boat lanes and beach landing areas and would conduct their beach landings and departures at high tide one vehicle at a time within their designated boat lane (COMNAVMARINST 3500.4A). Based on the surveys, if the beach landing area and boat lane is clear, the activity could be conducted, and crews would follow procedures to avoid obstructions to navigation, including coral reefs; however, if there is any potential for impacts to occur on corals or hard bottom substrate, the Navy will coordinate with applicable resource agencies before conducting the activity. Hydrographic and beach surveys would not be necessary for beach landings with small boats, such as RHIBs.

Benthic invertebrates within the disturbed area, such as crabs, clams, and polychaete worms, could be displaced, injured, or killed during amphibious operations. Benthic invertebrates inhabiting these areas are adapted to a highly variable environment and are expected to rapidly re-colonize disturbed areas by immigration and larval recruitment. Studies indicate that benthic communities of high-energy sandy beaches recover relatively quickly (typically within 2 to 7 months) following beach nourishment (U.S. Army Corps of Engineers 2001). Schoeman et al. (2000) found that the macrobenthic (visible organisms on the seafloor) community required between 7 and 16 days to recover following excavation and removal of sand from a 2,153 $ft.^2$ (200 m^2) quadrant in the mid-intertidal zone of a sandy beach.

Exposure of marine invertebrates to vessel disturbance and strikes would be limited to organisms in the water column (primarily in the uppermost portions of the water column) and organisms occupying shallow water habitats. Species that do not occur near the surface within the Study Area—including ESA-listed coral species—would not be exposed to vessel strikes. Most pelagic marine invertebrates are disturbed as the water flows around the vessel, towed in-water device, or autonomous vehicle. A consequence of vessel operation in shallow water is increased turbidity from stirring-up bottom sediments as well as the potential for running aground. Turbidity can impact corals and invertebrate communities in shallow water areas by reducing the amount of light that reaches these organisms and by increasing the effort the organism expends on sediment removal (Riegl and Branch 1995). Reef-building corals are sensitive to water clarity because of their symbiotic algae (i.e., zooxanthellae) that require sunlight to live. Encrusting organisms residing on hardbottom can be impacted by persistent silting from increased turbidity. In addition, propeller wash and physical contact with coral and hardbottom areas can cause structural damage to the substrate, as well as mortality to encrusting organisms. Injury or mortality caused directly or indirectly by propellers or vessels is possible, but the scale of impacts would be limited, and population-level impacts are unlikely.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, vessel or in-water device strikes or physical disturbance from training activities as described under Alternative 1 may affect ESA-listed coral species.

Testing Activities

Alternative 1 would introduce new testing activities into the Study Area involving ships and underwater vehicle types. Exposure of marine invertebrates to vessel disturbance and strikes would be limited to organisms in the water column, and primarily in the uppermost portions of the water column. Species that do not occur near the surface within the Study Area—including sessile ESA-listed coral species—would not be exposed to vessel strikes. The number of individual larvae exposed would be quite small in comparison to the total number of coral larvae that are produced by reproduction, and impacts to coral populations from unmanned underwater vehicles are expected to be inconsequential.

Most pelagic marine invertebrates are disturbed as the water flows around the vessel, towed in-water device, or autonomous vehicle. Injury or mortality caused directly or indirectly by propellers is possible, but the scale of impacts would be limited, and population-level impacts are unlikely.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, vessel or in-water device strikes or physical disturbance from testing activities as described under Alternative 1 may affect ESA-listed coral species.

3.8.3.3.1.3 Alternative 2

Training Activities

As described for Alternative 1, Alternative 2 includes the same new ship classes and vessels and activity numbers. Exposure of marine invertebrates to vessel disturbance and strikes would be limited to organisms in the water column (primarily in the uppermost portions of the water column) and organisms occupying shallow water habitats. As described above, while vessels may affect the developmental stages of ESA-listed coral species in the water column, they likely have little impact on their reproductive output at the population level. Species that do not occur near the surface within the Study Area—including ESA-listed coral species—would not be exposed to vessel strikes. Injury or mortality caused directly or indirectly by propellers or vessels is possible, but the scale of impacts would be limited, and population-level impacts are unlikely.

Amphibious Assault and Amphibious Raids could occur up to six times each annually. These could occur at beaches at Una Babui, Una Chulu, and Unai Dankulo on Tinian and can also occur at Dry Dock Island in Apra Harbor, Dadi Beach on Guam. Benthic invertebrates of the reef crest or flat, such as crabs, clams, and polychaete worms, within the disturbed area could be displaced, injured, or killed during amphibious operations. As is current practice, exposure of coral and other hard bottom habitats would continue to be avoided in the Proposed Action.

Prior to any amphibious over-the-beach training activity conducted with larger amphibious vehicles such as LCACs or AAVs (e.g., Amphibious Assaults), a hydrographic survey and a beach survey would be required. The surveys would be conducted to identify and designate boat lanes and beach landing areas that are clear of coral, hard bottom substrate, and obstructions. LCAC landing and departure activities would be scheduled at high tide. In addition, LCACs would stay fully on cushion or hover when over shallow reef to avoid corals and hard bottom substrate. This is a standard operating procedure for safe operation of LCACs. Over-the-beach amphibious activity would only occur within designated areas based on the hydrographic and beach surveys. Similarly, AAV activities would only be scheduled within designated boat lanes and beach landing areas and would conduct their beach landings and departures at high tide one vehicle at a time within their designated boat lane (COMNAVMARINST 3500.4A). Based on the surveys, if the beach landing area and boat lane is clear, the activity could be conducted, and crews would follow procedures to avoid obstructions to navigation, including coral reefs; however, if there is any potential for impacts to occur on corals or hard bottom substrate, the Navy will coordinate with applicable resource agencies before conducting the activity. Hydrographic and beach surveys would not be necessary for beach landings with small boats, such as RHIBs.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, vessel or in-water device strikes or physical disturbance from training activities as described under Alternative 2 may affect ESA-listed coral species.

Testing Activities

Alternative 2 would include an incremental increase above Alternative 1 testing activities. Exposure of marine invertebrates to vessel disturbance and strikes would be limited to organisms in the water column, and primarily in the uppermost portions of the water column. Species that do not occur near the surface within the Study Area—including ESA-listed coral species—would not be exposed to vessel strikes. Most pelagic marine invertebrates are disturbed as the water flows around the vessel, towed in-water device, or autonomous vehicle. Injury or mortality caused directly or indirectly by propellers is possible, but the scale of impacts would be limited, and population-level impacts are unlikely. Seafloor invertebrates, including sessile ESA-listed coral species, are not likely to be exposed to this sub-stressor. The larval stage of corals existing as part of the plankton within the water column may be disturbed by vessels or in-water devices.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, vessel or in-water device strikes or physical disturbance from testing activities as described under Alternative 2 may affect ESA-listed coral species.

3.8.3.3.1.4 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training and testing activities will have no effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern within the Study Area.

3.8.3.3.2 Impacts from Military Expended Materials

This section analyzes the strike potential to marine invertebrates of the following categories of military expended materials: (1) non-explosive practice munitions; (2) fragments from high-explosive munitions; and (3) expended materials other than ordnance, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.2.3.4 (Military Expended Materials).

The spatial extent of military expended materials deposition includes all of the Study Area. Despite this broad range, the majority of military expended materials deposition occurs within specific range complexes, such as Special Use Airspace and operating areas. These areas of higher military expended materials deposition are generally away from the coastline.

Chaff and flares include canisters, end-caps, and aluminum-coated glass fibers. Chaff, in particular, may be transported great distances by the wind, beyond the areas where they are deployed before contacting the sea surface. These materials contact the sea surface and seafloor with very little kinetic energy, and their low buoyant weight makes them an inconsequential strike and abrasion risk. Aerial countermeasures, therefore, will not be addressed as potential strike and disturbance stressors.

Physical disturbance or strikes by military expended materials on marine invertebrates is possible at the water's surface, through the water column, and at the seafloor. Disturbance or strike impacts on marine invertebrates by military expended materials falling through the water column is possible but not very likely because their kinetic energy dissipates within a few feet of the sea surface and they do not generally sink rapidly enough to cause strike injury. Exposed invertebrates would likely experience only temporary displacement as the object passes by. Therefore, the discussion of military expended materials disturbance and strikes will focus on military expended materials on the water's surface and the seafloor.

Sessile marine invertebrates and infauna are susceptible to military expended material strikes, particularly shallow-water corals, hardbottom, and deep-water corals. Most shallow-water coral reefs in the Study Area are within or adjacent to land masses, where expended materials are primarily lightweight flares and chaff, which have inconsequential strike potential.

3.8.3.3.2.1 Military Expended Materials that are Ordnance

Small-, Medium-, and Large-Caliber Projectiles

Various types of projectiles could cause a temporary local impact when they strike the surface of the water. Navy training and testing in the Study Area, such as gunnery exercises, include firing a variety of weapons and using a variety of non-explosive training and testing rounds, including and small-, medium, and large-caliber projectiles. With the exception of terrestrial based activities at FDM, the larger-caliber projectiles are primarily used in the open ocean beyond 12 nm from shore.

Direct ordnance strikes from firing weapons are potential strike stressors to marine invertebrates. Military expended materials have the potential to impact the water with great force. Physical disruption of the water column is a localized, temporary impact and would be limited to within tens of meters of the impact area, persisting for a matter of minutes. Physical and chemical properties of the surrounding water would be temporarily altered (e.g., slight heating or cooling and increased oxygen concentrations due to turbulent mixing with the atmosphere), but there would be no lasting change resulting in long-term impacts on marine invertebrates. Although the sea surface is rich with invertebrates, most are zooplankton and relatively few are large pelagic invertebrates (e.g., some jellyfish and some swimming crabs). Zooplankton, eggs and larvae, and larger pelagic organisms in the upper portions of the water column could be displaced, injured, or killed by military expended materials impacting the sea surface. Individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices is extremely small relative to population sizes.

Marine invertebrate communities and individuals at various stages of development (eggs, larvae, or adults) would be exposed to munitions, including small-, medium-, and large-caliber projectiles. Marine invertebrates on the seafloor could be displaced, injured, or killed by military expended materials contacting the seafloor.

Potential impacts of projectiles on marine invertebrates, including shallow-water, hardbottom, or deep-water corals, present the greatest risk of long-term damage compared with other seafloor communities because (1) many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable; (2) many of these organisms grow slowly, and could require decades to recover (Precht et al. 2001); and (3) military expended materials are likely to remain mobile for a longer period because natural encrusting and burial processes are much slower on these habitats than on hardbottom habitats.

Bombs, Missiles, and Rockets

Bombs, missiles, and rockets are potential strike stressors to marine invertebrates. The nature of their potential impacts is the same as projectiles. However, they are addressed separately because they are larger than most projectiles, and because high-explosive bombs, missiles, and rockets are likely to produce a greater number of small fragments than projectiles. Propelled fragments are produced by explosives. Close to the explosive, invertebrates could be injured by propelled fragments. However, studies of underwater bomb blasts have shown that fragments are larger than those produced during air blasts and decelerate much more rapidly (O'Keefe and Young 1984; Swisdak Jr. and Montaro 1992), reducing the risk to marine organisms. Bombs, missiles, and rockets are designed to explode within 3 ft. (1.01 m) of the sea surface where invertebrates are relatively infrequent. The fitness of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices would be extremely small relative to population sizes.

3.8.3.3.2.2 Military Expended Materials Other than Ordnance

Vessel Hulk

During a sinking exercise, aircraft, ship, and submarine crews deliver ordnance on a surface target, which is a clean (Section 3.1, Sediments and Water Quality) deactivated ship that is deliberately sunk using multiple weapon systems. Sinking exercises occur in specific open ocean areas, outside of the coastal range complexes. Ordnance strikes by the various weapons used in these exercises are a potential source of impacts. However, these impacts are discussed for each of those weapons categories in this section and are not repeated here. Therefore, the analysis of sinking exercises as a strike potential for benthic invertebrates is discussed in terms of the ship hulk landing on the seafloor. The primary difference between a vessel hulk and other military expended materials as a strike potential for marine invertebrates is a difference in scale. As the vessel hulk settles on the seafloor, all marine invertebrates within the footprint of the hulk would be impacted by strike or burial, and invertebrates a short distance beyond the footprint of the hulk would be disturbed. A deposited vessel hulk will potentially change local flow patterns, which could impact food delivery, patterns of sediment deposition and erosion, patterns of predation based on halo effects of predators around the vessel, and community changes based on new hard substratum high in the flow field off the seafloor. Habitat-forming invertebrates are likely absent where sinking exercises are planned because this activity occurs in depths greater than the range of corals and most other habitat-forming invertebrates (approximately 10,000 ft. [3,048 m]). It is possible that deep-sea corals may be impacted by a sinking vessel hulk or fragments of a hulk, but the size of the impact on the seafloor relative to the relatively broad distribution of deep sea corals suggests that these impacts would seldom occur.

Decelerators/Parachutes

Decelerators/Parachutes of varying sizes are used during training and testing activities. Sonobuoys, lightweight torpedoes, anti-submarine warfare training targets, and other devices deployed by aircraft use nylon decelerators/parachutes of various sizes. Decelerators/parachutes are made of cloth and nylon, and many have weights attached to the lines for rapid sinking. At water impact, the decelerator/parachute assembly is expended, and it sinks away from the unit. The decelerator/parachute assembly may remain at the surface for 5–15 seconds before the decelerator/parachute and its housing sink to the seafloor, where it becomes flattened (Section 3.0.5.2.4.2, Decelerators/Parachutes). Activities that expend sonobuoys and air-launched torpedo parachutes generally occur in water deeper than 183 m (600.4 ft.). Because they are in the air and water column for a time span of minutes, it is improbable that such a decelerator/parachute deployed over water deeper than 183 m (600.4 ft.) could travel far enough to affect shallow-water corals, including ESA-listed coral species. Movement of the decelerator/parachute in the water may break more fragile invertebrates such as deep-water corals.

3.8.3.3.2.3 No Action Alternative

Training Activities

Under the No Action Alternative, several different types of military expended materials with a potential for striking marine invertebrates are expended annually in the Study Area, as grouped below (Tables 3.0-18, 3.0-19, and 3.0-22):

- **Bombs:** Under the No Action Alternative, 32 explosive bombs and 522 non-explosive bombs would be expended during training activities in areas farther than 50 nm from shore. Additionally, 2,150 explosive bombs and 2,800 non-explosive bombs would be expended on the range at FDM.
- **Small-caliber projectiles:** Under the No Action Alternative, 60,000 small-caliber projectiles would be expended during training activities. These small-caliber projectiles would be expended throughout the Study Area. Additionally, 2,900 small caliber projectiles would be expended on the range at FDM.
- **Medium-caliber projectiles:** Under the No Action Alternative, 26,500 non-explosive, medium-caliber projectiles would be expended during training activities in areas farther than 3 nm from shore. Additionally, 21,500 explosive, medium-caliber projectiles would be expended on the range at FDM.
- **Large-caliber projectiles:** Under the No Action Alternative, 1,240 explosive, large-caliber projectiles would be expended during training activities in areas farther than 12 nm from shore. Additionally, 1,000 explosive large-caliber projectiles would be expended on the range at FDM.
- **Missiles:** Under the No Action Alternative, 58 explosive missiles would be expended during training activities in areas farther than 12 nm from shore. Additionally, 60 missiles would be expended on the range at FDM.
- **Sonobuoys:** Under the No Action Alternative, 8,065 non-explosive and 8 explosive sonobuoys would be used in areas farther than 3 nm from shore.
- **Decelerators/parachutes:** Under the No Action Alternative, 8,032 decelerators/parachutes would be expended during training activities in areas farther than 3 nm from shore throughout the Study Area.

Bombs, missiles, rockets, projectiles, and associated fragments may strike marine invertebrates, including zooplankton, eggs, and larvae, at the sea surface or on the seafloor. Consequences of strike or disturbance could include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. Individual organisms could be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices is extremely small relative to population sizes. The exceptions to this are corals (potentially including proposed coral species), which would be susceptible to abrasion injury, breakage, or mortality from fragments striking or settling upon the coral. Because these organisms are habitat-forming and also constitute some habitat areas of particular concern, these same impacts could degrade habitat quality. Individual organisms would be impacted directly or indirectly to the extent that the viability of populations or species would be impacted. However, as indicated in Chapter 2 (Description of Proposed Action and Alternatives), with the exception of those used on FDM, projectiles are used greater than 3 nm from the shore, and typically greater than 12 nm from shore, within the Study Area. At these distances from shore, the overlap between the area potentially impacted and areas containing coral habitat is extremely low. In the nearshore areas of FDM, some corals could be exposed if shore targets are missed. Intact bombs and other ordnance items, as well as munition and associated fragments, could strike ESA-listed coral species in the FDM nearshore environment. Any ESA-listed coral species present in the FDM nearshore environment could be subject to injury or mortality. Fitness of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms impacted would be extremely small relative to population sizes.

During sinking exercises, pelagic invertebrates present near the water's surface in the immediate vicinity of the exercise could potentially be injured or killed. Sinking exercise vessel hulks contacting the seafloor would result in mortality of marine invertebrates within the footprint of the hulk and disturbance of marine invertebrates near the footprint of the hulk. Sinking exercises may result in injury or mortality of marine invertebrates near the footprint of the hulk. Though the footprint of a sinking exercise is large relative to other military expended materials, the impacted area is extremely small relative to the spatial distribution of marine invertebrate populations as the location of a sinking exercise would not overlap with known coral habitats. Consequences of sinking exercises would impact individual organisms directly or indirectly, but not to the extent that the viability of populations or species would be measurably impacted.

Activities occurring at depths less than 2,600 ft. (800 m) may impact deep-water corals and other marine invertebrate assemblages. Consequences may include breakage, injury, or mortality as a result of projectiles or munitions (see Section 3.3, Marine Habitats). Decelerators/parachutes may cause abrasion injury or mortality, or breakage. Because these organisms are habitat-forming and also constitute some habitat areas of particular concern, these same impacts could degrade habitat quality. Individual organisms would be impacted directly or indirectly to the extent that the viability of populations or species would be impacted.

The impact of military expended materials on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) exposures would be localized and would cease when the military expended material stops moving. Activities involving military expended material are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Pursuant to the ESA, the use of military expended materials may affect ESA-listed coral species. Pursuant to the ESA, the use of military expended materials on FDM may affect ESA-listed coral species as a result of direct strikes from off island munitions.

Testing Activities

Under the No Action Alternative, no military expended materials are deposited in the Study Area from testing activities.

3.8.3.3.2.4 Alternative 1

Training Activities

Under Alternative 1, several different types of military expended materials with a potential for striking marine invertebrates would be expended in the Study Area annually (see Table 2.8-1 and Tables 3.0-18, 3.0-19, and 3.0-22 for additional detail), as grouped below:

- **Bombs:** Under Alternative 1, 212 explosive bombs and 848 non-explosive bombs would be expended during training activities in areas farther than 50 nm from shore. Additionally, 6,242 explosive bombs and 2,670 non-explosive bombs would be expended on the range at FDM.
- **Small-caliber projectiles:** Under Alternative 1, approximately 86,000 non-explosive, small-caliber projectiles would be expended annually during training and testing activities in areas farther than 3 nm from shore. Additionally, approximately 42,000 small-caliber projectiles would be expended on the range at FDM.
- **Medium-caliber projectiles:** Under Alternative 1, approximately 85,500 non-explosive, medium-caliber projectiles and 8,500 explosive, medium-caliber projectiles would be expended annually during training activities in areas farther than 3 nm from shore. Additionally, 17,350 explosive and 94,150 non-explosive, medium-caliber projectiles would be expended on the range at FDM.
- **Large-caliber projectiles:** Under Alternative 1, 1,300 explosive, large-caliber projectiles and over 5,200 non-explosive large-caliber projectiles would be expended annually during training activities in areas farther than 12 nm from shore. Additionally, approximately 1,200 explosive, large-caliber projectiles and 1,800 non-explosive large-caliber projectiles would be expended on the range at FDM.
- **Missiles:** Under Alternative 1, 125 explosive missiles would be expended during training activities in areas farther than 12 nm from shore. Additionally, approximately 85 explosive, missiles would be expended on the range at FDM.
- **Rockets:** Under Alternative 1, 114 explosive rockets would be expended during training activities in areas farther than 12 nm from shore. Additionally, 2,000 explosive rockets would be expended on the range at FDM.
- **Sonobuoys:** Under the Alternative 1, 10,980 non-explosive and 11 explosive sonobuoys would be used in areas farther than 3 nm from shore.
- **Decelerators/parachutes:** Under Alternative 1, 10,845 decelerators/parachutes would be expended. Decelerators/parachutes associated with the use of air-launched torpedoes and sonobuoys would be expended in areas farther than 3 nm from shore throughout the Study Area.

Alternative 1 would include multi-fold increases in small- and medium-caliber projectiles. Bombs, missiles, rockets, projectiles, and associated fragments could strike zooplankton, eggs, or larvae at the sea surface or on the seafloor. Consequences of strike or disturbance could include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. Individual organisms could be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices is extremely small relative to population sizes. Additionally, as indicated in Chapter 2 (Description of Proposed Action and Alternatives), other than those used at FDM, projectiles are used greater than 3 nm from the shore, and typically greater than 12 nm from shore, within the Study Area. At these distances from shore, the overlap between the area potentially impacted and areas containing coral habitat is extremely low.

In the nearshore areas of FDM, some corals could be exposed if shore targets are missed. Intact bombs and other ordnance items, as well as munition and associated fragments, could strike ESA-listed coral species in the FDM nearshore environment. Any ESA-listed coral species present in the FDM nearshore environment could be subject to injury or mortality. Fitness of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms impact would be extremely small relative to population sizes.

Sinking exercises may result in injury or mortality of marine invertebrates near the footprint of the hulk. Though the footprint of a sinking exercise is large relative to other military expended materials, the impacted area is extremely small relative to the spatial distribution of marine invertebrate populations. Consequences of sinking exercises would impact individual organisms directly or indirectly, but not to the extent that the viability of populations or species would be measurably impacted.

Activities occurring at depths less than 2,600 ft. (800 m) may impact deep-water corals and other marine invertebrate assemblages. Consequences may include breakage, injury, or mortality as a result of projectiles or munitions. Decelerators/parachutes may cause abrasion injury or mortality, or breakage. Because these organisms are habitat-forming and also constitute some habitat areas of particular concern, these same impacts could degrade habitat quality. Individual organisms would be impacted directly or indirectly to the extent that the viability of populations or species would be impacted.

Although the number of military expended materials would increase under Alternative 1 compared to the No Action Alternative, the types of impacts would be similar to those described under the No Action Alternative. The probability of military expended material strikes on marine invertebrates, however, would increase because of the increase in the number of military expended materials. Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Pursuant to the ESA, the use of military expended materials may affect ESA-listed coral species. The use of military expended materials on FDM may affect ESA-listed coral species as a result of direct strikes from off island munitions.

Testing Activities

Under Alternative 1, 2,000 small caliber rounds, 2,040 non-explosive medium caliber rounds, 1,680 non-explosive large caliber rounds, 20 non-explosive missiles, 932 non-explosive sonobuoys, and 1,727 decelerators/parachutes would be used during testing activities, and those items would be expended in areas farther than 3 nm from shore in the Study Area. Approximately 13,781 explosives would be used for testing activities under Alternative 1 (2,040 explosive medium caliber rounds, 10,920 in-air explosive large caliber rounds, 20 explosive missiles, 8 explosive torpedoes, 793 explosive sonobuoys).

Missiles, rockets, projectiles, and associated fragments could strike zooplankton, eggs, or larvae at the sea surface or on the seafloor. Consequences of strike or disturbance could include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. Individual organisms could be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices is extremely small relative to population sizes. As indicated in Chapter 2 (Description of Proposed Action and Alternatives), projectiles are used greater than 3 nm from the shore, and typically greater than 12 nm from shore, within the Study Area. At these distances from shore, the overlap between the area potentially impacted and areas containing ESA-listed coral species is extremely low.

Consequences of strikes or disturbances could include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. The fitness (ability to produce offspring) of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices would be extremely small relative to population sizes.

Although the number of military expended materials would increase under Alternative 1 compared to the No Action Alternative, the types of impacts would be similar to those described under the No Action Alternative. The probability of military expended material strikes on marine invertebrates, however, would increase because of the increase in the number of military expended materials. Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Pursuant to the ESA, the use of military expended materials may affect ESA-listed coral species.

3.8.3.3.2.5 Alternative 2

Training Activities

Under Alternative 2, the Navy proposes the same numbers and types of military expended materials as described in Alternative 1 with the exception of non-explosive medium-caliber projectiles, targets, rockets (explosive), and missiles, which will increase from Alternative 1 to 85,750, 426, 380, and 125 (explosive), respectively (Table 3.0-18, 3.0-19, and 3.0-22). With only slight increases from those of Alternative 1, the impacts of Alternative 2 training activities on marine invertebrates would be the same as for Alternative 1.

Pursuant to the ESA, the use of military expended materials may affect ESA-listed coral species. The use of military expended materials on FDM may affect ESA-listed coral species as a result of direct strikes from off island munitions.

Testing Activities

Under Alternative 2, 2,500 small caliber rounds, 2,490 non-explosive medium-caliber rounds, 2,100 non-explosive large-caliber rounds, 27 non-explosive missiles, 1,025 non-explosive sonobuoys, and 1,912 decelerators/parachutes would be used during testing activities, and those items would be expended in areas greater than 3 nm from shore in the Study Area. Approximately 2,490 explosive medium caliber rounds, 12,100 in-air explosive large caliber rounds, 25 explosive missiles, 8 explosive torpedoes, and 884 explosive sonobuoys would be used for testing activities under Alternative 2.

Missiles, rockets, projectiles, and associated fragments could strike zooplankton, eggs, or larvae at the sea surface or on the seafloor. Consequences of strike or disturbance could include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. Individual organisms could be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices is extremely small relative to population sizes. As indicated in Chapter 2 (Description of Proposed Action and Alternatives), projectiles are used greater than 3 nm from the shore, and typically greater than 12 nm from shore, within the Study Area. At these distances from shore, the overlap between the area potentially impacted and areas containing ESA-listed coral species is extremely low.

Consequences of strikes or disturbances could include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. The fitness (ability to produce offspring) of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices would be extremely small relative to population sizes.

Although the number of military expended materials would increase under Alternative 1 compared to the No Action Alternative, the types of impacts would be similar to those described under the No Action Alternative. The probability of military expended material strikes on marine invertebrates, however, would increase because of the increase in the number of military expended materials. Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Pursuant to the ESA, the use of military expended materials may affect ESA-listed coral species.

3.8.3.3.2.6 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials during training and testing activities may have an adverse effect on EFH by reducing the quality or quantity of sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The EFHA states that the impact to sedentary invertebrate beds would be minimal and long-term to permanent in duration (based on substrate impacts), whereas impacts to reefs would be individually minimal and permanent in duration within the Study Area.

3.8.3.3.3 Impacts from Seafloor Devices

Seafloor devices include items that are placed on, dropped on, or moved along, the seafloor, such as mine shapes, anchor blocks or anchors (such as those associated with the Portable Undersea Training Range [PUTR]) that are placed on the substrate for a specific purpose. Deployment of seafloor devices would cause disturbance, injury, or mortality within the footprint of the device, may disturb marine invertebrates outside the footprint of the device, and would cause temporary local increases in turbidity near the ocean bottom. Objects placed on the seafloor may attract invertebrates, or provide temporary attachment points for invertebrates. Some invertebrates attached to the devices would be removed from the habitat when the devices are recovered. A shallow depression may remain in the soft bottom sediment where an anchor was dropped.

3.8.3.3.3.1 No Action Alternative

Training Activities

Table 3.0-21 presents the number and types of training activities involving seafloor devices. Under the No Action Alternative, 44 events involving seafloor devices occur annually. These events are related to mine warfare and PUTR activities. These involve the placement of up to 480 mine shapes on the sea floor within Warning Area-517 and placement of anchor blocks within the MITT Study Area, respectively. The impact of seafloor devices on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, and (3) exposures would be localized. Activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, physical disturbance and strikes by seafloor devices associated with training activities as described under the No Action Alternative would have no effect on ESA-listed coral species.

Testing Activities

Under the No Action Alternative, seafloor devices are only utilized during testing activities at the North Pacific Acoustic Lab's Deep Water site, which would occur once per year. The deep water experimental site (> 1,000 m deep [> 3,281 ft.]) consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment of the northwestern Philippine Sea, which is not known to support shallow-water corals. The impact of seafloor devices on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, and (2) the activities and subsequent exposures would be localized. Activities involving seafloor devices associated with testing activities are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, physical disturbance and strikes by seafloor devices associated with testing activities as described under the no Action Alternative would have no effect on ESA-listed coral species.

3.8.3.3.3.2 Alternative 1

Training Activities

Table 3.0-21 presents the number and types of training activities involving seafloor devices. Under the Alternative 1, 136 events involving seafloor devices occur annually. Mine laying activities involve the placement of up to 480 mine shapes on the sea floor within MIRC warning areas. Other items encountering the sea floor include moored mine shapes, anchors, bottom placed instruments, and robotic vehicles referred to as "crawlers," which are typically placed in soft-bottom areas that do not overlap with areas that support coral species. These items are primarily used in mine warfare and anti-submarine warfare activities.

Seafloor devices are either stationary or move very slowly along the bottom and do not pose a threat to highly mobile organisms. The impact of seafloor devices on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, and (3) exposures would be localized. Activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, physical disturbance and strikes by seafloor devices associated with training activities as described under Alternative 1 would have no effect on ESA-listed coral species.

Testing Activities

Under Alternative 1, seafloor devices are utilized during pierside integrated swimmer defense activities within inner Apra Harbor, MCM mission package testing, and testing activities at the North Pacific Acoustic Lab's Deep Water site. The Inner Apra Harbor and North Pacific Acoustic Lab sites are located in areas that are not known to support shallow-water coral species, the first being a highly disturbed area, and the second being a deep water site. The deep water experimental site consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment (depths greater than 3,280 ft. [1,000 m]) of the northwestern Philippine Sea and would occur once per year. MCM Mission Package testing would occur up to 32 times per year throughout the Study Area. Pierside integrated swimmer defense activities would occur up to 11 times per year.

The impact of seafloor devices on marine invertebrates could cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) the activities and subsequent exposures would be localized. Activities involving seafloor devices associated with testing activities are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, physical disturbance and strikes by seafloor devices associated with testing activities as described under Alternative 1 would have no effect on ESA-listed coral species.

3.8.3.3.3.3 Alternative 2

Training Activities

Table 3.0-21 presents the number and types of training activities involving seafloor devices. Under the Alternative 2, 136 events involving seafloor devices occur annually. Sea floor items include moored mine shapes, anchors, bottom placed instruments, and robotic vehicles referred to as "crawlers," which are typically placed in soft-bottom areas that do not overlap with areas that support coral species. Seafloor devices are either stationary or move very slowly along the bottom and do not pose a threat to highly mobile organisms. The impact of seafloor devices on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, and (3) exposures would be localized. Activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, physical disturbance and strikes by seafloor devices associated with training activities as described under Alternative 2 would have no effect on ESA-listed coral species.

Testing Activities

Under Alternative 2, seafloor devices are utilized during pierside integrated swimmer defense activities within inner Apra Harbor, MCM mission package testing, and testing activities at the North Pacific Acoustic Lab's Deep Water site. The Inner Apra Harbor and North Pacific Acoustic Lab sites are located in areas that are not known to support shallow-water coral species, the first being a highly disturbed area, and the second being a deep water site. The deep water experimental site consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment (depths greater than 3,280 ft. [1,000 m]) of the northwestern Philippine Sea and would occur once per year. MCM Mission Package testing would occur up to 36 times per year throughout the Study Area. Pierside integrated swimmer defense activities would occur up to 11 times per year.

The impact of seafloor devices on marine invertebrates could cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) the activities and subsequent exposures would be localized. Activities involving seafloor devices associated with testing activities are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the ESA, physical disturbance and strikes by seafloor devices associated with testing activities as described under Alternative 2 would have no effect on ESA-listed coral species.

3.8.3.3.3.4 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training and testing activities could have an adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The EFHA states that the impact to sedentary invertebrate beds (e.g., amphipod tubes, bryozoans) may be minimal and long-term.

3.8.3.4 Entanglement Stressors

This section analyzes the potential entanglement impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. Included are potential impacts from two types of military expended materials: (1) fiber optic cables and guidance wires, and (2) decelerators/parachutes. Aspects of entanglement stressors that are applicable to marine organisms in general are presented in Section 3.0.5.2.4 (Entanglement Stressors).

Most marine invertebrates are less susceptible to entanglement than fishes, sea turtles, and marine mammals due to their size, behavior, and morphology. Because even fishing nets, which are designed to take marine invertebrates, operate by enclosing rather than entangling, marine invertebrates seem to be somewhat less susceptible than vertebrates to entanglement (Chuenpagdee et al. 2003; Morgan and Chuenpagdee 2003). A survey of marine debris entanglements found that marine invertebrates composed 16 percent of all animal entanglements (Ocean Conservancy 2010). The same survey cites potential entanglement in military items only in the context of waste-handling aboard ships, and not for military expended materials. Nevertheless, it is conceivable that marine invertebrates, particularly arthropods and echinoderms with rigid appendages, might become entangled in fiber optic cables and guidance wires and in decelerators/parachutes.

3.8.3.4.1 Impacts from Fiber Optic Cables and Guidance Wires

Fiber optic cables are only expended during airborne mine neutralization testing activities and torpedo guidance wires are used in training and testing activities involving heavyweight torpedoes. For a discussion of the types of activities that use guidance wires and fiber optic cables, physical characteristics of these expended materials, where they are used, and how many activities would occur under each alternative, please see Section 3.0.5.2.4.1 (Fiber Optic Cables and Guidance Wires). Abrasion and shading-related impacts on sessile benthic (attached to the seafloor) marine invertebrates that may result from entanglement stressors are discussed with physical impacts in Section 3.8.3.3 (Physical Disturbance and Strike Stressors).

A marine invertebrate that might become entangled could be only temporarily confused and escape unharmed, it could be held tightly enough that it could be injured during its struggle to escape, it could be preyed upon while entangled, or it could starve while entangled. The likelihood of these outcomes cannot be predicted with any certainty because interactions between invertebrate species and entanglement hazards are not well known. The potential entanglement scenarios are based on observations of how marine invertebrates are entangled in marine debris, which is far more prone to tangling than guidance wire or fiber optic cable (Environmental Sciences Group 2005; Ocean Conservancy 2010). The small number of guidance wires and fiber optic cables expended across the Study Area results in an extremely low rate of potential encounter for marine invertebrates.

3.8.3.4.1.1 No Action Alternative

<u>Training Activities</u>

As indicated in Table 2.8-1, under the No Action Alternative, torpedoes expending guidance wire would occur in throughout the Study Area during tracking exercises, all greater than 3 nm from the shore. Only 53 torpedoes and torpedo accessories would be used under the No Action Alternative (Table 3.0-18 and Table 3.0-19), and only heavyweight torpedoes utilize guidance wires (40; Table 3.0-24). Due to the location of the activities, only pelagic and deep water benthic invertebrates could be exposed to this substressor; therefore, there would be no overlap between activities and shallow-water corals—including ESA-listed coral species. Given the low numbers used, most marine invertebrates would never be exposed to guidance wire. However, if the guidance wires drifted to nearshore locations they could potentially entangle corals and cause abrasions, breakage, and potential mortality, though given the negatively buoyancy of these wires, this event is improbable.

The impact of guidance wires on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of fiber optic cables and guidance wires expended during training activities as described under the No Action Alternative would have no effect on ESA-listed coral species.

Testing Activities

Under the No Action Alternative, no events would occur that would expend fiber optic or guidance wires during testing events (Table 3.0-23 and Table 3.0-24).

3.8.3.4.1.2 Alternative 1

Training Activities

As indicated in Table 2.8-1, under Alternative 1, torpedoes expending guidance wire would occur throughout the Study Area during tracking exercises, all greater than 3 nm from the shore. Alternative 1 proposes a slight increase in the number of torpedoes used, 63, as compared to the 53 torpedoes and torpedo accessories that would be used under the No Action Alternative, though not all of these are heavyweight torpedoes, which utilize guidance wires (40, Table 3.0-24). Alternative 1 would also introduce the usage of 16 fiber optic cables annually (Table 3.0-23). Due to the location of the activities, only pelagic and deep water benthic invertebrates could be exposed to this sub-stressor, and only slightly more than the exposure under the No Action Alternative; therefore, there would be no overlap between activities and shallow-water corals—including ESA-listed coral species. Given the low numbers used, most marine invertebrates would never be exposed to a cable or guidance wire. However, if the guidance wires drifted to nearshore locations they could potentially entangle corals and cause abrasions, breakage, and potential mortality, though given the negatively buoyancy of these wires, this event is improbable.

The impact of fiber optic cables and guidance wires on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving cables and guidance wires are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of fiber optic cables and guidance wires expended during training activities as described under Alternative 1 would have no effect on ESA-listed coral species.

Testing Activities

Under Alternative 1, 60 torpedoes are utilized throughout the Study Area during torpedo testing (Table 3.0-24) though only 20 of those are heavyweight torpedoes that utilize guidance wires. Additionally, MCM Mission Package testing (Table 2.8-3) expends up to 48 fiber optic cables. All testing activities involving fiber optic cables and guidance wires would occur greater than 3 nm from the shore. Due to the location of the activities, only pelagic and deep water benthic invertebrates could be exposed to this stressor. There would be no overlap between activities and shallow-water corals—including ESA-listed coral species. Given the low numbers used, most marine invertebrates would never be exposed to a fiber optic cables or guidance wire from testing activities. However, if the guidance wires drifted to nearshore locations they could potentially entangle corals and cause abrasions, breakage, and potential mortality, though given the negatively buoyancy of these wires, this event is improbable.

The impact of fiber optic cables and guidance wires on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of fiber optic cables and guidance wires expended during testing activities as described under Alternative 1 would have no effect on ESA-listed coral species.

3.8.3.4.1.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical as described for Alternative 1.

Pursuant to the ESA, the use of fiber optic cables and guidance wires expended during training activities as described under Alternative 2 would have no effect on ESA-listed coral species.

Testing Activities

Under Alternative 2, 70 torpedoes would be used throughout the Study Area though only 20 of those are heavyweight torpedoes that utilize guidance wires (Table 3.0-24). Additionally, MCM Mission Package testing (Table 2.8-3) expends up to 56 fiber optic cables. All testing activities involving fiber optic cables and guidance wires would occur greater than 3 nm from the shore. Due to the location of the activities, only pelagic and deep water benthic invertebrates could be exposed to this stressor. There would be no overlap between activities and shallow-water corals—including ESA-listed coral species. Given the low numbers used, most marine invertebrates would never be exposed to a fiber optic cable or guidance wire from testing activities. However, if the guidance wires drifted to nearshore locations they could potentially entangle corals and cause abrasions, breakage, and potential mortality, though given the negatively buoyancy of these wires, this event is improbable.

The impact of fiber optic cables and guidance wires on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of fiber optic cables and guidance wires expended during testing activities as described under Alternative 2 would have no effect on ESA-listed coral species.

3.8.3.4.1.4 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of fiber optic cables and guidance wires during training and testing activities could have an adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The EFHA states that the impact to sedentary invertebrate beds (e.g., amphipod tubes, bryozoans) may be minimal and long-term.

3.8.3.4.2 Impacts from Decelerators/Parachutes

Decelerators/parachutes of varying sizes are used during training and testing activities. Sonobuoys, lightweight torpedoes, anti-submarine warfare training targets, and other devices deployed by aircraft use decelerators/parachutes that are made of cloth and nylon, and many have weights attached to the lines for rapid sinking. At water impact, the decelerator/parachute assembly is expended, and it sinks away from the unit. The decelerator/parachute assembly may remain at the surface for 5–15 seconds before the decelerator/parachute and its housing sink to the seafloor, where it becomes flattened (Section 3.0.5.2.4.2, Decelerators/Parachutes). Because they are in the air and water column for a time span of minutes, it is improbable that such a decelerator/parachute deployed in areas greater than 3 nm from shore (in water depths deeper than 183 m [600.4 ft.]) could travel far enough to affect shallow-water corals, including ESA-listed coral species. Movement of the decelerator/parachute in the water may break more fragile invertebrates such as deep-water corals which would also reduce suitable hard substrate for encrusting organisms. Deep-water coral species potentially occur everywhere that decelerator/parachute use occurs. The ESA-listed coral species are susceptible to entanglement in decelerators/parachutes, but the principal mechanism of damage is abrasion or breakage; therefore, this potential stressor is addressed in Section 3.8.3.2.2 (Impacts from Military Expended Materials).

Decelerators/parachutes pose a potential, though unlikely, entanglement risk to susceptible marine invertebrates. The most likely method of entanglement would be a marine invertebrate crawling through the fabric or cord that then would tighten around it. A marine invertebrate that might become entangled could be temporarily confused and escape unharmed, held tightly enough that it could be injured during its struggle to escape, preyed upon while entangled, or starved while entangled. The likelihood of these outcomes cannot be predicted with any certainty because interactions between invertebrate species and entanglement hazards are not well known. The potential entanglement scenarios are based on observations of how marine invertebrates are entangled in marine debris (Environmental Sciences Group 2005; Ocean Conservancy 2010). Filter-feeding invertebrates such as deep water corals and sponges could be entangled in the fabric and suffocate or starve.

3.8.3.4.2.1 No Action Alternative

<u>Training Activities</u>

Under the No Action Alternative, 8,032 decelerators/parachutes would be expended during training activities (Table 3.0-25) and would be expended in locations greater than 3 nm from shore throughout the Study Area (in water typically deeper than 183 m [600.4 ft.]). Because they are in the air and water column for a time span of minutes, it is improbable that such a decelerator/parachute deployed greater than 3 nm from shore could travel far enough to affect shallow-water corals, including ESA-listed coral species. Movement of the decelerator/parachute in the water may break more fragile invertebrates such as deep-water corals, which would also reduce suitable hard substrate for encrusting organisms. Filter-feeding invertebrates such as deep water corals and sponges could be entangled in the fabric and suffocate or starve.

Most marine invertebrates would never encounter a decelerator/parachute. The impact of decelerators/parachutes on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving decelerators/parachutes are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of decelerators/parachutes expended during training activities as described under the No Action Alternative would have no effect on ESA-listed coral species.

Testing Activities

Under the No Action Alternative, no testing activities that would create entanglement hazards from decelerators/parachutes are conducted in the Study Area.

3.8.3.4.2.2 Alternative 1

Training Activities

Under Alternative 1, 10,845 decelerators/parachutes would be expended (Table 3.0-25) during training activities. Decelerators/parachutes would be expended in areas greater than 3 nm from shore throughout the Study Area. Similar to the No Action Alternative, activities that expend sonobuoys and air-launched torpedo parachutes generally occur in water deeper than 183 m (600.4 ft.). Because they are in the air and water column for a time span of minutes, it is improbable that such a decelerator/parachute deployed over water deeper than 183 m (600.4 ft.) could travel far enough to affect shallow-water corals, including ESA-listed coral species. Movement of the decelerator/parachute in deeper water may break more fragile invertebrates such as deep-water corals which would also reduce suitable hard substrate for encrusting organisms. Filter-feeding invertebrates such as deep water corals and sponges could be entangled in the fabric and suffocate or starve.

Most marine invertebrates would never encounter a decelerator/parachute. The impact of decelerators/parachutes on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving decelerators/parachutes are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of decelerators/parachutes expended during training activities as described under Alternative 1 would have no effect on ESA-listed coral species.

Testing Activities

Under Alternative 1, 1,727 decelerators/parachutes would be expended (Table 3.0-25) during testing activities. Decelerators/parachutes would be expended in areas greater than 3 nm from shore throughout the Study Area. Activities that expend sonobuoys and air-launched torpedo parachutes generally occur in water deeper than 183 m (600.4 ft.). Because they are in the air and water column for a time span of minutes, it is improbable that such a decelerator/parachute deployed over water deeper than 183 m (600.4 ft.) could travel far enough to affect shallow-water corals, including ESA-listed coral species. Movement of the decelerator/parachute in the water may break more fragile invertebrates such as deep-water corals also reduce suitable hard substrate for encrusting organisms.

Most marine invertebrates would never encounter a decelerator/parachute from testing activities. The impact of decelerators/parachutes on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving decelerators/parachutes are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of decelerators/parachutes expended during testing activities as described under Alternative 1 would have no effect on ESA-listed coral species.

3.8.3.4.2.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative will also be identical.

Pursuant to the ESA, the use of decelerators/parachutes expended during training activities as described under Alternative 2 would have no effect on ESA-listed coral species.

Testing Activities

Under Alternative 2, 1,912 decelerators/parachutes would be expended (Table 3.0-25) during testing activities. Decelerators/parachutes would be expended in areas greater than 3 nm from shore throughout the Study Area. Activities that expend sonobuoys and air-launched torpedo parachutes generally occur in water deeper than 183 m (600.4 ft.). Because they are in the air and water column for a time span of minutes, it is improbable that such a decelerator/parachute deployed over water deeper than 183 m (600.4 ft.) could travel far enough to affect shallow-water corals, including ESA-listed coral species. Movement of the decelerator/parachute in the water may break more fragile invertebrates, such as deep-water corals, and also reduce suitable hard substrate for encrusting organisms.

Most marine invertebrates would never encounter a decelerator/parachute from testing activities. The impact of decelerators/parachutes on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving decelerators/parachutes are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the ESA, the use of decelerators/parachutes expended during testing activities as described under Alternative 2 would have no effect on ESA-listed coral species.

3.8.3.4.2.4 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes during training and testing activities could have an adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The EFHA states that the impact to sedentary invertebrate beds (e.g., amphipod tubes, bryozoans) may be minimal and long-term.

3.8.3.5 Ingestion Stressors

3.8.3.5.1 Impacts from Military Expended Materials

This section analyzes the potential ingestion impacts of the various types of military expended materials used by the Navy during training and testing activities within the Study Area. As presented in Section 3.0.5.2.5 (Ingestion Stressors), the Navy expends the following types of materials that could become ingestion stressors during training and testing in the Study Area: non-explosive practice munitions (small- and medium-caliber), fragments from explosives, fragments from targets, chaff, flare casings (including plastic end caps and pistons), and decelerators/parachutes. Other military expended materials such as targets, large-caliber projectiles, intact training and testing bombs, guidance wires, 55-gallon drums, sonobuoy tubes, and marine markers are too large for marine organisms to consume and are eliminated from further discussion. Expended materials could be ingested by marine invertebrates in all large marine ecosystems and open ocean areas. Ingestion could occur at the surface, in the water column, or on the seafloor, depending on the size and buoyancy of the expended object and the feeding behavior of the animal. Floating material is more likely to be eaten by animals that feed at or near the water surface, while materials that sink to the seafloor present a higher risk to both filter-feeding sessile and bottom-feeding animals. Marine invertebrates are universally present in the water and the seafloor, but the majority of individuals are smaller than a few millimeters (e.g., zooplankton, most roundworms, and most arthropods). Most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrades into smaller fragments.

If expended material is ingested by marine invertebrates, the primary risk is from a blocked digestive tract. Most military expended materials are relatively inert in the marine environment, and are not likely to cause injury or mortality via chemical effects (see Section 3.8.3.6, Secondary Stressors, for more information on the chemical properties of these materials).

The most abundant military expended material of ingestible size is chaff. The materials in chaff are generally nontoxic in the marine environment except in quantities substantially larger than those any marine invertebrate could reasonably be exposed to from normal usage. Fibers are composed of an aluminum alloy coating on glass fibers of silicon dioxide. Chaff is similar in form to fine human hair, and somewhat analogous to the spicules of sponges or the siliceous cases of diatoms (Spargo 1999). Many invertebrates ingest sponges, including the spicules, without suffering harm (Spargo 1999). Marine invertebrates may occasionally encounter chaff fibers in the marine environment and may incidentally ingest chaff when they ingest prey or water. Literature reviews and controlled experiments suggest that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al. 2002; Spargo 1999). Studies were conducted to determine likely effects on marine invertebrates from ingesting chaff involving a laboratory investigation of crabs that were fed radiofrequency chaff. Blue crabs were force-fed a chaff-and-food mixture daily for a few weeks at concentrations 10 to 100 times predicted real-world exposure levels without a notable increase in mortality (Arfsten et al. 2002).

As described in Section 3.8.2 (Affected Environment), tens of thousands of marine invertebrate species inhabit the Study Area. There is little literature about the effects of debris ingestion on marine invertebrates; consequently, there is little basis for an evidence-based assessment of risks. It is not feasible to speculate on which invertebrates in which locations might ingest specific types of military expended materials. However, invertebrates that actively forage (e.g., worms, octopus, shrimp, and sea cucumbers) are at much greater risk of ingesting military expended materials than invertebrates that filter-feed (e.g., sponges, corals, oysters, and barnacles). Though ingestion is possible in some circumstances, based on the little scientific information available, it seems that negative impacts on individuals are unlikely and impacts on populations would be inconsequential and not detectable. Adverse consequences of marine invertebrates ingesting military expended materials are possible but not probable.

3.8.3.5.1.1 No Action Alternative

Training Activities

Under the No Action Alternative, a variety of potentially ingestible military expended materials (i.e., chaff) would be released to the marine environment by Navy training activities (Table 2.8-1). Ingestion is not likely in the majority of cases because most military expended materials are too large to be ingested by most marine invertebrates. Though ingestion is possible in some circumstances, based on the little scientific information available, it seems that negative impacts on individuals are unlikely and the potential for impacts on populations would be inconsequential and not detectable. Marine invertebrates may occasionally encounter chaff fibers in the marine environment and may incidentally ingest chaff when they ingest prey or water. Literature reviews and controlled experiments suggest that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al. 2002; Spargo 1999). Adverse consequences of marine invertebrates ingesting military expended materials are possible but not probable. The fraction of military expended materials of ingestible size, or that become ingestible after degradation, is unlikely to impact individuals.

Pursuant to the ESA, the use of military expended materials of ingestible size during training activities as described under the No Action Alternative would have no effect on ESA-listed coral species.

Testing Activities

Under the No Action Alternative, no testing activities that would create ingestion stressors are conducted in the Study Area.

3.8.3.5.1.2 Alternative 1

Training Activities

Under Alternative 1, a variety of potentially ingestible military expended materials would be released to the marine environment by Navy training activities. As with the No Action Alternative, ingestion is not likely because most military expended materials are too large to be ingested by most marine invertebrates. The fraction of military expended materials that are of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to have impacts on populations or sub-populations.

Under Alternative 1, the expended chaff would increase to 25,840 canisters per year in areas greater than 12 nm from shore within the Study Area compared with the No Action Alternative of 5,830 (Table 3.0-26). Marine invertebrates may occasionally encounter chaff fibers in the marine environment and may incidentally ingest chaff when they ingest prey or water. Literature reviews and controlled experiments suggest that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al. 2002, Spargo 1999). Adverse consequences of marine invertebrates ingesting military expended materials are possible but not probable.

Pursuant to the ESA, the use of military expended materials of ingestible size during training activities as described under Alternative 1 would have no effect on ESA-listed coral species.

Testing Activities

Under Alternative 1, a variety of potentially ingestible military expended materials would be released to the marine environment by Navy testing activities. Six hundred chaff canisters and 300 flares would be released during testing activities under Alternative 1. Ingestion is not likely in the majority of cases because most military expended materials are too large to be ingested by most marine invertebrates. The fractions of military expended materials that are of ingestible size, or become ingestible after degradation, are unlikely to impact individuals. Marine invertebrates may occasionally encounter chaff fibers in the marine environment and may incidentally ingest chaff when they ingest prey or water. Literature reviews and controlled experiments suggest that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al. 2002, Spargo 1999). Adverse consequences of marine invertebrates ingesting military expended materials are possible but not probable.

Pursuant to the ESA, the use of military expended materials of ingestible size during testing activities as described under Alternative 1 would have no effect on ESA-listed coral species.

3.8.3.5.1.3 Alternative 2

Training Activities

Under Alternative 2, the expended chaff would increase to 28,512 canisters per year in areas greater than 12 nm from shore within the Study Area compared with the No Action Alternative of 5,836 (Table 3.0-26). Though the number of canisters increases, it remains that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al. 2002, Spargo 1999). Adverse consequences of marine invertebrates ingesting military expended materials are possible but not probable.

Pursuant to the ESA, the use of military expended materials of ingestible size during training activities as described under Alternative 2 would have no effect on ESA-listed coral species.

Testing Activities

Under Alternative 2, a variety of potentially ingestible military expended materials would be released to the marine environment by Navy testing activities. Six hundred sixty chaff canisters and 330 flares would be released during testing activities under Alternative 2. Ingestion is not likely in the majority of cases because most military expended materials are too large to be ingested by most marine invertebrates. The fractions of military expended materials that are of ingestible size, or become ingestible after degradation, are unlikely to impact individuals. Marine invertebrates may occasionally encounter chaff fibers in the marine environment and may incidentally ingest chaff when they ingest prey or water.

Literature reviews and controlled experiments suggest that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al. 2002, Spargo 1999). Adverse consequences of marine invertebrates ingesting military expended materials are possible but not probable.

Pursuant to the ESA, the use of military expended materials of ingestible size during testing activities as described under Alternative 2 would have no effect on ESA-listed coral species.

3.8.3.5.1.4 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of potentially ingestible military expended materials during training and testing activities could have an adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The EFHA states that the impact to sedentary invertebrate beds (e.g., amphipod tubes, bryozoans) may be minimal and long term.

3.8.3.5.2 Summary of Ingestion Impacts

Most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

3.8.3.6 Secondary Stressors

This section analyzes potential impacts on marine invertebrates exposed to stressors indirectly through sediments and water quality. These two ecosystem constituents, sediment and water, are also primary constituents of marine invertebrate habitat and clear distinctions between indirect impacts and habitat impacts are difficult to maintain. For this analysis, indirect impacts on marine invertebrates via sediment or water that do not require trophic transfers (e.g., bioaccumulation) to be observed are considered here. The terms “indirect” and “secondary” do not imply reduced severity of environmental consequences, but instead describe *how* the impact may occur in an organism or its ecosystem.

Stressors from Navy training and testing activities could pose secondary or indirect impacts on marine invertebrates via habitat, sediment, or water quality. Components of these stressors that could pose indirect impacts include (1) explosives and byproducts; (2) metals; (3) chemicals; and (4) other materials such as targets, chaff, and plastics.

3.8.3.6.1 Explosives and Explosive Byproducts

High-order explosives consume most of the explosive material, creating typical combustion products. In the case of Royal Demolition Explosive, 98 percent of the combustion products are common seawater constituents and the remainder is rapidly diluted. Explosive byproducts from high order detonations present no indirect impacts to marine invertebrates through sediment or water. Low-order detonations and unexploded ordnance present an elevated likelihood of effects on marine invertebrates, and the potential impacts of these on marine invertebrates will be analyzed. Explosive material not completely consumed during a detonation from ordnance disposal and mine clearance training are collected after training is complete; therefore, potential impacts are assumed to be inconsequential and not detectable for these training and testing activities. Marine invertebrates may be exposed by contact with the explosive, contact with explosive byproducts within the sediments or water, and ingestion of chemical constituents in sediments. Most marine invertebrates are very small relative to ordnance or fragments, and direct ingestion of unexploded ordnance is unlikely.

Indirect impacts of explosives and unexploded ordnance on marine invertebrates via sediment are possible near the ordnance. Degradation of explosives proceeds via several pathways as discussed in Section 3.1 (Sediments and Water Quality). Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo 2010). Trinitrotoluene and its degradation products impact developmental processes in marine invertebrates and are acutely toxic to adults at concentrations similar to real-world exposures (Rosen and Lotufo 2007b, 2010). The relatively low solubility of most explosives and their degradation products indicate that concentrations of these byproducts in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 6–12 inches (15–30 centimeters) away from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3 and 6 ft. (1 and 1.8 m) from the degrading ordnance (Section 3.1.3.1, Explosives and Explosive Byproducts). Taken together, marine invertebrates, eggs, and larvae probably would be adversely impacted by the indirect effects of degrading explosives within a very small radius of the explosive (1 to 6 ft. [0.3 to 1.8 m]).

Indirect impacts of explosives and unexploded ordnance on marine invertebrates via water are likely to be inconsequential and not detectable for two reasons. First, most explosives and explosive degradation products have very low solubility in sea water (Section 3.1, Sediments and Water Quality). This means that dissolution occurs extremely slowly, and harmful concentrations of explosives and degradation are not likely to accumulate except within confined spaces. Second, a low concentration of byproducts, slowly delivered into the water column, is readily diluted to non-harmful concentrations. Filter feeders in the immediate vicinity of degrading explosives may be more susceptible to bioaccumulation of chemical byproducts. While marine invertebrates may be adversely impacted by the indirect effects of degrading explosives via water (Rosen and Lotufo 2007a, 2010), this is extremely unlikely in realistic scenarios.

Impacts on marine invertebrates, including zooplankton, eggs, and larvae, are likely within a very small radius of the ordnance (1 to 6 ft. [0.3 to 1.8 m]). These impacts may continue as the ordnance degrades over months to decades. Because most ordnance is deployed as projectiles, multiple unexploded or low-order detonations would accumulate on spatial scales of 1 to 6 ft. (0.3 to 1.8 m); therefore, potential impacts are likely to remain local and widely separated. Given these conditions, the possibility of population-level impacts on marine invertebrates is inconsequential. However, if the sites of the depositions are the same over time, this could alter the benthic composition, affect bioaccumulation, and impact local invertebrate communities.

Strike warfare activities such as bombing exercises (Land) and missile exercises involve the use of live munitions by aircrews that practice on ground targets on FDM. These warfare training activities occur on FDM and are limited to the designated impact zones along the central corridor of the island. Explosives that detonate on land would disturb nearby soils that could then be transported through natural processes such as erosion by wind or rain into surface drainage areas or nearshore waters. It should be noted that FDM is highly susceptible to natural causes of erosion, because the island is comprised of highly weathered limestone overlain by a thin layer of clay soil. Sediments entering the nearshore environment as a result of natural processes or explosion on land could cause temporary water quality impacts, some of which may be in foraging areas used by marine organisms. By limiting the location and extent of target areas, along with the types of ordnance allowed within specific impact areas, the Navy minimizes the potential for soil transport and, thus, water quality impacts.

Erosion as a result of training activities at FDM may contribute to deposition of soils into the nearshore areas of FDM, causing increased turbidity. Turbidity can impact corals and invertebrate communities on hardbottom areas by reducing the amount of light that reaches these organisms and by clogging siphons for filter-feeding organisms. Reef-building corals are sensitive to water clarity because they host symbiotic algae that require sunlight to live. Encrusting organisms residing on hardbottom can be impacted by persistent silting from increased turbidity. However, as listed in the High-Order Explosions at FDM and Explosive Byproducts subsection of Section 3.1.3.1.6.1 (No Action Alternative), the impacts of explosive byproducts on sediment and water quality would be indirect, short term, local, and negative. Explosive ordnance could loosen soil on FDM, and runoff from surface drainage areas containing soil and explosive byproducts could subsequently enter nearshore waters. However, chemical, physical, or biological changes in sediment or water quality would not be detectable. Therefore, impacts on marine invertebrates from erosion or sedimentation are not anticipated. Refer to Section 3.1.3.1.5.3 (Farallon de Medinilla Specific Impacts) for information on surveys of the nearshore waters around FDM which assess impacts to the nearshore environment.

3.8.3.6.2 Metals

Certain metals and metal-containing compounds are harmful to marine invertebrates at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Negri et al. 2002; Wang and Rainbow 2008). Metals are introduced into seawater and sediments as a result of training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended materials (Section 3.1.3.2, Metals). Many metals bioaccumulate and some physiological impacts begin to occur only after several trophic transfers concentrate the toxic metals. Indirect impacts of metals on marine invertebrates via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Marine invertebrates may be exposed by contact with the metal, contact with trace amounts in the sediments or water, and ingestion of sediments. Ingested metals are toxic at substantially lower effective concentrations than metals dissolved or suspended in the water. Most marine invertebrates are very small relative to Navy military expended materials, and direct ingestion of metals is unlikely.

Because metals often concentrate in sediments, potential adverse indirect impacts are much more likely via sediment than via water. Despite the acute toxicity of some metals (e.g., hexavalent chromium or tributyltin) (Negri et al. 2002) concentrations above safe limits are rarely encountered even in live-fire areas such as Vieques (which is not in the MITT Study Area) where deposition of metals from Navy activities is very high. Pait (2010) and others sampled in areas in which live ammunition and weapons were used. Other studies described in Section 3.1.3.2 (Metals) find no harmful concentrations of metals from deposition of military metals into the marine environment. Marine invertebrates, eggs, or larvae could be indirectly impacted by metals via sediment within a few inches of the object.

As described in Section 3.1.3.2 (Metals), bomb fragments and unexploded bombs on FDM could be a source of metal byproducts in terrestrial and marine sediments. The Navy has in place an Operational Range Clearance Plan for FDM that includes range clearance, inspection, certification, demilitarization, and recycling or disposal procedures. The plan requires range surfaces at FDM to be cleared of ordnance, inert ordnance debris, inert munitions, and other material greater than 2 ft. (0.6 m) in length or diameter that may potentially present an explosive hazard. Range clearance on FDM occurs every 2–4 years, which removes potential sources of chemical byproducts from terrestrial sediments, marine sediments, and nearshore waters.

Concentrations of metals in sea water are orders of magnitude lower than concentrations in marine sediments. Marine invertebrates probably would not be indirectly impacted by Navy-derived toxic metals via the water, in the absence of bioaccumulation. It is conceivable, though extremely unlikely, that marine invertebrates, eggs, or larvae could be indirectly impacted by metals via sediment within a few inches of the object, but these potential impacts would be localized and widely separated. Concentrations of metals in water are extremely unlikely to be high enough to cause injury or mortality to marine invertebrates; therefore, indirect impacts of metals via water are likely to be inconsequential and not detectable. Given these conditions, the possibility of population-level impacts on marine invertebrates is likely to be inconsequential and not detectable.

3.8.3.6.3 Chemicals

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment; principally, flares and propellants from rockets, missiles, and torpedoes. Properly functioning flares, missiles, rockets, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures allow propellants and their degradation products to be released into the marine environment. The greatest risk to marine invertebrates from flares, missiles, and rocket propellants is perchlorate, which is highly soluble in water, persists in the environment, and is known to impact metabolic processes in many plants and animals. Marine invertebrates may be exposed by direct contact with a chemical found in the sediments or water or through ingestion of sediments containing trace amounts of a chemical. For perchlorate, these pathways are limited given that rapid dilution within the water column would be expected and missile and rocket propellant is mostly, if not completely, expended before the munition enters the water. Additionally, perchlorate does not readily absorb into sediments. Doses large enough to have detectable impacts on invertebrates would not be expected. Therefore, missile and rocket fuel pose inconsequential risks of direct or indirect impacts on marine invertebrates.

The principal toxic components of torpedo fuel, propylene glycol dinitrate and nitrodiphenylamine, do readily adsorb into sediments, but have relatively low toxicity and are readily degraded by physical and biological processes (Section 3.1.3.3, Chemicals Other Than Explosives). It is possible that marine invertebrates, eggs, or larvae could be indirectly impacted by hydrogen cyanide produced by torpedo fuel combustion, but these impacts would diminish rapidly as the chemical becomes diluted below toxic levels. Individual marine invertebrates, including eggs and larvae, could be indirectly impacted by chemicals from propellants, fuels (e.g., hydrogen cyanide from torpedoes fuel), or other chemicals imbedded in sediments, if the organisms are located in close proximity to the chemical (i.e., within a few inches), but any potential effects would diminish rapidly with distance from the source and as the chemical degrades in the environment.

Concentrations of chemicals in sediment and water are not likely to cause injury or mortality to marine invertebrates; therefore, indirect impacts of chemicals via sediment and water are likely to be inconsequential and not detectable. Potential impacts of chemicals after bioaccumulation are discussed separately. Population-level impacts on marine invertebrates would be inconsequential and not detectable.

3.8.3.6.4 Other Materials

Military expended materials that are re-mobilized after their initial contact with the seafloor (e.g., by waves or currents) may continue to strike or abrade marine invertebrates. Secondary physical strike and disturbances are relatively unlikely because most expended materials are more dense than the surrounding sediments (i.e., metal), and are likely to remain in place as the surrounding sediment moves. The principal exception is likely to be decelerators/parachutes, which are moved easily relative to projectiles and fragments. Potential secondary physical strike and disturbance impacts may cease only: (1) when the military expended materials is too massive to be mobilized by typical oceanographic processes, (2) when the military expended material becomes encrusted by natural processes and incorporated into the seafloor, or (3) when the military expended materials becomes permanently buried. The fitness of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted.

All military expended material, including targets and vessel hulks used for Sinking Exercises that contain materials other than metals, explosives, or chemicals, is evaluated for potential indirect impacts on marine invertebrates via sediment and water. Principal components of these military expended materials include aluminized fiberglass (chaff); carbon or Kevlar fiber (missiles); and plastics (canisters, targets, sonobuoy components, decelerators/parachutes, etc.). Potential effects of these materials are discussed in Section 3.1.3.4 (Other Materials). Chaff has been extensively studied, and no indirect toxic effects are known to occur at realistic concentrations in the marine environment (Arfsten et al. 2002). Glass, carbon, and Kevlar fibers have no known potential toxic effects on marine invertebrates. Plastics contain chemicals which could indirectly affect marine invertebrates (Derraik 2002; Mato et al. 2001; Teuten et al. 2007). Marine invertebrates may be exposed by contact with the plastic, contact with residual plastic chemical byproducts in the sediment or water, or ingestion of sediments containing plastic byproducts. Most marine invertebrates are very small relative to Navy military expended materials or fragments of military expended materials, and direct ingestion of plastics is unlikely.

The only material that could impact marine invertebrates via sediment is plastics. Harmful chemicals in plastics interfere with metabolic and endocrine processes in many plants and animals (Derraik 2002). Potentially harmful chemicals in plastics are not readily adsorbed to marine sediments; instead, marine invertebrates are most at risk via ingestion or bioaccumulation (Section 3.8.3.5, Ingestion Stressors; this section; and Section 3.3, Marine Habitats). Because plastics retain many of their chemical properties as they are physically degraded into microplasticparticles (Singh and Sharma 2008), the exposure risks to marine invertebrates are dispersed over time. Marine invertebrates could be indirectly impacted by chemicals from plastics but, absent bioaccumulation, these impacts would be limited to direct contact with the material. Because of these conditions, population-level impacts on marine invertebrates attributable to Navy expended materials are likely to be inconsequential and not detectable.

Pursuant to the ESA, secondary stressors from training and testing activities under the No Action Alternative, Alternative 1, and Alternative 2 would have no effect on ESA-listed coral species.

3.8.3.6.5 Substressor Impact on Sedentary Invertebrate Beds and Reefs as Essential Fish Habitat (Preferred Alternative)

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of metal, chemical, and other material byproducts, and secondary physical disturbances during training and testing activities, will have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The use of explosives, explosive byproducts, and unexploded ordnance during training and testing activities may have an adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The EFHA states that substressor impacts on invertebrate beds or reefs would be minimal and short-term within the Study Area.

3.8.4 Summary of Potential Impacts on Marine Invertebrates

3.8.4.1 Combined Impacts of All Stressors

This section evaluates the potential for combined impacts of all the stressors from the proposed action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the sections above. Stressors associated with Navy training and testing activities do not typically occur in isolation but rather occur in some combination. For example, mine neutralization activities include elements of acoustic, physical disturbance and strike, entanglement, ingestion, and secondary stressors that are all coincident in space and time. An analysis of the combined impacts of all stressors considers the potential consequences of aggregate exposure to all stressors and the repetitive or additive consequences of exposure over multiple years. This analysis makes the reasonable assumption that the majority of exposures to stressors are non-lethal, and instead focuses on consequences potentially impacting the organism's fitness (e.g., physiology, behavior, reproductive potential).

It is unlikely that mobile or migratory marine invertebrates that occur within the water column would be exposed to multiple activities during their lifespan because they are relatively short-lived, and most Navy training and testing activities impact small widely-dispersed areas. It is much more likely that stationary organisms or those that only move over a small range (e.g., corals, worms, and sea urchins) would be exposed to multiple activities because many Navy activities recur in the same location (e.g., gunnery and mine warfare).

Multiple stressors can co-occur with marine invertebrates in two general ways. The first would be if a marine invertebrate were exposed to multiple sources of stress from a single activity. The second is exposure to a combination of stressors over the course of the organism's life. Both general scenarios are more likely to occur where training and testing activities are concentrated. The key difference between the two scenarios is the amount of time between exposures to stressors. Time is an important factor because some stressors develop over a long period while others occur and pass quickly (e.g., dissolution of secondary stressors into the sediment versus physical disturbance). Similarly, time is an important factor for the organism because subsequent disturbances or injuries often increase the time needed for the organism to recover to baseline behavior/physiology, extending the time that the organism's fitness is impacted.

Marine invertebrates are susceptible to multiple stressors, and susceptibilities of many species are enhanced by additive or synergistic effects of multiple stressors. The global decline of corals, for example, is driven primarily by synergistic impacts of pollution, ecological consequences of overfishing, and climate change. As discussed in the analyses above, marine invertebrates are not particularly susceptible to energy, entanglement, or ingestion stressors resulting from Navy activities; therefore, the opportunity for Navy stressors to result in additive or synergistic consequences is most likely limited to acoustic, physical strike and disturbance, and secondary stressors.

Despite uncertainty in the nature of consequences resulting from combined impacts, the location of potential combined impacts can be predicted with more certainty because combinations are much more likely in locations that training and testing activities are concentrated. However, analyses of the nature of potential consequences of combined impacts of all stressors on marine invertebrates remain largely qualitative and speculative. Where multiple stressors coincide with marine invertebrates, the likelihood of a negative consequence is elevated but it is not feasible to predict the nature of the consequence or its likelihood because not enough is known about potential additive or synergistic interactions. Even for shallow-water coral reefs, an exceptionally well-studied resource, predictions of the consequences of multiple stressors are semi-quantitative and generalized predictions remain qualitative (Hughes and Connell 1999; Jackson 2008; Norström et al. 2009). It is also possible that Navy stressors will combine with non-Navy stressors, and this is qualitatively discussed in Chapter 4 (Cumulative Impacts).

3.8.4.2 Endangered Species Act Determinations

Table 3.8-4 summarizes the Navy's determination of effect on ESA-listed marine invertebrates for each stressor based on the previous analysis sections. Accordingly, the Navy is including the 4 listed species of corals in the Section 7 ESA consultation with NMFS. No other ESA-listed invertebrate species occurs within the Study Area.

3.8.4.3 Essential Fish Habitat Determinations

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other acoustic sources; vessel noise; swimmer defense airguns; weapons firing noise; vessel movement; in-water devices; and metal, chemical, or other material byproducts will have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The use of explosives, electromagnetic sources, military expended materials, seafloor devices, and explosives and explosive byproducts may have an adverse effect on EFH by reducing the quality and quantity of sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern. The EFHA states that individual stressor impacts were all either no effect, or minimal and ranged in duration from temporary to permanent, depending on the stressor.

Table 3.8-4: Summary of Endangered Species Act Determinations for Marine Invertebrates for the Preferred Alternative (Alternative 1)

Stressor		ESA-listed Corals
Acoustic Stressors		
Sonar and Other Active Acoustic Sources	Training Activities	May affect
	Testing Activities	May affect
Explosives and Other Impulsive Acoustic Sources	Training Activities	May affect
	Testing Activities	May affect
Energy Stressors		
Electromagnetic Devices	Training Activities	No Effect
	Testing Activities	No Effect
Physical Disturbance and Strike Stressors		
Vessels and In-water Devices	Training Activities	May affect
	Testing Activities	May affect
Military Expended Materials	Training Activities	May affect
	Testing Activities	May affect
Seafloor devices	Training Activities	No Effect
	Testing Activities	No Effect
Entanglement Stressors		
Fiber Optic Cables and Guidance Wires	Training Activities	No Effect
	Testing Activities	No Effect
Decelerators/parachutes	Training Activities	No Effect
	Testing Activities	No Effect
Ingestion Stressors		
Military Expended Materials	Training Activities	No Effect
	Testing Activities	No Effect
Secondary Stressors		
Explosives, Explosive Byproducts, Unexploded Ordnance, Metals, Chemicals, and Other Materials	Training Activities	No Effect
	Testing Activities	No Effect

Note: ESA = Endangered Species Act

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3.9 Fish

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3.9 FISH

FISH SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following have been analyzed for fish:

- Acoustic (sonar and other active acoustic sources; underwater explosives; swimmer defense airguns; weapons firing, launch, and impact noise; vessel noise; and aircraft noise)
- Energy (electromagnetic devices)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, and seafloor devices)
- Entanglement (fiber optic cables and guidance wires, and decelerators/parachutes)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary (impacts associated with sediments and water quality)

Preferred Alternative (Alternative 1)

- Acoustic: Pursuant to the Endangered Species Act (ESA), the use of sonar and other non-impulse acoustic sources may affect but is not likely to adversely affect ESA-listed scalloped hammerhead sharks. The use of explosives and other impulse acoustic sources may affect and is likely to adversely affect ESA-listed scalloped hammerhead sharks.
- Energy: Pursuant to the ESA, the use of electromagnetic devices may affect but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.
- Physical Disturbance and Strike: Pursuant to the ESA, the use of vessels and in-water devices, military expended materials, and seafloor devices would have no effect on ESA-listed scalloped hammerhead sharks.
- Entanglement: Pursuant to the ESA, the use of fiber optic cables, guidance wires, and parachutes may affect but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.
- Ingestion: Pursuant to the ESA, the potential for ingestion of military expended materials may affect but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.
- Secondary: Pursuant to the ESA, secondary stressors may affect, but are not likely to adversely affect, ESA-listed scalloped hammerhead sharks.
- Pursuant to the Essential Fish Habitat (EFH) requirements, the use of sonar and other active acoustic sources, explosives, and electromagnetic devices may have a minimal and temporary adverse effect on the fishes that occupy water column EFH.

3.9.1 INTRODUCTION

This section analyzes the potential impacts of the Proposed Action on fish found in the Mariana Islands Training and Testing (MITT) Study Area (Study Area) and provides a synopsis of the United States (U.S.) Department of the Navy's (Navy's) determinations of the impacts of the Proposed Action on fish. Section 3.9.1 (Introduction) introduces the Endangered Species Act (ESA) species and taxonomic groups that occur in the Study Area. Section 3.9.2 (Affected Environment) discusses the baseline affected environment. The complete analysis of environmental consequences is in Section 3.9.3 (Environmental Consequences) and the potential impacts of the Proposed Action on fish are summarized in Section 3.9.4 (Summary of Potential Impacts on Fish).

For this Environmental Impact Statement (EIS)/Overseas EIS (OEIS), marine fishes are evaluated as groups of species characterized by either distribution, morphology (body type), or behavior relevant to the stressor being evaluated in Section 3.9.3 (Environmental Consequences). Activities are evaluated for their potential effect on all fishes in general.

Marine fish species that are regulated under Magnuson-Stevens Fishery Conservation and Management Act are discussed in Section 3.9.1.3 (Federally Managed Species). Additional general information on the biology, life history, distribution, and conservation of marine fishes can be found on the following websites, as well as many others:

- National Marine Fisheries Services (NMFS), Office of Protected Resources (including ESA-listed species distribution maps)
- Regional Fishery Management Councils
- International Union for Conservation of Nature
- EFH Text Descriptions

Fishes are not distributed uniformly throughout the Study Area but are closely associated with a variety of habitats. Some species, such as large sharks, salmon, tuna, and billfishes, range across thousands of square miles; others, such as gobies and reef fishes, have small home ranges and restricted distributions (Helfman et al. 2009). The movements of some open-ocean species may never overlap with coastal fishes that spend their lives within several hundred feet of the shore. The distribution and specific habitats in which an individual of a single fish species occurs may be influenced by its developmental stage, size, sex, reproductive condition, and other factors. There are approximately 1,106 marine fish species in the coastal zone of the Study Area (Myers and Donaldson 2003).

For analyses of impacts on those habitats included as EFH within the Study Area, refer to Sections 3.3 (Marine Habitats), 3.7 (Marine Vegetation), and 3.8 (Marine Invertebrates).

3.9.1.1 Endangered Species Act Species

There is only one marine fish species, scalloped hammerhead shark (*Sphyrna* lewini), in the Study Area that is listed as threatened under the ESA (Table 3.9-1 and Section 3.9.2.3, Scalloped Hammerhead Shark). Two species are listed as a candidate that may be listed as threatened or endangered in the future, and one species is listed as a species of concern. The NMFS has some concerns regarding status and threats for species of concern, but insufficient information is available to indicate a need to list the species under the ESA. Species of concern status does not carry any procedural or substantive protections under the ESA. Marine fishes listed under the ESA as threatened, candidate species, and species of concern are listed in Table 3.9-1. All the species listed in Table 3.9-1 have been on decline because of impacts from fishing (including night spear fishing, bycatch, and illegal fishing activities) and habitat degradation.

Table 3.9-1: Endangered Species Act Listed and Special Status Fish Species in the Mariana Islands Training and Testing Study Area

Species Name and Regulatory Status			Presence in Study Area	
Common Name	**Scientific Name**	**Endangered Species Act Status**	**Open Ocean**	**Coastal Ocean**
Scalloped hammerhead shark	*Sphyrna lewini*	Threatened (Indo-West Pacific Distinct Population Segment)	Yes	Yes
Humpheaded wrasse	*Cheilinus undulatus*	Candidate Species	No	Yes
Great hammerhead shark	*Sphyrna mokarran*	Candidate Species	Yes	Yes
Bumphead parrotfish	*Bolbometopon muricatum*	Species of Concern	No	Yes

3.9.1.2 Taxonomic Groups

Groups of marine fish are provided in Table 3.9-2 and are described further in Section 3.9.2 (Affected Environment). These fish groups are based on the organization presented in Helfman et al. (1997), Moyle and Cech (1996), and Nelson (2006). These groupings are intended to organize the extensive and diverse list of fish that occur in the Study Area, as a means to structure the analysis of potential impacts to fish with similar ecological niches, behavioral characteristics, and habitat preferences. Exceptions to these generalizations exist within each group, and are noted wherever appropriate in the analysis of potential impacts.

Table 3.9-2: Major Taxonomic Groups of Marine Fishes within the Mariana Islands Training and Testing Study Area

Major Marine Fish Groups[1]		Vertical Distribution Within Study Area	
Common Name (Taxonomic Group)	**Description**	**Open Ocean**	**Coastal Waters**
Jawless fishes (order Myxiniformes and order Petromyzontiformes)	Primitive fishes with an eel-like body shape that feed on dead fishes or are parasitic on other fishes	Water column, seafloor	Seafloor
Sharks, skates, rays, and chimaeras (class Chondrichthyes)	Cartilaginous (non-bony) fishes, many of which are open-ocean predators	Surface, water column, seafloor	Surface, water column, seafloor
Eels and bonefishes (order Anguilliformes, order Elopiformes)	Undergo a unique willow leaf-shaped larval stage with a small head and often an elongated body; very different from other fishes	Surface, water column, seafloor	Surface, water column, seafloor
Herrings (order Clupeiformes)	Commercially valuable schooling plankton eaters such as herrings, sardines, menhaden, and anchovies	Surface, water column	Surface, water column
Dragonfishes and lanternfishes (orders Stomiiformes and Myctophiformes)	Largest group of deepwater fishes, some have adaptations for low-light conditions	Water column, seafloor	Water column, seafloor
Greeneyes, lizardfishes, lancetfishes, and telescopefishes (order Aulopiformes)	Have both primitive and advanced features of marine fishes; includes both coastal and estuarine species, as well as deepsea fish that occur in midwaters and along the bottom.	Seafloor	Water column, seafloor
Cods (orders Gadiformes and Ophidiiformes)	Are associated with bottom habitats, also includes some deepwater groups. Most have a distinctive barbel (a slender tactile organ) below the mouth.	Water column, seafloor	Water column, seafloor
Toadfishes and anglerfishes (orders Batrachoidiformes and Lophiiformes)	Includes the sound-producing toadfishes and the anglerfishes, a classic lie-in-wait predator	Seafloor	Seafloor
Mullets, silversides, and needlefishes (orders Mugiliformes, Atheriniformes, and Beloniformes)	Small-sized nearshore/coastal fishes (within 3 nm of shoreline), primarily feed on organic debris; also includes the surface-oriented flyingfishes	Surface	Surface, water column, seafloor
Oarfishes, squirrelfishes, dories (orders Lampridiformes, Beryciformes, Zeiformes)	Primarily open-ocean or deepwater fishes, except for squirrelfishes (reef-associated)	Surface, water column, seafloor	Surface, water column, seafloor

Table 3.9-2: Major Taxonomic Groups of Marine Fishes within the Mariana Islands Training and Testing Study Area (continued)

Major Marine Fish Groups[1]		Vertical Distribution Within Study Area	
Common Name (Taxonomic Group)	**Description**	**Open Ocean**	**Coastal Waters**
Pipefishes and seahorses (order Gasterosteiformes)	Small mouth with tubular snout and armor like scales; males care for young in nests or pouches	-	Surface, water column, seafloor
Scorpionfishes (order Scorpaeniformes)	Bottom dwelling with modified pectoral fins to rest on the bottom. Many are venomous.	Seafloor	Seafloor
Snappers, drums, and croakers (families Sciaenidae and Lutjanidae)	Important gamefishes and common predators in all marine waters; sciaenids produce sounds with their swim bladders	Surface, water column, seafloor	Surface, water column, seafloor
Groupers and seabasses (order Perciformes,[2] with representative families; Serranidae)	Important gamefish with vulnerable conservation status; in some species, individuals change from female to male as they mature.	Water column, seafloor	Surface, water column, seafloor
Wrasses, damselfishes (family Pomacentridae), and parrotfishes (families Labridae and Scaridae)	Primarily reef-associated fish; in some species, individuals change from female to make as they mature.	-	Surface, water column, seafloor
Gobies and blennies (families Gobiidae and Blennidae)	Gobies are the largest and most diverse family of marine fish, mostly found in bottom habitats of coastal areas.	Surface, water column, seafloor	Surface, water column, seafloor
Jacks, tunas, mackerels, and billfish (order Perciformes,[2] with representative families: Carangidae, Scombridae, Xiphiidae, and Istiophoridae)	Highly migratory predators found near the surface; commercially valuable fisheries.	Surface, water column, seafloor	Surface, water column
Flounders (order Pleuronectiformes)	Flatfish lack swim bladders, are well camouflaged, and occur in bottom habitats throughout the world.	Seafloor	Seafloor
Triggerfishes, puffers, and molas (order Tetraodontiformes)	Unique body shapes and characteristics to deter predators (e.g., spines); includes ocean sunfish, the largest bony fish	Surface, water column, seafloor	Surface, water column, seafloor

[1] Taxonomic groups are based on the following commonly accepted references (Moyle and Cech 1996; Helfman et al. 1997; Nelson 2006).
[2] Order Perciformes includes approximately 40 percent of all bony fish and includes highly diverse fish. Representative families are included here to reflect this diversity.
Notes: nm = nautical miles, Study Area = Mariana Islands Training and Testing Study Area

3.9.1.3 Federally Managed Species

The fisheries of the United States are managed within a framework of overlapping international, federal, state, interstate, and tribal authorities. Individual states and territories generally have jurisdiction over fisheries in marine waters within 3 nautical miles (nm) (12 nm for territories) of their coast. Federal jurisdiction includes fisheries in marine waters inside the U.S. Exclusive Economic Zone, which encompasses the area from the outer boundary of state or territorial waters out to 200 nm offshore of any U.S. coastline, except where intersected closer than 200 nm by bordering countries (National Oceanic and Atmospheric Administration 1996).

The Magnuson-Stevens Fishery Conservation and Management Act and Sustainable Fisheries Act (see Section 3.0.1.1, Federal Statutes) led to the formation of eight fishery management councils that share authority with NMFS to manage and conserve the fisheries in federal waters. Essential Fish Habitat is also identified and managed under this act. For analyses of impacts on those habitats included as EFH within the Study Area, refer to Sections 3.3 (Marine Habitats), 3.7 (Marine Vegetation), and 3.8 (Marine Invertebrates). Together with NMFS, the councils maintain fishery management plans for species or species groups to regulate commercial and recreational fishing within their geographic regions. The Study Area is under the jurisdiction of the Western Pacific Regional Fishery Management Council.

Federally managed marine fish species are listed in Table 3.9-3. These species are also given consideration as recreationally and commercially important species in the analysis of impacts in Section 3.9.3 (Environmental Consequences). The analysis of impacts on commercial and recreational fisheries is provided in Section 3.12 (Socioeconomic Resources).

Table 3.9-3: Federally Managed Fish Species within the Mariana Islands Training and Testing Study Area, Listed under Each Fishery Management Unit

Western Pacific Regional Fishery Management Council	
Marianas Bottomfish Management Unit	
Common Name	**Scientific Name**
Amberjack	*Seriola dumerili*
Black trevally/jack	*Caranx lugubris*
Blacktip grouper	*Epinephelus fasciatus*
Blueline snapper	*Lutjanus kasmira*
Giant trevally/jack	*Caranx ignobilis*
Gray snapper	*Aprion virescens*
Lunartail grouper	*Variola louti*
Pink snapper	*Pristipomoides filamentosus*
Pink snapper	*Pristipomoides flavipinnis*
Red snapper/silvermouth	*Aphareus rutilans*
Red snapper/buninas agaga	*Etelis carbunculus*
Red snapper/buninas	*Etelis coruscans*
Redgill emperor	*Lethrinus rubrioperculatus*
Snapper	*Pristipomoides zonatus*
Yelloweye snapper	*Pristipomoides flavipinnis*
Yellowtail snapper	*Pristipomoides auricilla*
Marianas Coral Reef Ecosystem Management Unit	
Banded goatfish	*Parupeneus spp.*
Bantail goatfish	*Upeneus arge*
Barred flag-tail	*Kuhlia mugil*
Barred thicklip	*Hemigymnus fasciatus*
Bigeye	*Priacanthus hamrur*
Bigeye scad	*Selar crumenophthalmus*

Table 3.9-3: Federally Managed Fish Species within the Mariana Islands Training and Testing Study Area, Listed under Each Fishery Management Unit (continued)

Western Pacific Regional Fishery Management Council	
Marianas Coral Reef Ecosystem Management Unit (continued)	
Common Name	**Scientific Name**
Bignose unicornfish	*Naso vlamingii*
Bigscale soldierfish	*Myripristis berndti*
Black tongue unicornfish	*Naso hexacanthus*
Black triggerfish	*Melichthys niger*
Blackeye thicklip	*Hemigymnus melapterus*
Blackstreak surgeonfish	*Acanthurus nigricauda*
Blacktip reef shark	*Carcharhinus melanopterus*
Blotcheye soldierfish	*Myripristis murdjan*
Blue-banded surgeonfish	*Acanthurus lineatus*
Blue-lined squirrelfish	*Sargocentron tiere*
Bluespine unicornfish	*Naso unicornus*
Brick soldierfish	*Myripristis amaena*
Bronze soldierfish	*Myripristis adusta*
Cigar wrasse	*Cheilio inermis*
Clown triggerfish	*Balistoides conspicillum*
Convict tang	*Acanthurus triostegus*
Crown squirrelfish	*Sargocentron diadema*
Dash-dot goatfish	*Parupeneus barberinus*
Dogtooth tuna	*Gymnosarda unicolor*
Doublebar goatfish	*Parupeneus bifasciatus*
Engel’s mullet	*Moolgarda engeli*
Floral wrasse	*Cheilinus chlorourus*
Forktail rabbitfish	*Siganus aregentus*
Fringelip mullet	*Crenimugil crenilabis*
Galapagos shark	*Carcharhinus galapagensis*
Giant moray eel	*Gymnothorax javanicus*
Glasseye	*Heteropriacanthus cruentatus*
Golden rabbitfish	*Siganus guttatus*
Gold-spot rabbitfish	*Siganus punctatissimus*
Gray unicornfish	*Naso caesius*
Great barracuda	*Sphyraena barracuda*
Grey reef shark	*Carcharhinus amblyrhynchos*
Heller’s barracuda	*Sphyraena helleri*
Humphead parrotfish	*Bolbometopon muricatum*
Humpnose unicornfish	*Naso tuberosus*
Longface wrasse	*Hologynmosus doliatus*

Table 3.9-3: Federally Managed Fish Species within the Mariana Islands Training and Testing Study Area, Listed under Each Fishery Management Unit (continued)

Western Pacific Regional Fishery Management Council	
Marianas Coral Reef Ecosystem Management Unit (continued)	
Common Name	**Scientific Name**
Mackerel scad	*Decapterus macarellus*
Mimic surgeonfish	*Acanthurus pyroferus*
Multi-barred goatfish	*Parupeneus multifaciatus*
Napoleon wrasse	*Cheilinus undulates*
Orange-spot surgeonfish	*Acanthurus olivaceus*
Orangespine unicornfish	*Naso lituratus*
Orangestriped triggerfish	*Balistapus undulates*
Pacific longnose parrotfish	*Hipposcarus longiceps*
Parrotfish	*Scarus spp.*
Pearly soldierfish	*Myripristis kuntee*
Pinktail triggerfish	*Melichthys vidua*
Razor wrasse	*Xyrichtys pavo*
Red-breasted wrasse	*Cheilinus fasciatus*
Ring-tailed wrasse	*Oxycheilinus unifasciatus*
Ringtail surgeonfish	*Acanthurus blochii*
Rudderfish	*Kyphosus biggibus*
Rudderfish	*Kyphosus cinerascens*
Rudderfish	*Kyphosus vaigienses*
Saber or long jaw squirrelfish	*Sargocentron spiniferum*
Scarlet soldierfish	*Myripristis pralinia*
Scribbled rabbitfish	*Siganus spinus*
Side-spot goatfish	*Parupeneus pleurostigma*
Silvertip shark	*Carcharhinus albimarginatus*
Spotfin squirrelfish	*Neoniphon spp.*
Spotted unicornfish	*Naso brevirostris*
Stareye parrotfish	*Calotomus carolinus*
Striped bristletooth	*Ctenochaetus striatus*
Stripped mullet	*Mugil cephalus*
Surge wrasse	*Thalassoma purpureum*
Tailspot squirrelfish	*Sargocentron caudimaculatum*
Threadfin	*Polydactylus sexfilis*
Three-spot wrasee	*Halicoeres trimaculatus*
Titan triggerfish	*Balistoides viridescens*
Triple-tail wrasee	*Cheilinus trilobatus*
Twospot bristletooth	*Ctenochaetus binotatus*
Undulated moray eel	*Gymnothorax undulatus*
Vermiculate rabbitfish	*Siganus vermiculatus*

Table 3.9-3: Federally Managed Fish Species within the Mariana Islands Training and Testing Study Area, Listed under Each Fishery Management Unit (continued)

Western Pacific Regional Fishery Management Council	
Marianas Coral Reef Ecosystem Management Unit (continued)	
Common Name	**Scientific Name**
Violet soldierfish	*Myripristis violacea*
White-lined goatfish	*Parupeneus ciliatus*
White-spotted surgeonfish	*Acanthurus guttatus*
Whitebar surgeonfish	*Acanthurus leucopareius*
Whitecheek surgeonfish	*Acanthurus nigricans*
Whitemargin unicornfish	*Naso annulatus*
Whitepatch wrasse	*Xyrichtys aneitensis*
Whitetip reef shark	*Triaenodon obesus*
Whitetip soldierfish	*Myripristis vittata*
Yellow goatfish	*Mulloidichthys spp.*
Yellow tang	*Zebrasoma flavescens*
Yellowfin goatfish	*Mulloidichthys vanicolensis*
Yellowfin soldierfish	*Myripristis chryseres*
Yellowfin surgeonfish	*Acanthurus xanthopterus*
Yellowmarfin moray eel	*Gymnothorax flavimarginatus*
Yellowsaddle goatfish	*Parupeneus cyclostomas*
Yellowstripe goatfish	*Mylloidichthys flaviolineatus*
Guam and Northern Mariana Islands Pelagic Fisheries	
Dogtooth tuna	*Gymnosarda unicolor*
Double-lined mackerel	*Grammatorcynus bilineatus*
Kawakawa	*Euthynnus affinis*
Mahi	*Coryphaena hippurus*
Oilfish	*Ruvettus pretiosus*
Pacific blue marlin	*Makaira mazara*
Rainbow runner	*Elagatis bipinnulatus*
Skipjack tuna	*Katsuwonus pelamis*
Wahoo	*Acanthocybium solandri*
Yellowfin tuna	*Thunnus albacares*

3.9.2 Affected Environment

The distribution and abundance of fishes depends greatly on the physical and biological factors of the marine ecosystem, such as salinity, temperature, dissolved oxygen, population dynamics, predator and prey interaction oscillations, seasonal movements, reproduction and life cycles, and recruitment success (the success of an individual reaching a specific size or reproductive stage) (Helfman et al. 2009). A single factor is rarely responsible for the distribution of fish species; more often, a combination of factors is accountable. For example, open-ocean species optimize their growth, reproduction, and survival by tracking gradients of temperature, oxygen, or salinity (Helfman et al. 2009). Another major component in understanding species distribution is the location of highly productive regions, such as frontal zones (i.e., areas where two or more bodies of water with different oceanographic characteristics meet).

These areas concentrate various prey species and their predators and provide visual cues for the location of target species for commercial fisheries (National Marine Fisheries Service 2001).

Environmental variations, such as the Pacific decadal oscillation events (e.g., El Niño or La Niña), change the normal water temperatures in an area which affects the distribution, habitat range, and movement of open-ocean species (Adams et al. 2002; Sabarros et al. 2009; Bakun et al. 2010) within the Study Area. Pacific decadal oscillation events have caused the distribution of fisheries, such as that of the skipjack tuna (*Katsuwonus pelamis*), to shift by more than 620 miles (mi.) (997.8 kilometers [km]) (National Marine Fisheries Service 2001; Stenseth et al. 2002).

Currently 1,106 species of coastal zone fishes are known to occur around the Mariana Islands within the Study Area. The species found in the Study Area include widespread Indo-Pacific species (58 percent), circumtropical species (3.6 percent), Indo-west Pacific and west Pacific species (17.6 percent), west-central Pacific and Pacific Plate species (18.3 percent), and species confined to specific geographic areas, such as Micronesia, the Philippine plate and endemic to the Marianas (2.5 percent) (Myers and Donaldson 2003). Only 10 of the shallow water species found in the Study Area are endemic to the Mariana Islands (Myers and Donaldson 2003). Migratory open-ocean fishes, such as the larger tunas, the billfishes, and some sharks, are able to move across the great distance that separates the Mariana Islands from other islands or continents in the Pacific. Coral reef fish communities in the Mariana Islands tend to show a more consistent pattern of species throughout the year.

3.9.2.1 Hearing and Vocalization

Many researchers have investigated hearing and vocalizations in fish species (e.g., Astrup 1999; Hawkins and Johnstone 1978; Coombs and Popper 1979; Dunning et al. 1992; Astrup and Møhl 1993; Casper et al. 2003; Gregory and Clabburn 2003; Egner and Mann 2005; Casper and Mann 2006; Higgs et al. 2004; Iversen 1967; Iversen 1969; Jørgensen et al. 2005; Kenyon 1996; Meyer et al. 2010; Popper 1981; Popper and Tavolga 1981; Mann et al. 1997; Popper and Carlson 1998; Mann et al. 2001; Myrberg 2001; Ramcharitar et al. 2001; Nestler 2002; Sisneros and Bass 2003; Ramcharitar and Popper 2004; Ramcharitar et al. 2004; Mann et al. 2005; Wright et al. 2005; Ramcharitar et al. 2006; Remage-Healey et al. 2006; Song et al. 2006; Wright et al. 2007; Popper 2008).

All fish have two sensory systems to detect sound in the water: the inner ear, which functions very much like the inner ear in other vertebrates, and the lateral line, which consists of a series of receptors along the fish's body (Popper and Schilt 2008). The inner ear generally detects relatively higher-frequency sounds, while the lateral line detects water motion at low frequencies (below a few hundred Hertz [Hz]) (Hastings and Popper 2005).

Although hearing capability data only exist for fewer than 100 of the 32,000 fish species, current data suggest that most species of fish detect sounds from 50 to 1,000 Hz (low frequency), with few fish hearing sounds above 4,000 Hz (mid-frequency) (Popper 2008). It is believed that most fish have their best hearing sensitivity from 100 to 400 Hz (low frequency) (Popper 2003). Additionally, some clupeids (shad in the subfamily Alosinae) possess very high frequency hearing (i.e., able to detect sounds above 100,000 Hz) (Astrup 1999).

The inner ears of fish are directly sensitive to acoustic particle motion rather than acoustic pressure (for a more detailed discussion of particle motion versus pressure, see Section 3.0.4, Acoustic and Explosives Primer). Although a propagating sound wave contains both pressure and particle motion components, particle motion is most significant at low frequencies (less than a few hundred Hz) and closer to the sound source. However, a fish's gas-filled swim bladder can enhance sound detection by converting acoustic pressure into localized particle motion, which may then be detected by the inner ear. Fish with swim bladders generally have better sensitivity and better high-frequency hearing than fish without swim bladders (Popper and Fay 2010). Some fish also have specialized structures such as small gas bubbles or gas-filled projections that terminate near the inner ear. These fish have been called "hearing specialists," while fish that do not possess specialized structures have been referred to as "generalists" (Popper et al. 2003). In reality many fish species possess a continuum of anatomical specializations that may enhance their sensitivity to pressure (versus particle motion), and thus higher frequencies and lower intensities (Popper and Fay 2010).

Past studies indicated that hearing specializations in marine fish were quite rare (Popper 2003; Amoser and Ladich 2005). However, more recent studies have shown that there are more fish species than originally investigated by researchers, such as deep sea fish, that may have evolved structural adaptations to enhance hearing capabilities (Buran et al. 2005; Deng et al. 2011). Marine fish families Holocentridae (squirrelfish and soldierfish), Pomacentridae (damselfish), Gadidae (cod, hakes, and grenadiers), and Sciaenidae (drums, weakfish, and croakers) have some members that can potentially hear mid-frequency sound up to a few kilohertz (kHz). There is also evidence, based on the structure of the ear and the relationship between the ear and the swim bladder, that at least some deep-sea species, including myctophids, may have hearing specializations and thus be able to hear higher frequencies (Popper 1977; Popper 1980; Deng et al. 2011), although it has not been possible to do actual measures of hearing on these fish from great depths.

Several species of reef fish tested have shown sensitivity to mid-frequencies (i.e., over 1000 Hz). The hearing of the shoulderbar soldierfish (*Myripristis kuntee*) has a mid-frequency auditory range extending toward 3 kHz (Coombs and Popper 1979), while other species tested in this family have been demonstrated to lack this mid-frequency hearing ability (e.g., Hawaiian squirrelfish [*Adioryx xantherythrum*] and saber squirrelfish [*Sargocentron spiniferum*]). Some damselfish can hear frequencies of up to 2 kHz, but with best sensitivity well below 1 kHz (Kenyon 1996; Egner and Mann 2005; Wright et al. 2005; Wright et al. 2007).

Sciaenid research by Ramcharitar et al. (2006) investigated the hearing sensitivity of weakfish (*Cynoscion regalis*). Weakfish were found to detect frequencies up to 2 kHz. The sciaenid with the greatest hearing sensitivity discovered thus far is the silver perch (*Bairdiella chrysoura*), which has responded to sounds up to 4 kHz (Ramcharitar et al. 2004). Other species tested in the family Sciaenidae have been demonstrated to lack this mid-frequency sensitivity.

It is possible that the Atlantic cod (*Gadus morhua,* Family: Gadidae) is also able to detect high-frequency sounds (Astrup and Mohl 1993). However, in Astrup and Mohl's (1993) study it is feasible that the cod was detecting the stimulus using touch receptors that were over driven by very intense fish-finding sonar emissions (Astrup 1999; Ladich and Popper 2004). Nevertheless, Astrup and Mohl (1993) indicated that cod have high frequency thresholds of up to 38 kHz at 185 to 200 decibels (dB) referenced to (re) 1 micropascal (µPa), which likely only allows for detection of odontocete's clicks at distances no greater than 33 to 98 feet (ft.) (10.06 to 29.9 meters [m]) (Astrup 1999).Experiments on several species of the Clupeidae (i.e., herrings, shads, and menhadens) have obtained responses to frequencies between 40 kHz and 180 kHz (Astrup 1999); however, not all clupeid species tested have demonstrated this very high-frequency hearing. Mann et al. (1998) reported that the American shad can detect sounds from 0.1 to 180 kHz with two regions of best sensitivity: one from a low-frequency region (0.2 to 0.8 kHz), and the other from a mid-to high-frequency region (25 kHz to 150 kHz). This shad species has relatively high thresholds (about 145 dB re 1 µPa), which should enable the fish to detect odontocete clicks at distances up to about 656 ft. (199.9 m) (Mann et al. 1997). Likewise, other members of the subfamily Alosinae, including Alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and Gulf menhaden (*Brevoortia patronus*), have upper hearing thresholds exceeding 100 to 120 kHz. In contrast, the Clupeidae bay anchovy (*Anchoa mitchilli*), scaled sardine (*Harengula jaguana*), and Spanish sardine (*Sardinella aurita*) did not respond to frequencies over 4 kHz (Mann et al. 2001; Gregory and Clabburn 2003). Mann et al. (2005) found hearing thresholds of 0.1 kHz to 5 kHz for Pacific herring (*Clupyea pallasii*).

Two other groups to consider are the jawless fish (Superclass: Agnatha—lamprey) and the cartilaginous fish (Class: Chondrichthyes—the sharks, rays, and chimeras). While there are some lampreys in the marine environment, virtually nothing is known about their hearing capability. They do have ears, but these are relatively primitive compared to the ears of other vertebrates, and it is unknown whether they can detect sound (Popper and Hoxter 1987). While there have been some studies on the hearing of cartilaginous fish, these have not been extensive. However, available data suggest detection of sounds from 20 to 1000 Hz, with best sensitivity at lower ranges (Myrberg 2001; Casper et al. 2003; Casper and Mann 2006; Casper and Mann 2009). It is likely that elasmobranchs only detect low-frequency sounds because they lack a swim bladder or other pressure detector.

Most other marine species investigated to date lack mid-frequency hearing (i.e., greater than 1,000 Hz). This notably includes sturgeon species tested to date that could detect sound up to 400 or 500 Hz (Meyer et al. 2010; Lovell et al. 2005) and Atlantic salmon that could detect sound up to about 500 Hz (Hawkins and Johnstone 1978; Kane et al. 2010).

Bony fish can produce sounds in a number of ways and use them for a number of behavioral functions (Ladich 2008). Over 30 families of fish are known to use vocalizations in aggressive interactions, whereas over 20 families known to use vocalizations in mating (Ladich 2008). Sound generated by fish as a means of communication is generally low-frequency below 500 Hz (Slabbekoorn et al. 2010). The air in the swim bladder is vibrated by the sound producing structures (often muscles that are integral to the swim bladder wall) and radiates sound into the water (Zelick et al. 1999). Sprague and Luczkovich (2004) calculated that silver perch (*Bidyanus bidyanus*) can produce drumming sounds ranging from 128 to 135 dB re 1 µPa. Female midshipman fish (genus Porichthys) apparently use the auditory sense to detect and locate vocalizing males during the breeding season (Sisneros and Bass 2003).

3.9.2.2 General Threats

This section covers the existing condition of marine fish as a resource and presents some of the major threats to that resource within the Study Area. Human impacts are widespread throughout the world's oceans, such that very few habitats remain unaffected by human influence (Halpern et al. 2008). These stressors have shaped the condition of marine fish populations, particularly those species with large body sizes and late maturity ages, because these species are especially vulnerable to habitat losses and fishing pressure (Reynolds et al. 2005). This trend is evidenced by the world's shark species, which make up 60 percent of the marine fishes of conservation concern (International Union for Conservation of Nature 2009). Furthermore, the conservation status of only 3 percent of the world's marine fish species has been evaluated, so the threats to the remaining species are largely unknown at this point (Reynolds et al. 2005).

Overfishing is the most serious threat that has led to the listing of ESA-protected marine species (Kappel 2005; Crain et al. 2009), with habitat loss also contributing to extinction risk (Jonsson et al. 1999; Musick et al. 2000; Dulvy et al. 2003; Cheung et al. 2007; Limburg and Waldman 2009). Approximately 30 percent of the fishery stocks managed by the United States are overfished (U.S. Fish and Wildlife Service and National Marine Fisheries Service 2009). Overfishing occurs when fish are harvested in quantities above a sustainable level. Overfishing impacts both targeted species and non-targeted species (or “bycatch” species) that are often important in marine food webs. Bycatch may also include seabirds, turtles, and marine mammals. In recent decades marine fisheries have targeted species lower on the food chain as the abundance of higher-level predators has decreased; some entire marine food webs have collapsed as a result (Pauly and Palomares 2005; Crain et al. 2009). Other factors, such as fisheries-induced evolution and intrinsic vulnerability to overfishing, have been shown to reduce the abundance of some populations (Kuparinen and Merila 2007). Fisheries-induced evolution is a change in genetic composition of the population, such as a reduction in the overall size of fish and individual growth rates resulting from intense fishing pressure. Intrinsic vulnerability describes certain life history traits (e.g., large body size, late maturity age, low growth rate), which increases the susceptibility of a species to overfishing (Cheung et al. 2007).

Pollution primarily impacts coastal fish near the sources of pollution. However, global oceanic circulation patterns result in a considerable amount of marine pollutants and debris scattered throughout the open ocean (Crain et al. 2009). Pollutants in the marine environment that may impact marine fish include organic contaminants (e.g., pesticides, herbicides, polycyclic aromatic hydrocarbons, flame retardants, and oil from run-off), inorganic chemicals (e.g., heavy metals), and debris (e.g., plastics and waste from dumping at sea) (Pew Oceans Commission 2003). High chemical pollutant levels in marine fish may cause behavioral changes, physiological changes, or genetic damage in some species (Pew Oceans Commission 2003; van der Oost et al. 2003; Goncalves et al. 2008; Moore 2008). Bioaccumulation of metals and organic pollutants is also a concern, particularly in terms of human health, because people consume top predators with potentially high pollutant loads. Bioaccumulation is the net buildup of substances (e.g., chemicals or metals) in an organism directly from contaminated water or sediment through the gills or skin, from ingesting food containing the substance (Newman 1998), or from ingestion of the substance itself (Moore 2008).

Entanglement in abandoned commercial and recreational fishing gear has also caused pollution-related declines for some marine fishes; some species are more susceptible to entanglement by marine debris than others (Musick et al. 2000).

Other human-caused stressors on marine fish are invasive species, climate change, aquaculture, energy production, vessel movement, and underwater noise:

- Non-native fish pose threats to native fish when they are introduced into an environment lacking natural predators and then compete with, and prey upon, native marine fish for resources (Whitfield et al. 2007; Crain et al. 2009), such as lionfish in the southeastern United States and the Caribbean.
- Global climate change is contributing to a shift in fish distribution from lower to higher latitudes (Glover and Smith 2003; Brander 2007; Limburg and Waldman 2009; Brander 2010; Dufour et al. 2010; Wilson et al. 2010).
- The threats of aquaculture operations on wild fish populations are reduced water quality, competition for food, predation by escaped or released farmed fish, spread of disease, and reduced genetic diversity (Ormerod 2003; Kappel 2005; Hansen and Windsor 2006). The National Oceanic and Atmospheric Administration is developing an aquaculture policy aimed at

promoting sustainable marine aquaculture (National Oceanic and Atmospheric Administration 2011).

- Energy production and offshore activities associated with power-generating facilities result in direct and indirect fish injury or mortality from two primary sources; including cooling water withdrawal that results in entrainment mortality of eggs and larvae and impingement mortality of juveniles and adults (U.S. Environmental Protection Agency 2004), and offshore wind energy development that results in acoustic impacts (Madsen et al. 2006).
- Vessel strikes pose threats to some large, slow-moving fish at the surface, although this is not considered a major threat to most marine fish (Kappel 2005). However, some species such as whale sharks, basking sharks, ocean sunfish, and manta rays have been struck by vessels (The Hawaii Association for Marine Education and Research Inc. 2005; Rowat et al. 2007; Stevens 2007; National Marine Fisheries Service 2010).
- Underwater noise is a threat to marine fish. However, the physiological and behavioral responses of marine fish to underwater noise (Popper 2003; Codarin et al. 2009; Slabbekoorn et al. 2010; Wright et al. 2010) have been investigated for only a limited number of fish species (Popper and Hastings 2009a, b). In addition to vessels, other sources of underwater noise include pile-driving activity (Feist et al. 1992; California Department of Transportation 2001; Nedwell et al. 2003; Popper et al. 2006; Carlson et al. 2007; Mueller-Blenkle et al. 2010, Halvorsen et al. 2012a) and seismic activity (Popper and Hastings 2009a). Information on fish hearing is provided in Section 3.9.2.1 (Hearing and Vocalization), with further discussion in Section 3.9.3.1 (Acoustic Stressors).

3.9.2.3 Scalloped Hammerhead Shark (*Sphyrna lewini*)

3.9.2.3.1 Status and Management

In August 2011, NMFS received a petition to list the scalloped hammerhead shark as threatened or endangered under the ESA and to designate critical habitat concurrently with the listing (National Marine Fisheries Service 2011). In 2013, based on the best scientific and commercial information available, including the status review report (Miller et al. 2013), and other information available since completion of the status review report, NMFS determined that the species is comprised of six distinct population segments (DPSs) that qualify as species under the ESA: Northwest (NW) Atlantic and Gulf of Mexico (GOM) DPS, Central and Southwest (SW) Atlantic DPS, Eastern Atlantic DPS, Indo-West Pacific DPS, Central Pacific DPS, and Eastern Pacific DPS. After reviewing the best available scientific and commercial information on the DPSs, NMFS determined that two DPSs warrant listing as endangered, the Eastern Atlantic and Eastern Pacific DPSs; two DPSs warrant listing as threatened, the Central and SW Atlantic and Indo-West Pacific DPSs; and two DPSs do not warrant listing at this time, the NW Atlantic and GOM DPS, and the Central Pacific DPS. The Indo-West Pacific DPS is the only one located within the Study Area.

3.9.2.3.2 Habitat and Geographic Range

The scalloped hammerhead shark is circumglobal, occurring in all temperate to tropical waters (Duncan and Holland 2006) from the surface to depths of 512 m (1,600 feet [ft.]) and possibly deeper (Miller et al. 2014). It typically inhabits nearshore waters of bays and estuaries where water temperatures are at least 22 degrees (°) Celsius (C) (72° Fahrenheit [F]) (Castro 1983; Compagno 1984, Ketchum et al. 2014). The scalloped hammerhead shark remains close to shore during the day and moves to deeper waters at night to feed (Bester 1999). A genetic marker study suggests that females typically remain close to coastal habitats, while males are more likely to disperse across larger open ocean areas (Daly-Engel et al. 2012).

3.9.2.3.3 Population and Abundance

NMFS data and information provided in the listing petition suggest that the scalloped hammerhead shark has undergone substantial declines throughout its range (National Marine Fisheries Service 2011). Specific information for scalloped hammerhead shark in the Indo-West Pacific region is unavailable as only data for overall shark population estimates are available. In its 2013 status review, NMFS used two models to estimate the overall population of scalloped hammerhead sharks as ranging from approximately 142,000 to 169,000 individuals in 1981 and between 24,000 and 28,000 individuals in 2005 (Miller et al. 2014).

3.9.2.3.4 Predator and Prey Interactions

Scalloped hammerhead sharks follow daily vertical movement patterns within their home range (Holland et al. 1993; Klimley and Nelson 1984) and feed primarily at night (Compagno 1984). They are a high trophic level predator and feed opportunistically on all types of teleost fish, cephalopods, crustaceans, and rays (Bethea et al. 2011; Compagno 1984; Torres-Rojas et al. 2010; Torres-Rojas et al. 2014; Vaske et al. 2009).

3.9.2.3.5 Species-Specific Threats

The primary threat to the scalloped hammerhead shark is direct take, especially by the foreign commercial shark fin market (National Marine Fisheries Service 2011). Scalloped hammerhead sharks are a principal component of the total shark bycatch in the swordfish and tuna longline fishery and are particularly susceptible to overfishing and bycatch in gillnet fisheries because of schooling habits (Food and Agriculture Organization of the United Nations 2012). Longline mortality for this species is estimated between 91 and 94 percent (National Marine Fisheries Service 2011).

3.9.2.4 Jawless Fishes (Orders Myxiniformes and Petromyzontiformes)

Hagfish (Myxiniformes) are the most primitive fish group (Nelson 2006). In fact, recent taxonomic revisions suggest that Myxiniformes are not fish at all but are a "sister" group to all vertebrates (Nelson 2006). However, jawless fish are generally thought of as fish and are therefore included in this section. Hagfish occur exclusively in marine habitats and are represented by 70 species worldwide in temperate marine locations. This group feeds on dead or dying fishes and have very limited external features often associated with fishes, such as fins and scales (Helfman et al. 2009). The members of this group are important scavengers that recycle nutrients back through the ecosystem.

No lampreys have been recorded in the Study Area, and only one species of hagfish has been recorded at depths greater than 650 ft. (200 m) (Myers and Donaldson 2003).

3.9.2.5 Sharks, Rays, and Chimaeras (Class Chondrichthyes)

The cartilaginous (non-bony) marine fishes of the class Chondrichthyes are distributed throughout the world's oceans, occupying all areas of the water column (Paxton and Eschmeyer 1998). This group is mainly predatory and contains many of the apex predators found in the ocean (e.g., great white shark, mako shark, and tiger shark) (Helfman et al. 1997). The whale shark and basking shark are notable exceptions as filter-feeders. Sharks and rays have some unique features among marine fishes; no swim bladder; protective toothlike scales; unique sensory systems (electroreception, mechanoreception); and some species bear live young in a variety of life history strategies (Moyle and Cech 1996). The subclass Elasmobranchii contains more than 850 marine species, including sharks, rays and skates, spread across nine orders (Nelson 2006). Very little is known about the subclass Holocephali, which contains 58 marine species of chimaeras (Nelson 2006).

Sharks and rays occupy relatively shallow temperate and tropical waters throughout the world. More than half of these species occur in less than 655 ft. (199.6 m) of water, and nearly all are found at depths less than 6,560 ft. (1,999.5 m) (Nelson 2006). Sharks and rays are found in all open-ocean areas and coastal waters of the Study Area (Paxton and Eschmeyer 1998). While most sharks occur in the water column, many rays occur on or near the seafloor. In May 2007, a whale shark was sighted in the Study Area, halfway between Saipan and Farallon de Medinilla (FDM) (Vogt 2008). A manta ray was observed off of Guam in March 2012 during a cetacean survey (HDR EOC 2012). Chimaeras are cool-water benthic marine fishes that are found on seafloors at depths between 260 and 8,500 ft. (79.2 and 2,590.8 m) (Nelson 2006). They may occur in the open-ocean portions of the Study Area (Paxton and Eschmeyer 1998).

3.9.2.6 Eels and Bonefishes (Orders Anguilliformes and Elopiformes)

These fishes have a unique larval stage, called leptocephalus, in which leptocephali grow to much larger sizes during an extended larval period as compared to most other fishes. The eels (Anguilliformes) have an elongated snakelike body; most of the 780 eel species do not inhabit the deep ocean. Eels generally feed on other fishes or small bottom-dwelling invertebrates, but will also take larger organisms (Helfman et al. 1997). Moray eels, snake eels, and conger eels are well represented by many species that occur in the Study Area (Paxton and Eschmeyer 1998). The order Elopiformes include two distinct groups with very different forms: the bonefishes, predators of shallow tropical waters; and the little-known spiny eels, elongated seafloor feeders which feed on decaying organic matter in deep ocean areas (Paxton and Eschmeyer 1998).

Eels are found in all marine habitat types, although most inhabit shallow subtropical or tropical marine habitats (Paxton and Eschmeyer 1998) in the Study Area. The bonefishes and spiny eels occur in deep ocean waters, ranging from 400 to 16,000 ft. (121.9 to 4,876.8 m) within the open-ocean area of the Study Area, throughout the Pacific on the seafloor and in the water column, and bonefish are also found in near-shore habitats (Paxton and Eschmeyer 1998).

3.9.2.7 Sardines and Anchovies (Order Clupeiformes)

Many of the 364 species of the order Clupeiformes are found primarily in the Indo-west Pacific or the western Atlantic. These sardine and anchovy species are one of the most well-defined orders of fishes because of their importance to commercial fisheries (Nelson 2006). This group of fishes swims together (school) to help conserve energy and minimize predation (Brehmer et al. 2007). Herrings account for a large portion of the total worldwide fish catch (United Nations Environment Programme 2005; United Nations Environment Programme 2009). Sardine and anchovies are also an important part of marine food webs because they are the targeted prey for many marine species, including other fishes, birds, and mammals. The clupeids feed on decaying organic matter and plankton (Moyle and Cech 1996).

Clupeiformes are often concentrated in large schools near the surface. They are common in the coastal waters of the Study Area (Paxton and Eschmeyer 1998; Myers and Donaldson 2003).

3.9.2.8 Hatchetfish and Lanternfishes (Orders Stomiiformes and Myctophiformes)

The orders Stomiiformes and Myctophiformes comprise one of the largest groups of the world's deepwater fishes—more than 500 total species, many of which are not very well described in the scientific literature (Nelson 2006). The ecological role of many of these species is also not well understood (Helfman et al. 2009) These fishes are known for their unique body forms (e.g., slender bodies, or disc-like bodies, often possessing light-producing capabilities) and adaptations that likely present some advantages within the deepwater habitats in which they occur (e.g., large mouths, sharp teeth, and sensitive lateral line [sensory] systems) (Haedrich 1996; Koslow 1996; Marshall 1996; Rex and Etter 1998; Warrant and Locket 2004).

Overall the hatchetfish and lanternfishes occur in deep ocean waters, ranging from 3,280 to 16,000 ft. (999.7 to 4,876.8 m), making diurnal migrations within the open ocean area of the Study Area (Froese and Pauly 2010; Paxton and Eschmeyer 1998).

3.9.2.9 Greeneyes, Lizardfishes, Lancetfishes, and Telescopefishes (Order Aulopiformes)

Fishes of the order Aulopiformes are a diverse group that possess both primitive (adipose [fatty] fin, rounded scales) and advanced (unique swim bladder and jawbone) features of marine fishes (Paxton and Eschmeyer 1998). They are common in estuarine and coastal waters to the deep ocean. The lizardfish (Synodontidae), Bombay ducks (Harpadontidae) primarily occur in coastal waters to the outer shelf, where they rest on the bottom and are well camouflaged with the substrate (Paxton and Eschmeyer 1998). Lancetfish (Alepisauridae) are primarily mid-water column fish, but are known from the surface to deep water. Telescopefish are primarily found in deep waters from 1,640 to 3,280 ft. (499.9 to 999.7 m), but they can also be found at shallower depths and may approach the surface at night (Paxton and Eschmeyer 1998).

In general, greeneyes, lizardfishes, and lancetfishes occur in the coastal waters of the Study Area. Telescopefishes and bathysaurids occur primarily in the deeper waters associated with the open-ocean areas of the Study Area (Paxton and Eschmeyer 1998).

3.9.2.10 Cods and Cusk-eels (Orders Gadiformes and Ophidiiformes)

The order Ophidiiformes includes cusk-eels and brotulas, which have long eel-like tapering bodies and are distributed in deepwater areas throughout tropical and temperate oceans (Paxton and Eschmeyer 1998). The characteristics of ophidiiforms are similar to those of the other deepwater groups. Other fishes of this order are also found in shallow waters on coral reefs. In addition, there are several cusk-eel species which are pelagic or found on the continental shelves and slopes.

Cods are generally found near the seafloor and feed on bottom-dwelling organisms. They do not occur in the Study Area (Paxton and Eschmeyer 1998). Cusk-eels occur near the seafloor of the coastal waters and in the open-ocean areas of the Study Area (Paxton and Eschmeyer 1998).

3.9.2.11 Toadfishes and Anglerfishes (Orders Batrachoidiformes and Lophiiformes)

The order Batrachoidiformes includes only the toadfish family. Some species of toadfishes produce and detect sounds by vibrating the swimbladder. They spawn in and around bottom structures and invest a substantial amount of parental care by defending their nests (Moyle and Cech 1996, Paxton and Eschmeyer 1998). The order Lophiiformes includes all of the world’s anglerfishes, goosefishes, frogfishes, batfishes, and deepwater anglerfishes, most of which occur in seafloor habitats of all oceans. Some deepwater anglerfish use highly modified “lures” to attract prey (Koslow 1996; Helfman et al. 2009). The males of these species are small and parasitic, spending their life attached to the side of the female (Helfman et al. 2009). The anglerfishes can be broken into two groups: (1) those that dwell in the deep water (10 families), and (2) those that live on the bottom or attached to drifting seaweed in shallow water (5 families). Toadfish are not found within the Study Area; however, anglerfish are found in the Study Area at depths ranging from 65.5 to 328 ft. (20 to 100 m) (Paxton and Eschmeyer 1998).

3.9.2.12 Mullets, Silversides, Needlefish, and Killifish (Orders Mugiliformes, Atheriniformes, Beloniformes, and Cyprinodontiformes)

Mugiliformes (mullets) contain 71 marine species that occupy coastal marine and estuarine waters of all tropical and temperate oceans. There has been disagreement in the taxonomic classification of this group; some have included this group within the super order Athinerimorpha (Nelson 2006), while others have placed it as a suborder within the Perciformes (Moyle and Cech 1996). Mullets feed on decaying organic matter in estuaries and possess a filter-feeding mechanism with a gizzard-like digestive tract. They feed on the bottom by scooping up food and retaining it in their very small gill rakers (Moyle and Cech 1996). Most species within these groups are important prey for predators in all estuarine habitats within the Study Area.

Most of these fishes are found in tropical or temperate marine waters and occupy shallow habitats near the water surface. An exception to this nearshore distribution includes the flyingfishes and halfbeaks, which occur in the oceanic or shallow seacoast regions where light penetrates, in tropical to warm-temperate regions. The silversides are a small inshore species often found in intertidal habitats. The Cyprinodontiformes include the killifishes that are often associated with intertidal coastal zones and salt marsh habitats and are highly tolerant of pollution. These fishes are found in all coastal waters and open ocean areas of the Study Area (Froese and Pauly 2010; Paxton and Eschmeyer 1998).

3.9.2.13 Oarfishes, Squirrelfishes, and Dories (Orders Lampridiformes, Beryciformes, and Zeiformes)

There are only 19 species in the order Lampridiformes—the oarfishes (Nelson 2006). They exhibit diverse body shapes, and some have a protruding mouth, which allows for a suction feeding technique while feeding on plankton. Other species, including the crestfish, possess grasping teeth used to catch prey. They occur only in the mid-water column of the open ocean, but are rarely observed (Nelson 2006). Fishes in the order Beryciformes are primarily either deepwater or nocturnal species, many of which are poorly described. There are a few shallow water exceptions, including squirrelfishes, which are distributed throughout reef systems in tropical and subtropical marine regions (Nelson 2006). Squirrelfishes are relied upon by some communities who catch their own food (Froese and Pauly 2010). They possess specialized eyes and large mouths and primarily feed on bottom-dwelling crustaceans (Goatley and Bellwood 2009). Very little is known about the order Zeiformes, or dories, which includes some very rare families, many containing only a single species (Paxton and Eschmeyer 1998). Even general information on their biology, ecology, and behavior is limited.

Squirrelfishes are common in coral reef systems in the Study Area. Most of the Lampridiformes and Zeiformes are confined to seafloor regions in all coastal waters of the Study Area, as well as the open-ocean areas at depths of 130 to 330 ft. (39.6 to 100.6 m) (Paxton and Eschmeyer 1994; Moyle and Cech 1996).

3.9.2.14 Pipefishes and Seahorses (Order Gasterosteiformes)

Gasterosteiformes include sticklebacks, pipefishes, and seahorses. Most of these species are found in brackish water (a mixture of seawater and freshwater) throughout the world (Nelson 2006) and occur in surface, water column, and seafloor habitats. Small mouths on a long snout and armorlike scales are characteristic of this group. Most of these species exhibit a high level of parental care, either through nest building (sticklebacks) or brooding pouches (seahorses have a pouch where eggs develop), which results in relatively few young being produced (Helfman et al. 1997). This group also includes the trumpetfishes and cornetfishes, ambush predators, with a large mouth used to capture smaller lifestages of fishes.

This group is associated with tropical and temperate reef systems. They are found in the coastal waters of the Study Area (Paxton and Eschmeyer 1998).

3.9.2.15 Scorpionfishes (Order Scorpaeniformes)

The order Scorpaeniformes is a diverse group of more than 1,400 marine species, all with bony plates or spines near the head. This group contains the scorpionfishes, waspfishes, rockfishes, velvetfishes, pigfishes, sea robins, gurnards, sculpins, snailfishes, and lumpfishes (Paxton and Eschmeyer 1998). Many of these fishes are adapted for inhabiting the seafloor of the marine environment (e.g., modified pectoral fins or suction discs), where they feed on smaller crustaceans and fishes. Sea robins are capable of generating sounds with their swimbladders and are among the noisiest of all fish species within the Study Area (Moyle and Cech 1996).

Scorpionfishes are widely distributed in open-ocean and coastal habitats, at all depths, throughout the world. They occur in all waters of the Study Area. Most occur in depths less than 330 ft. (100.6 m), but others are found in deepwater habitat, down to 7,000 ft. (2,133.6 m) (Paxton and Eschmeyer 1998).

3.9.2.16 Snappers, Drums, and Croakers (Families Sciaenidae and Lutjanidae)

The families Sciaenidae and Lutjanidae include mainly predatory coastal marine fishes, including the recreationally important snappers, drums, and croakers. These fishes are sometimes distributed in schools as juveniles then become more solitary as they grow larger. They feed on fishes and crustaceans. Drums and croakers (Sciaenidae) produce sounds via their swimbladders, which generate a drumming sound. The snappers (Lutjanidae) are generally associated with seafloor habitats and tend to congregate near structured habitats, including natural/artificial reefs and oil platforms (Moyle and Cech 1996). Other representative groups include the brightly colored and diverse forms of reef-associated cardinalfishes, butterflyfishes, angelfishes, dottybacks, and goatfishes (Paxton and Eschmeyer 1998).

Like the scorpionfishes, the drums, snappers, snooks, and temperate basses are widely distributed in open-ocean and coastal habitats throughout the world. They occur in all waters of the Study Area, but are particularly concentrated, and exhibit the most varieties, in depths less than 330 ft. (100.6 m), often associated with reef systems (Paxton and Eschmeyer 1994; Froese and Pauly 2010).

3.9.2.17 Groupers and Sea Basses (Family Serranidae)

The Serranidae are primarily nearshore marine fishes that support recreational and commercial fisheries. Seabasses and groupers are nocturnal predators found primarily within reef systems. They generally possess specialized eyes and large mouths and feed mostly on bottom-dwelling fishes and crustaceans (Goatley and Bellwood 2009). Some groupers and seabasses take advantage of feeding opportunities in the low-light conditions of twilight when countershaded fishes become conspicuous and easier for these predators to locate (Rickel and Genin 2005). Other groupers are active during the daytime and exhibit a variety of opportunistic predatory strategies, such as ambush (Wainwright and Richard 1995) to benefit from mistakes made by prey species. Many of the serranids begin life as females and then become male as they grow larger (Moyle and Cech 1996). This group occurs in all coastal waters of the Study Area, but are mostly concentrated in depths less than 100 ft. (30.5 m) within the Study Area (Moyle and Cech 1996; Paxton and Eschmeyer 1998; Froese and Pauly 2010).

3.9.2.18 Wrasses, Parrotfish, and Damselfishes (Families Labridae, Scaridae, and Pomacentridae)

The suborder Labroidei contains many nearshore marine reef or structure-associated fishes, including the diverse wrasses (Labridae), parrotfishes (Scaridae), and damselfishes (Pomacentridae). Most of the wrasses are conspicuous, brightly colored, coral reef fishes, but others are found in temperate waters. Most are active during the daytime and exhibit a variety of opportunistic predatory strategies, such as ambush (Wainwright and Richard 1995) to capitalize on mistakes made by prey species. Parrotfishes provide important ecological functions to the reef system by grazing on coral and processing sediments (Goatley and Bellwood 2009). Similar to the Serranidae, many wrasses and parrotfishes begin life as females but change into males as they grow larger and exhibit with a variety of reproductive strategies found among the species and between populations (Moyle and Cech 1996). Damselfishes are noted for their territoriality and are brightly colored. This group occurs in all coastal waters of the Study Area, but are mostly concentrated in depths less than 100 ft. (30.5 m) within the Study Area (Moyle and Cech 1996; Paxton and Eschmeyer 1998; Froese and Pauly 2010). This group includes the ESA candidate species, the humpheaded wrasse (Section 3.9.1.1, Endangered Species Act Species).

3.9.2.19 Gobies, Blennies, and Surgeonfishes (Suborders Gobiodei, Blennioidei, and Acanthuroidei)

The seafloor-dwelling gobies (suborder Gobiodei) include Gobiidae, the largest family of marine fishes (Nelson 2006); they exhibit modified pelvic fins that allow them to adhere to various bottom surfaces (Helfman et al. 2009). Fishes of the suborder Blennioidei primarily occupy the intertidal zones throughout the world, including the clinid blennies and the combtooth blennies of the family Blenniidae (Moyle and Cech 1996; Mahon et al. 1998; Nelson 2006). The blennies and gobies primarily feed on seafloor debris. The suborder Acanthuroidei contains the surgeonfishes, moorish idols, and rabbitfishes of tropical reef systems. They have elongated small mouths used to scrape algae from coral. These grazers provide an important function to the reef system by controlling the growth of algae on the reef (Goatley and Bellwood 2009). Some of these species are adapted to target particular prey species; for example, the elongated snouts of butterflyfishes allow them to bite off exposed parts of invertebrates (Leysen et al. 2010).

These fishes occur in all coastal waters of the Study Area, but are mostly concentrated, and exhibit the most varieties, in depths less than 100 ft. (30.5 m) within the Study Area (Moyle and Cech 1996; Paxton and Eschmeyer 1998; Froese and Pauly 2010).

3.9.2.20 Jacks, Tunas, Mackerels, and Billfishes (Families Carangidae, Xiphiidae, and Istiophoridae and Suborder Scombroidei)

The suborder Scombroidei contains some of the most voracious open-ocean predators: the jacks, mackerels, barracudas, billfishes, and tunas (Estrada et al. 2003; Sibert et al. 2006). Many jacks are known to feed nocturnally (Goatley and Bellwood 2009) and in the low light of twilight (Rickel and Genin 2005) by ambushing their prey (Sancho 2000). The open-ocean, highly migratory tunas, mackerels, and billfishes are extremely important to fisheries; they constitute a large component of the total annual worldwide catch by weight, with tunas and swordfish as the most important species (United Nations Environment Programme 2005; United Nations Environment Programme 2009). One unique adaptation found in these fishes is ram ventilation (Wegner et al. 2006). Ram ventilation uses the motion of the fish through the water to increase respiratory efficiency in large, fast-swimming open-ocean fishes (Wegner et al. 2006). Many fishes in this group have large-scale migrations that allow for feeding in highly productive areas, which vary by season (Pitcher 1995).

These fishes occupy the open-ocean areas that comprise the largest area of ocean but make up only about 5 percent of the total marine fishes (Helfman et al. 1997; Froese and Pauly 2010). They are mostly found near the surface, or the upper portion of the water column, located within all coastal waters and open-ocean areas of the Study Area (Paxton and Eschmeyer 1998; Froese and Pauly 2010).

3.9.2.21 Flounders (Order Pleuronectiformes)

The order Pleuronectiformes includes flatfishes (flounders, dabs, soles, and tonguefishes) that are found in all marine seafloor habitats throughout the world (Nelson 2006). Fishes in this group have eyes on either the left side or the right side of the head and are not symmetrical like other fishes (Saele et al. 2004). All flounder species are ambush predators, feeding mostly on other fishes and bottom-dwelling invertebrates (Drazen and Seibel 2007; Froese and Pauly 2010).

This group is widely distributed on the seafloor of open-ocean and coastal habitats throughout the world. They occur in all waters of the Study Area, but are particularly concentrated, and exhibit the most varieties, in depths less than 330 ft. (100.6 m), often associated with sand bottoms within the Study Area (Paxton and Eschmeyer 1998; Froese and Pauly 2010).

3.9.2.22 Triggerfish, Puffers, and Molas (Order Tetraodontiformes)

The fishes in the order Tetraodontiformes are the most advanced group of modern bony fishes. This order includes the triggerfishes, filefishes, puffers, and ocean sunfishes (Nelson 2006). Like the flounders, this group exhibits body shapes unique among marine fishes, including modified spines or other structures advantageous in predator avoidance. The unique body shapes also require the use of a tail swimming style because some species lack the muscle structure and body shape of other fishes. Most of these fishes are active during the daytime and exhibit a variety of strategies for catching prey, such as ambushing their prey (Wainwright and Richard 1995). The ocean sunfishes (*Mola* species) are the largest bony fish and the most prolific vertebrate species, with females producing more than 300 million eggs in a breeding season (Moyle and Cech 1996). The ocean sunfishes occur very close to the surface. They are slow swimming and feed on a variety of plankton (including jellyfish), crustaceans, and fishes (Froese and Pauly 2010). Their only natural predators are sharks, orcas, and sea lions (Helfman et al. 1997).

Most species within this group are associated with reef systems. This group is widely distributed in tropical and temperate bottom or mid-water column habitats (open-ocean and coastal) throughout the world. They occur in all waters of the Study Area, but are particularly concentrated, and exhibit the most varieties, in depths less than 330 ft. (100.6 m), often associated with reefs or structured seafloor habitats (Paxton and Eschmeyer 1998; Froese and Pauly 2010). One major exception is for the molas (ocean sunfishes), which occur at the surface in all open-ocean areas (Helfman et al. 1997).

3.9.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact marine fishes known to occur within the Study Area. Chapter 2 presents the baseline and proposed training and testing activity locations for each alternative (including number of activities and ordnance expended). The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to marine fish in the Study Area and analyzed below include the following:

- Acoustic (sonar and other active acoustic sources; underwater explosives; swimmer defense airguns; weapons firing, launch, and impact noise; vessel noise; and aircraft noise)
- Energy (electromagnetic devices)
- Physical disturbance and strike (vessels, in-water devices, military expended materials, seafloor devices)
- Entanglement (fiber optic cables and guidance wires, decelerators/parachutes)

- Ingestion (munitions and military expended materials other than munitions)
- Secondary (impacts associated with sediments and water quality)

Each of these components was carefully analyzed for potential impacts on fishes within the stressor categories contained in this section. The specific analysis of the training and testing activities considers these components within the context of geographic location and overlap of marine fish resources. In addition to the analysis here, the details of all training and testing activities, stressors, components that cause the stressor, and geographic overlap within the Study Area are included in Chapter 2 (Description of Proposed Action and Alternatives).

3.9.3.1 Acoustic Stressors

The following sections analyze potential impacts on fish from proposed activities that involve acoustic stressors (non-impulse and impulse).

3.9.3.1.1 Analysis Background and Framework

This section is largely based on a technical report prepared for the Navy: *Effects of Mid- and High-Frequency Sonars on Fish* (Popper 2008). Additionally, Popper and Hastings (2009a) provide a critical overview of some of the most recent research regarding potential effects of anthropogenic sound on fish.

Studies of the effects of human-generated sound on fish have been reviewed in numerous places (e.g., National Research Council 1994; National Research Council 2003; Popper 2003; Popper et al. 2004; Hastings and Popper 2005; Popper 2008; Popper and Hastings 2009a, b). Most investigations, however, have been in the gray literature (non peer-reviewed reports). See Hastings and Popper (2005), Popper (2008), and Popper and Hastings (2009a, b) for extensive critical reviews of this material.

Fish have been exposed to short-duration, high-intensity signals such as those that might be found near high-frequency sonar, pile driving, or a seismic airgun survey. Such studies examined short-term effects that could result in death to the exposed fish, as well as hearing loss and long-term consequences. Recent experimental studies have provided additional insight into the issues (e.g., Govoni et al. 2003; McCauley et al. 2003; Popper et al. 2005; Popper et al. 2007; Doksaeter et al. 2009; Kane et al. 2010).

3.9.3.1.1.1 Direct Injury

<u>Non-Impulse Acoustic Sources</u>

Potential direct injuries from non-impulse sound sources, such as sonar, are unlikely because of the relatively lower peak pressures and slower rise times than potentially injurious sources such as explosives. Non-impulse sources also lack the strong shock wave such as that associated with an explosion. Therefore, direct injury is not likely to occur from exposure to non-impulse sources such as sonar, vessel noise, or subsonic aircraft noise. The theories of sonar-induced acoustic resonance, neurotrauma, and lateral line system injury are discussed below, although these phenomena are difficult to recreate under real-world conditions and are therefore unlikely to occur.

Two unpublished reports examined the effects of mid-frequency sonar-like signals (1.5–6.5 kHz) on larval and juvenile fish of several species (Jørgensen et al. 2005; Kvadsheim and Sevaldsen 2005). In the first study, Kvadsheim and Sevaldsen (2005) showed that intense sonar activities in herring spawning areas affected less than 0.3 percent of the total juvenile stock. The second study, Jørgensen et al. (2005) exposed larval and juvenile fish to various sounds to investigate potential effects on survival, development, and behavior. The study used herring (*Clupea harengus*) (standard length 2–5 centimeters

[cm] [0.8–2 inches {in.}]), Atlantic cod (*Gadus morhua*) (standard length 2 and 6 cm [0.8 and 2.3 in.]), saithe (*Pollachius virens*) (4 cm [1.6 in.]), and spotted wolffish (*Anarhichas minor*) (4 cm [1.6 in.]) at different developmental stages. The researchers placed the fish in plastic bags 10 ft. (3 m) from the sound source and exposed them to between 4 and 100 pulses of 1-second duration of pure tones at 1.5, 4, and 6.5 kHz. The fish in only two groups out of the 82 tested exhibited any adverse effects. These two groups were both composed of herring and were tested with sound pressure levels of 189 dB re 1 µPa, which resulted in a post-exposure mortality of 20 to 30 percent. In the remaining 80 groups tested, 42 of which were replicates of herring only, there were no observed effects on growth (length and weight) or the survival of fish that were kept as long as 34 days post exposure. While statistically significant losses were documented in the two groups impacted, the researchers only tested that particular sound level once, so it is not known if this increased mortality was due to the level of the test signal or to other unknown factors.

High sound pressure levels may cause bubbles to form from micronuclei in the blood stream or other tissues of animals, possibly causing embolism damage (Ketten 1998). Fish have small capillaries where these bubbles could be caught and lead to the rupturing of the capillaries and internal bleeding. It has also been speculated that this phenomena could also take place in the eyes of fish due to potentially high gas saturation within the fish's eye tissues (Popper and Hastings 2009a).

As reviewed in Popper and Hastings (2009a), Hastings (1990, 1995) found 'acoustic stunning' (loss of consciousness) in blue gouramis (*Trichogaster trichopterus*) following an 8-minute exposure to a 150 Hz pure tone with a peak sound pressure level of 198 dB re 1 µPa. This species of fish has an air bubble in the mouth cavity directly adjacent to the animal's braincase that may have caused this injury. Hastings (1990, 1995) also found that goldfish exposed to 2 hours of continuous wave sound at 250 Hz with peak pressures of 204 dB re 1 µPa, and fathead minnows exposed to 0.5 hour of 150 Hz continuous wave sound at a peak level of 198 dB re 1 µPa, did not survive.

The only study on the effect of exposure of the lateral line system to continuous wave sound (conducted on one freshwater species, the Oscar [*Astronatus ocellatus*]) suggests no effect on these sensory cells by intense pure tone signals (Hastings et al. 1996).

Explosives and Other Acoustic Sources

The greatest potential for direct, non-auditory tissue effects is primary blast injury and barotrauma following exposure to high amplitude impulse sources, such as explosions. Primary blast injury refers to those injuries that result from the initial compression of a body exposed to a blast wave. Primary blast injury is usually limited to gas-containing structures (e.g., swim bladder and gut) and the auditory system. Barotrauma refers to injuries caused when large pressure changes occur across tissue interfaces, normally at the boundaries of gas-filled tissues such as the swim bladder of fish.

An underwater explosion generates a shock wave that produces a sudden, intense change in local pressure as it passes through the water (U.S. Department of the Navy 1998, 2001c). Pressure waves extend to a greater distance than other forms of energy produced by the explosion (i.e., heat and light) and are therefore the most likely source of negative effects to marine life from underwater explosions (Craig 2001; Scripps Institution of Oceanography 2005; U.S. Department of the Navy 2006).

The shock wave from an underwater explosion is lethal to fish at close range, causing massive organ and tissue damage and internal bleeding (Keevin and Hempen 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, orientation, and species (Wright 1982; Keevin and Hempen 1997). At the same distance from the source, larger fish are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fish oriented sideways to the blast suffer the greatest impact (Yelverton et al. 1975; Wiley et al. 1981; O'Keefe and Young 1984; Edds-Walton and Finneran 2006). Species with gas-filled organs have higher mortality than those without them (Goertner et al. 1994), which includes most fish found in the Study Area.

Two aspects of the shock wave appear most responsible for injury and death to fish: the received peak pressure and the time required for the pressure to rise and decay (Dzwilewski and Fenton 2002). Higher peak pressure and abrupt rise and decay times are more likely to cause acute pathological effects (Wright and Hopky 1998). Rapidly oscillating pressure waves might rupture the kidney, liver, spleen, and sinus and cause venous hemorrhaging (Keevin and Hempen 1997). They can also generate bubbles in blood and other tissues, possibly causing embolism damage (Ketten 1998). Oscillating pressure waves might also burst gas-containing organs. The swim bladder, the gas-filled organ used by many pelagic fish and coastal fish to control buoyancy, is the primary site of damage from explosives (Yelverton et al. 1975; Wright 1982). Gas-filled swim bladders resonate at different frequencies than surrounding tissue and can be torn by rapid oscillation between high- and low-pressure waves. Swim bladders are a characteristic of bony fishes and are not present in sharks and rays.

Studies that have documented fish killed during planned underwater explosions indicate that most fish that die do so within 1 to 4 hours, and almost all die within a day (Hubbs and Rechnizer 1952; Yelverton et al. 1975). Fitch and Young (1948) found that the type of fish killed changed when blasting was repeated at the same marine location within 24 hours of previous blasting. They observed that most fish killed on the second day were scavengers, presumably attracted by the victims of the previous day's blasts. However, fishes collected during these types of studies have mostly been recovered floating on the water's surface. Gitschlag et al. (2000) collected both floating fish and those that were sinking or lying on the bottom after explosive removal of nine oil platforms in the northern Gulf of Mexico. They found that 3 to 87 percent (46 percent average) of the specimens killed during a blast might float to the surface. Other impediments to accurately characterizing the magnitude of fish mortality included currents and winds that transported floating fishes out of the sampling area and predation by seabirds or other fishes.

There have been few studies of the impact of underwater explosions on early life stages of fish (eggs, larvae, juveniles). Fitch and Young (1948) reported the demise of larval anchovies exposed to underwater blasts off California, and Nix and Chapman (1985) found that anchovy and smelt larvae died following the detonation of buried charges. Similar to adult fish, the presence of a swim bladder contributes to shock wave-induced internal damage in larval and juvenile fish (Settle et al. 2002). Shock wave trauma to internal organs of larval pinfish and spot from shock waves was documented by Govoni et al. (2003). These were laboratory studies, however, and have not been verified in the field.

It has been suggested that impulse sounds, such as those produced by seismic airguns, may cause damage to the cells of the lateral line in fish larvae and juveniles when in proximity (5 m [16 ft.]) to the sound source (Booman et al. 1996).

3.9.3.1.1.2 Hearing Loss

Exposure to high intensity sound can cause hearing loss, also known as a noise-induced threshold shift, or simply a threshold shift (Miller 1974). A Temporary Threshold Shift (TTS) is a temporary, recoverable loss of hearing sensitivity. A TTS may last several minutes to several weeks and the duration may be related to the intensity of the sound source and the duration of the sound (including multiple exposures). A Permanent Threshold Shift (PTS) is non-recoverable, results from the destruction of tissues within the auditory system, and can occur over a small range of frequencies related to the sound exposure. As with TTS, the animal does not become deaf but requires a louder sound stimulus (relative to the amount of PTS) to detect a sound within the affected frequencies; however, in this case, the effect is permanent.

Permanent hearing loss has not been documented in fish. The sensory hair cells of the inner ear in fish can regenerate after they are damaged, unlike in mammals where sensory hair cells loss is permanent (Lombarte et al. 1993; Smith et al. 2006). As a consequence, any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (e.g., Smith et al. 2006).

Non-Impulse Acoustic Sources

Studies of the effects of long-duration sounds with sound pressure levels below 170 to 180 dB re 1 µPa indicate that there is little to no effect of long-term exposure on species that lack notable anatomical hearing specialization (Scholik and Yan 2001; Amoser and Ladich 2003; Smith et al. 2004a, b; Wysocki et al. 2007). The longest of these studies exposed young rainbow trout (*Onorhynchus mykiss*), to a level of noise equivalent to one that fish would experience in an aquaculture facility (e.g., on the order of 150 dB re 1 µPa) for about nine months. The investigators found no effect on hearing (i.e., TTS) as compared to fish raised at 110 dB re 1 µPa.

In contrast, studies on fish with hearing specializations (i.e., greater sensitivity to lower sound pressures and higher frequencies) have shown that there is some hearing loss after several days or weeks of exposure to increased background sounds, although the hearing loss seems to recover (e.g., Scholik and Yan 2002; Smith et al. 2004a; Smith et al. 2006). Smith et al. (2004b, 2006) exposed goldfish to noise at 170 dB re 1 µPa and found a clear relationship between the amount of hearing loss (TTS) and the duration of exposure until maximum hearing loss occurred after 24 hours of exposure. A 10-minute exposure resulted in a 5 dB TTS, whereas a 3-week exposure resulted in a 28 dB TTS that took over 2 weeks to return to pre-exposure baseline levels (Smith et al. 2004a) (note: recovery time was not measured by investigators for shorter exposure durations).

Similarly, Wysocki and Ladich (2005) investigated the influence of noise exposure on the auditory sensitivity of two freshwater fish with notable hearing specializations, the goldfish and the lined Raphael catfish (*Platydoras costatus*), and on a freshwater fish without notable specializations, the pumpkinseed sunfish (*Lepomis gibbosus*). Baseline thresholds showed greatest hearing sensitivity around 500 Hz in the goldfish and catfish and at 100 Hz in the sunfish. For the goldfish and catfish, continuous white noise of approximately 130 dB re 1 µPa at 1 m resulted in a significant TTS of 23 to 44 dB. In contrast, the auditory thresholds in the sunfish declined by 7 to 11 dB. The duration of exposure and time to recovery was not addressed in this study. Scholik and Yan (2001) demonstrated TTS in fathead minnows (*Pimephales promelas*). After a 24-hour exposure to white noise (300–2,000 Hz) at 142 dB re 1 µPa, recovery took as long as 14 days post-exposure.

Some studies have suggested that there may be some loss of sensory hair cells due to high intensity sources; however, none of these studies concurrently investigated effects on hearing. Enger (1981) found loss of ciliary bundles of the sensory cells in the inner ears of Atlantic cod (*Gadus morhua*) following 1 to 5 hours of exposure to pure tone sounds between 50 and 400 Hz with a sound pressure level of 180 dB re 1 µPa. Hastings (1995) found auditory hair-cell damage in a species with notable anatomical hearing specializations, the goldfish, exposed to 250 Hz and 500 Hz continuous tones with maximum peak levels of 204 dB re 1 µPa and 197 dB re 1 µPa, respectively, for about two hours. Similarly, Hastings et al. (1996) demonstrated damage to some sensory hair cells in oscars (*Astronotus ocellatus*) following a one hour exposure to a pure tone at 300 Hz with a peak pressure level of 180 dB re 1 µPa. In none of the studies was the hair cell loss more than a relatively small percent (less than a maximum of 15 percent) of the total sensory hair cells in the hearing organs.

Studies have also examined the effects of the sound exposures from Surveillance Towed Array Sensor System Low-Frequency Active sonar on fish hearing (Popper et al. 2007; Kane et al. 2010). Hearing was measured both immediately post exposure and for several days thereafter. Maximum received sound pressure levels were 193 dB re 1 µPa for 324 or 628 seconds. Catfish and some specimens of rainbow trout showed 10 to 20 dB of hearing loss immediately after exposure to the low-frequency active sonar when compared to baseline and control animals; however, another group of rainbow trout showed no hearing loss. Recovery in trout took at least 48 hours, but studies were not completed. The different results between rainbow trout groups is difficult to understand, but may be due to developmental or genetic differences in the various groups of fish. Catfish hearing returned to, or close to, normal within about 24 hours after exposure to low-frequency active sonar. Furthermore, examination of the inner ears of the fish during necropsy (note: maximum time fish were held post exposure before sacrifice was 96 hours) revealed no differences from the control groups in ciliary bundles or other features indicative of hearing loss (Kane et al. 2010). More recently, Halvorsen et al. (2013) exposed three fish species, largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), and yellow perch (*Perca flavescens*) to low–frequency sonar with received sound pressure levels of approximately 195 dB re 1 µPa. The two species without hearing specializations, largemouth bass and yellow perch, showed no loss in hearing sensitivity from sound exposure neither immediately after the test nor after 24 hours. Channel catfish, which do have anatomical specializations allowing them greater sensitivity to higher frequencies, did show a small threshold shift up to 24 hours after the experiment.

The study of mid-frequency active sonar by the same investigators also examined potential effects on fish hearing and the inner ear (Kane et al. 2010; Halvorsen et al. 2012b). Out of the four species tested (rainbow trout, channel catfish, largemouth bass, and yellow perch) only one group of channel catfish, tested in December, showed any hearing loss after exposure to mid-frequency active sonar. The signal consisted of a 2-second-long, 2.8–3.8 kHz frequency sweep followed by a 3,300 Hz tone of 1-second duration. The stimulus was repeated five times with a 25-second interval. The maximum received sound pressure level was 210 dB re 1 µPa. These animals, which have the widest hearing range of any of the species tested, experienced approximately 10 dB of threshold shift that recovered within 24 hours. Channel catfish tested in October did not show any hearing loss. The investigators speculated that the difference in hearing loss between catfish groups might have been due to the difference in water temperature of the lake where all of the testing took place (Seneca Lake, New York) between October and December. Alternatively, the observed hearing loss differences between the two catfish groups might have been due to differences between the two stocks of fish (Halvorsen et al. 2012b). Any effects on hearing in channel catfish due to sound exposure appear to be transient (Kane et al. 2010; Halvorsen et al. 2012b). Investigators observed no damage to ciliary bundles or other features indicative of hearing loss in any of the other fish tested including the catfish tested in October (Kane et al. 2010).

Popper et al. (2014) summarized in a technical report the outcome of a working group session that evaluated the sound detection capabilities for a wide range of fishes and sea turtles, which were organized into broad groups based on how they detect sound. The technical report presents sound exposure guidelines for assessing how a variety of natural and anthropogenic sound sources may affect fish and sea turtle species. Sivle et al. (2015) reported on possible population-level effects to Atlantic herring (*Clupae harengus*) from active naval sonar. The herring were exposed to source levels up 235 dB re 1 μPa at 1 m for durations exceeding 24 hours with frequencies of 1 – 2 kHz. The authors concluded that the use of naval sonar poses little risk to populations of herring even when the herring are aggregated during sonar exposure. In a related study, herring were exposed to both low-frequency (1-2 kHz) and mid-frequency (6-7 kHz) sonar as well as killer whale feeding calls (Sivle et al. 2012). The results were similar to Sivle et al. (2015) in that the herring did not respond to either the low- or mid-frequency sonar, but did show obvious avoidance behavior (diving) when exposed to the killer whale feeding sounds, which were at lower received sound pressure levels than the sonar (150 dB re 1 μPa for the killer whale calls, 176 dB re 1 μPa for the low-frequency sonar, and 162 dB re 1 μPa for the mid-frequency sonar).

Explosives and Other Impulse Acoustic Sources

Popper et al. (2005) examined the effects of a seismic airgun array on a fish with hearing specializations, the lake chub (*Couesius plumbeus*), and two species that lack notable specializations, the northern pike (*Esox lucius*) and the broad whitefish (*Coregonus nasus*) (a salmonid). In this study the average received exposure levels were a mean peak pressure level of 207 dB re 1 µPa; sound pressure level of 197 dB re 1 µPa; and single-shot sound exposure level of 177 decibels referenced to 1 micropascal squared second (dB re 1 μPa^2-s). The results showed temporary hearing loss for both lake chub and northern pike to both 5 and 20 airgun shots, but not for the broad whitefish. Hearing loss was approximately 20 to 25 dB at some frequencies for both the northern pike and lake chub, and full recovery of hearing took place within 18 hours after sound exposure. Examination of the sensory surfaces of the ears by an expert on fish inner ear structure showed no damage to sensory hair cells in any of the fish from these exposures (Song et al. 2008).

McCauley et al. (2003) showed loss of a small percent of sensory hair cells in the inner ear of the pink snapper (*Pagrus auratus*) exposed to a moving airgun array for 1.5 hours. Maximum received levels exceeded 180 dB re 1 μPa^2-s for a few shots. The loss of sensory hair cells continued to increase for up to at least 58 days post exposure to 2.7 percent of the total cells, with disproportionate damage (approximately 15 percent of hair cells) in the caudal portion of the ear. It is not known if this hair cell loss would result in hearing loss since fish have tens or even hundreds of thousands of sensory hair cells in the inner ear (Popper and Hoxter 1984; Lombarte and Popper 1994) and only a small portion were affected by the sound. The question remains as to why McCauley et al. (2003) found damage to sensory hair cells while Popper et al. (2005) did not. There are many differences between the studies, including species, precise sound source, and spectrum of the sound that it is hard to speculate.

Hastings et al. (2008) exposed the pinecone soldierfish (*Myripristis murdjan*), a fish with anatomical specializations to enhance their hearing; and three species without notable specializations: the blue green damselfish (*Chromis viridis*), the saber squirrelfish (*Sargocentron spiniferum*), and the bluestripe seaperch (*Lutjanus kasmira*) to an airgun array. Fish in cages in 5 m (16 ft.) of water were exposed to multiple airgun shots with a cumulative sound exposure level of 190 dB re 1 μPa^2-s. The authors found no hearing loss in any fish following exposures.

3.9.3.1.1.3 Auditory Masking

Auditory masking refers to the presence of a noise that interferes with a fish's ability to hear biologically relevant sounds. Fish use sounds to detect predators and prey, and for schooling, mating, and navigating, among other uses (Myrberg 1980; Popper et al. 2003). Masking of sounds associated with these behaviors could have impacts to fish by reducing their ability to perform these biological functions.

Any noise (i.e., unwanted or irrelevant sound, often of an anthropogenic nature) detectable by a fish can prevent the fish from hearing biologically important sounds including those produced by prey or predators (Myrberg 1980; Popper et al. 2003). Auditory masking may take place whenever the noise level heard by a fish exceeds ambient noise levels, the animal's hearing threshold, and the level of a biologically relevant sound. Masking is found among all vertebrate groups, and the auditory system in all vertebrates, including fish, is capable of limiting the effects of masking noise, especially when the frequency range of the noise and biologically relevant signal differ (Fay 1988; Fay and Megela-Simmons 1999).

The frequency of the sound is an important consideration for fish because many marine fish are limited to detection of the particle motion component of low frequency sounds at relatively high sound intensities (Amoser and Ladich 2005). The frequency of the acoustic stimuli must first be compared to the animal's known or suspected hearing sensitivity to establish if the animal can potentially detect the sound.

One of the problems with existing fish auditory masking data is that the bulk of the studies have been done with goldfish, a freshwater fish with well-developed anatomical specializations that enhance hearing abilities. The data on other species are much less extensive. As a result, less is known about masking in marine species, many of which lack the notable anatomical hearing specializations. However, Wysocki and Ladich (2005) suggest that ambient sound regimes may limit acoustic communication and orientation, especially in animals with notable hearing specializations.

Tavolga (1974a, b) studied the effects of noise on pure-tone detection in two species without notable anatomical hearing specializations, the pin fish (*Lagodon rhomboids*) and the African mouth-Breeder (*Tilapia macrocephala*), and found that the masking effect was generally a linear function of masking level, independent of frequency. In addition, Buerkle (1968, 1969) studied five frequency bandwidths for Atlantic cod in the 20 to 340 Hz region and showed masking across all hearing ranges. Chapman and Hawkins (1973) found that ambient noise at higher sea states in the ocean has masking effects in cod, *Gadus morhua* (L.), haddock, *Melanogrammus aeglefinus* (L.), and pollock, *Pollochinus pollachinus* (L.), and similar results were suggested for several sciaenid species by Ramcharitar and Popper (2004).Thus, based on limited data, it appears that for fish, as for mammals, masking may be most problematic in the frequency region near the signal.

There have been a few field studies that may suggest masking could have an impact on wild fish. Gannon et al. (2005) shows that bottlenose dolphins (*Tursiops truncatus*) move toward acoustic playbacks of the vocalization of Gulf toadfish (*Opsanus beta*). Bottlenose dolphins employ a variety of vocalizations during social communication including low-frequency pops. Toadfish may be able to best detect the low-frequency pops since their hearing is best below 1 kHz, and there is some indication that toadfish have reduced levels of calling when bottlenose dolphins approach (Remage-Healey et al. 2006). Silver perch have also been shown to decrease calls when exposed to playbacks of dolphin whistles mixed with other biological sounds (Luczkovich et al. 2000). Results of the Luczkovich et al. (2000) study, however, must be viewed with caution because it is not clear what sound may have elicited the silver perch response (Ramcharitar et al. 2006). Astrup (1999) and Mann et al. (1998) hypothesize that high frequency detecting species (e.g., clupeids) may have developed sensitivity to high frequency sounds to avoid predation by odontocetes. Therefore, the presence of masking noise may hinder a fish's ability to detect predators and therefore increase predation.

Of considerable concern is that human-generated sounds could mask the ability of fish to use communication sounds, especially when the fish are communicating over some distance. In effect, the masking sound may limit the distance over which fish can communicate, thereby having an impact on important components of their behavior. For example, the sciaenids, which are primarily inshore species, are one of the most active sound producers among fish, and the sounds produced by males are used to "call" females to breeding sights (Ramcharitar et al. 2001) reviewed in Ramcharitar (2006). If the females are not able to hear the reproductive sounds of the males, there could be a significant impact on the reproductive success of a population of sciaenids. Since most sound production in fish used for communication is generally below 500 Hz (Slabbekoorn et al. 2010), sources with significant low-frequency acoustic energy could affect communication in fish.

Also potentially vulnerable to masking is navigation by larval fish, although the data to support such an idea are still exceedingly limited. There is indication that larvae of some reef fish (species not identified in study) may have the potential to navigate to juvenile and adult habitat by listening for sounds emitted from a reef (either due to animal sounds or non-biological sources such as surf action) (e.g., Higgs 2005). In a study of an Australian reef system, the sound signature emitted from fish choruses was between 0.8 and 1.6 kHz (Cato 1978) and could be detected by hydrophones 3 to 4 nm from the reef (McCauley and Cato 2000). This bandwidth is within the detectable bandwidth of adults and larvae of the few species of reef fish, such as the damselfish, *Pomacentrus partitus,* and bicolor damselfish, *Eupomacentrus partitus,* that have been studied (Myrberg 1980; Kenyon 1996). At the same time, it has not been demonstrated conclusively that sound, or sound alone, is an attractant of larval fish to a reef, and the number of species tested has been very limited. Moreover, there is also evidence that larval fish may be using other kinds of sensory cues, such as chemical signals, instead of, or alongside of, sound (Atema et al. 2002).

3.9.3.1.1.4 Physiological Stress and Behavioral Reactions

As with masking, a fish must first be able to detect a sound above its hearing threshold for that particular frequency and the ambient noise before a behavioral reaction or physiological stress can occur. There are little data available on the behavioral reactions of fish, and almost no research conducted on any long-term behavioral effects or the potential cumulative effects from repeated exposures to loud sounds (Popper and Hastings 2009a).

Stress refers to biochemical and physiological responses to increases in background sound. The initial response to an acute stimulus is a rapid release of stress hormones into the circulatory system, which may cause other responses such as elevated heart rate and blood chemistry changes. Although an increase in background sound has been shown to cause stress in humans, only a limited number of studies have measured biochemical responses by fish to acoustic stress (e.g., Smith et al. 2004b; Remage-Healey et al. 2006; Wysocki et al. 2006; Wysocki et al. 2007) and the results have varied. There is evidence that a sudden increase in sound pressure level or an increase in background noise levels can increase stress levels in fish (Popper and Hastings 2009a). Exposure to acoustic energy has been shown to cause a change in hormone levels (physiological stress) and altered behavior in some species such as the goldfish (*Carassius auratus*) (Pickering 1981; Smith et al. 2004a, b), but not all species tested to date, such as the rainbow trout (*Oncorhynchus mykiss*) (Wysocki et al. 2007).

Behavioral effects to fish could include disruption or alteration of natural activities such as swimming, schooling, feeding, breeding, and migrating. Sudden changes in sound level can cause fish to dive, rise, or change swimming direction. There is a lack of studies that have investigated the behavioral reactions of unrestrained fish to anthropogenic sound. Studies of caged fish have identified three basic behavioral reactions to sound: startle, alarm, and avoidance (Pearson et al. 1992; McCauley et al. 2000; Scripps Institution of Oceanography and National Science Foundation 2008). Changes in sound intensity may be more important to a fish's behavior than the maximum sound level. Sounds that fluctuate in level tend to elicit stronger responses from fish than even stronger sounds with a continuous level (Schwartz 1985).

Non-Impulse Acoustic Sources

Remage-Healey et al. (2006) found elevated cortisol levels, a stress hormone, in Gulf toadfish (*Opsanus beta*) exposed to low frequency bottlenose dolphin sounds. Additionally, the toadfish' call rates dropped by about 50 percent, presumably because the calls of the toadfish, a primary prey for bottlenose dolphins, give away the fish's location to the dolphin. The researchers observed none of these effects in toadfish exposed to an ambient control sound (i.e., low-frequency snapping shrimp "pops").

Smith et al. (2004b) found no increase in corticosteroid, a stress hormone, in goldfish (*Carassius auratus*) exposed to a continuous, band-limited noise (0.1 to 10 kHz) with a sound pressure level of 170 dB re 1 µPa for 1 month. Wysocki et al. (2007) exposed rainbow trout (*Onorhynchus mykiss*) to continuous band-limited noise with a sound pressure level of about 150 dB re 1 µPa for 9 months with no observed stress effects. Growth rates and effects on the trout's immune system were not significantly different from control animals held at sound pressure level of 110 dB re 1 µPa.

Gearin et al. (2000) studied responses of adult sockeye salmon (*Oncorhynchus nerka*) and sturgeon (*Acipenser* sp.) to pinger sounds produced by acoustic devices designed to deter marine mammals from gillnet fisheries. The pingers produced sounds with broadband energy with peaks at 2 kHz or 20 kHz. They found that fish did not exhibit any reaction or behavior change to the pingers, which demonstrated that the alarm was either inaudible to the salmon and sturgeon, or that neither species was disturbed by the mid-frequency sound (Gearin et al. 2000). Based on hearing threshold data, it is highly likely that the salmonids did not hear the sounds.

Culik et al. (2001) did a very limited number of experiments to determine the catch rate of herring (*Clupea harengus*) in the presence of pingers producing sounds that overlapped with the frequency range of hearing for herring (base frequency of 2.7 kHz with harmonics to 19 kHz). They found no change in catch rates in gill nets with or without the higher frequency (greater than 20 kHz) sounds present, although there was an increase in the catch rate with the signals from 2.7 kHz to 19 kHz (a different source than the higher frequency source). The results could mean that the fish did not "pay attention" to the higher frequency sound or that they did not hear it, but that lower frequency sounds may be attractive to fish. At the same time, it should be noted that there were no behavioral observations on the fish, and so how the fish actually responded when they detected the sound is not known.

Doksæter et al. (2009) studied the reactions of wild, overwintering herring to Royal Netherlands Navy experimental mid-frequency active sonar and killer whale feeding sounds. The behavior of the fish was monitored using upward looking echosounders. The received levels from the 1 to 2 kHz and 6 to 7 kHz sonar signals ranged from 127 to 197 dB re 1 µPa and 139 to 209 dB re 1 µPa, respectively. Escape reactions were not observed upon the presentation of the mid-frequency active sonar signals; however, the playback of the killer whale sounds elicited an avoidance reaction. The authors concluded that these mid-frequency sonar could be used in areas of overwintering herring without substantially affecting the fish.

There is evidence that elasmobranchs respond to human-generated sounds. Myrberg and colleagues did experiments in which they played back sounds and attracted a number of different shark species to the sound source (e.g., Myrberg et al. 1969; Myrberg et al. 1972; Nelson and Johnson 1972; Myrberg et al. 1976). The results of these studies show that sharks were attracted to low-frequency sounds (below several hundred Hz), in the same frequency range of sounds that might be produced by struggling prey. However, sharks are not known to be attracted by continuous signals or higher frequencies (which they presumably cannot hear since their best hearing sensitivity is around 20 Hz, and drops off above 1000 Hz [Casper and Mann 2006; Casper and Mann 2009]).

Studies documenting behavioral responses of fish to vessels show that Barents Sea capelin (*Mallotus villosus*) may exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jørgensen et al. 2004). Avoidance reactions are quite variable depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwartz 1985). Misund (1997) found that fish ahead of a ship, that showed avoidance reactions, did so at ranges of 160 to 490 ft. (49 to 150 m). When the vessel passed over them, some species of fish responded with sudden escape responses that included lateral avoidance or downward compression of the school.

In a study by Chapman and Hawkins (1973) the low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses by herring. Avoidance ended within 10 seconds after the vessel departed. Twenty-five percent of the fish groups habituated to the sound of the large vessel and 75 percent of the responsive fish groups habituated to the sound of small boats.

Explosives and Other Impulse Acoustic Sources

Pearson et al. (1992) exposed several species of rockfish (*Sebastes* spp.) to a seismic airgun. The investigators placed the rockfish in field enclosures and observed the fish's behavior while firing the airgun at various distances for 10-minute trials. Dependent upon the species, rockfish exhibited startle or alarm reactions between peak to peak sound pressure level of 180 dB re 1 µPa and 205 dB re 1 µPa. The authors reported the general sound level where behavioral alterations became evident was at about 161 dB re 1 µPa for all species. During all of the observations, the initial behavioral responses only lasted for a few minutes, ceasing before the end of the 10-minute trial.

Similarly, Skalski et al. (1992) show a 52 percent decrease in rockfish (*Sebastes* sp.) caught with hook-and-line (as part of the study—fisheries independent) when the area of catch was exposed to a single airgun emission at 186 to 191 dB re 1 µPa (mean peak level) (See also Pearson et al. 1987; Pearson et al. 1992). They also demonstrate that fish would show a startle response to sounds as low as 160 dB re 1 µPa, but this level of sound did not appear to elicit decline in catch. Wright (1982) also observed changes in fish behavior as a result of the sound produced by an explosion, with effects intensified in areas of hard substrate.

Wardle et al. (2001) used a video system to examine the behaviors of fish and invertebrates on reefs in response to emissions from seismic airguns. The researchers carefully calibrated the airguns to have a peak level of 210 dB re 1 µPa at 16 m (52.5 ft.) and 195 dB re 1 µPa at 109 m (357.6 ft.) from the source. There was no indication of any observed damage to the marine organisms. They found no substantial or permanent changes in the behavior of the fish or invertebrates on the reef throughout the course of the study, and no marine organisms appeared to leave the reef.

Engås et al. (1996) and Engås and Løkkeborg (2002) examined movement of fish during and after a seismic airgun study by measuring catch rates of haddock (*Melanogrammus aeglefinus*) and Atlantic cod (*Gadus morhua*) as an indicator of fish behavior using both trawls and long-lines as part of the experiment. These investigators found a significant decline in catch of both species that lasted for several days after termination of airgun use. Catch rate subsequently returned to normal. The conclusion reached by the investigators was that the decline in catch rate resulted from the fish moving away from the airgun sounds at the fishing site. However, the investigators did not actually observe behavior, and it is possible that the fish just changed depth.

The same research group showed, more recently, parallel results for several additional pelagic species including blue whiting and Norwegian spring spawning herring (Slotte et al. 2004). However, unlike earlier studies from this group, the researchers used fishing sonar to observe behavior of the local fish schools. They reported that fish in the area of the airguns appeared to go to greater depths after the airgun exposure compared to their vertical position prior to the airgun usage. Moreover, the abundance of animals 30 to 50 km (18.6 to 31.1 mi.) away from the ensonification increased, suggesting that migrating fish would not enter the zone of seismic activity.

Alteration in natural behavior patterns due to exposure to pile driving noise has not been well studied. However, one study (Mueller-Blenkle et al. 2010) demonstrates behavioral reactions of cod (*Gadus morhua*) and Dover sole (*Solea solea*) to pile driving noise. Sole showed a significant increase in swimming speed. Cod reacted, but not significantly, and both species showed directed movement away from the sources with signs of habituation after multiple exposures. For sole, reactions were seen with peak sound pressure levels of 144 to 156 dB re 1 µPa; and cod showed altered behavior at peak sound pressure levels of 140 to 161 dB re 1 µPa. For both species, this corresponds to a peak particle motion between 6.51×10^{-3} and 8.62×10^{-4} meters per second squared.

3.9.3.1.2 Impacts from Sonar and Other Active Acoustic Sources

Non-impulse sources from the Proposed Action include sonar and other active acoustic sources, vessel noise, and subsonic aircraft noise. Potential acoustic effects to fish from non-impulse sources may be considered in four categories, as detailed above in Section 3.9.3.1.1 (Analysis Background and Framework): (1) direct injury, (2) hearing loss, (3) auditory masking, and (4) physiological stress and behavioral reactions.

As discussed in Section 3.9.3.1.1.1 (Direct Injury), direct injury to fish as a result of exposure to non-impulse sounds is highly unlikely to occur. Therefore, direct injury as a result of exposure to non-impulse sound sources is not discussed further in this analysis.

Research discussed in Section 3.9.3.1.1.2 (Hearing Loss), indicates that exposure of fish to transient, non-impulse sources is unlikely to result in any hearing loss. Most sonar sources are outside of the hearing and sensitivity range of most marine fish, and noise sources such as vessel movement and aircraft overflight lack the duration and intensity to cause hearing loss. Furthermore, PTS has not been demonstrated in fish as they have been shown to regenerate lost sensory hair cells. Therefore, hearing loss as a result of exposure to non-impulse sound sources is not discussed further in this analysis.

3.9.3.1.2.1 No Action Alternative – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.2.1.1 (Sonar and Other Active Acoustic Sources), training activities under the No Action Alternative include activities that produce in-water sound from the use of sonar and other active acoustic sources, and could occur throughout the Study Area. Sonar and other active acoustic sources proposed for use are transient in most locations as active sonar activities pass through the Study Area. Based on current research, only a few species of shad within the Clupeidae family (herrings) are known to be able to detect high-frequency sonar and other active acoustic sources (greater than 10,000 Hz). Other marine fish would probably not detect these sounds and would therefore experience no stress, behavioral disturbance, or auditory masking. Shad species, especially in nearshore and inland areas where mine warfare activities take place that often employ high-frequency sonar systems, could have behavioral reactions and experience auditory masking during these activities. However, mine warfare activities are typically limited in duration and geographic extent. Furthermore, sound from high-frequency systems may only be detectable above ambient noise regimes in these coastal habitats from within a few kilometers. Behavioral reactions and auditory masking if they occurred for some shad species are expected to be transient. Long-term consequences for the population would not be expected.

The fish species that are known to detect mid-frequencies (some sciaenids [drum], most clupeids [herring], and potentially deep-water fish such as myctophids [lanternfish]) do not have their best sensitivities in the range of the operational sonar (see Chapter 3, Affected Environment and Environmental Consequences, for more details). Thus, these fish may only detect the most powerful systems, such as hull-mounted sonar within a few kilometers; and most other, less powerful mid-frequency sonar systems, for a kilometer or less. Due to the limited time of exposure due to the moving sound sources, most mid-frequency active sonar used in the Study Area would not have the potential to substantially mask key environmental sounds or produce sustained physiological stress or behavioral reactions. Furthermore, although some species may be able to produce sound at higher frequencies (greater than 1 kHz), vocal marine fish, such as sciaenids, largely communicate below the range of mid-frequency levels used by most sonar. However, any such effects would be temporary and infrequent as a vessel operating mid-frequency sonar transits an area. As such, sonar use is unlikely to impact fish species. Long-term consequences for fish populations due to exposure to mid-frequency sonar and other active acoustic sources are not expected.

A large number of marine fish species, including cartilaginous fish, may be able to detect low-frequency sonar and other active acoustic sources. However, low-frequency active usage is rare, and most low-frequency training activities are conducted in deeper waters. The majority of fish species, including those that are the most highly vocal, exist within nearshore areas. Fish within a few tens of kilometers around a low-frequency active sonar could experience brief periods of masking, physiological stress, and behavioral disturbance while the system is used, with effects most pronounced closer to the source. However, overall effects would be localized and infrequent. Based on the lack of low-frequency sonar for training and the majority of sonar and other active acoustic sources that are outside the hearing range of scalloped hammerhead sharks, long-term consequences are not expected.

Vessel Noise

As discussed in Section 3.0.5.2.1.5 (Vessel Noise), training activities under the No Action Alternative include vessel movement. Military vessel traffic could occur anywhere within the Study Area; however, it would be concentrated near ports or naval installations and training ranges. Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to 2 weeks.

Additionally, a variety of smaller craft would be operated within the Study Area. Small craft types, sizes and speeds vary. These activities would be spread across the coastal and open ocean areas designated within the Study Area. Vessel movements involve transit to and from ports to various locations within the Study Area, and many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels).

A detailed description of vessel noise associated with the proposed action is provided in Section 3.0.5.2.1.5 (Vessel Noise). Vessel noise has the potential to expose fish to sound and general disturbance, which could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased heart rate). Training and testing activities involving vessel movements occur intermittently and range in duration from a few hours up to a few weeks. These activities are widely dispersed throughout the Study Area. While vessel movements have the potential to expose fish occupying the water column to sound and general disturbance, potentially resulting in short-term behavioral or physiological responses, such responses would not be expected to compromise the general health or condition of individual fish. In addition, most activities involving vessel movements are infrequent and widely dispersed throughout the Study Area. The exception is for pierside activities, although these areas are located in inshore, these are industrialized areas that are already exposed to high levels of anthropogenic noise due to numerous waterfront users (e.g., industrial and marinas). Therefore, impacts from vessel noise would be temporary and localized. Long-term consequences for the population are not expected.

Aircraft Noise

As described in Section 3.0.5.2.1.6 (Aircraft Overflight Noise), training activities under the No Action Alternative include fixed and rotary wing aircraft overflights. Certain portions of the Study Area, such as areas near military airfields, installations, and ranges are used more heavily by military aircraft than other portions. These activities would be spread across the coastal and open ocean areas designated within the Study Area. A detailed description of aircraft noise as a stressor is provided in Section 3.0.5.2.1.6 (Aircraft Overflight Noise). Aircraft produce extensive airborne noise from either turbofan or turbojet engines. A severe but infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. Rotary wing aircraft (helicopters) produce low-frequency sound and vibration (Pepper et al. 2003). Most fixed-wing aircraft sorties would occur above 3,000 ft. (900 m). Exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead.

Fish may be exposed to aircraft-generated noise wherever aircraft overflights occur; however, sound is primarily transferred into the water from air in a narrow cone under the aircraft. Most of these sounds would occur near airbases and fixed ranges within each range complex. Some species of fish could respond to noise associated with low-altitude aircraft overflights or to the surface disturbance created by downdrafts from helicopters. Aircraft overflights have the potential to affect surface waters and, therefore, to expose fish occupying those upper portions of the water column to sound and general disturbance potentially resulting in short-term behavioral or physiological responses. If fish were to respond to aircraft overflights, only short-term behavioral or physiological reactions (e.g., temporarily swimming away and increased heart rate) would be expected. Therefore, long-term consequences for individuals would be unlikely and long-term consequences for the populations are not expected. The primary exposure to vessel and aircraft noise may have the potential to expose scalloped hammerhead sharks to sound or general disturbance. However, any potential impacts would result in short-term behavioral or physiological responses; long-term impacts would be unlikely.

Pursuant to the ESA, the use of sonar and other non-impulse acoustic sources during training activities under the No Action Alternative may affect, but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.

3.9.3.1.2.2 No Action Alternative – Testing Activities

Testing activities potentially using non-impulse acoustic sources under the No Action Alternative are restricted to the North Pacific Acoustic Lab Philippine Sea Experiment (Table 2.8-4). Research vessels, acoustic test sources, side scan sonar, ocean gliders, the existing moored acoustic topographic array and distributed vertical line array, and other oceanographic data collection equipment will be used to collect information on the ocean environment and sound propagation during the 2018 data collection period. Currently, the array is being used to passively collect oceanographic and acoustic data in the region. Therefore, impacts to fish due to non-impulse sound are expected to be limited to short-term, minor behavioral reactions. Long-term consequences for populations would not be expected. Based on the lack of low-frequency sonar for testing and the majority of sonar and other active acoustic sources that are outside the hearing range of scalloped hammerhead sharks, long-term consequences are not expected.

The primary exposure to vessel noise would occur around ports and air bases. Vessel noise has the potential to expose fish to sound and general disturbance, potentially resulting in short-term behavioral responses. However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking is unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected. The primary exposure to vessel noise may have the potential to expose scalloped hammerhead sharks to sound or general disturbance. However, any potential impacts would result in short-term behavioral or physiological responses; long-term impacts would be unlikely.

Pursuant to the ESA, the use of sonar and other non-impulse acoustic sources during testing activities under the No Action Alternative may affect, but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.

3.9.3.1.2.3 Alternative 1 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Chapter 3 (Affected Environment and Environmental Consequences), the number of annual training activities that produce in-water sound from the use of sonar and other active acoustic sources under Alternative 1 would increase; however, the locations, types, and severity of impacts would not be discernable from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training). Under Alternative 1, there will be the additional use of low-frequency sonar. A large number of marine fish species may be able to detect low-frequency sonar and other active acoustic sources. However, low-frequency active usage is rare and most low-frequency active operations are conducted in deeper waters, usually beyond the continental shelf break. The majority of fish species, including those that are the most highly vocal, exist on the continental shelf and within nearshore, estuarine areas. Fish within several dozen kilometers around a low-frequency active sonar could experience brief periods of masking, physiological stress, and behavioral disturbance while the system is used, with effects most pronounced closer to the source. However, overall effects would be localized and infrequent. Based on the low level and short duration of potential exposure to low-frequency sonar and other active acoustic sources, long-term consequences for fish populations are not expected. Available data on cartilaginous fish hearing, such as the scalloped hammerhead, suggests the detection of sounds from 20 to 1,000 Hz, with sensitivity at lower ranges (Myrberg 2001; Casper et al. 2003; Casper and Mann 2006 and 2009). However, it is likely that elasmobranchs detect only low-frequency sounds because they lack a swim bladder or other pressure detectors. Based on the lack of low-frequency sonar for training and the majority of sonar and other active acoustic sources that are outside the hearing range of scalloped hammerhead sharks, long-term consequences are not expected.

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.2.1.5 (Vessel Noise), training activities, under Alternative 1 include an increase in the numbers of activities that involve vessels compared to the No Action Alternative; however, the locations and predicted impacts would not differ. Proposed training activities under Alternative 1 that involve vessel movement differ in number from training activities proposed under the No Action Alternative; however, the locations, types, and severity of impacts would not be discernable from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training).

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.2.1.6 (Aircraft Overflight Noise), training activities under Alternative 1 include an increase in the number of activities that involve aircraft as compared to the No Action Alternative; however, the training locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 1 aircraft overflight noise may increase; however, the locations, types, and severity of impacts would not be discernable from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training). The primary exposure to vessel and aircraft noise may have the potential to expose scalloped hammerhead sharks to sound or general disturbance. However, any potential impacts would result in short-term behavioral or physiological responses; long-term impacts would be unlikely.

Despite the increase in activity, the potential effects of training activities involving sonar and other active acoustic sources under Alternative 1 on fish species would be similar to those described above for training activities under the No Action Alternative, and are expected to be limited to short-term, minor behavioral reactions. Effects to fish populations would not occur as a result of non-impulse sounds associated with training activities under Alternative 1.

Pursuant to the ESA, the use of sonar and other non-impulse acoustic sources during training activities under Alternative 1 may affect, but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.

3.9.3.1.2.4 Alternative 1 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-4, and Section 3.0.5.2.1 (Acoustic Stressors), the number of annual testing activities that produce sound from vessels and aircraft, and the use of sonar and other active acoustic sources, analyzed under Alternative 1 would increase over what was analyzed for the No Action Alternative. These activities would happen in the same general locations under Alternative 1 as described under the Alternative 1 – Training. The use of low-frequency sonar for testing activities may have the potential to expose scalloped hammerhead sharks to sound or general disturbance. However, any potential impacts would result in short-term behavioral or physiological responses; long-term impacts would be unlikely.

The primary exposure to vessel and aircraft noise would occur around ports and air bases. Vessel and aircraft overflight noise have the potential to expose fish to sound and general disturbance, potentially resulting in short-term behavioral responses. However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking is unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected. The primary exposure to vessel and aircraft noise may have the potential to expose scalloped hammerhead sharks to sound or general disturbance. However, any potential impacts would result in short-term behavioral or physiological responses; long-term impacts would be unlikely.

The potential effects of testing activities involving sonar and other active acoustic sources under Alternative 1 on fish species would are expected to be limited to short-term, minor behavioral reactions. Effects to fish populations would not occur as a result of non-impulse sounds associated with testing activities under Alternative 1.

Pursuant to the ESA, the use of sonar and other non-impulse acoustic sources during testing activities under Alternative 1 may affect, but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.

3.9.3.1.2.5 Alternative 2 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Chapter 3 (Affected Environment and Environmental Consequences), the number of annual training activities that produce noise from vessels and aircraft, and the use of sonar and other active acoustic sources under Alternative 2 would increase; however, the locations, types, and severity of impacts would not be discernable from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training). Based on the lack of low-frequency sonar for training and the majority of sonar and other active acoustic sources that are outside the hearing range of scalloped hammerhead sharks, long-term consequences are not expected.

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.2.1.5 (Vessel Noise), training activities, under Alternative 2 include an increase in the numbers of activities that involve vessels compared to the No Action Alternative; however, the locations and predicted impacts would not differ. Proposed training activities under Alternative 2 that involve vessel movement differ in number from training activities proposed under the No Action Alternative; however, the locations, types, and severity of impacts would not be discernable from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training).

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.6 (Aircraft Overflight Noise), training activities under Alternative 2 include an increase in the number of activities that involve aircraft as compared to the No Action Alternative; however, the training locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 2 aircraft overflight noise may increase; however, the locations, types, and severity of impacts would not be discernable from those described above in Section 3.9.3.1.2.1 (No Action Alternative – Training). The primary exposure to vessel and aircraft noise may have the potential to expose scalloped hammerhead sharks to sound or general disturbance. However, any potential impacts would result in short-term behavioral or physiological responses; long-term impacts would be unlikely.

Despite the increase in activity, the potential effects of training activities involving sonar and other active acoustic sources under Alternative 2 on fish species would be similar to those described above for training activities under the No Action Alternative, and are expected to be limited to short-term, minor behavioral reactions. Effects to fish populations would not occur as a result of non-impulse sounds associated with training activities under Alternative 2.

Pursuant to the ESA, the use of sonar and other non-impulse acoustic sources during training activities under Alternative 2 may affect, but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.

3.9.3.1.2.6 Alternative 2 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-4, and Section 3.0.5.2.1 (Acoustic Stressors), the number of annual testing activities that produce in-water sound from the use of sonar and other active acoustic sources analyzed under Alternative 2 would increase over what was analyzed for the No Action Alternative. These activities would happen in the same general locations under Alternative 2 as described under Alternative 2 in Section 3.9.3.1.2.5 (Alternative 2 – Training). The use of low-frequency sonar for testing activities may have the potential to expose scalloped hammerhead sharks to sound or general disturbance. However, any potential impacts would result in short-term behavioral or physiological responses; long-term impacts would be unlikely.

The primary exposure to vessel and aircraft noise would occur around ports and air bases. Vessel and aircraft overflight noise have the potential to expose fish to sound and general disturbance, potentially resulting in short-term behavioral responses. However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking is unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected. The primary exposure to vessel and aircraft noise may have the potential to expose scalloped hammerhead sharks to sound or general disturbance. However, any potential impacts would result in short-term behavioral or physiological responses; long-term impacts would be unlikely.

Despite the increase in activity, the potential effects of testing activities involving sonar and other active acoustic sources under Alternative 2 on fish species would be similar to those described above for training activities under Alternative 1, and are expected to be limited to short-term, minor behavioral reactions. No population level effects on fish are expected as a result of non-impulse sounds associated with testing activities under Alternative 2.

Pursuant to the ESA, the use of sonar and other non-impulse acoustic sources during testing activities under Alternative 2 may affect, but is not likely to adversely affect ESA-listed scalloped hammerhead sharks.

3.9.3.1.3 Impacts from Explosives and Other Impulse Sound Sources

Explosions and other impulse sound sources include explosions from underwater detonations and explosive ordnance, swimmer defense airguns, and noise from weapons firing, launch, and impact with the water's surface. Potential acoustic effects to fish from impulse sound sources may be considered in four categories, as detailed above in Section 3.9.3.1 (Acoustic Stressors): (1) direct injury, (2) hearing loss, (3) auditory masking, and (4) physiological stress and behavioral reactions.

Potential impacts on fish from explosions and impulse sound sources can range from brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin and Hempen 1997).

Animals that experience hearing loss (permanent or temporary threshold shift) as a result of exposure to explosions and impulse sound sources may have a reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. It is uncertain whether some permanent hearing loss over a part of a fish's hearing range would have long-term consequences for that individual. If this did affect the fitness (reproductive success) of a few individuals, it is unlikely to have long-term consequences for the population.

Occasional behavioral reactions to intermittent explosions and impulse sound sources are unlikely to cause long-term consequences for individual fish or populations.

Explosives

Concern about potential fish mortality associated with the use of at-sea explosives led military researchers to develop mathematical and computer models that predict safe ranges for fish and other animals from explosions of various sizes (e.g., Yelverton et al. 1975, Goertner 1982, Goertner et al. 1994). Young (1991) provides equations that allow estimation of the potential effect of underwater explosions on fish possessing swim bladders using a damage prediction method developed by Goertner (1982). Young's parameters include the size of the fish and its location relative to the explosive source, but are independent of environmental conditions (e.g., depth of fish and explosive shot frequency). An example of such model predictions is shown in Table 3.9-4, which lists estimated explosive-effects ranges using Young's (1991) method for fish possessing swim bladders exposed to explosions that would typically occur during training exercises. The 10 percent mortality range is the distance beyond which 90 percent of the fish present would be expected to survive. It is difficult to predict the range of more subtle effects causing injury but not mortality (Continental Shelf Associates 2004).

Table 3.9-4: Estimated Explosive Effects Ranges for Fish with Swim Bladders

Training Operation and Type of Ordnance	Net Explosive Weight (lb.)	Depth of Explosion (ft.)	10% Mortality Range (ft.)		
			1 oz. Fish	1 lb. Fish	30 lb. Fish
Mine Neutralization					
MK 103 Charge	0.002	10	40	28	18
AMNS Charge	3.24	20	366	255	164
20 lb. NEW UNDET Charge	20	30	666	464	299
Missile Exercise					
Hellfire	8	3.3	317	221	142
Maverick	100	3.3	643	449	288
Firing Exercise with IMPASS					
Explosive Naval Gun Shell, 5-inch	8	1	244	170	109
Bombing Exercise					
MK 20	109.7	3.3	660	460	296
MK 82	192.2	3.3	772	539	346
MK 83	415.8	3.3	959	668	430
MK 84	945	3.3	1,206	841	541

Notes: ft. = foot/feet, lb. = pound, NEW = Net Explosive Weight, oz. = ounce

Fish not killed or driven from a location by an explosion might change their behavior, feeding pattern, or distribution. Changes in behavior of fish have been observed as a result of sound produced by explosives, with effect intensified in areas of hard substrate (Wright 1982). Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation.

The number of fish killed by an underwater explosion would depend on the population density in the vicinity of the blast, as well as factors discussed above such as net explosive weight, depth of the explosion, and fish size. For example, if an explosion occurred in the middle of a dense school of fish, a large number of fish could be killed. Furthermore, the probability of this occurring is low based on the patchy distribution of dense schooling fish.

Sounds from explosions could cause hearing loss in nearby fish (dependent upon charge size). Permanent hearing loss has not been demonstrated in fish, as lost sensory hair cells can be replaced unlike in mammals. Fish that experience hearing loss could miss opportunities to detect predators or prey, or reduce interspecific communication. If an individual fish were repeatedly exposed to sounds from underwater explosions that caused alterations in natural behavioral patterns or physiological stress, these impacts could lead to long-term consequences for the individual such as reduced survival, growth, or reproductive capacity. However, the time scale of individual explosions is very limited, and training exercises involving explosions are dispersed in space and time. Consequently, repeated exposure of individual fish to sounds from underwater explosions is not likely and most acoustic effects are expected to be short-term and localized. Long-term consequences for populations would not be expected.

Weapons Firing, Launch, and Impact Noise

As described in Chapter 2 (Description of Proposed Action and Alternatives) and Table 2.8-1, training activities under the No Action Alternative include activities that produce in water noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface. Activities are spread throughout the Study Area, and could take place within coastal or open ocean areas. Most activities involving large-caliber naval gunfire or the launching of targets, missiles, bombs, or other ordnance are conducted greater than 12 nm from shore.

A detailed description of weapons firing, launch, and impact noise is provided in Section 3.0.5.2.1.4 (Weapons Firing, Launch, and Impact Noise). Noise under the muzzle blast of a 5 in. (12.7 cm) gun and directly under the flight path of the shell (assuming the shell is a few meters above the water's surface) would produce a peak sound pressure level of approximately 200 dB re 1 µPa near the surface of the water (1 to 2 m [3.3 to 6.6 ft.] depth). Sound due to missile and target launches is typically at a maximum during initiation of the booster rocket and rapidly fades as the missile or target travels downrange. Many missiles and targets are launched from aircraft, which would produce minimal noise in the water due to the altitude of the aircraft at launch. Mines, non-explosive bombs, and intact missiles and targets could impact the water with great force and produce a large impulse and loud noise of up to approximately 270 dB re 1 µPa at 1 m (3.3 ft.), but with very short pulse durations, depending on the size, weight, and speed of the object at impact (McLennan 1997). This corresponds to sound exposure levels of around 200 dB re 1 μPa^2-s at 1 m (3.3 ft.). These sounds from weapons firing launch, and impact noise would be transient and of short duration, lasting no more than a few seconds at any given location.

Fish that are exposed to noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface may exhibit brief behavioral reactions; however, due to the short term, transient nature of weapons firing, launch, and non-explosive impact noise, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected.

3.9.3.1.3.1 No Action Alternative – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.2.1.2 (Explosives), training activities under the No Action Alternative would use underwater detonations and explosive ordnance. With the exception of those used at FDM and the nearshore underwater detonation sites, the vast majority of explosives used under the No Action Alternative occur in areas greater than 3 nm from shore. There is a potential (albeit small) for aberrant ordnance at FDM to miss land-based targets and strike the beaches and nearshore habitats of FDM.

Under the No Action Alternative, explosive bombs (32), missiles/rockets (58), explosive sonobuoys (8), and large-caliber projectiles (1,240) are proposed to be expended during training activities in the Study Area (see Table 3.0-19). As described above, impacts from weapons firing, launch, and impact noise would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected. Additionally, individuals are unlikely to be exposed multiple times within a short period.

Scalloped hammerhead sharks have the potential to be exposed to explosive energy and sound associated with training activities under the No Action Alternative. Training activities involving impulse acoustic sources have the potential to affect the ESA-listed species present, potentially resulting in short-term behavioral or physiological responses, hearing loss, injury, or mortality. However, given the infrequent nature of training activities involving impulse acoustic sources, the likelihood of these species encountering an explosive activity is remote.

Pursuant to the ESA, the use of explosives and other impulse sound sources during training activities under the No Action Alternative may affect, and is likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.1.3.2 No Action Alternative – Testing Activities

Testing activities under the No Action Alternative do not involve the use of impulse sources.

3.9.3.1.3.3 Alternative 1 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.2.1.2 (Explosives), the number of annual training activities that use explosions under Alternative 1 would increase. Under Alternative 1, explosive bombs (212), missiles/rockets (239), large- and medium-caliber projectiles (9,450), and explosive sonobuoys (11) are proposed to be expended during training activities in the Study Area (see Table 3.0-19 for details), which would be a 640 percent increase over the No Action Alternative. As described above, impacts from weapons firing, launch, and impact noise would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected. Additionally, individuals are unlikely to be exposed multiple times within a short period. These activities would happen in the same general locations as described by the No Action Alternative.

As discussed for the No Action Alternative, potential impacts on fish from explosions and impulse sound sources can range from no effect, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin and Hempen 1997). Occasional behavioral reactions to intermittent explosions and impulse sound sources are unlikely to cause long-term consequences for individual fish or populations. While serious injury and/or mortality to individual fish would be expected if they were present in the immediate vicinity of explosive ordnance use, despite the increase in activities under Alternative 1, the activities are infrequent and widely dispersed throughout the Study Area, and the distribution of potentially affected fishes also varies, impacts from at-sea explosion from training activities would be temporary and localized, and are not expected to result in population level impacts.

Scalloped hammerhead sharks have the potential to be exposed to explosive energy and sound associated with training activities under Alternative 1. Training activities involving impulse acoustic sources have the potential to affect the ESA-listed species present, potentially resulting in short-term behavioral or physiological responses, hearing loss, injury, or mortality. However, given the infrequent nature of training activities involving impulse acoustic sources, the likelihood of these species encountering an explosive activity is remote.

Pursuant to the ESA, the use of explosives and other impulse sound sources during training activities under Alternative 1 may affect, and is likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.1.3.4 Alternative 1 –Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-4, and Section 3.0.5.2.1.2 (Explosives), the number of annual testing activities that use explosives under Alternative 1 would increase over the No Action Alternative (see Table 3.0-9 for details). Testing activities involving explosions could be conducted throughout the Study Area, although activities do not normally occur within 3 nm of shore except at designated underwater detonation areas. As described above, impacts from weapons firing, launch, and impact noise would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected. Additionally, individuals are unlikely to be exposed multiple times within a short period. These testing activities are spread throughout the Study Area, and described in Tables 2.8-2 to 2.8-4.

Swimmer Defense Airguns

Testing activities under Alternative 1 would include the use of swimmer defense airguns up in Inner Apra Harbor as described in Section 3.0.5.2.1.3 (Swimmer Defense Airguns). Source levels are estimated to be 185 to 195 dB re 1 μPa^2-s at 1 m. For 100 shots, the cumulative sound exposure level would be approximately 215 to 225 dB re 1 μPa^2-s at 1 m.

Single, small airguns (60 cubic inches) are unlikely to cause direct trauma to marine fish. Impulses from airguns lack the strong shock wave and rapid pressure increase, as would be expected from explosive sources that can cause primary blast injury or barotrauma. As discussed in Section 3.9.3.1.1.1 (Direct Injury), there is little evidence that airguns can cause direct injury to adult fish, with the possible exception of injuring small juvenile or larval fish nearby (approximately 16 ft. [4.9 m]). Therefore, larval and small juvenile fish within a few meters of the airgun may be injured or killed. Considering the small footprint of this hypothesized injury zone, and the isolated and infrequent use of the swimmer defense airgun, population consequences would not be expected.

As discussed in Section 3.9.3.1.1.2 (Hearing Loss), temporary hearing loss in fish could occur if fish were exposed to impulses from swimmer defense airguns, although some studies have shown no hearing loss from exposure to airguns within 16 ft. (4.9 m). Therefore, fish within a few meters of the airgun may receive temporary hearing loss. However, due to the relatively small size of the airgun, and their limited use in pierside areas, impacts would be minor, and may only impact a few individual fish. Population consequences would not be expected.

Airguns do produce broadband sounds; however, the duration of an individual impulse is about one-tenth of a second. Airguns could be fired up to 100 times per activity, but would generally be used less based on the actual testing requirements. The pierside areas where these activities are proposed are inshore, with high levels of use, and therefore have high levels of ambient noise, see Appendix I (Acoustic and Explosives Primer). Auditory masking is discussed in Section 3.9.3.1.1.3 (Auditory

Masking), and only occurs when the interfering signal is present. Due to the limited duration of individual shots and the limited number of shots proposed for the swimmer defense airgun, only brief, isolated auditory masking to marine fish would be expected. Population consequences would not be expected.

In addition, fish that are able to detect the airgun impulses may exhibit alterations in natural behavior. As discussed in Section 3.9.3.1.1.4 (Physiological Stress and Behavioral Reactions), some fish species with site fidelity such as reef fish may show initial startle reactions, returning to normal behavioral patterns within a matter of a few minutes. Pelagic and schooling fish that typically show less site fidelity may avoid the immediate area for the duration of the activities. Due to the limited use and relatively small footprint of swimmer defense airguns, impacts to fish are expected to be minor. Population consequences would not be expected.

Conclusion

As discussed for training activities, potential impacts on fish from explosions and impulse acoustic sources can range from no impact, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin and Hempen 1997). Occasional behavioral reactions to intermittent explosives and impulse acoustic sources are unlikely to cause long-term consequences for individual fish or populations.

Animals that experience hearing loss (permanent or temporary threshold shift) as a result of exposure to explosions and impulse acoustic sources may have a reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. It is uncertain whether some permanent hearing loss over a part of a fish's hearing range would have long-term consequences for that individual. If this did affect the fitness of a few individuals, it is unlikely to have long-term consequences for the population.

It is possible for fish to be injured or killed by an explosion; however, the loss of a few individuals is unlikely to have measureable impacts on overall stocks or populations present in the Study Area. Therefore, long-term consequences to fish populations or stocks would not be expected.

Scalloped hammerhead sharks have the potential to be exposed to explosive energy and sound associated with testing activities under Alternative 1. Testing activities involving impulse acoustic sources have the potential to affect the ESA-listed species present, potentially resulting in short-term behavioral or physiological responses, hearing loss, injury, or mortality. However, given the infrequent nature of testing activities involving impulse acoustic sources, the likelihood of these species encountering an explosive activity is remote.

Pursuant to the ESA, the use of explosives and other impulse sound sources during testing activities under Alternative 1 may affect, and is likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.1.3.5 Alternative 2 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.2.1.2 (Explosives), the number of annual training activities that use explosions under Alternative 2 would increase. Under Alternative 2, explosive torpedoes (2), explosive bombs (212), missiles/rockets (517), large- and medium-caliber projectiles (9,450), and explosive sonobuoys (11) are proposed to be expended during training activities in the Study Area (see Table 3.0-19), which would be a 662 percent increase over the No Action Alternative. As described above, impacts from weapons firing, launch, and impact noise would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected. Additionally, individuals are unlikely to be exposed multiple times within a short period. These activities would happen in the same general locations as described by the No Action Alternative.

As discussed for Alternative 1, potential impacts on fish from explosions and impulse sound sources can range from no effect, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin and Hempen 1997). Occasional behavioral reactions to intermittent explosions and impulse sound sources are unlikely to cause long-term consequences for individual fish or populations. While serious injury and/or mortality to individual fish would be expected if they were present in the immediate vicinity of explosive ordnance use, the activities are infrequent and widely dispersed throughout the Study Area, and the distribution of potentially affected fishes also varies, impacts from at-sea explosion from training activities would be temporary and localized, and are not expected to result in population level impacts.

Scalloped hammerhead sharks have the potential to be exposed to explosive energy and sound associated with training activities under Alternative 2. Training activities involving impulse acoustic sources have the potential to affect the ESA-listed species present, potentially resulting in short-term behavioral or physiological responses, hearing loss, injury, or mortality. However, given the infrequent nature of training activities involving impulse acoustic sources, the likelihood of these species encountering an explosive activity is remote.

Pursuant to the ESA, the use of explosives and other impulse sound sources during training activities under Alternative 2 may affect, and is likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.1.3.6 Alternative 2 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-4, and Section 3.0.5.2.1.2 (Explosives), the number of annual testing activities that use explosives under Alternative 2 would increase over the No Action Alternative (see Table 3.0-9). Testing activities involving explosions could be conducted throughout the Study Area, although activities do not normally occur within 3 nm of shore except at designated underwater detonation areas. As described above, impacts from weapons firing, launch, and impact noise would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected. Additionally, individuals are unlikely to be exposed multiple times within a short period. These activities are spread throughout the Study Area and described in Tables 2.8-2 to 2.8-4.

Swimmer Defense Airguns

Testing activities under Alternative 2 would include the use of swimmer defense airguns up in Inner Apra Harbor as described in Section 3.0.5.2.1.3 (Swimmer Defense Airguns). Source levels are estimated to be 185 to 195 dB re 1 μPa^2-s at 1 m. For 100 shots, the cumulative sound exposure level would be approximately 215 to 225 dB re 1 μPa^2-s at 1 m.

Single, small airguns (60 cubic inches) are unlikely to cause direct trauma to marine fish. Impulses from airguns lack the strong shock wave and rapid pressure increase, as would be expected from explosive sources that can cause primary blast injury or barotrauma. As discussed in Section 3.9.3.1.1.1 (Direct Injury), there is little evidence that airguns can cause direct injury to adult fish, with the possible exception of injuring small juvenile or larval fish nearby (approximately 16 ft. [4.9 m]). Therefore, larval and small juvenile fish within a few meters of the airgun may be injured or killed. Considering the small footprint of this hypothesized injury zone, and the isolated and infrequent use of the swimmer defense airgun, population consequences would not be expected.

As discussed in Section 3.9.3.1.1.2 (Hearing Loss), temporary hearing loss in fish could occur if fish were exposed to impulses from swimmer defense airguns, although some studies have shown no hearing loss from exposure to airguns within 16 ft. (4.9 m). Therefore, fish within a few meters of the airgun may receive temporary hearing loss. However, due to the relatively small size of the airgun, and their limited use in pierside areas, impacts would be minor, and may only impact a few individual fish. Population consequences would not be expected.

Airguns do produce broadband sounds; however, the duration of an individual impulse is about one-tenth of a second. Airguns could be fired up to 100 times per activity, but would generally be used less based on the actual testing requirements. The pierside areas where these activities are proposed are inshore, with high levels of use, and therefore have high levels of ambient noise, see Appendix I (Acoustic and Explosives Primer). Auditory masking is discussed in Section 3.9.3.1.1.3 (Auditory Masking), and only occurs when the interfering signal is present. Due to the limited duration of individual shots and the limited number of shots proposed for the swimmer defense airgun, only brief, isolated auditory masking to marine fish would be expected. Population consequences would not be expected.

In addition, fish that are able to detect the airgun impulses may exhibit alterations in natural behavior. As discussed in Section 3.9.3.1.1.4 (Physiological Stress and Behavioral Reactions), some fish species with site fidelity such as reef fish may show initial startle reactions, returning to normal behavioral patterns within a matter of a few minutes. Pelagic and schooling fish that typically show less site fidelity may avoid the immediate area for the duration of the activities. Due to the limited use and relatively small footprint of swimmer defense airguns, impacts to fish are expected to be minor. Population consequences would not be expected.

Conclusion

As discussed for training activities, potential impacts on fish from explosions and impulse acoustic sources can range from no impact, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin and Hempen 1997). Occasional behavioral reactions to intermittent explosives and impulse acoustic sources are unlikely to cause long-term consequences for individual fish or populations.

Animals that experience hearing loss (permanent or temporary threshold shift) as a result of exposure to explosions and impulse acoustic sources may have a reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. It is uncertain whether some permanent hearing loss over a part of a fish's hearing range would have long-term consequences for that individual. If this did affect the fitness of a few individuals, it is unlikely to have long-term consequences for the population.

It is possible for fish to be injured or killed by an explosion; however, long-term consequences for a loss of a few individuals are unlikely to have measureable impacts on overall stocks or populations. Therefore, long-term consequences to fish populations would not be expected.

Scalloped hammerhead sharks have the potential to be exposed to explosive energy and sound associated with testing activities under Alternative 2. Testing activities involving impulse acoustic sources have the potential to affect the ESA-listed species present, potentially resulting in short-term behavioral or physiological responses, hearing loss, injury, or mortality. However, given the infrequent nature of testing activities involving impulse acoustic sources, the likelihood of these species encountering an explosive activity is remote.

Pursuant to the ESA, the use of explosives and other impulse sound sources during testing activities under Alternative 2 may affect, and is likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.1.3.7 Summary of Effects to Marine Fish from Acoustic Stressors

Under the No Action Alternative, Alternative 1, or Alternative 2, potential impacts on fish from acoustic stressors can range from no impact, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin and Hempen 1997). Occasional behavioral reactions to intermittent explosions and impulse sound sources are unlikely to cause long-term consequences for individual fish or populations. While serious injury or mortality to individual fish would be expected if they were present in the immediate vicinity of explosive ordnance use; however, population level impacts are not expected.

Pursuant to the ESA, the use of acoustic stressors under the No Action Alternative, Alternative 1, or Alternative 2 may affect, and is likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.2 Energy Stressors

This section evaluates the potential for fishes to be impacted by electromagnetic devices used during training and testing activities in the Study Area. No high-energy lasers are used in the MITT Study Area, so the discussion of energy stressors will be restricted to electromagnetic stressors.

3.9.3.2.1 Impacts from Electromagnetic Devices

Several different electromagnetic devices are used during training and testing activities. A discussion of the type, number, and location of activities using these devices under each alternative is presented in Section 3.0.5.2.2.1 (Electromagnetic Devices).

A comprehensive review of information regarding the sensitivity of marine organisms to electric and magnetic fields, including fishes comprising the subclass elasmobranchii (sharks, skates, and rays), as well as other bony fishes, is presented in Normandeau (2011). The synthesis of available data and information contained in this report suggests that while many fish species (particularly elasmobranchs) are sensitive to electromagnetic fields, further investigation is necessary to understand the physiological response and magnitude of the potential effects. This study also highlights investigations into which electric and magnetic field strengths initiate biological and physiological responses on specific fish species (Normandeau et al. 2011). Most examinations of electromagnetic fields on marine fishes have focused on buried undersea cables associated with offshore wind farms in European waters (Boehlert and Gill 2010; Gill 2005; Ohman et al. 2007). By comparison, in the Study Area, electromagnetic devices simply mimic the electromagnetic signature of a vessel passing through the water, and none of these devices include any type of electromagnetic "pulse."

Many fish groups including lamprey, elasmobranchs, eels, salmonids, stargazers, and others, have an acute sensitivity to electrical fields, known as electroreception (Bullock et al. 1983; Helfman et al. 2009). Electroreceptors are thought to aid in navigation, orientation, and migration of sharks and rays (Kalmijn 2000). In elasmobranchs, behavioral and physiological response to electromagnetic stimulus varies by species and age, and appears to be related to foraging behavior (Rigg et al. 2009). Many elasmobranchs respond physiologically to electric fields of 10 nanovolts (nV) per cm and behaviorally at 5 nV per cm (Collin and Whitehead 2004). Electroreceptive marine fishes with ampullary (pouch) organs can detect considerably higher frequencies of 50 Hz to more than 2 kHz (Helfman et al. 2009). The distribution of electroreceptors on the head of these fishes, especially around the mouth suggests that these sensory organs may be used in foraging. Additionally, some researchers hypothesize that the electroreceptors aid in social communication (Collin and Whitehead 2004). The ampullae of some fishes are sensitive to low frequencies (< 0.1 to 25 Hz) of electrical energy (Helfman et al. 2009), which may be of physical or biological origin, such as muscle contractions. For example, the ampullae of the shovelnose sturgeon (*Scaphirhynchus platorynchus*), were shown to respond to electromagnetic stimuli in a way comparable to the well-studied elasmobranchs, which are sensitive to electric fields as low as 1 microvolt (μV) per cm with a magnetic field of 100 gauss (Bleckmann and Zelick 2009).

While elasmobranchs and other fishes can sense the level of the earth's electromagnetic field, the potential effects on fish resulting from changes in the strength or orientation of the background field are not well understood. When the electromagnetic field is enhanced or altered, sensitive fishes may experience an interruption or disturbance in normal sensory perception. Research on the electrosensitivity of sharks indicates that some species respond to electrical impulses with an apparent avoidance reaction (Helfman et al. 2009; Kalmijn 2000). This avoidance response has been exploited as a shark deterrent, to repel sharks from areas of overlap with human activity (Marcotte and Lowe 2008).

Experiments with electromagnetic pulses can provide indirect evidence of the range of sensitivity of fishes to similar stimuli. Two studies reported that exposure to electromagnetic pulses do not have any effect on fishes (Hartwell et al. 1991; Nemeth and Hocutt 1990). The observed 48-hour mortality of small estuarine fishes (sheepshead minnow, mummichog, Atlantic menhaden, striped bass, Atlantic silverside, fourspine stickleback, and rainwater killifish) exposed to electromagnetic pulses of 100 to 200 kilovolts (kV) per m (10 nanoseconds per pulse) from distances greater than 164 ft. (50 m) was not statistically different than the control group (Hartwell et al. 1991; Nemeth and Hocutt 1990). During a study of Atlantic menhaden, there were no statistical differences in swimming speed and direction (toward or away from the electromagnetic pulse source) between a group of individuals exposed to electromagnetic pulses and the control group (Hartwell et al. 1991; Nemeth and Hocutt 1990).

Both laboratory and field studies confirm that elasmobranchs (and some teleost [bony] fishes) are sensitive to electromagnetic fields, but the long-term impacts are not well known. Electromagnetic sensitivity in some marine fishes (e.g., salmonids) is already well-developed at early life stages (Ohman et al. 2007), with sensitivities reported as low as 0.6 millivolt per centimeter (mV/cm) in Atlantic salmon (Formicki et al. 2004); however, most of the limited research that has occurred focuses on adults. Some species appear to be attracted to undersea cables, while others show avoidance (Ohman et al. 2007). Under controlled laboratory conditions, the scalloped hammerhead (*Sphyrna lewini*) and sandbar shark (*Carcharhinus plumbeus*) exhibited altered swimming and feeding behaviors in response to very weak electric fields (less than 1 nV per cm) (Kajiura and Holland 2002). In a test of sensitivity to fixed magnets, five Pacific sharks were shown to react to magnetic field strengths of 25 to 234 gauss at distances ranging between 0.85 and 1.90 ft. (0.26 and 0.58 m) and avoid the area (Rigg et al. 2009). A field trial in the Florida Keys demonstrated that southern stingray (*Dasyatis americana*) and nurse shark (*Ginglymostoma cirratum*) detected and avoided a fixed magnetic field producing a flux of 950 gauss (O'Connell et al. 2010). Scalloped hammerhead sharks may also experience temporary disturbance of normal sensory perception or could experience avoidance reactions (Kalmijn 2000).

Potential impacts of electromagnetic activity on adult fishes may not be relevant to early life stages (eggs, larvae, juveniles) due to ontogenic (lifestage-based) shifts in habitat utilization (Botsford et al. 2009; Sabates et al. 2007). Some skates and rays produce egg cases that occur on the bottom, while many neonate and adult sharks occur in the water column or near the water surface. Other species may have an opposite life history, with egg and larval stages occurring near the water surface, while adults may be demersal.

Based on current literature, only the fish groups identified above as capable of detecting electromagnetic fields (primarily elasmobranchs, tuna, and eels) will be carried forward in this analysis and the remaining groups (from Table 3.9-2) will not be discussed further.

3.9.3.2.1.1 No Action Alternative

Training Activities

There are no training activities under the No Action Alternative that would involve electromagnetic activities.

Testing Activities

There are no testing activities under the No Action Alternative that would involve electromagnetic activities.

3.9.3.2.1.2 Alternative 1

Training Activities

As indicated in Section 3.0.5.2.2.1 (Electromagnetic Devices), training activities involving electromagnetic devices under Alternative 1 occur up to five times annually as part of mine countermeasure (MCM) (towed mine detection) and Civilian Port Defense activities. Table 2.8-1 lists the number and location of training activities that use electromagnetic devices. Exposure of fishes to electromagnetic stressors is limited to those fish (primarily elasmobranchs, tuna, and eels) that are able to detect the electromagnetic properties in the water column (Bullock et al. 1983; Helfman et al. 2009).

Electromagnetic devices are used primarily during mine detection/neutralization activities, and in most cases, the devices simply mimic the electromagnetic signature of a vessel passing through the water. None of the devices include any type of electromagnetic "pulse." The towed body used for mine sweeping is designed to simulate a ship's electromagnetic signal in the water, and so would not be experienced by fishes as anything unusual. The static magnetic field generated by the electromagnetic systems is of relatively minute strength, typically 23 gauss at the cable surface and 0.002 gauss at a radius of 656 ft. (199.9 m). The strength of the electromagnetic field decreases quickly away from the cable down to the level of earth's magnetic field (0.5 gauss) at less than 13 ft. (3.9 m) from the source. In addition, training activities generally occur offshore in the water column, where fishes with high mobility predominate and fish densities are relatively low, compared with nearshore benthic habitat. Because the towed body is continuously moving, most fishes are expected to move away from it or follow behind it, in ways similar to responses to a vessel.

For any electromagnetically sensitive fishes in close proximity to the source, the generation of electromagnetic fields during training activities has the potential to interfere with prey detection and navigation. They may also experience temporary disturbance of normal sensory perception or could experience avoidance reactions (Kalmijn 2000), resulting in alterations of behavior and avoidance of normal foraging areas or migration routes. Mortality from electromagnetic devices is not expected.

Therefore, the electromagnetic devices used would not cause any potential risk to fishes because (1) the range of impact (i.e., greater than earth's magnetic field) is small (i.e., 13 ft. [3.9 m] from the source), (2) the electromagnetic components of these activities are limited to simulating the electromagnetic signature of a vessel as it passes through the water, and (3) the electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area. Some fishes could have a detectable response to electromagnetic exposure, but any impacts would be temporary with no anticipated impact on an individual's growth, survival, annual reproductive success, or lifetime reproductive success (i.e., fitness). Fitness refers to changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success. Electromagnetic exposure of eggs and larvae of sensitive bony fishes would be low relative to their total ichthyoplankton biomass (Able and Fahay 1998) and; therefore, potential impacts on recruitment would not be expected.

The ESA-listed scalloped hammerhead shark is capable of detecting electromagnetic energy. Therefore, electromagnetic stressors could affect scalloped hammerhead sharks. The electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area, therefore any disturbance to scalloped hammerhead sharks would be limited in range. If located in the immediate area where electromagnetic devices are being used, scalloped hammerhead sharks could experience temporary disturbance in normal sensory perception during migratory or foraging movements, or avoidance reactions (Kalmijn 2000).

Pursuant to the ESA, the use of electromagnetic devices during training activities under, Alternative 1 may affect, but is not likely to adversely affect, ESA-listed scalloped hammerhead sharks.

Testing Activities

As described in Section 2.7 (Alternative 1 [Preferred Alternative]: Expansion of Study Area Plus Adjustments to the Baseline and Additional Weapons, Platforms, and Systems), Alternative 1 consists of the No Action Alternative and adjustments to location, type, and tempo of training and testing activities, which includes the addition of platforms and systems.

Mine Countermeasure Mission package testing for new ship systems includes the use of electromagnetic devices (magnetic fields generated underwater to detect mines). Under Alternative 1, the Naval Sea Systems Command will engage in up to 32 MCM mission package testing activities annually. Exposure of fishes to electromagnetic stressors is limited to those fish groups identified in Sections 3.9.2.3 to 3.9.2.21 (Marine Fish Groups) that are able to detect the electromagnetic properties in the water column (Bullock et al. 1983; Helfman et al. 2009). Fish species that do not occur within these specified areas would not be exposed to the electromagnetic fields. The electromagnetic devices used in testing activities would not cause any potential risk to fishes for the same reasons stated for training activities above.

The ESA-listed scalloped hammerhead shark is capable of detecting electromagnetic energy. Therefore, electromagnetic stressors could affect scalloped hammerhead sharks. The electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area, therefore any disturbance to scalloped hammerhead sharks would be limited in range. If located in the immediate area where electromagnetic devices are being used, scalloped hammerhead sharks could experience temporary disturbance in normal sensory perception during migratory or foraging movements, or avoidance reactions (Kalmijn 2000).

Pursuant to the ESA, the use of electromagnetic devices during testing activities under, Alternative 1 may affect, but is not likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.2.1.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, the impacts from electromagnetic training events under Alternative 2 would be the same as those described under Alternative 1.

The ESA-listed scalloped hammerhead shark is capable of detecting electromagnetic energy. Therefore, electromagnetic stressors could affect scalloped hammerhead sharks. The electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area, therefore any disturbance to scalloped hammerhead sharks would be limited in range. If located in the immediate area where electromagnetic devices are being used, scalloped hammerhead sharks could experience temporary disturbance in normal sensory perception during migratory or foraging movements, or avoidance reactions (Kalmijn 2000).

Pursuant to the ESA, the use of electromagnetic devices during training activities under, Alternative 2 may affect, but is not likely to adversely affect, ESA-listed scalloped hammerhead sharks.

Testing Activities

Mine Countermeasure Mission package testing for new ship systems includes the use of electromagnetic devices (magnetic fields generated underwater to detect mines). Under Alternative 2, the Naval Sea Systems Command will engage in up to 36 Mine Counter Measure mission package testing activities annually. Exposure of fishes to electromagnetic stressors is limited to those fish groups identified in Sections 3.9.2.3 to 3.9.2.21 (Marine Fish Groups) that are able to detect the electromagnetic properties in the water column (Bullock et al. 1983; Helfman et al. 2009). Fish species that do not occur within these specified areas would not be exposed to the electromagnetic fields. The electromagnetic devices used in testing activities would not cause any potential risk to fishes for the same reasons stated for training activities above.

The ESA-listed scalloped hammerhead shark is capable of detecting electromagnetic energy. Therefore, electromagnetic stressors could affect scalloped hammerhead sharks. The electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area, therefore any disturbance to scalloped hammerhead sharks would be limited in range. If located in the immediate area where electromagnetic devices are being used, scalloped hammerhead sharks could experience temporary disturbance in normal sensory perception during migratory or foraging movements, or avoidance reactions (Kalmijn 2000).

Pursuant to the ESA, the use of electromagnetic devices during testing activities under, Alternative 2 may affect, but is not likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.2.2 Summary and Conclusions of Energy Impacts

Under the No Action Alternative, Alternative 1, or Alternative 2, disturbance from activities using electromagnetic energy could be expected to elicit brief behavioral or physiological responses only in those exposed fishes with sensitivities/detection abilities (primarily sharks and rays) within the corresponding portion of the electromagnetic spectrum that these activities use. For electromagnetic devices, the typical reaction would be for the fish to avoid (move away from) the signal upon detection. The impact of electromagnetic signals are expected to be inconsequential on fishes or fish populations because signals are similar to regular vessel traffic, and the electromagnetic signal would be continuously moving and cover only a small spatial area during use.

Pursuant to the ESA, energy stressors under the No Action Alternative, Alternative 1, or Alternative 2 may affect, but are not likely to adversely affect, ESA-listed scalloped hammerhead sharks.

3.9.3.3 Physical Disturbance and Strike Stressors

This section evaluates the potential effects of various types of physical disturbance and strike stressors associated with military training and testing activities within the Study Area. Section 3.0.5.2.3 (Physical Disturbance and Strike Stressors) discusses the activities that may produce physical disturbance and strike stressors.

Physical disturbance and strike risks have the potential to impact all taxonomic groups found within the Study Area (Table 3.9-2), because strikes could occur anywhere in the water column or on the seafloor. Potential impacts of physical strike include behavioral responses such as avoidance response behavior, change in swimming speed/direction, physiological stress response, temporary disorientation, injury, or mortality. These disturbances could result in abnormal behavioral, growth, or reproductive impacts. Although fishes can detect approaching vessels using a combination of sensory abilities (sight, hearing, lateral line), the slow-moving fishes (e.g., ocean sunfish, basking sharks) are unable to avoid all collisions, with some vessel strikes resulting in mortality.

The way a physical strike impacts a fish would depend in part on the relative size of the object and the location of the fish in the water column. Before being struck by an object, the fish would sense a pressure wave through the water (Hawkins and Johnstone 1978). Small fishes in the open water, such as anchovies or sardines, would simply be displaced by the movement generated by a large object moving through the water. Some fish might have time to detect the approaching object and swim away; others could be struck before it becomes aware of the object. An open-ocean fish displaced a small distance by movements from an object falling into the water nearby would likely continue on as if nothing had happened. However, a bottom-dwelling fish in the vicinity of a falling object would likely be disturbed and may exhibit a generalized stress response. If the object actually hit the fish, direct injury in addition to stress may result. As in all vertebrates, the function of the stress response in fishes is to rapidly raise the blood sugar level to prepare the fish to flee or fight (Helfman et al. 2009). This generally adaptive physiological response can become a liability to the fish if the stressor persists and the fish is not able to return to its baseline physiological state. When stressors are chronic, the fish may experience reduced growth, health, or survival (Wedemeyer et al. 1990).

Most fishes respond to sudden physical approach or contact by darting quickly away from the stimulus. Other species may respond by freezing in place and adopting cryptic coloration. In either case, the individual must stop its current activity and divert its physiological and cognitive attention to responding to the stressor (Helfman et al. 2009). The energy costs of reacting to a stressor depend on the specific situation, but in all cases the caloric requirements of stress reactions reduce the amount of energy available to the fish for other functions, such as predator avoidance, reproduction, growth, and maintenance (Wedemeyer et al. 1990).

The ability of a fish to return to its previous activity following a physical strike (or near-miss resulting in a stress response) is a function of both genetic and environmental factors. Some fish species are more tolerant of stressors than others and become acclimated more easily. Experiments with species for use in aquaculture have revealed the immense variability among species in their tolerance to crowding, handling, and other physical stressors, as well as to chemical stressors. Within a species, the rate at which an individual recovers from a physical strike may be influenced by its age, sex, reproductive state, and general condition. A fish that has reacted to a sudden disturbance by swimming at burst speed would tire after only a few minutes; its blood hormone and sugar levels (cortisol and glucose) may not return to normal for 24 hours. During the recovery period, the fish would not be able to attain burst speeds and would be more vulnerable to predators (Wardle 1986). If the individual were not able to regain a steady state following exposure to a physical stressor, it may suffer reduced immune function and even death (Wedemeyer et al. 1990).

Potential impacts of physical disturbance or strike to adults may be different than for other lifestages (eggs, larvae, juveniles) because these lifestages do not necessarily occur together in the same location (Botsford et al. 2009; Sabates et al. 2007), and many egg and larval stages occur near the water surface. Early lifestages of most fishes could be displaced by vessels, but not struck in the same manner as adults of larger species. Early lifestages could also become entrained by the propeller movement, or propeller wash, of vessels. However, no measurable impacts on fish recruitment would occur because the number of eggs and larvae exposed to vessel movements would be low relative to total ichthyoplankton biomass.

3.9.3.3.1 Impacts from Vessel and In-Water Devices

The majority of the activities under all alternatives involve vessels, and a few of the activities involve the use of in-water devices. For a discussion of the types of activities that use vessels and in-water devices, where they are used, and how many activities would occur under each Alternative, see Chapter 2 and Section 3.0.5.2.3 (Physical Disturbance and Strike Stressors).

Vessels and in-water devices do not normally collide with adult fish, most of which can detect and avoid them. One study on fishes' behavioral responses to vessels showed that most adults exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jørgensen et al. 2004), reducing the potential for vessel strikes. Misund (1997) found that fishes ahead of a ship that showed avoidance reactions did so at ranges of 160 to 490 ft. (48.8 to 149.4 m). When the vessel passed over them, some fishes responded with sudden escape responses that included lateral avoidance or downward compression of the school. Conversely, Rostad et al. (2006) observed that some fishes are attracted to different types of vessels (e.g., research vessels, commercial vessels) of varying sizes, noise levels, and habitat locations. Fish behavior in the vicinity of a vessel is therefore quite variable, depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwarz 1985). Early life stages of most fishes could be displaced by vessels and not struck in the same manner as adults of larger species. However, a vessel's propeller movement or propeller wash could entrain early life stages. The low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring (Chapman and Hawkins 1973), but avoidance ended within 10 seconds after the vessel departed. Because a towed in-water device is continuously moving, most fishes are expected to move away from it or to follow behind it, in a manner similar to their responses to a vessel. When the device is removed, most fishes would simply move to another area.

There are a few notable exceptions to this assessment of potential vessel strike impacts on marine fish groups. Large slow-moving fish such as ocean sunfish, whale sharks, basking sharks, and manta rays occur near the surface in open-ocean and coastal areas, and are more susceptible to ship strikes, causing blunt trauma, lacerations, fin damage, or mortality. Speed et al. (2008) evaluated this specifically for whale sharks, but these other large slow-moving fishes are also likely to be susceptible because of their similar behavior and location in the water column. Increases in the numbers and sizes of shipping vessels in the modern cargo fleets make it difficult to gather mortality data because personnel on large ships are often unaware of whale shark collisions (Stevens 2007), therefore, the occurrence of whale shark strikes is likely much higher than has been documented by the few studies that have been conducted. The results of a whale shark study outside of the Study Area in the Gulf of Tadjoura, Djibouti, revealed that of the 23 whale sharks observed during a 5-day period, 65 percent had scarring from boat and propeller strikes (Rowat et al. 2007). Based on the typical physiological responses described in Section 3.9.3.3 (Physical Disturbance and Strike Stressors), vessel movements are not expected to compromise the general health or condition of individual fishes, except for whale sharks, basking sharks, manta rays, and ocean sunfish.

3.9.3.3.1.1 No Action Alternative, Alternative 1 and Alternative 2

Training Activities

As indicated in Sections 3.0.5.2.3 (Physical Disturbance and Strike Stressors) and 3.0.5.2.3.3 (In-Water Devices), training activities involving in-water devices can occur anywhere in the Study Area. Navy vessel activity primarily occurs within the U.S. Exclusive Economic Zone, and certain portions of the Study Area, such as areas near ports or naval installations and training ranges are used more heavily by vessels than other portions of the Study Area. These activities do not differ seasonally and could be widely dispersed throughout the Study Area. The differences in the number of in-water device activities between alternatives increases under Alternative 1 and Alternative 2 compared to the No Action Alternative; however, this increase is not expected to increase impacts. Species that do not occur near the surface within the Study Area would not be exposed to in-water device strike potential.

Exposure of fishes to vessel strike stressors is limited to those fish groups identified in Sections 3.9.2.3 to 3.9.2.21 (Marine Fish Groups) that are large, slow-moving, and may occur near the surface, such as ocean sunfish, whale sharks, and manta rays. These species are most likely distributed widely in offshore and nearshore portions of the Study Area. Any isolated cases of a military vessel striking an individual could injure that individual, impacting the fitness of an individual fish, but not to the extent that the viability of populations would be impacted. Vessel strikes would not pose a risk to most of the other marine fish groups, because many fish can detect and avoid vessel movements, making strikes rare and allowing the fish to return to their normal behavior after the ship or device passes. As a vessel approaches a fish, they could have a detectable behavioral or physiological response (e.g., swimming away and increased heart rate) as the passing vessel displaces them. However, such reactions are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of these marine fish groups at the population level.

Operational features of in-water devices and their use substantially limit the exposure of fish to potential strikes. First, in-water devices would not pose any strike risk to benthic fishes because the towed equipment is designed to stay off the bottom. Prior to deploying a towed in-water device, there is a standard operating procedure to search the intended path of the device for any floating debris (i.e., driftwood) or other potential obstructions, since they have the potential to cause damage to the device.

The likelihood of strikes by towed mine warfare devices on adult fish, which could result in injury or mortality, would be extremely low because these life stages are highly mobile. The use of in-water devices may result in short-term and local displacement of fishes in the water column. However, these behavioral reactions are not expected to result in substantial changes to an individual’s fitness, or species recruitment, and are not expected to result in population-level impacts. Ichthyoplankton (fish eggs and larvae) in the water column could be displaced, injured, or killed by towed mine warfare devices. The numbers of eggs and larvae exposed to vessels or in-water devices would be extremely low relative to total ichthyoplankton biomass (Able and Fahay 1998); therefore, measurable changes on fish recruitment would not occur.

The risk of a strike from vessels and in-water devices used in training activities would be extremely low because: (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Since impacts from strikes would be rare, and although any increase in vessel and in-water device use proposed under Alternatives 1 and 2 could potentially increase the probability of a strike, for the reasons stated above for the No Action Alternative, impacts on fish or fish populations would be negligible. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices. Therefore, vessel and in-water device use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of vessels and in-water devices during training activities under the No Action Alternative, Alternative 1, and Alternative 2 will have no effect on ESA-listed scalloped hammerhead sharks.

Testing Activities

As indicated in Sections 3.0.5.2.3 (Physical Disturbance and Strike Stressors) and 3.0.5.2.3.3 (In-Water Devices), testing activities involving in-water devices can occur anywhere in the Study Area.

As discussed for training activities, the risk of a strike from vessels and in-water devices used in testing activities would be extremely low because: (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Since impacts from strikes would be rare, and although any increase in vessel and in-water device use proposed under Alternatives 1 and 2 could potentially increase the probability of a strike, for the reasons stated above for the No Action Alternative, Alternative 1, and Alternative 2, impacts on fish or fish populations would be negligible. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices. Therefore, vessel and in-water device use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities under the No Action Alternative, Alternative 1, and Alternative 2 will have no effect on ESA-listed scalloped hammerhead sharks.

3.9.3.3.2 Impacts from Military Expended Materials

Navy training and testing activities in the Study Area include firing a variety of weapons and employing a variety of explosive and non-explosive rounds including bombs, and small-, medium-, and large-caliber projectiles, or even entire ship hulks during a sinking exercise. During these training and testing activities, various items may be introduced and expended into the marine environment and are referred to as military expended materials.

This section analyzes the strike potential to marine fish of the following categories of military expended materials: (1) non-explosive practice munitions; (2) fragments from explosive munitions; and (3) expended materials other than ordnance, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.2.3.4 (Military Expended Materials).

While disturbance or strike from any of these objects as they sink through the water column is possible, it is not very likely for most expended materials because the objects generally sink through the water slowly and can be avoided by most fishes. Although some objects may sink faster, it is unlikely even at these faster rates that fish in the middle of the water column would be struck. Therefore, with the exception of sinking exercises, the discussion of military expended materials strikes focuses on strikes at the surface or in the upper water column from fragments (of explosives) and projectiles because those items have a greater potential for a fish strike as they hit the water, before slowing down as they move through the water column.

Vessel Hulk. During a sinking exercise, aircraft, ship, and submarine crews deliver ordnance on a seaborne target, usually a clean deactivated ship (Section 3.1, Sediments and Water Quality), which is deliberately sunk using multiple weapon systems. Sinking exercises occur in specific open ocean areas, outside of the coastal area, in waters exceeding 3,000 m (9,842.5 ft.) in depth, as shown in Figure 3.0-2. Direct ordnance strikes from the various weapons used in these exercises are a source of potential impact. However, these impacts are discussed for each of those weapons categories in this section and are not repeated here. Therefore, the analysis of sinking exercises as a strike potential for benthic fishes is discussed in terms of the ship hulk landing on the seafloor.

Small-, Medium-, and Large-Caliber Projectiles. Various types of projectiles could cause a temporary (seconds), localized impact when they strike the surface of the water. Current Navy training and testing in the Study Area, such as gunnery exercises, include firing a variety of weapons and using a variety of non-explosive training and testing rounds, including small-, medium-, and large-caliber projectiles. The larger-caliber projectiles are primarily used in the open ocean beyond 12 nm. Direct ordnance strikes from firing weapons are potential stressors to fishes. There is a remote possibility that an individual fish at or near the surface may be struck directly if it is at the point of impact at the time of non-explosive ordnance delivery. Expended rounds may strike the water surface with sufficient force to cause injury or mortality. There are 77 epipelagic species (including flying fish, jacks, and tuna) in the Study Area swim right at, or near, the surface of the water (Myers and Donaldson 2003).

Various projectiles will fall on soft or hard bottom habitats, where they could either become buried immediately in the sediments, or sit on the bottom for an extended time period (see Figures 3.3-1 through 3.3-5). Except for the 5 in. (12.7 cm) and the 30 mm rounds, which are fired from a helicopter, all projectiles will be aimed at surface targets. These targets will absorb most of the projectiles' energy before they strike the surface of the water and sink. This factor will limit the possibility of high-velocity impacts with fish from the rounds entering the water. Furthermore, fish can quickly and easily leave an area temporarily when vessels or helicopters approach. It is reasonable to assume, therefore, that fish will leave an area prior to, or just after the onset of, projectile firing and will return once tests are completed.

Most ordnance would sink through the water column and come to rest on the seafloor, stirring up sediment and possibly inducing a startle response, displacing, or injuring nearby fishes in extremely rare cases. Particular impacts on a given fish species would depend on the size and speed of the ordnance, the water depth, the number of rounds delivered, the frequency of training and testing, and the sensitivity of the fish.

Bombs, Missiles, and Rockets. Direct ordnance strikes from bombs, missiles, and rockets are potential stressors to fishes. Some individual fish at or near the surface may be struck directly if they are at the point of impact at the time of non-explosive ordnance delivery. However, most missiles hit their target or are disabled before hitting the water. Thus, most of these missiles and aerial targets hit the water as fragments, which quickly dissipates their kinetic energy within a short distance of the surface. A limited number of fishes swim right at, or near, the surface of the water, as described for small-, medium-, and large-caliber projectiles.

Statistical modeling could not be conducted to estimate the probability of military expended material strikes on fish, because fish density data are not available at the scale of an Operating Area or testing range. In lieu of strike probability modeling, the number, size, and area of potential impact (or "footprints") of each type of military expended material is presented in Tables 3.3-4 through 3.3-6. The application of this type of footprint analysis to fish follows the notion that a fish occupying the impact area could be susceptible to potential impacts, either at the water surface (e.g., pelagic sharks, flying fishes, jacks, tuna, mackerels, billfishes, and molas [Table 3.9-2]) or as military expended material falls through the water column and settles to the bottom (e.g., flounders, skates, and other benthic fishes listed in Table 3.9-2). Furthermore, most of the projectiles fired during training and testing activities are fired at targets, and most projectiles hit those targets, so only a very small portion of those would hit the water with their maximum velocity and force. Of that small portion, a small number of fish at or near the surface (pelagic fishes) or near the bottom (benthic fishes) may be directly impacted if they are in the target area and near the expended item that hits the water surface (or bottom), but population-level effects would not occur.

Propelled fragments are produced by an exploding bomb. Close to the explosion, fishes could potentially sustain injury or death from propelled fragments (Stuhmiller et al. 1990). However, studies of underwater bomb blasts have shown that fragments are larger than those produced during air blasts and decelerate much more rapidly (O'Keefe and Young 1984; Swisdak Jr. and Montaro 1992), reducing the risk to marine organisms.

Fish disturbance or strike could result from bomb fragments (after explosion) falling through the water column in very small areas compared to the vast expanse of the testing ranges, operating areas, range complexes, or the Study Area. The expected reaction of fishes exposed to this stressor would be to immediately leave the area where bombing is occurring, thereby reducing the probability of a fish strike after the initial expended materials hit the water surface. When a disturbance of this type concludes, the area would be repopulated and the fish stock would rebound with inconsequential impacts on the resource (Lundquist et al. 2010).

3.9.3.3.2.1 No Action Alternative

Training Activities

Marine fish groups identified in Sections 3.9.2.3 to 3.9.2.21 (Marine Fish Groups) that are particularly susceptible to military expended material strikes are those occurring at the surface, within the offshore and coastal portions of the range complexes (where the strike would occur). Those groups include pelagic sharks, flying fishes, jacks, tuna, mackerels, billfishes, molas, and other similar species (see Table 3.9-2). Additionally, certain deep-sea fishes would be exposed to strike risk as a ship hulk, expended during a sinking exercise, settles to the seafloor. These groups include hagfishes, lanternfishes, and anglerfishes.

An estimated 116,271 military expended materials would be used annually during training activities within the MITT Study Area (Tables 3.0-18 through 3.0-20 and 3.0-25 through 3.0-27). Projectiles, bombs, missiles, rockets, torpedoes and associated fragments have the potential to directly strike fish as they hit the water surface and below the surface to the point where the projectile loses its forward momentum. Fish at and just below the surface would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as the materials travel through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching munitions or fragments as they fall through the water column. The probability of strike based on the "footprint" analysis included in Table 3.3-4 indicates that even for an extreme case of expending all small-caliber projectiles within a single gunnery box, the probability of any of these items striking a fish (even as large as bluefin tuna or whale sharks) is extremely low. Therefore, since most fishes are smaller than bluefin tuna or whale sharks, and most military expended materials are less abundant than small-caliber projectiles, the risk of strike by these items is exceedingly low for fish overall. A possibility exists that a small number of fish at or near the surface may be directly impacted if they are in the target area and near the point of physical impact at the time of military expended material strike, but population-level impacts would not occur.

Sinking exercises occur in open-ocean areas, outside of the coastal waters. While serious injury or mortality to individual fish would be expected if they were present in the immediate vicinity of the high intensity of explosive stressors (analyzed in Section 3.9.3.1, Acoustic Stressors), sinking exercises under the No Action Alternative would not result in impacts on pelagic fish populations at the surface based on the low number of fish in the immediate area and the placement of these activities in deep, ocean areas where fish abundance is low or widely dispersed. Disturbances to benthic fishes from sinking exercises would be highly localized. Any deep sea fishes located on the bottom where a ship hulk would settle could experience displacement, injury, or death. However, population level impacts on the deep sea fish community would not occur because of the limited spatial extent of the impact.

The impact of military expended material strikes would be inconsequential due to (1) the limited number of species found directly at the surface where military expended material strikes could occur, (2) the rare chance that a fish might be directly struck at the surface by military expended materials, and (3) the ability of most fish to detect and avoid an object falling through the water below the surface. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface (and seafloor areas within sinking exercise boxes), and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Additionally, scalloped hammerhead sharks are more likely to be located near the seafloor and not on the surface, where there would be a greater potential for a strike. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of military expended materials during training activities under the No Action Alternative will have no effect on ESA-listed scalloped hammerhead sharks.

Testing Activities

No military expended materials will be used during testing activities under the No Action Alternative (Tables 3.0-18 through 3.0-20 and 3.0-25 through 3.0-27).

3.9.3.3.2.2 Alternative 1

Training Activities

An estimated 261,482 military expended materials would be used annually during training activities (Tables 3.0-18 through 3.0-20 and 3.0-25 through 3.0-27), which is a 120 percent increase over the No Action Alternative. Compared to the No Action Alternative, the overall increase in military expended materials used under Alternative 1 is due primarily to a large increase in medium-caliber projectiles, and a relatively smaller increase in the number of small-caliber projectiles. These changes would result in increased exposure of fish to military expended materials; however, for reasons stated in the No Action Alternative, the overall increase of military expended material under Alternative 1 would not result in an increased strike risk. The impact of military expended material strikes would be inconsequential due to (1) the limited number of species found directly at the surface where military expended material strikes could occur, (2) the rare chance that a fish might be directly struck at the surface by military expended materials, and (3) the ability of most fish to detect and avoid an object falling through the water below the surface. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface and seafloor areas, and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Additionally, scalloped hammerhead sharks are more likely to be located near the seafloor and not on the surface, where there would be a greater potential for a strike. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of military expended materials during training activities under Alternative 1 will have no effect on ESA-listed scalloped hammerhead sharks.

Testing Activities

An estimated 23,713 military expended materials would be used annually during testing activities under Alternative 1 (Tables 3.0-18 through 3.0-20 and 3.0-25 through 3.0-27). These expended materials would result in increased exposure of fish to potential strikes; however, for reasons stated in the No Action Alternative for training, the overall increase of military expended material under Alternative 1 would result in an increased strike risk; however, this increase would be negligible. The impact of military expended material strikes would be inconsequential due to (1) the limited number of species found directly at the surface where military expended material strikes could occur, (2) the rare chance that a fish might be directly struck at the surface by military expended materials, and (3) the ability of most fish to detect and avoid an object falling through the water below the surface. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface and seafloor areas, and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Additionally, scalloped hammerhead sharks are more likely to be located near the seafloor and not on the surface, where there would be a greater potential for a strike. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of military expended materials during testing activities under Alternative 1 will have no effect on ESA-listed scalloped hammerhead sharks.

3.9.3.3.2.3 Alternative 2

Training Activities

An estimated 269,375 military expended materials would be used annually during training activities under Alternative 2 (Tables 3.0-18 through 3.0-20 and 3.0-25 through 3.0-27), which is a 130 percent increase over the No Action Alternative. Compared to the No Action Alternative, the overall increase in military expended materials used under Alternative 2 is due primarily to a large increase in medium-caliber projectiles, and a relatively smaller increase in the number of small-caliber projectiles. These changes would result in increased exposure of fish to military expended materials; however, for reasons stated in the No Action Alternative and Alternative 1, the overall increase of military expended material under Alternative 2 would not result in an increased strike risk. The impact of military expended material strikes would be inconsequential due to (1) the limited number of species found directly at the surface where military expended material strikes could occur, (2) the rare chance that a fish might be directly struck at the surface by military expended materials, and (3) the ability of most fish to detect and avoid an object falling through the water below the surface. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface (and seafloor areas, and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Additionally, scalloped hammerhead sharks are more likely to be located near the seafloor and not on the surface, where there would be a greater potential for a strike. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of military expended materials during training activities under Alternative 2 will have no effect on ESA-listed scalloped hammerhead sharks.

Testing Activities

An estimated 27,415 military expended materials would be used annually during testing activities under Alternative 2 (Tables 3.0-18 through 3.0-20 and 3.0-25 through 3.0-27). These expended materials would result in increased exposure of fish to potential strikes; however, for reasons stated in Alternative 1, the overall increase of military expended material under Alternative 2 would result in an increased strike risk, although this risk would be minimal. The impact of military expended material strikes would be inconsequential due to (1) the limited number of species found directly at the surface where military expended material strikes could occur, (2) the rare chance that a fish might be directly struck at the surface by military expended materials, and (3) the ability of most fish to detect and avoid an object falling through the water below the surface. The potential impacts of military expended material strikes would be short-term (seconds) and localized disturbances of the water surface and seafloor areas, and are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction at the population level.

The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Additionally, scalloped hammerhead sharks are more likely to be located near the seafloor and not on the surface where there would be a greater potential for a strike. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of military expended materials during testing activities under Alternative 2 will have no effect on ESA-listed scalloped hammerhead sharks.

3.9.3.3.3 Impacts from Seafloor Devices

For a discussion of the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.2.3.5 (Seafloor Devices). Seafloor devices include items that are placed on, dropped on, or moved along the seafloor such as mine shapes, anchor blocks, anchors, bottom-placed instruments, bottom-crawling unmanned undersea vehicles, and bottom-placed targets that are not expended. As discussed in the military expended materials strike section, objects falling through the water column will slow in velocity as they sink toward the bottom and could be avoided by most fish.

Seafloor devices with a strike potential for fish include those items temporarily deployed on the seafloor. The potential strike impacts of unmanned underwater vehicles, including bottom crawling types, are also included here. Some fishes are attracted to virtually any tethered object in the water column (Dempster and Taquet 2004) and could be attracted to an inert mine assembly. However, while a fish might be attracted to the object, their sensory abilities allow them to avoid colliding with fixed tethered objects in the water column (Bleckmann and Zelick 2009), so the likelihood of a fish striking one of these objects is implausible. Therefore, strike hazards associated with collision into other seafloor devices such as deployed mine shapes or anchored devices are highly unlikely to pose any strike hazard to fishes and are not discussed further.

3.9.3.3.3.1 No Action Alternative

Training Activities

Under the No Action Alternative, 480 mine shapes would be used during mine-laying training activities. Seafloor devices have the potential to directly strike fish as they hit the water surface and below the surface to the point where the device strikes the bottom. Fish at and just below the surface, as well as those on the bottom, would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as the materials travel through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching devices as they fall through the water column. A possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike. However, the likelihood of one of these objects striking a fish is implausible, and in the rare event that a strike occurred, population-level impacts would not occur. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of seafloor devices during training activities under the No Action Alternative will have no effect on ESA-listed scalloped hammerhead sharks.

Testing Activities

Under the No Action Alternative, seafloor devices are only utilized during testing activities at the North Pacific Acoustic Lab's Deep Water site. The deep water experimental site consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment (depths greater than 3,280 ft. [1,000 m]) of the northwestern Philippine Sea. A possibility exists that a small number of fish at or near the surface may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike, but the likelihood of one of these objects striking a fish is implausible and in the rare event that a strike occurred, population-level impacts would not occur. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of seafloor devices during testing activities under the No Action Alternative will have no effect on ESA-listed scalloped hammerhead sharks.

3.9.3.3.3.2 Alternative 1

Training Activities

Under Alternative 1, 480 mine shapes would be used during mine-laying training activities. Mine shapes would be used throughout Warning Area (W-)517. Additionally there would be 18 precision anchoring activities which would occur within predetermined shallow water anchorage locations near ports. Seafloor devices have the potential to directly strike fish as they hit the water surface and below the surface to the point where the device strikes the bottom. Fish at and just below the surface, as well as those on the bottom, would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as the materials travel through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching devices as they fall through the water column. A possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike. However, the likelihood of one of these objects striking a fish is implausible, and in the rare event that a strike occurred, population-level impacts would not occur. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of seafloor devices during training activities under Alternative 1 will have no effect on ESA-listed scalloped hammerhead sharks.

Testing Activities

Under Alternative 1, seafloor devices are utilized during pierside integrated swimmer defense activities, testing activities at the North Pacific Acoustic Lab's Deep Water site, and during the MCM mission package testing. The deep water experimental site consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment (depths greater than 3,280 ft. [1,000 m]) of the northwestern Philippine Sea.

Seafloor devices have the potential to directly strike fish as they hit the water surface and below the surface to the point where the device strikes the bottom. Fish at and just below the surface, as well as those on the bottom, would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as it the materials travel through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching devices as they fall through the water column. A possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike. During the pierside integrated swimmer defense activities, seafloor devices are placed by hand on the seafloor and removed after the activity; therefore, there would be no impact to fish from these items. However, the likelihood of objects used during MCM mission package testing striking a fish is implausible, and in the rare event that a strike occurred, population-level impacts would not occur. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of seafloor devices during testing activities under Alternative 1 will have no effect on ESA-listed scalloped hammerhead sharks.

3.9.3.3.3.3 Alternative 2

Training Activities

Under Alternative 2, 480 mine shapes would be used during mine laying training activities. Mine shapes would be deployed throughout W-517. Additionally there would be 18 precision anchoring activities which would occur within predetermined shallow water anchorage locations near ports. Seafloor devices have the potential to directly strike fish as they hit the water surface and below the surface to the point where the device strikes the bottom. Fish at and just below the surface, as well as those on the bottom, would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as it the materials travel through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching devices as they fall through the water column. A possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike. However, the likelihood of one of these objects striking a fish is implausible, and in the rare event that a strike occurred, population-level impacts would not occur. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of seafloor devices during training activities under Alternative 2 will have no effect on ESA-listed scalloped hammerhead sharks.

Testing Activities

Under Alternative 2, seafloor devices are utilized during pierside integrated swimmer defense activities, testing activities at the North Pacific Acoustic Lab's Deep Water site, and during the MCM mission package testing. The deep water experimental site consists of an acoustic tomography array, a distributed vertical line array, and moorings in the deep-water environment (depths greater than 3,280 ft. [1,000 m]) of the northwestern Philippine Sea.

Seafloor devices have the potential to directly strike fish as they hit the water surface and below the surface to the point where the device strikes the bottom. Fish at and just below the surface, as well as those on the bottom, would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as it the materials travel through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching devices as they fall through the water column. A possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike During the pierside integrated swimmer defense activities, seafloor devices are placed by hand on the seafloor and removed after the activity; therefore, there would be no impact to fish from these items. However, the likelihood of objects used during MCM mission package testing striking a fish is implausible, and in the rare event that a strike occurred, population-level impacts would not occur. The ESA-listed scalloped hammerhead sharks can sense pressure changes in the water column and swim quickly, and are likely to avoid an object falling through the water. Therefore, military expended materials use would not affect scalloped hammerhead sharks.

Pursuant to the ESA, the use of seafloor devices during testing activities under Alternative 2 will have no effect on ESA-listed scalloped hammerhead sharks.

3.9.3.3.4 Summary and Conclusions of Physical Disturbance and Strike Impacts

The greatest potential for combined impacts of physical disturbance and strike stressors under the Proposed Action would occur for sinking exercises because of multiple opportunities for potential strike by vessel, ordnance, or other military expended material. Under the Proposed Action, no more than two sinking exercises would occur per year. Sinking exercises were specifically chosen to evaluate impacts on military expended material strike because sinking exercises represent the activity with the greatest amount of military expended materials by weight. During each sinking exercise, approximately 725 objects would be expended, including large bombs, missiles, large projectiles, torpedoes, and one target vessel. Therefore, during each sinking exercise, approximately 105 objects per square kilometer would sink to the ocean floor. These items, combined with the mass and size of the ship hulk itself, are representative of an extreme case for military expended materials of all types striking benthic fishes. However, the overlap of these activities would only occur during a limited number of activities and only within the open ocean areas where the sinking exercises areas are located.

A less intensive example of potential impacts of combined strike stressors would be for cases where a fish could be displaced by a vessel in the water column during any number of activities utilizing bombs, missiles, rockets, or projectiles. As the vessel maneuvers during the exercise, any fishes displaced by that vessel movement could potentially be struck by munitions expended by that vessel during that same exercise. This would be more likely to occur in concentrated areas of this type of activity (e.g., a gunnery exercise inside a gunnery box). However, the likelihood of this occurring is probably quite low anywhere else, because most activities do not expend their munitions towards, or in proximity to, a training or testing vessel for safety reasons. While small-caliber projectiles are expended away from but often close to the vessel from which the projectiles are fired, this does not necessarily increase the risk of strike. During the initial displacement of the fish from vessel activity, or after the first several projectiles are fired, most fishes would disperse widely and the probability of strike may actually be reduced in most cases. Also, the combination of these stressors would cease immediately when the activity ends; therefore, combination is possible but not reasonably foreseeable.

Research suggests that only a limited number of marine fish species are susceptible to being struck by a vessel. Most fishes would not respond to vessel disturbance beyond a temporary displacement from their normal activity, which would be inconsequential and not detectable. The Navy identified and analyzed three physical disturbance or strike substressors that have potential to impact fishes: vessel and in-water device strikes, military expended material strikes, and seafloor device strikes. While the potential for vessel strikes on fish can occur anywhere vessels are operated, most fishes are highly mobile and capable of avoiding vessels, expended materials, or objects in the water column. For the larger slower-moving species (e.g., whale shark, manta ray, and molas) the potential for a vessel or military expended material strike increases, as discussed in the analysis. The potential for a seafloor device striking a fish is very low because the sensory capabilities of most fishes allow them to detect and avoid underwater objects.

Pursuant to the ESA, physical disturbance and strikes under the No Action Alternative, Alternative 1, or Alternative 2 will have no effect on ESA-listed scalloped hammerhead sharks.

3.9.3.4 Entanglement Stressors

This section evaluates potential entanglement impacts of various types of expended materials used by the military during training and testing activities within the Study Area. The likelihood of fish being affected by an entanglement stressor is a function of the physical properties, location, and buoyancy of the object and the behavior of the fish as described in Appendix H.5 (Conceptual Framework for Assessing Effects from Entanglement). Two types of military expended materials are considered here: (1) fiber optic cables and guidance wires, and (2) decelerators/parachutes.

Most entanglement observations involve abandoned or discarded nets, lines, and other materials that form loops or incorporate rings (Laist 1987; Derraik 2002; Macfadyen et al. 2009; Keller et al. 2010). A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for approximately 68 percent of fish entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010). No occurrences involving military expended materials were documented.

Fish entanglement occurs most frequently at or just below the surface or in the water column where objects are suspended. A smaller number involve objects on the seafloor, particularly abandoned fishing gear designed to catch bottom fish or invertebrates (Ocean Conservancy 2010). More fish species are entangled in coastal waters and the continental shelf than elsewhere in the marine environment because of higher concentrations of human activity (e.g., fishing, sources of entangling debris), higher fish abundances, and greater species diversity (Helfman et al. 2009; Macfadyen et al. 2009). The consequences of entanglement range from temporary and inconsequential to major physiological stress or mortality.

The military uses some types of materials that could become entanglement stressors during training and testing activities in the Study Area. Possible expended materials from MITT activities that pose a risk of entanglement include sonobuoy components, torpedo guidance wires, torpedo flex hoses, cables, and decelerators/parachutes. Cables are used to moor vessels, mine shapes, and other objects to the bottom, and to connect to seafloor devices. Cables used in these scenarios are held taut, have insufficient slack to form loops, and are recovered after use; therefore, no potential for entanglement exists and activities using cables in this way are not discussed further. A flex hose is released when a torpedo is deployed to protect the guidance wire while near the launch vessel. Flex hoses are stiff, heavy, and would rapidly sink to the bottom on release. The flex hose is designed to remain free of loops, so no potential for entanglement exists and is not discussed further.

Oceanic fishes may encounter guidance wires and decelerators/parachutes, but nearshore fishes are extremely unlikely to encounter these materials because of where activities occur. Training and testing using heavyweight torpedoes do not take place in nearshore waters, so guidance wires would not be expended there, although decelerators/parachutes could be expended indirectly by drifting in from offshore areas. The discussion in this section focuses on the likelihood of overlap of these expended items with those fishes in the water column and benthic habitats that might be susceptible to becoming entangled in these items. This evaluation is based on the size, location, and buoyancy of the object and the behavior of the fishes.

3.9.3.4.1 Impacts from Fiber Optic Cables and Guidance Wires

Fiber optic cables and guidance wires are used during training and testing activities. A discussion of the types of activities, physical characteristics, location of use, and the number of items expended under each alternative is presented in Section 3.0.5.2.4.1 (Fiber Optic Cables and Guidance Wires).

Marine fish groups identified in Sections 3.9.2 (Affected Environment), that could be susceptible to entanglement in expended cables and wires are those with elongated snouts lined with tooth-like structures that easily snag on other similar marine debris, such as derelict fishing gear (Macfadyen et al. 2009). Some elasmobranchs (hammerhead sharks) and billfish occurring within the offshore and continental shelf portions of the range complexes (where the potential for entanglement would occur) could be susceptible to entanglement in cables and wires. Species occurring outside the specified areas within these range complexes would not be exposed to fiber optic cables or guidance wires.

Once a guidance wire is released, it is likely to sink immediately and remain on the seafloor. In some cases, the wire may snag on a hard structure near the bottom and remain partially or completely suspended. The types of fish that encounter any given wire would depend, in part, on its geographic location and vertical location in the water column. In any situation, the most likely mechanism for entanglement would involve fish swimming through loops in the wire that tighten around it; however, loops are unlikely to form in guidance wire (Environmental Sciences Group 2005).

Because of their physical characteristics, guidance wires and fiber optic cables pose a potential, though unlikely, entanglement risk to susceptible fish. Potential entanglement scenarios are based on fish behavior in abandoned monofilament, nylon, and polypropylene lines used in commercial nets. Such derelict fishing gear is abundant in the ocean (Macfadyen et al. 2009) and pose a greater hazard to fish than the very thin wire expended by the military. Fishing gear materials often have breaking strengths that can be up to orders of magnitude greater than that of guidance wire and fiber optic cables (Environmental Sciences Group 2005), and are far more prone to tangling, as discussed in Section 3.0.5.2.4.1 (Fiber Optic Cables and Guidance Wires). Fiber optic cables do not easily form loops, are brittle, and break easily if bent, so they pose a negligible entanglement risk. Additionally, the encounter rate and probability of impact from guidance wires and fiber optic cables are low, as few are expended.

3.9.3.4.1.1 No Action Alternative

Training Activities

As indicated in Table 2.8-1, under the No Action Alternative, torpedoes expending guidance wire would occur in throughout the Study Area during tracking exercises, all greater than 3 nm from the shore. Under the No Action Alternative there would be a total of 40 events that would expend wires per year during training activities (Table 2.8-1). Billfishes and other open ocean species susceptible to entanglement that occur where the torpedoes are used may encounter the expended guidance wires. However, given the low numbers used, the likelihood of encountering the expended guidance wires would be extremely low in those isolated areas. Some individual fish could be injured or killed if entangled by guidance wire, but most would simply be temporarily disturbed and would recover completely soon after exposure.

Scalloped hammerhead sharks that occur in areas where torpedoes are used may encounter an expended guidance wire. However, given that few are expended annually, in mostly offshore areas; and given that guidance wires would sink to the seafloor and would not remain suspended in the water column, the likelihood of a scalloped hammerhead shark encountering expended guidance wires would be extremely low.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities under the No Action Alternative may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

Testing Activities

Under the No Action Alternative, no activities that could generate entanglement stressors are conducted in the Study Area (see Tables 2.8-2 to 2.8-4).

3.9.3.4.1.2 Alternative 1

Training Activities

Under Alternative 1, the number of fiber optic cables and guidance wires used for training activities would increase by approximately 40 percent compared to the No Action Alternative (Tables 3.0-23 and 3.0-24). Billfishes and other open ocean species susceptible to entanglement that occur where the torpedoes are used may encounter the expended guidance wires and fiber optic cables. However, given the low numbers used, the likelihood of encountering the expended guidance wires and fiber optic cables would be extremely low in those isolated areas. Some individual fish could be injured or killed if entangled by guidance wire or fiber optic cable, but most would simply be temporarily disturbed and would recover completely soon after exposure. Scalloped hammerhead sharks that occur in areas where torpedoes are used may encounter an expended guidance wire. However, given that few are expended annually, in mostly offshore areas; and given that guidance wires would sink to the seafloor and would not remain suspended in the water column, the likelihood of a scalloped hammerhead shark encountering expended guidance wires would be extremely low.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities under Alternative 1 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

Testing Activities

As indicated in Tables 2.8-2 through 2.8-4 and Table 3.0-24, under Alternative 1, the number of torpedo activities that expended guidance wire increases from that of the No Action Alternative from 0 to 20.

Under Alternative 1, MCM Mission Package testing (Table 2.8-3) expends up to 48 fiber optic cables. Billfishes and other open ocean species susceptible to entanglement may encounter expended fiber optic cables and guidance wires, if these species are in the same location. However, given the low numbers used, the likelihood of encountering the expended fiber optic cables and guidance wires would be extremely low in those isolated areas. Some individual fish could be injured or killed if entangled by fiber optic cables and guidance wire, but most would simply be temporarily disturbed and would recover completely soon after exposure.

Scalloped hammerheads that occur in areas where torpedoes are used and mine countermeasure mission package testing activities occur may encounter an expended guidance wire or fiber optic cable. However, given that few are expended annually, most would sink to the seafloor and would not remain suspended in the water column, and most are expended in offshore areas, the likelihood of a scalloped hammerhead encountering an expended guidance wire or fiber optic cable would be extremely low.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities under Alternative1 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.3.4.1.3 Alternative 2

Training Activities

Under Alternative 2, the number of fiber optic cables and guidance wires used for training activities would increase by approximately 40 percent compared to the No Action Alternative (Tables 3.0-23 and 3.0-24). Billfishes and other open ocean species susceptible to entanglement that occur where the torpedoes are used may encounter the expended guidance wires and fiber optic cables. However, given the low numbers used, the likelihood of encountering the expended guidance wires and fiber optic cables would be extremely low in those isolated areas. Some individual fish could be injured or killed if entangled by guidance wire or fiber optic cable, but most would simply be temporarily disturbed and would recover completely soon after exposure.

Scalloped hammerhead sharks that occur in areas where torpedoes are used may encounter an expended guidance wire. However, given that few are expended annually, in mostly offshore areas; and given that guidance wires would sink to the seafloor and would not remain suspended in the water column, the likelihood of a scalloped hammerhead shark encountering expended guidance wires would be extremely low.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during training activities under Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

Testing Activities

As indicated in Tables 2.8-2 through 2.8-4 and Table 3.0-24, under Alternative 2, the number of torpedo activities that expended guidance wire increases from that of the No Action Alternative from 0 to 20. Under Alternative 1, MCM Mission Package testing (Table 2.8-3) expends up to 56 fiber optic cables. Risk of entanglement resulting from proposed testing activities would be low as described in training activities above.

Scalloped hammerheads that occur in areas where torpedoes are used and mine countermeasure mission package testing activities occur may encounter an expended guidance wire or fiber optic cable. However, given that few are expended annually, most would sink to the seafloor and would not remain suspended in the water column, and most are expended in offshore areas, the likelihood of a scalloped hammerhead encountering an expended guidance wire or fiber optic cable would be extremely low.

Pursuant to the ESA, the use of fiber optic cables and guidance wires during testing activities under Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.3.4.2 Impacts from Decelerators/Parachutes

Decelerators/parachutes of varying sizes are used during training and testing activities. The types of activities that use decelerators/parachutes, physical characteristics and size of decelerators/parachutes, locations where decelerators/parachutes are used, and the number of parachute activities proposed under each alternative are presented in Section 3.0.5.2.4.2 (Decelerators/Parachutes).

Fish face many potential entanglement scenarios in abandoned monofilament, nylon, polypropylene line, and other derelict fishing gear in the nearshore and offshore marine habitats of the Study Area (Macfadyen et al. 2009; Ocean Conservancy 2010). Abandoned fishing gear is dangerous to fish because it is abundant, essentially invisible, strong, and easily tangled. In contrast, decelerators/parachutes are rare, highly visible, and not designed to capture fish.

Once a parachute has been released to the water, it poses a potential entanglement risk to fish. The Naval Ocean Systems Center identified the potential impacts of torpedo air launch accessories, including decelerators/parachutes, on fish (U.S. Department of the Navy 1996). Unlike other materials in which fish become entangled (such as gill nets and nylon fishing line), the parachute is relatively large and visible, reducing the chance that visually oriented fish would accidentally become entangled in it. No cases of fish entanglement have been reported for decelerators/parachutes (U.S. Department of the Navy 2001a; Ocean Conservancy 2010). Entanglement in a newly-expended decelerator/parachute while it is in the water column is unlikely because fish generally react to sound and motion at the surface with a behavioral reaction by swimming away from the source (see Section 3.9.3.3.2, Impacts from Military Expended Materials) and would detect the oncoming decelerator/parachute in time to avoid contact. While the decelerator/parachute is sinking, fish would have ample opportunity to swim away from the large moving object. Even if the decelerator/parachute landed directly on a fish, it would likely be able to swim away faster than the decelerator/parachute would sink because the resistance of the water would slow the parachute’s downward motion.

Once the decelerator/parachute is on the bottom, however, it is feasible that a fish could become entangled in the decelerator/parachute or its suspension lines while diving and feeding, especially in deeper waters where it is dark. If the decelerator/parachute dropped in an area of strong bottom currents, it could billow open and pose a short-term entanglement threat to large fish feeding on the bottom. Benthic fish with elongated spines could become caught on the decelerator/parachute or lines. Most sharks and other smooth-bodied fish are not expected to become entangled because their soft, streamlined bodies can more easily slip through potential snares. A fish with spines or protrusions (e.g., some sharks, billfish, or sawfish) on its body that swam into the decelerator/parachute or a loop in the lines, and then struggled, could become bound tightly enough to prevent escape. Although this scenario is possible based on the structure of the materials and the shape and behavior of fish, it is not considered a likely event.

Aerial-launched sonobuoys are deployed with a decelerator/parachute. The sonobuoy itself is not considered an entanglement hazard for upon deployment (Environmental Sciences Group 2005), but their components may pose an entanglement hazard once released into the ocean. Sonobuoys contain cords, electronic components, and plastic mesh that may entangle fish (Environmental Sciences Group 2005). Open-ocean filter feeding species, such as whale sharks, and manta rays could become entangled in these items, whereas smaller species such as flying fish could become entangled in the plastic mesh in the same manner as a small gillnet. Since most sonobuoys are expended in offshore areas, many coastal fish would not encounter or have any opportunity to become entangled in materials associated with sonobuoys, apart from the risk of entanglement in decelerators/parachutes described above.

3.9.3.4.2.1 No Action Alternative

Training Activities

Under the No Action Alternative, approximately 8,032 decelerators/parachutes would be expended during training activities (see Table 3.0-25). Decelerators/parachutes would be expended in locations greater than 3 nm from shore throughout the Study Area.

Given the size of the range complex and the resulting widely scattered decelerators/parachutes, it would be very unlikely that fishes would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a few individual fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of the population as a whole would not be impacted directly or indirectly.

Once a decelerator/parachute is released into the water, it could pose an entanglement risk to the scalloped hammerhead shark in offshore waters, although the risk is unlikely. Entanglement at the water's surface in a newly expended decelerator/parachute is unlikely, because scalloped hammerhead sharks would generally react to sound and motion at the surface by swimming away from the source (see Section 3.9.3.3.2, Impacts from Military Expended Materials) and would detect the decelerator/parachute in time to avoid contact. The probability of a decelerator/parachute landing directly on a scalloped hammerhead shark is remote.

Once the decelerator/parachute is on the bottom, however, it is feasible that a scalloped hammerhead shark, which is known to feed near the bottom, could become entangled in a decelerator/parachute or its suspension lines, especially in waters where visibility is poor and male scalloped hammerheads are known to feed. If the decelerator/parachute dropped in an area of strong bottom currents, it could billow open and pose a short-term entanglement threat. A fish with spines or protrusions (such as the scalloped hammerhead shark) on its body that swam into the decelerator/parachute or a loop in the lines, and then struggled, could become bound tightly enough to prevent escape and cause injury. Although this scenario is possible based on the structure of the materials and the shape and behavior of the scalloped hammerhead shark, it is not considered a likely event because the encounter rate and occurrence of this scenario is expected to be very low, given the seafloor depth in the majority of the Study Area is deeper than 500 m (1,640 ft.), which is deeper than the diving depth of a scalloped hammerhead shark.

Given the size of the Study Area and the widely scattered expended decelerators/parachutes, it would be very unlikely that the scalloped hammerhead shark would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a shark were to encounter and become entangled in any of these items it could be injured or killed, but the most likely scenario would be a temporary disturbance or behavioral response.

Pursuant to the ESA, the use of decelerators/parachutes during training activities under the No Action Alternative may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

Testing Activities

Under the No Action Alternative, no activities that would create entanglement hazards from decelerators/parachutes are conducted in the Study Area (see Table 3.0-25).

3.9.3.4.2.2 Alternative 1

As described in Section 2.7 (Alternative 1 [Preferred Alternative]: Expansion of Study Area Plus Adjustments to the Baseline and Additional Weapons, Platforms, and Systems), Alternative 1 consists of the No Action Alternative and adjustments to location, type, and tempo of training and testing activities, which includes the addition of platforms and systems.

Training Activities

Under Alternative 1, there would be 10,845 decelerators/parachutes expended during training activities, an increase by 35 percent from the number expended under the No Action Alternative (see Table 3.0-25).

Given the size of the range complexes and the resulting widely scattered decelerators/parachutes, it would be very unlikely that fishes would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a few individual fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of the population as a whole would not be impacted directly or indirectly.

Once a decelerator/parachute is released into the water, it could pose an entanglement risk to the scalloped hammerhead shark in offshore waters, although the risk is unlikely. Entanglement at the water's surface in a newly expended decelerator/parachute is unlikely, because scalloped hammerhead sharks would generally react to sound and motion at the surface by swimming away from the source (see Section 3.9.3.3.2, Impacts from Military Expended Materials) and would detect the decelerator/parachute in time to avoid contact. The probability of a decelerator/parachute landing directly on a scalloped hammerhead shark is remote.

Once the decelerator/parachute is on the bottom, however, it is feasible that a scalloped hammerhead shark, which is known to feed near the bottom, could become entangled in a decelerator/parachute or its suspension lines, especially in waters where visibility is poor and male scalloped hammerheads are known to feed. If the decelerator/parachute dropped in an area of strong bottom currents, it could billow open and pose a short-term entanglement threat. A fish with spines or protrusions (such as the scalloped hammerhead shark) on its body that swam into the decelerator/parachute or a loop in the lines, and then struggled, could become bound tightly enough to prevent escape and cause injury. Although this scenario is possible based on the structure of the materials and the shape and behavior of the scalloped hammerhead shark, it is not considered a likely event because the encounter rate and occurrence of this scenario is expected to be very low, given the seafloor depth in the majority of the Study Area is deeper than 500 m (1,640 ft.), which is deeper than the diving depth of a scalloped hammerhead shark.

Given the size of the Study Area and the widely scattered expended decelerators/parachutes, it would be very unlikely that the scalloped hammerhead shark would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a shark were to encounter and become entangled in any of these items it could be injured or killed, but the most likely scenario would be a temporary disturbance or behavioral response.

Pursuant to the ESA, the use of decelerators/parachutes during training activities under Alternative 1 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

Testing Activities

Under Alternative 1, there would be 1,727 decelerators/parachutes expended during testing activities, an increase from the No Action Alternative (see Table 3.0-25).

Given the size of the MITT Study Area and the resulting widely scattered decelerators/parachutes, it would be very unlikely that fishes would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Once a decelerator/parachute is released into the water, it could pose an entanglement risk to the scalloped hammerhead shark in offshore waters, although the risk is unlikely. Entanglement at the water's surface in a newly expended decelerator/parachute is unlikely, because scalloped hammerhead sharks would generally react to sound and motion at the surface with a behavioral reaction by swimming away from the source (see Section 3.9.3.3.2, Impacts from Military Expended Materials) and would detect the decelerator/parachute in time to avoid contact. The probability of a decelerator/parachute landing directly on a scalloped hammerhead shark is remote.

Once the decelerator/parachute is on the bottom, however, it is feasible that a scalloped hammerhead shark, which is known to feed near the bottom, could become entangled in a decelerator/parachute or its suspension lines, especially in waters where visibility is poor and male scalloped hammerheads are known to feed. If the decelerator/parachute dropped in an area of strong bottom currents, it could billow open and pose a short-term entanglement threat. A fish with spines or protrusions (such as the scalloped hammerhead shark) on its body that swam into the decelerator/parachute or a loop in the lines, and then struggled, could become bound tightly enough to prevent escape and cause injury. Although this scenario is possible based on the structure of the materials and the shape and behavior of the scalloped hammerhead shark, it is not considered a likely event because the encounter rate and occurrence of this scenario is expected to be very low, given the seafloor depth in the majority of the Study Area is deeper than 500 m (1,640 ft.), which is deeper than the diving depth of a scalloped hammerhead shark.

Given the size of the Study Area and the widely scattered expended decelerators/parachutes, it would be very unlikely that the scalloped hammerhead shark would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a shark were to encounter and become entangled in any of these items it could be injured or killed, but the most likely scenario would be a temporary disturbance or behavioral response.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities under Alternative 1 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.3.4.2.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1 (see Table 3.0-25). Therefore, impacts and comparisons to the No Action Alternative will also be identical.

Given the size of the Study Area and the widely scattered expended decelerators/parachutes, it would be very unlikely that the scalloped hammerhead shark would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a shark were to encounter and become entangled in any of these items it could be injured or killed, but the most likely scenario would be a temporary disturbance or behavioral response.

Pursuant to the ESA, the use of decelerators/parachutes during training activities under Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

Testing Activities

Under Alternative 2, there would be 1,912 decelerators/parachutes expended during testing activities, an increase from the No Action Alternative (see Table 3.0-25).

Given the size of the MITT Study Area and the resulting widely scattered decelerators/parachutes, it would be very unlikely that fishes would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a few individual fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of the populations as a whole would not be impacted directly or indirectly.

Given the size of the Study Area and the widely scattered expended decelerators/parachutes, it would be very unlikely that the scalloped hammerhead shark would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. If a shark were to encounter and become entangled in any of these items it could be injured or killed, but the most likely scenario would be a temporary disturbance or behavioral response.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities under Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.3.4.3 Combined Entanglement Stressors

An individual fish could experience the following consequences of entanglement stressors: displacement, stress, avoidance response, behavioral changes, entanglement causing injury, and entanglement causing mortality. If entanglement results in mortality, it cannot act in combination because mortal injuries occur with the first instance. Therefore, there is no possibility for the occurrence of this consequence to increase if sub-stressors are combined.

Sub-lethal consequences may result in delayed mortality because they cause irrecoverable injury or alter the individual's ability to feed or detect and avoid predation. Sub-lethal effects resulting in mortality could be more likely if the events occurred in essentially the same location and occurred within the individual's recovery time from the first disturbance. This circumstance is only likely to arise during training activities that cause frequent and recurring entanglement stressors to essentially the same location (e.g., torpedoes expended at the same location as sonobuoys). In these specific circumstances the potential consequences to fishes from combinations of entanglement stressors may be greater than the sum of their individual consequences.

These specific circumstances that could multiply the consequences of entanglement stressors are highly unlikely to occur for two reasons. First, it is highly unlikely that torpedo guidance wires and sonobuoy decelerators/parachutes would impact essentially the same space because most of these sub-stressors are widely dispersed in time and space. Second, the risk of injury or mortality is extremely low for each sub-stressor independently; therefore, the combined impact of these sub-stressors does not increase the risk in a meaningful way. Furthermore, while it is conceivable that interaction between sub-stressors could magnify their combined risks, the necessary circumstances are highly unlikely to overlap.

Interaction between entanglement sub-stressors is likely to have neutral consequences for fishes. There is no potential for these entangling objects to combine in a way that would multiply their impact, as is the case with derelict (abandoned or discarded) fishing nets that commonly occur in the Study Area (Macfadyen et al. 2009) and entangle fish by design. Fish entangled in derelict nets attract scavengers and predators that may themselves become entangled in an ongoing cycle (Morgan and Chuenpagdee 2003). Guidance wires and decelerators/parachutes are used relatively infrequently over a wide area, and are mobile for only a short time. Therefore, unlike discarded fishing gear, it is extremely unlikely that guidance wires and decelerators/parachutes could interact.

3.9.3.4.4 Summary of Entanglement Stressors

While most fish species are susceptible to entanglement in fishing gear that is designed to entangle a fish by trapping it by its gills or spines (e.g., gill nets), only a limited number of fish species that possess certain features such as an irregular shaped or rigid rostrum (snout) (e.g., billfish) are susceptible to entanglement by military expended materials. A survey of marine debris entanglements found no fish entanglements in military expended materials in a 25-year dataset (Ocean Conservancy 2010).

The Navy identified and analyzed three military expended materials types that have potential to entangle fishes: guidance wires, fiber optic cables, and decelerators/parachutes. Other military expended material types, such as bomb or missile fragments, do not have the physical characteristics to entangle fishes in the marine environment and were not analyzed. Even for fishes that might encounter and become entangled in an expended guidance wire, the breaking strength of that wire is low enough that the impact would be only temporary and not likely to cause harm to the individual.

Pursuant to the ESA, entanglement stressors used under the No Action Alternative, Alternative 1, and Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.3.5 Ingestion Stressors

This section evaluates the potential ingestion impacts of the various types of expended materials used by the military during training and testing activities within the Study Area. Aspects of ingestion stressors that are applicable to marine organisms in general are presented in Appendix H.6 (Conceptual Framework for Assessing Effects from Ingestion). Ingestion of expended materials by fish could occur in all large marine ecosystems and open ocean areas and can occur at or just below the surface, in the water column, or at the seafloor, depending on the size and buoyancy of the expended object and the feeding behavior of the fish. Floating material is more likely to be eaten by fish of all sizes that feed at or near the water surface (e.g., molas, whale sharks, manta rays, herring, or flying fish), while materials that sink to the seafloor present a higher risk to bottom-feeding fish (e.g., hammerhead sharks, skates, rays, and flounders).

It is reasonable to assume that any item of a size that can be swallowed by a fish could be eaten at some time; this analysis focuses on ingestion of materials in two locations: (1) at the surface or water column, and (2) at the seafloor. Open-ocean predators and open-ocean planktivores are most likely to ingest materials in the water column. Coastal bottom-dwelling predators and estuarine bottom-dwelling predators could ingest materials from the seafloor.

The military expends the following types of materials during training and testing in the Study Area that could become ingestion stressors: non-explosive practice munitions (small- and medium-caliber), fragments from explosives, fragments from targets, chaff, flare casings (including plastic end caps and pistons), and small decelerators/parachutes. The activities that expend these items and their general distribution are detailed in Section 3.0.5.2.5 (Ingestion Stressors). Metal items eaten by marine fish are generally small (such as fishhooks, bottle caps, and metal springs), suggesting that small- and medium-caliber projectiles, pistons, or end caps (from chaff canisters or flares) are more likely to be ingested. Both physical and toxicological impacts could occur as a result of consuming metal or plastic materials. Items of concern are those of ingestible size that either drift at or just below the surface (or in the water column) for a time or sink immediately to the seafloor. The likelihood that expended items would cause a potential impact on a given fish species depends on the size and feeding habits of the fish and the rate at which the fish encounters the item and the composition of the item. In this analysis only small- and medium-caliber munitions (or small fragments from larger munitions), chaff, small decelerators/parachutes, and end caps and pistons from flares and chaff cartridges are considered to be of ingestible size for a fish.

The analysis of ingestion impacts on fish is structured around the following feeding strategies:

Feeding at or Just Below the Surface or Within the Water Column

- **Open-Ocean Predators.** Large, migratory, open-ocean fish, such as tuna, sharks, and billfish, feed on fast-swimming prey in the water column of the Study Area. These fish range widely in search of unevenly distributed food patches. Smaller military expended materials could be mistaken for prey items and ingested purposefully or incidentally as the fish is swimming (Table 3.9-5). Prey fish sometimes dive deeper to avoid an approaching predator (Pitcher 1986). A few of these predatory fish (e.g., tiger sharks) are known to ingest any type of marine debris that they can swallow, even automobile tires. Some marine fish, such as the dolphinfish (*Coryphaena hippurus*) (South Atlantic Fishery Management Council 2011) and tuna (Hoss and Settle 1990), have been known to eat plastic fragments, strings, nylon lines, ropes, or even small light bulbs.
- **Open-Ocean Planktivores.** Plankton-eating fish in the open-ocean portion of the Study Area include flyingfish, whale sharks, and manta rays. These fish feed by either filtering plankton from the water column or by selectively ingesting larger zooplankton. These planktivores could encounter and incidentally feed on smaller types of military expended materials (e.g., chaff, end caps, and pistons) at or just below the surface or in the water column (Table 3.9-5). While not a plankton eater, molas may also be capable of ingesting items at or just below the surface in the open ocean.

Military expended materials that could potentially impact these types of fish at or just below the surface or in the water column include those items that float or are suspended in the water column for some period of time (e.g., decelerators/parachutes and end caps and pistons from chaff cartridges or flares).

Fish Feeding at the Seafloor

- **Coastal Bottom-Dwelling Predators/Scavengers.** Large predatory fishes near the seafloor are represented by scorpion fishes, groupers, and jacks, which are typical seafloor predators in coastal and oceanic waters of the Study Area (Table 3.9-5). These species feed opportunistically on or near the bottom, taking fish and invertebrates from the water column and from the bottom. Bottom-dwelling fishes in the coastal waters (Table 3.9-5) may feed by seeking prey and by scavenging on dead fishes and invertebrates (e.g., skates, rays, flatfish).

Military expended materials that could be ingested by fish at the seafloor include items that sink (e.g., small-caliber projectiles and casings, fragments from explosive munitions).

Table 3.9-5: Summary of Ingestion Stressors on Fish Based on Location

Feeding Guild	Representative Species	Overall Potential for Impact
Open-ocean predators	Tuna, most shark species	These fish may eat floating or sinking expended materials, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Open-ocean plankton eaters (planktivores)	Sardines, whale shark	These fish may ingest floating expended materials incidentally as they feed in the water column, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Coastal bottom-dwelling predators	Skates, and rays	These fish may eat expended materials on the seafloor, but the encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.
Coastal bottom-dwelling scavengers	Skates and rays, flounders	These fish could incidentally eat some expended materials while foraging, especially in muddy waters with limited visibility. However, encounter rate would be extremely low. May result in individual injury or death but is not anticipated to have population-level effects.

Potential impacts of ingestion on adults are different than for other life stages (larvae and juveniles) because early life stages are too small to ingest any military expended materials except for chaff, which has been shown to have no impact on fish (U.S. Air Force 1997; Spargo 1999; Arfsten et al. 2002). Therefore, no ingestion potential impacts on early life stages would occur, with the exception of later stage juveniles that are large enough to ingest military expended materials.

Within the context of fish location in the water column and feeding strategies, the analysis is divided into (1) munitions (small- and medium-caliber projectiles, and small fragments from larger munitions); and (2) military expended material other than munitions (chaff, chaff end caps, pistons, decelerators/parachutes, flares, and target fragments).

3.9.3.5.1 Impacts from Munitions and Military Expended Materials Other than Munitions

The potential impacts of ingesting foreign objects on a given fish depend on the species and size of the fish. Fish that normally eat spiny, hard-bodied invertebrates could be expected to have tougher mouths and digestive systems than fish that normally feed on softer prey. Materials that are similar to the normal diet of a fish would be more likely to be ingested and more easily handled once ingested—for example, by fish that feed on invertebrates with sharp appendages. These items could include fragments from explosives that a fish could encounter on the seafloor. Relatively small or smooth objects, such as small-caliber projectiles or their casings, might pass through the digestive tract without causing harm. A small sharp-edged item could cause a fish immediate physical distress by tearing or cutting the mouth, throat, or stomach. If the object is rigid and large (relative to the fish's mouth and throat), it may block the throat or obstruct the flow of waste through the digestive system. An object may be enclosed by a cyst in the gut lining (Hoss and Settle 1990; Danner et al. 2009). Ingestion of large foreign objects could lead to disruption of a fish's normal feeding behavior, which could be sublethal or lethal.

Munitions are heavy and would sink immediately to the seafloor, so exposure would be limited to those fish identified as bottom-dwelling predators and scavengers. It is possible that expended small-caliber projectiles on the seafloor could be colonized by seafloor organisms and mistaken for prey or that expended small-caliber projectiles could be accidentally or intentionally eaten during foraging. Over time, the metal may corrode or become covered by sediment in some habitats, reducing the likelihood of a fish encountering the small-caliber, non-explosive practice munitions.

Fish feeding on the seafloor in the offshore locations where these items are expended would be more likely to encounter and ingest them than fish in other locations. A particularly large item (relative to the fish ingesting it) could become permanently encapsulated by the stomach lining, with the rare chance that this could impede the fish's ability to feed or take in nutrients. However, in most cases, a fish would pass a round, smooth item through its digestive tract and expel it, with no long-term measurable reduction in the individual's fitness.

If explosive ordnance does not explode, it would sink to the bottom. In the unlikely event that explosive material, high-melting-point explosive (known as HMX) or royal demolition explosive (known as RDX), is exposed on the ocean floor it would break down in a few hours (U.S. Department of the Navy 2001a). HMX or RDX would not accumulate in the tissues of fish (Price et al. 1998; Lotufo et al. 2010). Fish may take up trinitrotoluene (TNT) from the water when it is present at high concentrations but not from sediments (Lotufo et al. 2010). The rapid dispersal and dilution of TNT expected in the marine water column reduces the likelihood of a fish encountering high concentrations of TNT to near zero. A study of discarded military munitions in Hawaii, at depths of 1,300–2,000 ft. (400–600 m), recorded no confirmed detections of chemical agents or explosives in the sediments or biota that could be attributed to the munitions (University of Hawaii at Manoa 2010).

3.9.3.5.1.1 No Action Alternative

<u>Training Activities</u>

Projectiles

Under the No Action Alternative, a total of 60,000 small-caliber projectiles would be expended during training activities). Under the No Action Alternative, a total of 61,786 munitions (other projectiles, bombs, and missiles of all sizes) would be expended during training activities.

These items are heavy and would sink immediately to the seafloor, so exposure to fishes would be limited to those groups identified as bottom-dwelling predators and scavengers. It is possible that expended small-caliber projectiles on the seafloor could be colonized by seafloor organisms and mistaken for prey or that expended small-caliber projectiles could be accidentally or intentionally eaten during foraging. Over time, the metal corrodes slowly or may become covered by sediment in some habitats, reducing the likelihood of a fish encountering the small-caliber non-explosive practice munitions. Explosive munitions are typically fused to detonate within 5 ft. (1.5 m) of the water surface, with steel fragments breaking off in all directions and rapidly decelerating in the water and settling to the seafloor. The analysis generally assumes that most explosive expended materials sink to the seafloor and become incorporated into the seafloor, with no substantial accumulations in any particular area (see Section 3.1, Sediments and Water Quality).

Encounter rates in locations with concentrated small-caliber projectiles would be assumed to be greater than in less concentrated areas. Fishes feeding on the seafloor in the offshore locations where these items are expended (e.g., focused in gunnery boxes) would be more likely to encounter these items and at risk for potential ingestion impacts than in other locations. If ingested, and swallowed, these items could potentially disrupt an individual's feeding behavior or digestive processes. If the item is particularly large for the fish ingesting it, the projectile could become permanently encapsulated by the stomach lining, with the rare chance that this could impede the fish's ability to feed or take in nutrients. However, in most cases a fish would pass the round and smooth item through their digestive tract and expel the item with full recovery expected without impacting the individual's growth, survival, annual reproductive success, or lifetime reproductive success.

Unexploded explosive munitions would sink to the bottom. The residual explosive material would not be exposed to the marine environment, as it is encased in a non-buoyant cylindrical package. Should the High Melting point Explosive or Royal Demolition Explosive be exposed on the ocean floor, they would break down within a few hours (U.S. Department of the Navy 2001b) and would not accumulate in the tissues of fishes (Lotufo et al. 2010; Price et al. 1998). TNT would bioaccumulate in fish tissues if present at high concentrations in the water, but not from fish exposure to TNT in sediments (Lotufo et al. 2010). Given the rapid dispersal and dilution expected in the marine water column, the likelihood of a fish encountering high concentrations of TNT is very low. Over time, Royal Demolition Explosive residue would be covered by ocean sediments in most habitats or diluted by ocean water.

It is not possible to predict the size or shape of fragments resulting from explosives. Explosives used in the Study Area range in size from medium-caliber projectiles to large bombs, and missiles. When these items explode, they partially break apart or remain largely intact with irregular shaped pieces—some of which may be small enough for a fish to ingest. Fishes would not be expected to ingest most fragments from explosives because most pieces would be too large to ingest. Also, since fragment size cannot be quantified, it is assumed that fragments from larger munitions are similarly sized as larger munitions, but more fragments would result from larger munitions than smaller munitions. Small-caliber projectiles far outnumber the larger-caliber explosive projectiles/bombs/missiles/rockets expended as fragments in the Study Area. Although it is possible that the number of fragments resulting from an explosive could exceed this number, this cannot be quantified. Therefore, small-caliber projectiles would be more prevalent throughout the Study Area, and more likely to be encountered by bottom-dwelling fishes, and potentially ingested than fragments from any type of explosive munitions.

Scalloped hammerhead sharks feeding near the seafloor in offshore locations where these items are expended would be more likely to encounter and ingest them than fish in nearshore locations. If ingested, a particularly large munition (relative to the digestive tract of the hammerhead) could become permanently encapsulated by the stomach lining, with the rare chance that this could impede the fish's ability to feed or take in nutrients. However, in most cases, a fish would pass a round, smooth item through its digestive tract and expel it, with no long-term measurable reduction in the individual's fitness.

The potential effects on a scalloped hammerhead shark ingesting a munition or fragment from an explosive munition could range from no effect to injury or mortality. However, with the exception of expended materials at FDM, it is unlikely that a scalloped hammerhead shark would encounter a projectile while foraging near the seafloor. In either case, it is unlikely that a scalloped hammerhead shark would inadvertently ingest a projectile or fragment in the event one is encountered. In a 23-year study, Miller et al. (2013) reported that in South African waters, only 2 of 1,916 scalloped hammerhead sharks examined had ingested plastic objects. Even if a projectile or fragment was inadvertently ingested by a foraging scalloped hammerhead shark, if small enough, the item should pass through the shark's digestive tract with no effect on the shark (Hoss and Settle 1990). Furthermore, a scalloped hammerhead shark might recognize an ingested munition as a non-food item and expel it before swallowing (Felix et al. 1995), in the same manner that fish would temporarily take a lure into its mouth, but then expel it. Based on these factors, the probability that a scalloped hammerhead shark would be affected by ingestion of munitions or munitions fragments would be very low.

Sonobuoys

Under the No Action Alternative, approximately 8,073 sonobuoys would be expended during training activities. Small decelerators/parachutes associated with sonobuoys could be potentially ingested by open-ocean plankton eaters. Molas are the only fish species that could be susceptible to ingestion of sonobuoy decelerators/parachutes, because they are large enough to eat a parachute that they might mistake for jellyfish while foraging. The estimated density of sonobuoys in the Study Area is 0.013 sonobuoy per square nautical mile (nm^2) and, given this low density, it is not likely that an ocean sunfish would encounter any sonobuoy decelerators/parachutes; therefore, the risk of ingestion is extremely low for these fish.

In the event a decelerator/parachute was encountered by a foraging scalloped hammerhead shark, the decelerator/parachute, which ranges in diameter from 18 to 48 in. (46 to 122 cm), could conceivably be mistaken for a ray or cephalopod. Along the seafloor, however, sub-surface currents and the likelihood that some decelerator/parachutes would be buried in soft sediments would result in a lower probability of being suspended on the seafloor and potentially mistaken as prey by a foraging scalloped hammerhead shark.

Chaff and Flares

Under the No Action Alternative, a total of 5,830 chaff cartridges would be expended from aircraft during training activities. No potential impacts would occur from the chaff itself, as previously discussed, but there is some potential for the end caps or pistons associated with the chaff cartridges to be ingested. Under the No Action Alternative, a total of 5,740 flares would be expended during training flare exercises. The flare device consists of a cylindrical cartridge approximately 1.4 in. (3.6 cm) in diameter and 5.8 in. (14.7 cm) in length. Items that could be potentially ingested from flares include plastic end caps and pistons. An extensive literature review and controlled experiments conducted by the U.S. Air Force revealed that self-protection flare use poses little risk to the environment (U.S. Air Force 1997). The light generated by flares in the air (designed to burn out completely prior to entering the water) would have no impact on fish based on short burn time, relatively high altitudes where they are used, and the wide-spread and infrequent use. The potential exists for large, open-ocean predators (e.g., tunas, billfishes, pelagic sharks) to ingest self-protection flare end caps or pistons as they float on the water column for some time. A variety of plastic and other solid materials have been recovered from the stomachs of billfishes, dorado (South Atlantic Fishery Management Council 2011) and tuna (Hoss and Settle 1990).

End caps and pistons sink in saltwater (Spargo 2007), which reduces the likelihood of ingestion by surface-feeding fishes. However, some of the material could remain at or near the surface, and predatory fishes may incidentally ingest these items. Assuming that all end-caps and pistons would be evenly dispersed, the annual relative end-cap and piston concentration would be very low (0.02 nm^2).

Based on the low environmental concentration, it is unlikely that a larger number of fish would ingest an end cap or piston, much less a harmful quantity. Furthermore, a fish might expel the item before swallowing it. The number of fish potentially impacted by ingestion of end caps or pistons would be low based on the low environmental concentration and population-level impacts would not occur.

Based on the small size of chaff fibers compared to the size of the preferred prey of scalloped hammerhead sharks, it is unlikely that the scalloped hammerhead shark would confuse the fibers with prey or purposefully feed on chaff fibers. Furthermore, scalloped hammerhead sharks feed near the seafloor, and chaff is expected to remain near the surface for some time. Once chaff has sunk to the bottom, concentrations, which are expected to be low at the surface, would be further reduced by dispersion throughout the water column as chaff fibers sink. Although unlikely, a scalloped hammerhead shark could ingest low concentrations of chaff inadvertently from the surface, water column, or seafloor. While no studies have been conducted to evaluate the effects of chaff ingestion on sharks, the effects are expected to be negligible, based on the low concentrations that could reasonably be ingested, the small size of chaff fibers, and available data on the toxicity of silicon and aluminum. In laboratory studies conducted by the University of Delaware (Hullar et al. 1999), blue crabs and killifish were fed a food-chaff mixture daily for several weeks, and no significant mortality was observed at the highest exposure treatment. Similar results were found when chaff was added directly to exposure chambers containing filter-feeding menhaden. Histological examination indicated no damage from chaff exposures.

Plastic end caps and pistons from chaff cartridges would also be released into the marine environment, where they would persist for long periods and could be ingested by scalloped hammerhead sharks foraging near the seafloor, because the items are expected to sink in saltwater (Spargo 2007).

An extensive literature review and controlled experiments conducted by the U.S. Air Force demonstrated that self-protection flare use poses little risk to the environment or animals (U.S. Air Force 1997). Nevertheless, a scalloped hammerhead shark within the vicinity of expended flares could encounter pistons and end caps from flares.

Summary of Training Activities

Overall, the potential impacts of ingesting small-caliber projectiles, explosive fragments, decelerators/parachutes, or end caps/pistons would be limited to individual cases where a fish might suffer a negative response, for example, ingesting an item too large to be digested. While ingestion of ordnance-related materials, or the other military expended materials identified here, could result in sublethal or lethal impacts, the likelihood of ingestion is low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor where certain fishes could be at risk of ingesting those items. Furthermore, a fish might taste an item then expel it before swallowing it (Felix et al. 1995), in the same manner that fish would temporarily take a lure into its mouth, then spit it out. Based on these factors, the number of fish potentially impacted by ingestion of ordnance-related materials would be low and population-level impacts would not occur.

It is unlikely that a scalloped hammerhead shark would encounter target related materials, pistons and end caps from chaff and flares, or decelerator parachutes while foraging near the seafloor, and it is even more unlikely that a scalloped hammerhead shark would ingest one of these items in the event a scalloped hammerhead shark encountered the item. Even if one of these expended materials were to be inadvertently ingested by a foraging scalloped hammerhead shark, a small enough item could pass through the shark's digestive tract with no effect on the shark (Hoss and Settle 1990). Furthermore, a hammerhead might recognize an ingested material, such as a decelerator/parachute, as a non-food item and expel it before swallowing (Felix et al. 1995), in the same manner that fish would temporarily take a lure into its mouth, but then expel it. Based on these factors, the probability that a scalloped hammerhead shark would be affected by ingestion of expended materials (i.e., target related materials, pistons and end caps from chaff and flares, or decelerator parachutes) would be very low.

Pursuant to the ESA, the use of munitions or military expended materials of ingestible size for training activities under the No Action Alternative may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

Testing Activities

Under the No Action Alternative, no military expended materials would be expended during testing activities.

3.9.3.5.1.2 Alternative 1

Training Activities

Projectiles

Under Alternative 1, a total of 86,140 small-caliber projectiles would be expended during training activities. Under Alternative 1, a total of 96,915 explosive munitions (projectiles, bombs, missiles, and rockets of all sizes) would be expended during training activities, a 57 percent increase over the No Action Alternative.

Sonobuoys

Under Alternative 1, a total of 10,980 sonobuoys would be expended during training activities, which would be a 37 percent increase over the No Action Alternative

Chaff and Flares

Under Alternative 1, a total of 25,840 chaff cartridges would be expended from aircraft during training activities, a 340 percent increase over the No Action Alternative. No potential impacts would occur from the chaff itself, as previously discussed, but there is some potential for the end caps or pistons associated with the chaff cartridges to be ingested.

Under Alternative 1, a total of 25,600 flares would be expended during training flare exercises, which would be a 340 percent increase over the No Action Alternative.

Summary of Training Activities

The increase in expended materials under Alternative 1 would increase the probability of ingestion risk; however, as discussed under the No Action Alternative, the likelihood of ingestion would still be low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor where certain fishes could be at risk of ingesting those items. Therefore, the number of fish potentially impacted by ingestion of expended materials would be low and population-level impacts would not occur.

It is unlikely that a scalloped hammerhead would encounter target related materials, pistons and end caps from chaff and flares, or decelerator parachutes while foraging near the seafloor, and it is even more unlikely that a scalloped hammerhead shark would ingest one of these items in the event a scalloped hammerhead shark encountered the item. Even if one of these expended materials were to be inadvertently ingested by a foraging scalloped hammerhead shark, a small enough item could pass through the shark's digestive tract with no effect on the shark (Hoss and Settle 1990). Furthermore, a hammerhead might recognize an ingested material, such as a decelerator/parachute, as a non-food item and expel it before swallowing (Felix et al. 1995), in the same manner that fish would temporarily take a lure into its mouth, but then expel it. Based on these factors, the probability that a scalloped hammerhead shark would be affected by ingestion of expended materials (i.e., target related materials, pistons and end caps from chaff and flares, or decelerator parachutes) would be very low.

Pursuant to the ESA, the use of munitions or military expended materials of ingestible size for training activities under Alternative 1 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

Testing Activities

Projectiles

Under Alternative 1, a total of 2,000 small-caliber projectiles would be expended during testing activities. Under Alternative 1, a total of 6,805 explosive munitions (projectiles, missiles, and torpedoes) would be expended during testing activities.

Sonobuoys

Under Alternative 1, a total of 2,006 sonobuoys would be expended during testing activities.

Chaff and Flares

Under Alternative 1, 600 chaff cartridges and 300 flares would be expended during testing exercises.

Summary of Testing Activities

The increase in expended materials under Alternative 1 would increase the probability of ingestion risk; however, the likelihood of ingestion would still be low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor where certain fishes could be at risk of ingesting those items. Therefore, the number of fish potentially impacted by ingestion of expended materials would be low and population-level impacts would not occur.

It is unlikely that a scalloped hammerhead shark would encounter target related materials, pistons and end caps from chaff and flares, or decelerator parachutes while foraging near the seafloor, and it is even more unlikely that a scalloped hammerhead shark would ingest one of these items in the event a scalloped hammerhead encountered the item. Even if one of these expended materials were to be inadvertently ingested by a foraging scalloped hammerhead shark, a small enough item could pass through the shark's digestive tract with no effect on the shark (Hoss and Settle 1990). Furthermore, a scalloped hammerhead shark might recognize an ingested material, such as a decelerator/parachute, as a non-food item and expel it before swallowing (Felix et al. 1995), in the same manner that fish would temporarily take a lure into its mouth, but then expel it. Based on these factors, the probability that a scalloped hammerhead shark would be affected by ingestion of expended materials (i.e., target related materials, pistons and end caps from chaff and flares, or decelerator parachutes) would be very low.

Pursuant to the ESA, the use of munitions or military expended materials of ingestible size for testing activities under Alternative 1 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.3.5.1.3 Alternative 2

Training Activities

Projectiles

Under Alternative 2, a total of 86,140 small-caliber projectiles would be expended during training activities. Under Alternative 2, a total of 97,193 explosive munitions (projectiles, bombs, missiles, and rockets of all sizes) would be expended during training activities, a 57 percent increase over the No Action Alternative.

Sonobuoys

Under Alternative 2, a total of 10,991 sonobuoys would be expended during training, a 37 percent increase over the No Action Alternative.

Chaff and Flares

Under Alternative 2, a total of 28,512 chaff cartridges would be expended from aircraft during training activities, a 390 percent increase over the No Action Alternative. No potential impacts would occur from the chaff itself, as previously discussed, but there is some potential for the end caps or pistons associated with the chaff cartridges to be ingested.

Under Alternative 2, a total of 28,272 flares would be expended during training flare exercises, a 390 percent increase over the No Action Alternative.

Summary of Training Activities

The increase in expended materials under Alternative 2 would increase the probability of ingestion risk; however, as discussed under the No Action Alternative, the likelihood of ingestion would still be low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor where certain fishes could be at risk of ingesting those items. Therefore, the number of fish potentially impacted by ingestion of expended materials would be low and population-level impacts would not occur.

It is unlikely that a scalloped hammerhead shark would encounter target related materials, pistons and end caps from chaff and flares, or decelerator parachutes while foraging near the seafloor, and it is even more unlikely that a scalloped hammerhead shark would ingest one of these items in the event a scalloped hammerhead shark encountered the item. Even if one of these expended materials were to be inadvertently ingested by a foraging scalloped hammerhead shark, if small enough the item could pass through the shark's digestive tract with no effect on the shark (Hoss and Settle 1990). Furthermore, a scalloped hammerhead shark might recognize an ingested material, such as a decelerator/parachute, as a non-food item and expel it before swallowing (Felix et al. 1995), in the same manner that fish would temporarily take a lure into its mouth, but then expel it. Based on these factors, the probability that a scalloped hammerhead shark would be affected by ingestion of expended materials (i.e., target related materials, pistons and end caps from chaff and flares, or decelerator parachutes) would be very low.

Pursuant to the ESA, the use of munitions or military expended materials of ingestible size for training activities under Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

<u>Testing Activities</u>

Projectiles

Under Alternative 2, a total of 2,500 small-caliber projectiles would be expended during testing activities. Under Alternative 2, a total of 8,335 explosive munitions (projectiles, missiles, and torpedoes) would be expended during testing activities. These explosive items would be detonated with fragments expended in the Study Area.

Sonobuoys

Under Alternative 2, a total of 2,228 sonobuoys would be expended during testing activities.

Chaff and Flares

Under Alternative 2, 660 chaff cartridges and 330 flares would be expended during testing exercises.

Summary of Testing Activities

The increase in expended materials under Alternative 2 would increase the probability of ingestion risk; however, as discussed under Alternative 1, the likelihood of ingestion would still be low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor where certain fishes could be at risk of ingesting those items. Therefore, the number of fish potentially impacted by ingestion of expended materials would be low and population-level impacts would not occur.

It is unlikely that a scalloped hammerhead shark would encounter target related materials, pistons and end caps from chaff and flares, or decelerator parachutes while foraging near the seafloor, and it is even more unlikely that a scalloped hammerhead shark would ingest one of these items in the event a scalloped hammerhead shark encountered the item. Even if one of these expended materials were to be inadvertently ingested by a foraging scalloped hammerhead shark, a small enough item could pass through the shark's digestive tract with no effect on the shark (Hoss and Settle 1990). Furthermore, a scalloped hammerhead shark might recognize an ingested material, such as a decelerator/parachute, as a non-food item and expel it before swallowing (Felix et al. 1995), in the same manner that fish would temporarily take a lure into its mouth, but then expel it. Based on these factors, the probability that a scalloped hammerhead shark would be affected by ingestion of expended materials (i.e., target related materials, pistons and end caps from chaff and flares, or decelerator parachutes) would be very low.

Pursuant to the ESA, the use of munitions or military expended materials of ingestible size for testing activities under Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.3.5.2 Combined Ingestion Stressors

An individual fish could experience the following consequences of ingestion stressors: stress, behavioral changes, ingestion causing injury, and ingestion causing mortality. Ingestion causing mortality cannot act in combination because mortal injuries occur with the first instance. Therefore, there is no possibility for the occurrence of this consequence to increase if sub-stressors are combined.

Sub-lethal consequences may result in delayed mortality because they cause irrecoverable injury or alter the individual's ability to feed or detect and avoid predation. Normally, for fish large enough to ingest it, most small-caliber projectiles would pass through a fish's digestive system without injury. However, in this scenario it is possible that a fish's digestive system could already be compromised or blocked in such a manner that the small-caliber projectiles can no longer easily pass through without harm. It is conceivable that a fish could first ingest a small bomb fragment that might damage or block its digestive tract, then ingest a small-caliber projectile, with magnified combined impacts. The frequency of sub-lethal consequences resulting in mortality could be magnified as a result of ingestion stressors acting in combination only if the combined activities occur in essentially the same location and occur within the individual's recovery time from the first disturbance. This circumstance is likely to arise only during training and testing activities that cause frequent and recurring ingestion stressors to essentially the same location (e.g., chaff cartridge end caps/flares expended at the same location as small-caliber projectiles). In these specific circumstances the potential consequences to fishes from combinations of ingestion stressors may be greater than the sum of their individual consequences.

These specific circumstances that could magnify the consequences of ingestion stressors are highly unlikely to occur because, with the exception of a sinking exercise, it is highly unlikely that chaff cartridge end caps/flares and small-caliber projectiles would impact essentially the same location because most of these sub-stressors are widely dispersed in time and space.

The combined impact of these sub-stressors does not increase the risk in a meaningful way because the risk of injury or mortality is extremely low for each sub-stressor independently. While it is conceivable that interaction between sub-stressors could magnify their combined risks, the necessary circumstances are highly unlikely to overlap. Interaction between ingestion sub-stressors is likely to have neutral consequences for fishes.

3.9.3.5.3 Summary and Conclusions of Ingestion Impacts

The Navy identified and analyzed three military expended materials types that have ingestion potential for fishes: non-explosive practice munitions, military expended materials from explosives, and military expended materials from non-ordnance items (e.g., end caps, canisters, chaff, and accessory materials). The probability of fishes ingesting military expended materials depends on factors such as the size, location, composition, and buoyancy of the expended material. These factors, combined with the location and feeding behavior of fishes, were used to analyze the likelihood the expended material would be mistaken for prey and what the potential impacts would be if ingested. Most expended materials, such as large- and medium-caliber ordnance, would be too large to be ingested by a fish, but other materials, such as small-caliber munitions or some fragments of larger items, may be small enough to be swallowed by some fishes. During normal feeding behavior, many fishes ingest nonfood items and often reject (spit out) nonfood items prior to swallowing. Other fishes may ingest and swallow both food and nonfood items indiscriminately. There are concentrated areas where bombing, missile, and gunnery activities generate materials that could be ingested. However, even within those areas, the overall impact on fishes would be inconsequential.

The potential impacts of military expended material ingestion would be limited to individual cases where a fish might suffer a negative response—for example, ingesting an item too large, sharp, or pointed to pass through the digestive tract without causing damage. Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual fishes. Nonetheless, the number of military expended materials ingested by fishes is expected to be very low and only an extremely small percentage of the total would be potentially encountered by fishes. Certain feeding behavior such as “suction feeding” along the seafloor exhibited by sturgeon may increase the probability of ingesting military expended materials relative to other fishes; however, encounter rates would still remain low.

Pursuant to the ESA, the use of munitions or military expended materials of ingestible size for training and testing activities under the No Action Alternative, Alternative 1, or Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.3.6 Secondary Stressors

This section analyzes potential impacts on fishes exposed to stressors indirectly through effects on habitat and prey availability from impacts associated with sediments and water quality. These are also primary elements of marine fish habitat and firm distinctions between indirect impacts and habitat impacts are difficult to maintain. For the purposes of this analysis, indirect impacts on fishes via sediment or water which do not require trophic transfer (e.g., bioaccumulation) in order to be observed are considered here. It is important to note that the terms "indirect" and "secondary" do not imply reduced severity of environmental consequences, but instead describe how the impact may occur in an organism or its ecosystem.

Stressors from training and testing activities could pose secondary or indirect impacts on fishes via habitat, sediment, and water quality. These include (1) explosives and byproducts; (2) metals; (3) chemicals; (4) other materials such as targets, chaff, and plastics; and (5) impacts on fish habitat. Activities associated with these stressors are detailed in Tables 2.8-1 to 2.8-4, and analyses of their potential impacts are discussed in Section 3.1 (Sediments and Water Quality) and Section 3.3 (Marine Habitats).

3.9.3.6.1 Explosives

In addition to directly impacting fish and fish habitat, underwater explosions could impact other species in the food web including plankton and other prey species that fish feed upon. The impacts of underwater explosions would differ depending upon the type of prey species in the area of the blast. As discussed in Section 3.9.3.1 (Acoustic Stressors), fish with swim bladders are more susceptible to blast injuries than fish without swim bladders.

In addition to physical impacts of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to detonations that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals. The sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity. The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. Alternatively, any prey species that would be directly injured or killed by the blast could draw in scavengers from the surrounding waters that would feed on those organisms, and in turn could be susceptible to becoming directly injured or killed by subsequent explosions. Any of these scenarios would be temporary, only occurring during activities involving explosives, and no lasting impact on prey availability or the pelagic food web would be expected. Indirect impacts of underwater detonations and explosive ordnance use under the proposed action would not result in a decrease in the quantity or quality of fish populations or fish habitats in the Study Area.

3.9.3.6.2 Explosive Byproducts and Unexploded Ordnance

Deposition of undetonated explosive materials into the marine environment can be reasonably well estimated by the known failure and low-order detonation rates of explosives. Undetonated explosives associated with ordnance disposal and mine clearance are collected after training is complete;

therefore, potential impacts are assumed to be inconsequential for these training and testing activities, but other activities could leave these items on the seafloor. Fishes may be exposed by contact with the explosive, contact with contaminants in the sediment or water, and ingestion of contaminated sediments.

Explosions consume most of the explosive material, creating typical combustion products. In the case of Royal Demolition Explosive, 98 percent of the products are common seawater constituents and the remainders are rapidly diluted below threshold impact level. Explosive byproducts associated with high order detonations present no indirect impacts to fishes through sediment or water. However, low order detonations and unexploded ordnance present elevated likelihood of impacts on fishes.

Indirect impacts of explosives and unexploded ordnance to fishes via sediment is possible in the immediate vicinity of the ordnance. Degradation of explosives proceeds via several pathways discussed in Section 3.1 (Sediments and Water Quality). Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo 2010). TNT and its degradation products impact developmental processes in fishes and are acutely toxic to adults at concentrations similar to real-world exposures (Halpern et al. 2008; Rosen and Lotufo 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the water are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 6 to 12 in. (15.2 to 30.5 m) away from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3 to 6 ft. (0.9 to 1.8 m) from the degrading ordnance (see Section 3.1, Sediments and Water Quality). Taken together, it is likely that various lifestages of fishes could be impacted by the indirect impacts of degrading explosives within a very small radius of the explosive (1–6 ft. [0.3–1.8 m]).

3.9.3.6.3 Metals

Certain metals are harmful to fishes at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Wang and Rainbow 2008). Metals are introduced into seawater and sediments as a result of Navy training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended materials (Section 3.1.3.2, Metals). Some metals bioaccumulate and physiological impacts begin to occur only after several trophic transfers concentrate the toxic metals (see Section 3.3, Marine Habitats, and Chapter 4, Cumulative Impacts). Indirect impacts of metals to fishes via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Fishes may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Concentrations of metals in sea water are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that fishes would be indirectly impacted by toxic metals via the water.

3.9.3.6.4 Chemicals

Several military training and testing activities introduce potentially harmful chemicals into the marine environment; principally, flares and propellants for rockets, missiles, and torpedoes. Polychlorinated biphenyls (PCBs) are discussed in Section 3.1 (Sediments and Water Quality), but there is no additional risk to fishes because the Proposed Action does not introduce this chemical into the Study Area and the use of PCBs has been nearly zero since 1979. Properly functioning flares missiles, rockets, and torpedoes combust most of their propellants; leaving benign or readily diluted soluble combustion byproducts (e.g., hydrogen cyanide). Operational failures allow propellants and their degradation products to be released into the marine environment.

The greatest risk to fishes from flares, missile, and rocket propellants is perchlorate, which is highly soluble in water, persistent, and impacts metabolic processes in many plants and animals. Fishes may be exposed by contact with contaminated water or ingestion of contaminated sediments. Since perchlorate is highly soluble, it does not readily absorb to sediments. Therefore, missile and rocket fuel poses no risk of indirect impact on fishes via sediment. In contrast, the principal toxic components of torpedo fuel, propylene glycol dinitrate and nitrodiphenylamine, adsorbs to sediments, has relatively low toxicity, and is readily degraded by biological processes (Section 3.1, Sediments and Water Quality). It is conceivable that various lifestages of fishes could be indirectly impacted by propellants via sediment in the immediate vicinity of the object (e.g., within a few inches), but these potential impacts would diminish rapidly as the propellant degrades.

3.9.3.6.5 Other Materials

Some military expended materials (e.g., decelerators/parachutes) could become remobilized after their initial contact with the sea floor (e.g., by waves or currents) and could be reintroduced as an entanglement or ingestion hazard for fishes. In some bottom types (without strong currents, hard-packed sediments, and low biological productivity), items such as projectiles might remain intact for some time before becoming degraded or broken down by natural processes. While these items remain intact sitting on the bottom, they could potentially remain ingestion hazards. These potential impacts may cease only (1) when the military expended materials is too massive to be mobilized by typical oceanographic processes, (2) if the military expended materials becomes encrusted by natural processes and incorporated into the seafloor, or (3) when the military expended materials becomes permanently buried. In this scenario, a parachute could initially sink to the seafloor, but then be transported laterally through the water column or along the seafloor, increasing the opportunity for entanglement. In the unlikely event that a fish would become entangled, injury or mortality could result. The entanglement stressor would eventually cease to pose an entanglement risk as it becomes encrusted or buried, or degrades.

3.9.3.6.6 Impacts on Fish Habitat

The Proposed Action could result in localized and temporary changes to the benthic community during activities that impact fish habitat. Fish habitat could become degraded during activities that would strike the seafloor or introduce military expended materials, bombs, projectiles, missiles, rockets, or fragments to the seafloor. During, or following activities that impact benthic habitats, fish species may experience loss of available benthic prey at locations in the Study Area where these items might be expended on EFH or habitat areas of particular concern. Additionally, plankton and zooplankton that are eaten by fish may also be negatively impacted by these same expended materials.

Impacts of physical disturbance and strike by small, medium, and large projectiles would be concentrated within designated gunnery box areas, resulting in localized disturbances of hard bottom areas, but could occur anywhere in the Study Area. Hard bottom is important habitat for many different species of fish, including those fishes managed by various fishery management plans.

When a projectile hits a biogenic habitat, the substrate immediately below the projectile is not available at that habitat type on a long-term basis, until the material corrodes. The substrate surrounding the projectile would be disturbed, possibly resulting in short-term localized increased turbidity. Given the large spatial area of the range complexes, it is unlikely that most of the small, medium, and large projectiles expended in the Study Area would fall onto this habitat type. Furthermore, these activities are distributed within discrete locations within the Study Area, and the overall footprint of these areas is quite small with respect to the spatial extent of this biogenic habitat within the Study Area.

Strike warfare activities such as Bombing Exercises (Land) and Missile Exercises involve the use of live munitions by aircrews that practice on ground targets on FDM. These warfare training activities occur on the FDM land mass and are limited to the designated impact zones along the central corridor of the island. Explosives that detonate on land could loosen soils and subsequently get transported into surface drainage areas or nearshore waters. It should be noted that FDM is highly susceptible to natural causes of erosion because it is comprised of highly weathered limestone overlain by a thin layer of clay soil. Sediments entering the nearshore environment could cause temporary water quality impacts, some of which may be in foraging areas used by marine organisms. By limiting the location and extent of target areas, along with the types of ordnance allowed within specific impact areas, the Navy minimizes the potential for soil transport and, thus, water quality impacts. Additionally, as described in Section 3.1.3.1.5.3 (Farallon de Medinilla Specific Impacts), the Navy has conducted annual marine dive surveys in waters surrounding FDM from 1999 to 2010. Throughout all dive surveys, the coral fauna at FDM was observed to be healthy and robust. The nearshore physical environment and basic habitat types at FDM have remained unchanged over the 13 years of survey activity. Given the status and stability of coral fauna in waters surrounding FDM, it is unlikely that temporary water quality impacts have contributed to degradation of fish habitat and thus, impacts to local fish populations.

Sinking exercises could also provide secondary impacts on deep sea populations. These activities occur in open-ocean areas, outside of the coastal range complexes, with potential direct disturbance or strike impacts on deep sea fishes. Secondary impacts on these fishes could occur after the ship hulks sink to the seafloor. Over time, the ship hulk would be colonized by marine organisms that attach to hard surfaces. For fishes that feed on these types of organisms, or whose abundances are limited by available hard structural habitat, the ships that are sunk during sinking exercises could provide an incidental beneficial impact on the fish community (Love and York 2005; Quattrini and Ross 2006).

Secondary stressors involve impacts to habitat (sediment or water quality) or prey (i.e., impacting the availability or quality of prey) that have the potential to affect scalloped hammerhead sharks. Secondary stressors from military training and testing activities could pose impacts to scalloped hammerhead sharks via habitat degradation or an effect on prey availability. Secondary stressors that may affect scalloped hammerhead sharks include only those related to the use of explosives. Secondary effects on scalloped hammerhead shark prey and habitat from the release of metals, chemicals, and other materials into the marine environment during training and testing activities are not anticipated. In addition to directly impacting scalloped hammerhead sharks, underwater explosives could impact other species in the food web, including prey species that scalloped hammerhead sharks feed upon. The impacts of explosions would differ depending upon the type of prey species in the area of the blast. In addition to physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to explosions that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals. The abundances of prey species near the detonation point could be diminished for a short period of time, affecting prey availability for scalloped hammerhead sharks feeding in the vicinity. Any effects to prey, other than prey located within the impact zone when the explosive detonates, would be temporary. The likelihood of direct impacts to fishes and mobile invertebrates is low, as described in this section. No lasting effects on prey availability or the pelagic food web would be expected.

Pursuant to the ESA, secondary stressors resulting under the No Action Alternative, Alternative 1, or Alternative 2 may affect, but is not likely to adversely affect, the scalloped hammerhead shark.

3.9.4 Summary of Potential Impacts on Fish

As described in Section 3.0.5.4 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all the stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each individual stressor are discussed in the analyses of each stressor in the sections above.

There are generally two ways that a fish could be exposed to multiple stressors. The first would be if a fish were exposed to multiple sources of stress from a single activity (e.g., a mine warfare activity may include the use of a sound source and a vessel). The potential for a combination of these impacts from a single activity would depend on the range of effects of each stressor and the response or lack of response to that stressor. Most of the activities as described in the Proposed Action involve multiple stressors; therefore, it is likely that if a fish were within the potential impact range of those activities, they may be impacted by multiple stressors simultaneously. This would be even more likely to occur during large-scale exercises or activities that span a period of days or weeks (such as a sinking exercises or composite training unit exercise).

Fish could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where training and testing activities are more concentrated and in areas that individual fish frequent because it is within the animal's home range (including spawning and feeding areas) or migratory corridor. Except for in the few concentration areas mentioned above, combinations are unlikely to occur because training and testing activities are generally separated in space and time in such a way that it would be very unlikely that any individual fish would be exposed to stressors from multiple activities. However, animals with a home range intersecting an area of concentrated military activity have elevated exposure risks relative to animals that simply transit the area through a migratory corridor. The majority of the proposed training and testing activities occur over a small spatial scale relative to the entire Study Area, have few participants, and are of a short duration (the order of a few hours or less).

Multiple stressors may also have synergistic effects. For example, fish that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Fish that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to entanglement and physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic impacts from the combination of Navy stressors are difficult to predict in any meaningful way. Navy research and monitoring efforts include data collection through conducting long-term studies in areas of Navy activity, occurrence surveys over large geographic areas, biopsy of animals occurring in areas of Navy activity, and tagging studies where animals are exposed to Navy stressors. These efforts are intended to contribute to the overall understanding of what impacts may be occurring overall to animals in these areas.

Although potential impacts to certain fish species from the Proposed Action may include injury or mortality, impacts are not expected to decrease the overall fitness of any given population. Mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). The potential impacts anticipated from the Proposed Action are summarized in Section 3.9.5 (Endangered Species Act Determinations), with respect to each regulation applicable to fish.

3.9.5 Endangered Species Act Determinations

Table 3.9-6 summarizes the ESA determinations for each substressor analyzed.

Table 3.9-6: Summary of Endangered Species Act Determinations for Training and Testing Activities for the Preferred Alternative

Stressor		Scalloped Hammerhead Shark
Acoustic Stressors		
Non-Impulse Sources	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Explosives and other non-impulse sources	Training Activities	May affect, likely to adversely affect
	Testing Activities	May affect, likely to adversely affect
Energy Stressors		
Electromagnetic devices	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Physical Disturbance and Strike Stressors		
Vessels and in-water devices	Training Activities	No effect
	Testing Activities	No effect
Military expended materials	Training Activities	No effect
	Testing Activities	No effect
Seafloor devices	Training Activities	No effect
	Testing Activities	No effect
Entanglement Stressors		
Cables and wires	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Decelerators/Parachutes	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Ingestion Stressors		
Munitions	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Military expended materials other than munitions	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Secondary Stressors		
Secondary Stressors	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect

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3.10 Terrestrial Species and Habitats

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TERRESTRIAL SPECIES AND HABITATS SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following were analyzed for terrestrial species and habitats:

- Acoustic (explosives noise, weapons firing noise, and aircraft noise)
- Physical (disturbance or strikes by aircraft and aerial targets, military expended materials including explosive munitions fragments, ground disturbance, and wildfires)
- Secondary (invasive species introductions)

Preferred Alternative (Alternative 1)

- Acoustic: Pursuant to the Endangered Species Act (ESA), acoustic stressors on Guam may affect, but are not likely to adversely affect, the Mariana fruit bat, Mariana common moorhen, and the Mariana swiftlet. Acoustic stressors on Guam would have no effect on the Guam rail, Mariana crow, Micronesian kingfisher, or *Serianthes nelsonii*. Acoustic stressors on Rota may affect, but are not likely to adversely affect, the Mariana fruit bat and Mariana crow. Acoustic stressors on Rota would have no effect on Rota bridled white-eye, *Serianthes nelsonii*, *Nesogenes rotensis*, or *Osmoxylon mariannense.* Acoustic stressors on Tinian may affect, but are not likely to adversely affect, the Mariana fruit bat, Micronesian megapode, or Mariana common moorhen. Acoustic stressors on Saipan may affect, but are not likely to adversely affect, the Mariana swiftlet, Micronesian megapode, and nightingale reed-warbler. Acoustic stressors on Farallon de Medinilla (FDM) may affect and are likely to adversely affect the Micronesian megapode and the Mariana fruit bat.
- Physical: Pursuant to the ESA, physical stressors on Guam may affect, but are not likely to adversely affect, the Mariana fruit bat, Mariana common moorhen, and the Mariana swiftlet. Physical stressors on Guam would have no effect on the Guam rail, Mariana crow, Micronesian kingfisher, or *Serianthes nelsonii*. Physical stressors on Rota may affect, but are not likely to adversely affect, the Mariana fruit bat and Mariana crow. Physical stressors on Rota would have no effect on Rota bridled white-eye, *Serianthes nelsonii*, *Nesogenes rotensis*, or *Osmoxylon mariannense.* Physical stressors on Tinian may affect, but are not likely to adversely affect, the Mariana fruit bat, Micronesian megapode, or Mariana common moorhen. Physical stressors on Saipan may affect, but are not likely to adversely affect, the Mariana swiftlet, Micronesian megapode, and nightingale reed-warbler. Physical stressors on FDM may affect and are likely to adversely affect the Micronesian megapode and the Mariana fruit bat on FDM.
- Secondary: Because of the Navy's biosecurity program, secondary stressors associated with the potential introduction of invasive species to terrestrial habitats resulting from training activities is not expected to affect the *Serianthes nelsonii*, *Osmoxylon mariannense*, *Nesogenes rotensis*, Rota bridled white-eye, Guam Micronesian kingfisher, Mariana crow, Mariana common moorhen, Mariana fruit bat, Mariana swiftlet, nightingale reed-warbler, or Micronesian megapode. Secondary stressors would not affect Critical Habitats on Guam or Rota.

TERRESTRIAL SPECIES AND HABITATS SYNOPSIS (continued)

- The U.S. Fish and Wildlife Service (USFWS) has designated Critical Habitats on Guam for the Mariana fruit bat, Mariana crow, and Guam Micronesian kingfisher. The USFWS has designated Critical Habitats on Rota for the Rota bridled white-eye, Mariana fruit bat, and Mariana crow. Proposed training and testing activities would not occur within these designated Critical Habitats; therefore, there would be no effect on critical habitat on Guam or Rota.
- Pursuant to the ESA, secondary stressors would have no effect on ESA-listed species. The Navy, in cooperation with the USFWS and other resource agencies, engages in policies and practices that reduce the potential for the transport of invasive species to the Mariana Islands and between military training areas.
- Acoustic and physical stressors have the potential to injure and kill terrestrial bird species that are not ESA listed, particularly those that roost and breed on FDM. Pursuant to the Migratory Bird Treaty Act (MBTA) and 50 Code of Federal Regulations Part 21.15, these impacts will not cause significant adverse effects to populations of bird species not ESA-listed and otherwise protected under the MBTA.

3.10.1 Introduction

This section addresses terrestrial species and habitats for military activities that occur on land training areas within the Mariana Islands Training and Testing (MITT) Study Area (Study Area). Specifically, this section addresses vegetation communities, wildlife communities, and Endangered Species Act (ESA) listed species (including species considered candidates for ESA listing) found on military owned and leased lands on Guam, Tinian, and Farallon de Medinilla (FDM). This section also addresses potential impacts on lands used by special agreement within the Study Area, such as lands on Rota and Saipan.

3.10.1.1 Endangered Species Act

The ESA of 1973 established protection over and conservation of threatened and endangered species and the ecosystems upon which they depend. An "endangered" species is a species in danger of extinction throughout all or a significant portion of its range, while a "threatened" species is one that is likely to become endangered within the near future throughout all or in a significant portion of its range. The United States (U.S.) Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service jointly administer the ESA and are also responsible for the listing of species (i.e., the labeling of a species as either threatened or endangered). The USFWS has primary management responsibility for terrestrial and freshwater species, while the National Marine Fisheries Service has primary management responsibility for marine species and anadromous fish species (species that migrate from saltwater to freshwater to spawn). The ESA allows the designation of geographic areas as Critical Habitat for threatened or endangered species.

The ESA requires federal agencies to conserve listed species and consult with the USFWS and/or National Marine Fisheries Service to ensure that proposed actions that may affect listed species or Critical Habitat are consistent with the requirements of the ESA. The ESA specifically requires agencies not to "take" or "jeopardize" the continued existence of any endangered or threatened species, nor to destroy or adversely modify designated critical habitat. Under Section 3 of the ESA, "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. "Jeopardize," a term used in

Section 7 of the ESA, is defined in Title 50, Section 402.30 of the Code of Federal Regulations (50 C.F.R. 402.30) as engaging in any action that would be expected to appreciably reduce the likelihood of the survival and recovery of a listed species by reducing its reproduction, numbers, or distribution.

Section 7 formal consultation with the USFWS is necessary because some training activities proposed by the military may potentially affect federally protected species, habitats, and recovery efforts. The U.S. Department of the Navy (Navy) and the USFWS completed formal Section 7 in January 2015 with the completion of the USFWS Biological Opinion (U.S. Fish and Wildlife Service 2015).

3.10.1.1.1 Endangered Species Act Listed Species and Designated Critical Habitat

The ESA-listed terrestrial species known to occur within the Study Area include three plant species, six bird species, and one mammal. These species are listed in Table 3.10-1. Two ESA-listed sea turtle species that nest on Department of Defense (DoD)-owned and leased lands on Guam and Tinian are included in this Environmental Impact Statement (EIS)/Overseas EIS (OEIS) in Section 3.5 (Sea Turtles). Three species of ESA-listed seabirds are addressed in Section 3.6 (Marine Birds).

Critical habitat is a term defined and used in the ESA and includes specific geographic areas that are essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. Critical habitat is designated on Guam and Rota for the Mariana fruit bat and Mariana crow (376 acres (ac.) [152 hectares {ha}]). The Micronesian kingfisher has critical habitat designated on Guam (376 ac. [152 ha]), and the Rota bridled white-eye has critical habitat designated on Rota (2,594 ac. [1,050 ha]). The Guam critical habitat designations are confined to the Guam National Wildlife Refuge Ritidian Unit and do not overlay or coincide with military training activities. Similarly, the military does not train within critical habitat designations on Rota. Figure 3.10-1 and Figure 3.10-2 show the critical habitat designations.

The Guam Micronesian kingfisher (*Todiramphus cinnamomina cinnamomina*) is extirpated from Guam habitats, and only exists in captive breeding programs. The Guam rail (*Rallus owstoni*) is also extirpated from Guam. A nonessential experimental population exists on Rota, and Guam rails have been introduced on Cocos Island (off the coast of Guam). The Mariana crow (*Corvus kubaryi*) is now considered extirpated from Guam, but still occurs on Rota. The Navy has determined that Alternative 1 and Alternative 2 will not affect these extirpated species. This conclusion was based on (1) the presence of the species relative to where military training activities occur, (2) the type of stressors introduced from the Proposed Action within these areas, (3) the status of recovery actions for extirpated species planned for portions of these areas, and (4) how stressors introduced from the Proposed Action may impact these future recovery efforts. In summary, no alternative proposed in this EIS/OEIS would require clearance of habitat that could be used in the future by a recovered species, and reintroduction of the species is not planned for the foreseeable future.

Table 3.10-1: Endangered Species Act-Listed Terrestrial Species in the Mariana Islands Training and Testing Study Area

Species Name and Regulatory Status			Presence in Study Area	
Local Name[1]	**Scientific Name**	**Endangered Species Act Status**	**Preferred Habitat**	**DoD Training Area[2]**
Plants				
Hayun lagu/ Tronkon guafi (Fire tree)[4,5]	*Serianthes nelsonii*	Endangered	Limestone forests on Guam and Rota	Andersen AFB
-	*Osmoxylon mariannense*	Endangered	Limestone forests of Rota	-
-	*Nesogenes rotensis*	Endangered	Coastal strand habitats	-
Birds				
Yayaguak (Mariana swiftlet)[4,5]	*Aerodramus bartschi*	Endangered	Nests in caves; forages in savanna and ravine forest	NBG Munitions Site
Aga (Mariana crow) [4,5]	*Corvus kubaryi*	Endangered	Limestone forests of Guam and Rota	Rota, extirpated on Guam[3]
Pulattat (Mariana common moorhen) [4,5]	*Gallinula chloropus guami*	Endangered	Freshwater aquatic habitat types (lake, pond, and springs)	NBG Apra Harbor, NBG Munitions Site, Tinian MLA
Sihek (Guam Micronesian kingfisher) [4]	*Todiramphus cinnamomina*	Endangered	Limestone forests on Guam	Extirpated[3]
Sasangat (Micronesian megapode) [5]	*Megapodius laperouse*	Endangered	Limestone forests and coconut groves	Saipan Marpi Maneuver Area, Tinian MLA, FDM. Formerly occupied Andersen AFB, NBG Telecommunications Site, NBG Munitions Site, and NBG Apra Harbor.
Ko'ko' (Guam rail)[4]	*Rallus owstoni*	Endangered	Secondary and open habitats in forests	Extirpated[3]
Ga'ga' karisu (Nightingale reed-warbler) [5]	*Acrocephalus luscinia*	Endangered	Tangantangan thickets and wetlands	Saipan Marpi Maneuver Area
Nossa' Luta (Rota bridled white-eye)[5]	*Zosterops rotensis*	Endangered	Limestone forests of Rota	-
Mammals				
Fanihi (Mariana fruit bat)[4]	*Pteropus mariannus*	Threatened	Limestone and Ravine forests. Guam, Rota, Saipan, Tinian, FDM	Andersen AFB, NBG Telecommunications Site, NBG Munitions Site, Tinian MLA, FDM

[1] Scientific, Chamorro, and English names for plants and animals are provided in the table. Chamorro names will be used for plants, with first mention of scientific name (not all plants within the Study Area have commonly used English names). English names will be used for animals, with scientific and Chamorro names at first mention. Some species do not have an English name or a known Chamorro name. In these instances, only the scientific name is used. There are no English common names or known Chamorro names for *Osmoxylon mariannense* or *Nesogenes rotensis.*
[2] Includes DoD-owned and leased lands.
[3] Indicates that the species is extirpated. The Guam rail, Guam Micronesian kingfisher, and Mariana crow are extirpated from the wild on Guam. A nonessential experimental population was established for the Guam rail on Rota and Cocos Island (off of Guam).
[4] Species considered by the Government of Guam as threatened or endangered under the local administrative code.
[5] Species considered by the CNMI as threatened or endangered under the local administrative code.
Notes: DoD = Department of Defense, MLA = Military Lease Area, FDM = Farallon de Medinilla, NBG = Naval Base Guam, AFB = Air Force Base

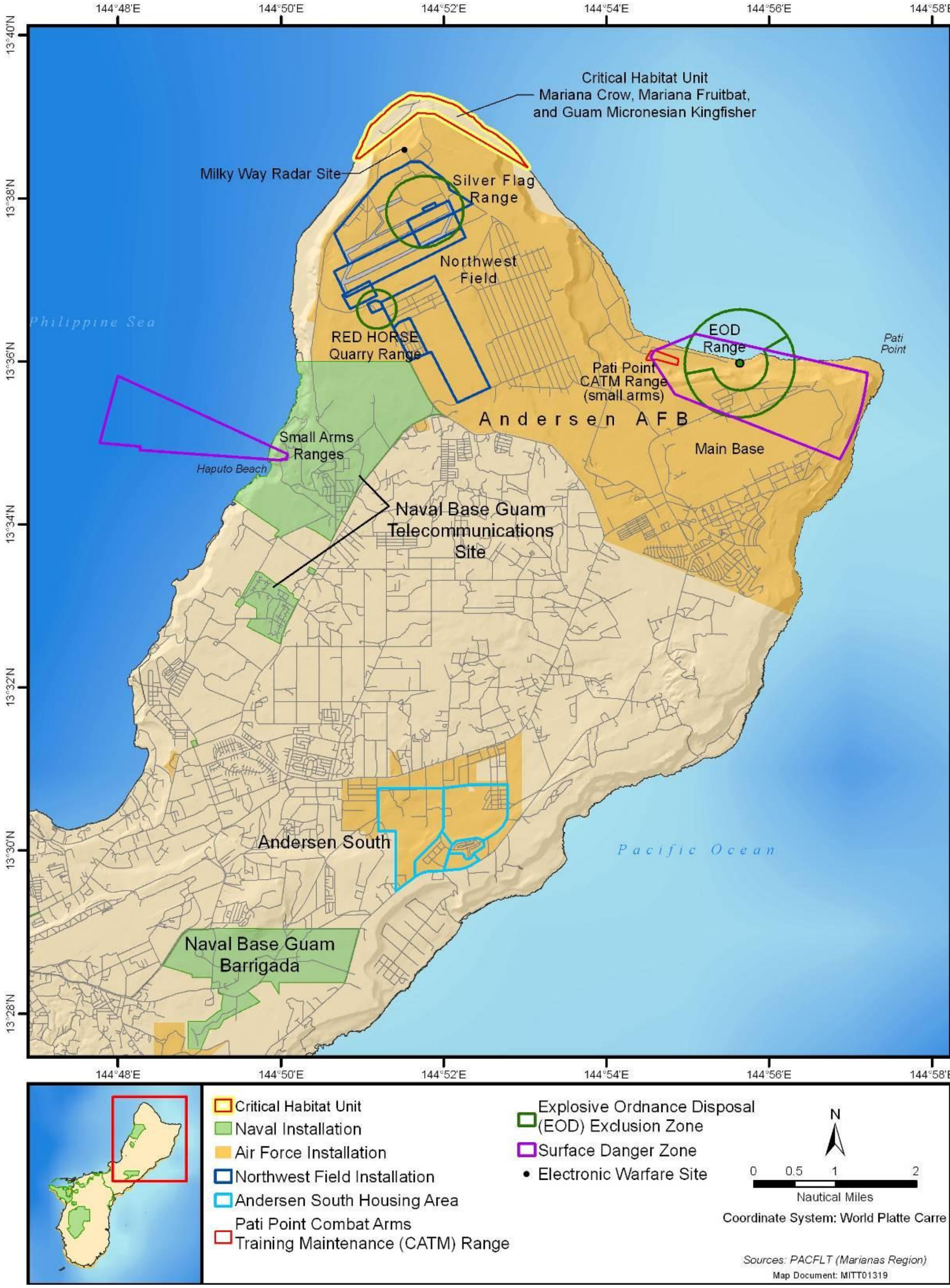
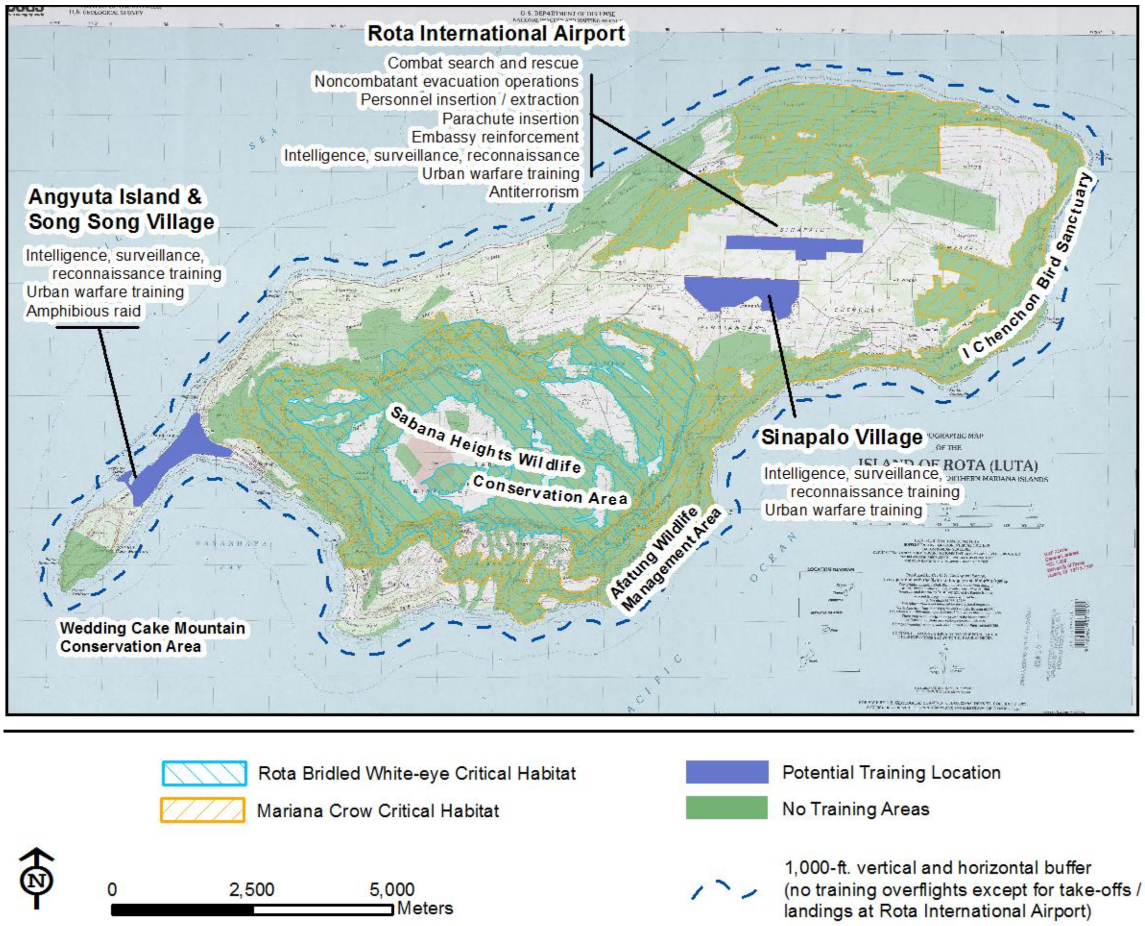


Figure 3.10-1: Critical Habitat Designations on Guam



Note: Potential training locations (shaded in blue) show where training activities may occur. Intelligence, surveillance, reconnaissance training and urban warfare training locations are not exact and are arranged in coordination with the Rota Mayor's office. These training activities occur in developed areas. No training activity would occur within designated critical habitat for the Mariana crow or Rota bridled white-eye, local conservation areas, or other any other area considered to be habitat for ESA-listed species. Green shaded areas represent all areas that could be occupied by ESA-listed species at any time throughout the year. These areas are not proposed for training. Mariana fruit bat colonies are not depicted in the map as they fall within designated critical habitat or conservation areas.

Figure 3.10-2: Training Locations, Critical Habitat, and Local Conservation Areas on Rota

3.10.1.1.2 Endangered Species Act Candidate Species

A candidate species is the subject of either a petition to list or status review, and for which the USFWS has determined that listing may be warranted (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998). Candidate species receive no statutory protection under the ESA; however, the USFWS encourages the formation of partnerships to conserve these species because they are, by definition, species that may warrant future protection under the ESA. In 2011, the USFWS completed a multi-year listing work plan that facilitates the systematic review of more than 250 species to determine if their listing is warranted under the ESA. The work plan and supplemental agreements were developed in coordination with two plaintiff groups (Wild Earth Guardians and the Center for Biological Diversity). These agreements were approved by the U.S. District Court for the District of Columbia in September 2011. In September 2014, the USFWS published in the Federal Register its intent to protect 23 species on Guam and on islands within the Commonwealth of the Northern Mariana Islands (CNMI). Public comments on the proposed rule were due on 1 December 2014; however, the USFWS extended the public comment period and will be conducting further review of these species' ESA listing eligibility through early 2015. Of the 23 species proposed for listing, 22 are found on islands where the military trains. These species include:

- Five plants are endemic to the island of Guam (*Eugenia bryanii*, *Hedyotis megalantha*, *Phyllanthus saffordii*, *Psychotria malaspinae*, and *Tinospora homosepala*)
- Eight plants are known from Guam and the CNMI (*Bulbophyllum guamense*, *Dendrobium guamense*, *Heritiera longipetiolata*, *Maesa walkeri*, *Nervilia jacksoniae*, *Solanum guamense*, *Tabernaemontana rotensis*, and *Tuberolabium guamense*)
- One plant, *Cycas micronesica*, occurs in Guam, the CNMI, Palau, and Yap.
- The remaining species include four Partulid snail species (Guam tree snail [*Partula radiolata*], humped tree snail [*Partula gibba*], fragile tree snail [*Samoana fragilis*], and Langford tree snail [*Partula langfordi*]), two butterfly species (Mariana eight-spot butterfly [*Hypolimnas octucula mariannensis*]and Mariana wondering butterfly [*Vagrans egistina*]), and an insectivorous bat (Pacific sheath-tailed bat [*Emballonura semicaudata rotensis*]).

These species are listed in Table 3.10-2 and described in more detail below.

Table 3.10-2: Species Considered as Candidates for Endangered Species Act Listing

Species Name		Presence in Study Area	
Local Name[1]	**Scientific Name**	**Habitat**	**Habitat within DoD Training Area[3]**
Plant Species			
-	*Eugenia bryanii*	Occurs within intact limestone forest, ravine forests on Guam	Andersen AFB, NBG Telecommunications Site, NBG Munitions Site
Fadang	*Cycas micronesica*	Tree fern of intact and secondary limestone forests	
Paudedo	*Hedyotis megalantha*	A perennial herb found in savanna habitat, southern Guam	NBG Munitions Site
-	*Phyllanthus saffordii*	A woody shrub found in savanna habitat, southern Guam	NBG Munitions Site
Aplokhating-Palaoan	*Psychotria malaspinae*	Occurs within forests, possibly only at Ritidian National Wildlife Refuge	Andersen AFB, NBG Telecommunications Site
-	*Tinospora homosepala*	A vine found in intact limestone forest	
-	*Bulbophyllum guamense*	Epiphyte orchid found within intact limestone forests along cliflines on Guam and Rota	
Cebello halumtano	*Dendrobium guamense*	Epiphyte orchid found within intact limestone forests on Guam and Rota	
Ufa-halomtano[5]	*Heritiera longipetiolata*	Tree found within intact limestone forests on Guam, Rota, Tinian, and Saipan	
-	*Maesa walkeri*	A woody shrub found within intact limestone forests on Guam	
-	*Nervilia jacksoniae*	Epiphyte orchid found within intact limestone forests on Guam and Rota	
Bereng-henas halomtano	*Solanum guamense*	A woody shrub found within intact limestone forests on Guam, only one occurrence known on Guam	
-	*Tabernaemontana rotensis*	Small tree or shrub on Guam and Rota associated with limestone forests	
-	*Tuberolabium guamense*	Epiphyte orchid found within intact limestone forests on Guam and Rota, one occurrence known on Guam	

Table 3.10-2: Species Considered as Candidates for Endangered Species Act Listing (continued)

Species Name		Presence in Study Area	
Local Name[1]	**Scientific Name**	**Habitat**	**Habitat within DoD Training Area[3]**
Invertebrate Species[2]			
Mariana eight-spot butterfly	*Hypolimnas octocula marianensis*	Limestone forests along cliffines, associated with two host plant species: *Procris pedunculata* and *Elatostema calcareum.* Occurs on Guam and Rota.	Andersen AFB, Tinian Military Lease Area
Mariana wandering butterfly	*Vagrans egistina*	Limestone forests along clifflines, associated with the host plant species *Maytenus thompsoni.* No longer occurs on Guam, but is known to occur on Rota.	Extirpated[4]
Humped tree snail[5]	*Partula gibba*	Sub-canopy vegetation in lower strata of intact limestone forests forested and river corridors. Humped tree snails occur on Guam, Rota, Aguiguan, Tinian, Saipan, Anatahan, Sarigan, Alamagan, and Pagan. Guam tree snails are restricted to Guam. Fragile tree snails are found on Guam and Rota. Langford tree snails are endemic to Aguiguan (they do not occur on other islands in the Mariana Archipelago).	Andersen AFB, NBG Telecommunications Site, NBG Munitions Site, Tinian MLA (potential)
Guam tree snail[5]	*Partula radiolata*		Andersen AFB, NBG Telecommunications Site, NBG Munitions Site
Fragile tree snail[5]	*Samoana fragilis*		
Langford tree snail	*Partula langfordi*		-
Rota damselfly	*Ischnura luta*	Limestone forests of Rota	-
Mammalian Species			
Pacific sheath-tailed bat[5,6]	*Emballonura semicaudata*	Inhabits caves, prefers limestone forests as foraging habitat. Restricted to Aguiguan.	Extirpated[4]

[1] Scientific, Chamorro, and English names for candidate species are provided in the table. Chamorro names will be used for plants, with first mention of scientific name (not all plants within the Study Area have commonly used English names). English names will be used for animals, with scientific and Chamorro names at first mention. Some species discussed in the text do not have an English name or a known Chamorro name. In these instances, only the scientific name is used.

[2] The Chamorro name, "ababang," is used for both butterfly species listed in this table. The Chamorro name, "akaleha," is used for all three tree snail species. Therefore, the English common name is used for the butterfly and snail species.

[3] Includes DoD-owned and leased lands.

[4] Indicates that the species is considered extirpated from the DoD training area. Mariana wandering butterfly is extirpated from Guam and is currently restricted to Rota. Pacific sheath-tailed bats are extirpated from Guam and other islands and are restricted to Aguiguan.

[5] Species considered by the Government of Guam as threatened or endangered under the local administrative code.

[6] Species considered by the CNMI as threatened or endangered under the local administrative code.

Notes: DoD = Department of Defense, NBG = Naval Base Guam, AFB = Air Force Base, ssp. = subspecies, MLA = Military Lease Area

3.10.1.2 Migratory Bird Treaty Act and 50 Code of Federal Regulations Part 21.15 Requirements

Terrestrial birds in the Study Area include those listed under the Migratory Bird Treaty Act (MBTA) of 1918 (16 United States Code 703-712; Ch. 128; 13 July 1918; 40 Stat. 755 as amended) (U.S. Department of Defense and U.S. Fish and Wildlife Service 2006). The MBTA established federal responsibilities for the protection of nearly all species of birds, eggs, and nests. Further, the MBTA affords protections to terrestrial bird species within the Study Area that are not listed under the ESA.

Through the National Defense Authorization Act, Congress determined that allowing incidental take of migratory birds as a result of military readiness activities is consistent with the MBTA. The Final Rule was published in the Federal Register (FR) on 28 February 2007 (FR Volume 72, No. 29, 28 February 2007), and may be found at 50 C.F.R. Part 21.15. Congress defined military readiness activities as all training and operations of the Armed Forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for the proper operation and suitability for combat use. The measure directs the Armed Forces to assess the effects of military readiness activities on migratory birds, in accordance with National Environmental Policy Act (NEPA). It also requires the Armed Forces to develop and implement appropriate conservation measures if a proposed action may have a significant adverse effect on a migratory bird population. The Navy has determined that no activity described in this EIS/OEIS would represent a significant adverse effect on any terrestrial bird population.

3.10.1.2.1 United States Fish and Wildlife Service Birds of Conservation Concern

Birds of Conservation Concern are species, subspecies, and populations of migratory and non-migratory birds that the USFWS determines through policy documents to be the highest priority for conservation actions (U.S. Fish and Wildlife Service 2008a). The purpose of the Birds of Conservation Concern category is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions needed to conserve these species. The USFWS maintains a list of Birds of Conservation Concern for U.S. Pacific Islands (U.S. Fish and Wildlife Service 2008a).

Of the 21 terrestrial bird species considered as Birds of Conservation Concern for U.S. Pacific Islands, six species are known to breed on islands within the Study Area and are listed in Table 3.10-3: Micronesian Myzomela (*Myzomela rubrata*), rufous fantail (which includes two subspecies, the Aguiguan and Rota subspecies [*Rhipidura rufifrons mariae*] and Saipan and Tinian s`ubspecies [*Rhipidura rufifrons saipanensis*]), Tinian monarch (*Monarcha takatsukasae*), bridled white-eye (Saipan subspecies [*Zosterops conspicillatus saypani*]), golden white-eye (*Cleptornis marchei*), and Micronesian starling (*Aplonis opaca*).

Table 3.10-3: United States Fish and Wildlife Service Birds of Conservation Concern and Breeding Terrestrial Birds within the Study Area

Common Name	Scientific Name	Breeding location on DoD Owned or Leased Property	Other Islands within the Study Area[1]
Chichirika/Naabak (Rufous fantail)[2]	***Rhipidura rufifrons saipanensis***	**Tinian MLA**	**Rota, Saipan, Aguiguan**
	Rhipidura rufifrons mariae	**-**	**Rota, Aguiguan**
Sali (Micronesian starling)[2]	***Aplonis opaca***	**Andersen AFB, Naval Base Guam Telecommunications Site, Tinian MLA**	**Rota, Saipan, Aguiguan, Anatahan, Sarigan, Guguan, Alamagan, Pagan, Agrihan, Asuncion, Maug**
Chichurikan Tinian (Tinian monarch)	***Monarcha takatsukasae***	**Tinian MLA**	**-**
Canario (Golden white-eye)	***Cleptornis marchei***	**-**	**Saipan, Aguiguan**
Nossa (Bridled White-eye)[3]	***Zosterops conspicillatus saypani***	**Tinian MLA**	**Saipan**
Egigi (Micronesian Myzomela)	***Myzomela rubrata***	**Tinian MLA**	**Saipan, Aguiguan**
Paluman apaka/Paluman kunao (White-throated ground dove)[2]	*Gallicolumba xanthonura*	Tinian MLA	Rota, Aguiguan, Saipan, Anatahan
Totot (Mariana fruit dove)[2]	*Ptilinopus roseicapilla*	Tinian MLA	Rota, Aguiguan, Saipan
Sihek Collared kingfisher	*Todiramphus chloris*	Tinian MLA	Rota, Aguiguan, Guguan, Sarigan, Alamagan, Pagan, Agrihan, Asuncion, Maug
Egigi (Micronesian honeyeater)[2]	*Myzomela rubratra*	Tinian MLA	Rota, Aguiguan, Saipan, Anatahan, Sarigan, Guguan, Alamagan, Pagan, Agrihan, Asuncion, Maug

[1] These islands are located within the Study Area; however, these islands do not include Navy owned or leased lands. Limited training activities may occur on Rota and Saipan through special use agreement with local authorities.

[2] Species considered by the Government of Guam as threatened or endangered under the local administrative code.

[3] Species considered by the CNMI as threatened or endangered under the local administrative code.

Notes: Birds listed in the above table are native terrestrial birds not currently protected under the Endangered Species Act. The rufous fantail, Micronesian starling, Tinian monarch, bridled white-eye, and golden white-eye are considered by the USFWS as Birds of Conservation Concern, and highlighted in bold text. The island collared dove, black francolin, black drongo, and Eurasian tree sparrow also breeds within the Study Area; however, these species are not listed in the table because they are introduced species. ESA-listed terrestrial bird species are listed under Table 3.10-1.

DoD = Department of Defense, Tinian MLA = Tinian Military Lease Area, Andersen AFB = Andersen Air Force Base

3.10.1.3 General Taxonomic Groups

The ecological profile of the Mariana Islands is complex, with many factors interacting with each other, such as geology, human environmental history, climate and weather events, and invasive species. One way to provide a "snapshot" of the ecological profile of the Mariana Islands is to consider the faunal assemblage. Accordingly, Table 3.10-4 lists major vertebrate taxonomic groups (amphibians, reptiles, birds, and mammals) known to occur within the Mariana Islands. Some species represented in Table 3.10-4 have special regulatory status and are discussed in more detail in Section 3.10.1.1.1 (Endangered Species Act Listed Species and Designated Critical Habitat). Species that do not have special regulatory status are discussed more generally in Section 3.10.2.1 (Vegetation Communities) and Section 3.10.2.2 (Wildlife Communities).

Table 3.10-4: Major Vertebrate Taxonomic Groups

Major Taxonomic Group		Presence in Study Area
Common Name (Species Grouping)[1]	**Description**	**DoD Training Area**
Amphibians		
Frogs and Toads (Family Ranidae, Family Microhylidae, Family Leptodactylidae, Family Eleutherodactylidae, Family Hylidae, and Family Bufonidae)	The marine toad, an introduced species established on Guam and the CNMI, inhabits upland and wetland sites. Ten species of frogs are known to occur on Guam and the CNMI, all introduced.	Marine toads occur on Guam, Tinian, and Saipan MMA. Other amphibians occur on Guam.
Reptiles		
Freshwater turtles (Family Emydidae)	Uncommon introduced turtles living in freshwater streams and wetlands, such as the red-eared slider. Likely introduced through the commercial pet trade and Asian food markets.	Occurring at Naval Base Guam, Naval Base Guam Munitions Site
Geckos, Anoles, Skinks (Family Gekkonidae, Polychridae, Scincidae)	On Guam, declining native populations with increasing introduced species serving as an additional food source for brown treesnakes. Introduced species in the Marianas are documented to displace native species. Endemic species in the CNMI include the slender-toed gecko, Micronesian gecko, tide pool skink, and Slevin's skink.	Occurring on all DoD owned and leased lands
Monitor lizards (Family Varnidae)	A native species considered to be an early introduction (approximately 1,600 years ago), this large lizard species inhabits upland and wetland sites.	Occurring on all DoD owned and leased lands, except for FDM
Blind snakes (Family Typhlopidae)	Recent introduction to Mariana Islands, ground burrowing snakes with vestigial (remnant) eyes.	Occurring on all DoD owned and leased lands, except for FDM
Colubrid snakes (Family Colubridae)	Represented by the invasive brown treesnake.	Established population on Guam
Birds[2]		
Megapodes (Family Megapodiidae)	Represented by the Micronesian megapode within the Mariana Islands. Extirpated from Guam.	Tinian MLA, Saipan MMA, FDM
Moorhens and Rails (Family Rallidae)	Represented by the Mariana common moorhen in the Marianas and Guam rails (Guam rails persist in captivity; a nonessential experimental population was established on Rota, and a Safe Harbor Agreement is in effect on Cocos Island).	Mariana common moorhens are found on all DoD-owned and leased lands, except for FDM.
Quails and Pheasants (Family Phasianidae)	Introduced species represented by the black francolin and the uncommon blue-breasted quail.	Occurring on all DoD-owned lands on Guam. Blue-breasted quail only found on the southern savannas of Guam, possibly including Naval Base Guam Munitions Site.
Pigeons and doves (Family Columbidae)	Represented by four species: the endemic Mariana fruit dove and white-throated ground dove, and the introduced island collared-dove and rock dove.	Native species extirpated on Guam, but native fruit doves and ground doves found on Tinian MLA, Saipan MMA, and Rota.

Table 3.10-4: Major Vertebrate Taxonomic Groups (continued)

Major Taxonomic Group		Presence in Study Area
Common Name (Species Grouping)[1]	**Description**	**DoD Training Area**
Swifts (Family Apodidae)	Represented by one cave-dwelling species (Mariana swiftlet). Extirpated from Tinian and Rota.	Occurs on Naval Base Guam Munitions Site, possible foraging in the Saipan MMA.
Kingfishers (Family Alcedinidae)	Species group extirpated from Guam. Guam Micronesian kingfisher persists in captivity; Collared Kingfisher present on Rota, Tinian, and Saipan.	Collared kingfisher present on Tinian MLA and Saipan MMA.
Drongos (Family Dicruridae)	Represented by the introduced black drongo.	Occurring on all DoD lands on Guam, potential training locations on Rota (e.g., Rota International Airport, Song Song Village, and Sinapalo Village).
Crows and jays (Family Corvidae)	Represented by the Mariana crow, declining numbers on Rota.	The last known crow on Guam was detected on Andersen Air Force Base in August 2011 and is considered extirpated from Guam. Crows occur in areas with suitable habitat that surround potential training locations on Rota.
Old World flycatchers and warblers (Family Muscicapidae)	On Guam, represented by four native species, all extirpated from Guam. The Guam flycatcher is extinct. This species group is found on Tinian and Saipan.	Tinian monarchs are found within Tinian MLA, nightingale reed-warblers are found on Saipan MMA.
Starlings (Family Sturnidae)	Represented by the native Micronesian starling.	Andersen Air Force Base, potential training locations on Rota (e.g., Rota International Airport, Song Song Village, and Sinapalo Village), Tinian MLA, Saipan MMA, and FDM,
Honeyeaters (Family Meliphagidae)	Represented by the Micronesian honeyeater; extirpated from Guam	Present on Tinian MLA and Saipan MMA.
White-eyes (Family Zosteropidae)	Represented by the bridled white-eye, golden white-eye; extirpated from Guam, but occurs within the CNMI. Golden white-eyes only occur on Aguiguan and Saipan. Rota bridled white-eye occurs on Rota, and bridled white-eye occurs on Saipan and Tinian.	Rota, Tinian MLA, and Saipan MMA.
Weavers (Family Passeridae)	Represented by the Eurasian tree sparrow.	All DoD-owned and leased lands
Mammals		
Rats, mice, shrews (Family Muridae and Soricidae)	Introduced species of musk shrews, Polynesian rats, roof rats, Norway rats, and house mice.	Occurring on all DoD-owned and leased lands. No shrews/house mice on FDM.
Bats (Family Pteropodidae and Emballonuridae)	The Mariana fruit bat and Pacific sheath-tailed bat. Sheath-tailed bats are restricted to Aguiguan Island in the CNMI and have been extirpated from Guam.	Mariana fruit bats on Andersen Air Force Base, Navy Communications Site, Naval Base Guam Munitions Site, potential training locations on Rota (e.g., Rota International Airport, Song Song Village, and Sinapalo Village), Tinian MLA, FDM

Table 3.10-4: Major Vertebrate Taxonomic Groups (continued)

Major Taxonomic Group		Presence in Study Area
Common Name (Species Grouping)[1]	**Description**	**DoD Training Area**
Dogs and cats (Family Canidae and Felidae)	Introduced feral, semi-feral, and domesticated dogs and cats.	Occurring on all DoD-owned and leased lands, except for FDM
Ungulates (Families Suidae, Cervidae, Bovidae)	Feral pigs, Philippine deer, Asiatic water buffalo	Water buffalo only occur on Naval Base Guam Munitions Site. Deer and pig potentially occur on all DoD-owned and leased lands, except for FDM.

[1] Various seabird and shorebird bird groups associated with marine and coastal environments are discussed in Section 3.6 (Marine Birds).
[2] Sources: Wiles (1998), U.S. Department of the Navy (2012); Pregill and Steadman (2009).
Notes: DoD = Department of Defense, FDM = Farallon de Medinilla, MLA = Military Lease Area, CNMI = Commonwealth of the Northern Mariana Islands, Saipan MMA = Saipan Marpi Maneuver Area.

3.10.1.4 General Threats to Terrestrial Species and Habitats within the Mariana Islands

There are numerous threats to native species and habitats in the Mariana Islands. Major threats to native species include (but are not limited to): (1) introduced and invasive plants and animals, and (2) loss and/or degradation of key habitat types. These threats are summarized below.

3.10.1.4.1 Introduced and Invasive Species

Terrestrial species may be classified as either native or introduced depending on their origin and the chronology of their introduction to Guam and other islands within the Study Area. A native species may be further considered as endemic to a particular island or the Mariana archipelago if the species is not found outside the area. An introduced species will demonstrate some degree of invasiveness, which is a measure of severity on native ecosystems (Davis 2009; Thompson and Davis 2011). Increasing populations, economic cycles of growth and retraction, and strategic location contributed to the escalating rate of intentional and accidental introductions of alien species in the Mariana Islands (Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife 2005; Guam Division of Aquatic and Wildlife Resources 2006).

Although there are many introduced plant and animal species important to the degradation of habitats and modification of ecological processes, the most notorious species introduced to Guam is the brown treesnake (*Boiga irregularis*), discussed in more detail in Section 3.10.2.2 (Wildlife Communities). The brown treesnake was accidentally introduced to Guam from the Admiralty Islands (a group of islands of northern Papua New Guinea) following World War II (Rodda et al. 1997). Snakes that survived the transport escaped into terrestrial habitats of Guam, expanding outward from Apra Harbor. The snakes established on Guam and, by 2011, only 2 of 12 native forest bird species remain (the Micronesian starling and the Mariana swiftlet) (Fritts and Leasman-Tanner 2001). Further, the snake population on Guam appears to be sustained by introduced skinks and geckos, which was a food source for the brown treesnake within its native range (Christy et al. 2007a). Introduction, establishment, and subsequent removal of ecological prey species could occur on other Mariana Islands or other suitable areas in the Pacific if brown treesnakes survive transport to new locations.

The potential for training activities to degrade island habitats through the accidental introduction of potentially invasive species is addressed in Section 3.10.3.3.1 (Impacts from Invasive Species

Introductions). This section identifies the potential introduction pathways associated with training activities described in this EIS/OEIS.

3.10.1.4.2 Loss and/or Degradation of Key Habitat Types

Loss of key habitats is a problem that will have long-term effects on terrestrial habitats and species. Major factors exacerbating habitat loss are ungulates (hoofed animals), development, introduction of invasive plant and animal species, natural events (such as typhoons), and the ecological modification of factors that affect recovery from natural events (Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife 2005; Guam Division of Aquatic and Wildlife Resources 2006).

Probably the most difficult and labor-intensive factor to control is damage by invasive species, such as brown treesnakes and ungulates. One of the potential cascading effects of the introduced brown treesnake is the loss and/or reduction of seed-dispersing birds and bats, which in turn may contribute to the loss of native forest. Feral pigs, deer, and water buffalo alter the forest composition by browsing on or disturbing vegetation. Many native flora are preferred by ungulates because native flora do not possess the chemical and physical defenses found in many introduced plants. This form of artificial selection allows invasive plant species to dominate natural habitats, which further modifies native habitats (Davis 2009; Guam Division of Aquatic and Wildlife Resources 2006; Thompson and Davis 2011).

3.10.2 Affected Environment

3.10.2.1 Vegetation Communities

This section describes vegetation communities found on DoD owned or leased lands on Guam and the CNMI. The composition and structure of these plant communities are influenced by a variety of factors, such as current and past disturbances, substrates, and precipitation. Many native plants discussed in this section are culturally important as medicinal plants, spiritual significance, or traditional food sources.[1]

3.10.2.1.1 Department of Defense Lands on Guam

The floristic complexity of Guam's plant communities and the absence of distinct associations of species have led ecologists to emphasize the underlying soil and the relative degree of disturbance when classifying plant communities, rather than solely their floristic composition. Navy natural resource specialists grouped vegetation types based on works by Fosberg (1960) and Stone (1970).

These vegetation types are grouped into the following five general plant communities: (1) limestone, (2) ravine, (3) wetland, (4) strand, and (5) savanna (U.S. Department of the Navy 2013a). The five general plant communities occurring on Guam are discussed in greater detail in the following paragraphs. Distinct communities within the general plant communities are identified where possible based on data from previous field surveys. Photos of representative community types are shown in Figure 3.10-3.

Limestone Communities. Limestone communities are situated on elevated limestone terraces, plateaus, and slopes. Forest community structure and composition are primarily influenced by the high winds of typhoons. Depending on the relative age of the vegetation within the community, limestone forest can be further divided into primary and secondary forests, with primary forests being the historic limestone

[1] Species of flora and fauna continue to have integral roles in contemporary Chamorro culture. In acknowledgement, this EIS/OEIS will use Chamorro names for plants, with first mention of scientific name (not all plants within the Study Area have commonly used English names). English names will be used for animals, with scientific and Chamorro names at first mention. Some species discussed in the text do not have an English name or a known Chamorro name. In these instances, only the scientific name is used.

forest and the secondary being a successional form after primary forests were impacted by catastrophic forces such as typhoons and intensive military actions (e.g., bombing). Limestone plant communities are diverse and highly variable, containing both native and nonnative woody plants, ferns, and herbaceous plants adapted to excessively drained, shallow limestone soil. The endangered *Serianthes* tree occurs in limestone forests and is restricted to the forested portion of Northwest Field above Ritidian Point (see Table 3.10-1). In their least disturbed state, these plant communities have a stratified canopy consisting of scattered, large, emergent trees, such as dukduk (*Artocarpus mariannensis*) and nunu (*Ficus prolixa*), with a maximum height of 60 to 70 feet (ft.) (18 to 21 meters [m]). Other dominant species composing both the upper canopy and mid-canopy layers include mapunao (*Aglaia mariannensis*), langiti (*Ochrosia marianensis*), ahgao (*Premna obtusifolia*), yoga (*Elaeocarpus joga*), ifit (*Intsia bijuga*), umumu (*Pisonia grandis*), pahong (*Pandanus dubius*), and kafo (*Pandanus tectorius*) (U.S. Department of the Navy 2013a). Mid-canopy layers can be 30 to 45 ft. (9 to 14 m) tall. Smaller individuals of the above species and species such as paipai (*Guamia mariannae*), fadang (*Cycas micronesica*), and lada (*Morinda citrifolia*) are often present as an understory layer. The floristic composition of a limestone forest can be variable depending on location and the history of disturbance (U.S. Department of the Navy 2013a).

Notes: 1. Upper left panel: large dukduk (*Artocarpus mariannensis*) in mature limestone forest, Naval Base Guam Telecommunications Site (March 2011). 2. Upper right panel: coastal strand community located at Mergagan Point, near Andersen AFB (April 2010). 3. Lower left panel: karisu (*Phragmites karka*) and open water near Laguas River bridge (April 2011). 4. Lower right panel: savanna communities and erosion scars west of the Naval Base Guam Munitions Site, along with ravine forests along drainages.

Figure 3.10-3: Representative Vegetation Community Types on Guam

Two subtypes of the limestone community type are recognized: disturbed limestone forest and halophytic-xerophytic scrub (salt tolerant vegetation on exposed and thin-soiled slopes and rock flats). Disturbed limestone plant communities are usually dominated by nonnative woody species of relatively short heights. The floristic composition represents subclimax seral stages following human-induced disturbances such as land clearing. The canopy of disturbed limestone forest is fairly open, which allows abundant sunlight to reach the forest floor. The majority of the woody biomass in the disturbed areas is derived from nonnative species, including tangantangan (*Leucaena leucocephala*), lemondichina (*Triphasia trifolia*), and papaya (*Carica papaya*). Some areas of disturbed limestone forest are dominated by larger, nonnative trees such as African tulip (*Spathodea campanulata*) and ahgao manila (*Vitex parviflora*). Scattered niyok or coconuts (*Cocos nucifera*) are common overstory components of disturbed limestone forests. Inland groves of coconuts are the remnants of copra plantations. Native species can be present in the understory, including kafo, nanaso (*Scaevola sericea*), panao (*Guettarda speciosa*), and nunu. The open understory, the result of ungulate browsing, rooting, and trampling, is occupied by various nonnative grasses, vines, and weeds. Chromolaena (*Chromolaena odorata*), known as masiksik in the Chamorro language, is a common nonnative shrub in recently disturbed areas (U.S. Department of the Navy 2013a).

The halophytic-xerophytic scrub subtype of the limestone community is a unique plant community that exists on limestone terraces and cliff edges. The presence of drying winds, exposure to salt spray, and excessively drained limestone soil result in a microclimate that supports a stunted, wind-pruned plant community. The floristic diversity in these communities varies from low to high. Common species in halophytic-xerophytic scrub communities include nigas (*Pemphis acidula*), nanaso, panao, chopak (*Mammea odorata*), hunik (*Tournefortia argentea*), lodugao (*Clerodendrum inerme*), kafo, pago (*Hibiscus tiliaceous*), langiti, nunu, gasoso (*Colubrina asiatica*), lalahag (*Jasminum marianum*), and gulos (*Cynometra ramiflora*) (U.S. Department of the Navy 2013a).

Ravine Communities. Fosberg (1960) classified the forest vegetation in valleys and ravines in southern Guam as ravine forests. Although the floristic composition of the ravine communities is similar to the limestone communities, these forests generally occur on volcanic soil or on argillaceous or clayey limestone soil, and are quite variable in floristic composition. Plant communities are often defined by the variability in soil moisture. Valley bottoms and ravines often have higher soil moisture than on the upper slopes. Canopies of ravine forest are structurally complex with multiple layers. Species present often include dukduk, pago, kafo, nunu, chosga (*Glochidion mariannensis*), ahgao, nunu, fagot, langiti, and da'ok (*Calophyllum inophyllum*). Because of their proximity to freshwater streams in southern Guam, these plant communities contain many species of cultivated plants such as coconut, betelnut palm or pugua (*Areca catechu*), alangilang (*Cananga odorata*), and banana or chotda (*Musa* spp.). Epiphytes and common woody climbers (i.e., lianas) are also present (U.S. Department of the Navy 2013a).

A disturbed ravine forest subtype is also recognized. Disturbed ravine plant communities are usually dominated by nonnative woody species with a more open canopy. The floristic composition represents subclimax seral stages following human-induced disturbances, such as agriculture. The majority of the woody biomass in the disturbed ravine forest is usually derived from nonnative species. Ahgao manila and alangilang are common components of disturbed ravine forests on Guam. The open understory is occupied by various nonnative grasses, vines, and weeds (U.S. Department of the Navy 2013a). Ravine forests and disturbed ravine forests are limited to the Naval Base Guam Apra Harbor and Naval Base Guam Munitions Site.

Wetland Communities. Wetlands are areas subject to permanent or periodic inundation by surface or groundwater with a frequency sufficient to support a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction. The surface or subsurface water must be sufficient for the establishment of hydrophytes or development of hydric soil or substrates. Wetlands generally include swamps, marshes, bogs, and similar areas, such as sloughs, depressions, wet meadows, river overflows, mud flats, and natural ponds (U.S. Department of the Navy 2013a). The northern limestone plateau of Guam is generally lacking in substantial wetlands, but marshes are found in the southern portion of the island (U.S. Department of the Navy 2013a).

Fosberg (1960) described seven subtypes of wetland plant communities based on their dominant floristic composition. Fosberg defined swamps as supporting plant communities with a predominance of woody species, and marshes as supporting herbaceous plant communities (Fosberg 1960). Marshes are generally situated in low places along the coast, along streams, in depressions and sinkholes with argillaceous limestone, or in poorly drained areas with volcanic soil. Marshes can be inundated with freshwater or brackish water if near the ocean. Swamps are generally situated along rivers, especially near the coast or along river valleys if inland, and are usually designated as ravine communities rather than as wetland communities (U.S. Department of the Navy 2013a).

Most marshes on Guam are floristically simple with few dominant plant species. Karisu (*Phragmites karka*), a tall, reedy perennial grass, is the most common marsh species, often forming a dense monocultural plant community. *Scirpus littoralis*, a perennial sedge with rhizomes, is also found in dense pure stands along stream banks and in estuaries. Langayao (*Acrostichum aureum*), a large fern, can dominate some marshes. Other floristic components of wetland plant communities on Guam can include introduced invasive grasses and sedges (U.S. Department of the Navy 2013a).

Mangroves, freshwater and brackish swamps of woody vegetation, on Guam are the largest category of wetlands and can be found on the edges of marshes, along river courses, and in wet depressions in forests. Pago is usually the dominant species, although the largest tract of swamp forest on the island, the Talofofo River Valley to the east of Naval Base Guam Munitions Site, is dominated by langasat (*Barringtonia racemosa*). Other trees that might be present are kafo, gulos, and the betelnut palm (Guam Division of Aquatic and Wildlife Resources 2006). Natural freshwater marshes are also common on Guam. Most are dominated by dense, nearly pure stands of karisu that are 6 to 16 ft. (2 to 5 m) tall. Other grasses (e.g., *Panicum muticum*), sedges (e.g., *Eleocharis ochrostachys* and *Cyperus* spp.), and langayao are often present but are usually less prevalent (Guam Division of Aquatic and Wildlife Resources 2006). Vegetation in man-made freshwater habitats is variable, but karisu and pago are usually present (Guam Division of Aquatic and Wildlife Resources 2006).

Coastal Strand Communities. Strand vegetation is adapted to excessively drained soil and salt spray from adjacent coastal waters. Many beach areas on Guam are occasionally inundated with salt water during storms, which imposes a controlling influence on all biota. Strand communities vary floristically and in diversity. Backstrand communities usually are inundated at high tide and dry out at low tide. Some common overstory species found in strand plant communities include coconut, gagu (*Casuarina equisetifolia*), nonak (*Hernandia* spp.), and da'ok. Where an overstory is lacking or the canopy is open and a shrub layer is common, the shrub species often include nanaso, hunik, and pago. Vines, including morning glory or halaihai (*Ipomoea* spp.), are often present. Grass species on these coastal strands can include bunchgrass (*Lepturus repens*) and *Paspalum distichum* (U.S. Department of the Navy 2013a). Strand plant communities are limited to narrow strips in coastal areas within Naval Base Guam, Main Cantonment Area, and Andersen Air Force Base (AFB).

Savanna Communities. Savannas, defined as grasslands with scattered individual or clumps of trees, cover extensive areas in southern Guam. Savannas are predominately found on volcanic soil and are maintained by periodic burning initiated by humans (U.S. Department of the Navy 2013a). If left undisturbed, savanna communities would gradually be colonized by an increasing number of woody trees and shrubs, and convert to a ravine or limestone forest depending on the soil type (U.S. Department of the Navy 2013a). These five savanna plant communities were recognized by (Fosberg 1960): (1) *Miscanthus*, (2) *Dimeria*, (3) erosion scar, (4) karisu, and (5) weed communities.

3.10.2.1.1.1 Andersen Air Force Base

Basewide vegetation surveying and mapping were conducted on Andersen AFB in 2007 and 2008, and included quantitative characterization of 3,211 randomly located plots on 15,371 ac. (6,220.4 ha) on Andersen AFB proper and the adjacent Guam National Wildlife Refuge on Ritidian Point (U.S. Department of the Navy 2013a). Twenty-two distinct communities (21 vegetative communities and disturbed land) were observed on Andersen AFB within the survey area (U.S. Air Force 2008). Vegetation community types were named in accordance with the Fosberg (1960) classification, with secondary forest subdivisions based on descriptions of Donnegan et al. (2004). Community types were typically named by the dominant or keystone plant species therein. No wetlands are identified on Andersen AFB (U.S. Air Force 2008).

The predominant vegetation type in undeveloped areas on Andersen AFB is limestone forest. This vegetative community occurs along portions of the western boundary and the northern and eastern boundaries of the installation, atop the plateau, on the fore slope (cliff face), and at the toe of the cliff slope.

Excellent examples of native strand vegetation are found on coastal areas of Andersen AFB. Strand plants are characteristically salt tolerant, thrive in sandy soil or on rocky coasts, and tolerate direct sunlight and hot, dry conditions. Major components of the coastal strand flora include trees and shrubs such as nanaso, hunik (*Tournefortia argentea*), masiksik hembra (*Triumfetta procumbens*), panao, nonak, binalo (*Thespesia populnea*), gagu, puting (*Barringtonia asiatica*), and coconut trees. Rocky coasts typically support stunted, wind-sheared shrubs.

3.10.2.1.1.2 Naval Base Guam Telecommunications Site

Three plant communities were described on Naval Base Guam Telecommunications Site (the northern portion previously called Finegayan North) in 2008: limestone forest, coconut forest (remnants of copra plantations), and disturbed/weed community (successional vegetation between vegetation types) (U.S. Department of the Navy 2013a). The disturbed/weed plant community occurs at forest edges and in patches within the forest (U.S. Department of the Navy 2013a). The predominant vegetation community in the southern portion of the area (Andersen South, previously called South Finegayan) is disturbed limestone forest (U.S. Department of the Navy 2013a).

Limestone forests on Naval Base Guam Telecommunications Site occur on the upper plateau and below the cliffline (U.S. Department of the Navy 2013a). The majority of the plateau area supports disturbed limestone communities composed of nonnative species (U.S. Department of the Navy 2013a). In the forests of the southern section of Naval Base Guam Telecommunications Site, the three species with the highest relative densities were paipai, kafo, and fagot, which are all native species and collectively account for 62 percent of the overall density. All native tree species within the southern section of Naval Base Guam Telecommunications Site had a combined density of 87 percent. Two native tree species, paipai and mapunao, are endemic to the Mariana Islands and have a combined density of 27 percent (U.S. Department of the Navy 2013a).

The limestone forested area in the southern portion of Naval Base Guam Telecommunications Site is dominated by nonnative ahgao manila, tangantangan, and papaya, which comprise 67 percent of the number of trees. The remaining 33 percent of tree cover is by five native species. The low native tree component might be the result of past clearing activities at the annex (U.S. Department of the Navy 2013a).

3.10.2.1.1.3 Andersen South

The most common native tree species within the disturbed limestone forest on Andersen South include the following: pago, paipai, lada (*Morinda citrifolia*), fagot, and ahgao (*Premna obtusifolia*). The most common introduced tree species on Andersen South include the following: ahgao manila, tangantangan and pickle tree (*Averrhoa bilimbi*). Aside from pickle tree, other nonnative species in the survey, such as papaya and custard apple (*Annona reticulata*), produce edible fruits that are likely dispersed by ungulate activity (U.S. Department of the Navy 2013a).

3.10.2.1.1.4 Naval Base Guam Barrigada

Activities carried out at Naval Base Guam Barrigada require large amounts of cleared, maintained land for operation. Vegetation communities include tangantangan scrub, limestone forest, disturbed limestone forest, shrub/grassland, and wetlands. The disturbance of land has led to an increase of nonnative and invasive species. The degree of disturbance within the annex results in portions of the remaining forested plant communities being highly modified and dominated by tangantangan and African tulip (U.S. Department of the Navy 2013a).

Twenty tree species were documented on transects quantified during the 2008 vegetation surveys performed on Naval Base Guam Barrigada (U.S. Department of the Navy 2013a). The most commonly observed trees included nunu, pago, and fagot. All three species are native to Guam. Paipai, which is also native, is a dominant understory species within the forests on Naval Base Guam Barrigada. Common introduced species on Naval Base Guam Barrigada include custard apple, limeberry, and tangantangan. Native species have a combined relative density of approximately 77 percent, far exceeding the relative density of introduced species for the survey transects at Naval Base Guam Barrigada (U.S. Department of the Navy 2013a).

3.10.2.1.1.5 Naval Base Guam Main Base

Naval Base Guam Main Base includes Naval Base Guam Polaris Point, Naval Base Guam Apra Harbor, Sasa Valley Tank Farm, and Tenjo Vista Tank Farm. Vegetation communities on Naval Base Guam Main Base include limestone, ravine, and wetland communities. Limestone communities are situated on slopes found within Naval Base Guam Main Base. Relatively large disturbed limestone communities are present on the lower slopes of Orote Peninsula and a narrow band of halophytic-xerophytic scrub communities exists on the cliff faces (U.S. Department of the Navy 2013a).

Vegetation surveys were performed along a transect in the upper plateau to the west of the old runway in the southern sector of Orote in 2008. The area has rugged limestone karst topography. The limestone forest is characterized by native fagot, which comprises 28 percent of the relative density. Collectively, approximately one-third of the relative tree density within this transect is composed of introduced understory tree species (i.e., tangantangan, limeberry, and papaya). The remaining two-thirds of the relative density are composed of native species, including the Mariana Islands endemic species mapunao. Absolute cover was highest for native upper canopy tree species, including nunu, umumu, and fai'a (*Tristiropsis acutangula*) (U.S. Department of the Navy 2013a). Based on the 2008 vegetation survey on Naval Base Guam Polaris Point, tangantangan comprises 88 percent of the tree layer within the transect (U.S. Department of the Navy 2013a).

Within the Naval Base Guam Main Base, ravine forests are restricted to narrow strips along the few freshwater drainages near the coast (U.S. Department of the Navy 2013a). Manmade wetlands are found at Sasa Valley Tank Farm and Tenjo Valley Tank Farm.

3.10.2.1.1.6 Naval Base Guam Munitions Site

Vegetation communities on the Naval Base Guam Munitions Site include limestone, ravine, wetland, and savanna communities. Limestone communities are situated on elevated limestone terraces, plateaus, and slopes found within the Naval Base Guam Munitions Site. The Naval Base Guam Munitions Site has the largest extent of interior limestone communities on Joint Region Marianas lands on Guam. These limestone communities persist on the ridge tops and upper slopes from Mount Lamlam northward to Mount Alifan. A narrow band of a halophytic-xerophytic scrub plant community is delineated near Mount Almagosa on the Naval Base Guam Munitions Site (U.S. Department of the Navy 2013a).

The ravine forest plant communities are abundant in the Naval Base Guam Munitions Site, occupying much of the south-central portion of the installation. Swamps, delineated as ravine communities, are often present on argillaceous limestone soil, bottomlands, and in depressional areas. Pago and kafo are the most common woody plants associated with these communities, often forming dense thickets. Langasat, a tall forest tree, dominates bottomland forest in areas along the Talofofo River. Extensive areas of disturbed ravine forest are also present in the Naval Base Guam Munitions Site, especially in areas subjected to low-intensity ground fires and past human disturbance. Several acres of coconut plantations still exist within the Naval Base Guam Munitions Site (U.S. Department of the Navy 2013a).

Twelve native species were documented along transects during the 2008 vegetation surveys within the ravine forests in the northern sector of the Naval Base Guam Munitions Site: akgak, pago, da'ok, chosgo (*Glochidion marianum*), *Melastoma malabathricum*, fadang, lada, gulos, chi'ute, pahong, *Discocalyx megacarpum*, and a'abang (*Eugenia reinwardtiana*) (U.S. Department of the Navy 2013a). Native tree species dominate the relative density of trees in all transects in the northern sector. Akgak and pago are the most dominant native species in the northern sector (U.S. Department of the Navy 2013a). Common introduced tree and shrub species within the northern sector include the betelnut palm, ahgao manila, the invasive bay rum tree (*Pimenta racemosa*), and limeberry (U.S. Department of the Navy 2013a).

A 2009 vegetation survey in the ravine forest in the valley slopes surrounding Mount Almagosa in the southern sector of the Naval Base Guam Munitions Site characterized the native fai'a (*Merrilliodendron megacarpum*) as the native species comprising more than 63 percent of the relative density. The ravine forest along the Sadog Gagu River in the southern sector of the Naval Base Guam Munitions Site is dominated by coconut and two introduced species, ahgao manila and betelnut palm. The overall relative density of native species along the Sadog Gagu River is approximately 33 percent, which is lower than the densities observed in ravine forest transects in the northern sectors of the Naval Base Guam Munitions Site. In the ravine forest in the southwestern sector of the installation, south and west of the explosive ordnance disposal range, the introduced species coconut and betelnut palms and native kafo trees are dominant (U.S. Department of the Navy 2013a).

Fena Dam, built in 1951, contains Fena Reservoir, the largest freshwater body of water on Guam. Fena Reservoir is approximately 200 ac. (81 ha), the shallow water fringes of the lake are dominated by karisu. The Naval Base Guam Munitions Site contains the greatest area of wetlands on DoD-owned or leased lands in Mariana Islands (U.S. Department of the Navy 2013a). Most of these freshwater wetlands are adjacent to the rivers or their tributaries. Wetlands on the Naval Base Guam Munitions Site occur in limestone forest, ravine forest, and savanna communities. Common forested wetland species include pago, coconut, kafo, and the betelnut palm (U.S. Department of the Navy 2013a).

Erosion in savanna communities is particularly evident within the Naval Base Guam Munitions Site. Large areas of bare ground are present primarily due to degraded soil and destruction of vegetation by feral ungulates. Without vegetation, slope failures expose bare ground.

3.10.2.1.2 Rota

Training activities on Rota described in this EIS/OEIS are limited to Rota International Airport and other areas in conjunction with local law enforcement. Potential training locations on Rota are shown on Figure 3.10-2. The infrequent use of locations on Rota occurs in developed areas, not in Rota's natural areas that support special status species. An overview of Rota's natural vegetation communities and locations of special ecological interest is included below.

No major military battles occurred on Rota during World War II. Therefore, the island of Rota was spared much of the ecological destruction that occurred on Guam, Saipan, and Tinian. With a small human population and limited agriculture, Rota has also been less developed than the other islands in the southern portion of the archipelago. The vegetation communities on Rota includes primary and secondary limestone forest, atoll forest, agricultural forest, coconut plantations, Formosan koa forest, secondary vegetation, open fields, grassland, and urban vegetation (Fosberg 1960, Mueller-Dombois and Fosberg 1998).

Rota also has a substantial portion of land in designated conservation areas, and other lands also remain relatively undisturbed. Consequently, intact limestone forest covers a majority of the island. Rota also hosts several rare plants, including *Tabernaemontana rotensis*, and nearly all *Serianthes* trees in existence (both of these species also occur on Andersen AFB on Guam). Two other ESA-listed plant species occur exclusively on Rota—*Osmoxylon mariannense*, and *Nesogenes rotensis* (U.S. Fish and Wildlife Service 2006c).

The Sabana region is an uplifted plateau 1,476 ft. (450 m) in elevation covering approximately 5 square miles (mi.) (13 square kilometers) on the western half of the island. This area supports dense limestone forests and also includes the known locations of the ESA-listed *Osmoxylon mariannense.* Cliffs border the Sabana on all sides except to the northeast, where the Sabana slopes down to the eastern part of the island, which has been covered since the 1930s in secondary growth forest intermingled with residential and agricultural lands. The cliff lines surrounding the plateau remain primary forest due to their steepness, a hindrance to past agricultural development. The plateau's western cliffs support the Rota population of the ESA-listed *Serianthes* tree. The I'Chinchon Bird Sanctuary is located on the southeastern and eastern coastlines of Rota and is now part of the Mariana Crow Conservation Area. The sanctuary is an important seabird and shorebird location and contains intact limestone forest and exposed limestone outcrops suitable for nesting habitat. This area is also the location of one of two populations of the ESA-listed *Nesogenes rotensis*.

Most of the ecological services provided by the native vertebrates, such as insectivory, pollination, and seed dispersal, still appear to function on Rota (Hess and Pratt 2006). However, introduced deer are responsible for unnatural native plant herbivory, and rats (*Rattus* spp.) are likely seed predators, as well as nest predators of native birds. The abundant Black Drongo (*Dicrurus macrocercus*) may also be responsible for nest predation of native forest birds. Despite these depredations and frequent typhoons, limestone forest regeneration processes appear to be unimpeded in comparison to Guam. Abundant birds that disperse large seeds include the Mariana fruit dove and the white-throated ground dove, whereas the Micronesian honeyeater may serve as an important pollinator bird species (Hess and Pratt 2006).

3.10.2.1.3 Tinian Military Lease Area

Tinian consists of a series of five limestone plateaus at various elevations, separated by escarpments and steeply sloping areas (U.S. Department of the Navy 2013a). These areas are described in more detail below.

3.10.2.1.3.1 Limestone Forests

Limestone forests fall into three types: mixed forest, coastal forest, and halophytic-xerophytic shrub. Mixed forest is classified as a cliff-line ecosystem. These forests occur on the peak of Mt. Lasso and areas surrounding the north escarpment of Maga. The coastal and halophytic-xerophytic forests occur in near-shore ecosystems. Limestone forests occurring in cliff-line ecosystems are referred to as “typhoon forests” due to adaptations in the vegetation promoting forest regeneration in the presence of typhoon damage. Some plant species will reproduce by generating new shoots from fallen branches and by flowering in exposed areas cleared by wind damage. Vegetation that occurs in typhoon forests includes umumu, gulos, nunu, and paipai.

Coastal limestone forest occurs on slopes above the ocean. Plants found in this vegetative community include chi’ute (*Cerbera dilatata*), langiti, paipai, and kafo. Coastal limestone forests can be found at Unai Masalok.

Halophytic-xerophytic scrub vegetation occurs in near ocean habitat on limestone rocks. The dominant plant species in a halophytic-xerophytic scrub habitat is *Pemphis acidula* (U.S. Department of the Navy 2013a).

3.10.2.1.3.2 Secondary Growth Forests

Secondary growth forests contain a mixture of native and introduced trees, shrubs, and dense understory plants. These forests comprise parts of the lowland ecosystem. Dominant trees include tangantangan, kamachili (*Pithecellobium dulce*), and gago (*Casuarina equisetifolia*), with rare occurrences of *Acacia confusa*. Dense stands of piao (*Bambusa vulgaris*) can also be found in secondary forests.

Tangantangan forest dominates mainly the level to moderately sloping areas at the north end of the island. Tangantangan is also included in secondary growth forest and is a part of the lowland ecosystem. However, on Tinian there are extensive homogeneous stands of this species. Often the stands are interspersed with *Panicum maximum*, which grows to 6 ft. (1.8 m) tall (U.S. Department of the Navy 2013a).

3.10.2.1.3.3 Open Fields and Grasslands

Open field habitat is characterized by grass and other ground-covering vegetation with small thickets of native and introduced vegetation. Open field habitat is also included as a component of the lowland ecosystem. Generally, these fields occur in areas of historical cattle grazing. Introduced species such as lantana (*Lantana camara*), morning glory, climbing hempvine (*Mikania scandens*), and giant false sensitive plant (*Mimosa invisa*) are present in open fields as well as small groves of trees, including African tulip tree (*Spathodea campanulata*).

Vegetation present near open water area is typically dominated by *Schoenoplectus litoralis* var. *capensis*, with patches of langayao and *Paspalum orbiculare*. This band of mixed vegetation is surrounded by a band of karisu, an obligate wetland species (U.S. Department of the Navy 2013a). Crop plants have been planted in areas, and these disturbed areas contain gago, vines, and weedy herbs.

3.10.2.1.3.4 Wetlands (Freshwater)

Although surface water is rare, some areas of limestone on Tinian have developed conditions that allow wetlands or seasonal wetlands to form. Three of these areas occur within the Tinian Military Lease Area (MLA). Each of these areas consists of discrete sites that impound rainwater and are entirely dependent upon rainfall as a source of water. Hagoi is the largest of the wetlands, with a capacity to hold approximately 39 ac. (15.5 ha) of surface water, with surrounding areas of karisu. The wetland submergent plant-like algae, *Chara* spp., is abundant in some of the open water areas within sedge vegetation. Green algae (Chlorophyta) are also present and increase during the dry season. During the dry season, more than 50 percent of the open water areas was found to be covered with algae (U.S. Department of the Navy 2013c). Mahalang (1.3 ac. [0.5 ha]) and Bateha (1.5 ac. [0.6 ha]) are both composed of depressions and crater features (possibly World War II bomb craters), some of which retain water after heavy rains or typhoons. Each of these sites, however, is dry for most of the year, and in dry years may not pond water even during the wet season (U.S. Department of the Navy 2013c).

3.10.2.1.3.5 Strand Vegetation

Strand vegetation occurs on sandy beaches, and is often mixed with halophytic-xerophytic species. This vegetation type is a component of the coastal ecosystem. Tinian beaches consisting of strand vegetation are Unai Chulu, Unai Babui, Unai Chiget, and Unai Dangkulo (U.S. Department of the Navy 2013a). Vegetation in strand habitat includes hunik, beggar's tick (*Bidens alba*), blue porterweed (*Stachytarpheta jamaicensis*), lantana, binalo, and morning glory. *Euphorbia sparrmannii* var. *tinianensis*, is a semi-succulent herb endemic to Tinian and occurs only at Unai Masalok. Lamanibot Bay and other headland communities are valued as healthy xerophytic-halophytic scrub and can contain ufa halom-tano (*Heritiera longipetiolata*) (U.S. Department of the Navy 2013a). *Heliotropium anomalum* can be found near the cliff slope rim terrace pools created by the Unai Chiget blow hole and is not reported elsewhere on Tinian. The Unai Chiget region also includes a forest of nonak trees. Dense areas of this tree are not common in its range and this particular stand is unique on Tinian.

3.10.2.1.4 Saipan Marpi Maneuver Area

As described in Chapter 2 (Description of Proposed Action and Alternatives), Marpi Maneuver Area is authorized for training; however, the area is seldom used. Portions of the Marpi Maneuver Area are owned by CNMI, and other portions are privately owned. The Marpi Maneuver Area is 374.5 ac. (151.5 ha) and is characterized by tangantangan thickets and elephant grass meadows with some limestone forest areas in the southwestern portion of the facility. The area includes some old building pads on the eastern side of the area, adjacent to an old motocross track. With the coordination of the Army Reserve Unit Saipan and the approval of CNMI government, land navigation training is conducted on non-DoD lands within the Marpi Maneuver Area (shown in Figure 2.1-11, east side of northern Saipan). Land navigation training does not include vehicular training, and no fires are allowed for associated bivouac activities. Generally, maneuver training on Saipan is infrequent and rare, and most training activities are expected to use only the areas surrounding the buildings on the western edge of the old motocross track.

3.10.2.1.5 Farallon de Medinilla

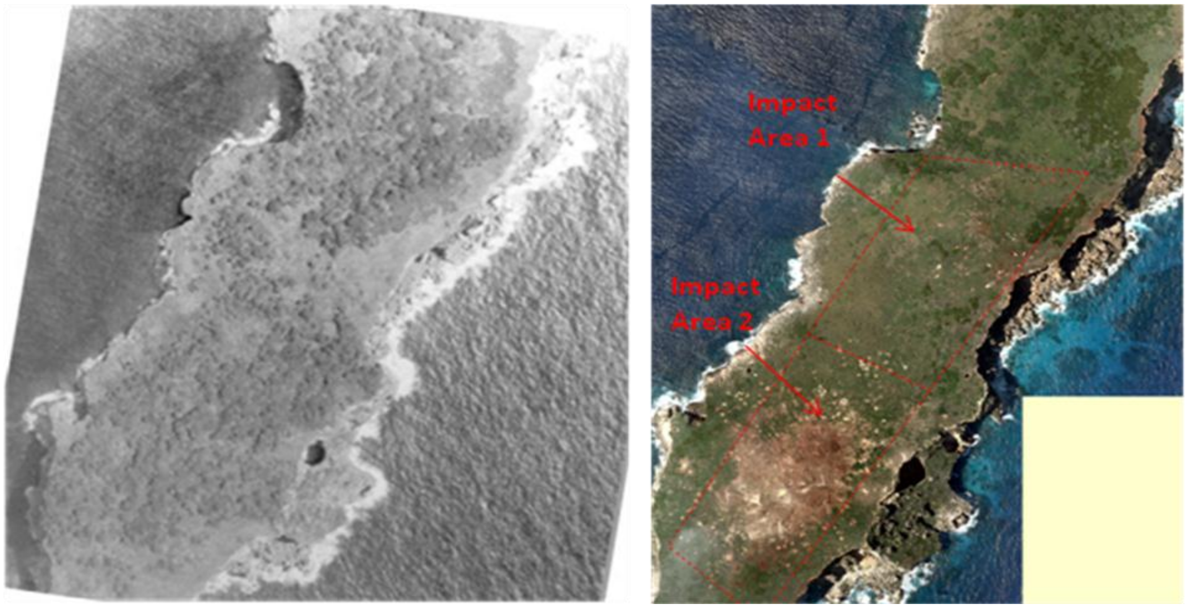
The U.S. military has used the island of FDM as a bombing range since at least 1971, and the agreement between the U.S. Government and the CNMI was formalized in a 50-year lease agreement (United States of America and Commonwealth of the Northern Mariana Islands 1983). Few vegetation surveys have been conducted on FDM. The first published flora record by Fritz in 1902 described the island as a plateau covered by brush approximately 13 ft. (4.0 m) high (Mueller-Dombois and Fosberg 1998); however, aerial photographs from 1944 show large canopy trees on FDM (Figure 3.10-4). FDM's vegetation appears to have undergone significant changes since the island was leased by the DoD and the subsequent bombardment for military training. The most intensive bombardment to date of FDM occurred during the Vietnam era, when as much as 22 tons of ordnance per month was dropped on the island (Lusk et al. 2000). Based on early 20th century descriptions of FDM vegetation and aerial photographs of the island prior to military bombardment activities, island tree height and canopy cover have been greatly reduced (Lusk et al. 2000; Mueller-Dombois and Fosberg 1998). A brief botanical survey of the northern portion of the island carried out in 1996 identified 43 plant species, 32 of which were native (Mueller-Dombois and Fosberg 1998). Vegetation on FDM may be grouped into coastal vegetation, cliff-line vegetation, and vegetation on the upper plateau known as the mesic terrace system. These vegetation types are described below.

3.10.2.1.5.1 Coastal Vegetation

Along the windward shoreline of FDM are large boulders interspersed with cobbles. The boulders are covered with microalgae of the genera *Padina*, *Liagora*, and *Asparagopsis*. The emergent portion of the beach is composed of rubble/cobbles with little sand and no vegetation (U.S. Department of the Navy 2013a). In the region of the isthmus is a reef terrace in the form of a ridge and spur system with sand channels. Algae of the genera *Padina*, *Dictyota*, *Hamimeda*, *Lyngbya*, *Liagora*, *Neomeris*, and *Calupera* cover the upper surface of the ridges (U.S. Department of the Navy 2013a). Along the leeward coastline is a structurally unique submerged shoreline forming a vertical wall to a depth of 49 to 66 ft. (15.0 to 20.1 m), undercut by ledges and caves. The exposed wall supports the green calcareous algae *Halimeda* and calcareous red algae (U.S. Department of the Navy 2013a).

3.10.2.1.5.2 Cliff-Line Vegetation

The dominant plant species in the cliff-line communities are *Exocoecaria aqallocha*, with less coverage by *Digitaria gaudichaudii*, *Bikkia tetandra*, *Hedyotis stringulosa*, and *Portulaca oleracea* (Lusk et al. 2000).



Notes: 1. Left panel photograph (circa 1944) shows apparent taller stature vegetation within the mesic terrace vegetation type in the central portion of the island (Source: U.S. Department of the Navy 2013a). 2. Right panel photograph (2012) shows recently cleared targets within range areas. Mesic terrace lacks forests evident from the 1944 photograph.

Figure 3.10-4: Reduction of Forest Communities on Farallon de Medinilla by Military Bombardment and Typhoons

3.10.2.1.5.3 Mesic Terrace System

Most of the mesic terrace ecosystem is dominated by dense herbaceous plant communities. Soil on the terrace is more developed and has higher moisture content than the cliff-line ecosystem soil. As a result, the once forested mesotropic environment supports greater diversity of plant species than observed in the cliff-line ecosystem. This area receives most of the ordnance at FDM, and subsequently has been altered the most in terms of structure and composition (from closed canopy forested areas to dense herbaceous and shrub cover (Lusk et al. 2000).

3.10.2.2 Wildlife Communities

3.10.2.2.1 Department of Defense Lands on Guam

3.10.2.2.1.1 Birds

Three endemic bird species from the Mariana Islands occur in small populations on Guam. The Mariana common moorhen persists in low numbers throughout Guam and on military-owned lands. The Mariana swiftlet was once common throughout the island but is now restricted to three caves on the Naval Munitions Site in southern Guam. The Micronesian starling, listed as endangered by Guam but not by the Federal government, was nearly extirpated in the early 1990s; however, it currently appears to be making a modest recovery and occurs in small numbers on Andersen AFB, Cocos Island, parts of Hagatna, Apra Harbor, and some coastal areas in southern Guam (U.S. Department of the Navy 2013a). Two other native terrestrial avian species are still found on military lands, neither of which is listed as threatened or endangered, but both are protected by the MBTA. These are the yellow bittern (*Ixobrychus sinensis*) and Pacific reef heron (*Egretta sacra*). The yellow bittern is the only native land bird that is still considered to be common on Guam (U.S. Department of the Navy 2013a). The Mariana crow has not survived in the wild on Guam and is believed to be extirpated from the island.

ESA-listed bird species are addressed in more detail in Section 3.10.2.3 (Endangered Species Act Listed Species). Seabirds and shorebirds protected under the MBTA are addressed separately in Section 3.6 (Marine Birds).

Several nonnative bird species are also present on Guam, which were either unintentionally introduced or intentionally introduced to provide hunting resources. Commonly observed introduced avian species include the island collared dove (*Streptopelia bitorquata bitorquata*), Eurasian tree sparrow (*Passer montanus*), black francolin (*Francolinus francolinus*), and the black drongo (*Dicrurus macrocercus harterti*). Guam Division of Aquatic and Wildlife Resources officially closed the dove hunting season in 1987; however, feral pigeons may be legally shot when it is legal to discharge a firearm (U.S. Department of the Navy 2013a). The island collared dove is present on all Joint Region Marianas lands on Guam (U.S. Department of the Navy 2013a). The Eurasian tree sparrow is commonly observed in small flocks, usually close by manmade structures. Black francolins were introduced to southern Guam as a game bird by the USFWS in 1961 and currently inhabit a variety of habitat types throughout the island, including Andersen AFB. The black drongo was introduced to Rota by the Japanese in the 1930s. The black drongo eventually spread to Guam and is considered a nuisance species that can be hunted at any time of the year. The black drongo occurs mostly in developed areas (U.S. Department of the Navy 2013a).

3.10.2.2.1.2 Mammals

Three species of bats, the Mariana fruit bat (*Pteropus mariannus mariannus*), the little Mariana fruit bat (*P. tokudae*), and the Pacific sheath-tailed bat (*Emballonura semicaudata rotensis*) were historically the only native mammals on Guam. The Pacific sheath-tailed bat has been extirpated from the island, while the little Mariana fruit bat is thought to be extinct. The Mariana fruit bat is federally listed as threatened; therefore, this is the only bat species addressed under Section 3.10.2.3 (Endangered Species Act Listed Species).

Spanish introductions included Asiatic water buffalo (known as carabao in Chamorro) (*Bubalus bubalis*), Philippine deer (*Cervus mariannus*), dogs (*Canis familiaris*), cats (*Felis catus*), feral pigs (*Sus scrofa*), goats (*Capra hircus*), and cattle (*Bos taurus*). Three of these introduced species, the Asiatic water buffalo, Philippine deer, and pigs, have feral populations that are damaging natural resources on Guam (U.S. Department of the Navy 2013a). Other introduced species include the Indian musk shrew (*Suncus murinus*) and several rodent species such as the common house mouse (*Mus musculus*), Malayan black rat (*Rattus diardii*), roof rat (*Rattus rattus*), Polynesian rat (*Rattus exulans*), and the Norwegian rat (*Rattus norvegicus*) (Wiewel et al. 2009).

3.10.2.2.1.3 Reptiles and Amphibians

Native reptile species known to still exist on Guam include stump-toed (mutilating) gecko (*Gehyra mutilata*), blue-tailed skink (*Emoia caeruleocauda*), Slevin's skink (*Emoia slevini*), moth skink (*Lipinia noctua*), snake-eyed skink (*Cryptoblepharus poecilopleurus*), Pacific slender-toed gecko (*Nactus pelagicus*), mourning gecko (*Lepidodactylus lugubris*), oceanic gecko (*Gehyra oceanica*), Micronesian gecko (*Perochirus ateles*), green sea turtle (*Chelonia mydas*), and hawksbill sea turtle (*Eretmochelys imbricata*) (Christy et al. 2007a, 2007b). Red-eared sliders (*Trachemys scripta elegans*) and snapping turtles (*Chelydra serpentinaare*) were recently introduced to some freshwater and brackish aquatic sites on Guam (Vogt and Williams 2004, U.S. Department of the Navy 2013a). The monitor lizard (*Varanus indicus*), which is common in some areas on Guam, is considered an early introduction to the Mariana Islands, approximately 1,600 years ago (Pregill and Steadman 2009). Sea turtles are discussed separately in Section 3.5 (Sea Turtles).

There are no native amphibian species on Guam; however, several nonnative amphibians have been introduced, including the marine toad (*Rhinella marina*), greenhouse frog (*Eleutherodactylus planirostris*), eastern dwarf tree frog (*Litoria fallax*), Guenther's Amoy frog (*Rana guntheri*), Hong Kong whipping frog (*Polypedates megacephalus*), Pacific chorus frog (*Pseudacris regilla*), slender-digit chorus frog (*Kaloula picta*), white-lipped tree frog (*Polypedates leucomystax),* grass frog (*Fejervary limnocharis*), crab-eating frog (*Fejervarya cancrivora*), and marbled pygmy frog (*Microhyla pluchra*) (Vogt and Williams 2004, Christy et al. 2007a, 2007b). Incidental occurrences of the Malaysian narrowmouth toad (*Kaloula pulchra*) and coqui (*Eleutherodactylus coqui*) have been recorded but neither species has become established on Guam (Christy et al. 2007a, 2007b).

The primary cause of the decline in native reptile populations on Guam is probably predation by introduced animals, including brown treesnakes, cats, and rats (*Rattus* spp.). The population of the blue-tailed skink has declined in response to predation or competition from the curious skink (*Carlia fusca*); however, it is relatively common in appropriate habitat (Fritts and Leasman-Tanner 2001, Vogt and Williams 2004). The stump-toed gecko has also declined, apparently in response to predation by introduced vertebrate predators, including rats, cats, shrews, and the brown treesnake. The mourning gecko is relatively common (Fritts and Leasman-Tanner 2001).

3.10.2.2.1.4 Invertebrates

Guam is home to dozens of endemic invertebrate species, many of which are rare or have extremely limited ranges. Endemic invertebrate species include the Mariana eight-spot butterfly (*Hypolimnas octocula marianensis*) and an undescribed *Catacanthus* species, known as the bronze boonie bug. Guam also supports three native tree snail species (humped tree snail [*Partula gibba*], fragile tree snail [*Samoana fragilis*], and Guam tree snail [*Partula radiolata*]). Additionally, Guam has a number of endemic invertebrate cave species that are likely extremely limited in their distribution. Among these are the Almagosa Cave amphipod (*Melita* spp.), at least three Almagosa isopods (*Isabelloscia* spp.), and the Guam karst katydid (*Salomona guamensis*).

The three native tree snails, Mariana eight-spot butterfly, and Mariana wondering butterfly are considered candidates for listing under the ESA. Population declines of native tree snails are likely due to overgrazing of vegetation by ungulates resulting in a loss of forest habitats, and the predation by introduced species, namely the terrestrial flatworm (*Platydemus manokwari*) and rosy wolfsnail (*Euglandina rosea*) (U.S. Department of the Navy 2013a). Overbrowse of nurse plants for the Mariana eight-spot butterfly and Mariana wandering butterfly is a major threat to the recovery of this species (U.S. Department of the Navy 2013a).

The native terrestrial crab or panglao (*Cardisoma carnifex*), land hermit crab or umang (*Coenobita brevimanus*) and coconut crab (*Birgus latro*) (known as ayuyu in Chamorro) begin life in the sea. After a planktonic larval stage, small crabs emerge from the ocean to live on land. Mangrove crabs or atmangao live in burrows among the roots of riverbank trees. Land hermit crabs rely on borrowed shells for protection throughout their lives, often using the shell of the introduced giant African land snail (*Achatina fulica*). Coconut crabs are the largest terrestrial land arthropod on Earth. They initially borrow shells, but then develop their own hard exoskeleton. Coconut crabs hide in holes during the day and, like the land hermit crab, forage at night. Land crabs are omnivorous and eat foods such as fruits, seeds, plants, rotting wood, dead insects, and carrion. Coconut, land, hermit and mangrove crabs are all found in various locations of DoD property within the Study Area. Threats to these species include rats, feral pigs, dogs, monitor lizards, and humans (U.S. Department of the Navy 2013a).

3.10.2.2.1.5 Guam National Wildlife Refuge and Overlay Units

The Guam National Wildlife Refuge was established in 1993 to protect and recover ESA-listed species, protect habitat, control non-native species (with an emphasis on the brown treesnake control), protect cultural resources, and provide public recreational and educational opportunities.

The Guam National Wildlife Refuge contains three major administrative units, two of which are considered "overlay refuge units" of DoD-administered properties. Overlay refuge units were established through a Memorandum of Understanding, signed by representatives from the Navy, Air Force, and the USFWS. The establishment and management of the overlay refuge units on military lands provides a commitment by the military and the USFWS to institute a coordinated program centered on the protection of threatened and endangered species and other native flora and fauna, maintenance of native ecosystems, and the conservation of native biological diversity in cooperation with the Guam Division of Aquatic and Wildlife Resources, and in support of the military mission (U.S. Department of the Navy 2013a). The three Guam National Wildlife Refuge units are described below:

- ***Ritidian Unit:*** The Ritidian Unit, in northern Guam, is approximately 772 ac. (312.4 ha), including approximately 370 ac. (149.7 ha) of land and 401 ac. (162.3 ha) of submerged lands. The Unit includes a densely vegetated coastal plain bounded on one side by sheer limestone cliffs jutting to approximately 200 ft. (61.0 m) above sea level. Native vegetation on the Ritidian Unit includes high-quality coastal strand, backstrand, and limestone forest natural communities; a sandy beach; and nearshore marine habitats to the depth of approximately 98.4 ft. (30 m). The terrestrial lands on the Ritidian Unit are designated Critical Habitat for the endangered Mariana crow, the endangered Guam Micronesian kingfisher, and the threatened Mariana fruit bat. Management programs at the Ritidian Unit focus on preserving and restoring essential wildlife habitat, and protection and recovery of endangered and threatened species. Protecting habitat for endangered species also conserves a rich diversity of other plant and animals species. The Ritidian Unit supports a diversity of tropical trees, shrubs, vines, ferns, cycads, grasses, and other species that, in turn, provide habitat for native birds, the Mariana fruit bat, tree snails, coconut crabs, land crabs, skinks, geckos, and myriad native insects.
- ***Andersen Air Force Base Overlay Unit:*** The 10,219 ac. (4,135.5 ha) Air Force Unit at Andersen AFB in northern Guam is contiguous with the Ritidian Unit and includes high-quality native limestone forest, coastal strand, and backstrand natural communities and beaches. The Air Force Unit supported some of the last remaining endangered Mariana crows on Guam, threatened Mariana fruit bats, and endangered *Serianthes nelsoni* trees in the wild, and supports a diversity of other native wildlife and plant species.
- ***Navy Overlay Unit:*** The Navy Unit includes approximately 12,237 ac. (4,952.1 ha) of native habitats in north, central, and south Guam on six land tracts. High-quality habitats on the Navy Unit include limestone forest, backstrand, coastal strand, and beaches in northern and central Guam and ravine forests, limestone forests, mangroves, and wetlands in southern and central Guam. These areas provide habitat for a diversity of tropical plants and wildlife, including threatened Mariana fruit bats, endangered Mariana swiftlets, endangered Mariana moorhen, threatened green turtles, and a rich diversity of other plants, skinks, lizards, land snails, and land crabs. Several freshwater rivers and springs are located on Navy lands and support aquatic fauna.

3.10.2.2.2 Rota

Amar et al. (2008) assessed the trends in abundance of eight terrestrial bird species (Mariana crow, Micronesian honeyeater, Mariana fruit-dove, rufous fantail, Philippine turtle-dove, collared kingfisher, black drongo, and Micronesian starling) on Rota between 1982 and 2004. Only the Micronesian starling increased in abundance. While the introduction of brown treesnakes on Guam has caused the collapse of Guam's native bird populations, brown treesnakes are not the cause of declines in Rota's bird populations (Amar et al. 2008). A nonessential experimental population of Guam rails was established on Rota. Suggested reasons for the decline of the Mariana crow and Rota bridled white-eye on Rota include the impact of introduced predators other than the brown treesnake or habitat loss and degradation of the native tropical forest (Craig and Taisacan 1994, Plentovich et al. 2005). For the Mariana crow, human persecution is also suspected, due to conflicts over land development and habitat protection (Plentovich et al. 2005).

Like Guam, several mammalian species have been intentionally or accidentally introduced to Rota. Feral ungulates (deer and pigs) negatively impact the natural regeneration of native forest in the Sabana region (U.S. Fish and Wildlife Service 2006c). Other mammals such as introduced rats and feral cats are present on Rota.

As stated previously, training activities on Rota described in this EIS/OEIS are limited to Rota International Airport and other areas in conjunction with the CNMI and local Rota government (see Figure 3.10-2). These locations are in previously developed areas.

3.10.2.2.3 Tinian Military Lease Area

Indigenous wildlife species on Tinian reported in the most recent Integrated Natural Resources Management Plan (U.S. Department of the Navy 2013a) include 46 bird species, the majority of which are classified as migratory birds under the MBTA; one bat species (Mariana fruit bat); seven reptile species (two sea turtles, three geckos, and two skinks); and two land crustaceans (coconut crab and land hermit crab). The Mariana common moorhen is reported from the area as well (Amidon 2009). Special-status species are addressed separately below.

3.10.2.2.3.1 Birds

A total of 18 land bird species were detected during one or more of the three surveys conducted between 1982 and 2008 on Tinian (Amidon 2009; Kessler and Amidon 2009, Camp et al. 2012). The most abundant native species were the bridled white-eye, rufous fantail, collared kingfisher, island-collared dove, white-throated ground dove, Mariana fruit dove, white tern, Tinian monarch (see additional discussion below), Micronesian honeyeater, Micronesian starling, and yellow bittern. Monthly monitoring by the Navy and periodic monitoring by CNMI Department of Fish and Wildlife were also conducted and support these observations. Of these species, the bridled white-eye and rufous fantail were the most abundant. The abundance of collared kingfisher, white-throated ground dove, rufous fantail, Micronesian starling, and yellow bittern increased since 1982 while the abundance of Tinian monarch, Mariana fruit dove, and Micronesian honeyeater decreased since 1982 (Camp et al. 2012). Feral chickens are also abundant throughout Navy-leased lands on Tinian (U.S. Department of the Navy 2013a).

The Tinian monarch is an endemic land bird species that nests in limestone, secondary, and tangantangan forest habitats. It was federally delisted in 2004. The status of the Tinian monarch was monitored by the USFWS for a period of 5 years, ending in 2009 (Amidon 2009).

3.10.2.2.3.2 Mammals

Introduced mammals on Tinian include cattle, rats, mice, shrews, cats, and dogs. Wiewel et al. (2009) found the Malaysian black rat to be the most abundant species of rat on Tinian. Densities of the Asian house shrew (*Suncus murinus*) are high in native and tangantangan forest; house mice (*Mus musculus*) are also present (Wiewel et al. 2009). All three species are known to severely impact biodiversity of Pacific islands. Rodents and shrews are predators of native birds, lizards, insects, and snails. Rats' omnivorous diet also includes native plants, seeds, and fruit. Changes in forest composition are associated with high rodent density. Aguiguan, an island approximately 5 mi. (8 kilometers [km]) off of Tinian, supports Pacific sheath-tailed bats. Similar habitats occur on Tinian; however, the Pacific sheath-tailed bat is assumed to be extirpated from Tinian because of a lack of sightings. The Pacific sheath-tailed bat is considered a candidate for ESA listing.

Philippine deer were introduced from Saipan and Rota to Tinian in the 1960s, and were subsequently extirpated through intensive hunting activities through the early 1980s (Wiles 1990). Approximately 500 feral goats inhabited the southeastern coast in the early 1900s before the population was either killed or captured for sale on Saipan (Wiles 1990). Apart from some domesticated goats on farms, it is unclear whether a feral herd still exists on the island (U.S. Department of the Navy 2013a).

3.10.2.2.3.3 Reptiles and Amphibians

Several native reptile species were identified on a recent survey, including the snake-eyed skink, found adjacent to Unai Chulu and in a monitoring plot just northeast of North Field (U.S. Fish and Wildlife Service 2009d). The tide-pool skink was reported as common in the *Pemphis acidula* vegetation zone north of Unai Chulu and thought likely to be present in similar habitat at other locations (U.S. Fish and Wildlife Service 2009d). In 2008 surveys, the blind snake was found in both mixed and limestone forest, but elsewhere in the Mariana Islands, this species has been reported in tangantangan thickets (U.S. Fish and Wildlife Service 2009d).

3.10.2.2.3.4 Invertebrates

Tinian's terrestrial native invertebrate fauna include two crustaceans and one land snail. The coconut crab is a highly valued game species in the CNMI and serves important ecological functions such as dispersing seeds and as scavengers. Hermit crabs are more associated with coastal environments, but some may be found inland. Like coconut crabs, hermit crabs are important scavengers. Tree snails (Partulid snails) are found on Tinian, although populations are likely impacted by Mankowar flatworm predation (U.S. Department of the Navy 2013a). The Langford tree snail and humped tree snail are considered candidates for ESA listing.

3.10.2.2.4 Farallon de Medinilla

3.10.2.2.4.1 Birds

FDM is recognized by regional ornithologists as an important bird area for many species of seabirds and migrant shorebirds (Lusk et al. 2000; U.S. Department of the Navy 2013a; U.S. Fish and Wildlife Service 1990, 1998, 2008a). These seabird and shorebird species are discussed in Section 3.6 (Marine Birds).

The island collared dove and Eurasian tree sparrow are the only introduced bird species recorded from FDM (Lusk et al. 2000; U.S. Department of the Navy 2013a). Sparrows are believed to have colonized FDM from Saipan (Lusk et al. 2000). Four sparrows were observed in 1996 (Lusk et al. 2000), but none were recorded in August 2008 (U.S. Department of the Navy 2008a, c). The ESA-listed Micronesian megapode, which breeds on FDM, is discussed in more detail in Section 3.10.2.3.8 (Micronesian Megapode/Sasangat (*Megapodius laperouse laperouse*).

3.10.2.2.4.2 Mammals

Incidental observations of fruit bats during recent bird surveys, along with fishermen reports from the early 1970s, suggest a small number of fruit bats use FDM, possibly as a stopover location while transiting between islands. Fruit bats are discussed in more detail below. The only other mammalian species known to occur on the island are introduced small-sized rats, believed to be *Rattus exulans.* A common observation during recent natural resource surveys (U.S. Department of the Navy 2008a, c), it is believed that rats negatively impact breeding activities for seabirds and shorebirds on the island (U.S. Department of the Navy 2013a).

3.10.2.2.4.3 Reptiles and Amphibians

Only two species of reptiles are reported on FDM—the Pacific blue-tailed skink (*Emoia caeruleocauda*) and the oceanic snake-eyed skink (*Cryptoblepharus poecilopleurus*) (U.S. Department of the Navy 2008a). No observations of brown treesnakes have been reported on the island.

3.10.2.2.4.4 Invertebrates

Inventories for invertebrate species have not been conducted on this island; accounts of invertebrates have been provided as incidental observations during other natural resource survey efforts. For instance, coconut crabs, including one female with eggs, were observed on FDM in August 2008 (U.S. Department of the Navy 2013a).

3.10.2.3 Endangered Species Act Listed Species

3.10.2.3.1 *Serianthes nelsonii* (Hayun Lagu or Tronkon Guafi)

3.10.2.3.1.1 Status and Management

The *Serianthes* tree is one of the largest native trees in the Mariana Islands. Tree heights may reach 118 ft. (36.0 m), with a trunk diameter (measured at breast-height) reaching 6.6 ft. (2.0 m). Mature individuals frequently have large spreading crowns, with several of the largest trees on Rota having crown diameters of 69 to 75 ft. (21 to 23 m). The *Serianthes* tree was listed as endangered under authority of ESA on 18 February 1987 (52 C.F.R. 4907–4910), and is listed as endangered by both Guam and CNMI (Guam Public Law 15–36, Commonwealth of the Northern Mariana Islands Public Law 2-51). Critical Habitat is not designated for this species.

A number of factors are involved in the decline of this species; however, these causes are poorly studied. Based on initial investigations and field observations, the primary threat on both Rota and Guam is a lack of regeneration probably caused by the browsing of seedlings by deer and by predation on seeds by insects. Other threats include browsing by feral pigs and cattle, typhoon damage, habitat loss, inbreeding, wild fires, and insect infestations (U.S. Department of the Navy 2013a).

3.10.2.3.1.2 Population and Abundance

According to the most current estimate from the CNMI, there are believed to be less than 40 mature trees left; however, only one mature tree is believed to be present on Guam, located near Ritidian Point on the upper plateau (located on Andersen AFB). In 1992, super typhoon Omar killed one mature tree on Guam (also on Andersen AFB), but five wild seedlings were observed near the felled native adult. Protective fencing was erected around the seedlings in an effort to protect them from feral ungulates, but by 1994 only one seedling had survived (U.S. Fish and Wildlife Service 1994). In 2002, super typhoon Pongsona partially uprooted this young tree. This tree suffered regular heavy herbivory from butterfly larvae (an unidentified yellow butterfly with green larvae). As of 2011, this tree was not alive (U.S. Department of the Navy 2013a).

In the 1990s, the University of Guam planted 50 seedlings within Area 50 on Andersen AFB; none are known to have survived. In 1999, 20 *Serianthes* tree seedlings from Rota were planted as a joint effort by USFWS, University of Guam, and Andersen AFB in limestone forest along a utility access road in Tarague Basin. Each seedling was protected from ungulate browsing with a wire enclosure. As of 2010, four of the original 20 seedlings survive, surrounded by a wire exclosure fence. As of 2014, two surviving trees are located in the Terague area, and one mature tree is located on the upper plateau at Ritidian.

3.10.2.3.1.3 Biology, Ecology, and Behavior

New leaves are produced continually throughout the year, but production is sensitive to the dry season (January to June), a time when most branches are dormant. Mature seed pods on Rota were reported during all seasons, and seed crops can be large, with 500 to 1,000 pods (U.S. Fish and Wildlife Service 1994). The age and size necessary for reproduction is unknown, but flowers and pods were seen on a tree known to be 10 years old with a diameter of 7.5 inches (in.) (19 centimeters [cm]). On Rota, Mariana fruit bats were observed to feed on *Serianthes* flowers, which may be a method of pollination; however, the most important pollinators are likely birds (U.S. Fish and Wildlife Service 1994).

3.10.2.3.1.4 Status within the Mariana Islands Training and Testing Study Area

As discussed above, the last mature *Serianthes* tree on Guam is located at on the upper plateau above Ritidian Point on Andersen AFB, and as of 2014, another two immature trees are located in Tarague Basin (also on Andersen AFB) (U.S. Department of the Navy 2013a). On Rota, the trees are located in mature limestone forests along cliffline forests of the Sabana region and As Matmos cliffs. No training activities occur in these areas.

3.10.2.3.2 *Nesogenes rotensis* (No Known Common or Local Name)

3.10.2.3.2.1 Status and Management

Nesogenes rotensis is a low-growing herbaceous (non-woody) plant with small, opposite, broadly lance-shaped, coarsely toothed leaves, restricted to Rota. *Nesogenes rotensis* was listed as endangered on April 8, 2004 (FR 04-7934). No critical habitat is designated for this species.

3.10.2.3.2.2 Population and Abundance

One population of fewer than 100 plants was reported in 1982 at the Poña Point Fishing Cliff public park land, owned by and under the jurisdiction of the CNMI Division of Forestry and Wildlife (U.S. Fish and Wildlife Service 2006c). In 1994, Raulerson and Rinehart (1997) recorded a population of about 20 plants, occupying 240 square yards ($yd.^2$) (200 square meters [m^2]) of habitat at the Poña Point Fishing Cliff. Biannual surveys for this species have been conducted since 2001 at Poña Point Fishing Cliff. A direct count was made on June 27, 2000. At that time there were 80 individuals within an approximate area of 960 $yd.^2$ (800 m^2). In May and November 2001, direct counts made by staff from the CNMI Division of Forestry and Wildlife identified 458 and 579 adult plants, respectively. No individuals plants were observed in May or November of 2003 following super typhoon Pongsona, but subsequent surveys in 2005 found 20 individual plants (U.S. Fish and Wildlife Service 2006c).

3.10.2.3.2.3 Biology, Ecology, and Behavior

Little is known of the life history or ecology of *Nesogenes rotensis*. Based on information from collections and observations, *Nesogenes rotensis* flowers in March, April, May, and November (Raulerson and Rinehart 1997). It was observed in fruit in January, March, and November (Raulerson and Rinehart 1997). All available information and recent observations suggest that these plants are perennials, but their above-ground parts die back annually (U.S. Fish and Wildlife Service 2006c).

3.10.2.3.2.4 Status within the Mariana Islands Training and Testing Study Area

The current distribution of this plant is restricted to Poña Point Fishing Cliff and As Matmos Cliffs. The Navy does not train these areas. Threats to *Nesogenes rotensis* include typhoons; ungulate impacts associated with herbivory, trampling, rooting; disease; decreased genetic variability; and pests.

3.10.2.3.3 *Osmoxylon mariannense* (No Known Common or Local Name)

3.10.2.3.3.1 Status and Management

Osmoxylon mariannense is a spindly, soft-wooded tree in the ginseng family, which can reach 33 ft. (10 m) in height. *Osmoxylon mariannense* was listed as endangered on 8 April 2004 (FR 04-7934). No critical habitat is designated for this species.

3.10.2.3.3.2 Population and Abundance

This species is endemic to Rota. Currently, the number of individuals remaining in the wild is unknown. (U.S. Fish and Wildlife Service 2012b). Individuals found in the wild have been reported along unimproved roads crossing the top of the Sabana Plateau (U.S. Fish and Wildlife Service 2006c). This distribution is possibly an artifact of limited access for surveys, as large areas of the Sabana away from the roads are difficult or dangerous to survey due to natural topography and large, often hidden holes left from abandoned mining activities.

3.10.2.3.3.3 Biology, Ecology, and Behavior

Little is known of the life history or ecology of *Osmoxylon mariannense*. It occurs as an understory species in mixed ocshal forests (limestone forests with *Hernandia labyrinthica* and *Pisonia umbellifera* dominating), and is often hard to see until some trunks are tall enough to mingle with the trunks of the other two species (Raulerson and Rinehart 1997). There are conflicting reports about the habitat requirements of *Osmoxylon mariannense.* The seeds of *Osmoxylon mariannense* are difficult to germinate, which may be due to production of "false seeds" (structures that appear to be seeds) or low viability rates (U.S. Fish and Wildlife Service 2006c).

3.10.2.3.3.4 Status within the Mariana Islands Training and Testing Study Area

Threats to *Osmoxylon mariannense* include habitat degradation due to ungulate herbivory, decreased genetic diversity, disease, and pests. No training activity on Rota overlaps with the Sabana.

3.10.2.3.4 Mariana Swiftlet/Yayaguak (*Aerodramus bartschi*)

3.10.2.3.4.1 Status and Management

The Mariana swiftlet was listed as endangered on 27 August 1984 (49 FR 33881–33885). No Critical Habitat for this species is designated.

3.10.2.3.4.2 Population and Abundance

The Mariana swiftlet occurs on Guam (in three known caves within the Naval Base Guam Munitions Site), Aguiguan Island, and Saipan, and the swiftlet is considered extirpated from Tinian and Rota (Cruz et al. 2008). The swiftlet was once thought to be very abundant on Guam. Rota was once thought to support large populations of swiftlets, as evidenced by prehistoric guano and bone deposits, persistent unused nests, and ethnographic reports (Steadman 1999).

3.10.2.3.4.3 Biology, Ecology, and Behavior

The Mariana swiftlet nests and roosts in limestone caves with entrances typically as high as at least 6.2 ft. (1.9 m). In suitable caves, nesting occurs in the dark areas (troglic zone), which is facilitated by the swiftlet's ability to echolocate. By nesting in total darkness, the birds escape harassment from visually oriented predators. As a further protection, this swiftlet often selects nest sites on the highest parts of the cave, often choosing clefts in the cave roof, overhanging walls, or stalactites. These caves are occupied throughout the year (U.S. Fish and Wildlife Service 1991).

Nests are cup shaped, constructed of moss or other plant material, and adhered together with saliva. The nesting season lasts between January and July, although it may be year round (Jenkins 1983). A clutch typically consists of only one egg. Incubation period lasts at least 12 days, followed by a long period for fledging to occur, perhaps up to 35 days. Foraging habitat is found in a wide range of areas, but ridge crests and open grassy savanna areas where they capture small insects while flying are favored (U.S. Fish and Wildlife Service 1991). Recent studies involving guano analyses on Aguiguan Island (Valdez et al. 2011) and Saipan and Rota (Kershner et al. 2007) suggest that preferred prey species are members of Hymenoptera, a large order of insects comprising of sawflies, wasps, bees, and flying ants. Flying ants were the dominant prey species identified in guano deposits in swiftlet caves on Aguiguan Island, but the prey species may vary depending on surrounding habitats and seasonal availability of different insect species (Valdez et al. 2011).

3.10.2.3.4.4 Status within the Mariana Islands Training and Testing Study Area

The Mariana swiftlet is known to nest in only three caves on Guam within the Naval Base Guam Munitions Site (Mahlac, Maemong, and Fachi caves), as shown in Figure 3.10-5. The Navy, USFWS, and Guam Division of Aquatic and Wildlife Resources have been monitoring the populations at these caves for 23 years (U.S. Department of the Navy 2013a). The Mariana swiftlet has maintained a small population of about 400–500 birds through the 1980s and 1990s, and overall increases are continuing through the present. Although small fluctuations in the population have been documented during this period, there was no significant growth. Brown treesnake traps were initially deployed outside Mahlac Cave in 2000. Declines of swiftlet numbers were noted after major typhoon events, the last major typhoon to hit Guam and the CNMI was Typhoon Pongsona in 2002 (U.S. Department of the Navy 2013a). The population of Mariana swiftlets appears to be increasing, as shown in Figure 3.10-6. The population in 2012 was estimated to be between 1,100 and 1,500 birds. Foraging likely occurs throughout Naval Base Guam Munitions Site, and may include other surrounding locations. Swiftlet populations on Saipan are also increasing, and brown treesnakes are not believed to be present in those caves. The general locations of the known swiftlet caves on Saipan are shown in Figure 3.10-7. The Saipan Mapri Maneuver Area does not contain nesting caves, but the area may be used for foraging (Mosher 2014).

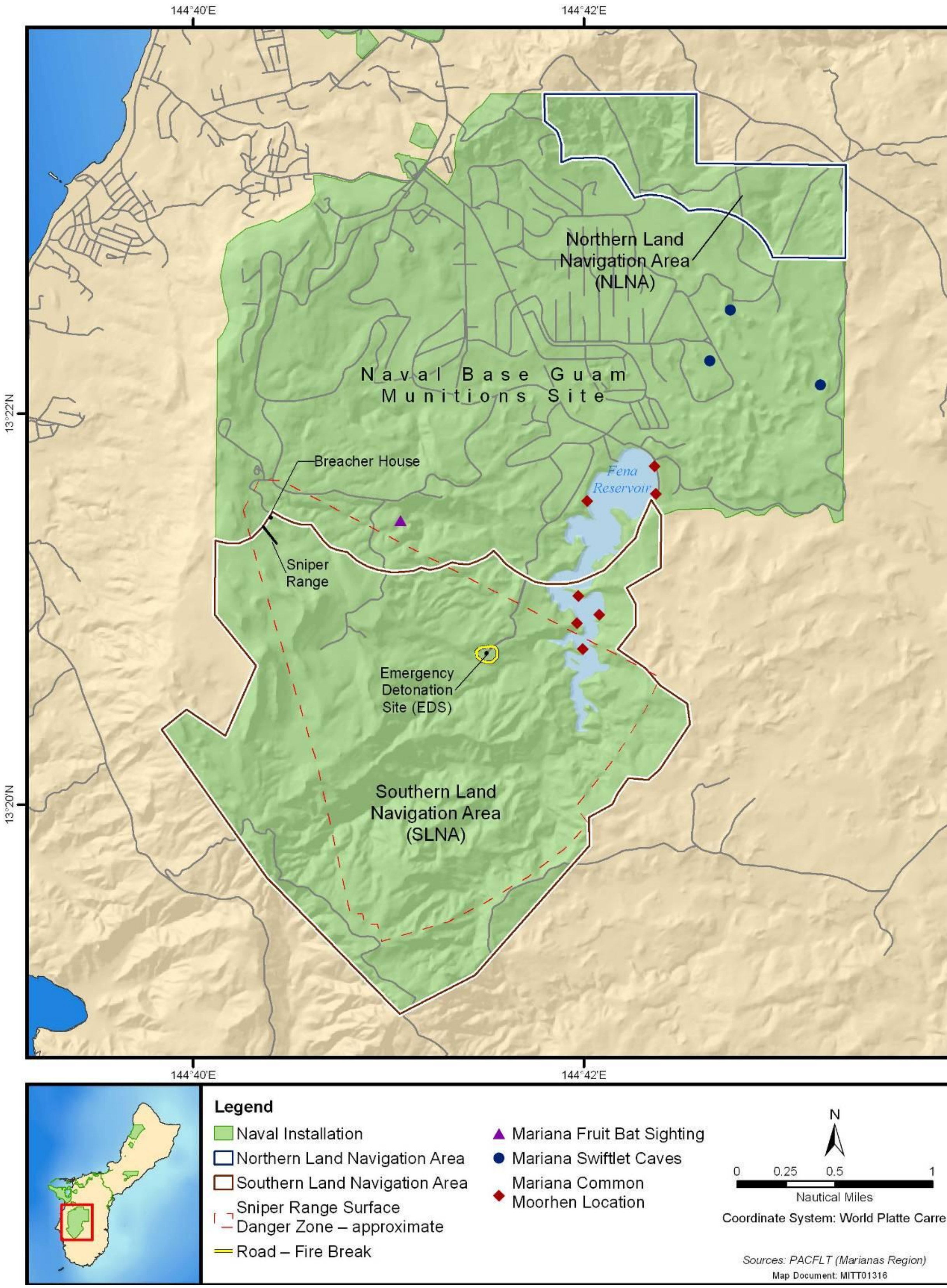
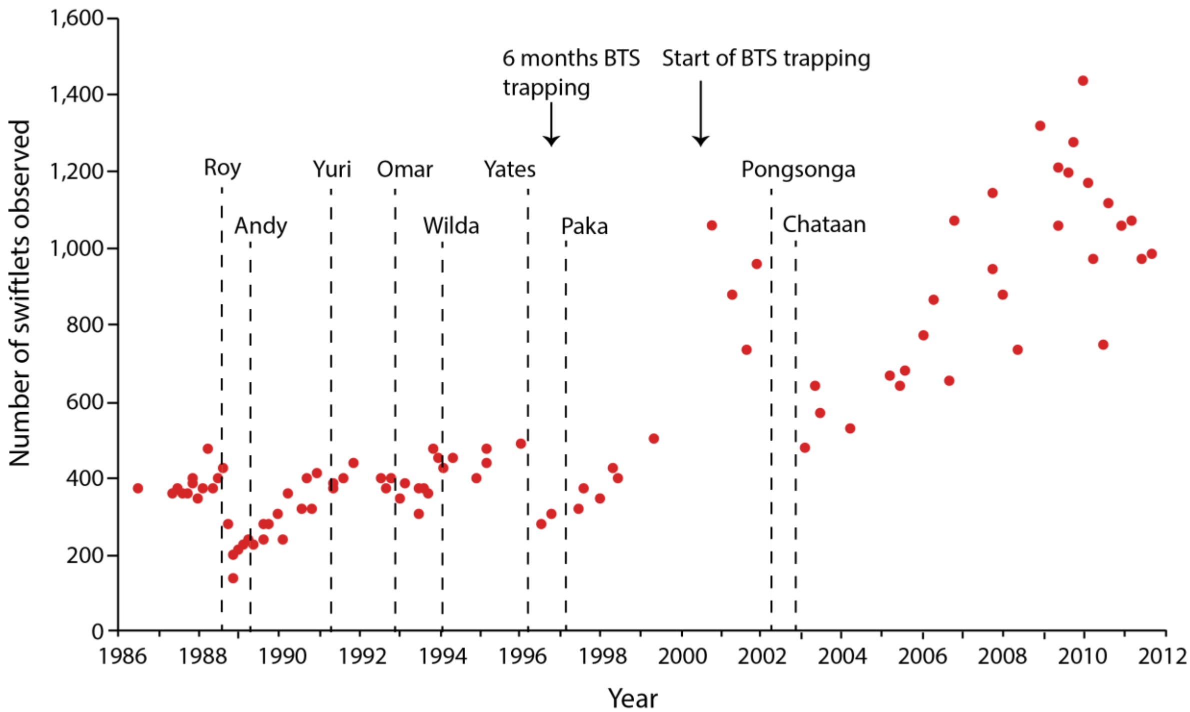


Figure 3.10-5: Naval Base Guam Munitions Site and Mariana Swiftlet Cave Locations



Notes: 1. Typhoons are shown on the graph where wind speeds were measured on Guam to be greater than 100 mph. 2. Typhoon occurrences and swiftlet data are indexed to Fiscal Years, beginning in October.

Figure 3.10-6: Mariana Swiftlet Population Data from Mahlac Cave, Naval Munitions Site, 1986–2012

3.10.2.3.5 Mariana Crow/Aga (*Corvus kubaryi*)

3.10.2.3.5.1 Status and Management

The Mariana crow was listed as endangered on 27 August 1984 (49 FR 33881-33885). On 28 October 2004, approximately 376 ac. (152.2 ha) were designated as Critical Habitat for the Mariana crow on Guam, and 6,033 ac. (2,441.5 ha) were designated on Rota (69 FR 629446). All Critical Habitat for the species on Guam is found on the fee simple portion of the Guam National Wildlife Refuge.

On Guam, its decline is due to predation by the introduced brown treesnake. On Rota, declines are associated with homestead development, resort and golf-course construction, and agricultural settlement. Additional threats include poaching, nest predation, disturbance by introduced species and feral cats, and disease (U.S. Department of the Navy 2013a).

3.10.2.3.5.2 Population and Abundance

The distribution of Mariana crows among habitats is similar on Guam and Rota. Mariana crows are known to use secondary, coastal, ravine, and agricultural forests, including coconut plantations (Jenkins 1983), but all evidence indicates they are most abundant in native limestone forests (Michael 1987; Morton 1996).

On Rota, breeding crows on six study areas averaged one pair per 50 ac. (20 ha) of forested habitat, and each territory was dominated by native forest (U.S. Fish and Wildlife Service 2006b, 2009a). Pair densities ranged from one per 91 ac. (37 ha) in relatively fragmented forest, to as high as one pair per 30 ac. (12 ha) in mostly intact limestone forest along a coastal terrace. Territories were aggressively defended from July through January, although established pairs occupied these areas throughout the year.

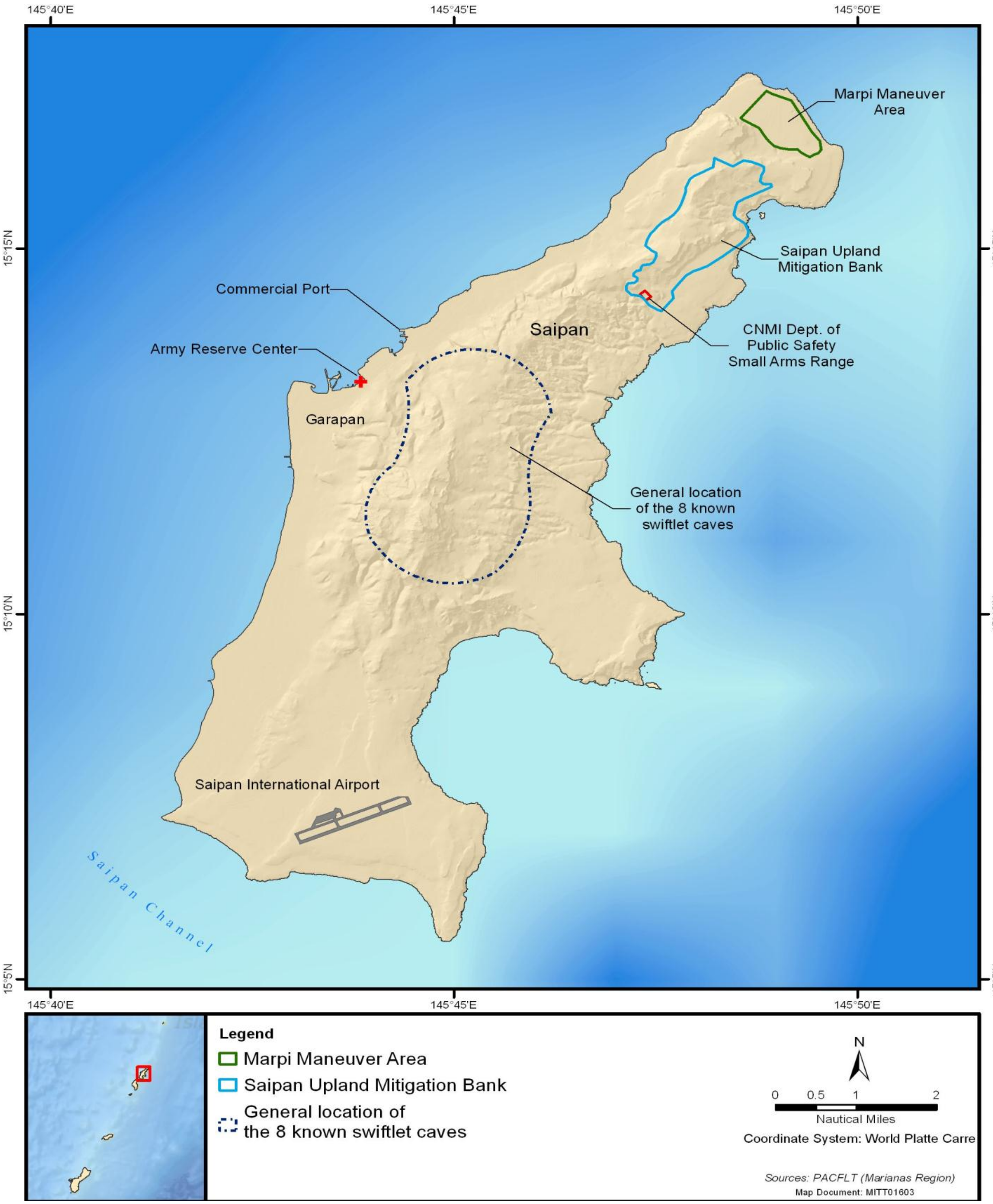


Figure 3.10-7: General Location of Mariana Swiftlet Caves on Saipan

3.10.2.3.5.3 Biology, Ecology, and Behavior

Mariana crows are omnivorous and forage at all heights in the forest and on the ground. They are observed feeding on a variety of native and non-native invertebrates, reptiles, young rats, and birds' eggs, as well as on the foliage, buds, fruits, and seeds of at least 26 plant species (Jenkins 1983; Michael 1987; Tomback 1986). Preferred nesting trees differ on Guam and Rota. Mariana crow nests on Guam were found in 11 tree genera, all but one of which are native. Most nests are located high in emergent nunu or yoga trees (Morton 1996). On Rota, crows primarily use both mature and secondary limestone forests. Of 156 nest sites on Rota, 39 percent and 42 percent were in mature and secondary limestone forest, respectively. Individual nest trees averaged 6.7 in. (17.0 cm) diameter at breast height and 28.5 ft. (8.69 m) high. Canopy cover over nest sites averaged 93 percent and was never less than 79 percent. Nests were located at least 950 ft. (290 m) from the nearest road and 203 ft. (61.9 m) from the nearest forest edge, in areas with forest canopy cover that averaged 93 percent. The distances from edges strongly suggest that nesting crows are sensitive to disturbance by humans.

3.10.2.3.5.4 Status within the Mariana Islands Training and Testing Study Area

As of February 2009, two Mariana crows remained at Andersen AFB Munitions Storage Area, both male (U.S. Department of the Navy 2013a). As of July 2011, a single male Mariana crow remained on Andersen AFB. This last remaining crow was last seen in August 2011. Continuing surveys have not located the crow again, and natural resource specialists on Guam believe the Mariana crow has been extirpated from Guam (SWCA Environmental Consultants 2012). Mariana crows on Rota are located in mature limestone forest areas, secondary forests, and strand forests. These areas are not used for training; however, potential training locations may be located near nesting and foraging areas for Mariana crows.

3.10.2.3.6 Mariana Common Moorhen/Pulattat (*Gallinula chloropus guami*)

3.10.2.3.6.1 Status and Management

The Mariana common moorhen was listed as endangered in 1984 (49 FR 33881-33885). No Critical Habitat is designated for this species.

The main threat to this species is loss and degradation of wetland habitat, including filling, alteration of hydrology, invasion of habitat by nonnative plants, and unrestricted grazing. The second-greatest threat is predation by introduced species. Other natural or manmade factors that threaten the species are environmental contaminants and fires (U.S. Department of the Navy 2013a).

3.10.2.3.6.2 Population and Abundance

The Mariana common moorhen was historically restricted to wetland areas of Guam, Saipan, Tinian, and Pagan, the only islands within the Marianas supporting sufficient wetlands capable of supporting the Mariana common moorhen. Major wetland areas of Guam apparently supported substantial populations, particularly marshes, taro patches, and rice fields. The greatest historical concentrations on Guam appeared to be in Agana Swamp, along the Ylig River in southern Guam. Other large populations in the CNMI were associated with Hagoi on Tinian and Lake Susupe on Saipan (Takano and Haig 2004). The Pagan population is believed to be extirpated due to ash and cinder fallout from a 1981 eruption of Mount Pagan, as well as ungulate impacts to wetland vegetation. Paleobiological evidence suggests that moorhens occurred in prehistoric times on Rota approximately 1,500 to 2,000 years ago. The prehistoric extirpation of this species from Rota has been attributed to draining of wetlands, natural degradation of wetlands over time due to sea level changes (Stinson et al. 1991), and hunting and predation by introduced predators (Stinson et al. 1991).

3.10.2.3.6.3 Biology, Ecology, and Behavior

Breeding is assumed to occur year-round for the Mariana common moorhen, as nests were located in all months except for October (Takano and Haig 2004). Similar subspecies in Hawaii build nests by folding over emergent vegetation into a platform nest. Apparently, vegetation structure is more important than species composition for nest construction and nest location, and nesting is apparently associated with water depth and availability of screening vegetation (Jenkins 1983; U.S. Fish and Wildlife Service 1990).

Clutch sizes of four to eight eggs for the Mariana common moorhen are recorded, although clutch sizes of similar subspecies were observed as high as 13 eggs. Incubation lasts approximately 22 days, and chicks hatch precocial and swim away from the nest shortly after hatching, but remain dependent on the parent birds for several weeks.

3.10.2.3.6.4 Status within the Mariana Islands Training and Testing Study Area

A survey of Mariana common moorhens on Guam was conducted in 2001 (Takano and Haig 2004). Three wetlands in Naval Base Guam Munitions Site were surveyed, including Fena Reservoir, Fena Dam spillway, and the Naval Magazine Pond. Surveys were conducted during the dry season when Mariana common moorhens were expected to be more concentrated on perennial wetlands and therefore easier to count. Of the 90 birds estimated to be on Guam during the survey, 38 birds were located on wetlands in the Naval Base Guam Munitions Site, 33 of which were using Fena Reservoir. Since 2001, eutrophication of Fena Reservoir following a typhoon resulted in the loss of *Hydrilla verticillata*, a non-native water plant used by moorhens as a nesting substrate. The Mariana common moorhen population at the reservoir subsequently declined dramatically (U.S. Fish and Wildlife Service 2010a).

Wetland habitat suitable for the Mariana common moorhen exists on Naval Base Guam Main Base. Moorhens are known to occupy these wetlands at least during the wet season and possibly also in the dry season if open water habitat remains present. Two Mariana common moorhens were observed at the San Luis Ponds during a recent survey in 2010 and 2011. Moorhens are not known to nest at any of the wetlands on Naval Base Guam. The Camp Covington wetland on Naval Base Guam was identified as a habitat requiring species-specific surveys to determine whether the Mariana common moorhen is present. Eleven listening survey stations were placed within the Camp Covington wetland during a 2009 endangered species survey. Moorhens were observed nesting in the Camp Covington wetland area in 2012 (U.S. Department of the Navy 2013a).

Since the construction of an 18-hole golf resort on the north coast of Rota in the early 1990s, moorhens have colonized polishing ponds associated with waste water treatment infrastructure for the resort. The polishing ponds contain suitable nesting habitat. Successful nesting was confirmed in 1996 (Worthington 1998). These areas are not used for military training activities.

On Tinian, monitoring surveys began at Hagoi in 1998 and are performed (generally) on a monthly basis at the end of each month. As index surveys, the surveys document population trends over time, but do not estimate the actual number of animals in the population. Yearly averages of the monthly monitoring program show that 2003, 2007, and 2011 were peak years for Mariana common moorhen numbers at Hagoi (16.9, 17.1, and 15.7, respectively), and troughs during 1999 and 2005 (10.1 and 9.9, respectively). The number of birds observed appears to correlate to periodic dry conditions at the Hagoi wetland (Hagoi was completely dry in April 2005 and in 2010); however, it is unknown if the apparent fluctuation in Mariana common moorhen numbers observed at Hagoi reflect true population changes, emigration or immigration, or observer bias (U.S. Department of the Navy 2008d, 2013a). Mahlang and Bateha are the other two wetlands within the Tinian MLA. As with Hagoi, the Navy does not conduct any training activities in wetland areas. Nest locations for moorhens on Tinian for 2011 and 2012 survey seasons are shown in Figure 3.10-8.

3.10.2.3.7 Guam Micronesian Kingfisher/Sihek (*Todiramphus cinnamomina cinnamomina*)

3.10.2.3.7.1 Status and Management

The Guam Micronesian kingfisher was listed as endangered on 27 August 1984 (49 FR 33881-33885). On 28 October 2004, approximately 376 ac. (152 ha) on Guam were designated as Critical Habitat for the Guam Micronesian kingfisher (69 FR 629446). All Critical Habitat for this subspecies is found on the fee simple portion of the Guam National Wildlife Refuge.

3.10.2.3.7.2 Population and Abundance

This subspecies of the Guam Micronesian kingfisher (*Todiramphus cinnamomina cinnamomina*) is endemic to Guam. The other two subspecies occur on the islands of Pohnpei (*Todiramphus cinnamomina reichenbachii*) and Palau (*Todiramphus cinnamomina pelwensis*). The Guam Micronesian kingfisher was considered “fairly common” and occurred throughout forested areas on Guam shortly after World War II (Jenkins 1983). Populations in southern and central Guam disappeared by the 1980s (Jenkins 1983) and only 3,023 individuals were recorded in 1981 in northern Guam (U.S. Fish and Wildlife Service 2008b). This population subsequently declined rapidly, and by 1985 only 30 individuals were recorded on Guam (U.S. Fish and Wildlife Service 2008b). This subspecies was believed extirpated by 1988, primarily because of predation by the brown treesnake (Fritts and Leasman-Tanner 2001; U.S. Fish and Wildlife Service 2008b). Guam Micronesian kingfishers survive in captive programs that seek to breed kingfishers and maintain the population until habitats are suitable for reintroduction. GovGuam Division of Aquatic and Wildlife Resources, as well as various zoos in the United States, maintain kingfishers in captivity.

3.10.2.3.7.3 Biology, Ecology, and Behavior

The Guam Micronesian kingfisher feeds both on invertebrates and small vertebrates, including insects, segmented worms, hermit crabs, skinks, geckoes, and possibly other small vertebrates (Jenkins 1983). This species typically forages by perching motionless on exposed perches and swooping down to capture prey on the ground (Jenkins 1983). Guam Micronesian kingfishers also will capture prey from foliage and were observed gleaning insects from tree bark (U.S. Fish and Wildlife Service 2008b).

This subspecies nests in cavities, and breeding activity appears to be concentrated from December to July (Jenkins 1983). Nests are reported in a variety of trees, including nunu*, Cocos nucifera, Artocarpus* spp., umumu, and fai’a (Jenkins 1983; U.S. Fish and Wildlife Service 2008b). Pairs may excavate their own nests in soft trees, arboreal termite nests, arboreal fern root masses, or they may utilize available natural cavities such as broken tree limbs (U.S. Fish and Wildlife Service 2008b), and excavation of cavities may be important in pair-bond formation and maintenance (Jenkins 1983).

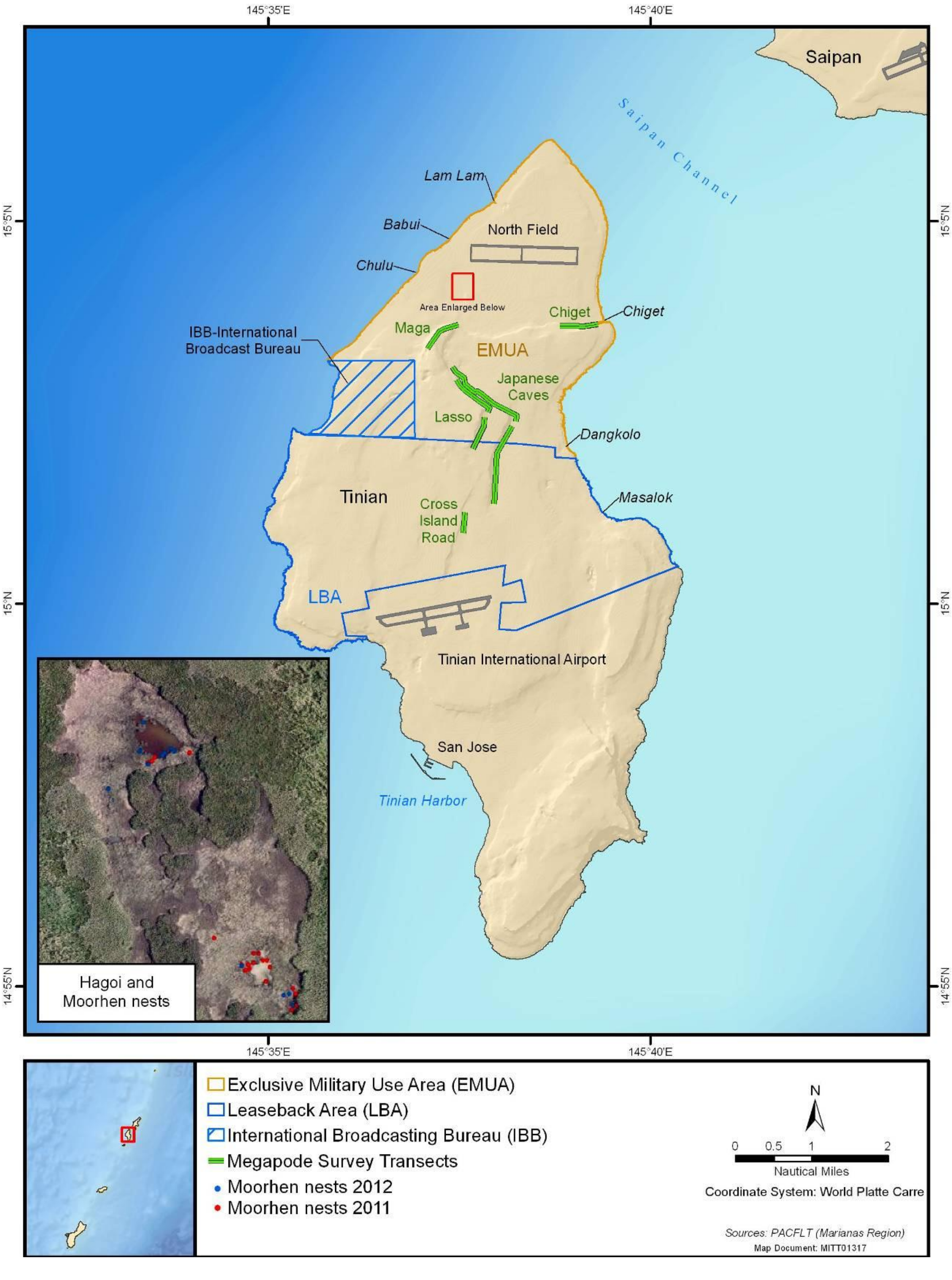


Figure 3.10-8: Tinian Military Lease Area and Mariana Common Moorhen Nest Locations

Both male and female Guam Micronesian kingfishers incubate eggs and brood and feed nestlings (Jenkins 1983). Clutch sizes from wild populations were either one or two eggs (Jenkins 1983) while clutch sizes of one to three eggs are reported in the captive populations (U.S. Fish and Wildlife Service 2008b). Incubation, nestling, and fledgling periods for populations of Guam Micronesian kingfishers in the wild are unknown. However, incubation and nesting periods of captive birds averaged 22 and 33 days, respectively (U.S. Fish and Wildlife Service 2008b).

Jenkins (1983) reported that the Guam Micronesian kingfisher nest and feed primarily in mature, secondary growth, and, to a lesser degree, in scrub limestone forest. It is also found in coastal strand vegetation containing coconut palm as well as riparian habitat. However, Jenkins (1983) reported that it was probably most common along the edges of mature limestone forest. Few data exist about specific kingfisher nest sites in the wild, but in one study in northern Guam 16 nest sites were correlated with closed canopy cover and dense understory vegetation. In this study, nest cavities were excavated in the soft, decaying wood of large, standing dead trees averaging 17 in. (43 cm) in diameter (U.S. Fish and Wildlife Service 2008b). Research on the Pohnpei Micronesian kingfisher indicates an area of approximately 20–25 ac. (8.1–10.1 ha) of mixed forest, and open area may be needed to support a pair of kingfishers. It should be noted that Micronesian kingfisher territories may differ from Pohnpei Micronesian kingfisher territories due to differences in forest structure on Guam and Pohnpei (Mueller-Dombois and Fosberg 1998).

3.10.2.3.7.4 Status within the Mariana Islands Training and Testing Study Area

The Guam Micronesian kingfisher is currently extirpated and is not found in the Study Area.

3.10.2.3.8 Micronesian Megapode/Sasangat (*Megapodius laperouse laperouse*)

3.10.2.3.8.1 Status and Management

The Micronesian megapode was first listed as endangered in 1970 (under the Endangered Species Conservation Act, 35 FR 8491-8498). No Critical Habitat is designated for this species. Threats to this species include habitat loss from typhoons and volcanic activity, damage by feral herbivores, historical hunting and illegal egg collection, increased tourism, and predation by introduced predators (U.S. Department of the Navy 2013a).

3.10.2.3.8.2 Population and Abundance

Small remnant populations are known to exist on the southern Mariana Islands of Aguiguan, Saipan, and FDM; larger populations are reported on uninhabited northern islands of Anatahan, Guguan, Sarigan, Alamagan, Pagan, Asuncion, Maug, and possibly Agrihan (U.S. Fish and Wildlife Service 1998, U.S. Department of the Navy 2013a). Megapodes observed on Tinian are believed to be transient and do not breed on Tinian (U.S. Department of the Navy 2013a, 2013b).

3.10.2.3.8.3 Biology, Ecology, and Behavior

Micronesian megapodes are generally dependent on native limestone forest, but may occasionally use native and non-native secondary forest adjacent to limestone forest. Micronesian megapode primarily select nest sites in sun-warmed cinder fields on volcanic islands and exposed limestone flats, but may nest in roots of rotting trees, logs, and in patches of rotting sword grass. The breeding season for Micronesian megapodes is reported on Saipan to begin in November and last through December, although the season may be year-round (U.S. Fish and Wildlife Service 1998). Megapodes are considered “incubator” birds because they rely on external energy sources, such as solar heat, volcanic activity, or heat produced from microbial decomposition of organic matter as heat sources for incubation. Multiple eggs are laid singly in a breeding season, each egg is laid after an interval of approximately 1 week.

Chicks emerge from nests super-precocial and able to function (and fly) independent of the parent birds (U.S. Fish and Wildlife Service 1998).

3.10.2.3.8.4 Status within the Mariana Islands Training and Testing Study Area

Surveys on FDM in 1996 documented the presence of the Micronesian megapode (Lusk et al. 2000; U.S. Fish and Wildlife Service 1998). From this survey, it was estimated that a population of 10 Micronesian megapodes were on FDM (Kessler and Amidon 2009; Lusk et al. 2000; U.S. Fish and Wildlife Service 1998). However, due to an incoming typhoon, biologists were only on the island for about 5.5 hours, so this estimate was based on limited data. FDM was surveyed more thoroughly in December 2007 by Navy biologists, which provided an estimate of 21 adult pairs (U.S. Department of the Navy 2008a, c). The northern part of FDM was surveyed for megapodes in April 2013 immediately following range clearance actions. Range safety restrictions precluded the same geographic coverage as the 2007 survey. Eleven birds were detected during this more limited survey (U.S. Department of the Navy, 2013b). Mitigation measures specified in previous consultations coupled with the restricted access preventing poaching activities, may have benefited megapodes on FDM. The mitigation measures included maintaining a no fire zone on the northern portion of the island and the use of inert ordnance in an area south of the no fire zone (explosive ordnance is deployed to the south of this area).

On Tinian, Micronesian megapodes have been previously reported but never in great numbers (O'Daniel and Kreuger 1999; U.S. Department of the Navy 2008a, d). Micronesian megapodes have been sighted on Tinian within forested portions of the Maga area to the northeast of the Voice of America Relay Station, a small section of native forest adjacent to Cross Island Road in the Bateha area and the Mount Lasso area south of the overlook on the ridgeline (O'Daniel and Kreuger 1999). Based on these sightings and other suitable habitat indicators, the Navy established monitoring transects in 1999, which were surveyed on a monthly basis through 2012 using point count stations (where trained observers listened for responses to recorded megapode vocalizations). These surveys are now conducted on an annual basis (U.S. Department of the Navy 2013a). One megapode was observed on Tinian during recent annual surveys in February 2013. Prior to this detection, one megapode was observed in February 2004 and two others in June 2005 by biologists transiting between point count stations (U.S. Department of the Navy 2013a).

On Saipan, Amidon et al. (2011) estimated a population between 130 and 174 Micronesian megapodes. Previous studies on Saipan provide lower island-wide population estimates, but these lower estimates are likely due to a less thorough survey effort relative to the 2010 surveys on Saipan (Amidon et al. 2011). Almost all of the detections on Saipan occurred in native limestone forest, including small remnant patches. Amidon et al. (2011) included a transect adjacent to the Saipan Marpi Maneuver Area, and verified the continued persistence of megapode populations below the Marpi cliffs (the Saipan Marpi Maneuver Area is north of and below the Marpi cliffs). Remnant patches of limestone forest occur within the Saipan Marpi Maneuver Area and may support Micronesian megapodes.

3.10.2.3.9 Guam Rail/Ko'ko' (*Rallus owstoni*)

3.10.2.3.9.1 Status and Management

The Guam rail was listed as endangered on 27 August 1984 (49 FR 33991-33885). No Critical Habitat for this species has been designated for the Guam rail. An experimental population has been established on Rota since reintroductions began in the late 1980s on the Sabana Plateau and in the I'Chinchon Bird Sanctuary. The USFWS has designated Guam rails released on Rota as a "nonessential experimental population," where the released rails on Rota are nonessential to the continued existence of the species. Members of a nonessential experimental population are treated as a species proposed for ESA listing. In other words, federal agencies are not required to consult with the USFWS pursuant to Section 7(a)(2) of the ESA for potential impacts to Guam rails on Rota, and are only required to confer with the USFWS if a proposed action is likely to jeopardize the continued existence of the Guam rail. A Safe Harbor Agreement was established in 2008 on Cocos Island to allow for management actions and reintroductions of Guam rails on Cocos Island.

3.10.2.3.9.2 Population and Abundance

The Guam rail is endemic to Guam. This species was once distributed throughout Guam but by 1981 a population of approximately 2,300 birds existed only in northern Guam (U.S. Fish and Wildlife Service 1990). In 1983, it was estimated that fewer than 100 individuals remained and it was considered extirpated by 1987 (Beauprez and Brock 1999). A captive breeding program began in 1983, which relocated individuals from the wild to breeding facilities on Guam (Guam Division of Aquatic and Wildlife Resources 2006). As of 2005, 173 individuals were found in captivity in zoological institutions on the U.S. mainland and Guam Division of Aquatic and Wildlife Resources captive propagation facilities (Guam Division of Aquatic and Wildlife Resources 2006; U.S. Fish and Wildlife Service 2006a). In addition, Guam Division of Aquatic and Wildlife Resources is releasing rails on Cocos Island (off southern Guam). Efforts to establish an experimental population on the island of Rota have been underway since 1989 (Beauprez and Brock 1999). The current population on Rota is estimated to be approximately 40 to 70 individuals (U.S. Department of the Navy 2013a; U.S. Fish and Wildlife Service 2006a). Releases of rails on Cocos Island and Rota were preceded by predator eradication and reduction programs (e.g., removal of rats and monitor lizards) at release sites (Brooke 2012).

3.10.2.3.9.3 Biology, Ecology, and Behavior

Guam rails are territorial ground nesters that breed year-round (Jenkins 1983); however, peak breeding may occur during the rainy season (July through November) (U.S. Fish and Wildlife Service 1990). Clutches typically consist of three to four eggs and broods range from one to four chicks. Guam rails are omnivorous but appear to prefer animal matter over vegetable foods. They are known to eat gastropods, skinks, geckos, insects, carrion, seeds, and palm leaves. This species is believed to prefer secondary vegetation, although it was found in all habitats except wetlands, and savanna and mature forest may be marginal habitats (Jenkins 1983).

3.10.2.3.9.4 Status within the Mariana Islands Training and Testing Study Area

There are no Guam rails currently located at Andersen AFB, or on any other DoD property.

3.10.2.3.9.5 Nightingale Reed-Warbler/Ga'ga' Karisu (*Acrocephalus luscinia*)

3.10.2.3.9.6 Status and Management

The nightingale reed-warbler was listed as endangered on 2 June 1970 (35 FR 8491-8498). The Saipan Upland Mitigation Bank was established in 2004 to provide perpetual conservation and management for endangered nightingale reed-warbler and other native species within the bank boundaries (Herod and William 2008). Further, the Saipan Upland Mitigation Bank is a mitigation option for eligible projects that will result in unavoidable impacts to the nightingale reed-warbler. Past and present threats to this species include loss and degradation of habitat (including wetland destruction and degradation due to feral ungulates); predation by introduced predators such as the brown treesnake, rats, and monitor lizard; and volcanic activity (U.S. Fish and Wildlife Service 2010b).

3.10.2.3.9.7 Biology, Ecology, and Behavior

The nightingale reed-warbler may be characterized as a secretive species that prefers screening provided by dense underbrush. Like many warbler species, the male is vocal and aggressive toward conspecific intruders. Mosher and Fancy (2002) observed two peak breeding periods from January through March (dry season) and from July through September (wet season), and active nests were found in all months except November and December.

Most birds found on Saipan occur in thicket-meadow mosaics, forest edge, reed-marshes, and forest openings, and are largely absent from mature native forest, beach strand, and swordgrass vegetation community types (Camp et al. 2009). Nightingale reed-warblers were observed to prey on insects by gleaning invertebrates from live and dead leaves (Craig 1992). Other food sources include snails and lizards (Marshall 1949).

3.10.2.3.9.8 Status within the Mariana Islands Training and Testing Study Area

Marpi Maneuver Area on Saipan contains suitable habitat for the nightingale reed-warbler. Craig (1992) surveyed the Marpi area and detected reed-warblers in areas, including the Marpi Maneuver Area.

3.10.2.3.10 Rota Bridled White-Eye/Nosa Luta (*Zosterops rotensis*)

3.10.2.3.10.1 Status and Management

The Rota bridled white-eye was listed as endangered on 22 January 2004 (69 FR 3022–3029). The Rota bridled white-eye has critical habitat designated on Rota (2,594 ac. [1,050 ha]). Current threats include habitat loss and degradation, predation by introduced rats and black drongos (*Dicrurus macrocercus*), and susceptibility of the single small population to random catastrophic events, such as typhoons. In addition, establishment of a new predator, such as the brown treesnake or avian diseases, such as West Nile virus, also threaten recovery of the species (U.S. Fish and Wildlife Service 2006b).

3.10.2.3.10.2 Biology, Ecology, and Behavior

Rota bridled white-eye primarily forage in the outer canopy of forests for insects, fruit, or nectar, and the majority of foraging observations were reported in yoga, nonak, pengua, and ahgao. Rota bridled white-eye nests are reported in fai'a, nonak, yoga, and *Acacia confusa* trees 10–49 ft. (3–15 m) tall and 1–24 in. (2.5–61 cm) in diameter (U.S. Fish and Wildlife Service 2006b).

Breeding was observed between December and August (U.S. Fish and Wildlife Service 2006b). Because this time period covers portions of both the wet season and dry season, the species may breed year round, similar to the Guam bridled white-eye (Marshall 1949; Jenkins 1983). Rota bridled white-eye nests are cup-like and typically suspended between branches and branchlets or leaf petioles (U.S. Fish and Wildlife Service 2006b).

3.10.2.3.10.3 Status within the Mariana Islands Training and Testing Study Area

The Rota bridled white-eye is endemic to Rota. Currently, the species is primarily restricted to mature forests above 490 ft. (150 m) in the Sabana region of Rota. There is no military training in these areas.

3.10.2.3.11 Mariana Fruit Bat/Fanihi (*Pteropus mariannus mariannus*)

3.10.2.3.11.1 Status and Management

The Guam population of the Mariana fruit bat was listed as endangered on 27 August 1984 (49 FR 33881-33885). However, in 2005, the subspecies was listed as threatened throughout the Mariana archipelago and downlisted to threatened on Guam (70 FR 1190-1210). On 28 October 2004, approximately 376 ac. (152 ha) were designated as Critical Habitat for the Mariana fruit bat on Guam (69 FR 629446). All Critical Habitat for the species is found on the fee simple portion of the Guam National Wildlife Refuge. Threats to this species include illegally hunting, predation by the brown treesnake, deforestation for development, and overgrazing by introduced species. Random events such as typhoons and volcanic eruptions are also a potential, direct threat to the species (U.S. Fish and Wildlife Service 2009c).

3.10.2.3.11.2 Biology, Ecology, and Behavior

During the day, the Mariana fruit bat roosts in colonies of a few to rarely up to 2,000 animals (Utzurrum et al. 2003); as well as in non-colonial roost sites. Bats are typically grouped into harems (one male and two to fifteen females) or bachelor groups (predominantly males); some single males reside at the colony's periphery (Morton and Wiles 2002). On Guam, the average estimated sex ratio in one colony varied from 37.5 to 72.7 males per 100 females. A smaller number of Mariana fruit bats roost solitarily away from the colony (Janeke 2006). Reproduction in Mariana fruit bats was observed year-round on Guam and on Rota; individual females have a single offspring each year (Pierson et al. 1996). Glass and Taisacan (1988) suggest that the peak birthing season may occur during May and June. Although specific data for the Mariana fruit bat are lacking, other species of bats within the family Pteropodidae have one offspring per year, generally are not sexually mature until at least 18 months of age, and have a gestation period of 4–6 months (Epstein et al. 2009). The average lifespan of this species is unknown; the average longevity of a similar species in Australia is 4–5 years, with a maximum of 8 years (Vardon and Tidemann 2000).

Colonial roost sites are an important aspect of the Mariana fruit bat biology because they are used for sleeping, grooming, breeding, and intra-specific interactions (Wiles et al. 1989). Published reports of roost sites on Guam indicate these sites occur in mature limestone forest and are found within 328 ft. (100 m) of 262–591 ft. (80–180 m) tall clifflines. Native forest habitat is also an important aspect of Mariana fruit bat biology as it is also used for roosting, feeding, etc., by non-colonial Mariana fruit bats. On Guam, Mariana fruit bats roost in mature nunu and chopak trees but will also roost in other tree species such as gago, pengua (*Macaranga thompsonii*), panao, and fagot. On other islands in the Mariana archipelago, Mariana fruit bats were observed in secondary forest and gago groves (Glass and Taisacan 1988). Factors involved in roost site selection are not clear, but data from Guam indicate that some sites may be selected for their inaccessibility by humans and thus limited human disturbance. Mariana fruit bats will abandon roost sites if disturbed and are reported to move to new locations up to 6 mi. (9.7 km) away (U.S. Fish and Wildlife Service 1990).

Several hours after sunset, Mariana fruit bats depart their roost sites to forage for fruit and other native and non-native plant materials such as leaves and nectar (Janeke 2006; U.S. Fish and Wildlife Service 1990). This species feeds on a variety of plant material but is primarily frugivorous (Wiles et al. 1989). Specifically, Mariana fruit bats forage on the fruit of at least 28 plant species, the flowers of 15 species, and the leaves of two plant species. Some plants used for foraging include dukduk, papaya, *Cycas micronesica*, nunu, kafo, *Cocos nucifera*, and *Terminalia catappa*. Many of these plant species are found in a variety of forested habitats on Guam, including limestone, ravine, coastal, and secondary forests (Donnegan et al. 2004; Raulerson and Rinehart 1991).

3.10.2.3.11.3 Status within the Mariana Islands Training and Testing Study Area

Non-colonial Mariana fruit bat roost throughout Northwest Field, Tarague basin, Jinapsan Beach area, Guam National Wildlife Refuge lands, Naval Communications Site, and private lands in northern Guam. Three solitary Mariana fruit bats were sighted on Navy lands during 90 hours of observations at 14 different survey locations (U.S. Department of the Navy 2008b). Two sightings were on Naval Communications Site, one below the cliff-line in the northern section of the Haputo Ecological Reserve near Falcona, and the other was seen flying westward across Route 3A from Andersen AFB onto Naval

Communications Site (U.S. Department of the Navy 2008b). The island-wide population on Guam is likely not to exceed 50 Mariana fruit bats (U.S. Department of the Navy 2013a). The last colony of Mariana fruit bats on Guam was located at Pati Point on Andersen AFB. This colony no longer exists, and Mariana fruit bats persist on Andersen AFB as solitary individuals (SWCA Environmental Consultants 2012). Bats were seen sporadically on the Naval Base Guam Munitions Site between 1985 and 1999 (Morton and Wiles 2002). In 2010, three sightings of the same individual Mariana fruit bat were reported within the Naval Base Guam Munitions Site. Seven detections of one Mariana fruit bat in flight, each on a different day, were recorded at Naval Base Guam Munitions Site between 10 May and 22 June 2012. It could not be determined if these observations represent one bat or multiple bats.

On Rota, Mariana fruit bats are found in mature limestone forests and coconut groves on the island. Military training activities do not occur in these areas.

On Tinian, few Mariana fruit bats were observed during surveys although island residents report occasionally seeing Mariana fruit bats (U.S. Department of the Navy 2008a). During surveys in 1979, two Mariana fruit bats were observed in the Kastiyu forest and an island-wide estimate of 25–100 was based on available forest habitat. Surveys in 1994 and 1995 did not observe Mariana fruit bats; however, two incidental sightings were reported from other locations on Tinian. No Mariana fruit bats were sighted during two surveys in 2000; however, Mariana fruit bats also reside on Aguiguan and travel to Tinian to forage (Cruz et al. 1999, 2000, 2002). In June 2005, approximately five Mariana fruit bats were seen in the cliff-line forest during a routine forest bird survey of the Maga bird transect (U.S. Department of the Navy 2008a). Because of the few numbers of bat observations and the likelihood that Mariana fruit bats observed on Tinian are not residents, the Mariana fruit bat should be considered incidental on Tinian.

FDM may serve as a stopover location for Mariana fruit bats while transiting between islands. Incidental observations of Mariana fruit bats during recent bird surveys, along with fisherman reports from the early 1970s, suggest a small number of Mariana fruit bats use FDM. Use of the island by Mariana fruit bats may have been higher prior to the use of the island as a bombing range. Also, historical photographs appear to show more intact forested areas on the mesic flats area of the northern portion of the island, which would have provided foraging and roosting habitats on FDM (U.S. Department of the Navy 2013a).

3.10.2.4 Species Considered as Candidates for Endangered Species Act Listing

3.10.2.4.1 Plant Species

Fourteen species of plants proposed by the USFWS for ESA listing may occur on islands that support military training activities. These species include *Eugenia bryanii*, *Cycas micronesica*, *Psychotria malaspinae*, *Tinospora homosepala*, *Bulbophyllum guamense*, *Dendrobium guamense*, *Heritiera longipetiolata*, *Maesa walker*, *Nervilia jacksoniae*, *Solanum guamense*, *Tabernaemontana rotensis*, *Tuberolabium guamense, Hedyotis megalantha,* and *Phyllanthus saffordii.*

Status within the Mariana Islands Training and Testing Study Area

All but two of the species proposed for listing are dependent on intact limestone forest habitats. Although these species may occur on military owned or leased lands, training activities discussed in this EIS/OEIS would not occur in these intact limestone forest habitats. Two species are associated with savanna habitats found on the southern portion of Guam—*Hedyotis megalantha* is a small perennial herb and *Phyllanthus saffordii* is a woody shrub. Although these species may occur in the Naval Base Guam Munitions Site, the only known occurrence on Guam of *Hedyotis megalantha* is on the Sigua highlands outside of Naval Base Guam Munitions Site. *Phyllanthus saffordii* is known from only four locations on Guam, none of which are believed to be located on military property.

3.10.2.4.2 Invertebrate Species

Four snails in the Partulid family are collectively known as "akaleha" in Chamorro—the humped tree snail (*Partula gibba*), the Guam tree snail (*Partula radiolata*), the fragile tree snail (*Samoana fragilis*), and Langford tree snail (*Partula langfordi*). The shell of the humped tree snail is described as somewhat enlarged resembling a hump in a conical shape with four to five whorls. The shell color is chestnut brown to whitish yellow, or occasionally purple with a white or brown line along the suture between the whorls on the shell (U.S. Fish and Wildlife Service 2008c, d). The humped tree snail was added to candidate listing in 1994 by the USFWS (U.S. Fish and Wildlife Service 2008c). The candidate status was reaffirmed most recently in 2012 by the USFWS (U.S. Fish and Wildlife Service 2012a).

The shell of a Guam tree snail is described as somewhat oblong and having a conical shape with five whorls. The shell color is pale straw yellow with darker axial rays and brown lines (U.S. Fish and Wildlife Service 2008d). The Guam tree snail was added to candidate listing in 1994 by the USFWS (U.S. Fish and Wildlife Service 2008d). The candidate status was reaffirmed in 2005 by the USFWS (U.S. Fish and Wildlife Service 2008d). The fragile tree snail was added to candidate listing in 1994 by the USFWS (U.S. Fish and Wildlife Service 2012). The candidate status was reaffirmed in 2012 (U.S. Fish and Wildlife Service 2012b).

Threats to the partulid snails include historical (following World War II) loss of native forest habitat, typhoons, overbrowsing by introduced ungulates, and market collection of tree snails. Predation by the alien rosy carnivore snail (*Euglandina rosea*) and the alien Manokwar flatworm (*Platydemis manokwari*) is a serious threat to the survival of tree snails from the Mariana Islands (U.S. Department of the Navy 2013a; U.S. Fish and Wildlife Service 2012b).

The Mariana eight-spot butterfly (*Hypolimnas octocula mariannensis*) and the Mariana wandering butterfly (*Vagrans egistina*) are two species in the Nymphalid family of butterflies that are candidates for ESA listing. Both butterflies are known in Chamorro as the "Ababang" and in Carolinian as "Libwueibogh," and are believed to be endemic to Rota and Guam (Hawley and Castro 2008). Like most nymphalid butterflies, orange and black are the primary colors exhibited by these species. Females are larger than males, appear brighter orange in color than males, and have black bands across the top margins of both pairs of wings. Males are predominantly black with an orange stripe running vertically on each wing. Mariana wandering butterflies do not have an orange stripe, but rather one large orange blot on each wing characterizes this species. The candidate status for these two species was re-affirmed in 2012 (U.S. Fish and Wildlife Service 2012a).

Threats to these butterfly species include predation by ants, parasitism by small wasps, and extremely low numbers (U.S. Fish and Wildlife Service 2008e, 2012b). These butterflies were apparently always uncommon and declined primarily due to browsing of the two host plants by introduced deer and other ungulates. The Mariana eight-spot butterfly is believed to have been extirpated from Saipan, but occurs rarely in Guam's northern forests. During surveys conducted in 1995, areas of Saipan supported healthy populations of the host plants, but no butterflies were observed (Scheiner and Nafus 1996).

Host plants for the Mariana eight-spot larvae include two native herbaceous plants, *Procris pedunculata* and *Elatostema calcareum*. These forest fleshy herbs only grow on karst limestone within limestone forests. *Maytenus thompsoni* is the host plant primarily associated with Mariana wandering butterfly larvae (Hawley and Castro 2008).

Status within the Mariana Islands Training and Testing Study Area

The humped tree snail is the most widely distributed partulid snail in the Mariana Islands (Kerr 2013) and likely occurs within intact limestone forests on Andersen AFB, Naval Base Guam Telecommunications Site at Finegayan, and intact limestone forest areas within the Tinian MLA. The Guam tree snail has a wide distribution on Guam and also likely occurs in intact forest areas of Andersen AFB and Navy-owned lands. The fragile treesnail is generally restricted to limestone forests of northern Guam (Kerr 2013) and potentially occurs in intact limestone forests of Andersen AFB, Naval Base Guam Telecommunications Site at Finegayan. The Langford tree snail does not occur on DoD-owned or leased lands, and is restricted to Aguiguan. It should be noted that military training activities described in this EIS/OEIS do not occur in these intact limestone forest areas that may be inhabited by Partulid snails.

Mariana wandering butterflies have been extirpated from Guam but are still found on Rota. Mariana eight-spot butterflies are still extant on Rota and northern limestone forests of Guam. Two Mariana eight-spot butterflies were observed in 2006 (Lawrence 2006) along a rocky pinnacle karst area toward Pati Point on Andersen AFB. A recent survey conducted by Hawley and Castro (2008) did not find either butterfly on Tinian; however, host plants for these species were identified. Mariana wandering butterflies and Mariana eight-spot butterflies occur in intact limestone forests characterized by rough terrain where no military training activities occur.

3.10.2.4.3 Sheath-Tailed Bats (*Emballonura semicaudata rotensis*)

The subspecies of the Pacific sheath-tailed bat known to occur throughout the Mariana Islands has not been well studied, and all available information indicates that this insectivorous bat is restricted to Aguiguan (U.S. Fish and Wildlife Service 2009d). Pacific sheath-tailed bats are known to only roost in caves. In 2008, surveys on Aguiguan were completed along with limited acoustical detection sampling on Tinian (using equipment designed to detect echolocating bats). No bats were detected on Tinian in 2008.

Status within the Mariana Islands Training and Testing Study Area

There have been no recent records of Pacific sheath-tailed bats on Tinian (U.S. Fish and Wildlife Service 2009d). There are habitats on Tinian that are similar to habitats located on Aguiguan (which is located 5 mi. [8 km]) away from Tinian. Mount Lasso is within the Tinian MLA, but the Kastiyu Forest area is on southern Tinian outside of the Tinian MLA.

3.10.3 Environmental Consequences

This section presents the analysis of potential impacts on terrestrial species from implementation of the project alternatives, including the No Action Alternative, Alternative 1, and Alternative 2. Navy training and testing activities are evaluated for their potential impact on terrestrial species in general, by taxonomic groups, and in detail for species listed under the ESA (Section 3.10.2, Affected Environment). For this EIS/OEIS, terrestrial species are evaluated as groups of species characterized by distribution, body type, or behavior relevant to the stressor being evaluated. Vegetation communities and the habitats for species these communities support are evaluated based on location of the training activities, the habitats these training areas support, and the type of stressors that are introduced into these habitats. Activities are evaluated for their potential effect on vegetation communities, wildlife communities, and in general, on each taxonomic grouping, and on the ESA-listed species considered in this analysis (see Section 3.10.1.1.1, Endangered Species Act Listed Species and Designated Critical Habitat). As described in Section 3.10.2 (Affected Environment), birds are not distributed uniformly throughout the Study Area, but are closely associated with a variety of habitats, with coastal birds and shorebirds concentrated along nearshore habitats and seabirds with patchy (uneven) distributions in offshore and open ocean areas.

General characteristics of all potential stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis). Certain activities on land take place on specific islands and within specific areas of islands. The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to terrestrial species in the study area and analyzed below include the following:

- Acoustic (explosives noise, weapons firing noise, and aircraft noise)
- Physical disturbance and strike (aircraft and aerial targets, military expended materials, ground disturbance, and wildfires)
- Secondary (introduction of invasive species)

The specific analysis of the training activities presented in this section considers the relevant components and associated data within the geographic location of the activity (see Tables 2.8-1 and 2.8-2) and the resource. There are no applicable testing activities to terrestrial resources, and therefore they are not analyzed.

3.10.3.1 Acoustic Stressors

This section evaluates the potential for non-impulse and impulse acoustic stressors to impact terrestrial species during training activities on land training areas within the Study Area. There are no testing activities that occur on land that require introducing sound into the environment. These stressors are associated with explosive detonations, aircraft noise, and weapons firing. Categories of potential impacts from exposure to explosions and sound are direct trauma, hearing loss, auditory masking, behavioral reactions, and physiological stress. Potential negative nonphysiological consequences to terrestrial animals from acoustic and explosive stressors include disturbance of foraging, roosting, or breeding; degradation of foraging habitat; and degradation of habitats. Table 3.10-5 lists each substressor, where they occur, and what species potentially are impacted by the activity.

Table 3.10-5: Acoustic Substressors in Land Training Areas and Terrestrial Resources Potentially Impacted

Acoustic Substressor	Land Training Area	Terrestrial Resource Potentially Impacted
Explosives and Weapons Firing Noise	Andersen AFB (Pati Point CATM Range, Pati Point EOD Range)	Mariana fruit bat, Mariana crow (believed to be extirpated) Non-ESA listed forest birds (e.g., Micronesian starlings)
	Naval Base Guam Main Base (Orote Point Known Distance Range,	None
	Naval Base Guam Munitions Site (emergency detonation site)	Mariana swiftlet Mariana common moorhen Mariana fruit bat
	Naval Base Guam Telecommunications Site (Finegayan Small Arms Range)	None
	FDM	Micronesian megapode Mariana fruit bat Non-ESA listed forest birds (e.g., Micronesian starlings, white-throated ground dove)
Aircraft Noise	Andersen AFB	Mariana fruit bat, Mariana crow (believed to be extirpated) Non-ESA listed forest birds (e.g., Micronesian starlings)
	Naval Base Guam Main Base	Mariana common moorhen Non-ESA listed terrestrial birds (e.g., yellow bittern)
	Naval Base Guam Munitions Site	Mariana swiftlet Mariana common moorhen Mariana fruit bat
	Tinian MLA	Micronesian megapode Mariana fruit bat Non-ESA listed forest birds (e.g., Tinian monarch)
	Rota	Mariana fruit bat Mariana crow
	FDM	Micronesian megapode Mariana fruit bat Non-ESA listed forest birds (e.g., Micronesian starlings, white-throated ground dove)

Notes: Andersen AFB = Andersen Air Force Base, CATM = Combat Arms and Maintenance Range, EOD = Explosive Ordnance Detonations, ESA = Endangered Species Act, FDM = Farallon de Medinilla, Tinian MLA = Tinian Military Lease Area

3.10.3.1.1 Impacts from Explosives and Weapons Firing Noise

The potential for animals to be exposed to explosions depends on several factors, including the presence of animals near the detonation, location of the detonation, size of the explosive, and distance from the detonation. Detonations create blast waves and acoustic waves in air and are also transmitted through the ground. Some of the sound could be attenuated by surrounding vegetation. Noise can result from direct munitions impacts (one object striking another), blasts (explosions that result in shock waves), bow shock waves (pressure waves from projectiles flying through the air), and substrate vibrations (combinations of explosion, recoil, or vehicle motion with the ground). Noise may be continuous (i.e., lasting for a long time without interruption) or impulse (i.e., short duration).

Continuous impulses (helicopter rotor noise, bursts from rapid-fire weapons) represent an intermediate type of sound and, when repeated rapidly, may resemble continuous noise. These types of sound are distinguished here as they differ in their effects. Continuous sounds can result in hearing damage while impulses typically elicit physiological or behavioral responses.

Continuous or repetitive loud noise appears to cause stress and vascular alteration (including structural damage) in the ear and could be harmful when animals are already under metabolic stress such as starvation. Sound levels over 85 A-weighted decibels (dBA) are considered harmful to inner ear hair cells; 95 dBA is considered unsafe for prolonged periods; and extreme damage occurs as a result of brief exposure to 140 dBA (Hamby 2004). Hearing loss in birds is difficult to characterize because birds, unlike mammals, regenerate inner ear hair cells, even after substantial loss (Corwin and Cotanche 1988; Stone and Rubel 2000). Recovery from metabolic ear stress can often occur after 10 hours (mammals) post loud impulse noise, even before ear structures are fully recovered. Repeated trauma may prolong the course of hearing sensitivity recovery; however, longer-term recovery from hearing loss is generally expected in birds due to cell regeneration. Lifelong hearing loss (threshold shifts) can occur in birds; about half the duration of noise is needed to produce a threshold shift in birds as opposed to mammals.

High-frequency sounds (or ultrasound) are frequencies above the human auditory range limit. These sounds diminish very rapidly in air with distance from the source, and terrestrial animals close enough to be adversely affected by the ultrasound produced by military training are likely close enough to be adversely affected by shrapnel, flying rock, or direct strikes. Therefore, ultrasound receives little attention in the terrestrial environment and it should be assumed that if an animal was close enough to experience impacts from ultrasound, the animal would likely be impacted directly by the actual munitions (U.S. Fish and Wildlife Service 2010a).

Infrasound is present in blast and helicopter noise, but not heard by humans. This low frequency sound, outside the range of human hearing, attenuates less in air than audible sound, which means these noises can affect wildlife at longer distances. Birds may use infrasound for communication; however, the extent to which birds are affected by infrasound is speculative. Infrasound can result in damage to the ears, which may affect the species' ability to hear and may also mask biologically meaningful infrasonic communication between individuals.

Severe noise, even if the noise is short in duration, can result in tympanum rupture, bone fracture, other damage to the ear, and deterioration of brain cells. These impulse noises can cause physical damage at lower intensity than continuous or rapidly repeating noises due to the ear reflex mechanism. For example, common canaries (*Serinus canaria*) exposed to continuous loud noises experienced changes in hearing thresholds, especially at high frequencies (Larkin et al. 1996). While a study with parakeets (*Melopsittacus undulates*) indicated that a permanent threshold shift (lifelong hearing loss) was experienced at low frequencies only and nearly absent at higher frequencies (Larkin et al. 1996). Many birds appear to tolerate noise that can cause pain in humans, for example: seabirds at airports, wild turkeys (*Meleagris gallopavo*) near a rocket testing plant in Florida, and ospreys (*Pandion haliaetus*) at the Naval Surface Warfare Center, Dahlgren (Larkin et al. 1996). These varied responses are often attributed to habituation, where after a period of exposure to a stimulus, an animal stops responding to the stimulus. In general, a species can often habituate to human-generated noise when the noise is not followed by an adverse impact. Even when a species appears to be habituated to a noise, the noise may produce a metabolic or stress response (increased heart rate results in increased energy expenditure) although the response may or may not lead to changes in overall energy balance.

In addition to physical damage to the ear, noise also produces other physiological and behavioral responses. The behavioral effects of military-related noise to wildlife have been investigated numerous times with mixed results (VanderWerf 2000); it is difficult, therefore, to generalize predictions about potential responses of Micronesian megapodes to noise based on data from other species. To summarize, noise can produce a variety of physiological impacts and behavioral responses in wildlife. Noise not only affects an individual but can affect the overall population. Hearing impairment, both temporary and permanent, can decrease viability or reproductive success, particularly when mate attraction and territory protection depend on calling or singing normally. Hearing impairment can also decrease the ability to detect and warn others of predators. Behavioral responses (startle response, alert or alarm response, and flushing) to noise are often examined as these response actions result in: birds expending excess energy that is not directed toward reproduction; nest exposure increasing the risk of predation, nest cooling or nest heating, which can result in egg and juvenile mortality; or accidently kicking eggs or juveniles out of the nest. Behavioral responses can also include lower breeding densities in suitable habitats that are subject to noise; therefore, suitable habitat may become otherwise unsuitable due to noise. Wildlife response to noise may also be more intense at night, if the species rely more on auditory cues than visual cues at night. Additionally, young animals may be more susceptible to hearing loss from noise exposure than adults; however, an experiment with common canaries did not show a differential response with age (Larkin et al. 1996).

Studies focusing on responses of birds on land to explosive noise show varied reactions ranging from no response to behavioral (e.g., flushing, cessation of foraging) and physiological responses (e.g., increased heart and respiration rates). Red-cockaded woodpeckers (*Picoides borealis*) successfully raised young near an active bombing range in Mississippi, while other birds at other sites did not. Oahu elepaio (*Chasiempis sandwichensis ibidis*) did not respond in statistically significant or biologically meaningful ways to noise generated by training with 155 and 105 millimeter howitzers, 60 and 81 millimeter mortars, hand grenades, and demolition of unexploded ordinance (VanderWerf 2000). Prairie falcons (*Falco mexicanus*) responded to blasts from ongoing civilian construction where the nests sites were not normally exposed to blasting; however, one northern harrier (*Circus cyaneus*) appeared to preferentially hunt near a location where 24-pound (lb.) bombing occurred. Anecdotal observations indicate the burrowing owl (*Athene cuniculariajloridana*) persists at Eglin AFB on a bombing range where a variety of inert ordnance (rockets, missiles, and bombs including a 21,700 lb. massive ordnance air blast bomb) has been used over the last 24 years (U.S. Fish and Wildlife Service 2010a). Behavioral responses (startle response, alert or alarm response, and flushing) to noise are often examined as these response actions result in birds expending excess energy not directed toward reproduction; nest exposure increasing the risk of predation, nest cooling or nest heating, which can result in egg and juvenile mortality; or accidently kicking eggs or juveniles out of the nest. Behavioral responses can also include lower breeding densities in suitable habitats that are subject to noise; therefore, suitable habitat may become otherwise unsuitable due to noise.

Impact Areas and Special Use Areas on FDM

The training activities that have the greatest impact on vegetation and wildlife communities within the impact areas on FDM are those that result in (1) percussive force from the use of explosive munitions, and (2) habitat alteration associated with ground disturbance and wildfires from explosive munitions.

FDM has four impact areas, a special use area on the northern portion of the island, and a special use area on the land bridge. Targeting of areas inside of the special use areas and other areas outside of impact areas are prohibited. In other words, all areas outside of the impact areas are considered "no-fire areas." Any ordnance that inadvertently lands outside of impact areas including special use areas and in water must be reported to MIRC Operations, in accordance with Commander, U.S. Naval Forces Marianas Instruction (COMNAVMARIANASINST) 3500.4A (U.S. Department of the Navy 2013d). The impact areas and special use areas are described below:

- **Northern Special Use Area**. Reserved for direct action (tactical air control party) type exercises and personnel recovery. This area is about 41 ac. (17 ha), and includes a landing zone.
- **Impact Area 1**. This area contains high-fidelity target structures and is comprised of vehicle shells and cargo containers. This area is authorized for inert ordnance only, and operators are required to report any live ordnance mistakenly dropped into Impact Area 1 to JRM Operations. Impact Area 1 contains nine targets of varying shapes and sizes, including four vehicles and five targets comprised of shipping containers. As shown in Figure 3.10-9, the target vehicles, rectangular target, the square target, and the L-shaped target only receive lightweight inert ordnance less than 100 lb. Strafing is prohibited on these targets. The H-shaped target may be targeted with inert ordnance less than 500 lb. with strafing also prohibited. The E-shaped target may be targeted with inert ordnance not exceeding 2,000 lb., and strafing is authorized on this target. Impact Area 1 is about 21 ac. (8.5 ha).
- **Impact Area 2**. Impact area 2 may be used for both live and inert ordnance. Strafing is permitted in this area. Impact Area 2 is about 22 ac. (9 ha).
- **Land Bridge**. Ordnance is prohibited from impacting the land bridge to the greatest extent possible. Operators are required to report ordnance observed impacting the land bridge.
- **Impact Area 3**. This area is south of the land bridge and is used for live and inert ordnance. Strafing is permitted in this area. Impact Area 3 is about 11 ac. (4.5 ha).
- **Non-contiguous Point Targets**. These targets are used for firing at vertical targets on the cliff, as part of Naval surface fire support training. There are six targets, all along the western side of FDM.

The potential for impacts resulting from direct strikes from inert munitions is orders of magnitudes lower than that from explosive munitions, particularly heavyweight explosive bombs (U.S. Department of the Navy 2010). Weapons use (i.e., direct strike) impacts are analyzed in Section 3.10.3.2.2 (Impacts from Military Expended Materials Including Explosive Munitions Fragments).

3.10.3.1.1.1 No Action Alternative

<u>Training Activities</u>

As shown in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives), land-based detonations occur primarily on FDM as part of strike warfare and firing exercises; however land detonations for training associated with unexploded ordnance discovery/disposal training and improvised explosive device training occur at Andersen AFB on Guam (Pati Point Explosive Ordnance Disposal Range). Weapons firing activities under the No Action Alternative occur at ranges on Guam. Fixed-wing and rotary-wing air to ground gunnery exercises and missile exercises occur on FDM, as well as during ship-based fire support for amphibious warfare training.

Land-based detonations at the Pati Point Explosive Ordnance Disposal Range were the subject of earlier consultations between Andersen AFB and the USFWS (U.S. Department of the Navy 2009; U.S. Fish and Wildlife Service 2010a). The Pacific Islands Fish and Wildlife Office concluded that activities at the Pati Point Explosive Ordnance Disposal Range would not adversely affect ESA-listed species. Because of the current status of the Mariana crow on Guam, it is unlikely that any remnant crows would be near explosive training at the range. Other species thought to be absent from habitats surrounding the Pati Point Range (Guam rail, Guam Micronesian kingfisher, Mariana common moorhen) will not be impacted. Transiting Mariana fruit bats, however, may experience temporary behavioral changes associated with birds, such as the Micronesian starling. Bats may exhibit behavioral responses to explosive noise, particularly at Pati Point ranges. These infrequent detonations are not expected to induce adverse population effects. It should be noted that Micronesian starling numbers are increasing in developed areas of Andersen AFB. These detonation activities occur on hardened surfaces and do not present a wildfire risk or impacts to vegetation communities.

Source: Commander, U.S. Naval Forces Marianas Instruction 3500.4A (Chapter 4).

Figure 3.10-9: Detailed View of Impact Areas and Special Use Areas on FDM

Explosive noise from strike warfare training at FDM impacts wildlife assemblages (primarily avifauna), and ESA-listed species (Lusk et al. 2000). Section 3.6 (Marine Birds) discusses the impacts to FDM's bird populations resulting from explosive noise. Section 3.10.3.2.4 (Impacts from Wildfires) and Section 3.10.3.2.2 (Impacts from Munitions Strike) discuss the potential impacts that explosions have on vegetation communities through a history of intense bombardment. Table 3.0-22 lists representative ordnance use on FDM under the No Action Alternative.

Mariana fruit bats on FDM may be transient bats (bats from other islands). The limited forest structure and composition currently found on FDM may support a small number of year-round residents. Natural resource experts expressed concern that volcanic eruptions could displace fruit bats to other islands (e.g., from Anatahan to FDM), thereby exposing an increased number of bats to potential impacts of military training on FDM (U.S. Fish and Wildlife Service 2006a, 2010a). It should be noted that after the Anatahan eruption began in 2003, the number of bat observations on other islands did not increase. However, the genetic variation demonstrated by fruit bats found in the far northern islands of the Mariana Archipelago and those bats found in the southern islands suggests that interisland movements do occur and are sufficient for northern bats and southern bats to not be classified as separate species or sub-species (Brown et al. 2011).

The Micronesian megapode would be exposed to noise and pressure waves from explosions on FDM from strike warfare and firing exercises. Response of the Micronesian megapode to explosive noise has not been evaluated under scientific investigation (U.S. Fish and Wildlife Service 2010a); however, Micronesian megapodes are vocal and presumably find mates and defend territories by duetting (U.S. Fish and Wildlife Service 1998). Therefore, explosive noise and pressure waves generated from explosions would impact the Micronesian megapode if it physically damages the ears such that an individual cannot hear and locate a mate; produces abnormal calls (hearing impaired learning) and cannot attract a mate; or is unable to defend a territory.

Other concerns from noise impacts to avian species are related to nesting and impacts to eggs or chicks (i.e., mortality through kicking eggs or young out of the nest during flushing, exposing young to temperature changes, failing to feed and care for young during nest flushing, exposing eggs and young to increased predation). Micronesian megapodes generally bury their eggs in mounds in which temperature is controlled by sources other than the bird (U.S. Fish and Wildlife Service 2010a). Chicks are precocial, able to fly upon emergence from the egg and not requiring parental care (U.S. Fish and Wildlife Service 1998). Therefore, behavioral responses typical to other avian species are not likely to result in adverse impacts to eggs, chicks, or juveniles of Micronesian megapodes.

Besides the Micronesian megapode, terrestrial bird species do not likely breed on FDM. There are a few terrestrial bird species that visit the island, such as the fork-tailed swiftlet, Eurasian tree-sparrow, and cattle egret. While visiting FDM, or using FDM as stopover habitat along migration routes, these birds would be exposed to noise and pressure waves from explosions on FDM from strike warfare and firing exercises. Some birds may be killed or injured during these activities, or expend energy stores needed for migration to avoid perturbations generated by explosions.

There are a number of protective measures used on FDM that minimize potential adverse impacts associated with explosives to Micronesian megapodes and habitats used by megapodes and other terrestrial animals. The protective measures were included in the 2010 USFWS Biological Opinion that included the Navy’s use of FDM (U.S. Fish and Wildlife Service 2010a). The measures include maintaining prohibitions on targeting the northern end of the island (which continues to support higher stature trees), placing of targets within impact areas, and maintaining prohibitions on the use of cluster bombs, bombs greater than 2,000 lb. net explosive weight (NEW), fuel-air explosives, and incendiary devices.

Pursuant to the ESA, sound generated from explosions and weapons firing on land during training activities under the No Action Alternative will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam rail, Guam Micronesian kingfisher, Mariana common moorhen, Mariana crow, Mariana swiftlet, and nightingale reed-warbler. Explosions on FDM may affect, and are likely to adversely affect, the Micronesian megapode and Mariana fruit bat.*

Critical Habitats on Guam or Rota will not be affected by explosive noise or weapons firing noise.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), explosions and weapons firing on land during training activities under the No Action Alternative will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

There are no testing activities that occur on land. Therefore, there are no potential impacts on terrestrial species or habitats.

3.10.3.1.1.2 Alternative 1

Training Activities

The number of detonations as part of explosive ordnance disposal and improvised explosive training will not change in Alternative 1, relative to the No Action Alternative. Therefore, the conclusion of the impacts on wildlife communities, ESA-listed species, and other terrestrial bird species not listed under the ESA on Guam associated with explosive noise is the same.

The FDM range is operated in accordance with COMNAVMARIANASINST 3500.4a, into which the terms and conditions specified in the 2010 Biological Opinion as amended (U.S. Fish and Wildlife Service 2010a), have been incorporated. Based on the ordnance expenditures authorized under the 2010 Biological Opinion, 516 tons is the maximum NEW authorized. In 2012, 331 tons NEW were dropped over the course of the year. Under Alternative 1, the Navy proposes to increase the number of strike warfare training exercises to allow for a maximum NEW of 1,484 tons.

As stated previously, the most important stressors to wildlife communities, including Micronesian megapodes and Mariana fruit bats on FDM are (1) percussive force from the use of explosive munitions, and (2) habitat alteration associated with ground disturbance and wildfires from explosive munitions. It should be noted that direct strike from inert munitions is far less likely to impact a megapode or bat relative to the potential for blast effects associated with explosive munitions, especially heavy weight munitions. Direct strike (by projectiles and explosive munition fragments) is analyzed in Section 3.10.3.2 (Physical Stressors). Although exposures to Micronesian megapodes, and potentially Mariana fruit bats, are expected to increase under Alternative 1 compared to the No Action Alternative, the expected impacts on any individual bird would remain the same for all three alternatives. For the same reasons provided in Section 3.10.3.1.2.1 (No Action Alternative), explosive noise may impact the Micronesian megapode if it physically damages the ears such that: an individual cannot hear and locate a mate; produces abnormal calls (hearing impaired learning) and cannot attract a mate; or is unable to defend a territory. As discussed under the No Action Alternative, there are a few terrestrial bird species that visit the island, such as the fork-tailed swiftlet, Eurasian tree-sparrow, and cattle egret. While visiting FDM, or using FDM as stopover habitat along migration routes, these birds would be exposed to noise and pressure waves from explosions on FDM from strike warfare and firing exercises. These exposures would increase under Alternative 1. Some birds may be killed or injured during these activities, or expend energy stores needed for migration to avoid perturbations generated by explosions.

The Navy will continue to implement protective measures to minimize the impacts on terrestrial species and habitats, pursuant with the USFWS Biological Opinion for Mariana Islands Range Complex (MIRC) training activities (U.S. Fish and Wildlife Service 2010a).

Pursuant to the ESA, sound generated from explosions and weapons firing on land during training activities under Alternative 1 will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam rail, Guam Micronesian kingfisher, Mariana common moorhen, Mariana crow, Mariana swiftlet, and nightingale reed-warbler. Explosions on FDM may affect, and are likely to adversely affect, the Micronesian megapode and the Mariana fruit bat.*

Critical Habitats on Guam or Rota will not be affected by explosive noise or weapons firing noise.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), explosions and weapons firing on land during training activities under Alternative 1 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

Under Alternative 1, there are no testing activities that would involve explosions on land. Therefore, there are no potential impacts on terrestrial species or habitats.

3.10.3.1.1.3 Alternative 2

Training Activities

The number of detonations as part of explosive ordnance disposal and improvised explosive training will not change in Alternative 2, relative to the No Action Alternative. Therefore, the conclusion of the impacts on wildlife communities, ESA-listed species, and other terrestrial bird species not listed under the ESA on Guam associated with explosive noise is the same.

On FDM, the explosive munitions use proposed under Alternative 2 differs only in the 2,000 lb. bomb category. Under Alternative 2, an additional 579 bombs in this category would be dropped relative to Alternative 1.

Although exposures to Micronesian megapodes, and potentially Mariana fruit bats, are expected to increase under Alternative 2 compared to the No Action Alternative, the expected impacts on any individual bird would remain the same for all three alternatives. Exposures to Micronesian megapodes, Mariana fruit bats, and the few terrestrial bird species that visit FDM would increase under Alternative 2 relative to the No Action Alternative. Some birds may be killed or injured during these activities, or expend energy stores needed for migration to avoid perturbations generated by explosions.

The Navy will continue to implement protective measures to minimize the impacts on terrestrial species and habitats, pursuant with the USFWS Biological Opinion for MIRC training activities (U.S. Fish and Wildlife Service 2010a).

Pursuant to the ESA, sound generated from explosions and weapons firing on land during training activities under Alternative 2 will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam rail, Guam Micronesian kingfisher, Mariana common moorhen, Mariana crow, Mariana swiftlet, and nightingale reed-warbler. Explosions on FDM may affect, and are likely to adversely affect, the Micronesian megapode and Mariana fruit bat.*

Critical Habitats on Guam or Rota will not be affected by explosive noise or weapons firing noise.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), explosions and weapons firing on land during training activities under Alternative 2 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

Under Alternative 2, there are no testing activities that would involve explosions on land. Therefore, there are no potential impacts on terrestrial species or habitats.

3.10.3.1.2 Impacts from Aircraft Noise

3.10.3.1.2.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights and vessel movements throughout the Study Area. Most helicopter training would occur adjacent to areas at Naval Base Guam Apra Harbor, Andersen AFB, Tinian landing beaches, and some transits to FDM and to training areas and drop zones at sea. Some training involving combat search and rescue training activities may occur at Rota International Airport.

Andersen AFB completed an aircraft noise and wildlife response study at Northwest Field, Munitions Storage Area, and Pati Point to monitor the effects of noise events associated with aircraft operations to the Mariana fruit bat and Mariana crow (SWCA Environmental Consultants 2009). The study monitored various behaviors of individual bats during periods of no aircraft noise and periods of take-offs and landings, and flushing behaviors associated with the former colony location at Pati Point. No flushing of the entire Mariana fruit bat colony was observed during any aircraft overflight activity (SWCA Environmental Consultants 2009). Flushing episodes associated with overflights were infrequent at less than 5 percent (on 228 occasions) but increased to 6 percent for overflights above 100 dB (in the SWCA study, noise was measured in dBC, or decibels referenced to the carrier). In all flushing events, noise levels remained above 75 dBC for between 31 and 87 seconds. The majority of flush events involved less than three individuals at one time (SWCA Environmental Consultants 2009). On one occasion, 14 fruit bats simultaneously flew from their colony roost sites and circled the main colony and surrounding cliff line. Noise from the aircraft peaked at 121.1 dBC and lasted almost 35 seconds (above 75 dBC), causing between 38 and 50 percent of the fruit bats to flush. Flushed individuals were in flight for a relatively short period, generally resettling between 7 and 10 minutes after first flight.

The most complete dataset on Guam for noise effects on Mariana crows comes from Morton’s 1996 study of aircraft overflights and effects on crows at Andersen AFB (Morton 1996). At the time of Morton’s study, eight pairs of Mariana crows remained on Guam, four pairs had established territories under low-altitude flight lines at Andersen AFB. Crows responded to some low-altitude aircraft overflights (less than 600 ft. [183 m]) with distress and flight, which disrupted nest building activities, incubation of eggs, and nest attendance. A subsequent noise study was completed by Andersen AFB in 2009 (SWCA Environmental Consultants 2009), a time when the last two crows on Guam inhabited the

Munitions Storage Area of Andersen AFB. On three occasions, fighter aircraft departed from either the north or south runway of Andersen AFB and flew around the south side of the Munitions Storage Area. Although both crows were alert and aware of the noise, neither departed the nest site. No direct overflights or noise level data were recorded during these occasions (SWCA Environmental Consultants 2009).

Micronesian starlings nest and forage in and adjacent to the developed portions of Andersen AFB, and have likely habituated to aircraft noise. Their reported increased on Guam suggest that the population of this species is not adversely affected by aircraft noise (U.S. Department of the Navy 2013a).

Fena Reservoir is a 203 ac. (82 ha) lake within the Naval Base Guam Munitions Site and supports a Mariana moorhen population (Guam Division of Aquatic and Wildlife Resources 2006). Helicopter-based fire bucket training occurs near the Fena Spillway on a regular basis, along with frequent overflights of HC-25s. In April 2009, two moorhens were observed near the spillway foraging in nearby aquatic vegetation, and during the wet season of 2008, six moorhens were observed in the shallower portions of the reservoir (U.S. Fish and Wildlife Service 2009b). Any moorhens that are at Fena Reservoir at the time of helicopter-based training will be exposed to noise and visual disturbance. Noise from helicopter overflights most likely adversely affect moorhens by masking predator approaches and mating calls. Other limiting factors seem to be more important, such as the decline of some aquatic emergent vegetation species since noise events for helicopter operations are short term. No noise studies have been conducted to measure responses of Mariana common moorhens to military noise (such as helicopter overflights). To minimize effects of this training activity, Navy natural resource specialists with specific Mariana common moorhen experience monitor any moorhens for behavioral responses during the first three fire bucket training exercises. In addition, the Navy maintains altitude restrictions over Fena Reservoir for helicopters and fixed wing aircraft outside the helicopter fire bucket training area. Continued use of the area may suggest an ability for the moorhen to acclimate to periodic increases in noise.

Other than the Mariana common moorhen, the only native resident terrestrial bird known to occur at Naval Base Guam Munitions Site is the yellow bittern. Population trends are not available for this species at this installation (U.S. Department of the Navy 2013a).

On Rota, aircraft noise would be generated by helicopters during combat search and rescue training activities. Typically, the Navy uses H-60 helicopters to practice day or night rescues of personnel in a simulated hostile area with the expectation of combat resistance. Crews typically include Naval special warfare personnel or combat trained personnel with rescue swimmer and medical qualifications. This activity is mostly restricted to the Rota International Airport; however, other locations may be used in coordination with local authorities (e.g., Rota's mayor office). Helicopters may also transit out to sea for rescue swimmer training.

The Rota International Airport is located on the east side of Rota (see Figure 3.10-2) and is near the critical habitat designation for the Mariana crow and foraging areas for the Mariana fruit bat. The Sabana Plateau is on the western portion of the island (the location of Rota bridled white-eyes and critical habitat, at least one of Mariana fruit bat colonial roosts and Mariana fruit bat critical habitat, and other important habitats associated with the Sabana Plateau). Low altitude overflights do not occur in critical habitat designations or designated conservation areas. Because the combat search and rescue training occurs near occupied habitat for the Mariana crow, aircraft noise may affect the Mariana crow. Combat search and rescue training, however, occurs infrequently on Rota, with the majority of these training activities scheduled to occur on Guam. Adverse effects to the Mariana crow are not anticipated because critical habitat areas are avoided and this training activity occurs infrequently.

Mariana fruit bats are generally more active at night (a primary time for foraging when bats would fan out over Rota from roost locations). Because suitable foraging habitat is adjacent to the Rota International Airport, helicopter noise may affect the Mariana fruit bat. Adverse effects associated with this training activity are not anticipated to include injury or mortality and be limited to minor behavioral changes.

Pursuant to the ESA, noise generated from aircraft overflights over land during training activities under the No Action Alternative will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam rail, Guam Micronesian kingfisher or the nightingale reed-warbler. Noise generated from aircraft overflights may affect, but not likely adversely affect, the Mariana common moorhen, Mariana crow, Mariana fruit bat, Mariana swiftlet, and the Micronesian megapode.*

Critical Habitats on Guam or Rota will not be affected by aircraft noise.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), noise generated from aircraft overflights over land under the No Action Alternative will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

There are no testing activities that occur on land. Therefore, there are no potential impacts on terrestrial species or habitats.

3.10.3.1.2.2 Alternative 1 and Alternative 2

Training activities under Alternative 1 and Alternative 2 would increase fixed- and rotary-wing aircraft overflights throughout the Study Area. Most helicopter training would occur adjacent to areas at Naval Base Guam Apra Harbor, Andersen AFB, Tinian landing beaches, and some transits to FDM and to training areas and drop zones at sea. Most increases would occur at FDM with five-fold increase in the number of sorties associated with bombing exercises during strike warfare training. Most of these flights, however, would be at high altitudes to reduce intensity of the sound.

Combat search and rescue training on Rota under Alternative 1 and Alternative 2 will not change relative to the No Action Alternative. Therefore, aircraft overflights associated with training activities may affect, but not likely adversely affect, Mariana fruit bats and Mariana crows on Rota. Activities at Fena Reservoir (within Naval Base Guam Munitions Site) would not change under Alternative 1 or Alternative 2, and the number of helicopter training supporting insertion/extraction and urban warfare type training activities would not change above the No Action Alternative. Therefore, under Alternative 1 and Alternative 2, increases in activities that generate aircraft noise may affect, but not likely adversely affect, Micronesian megapodes at FDM.

As with the No Action Alternative and Alternative 1, aircraft noise would not adversely impact bird populations for species not listed under the ESA, but protected under the MBTA.

Pursuant to the ESA, sound generated from aircraft overflights over land during training activities under Alternative 1 or Alternative 2 will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam rail, Guam Micronesian kingfisher or the nightingale reed-warbler. Sound generated from aircraft overflights may affect, but not likely adversely affect, the Mariana common moorhen, Mariana crow, Mariana fruit bat, Mariana swiftlet, and the Micronesian megapode.*

Critical Habitats on Guam or Rota will not be affected by aircraft noise.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), noise generated from aircraft overflights over land under Alternative 1 or Alternative 2 will not result in significant adverse effect on terrestrial bird populations.

Testing Activities

There are no testing activities that occur on land. Therefore, there are no potential impacts on terrestrial species or habitats.

3.10.3.2 Physical Stressors

This section describes the potential impacts to wildlife and ESA-listed terrestrial species by aircraft and aerial targets, military expended material strike including explosive munitions fragments, ground disturbance, and wildfires at FDM. Table 2.8-1 in Chapter 2 (Description of Proposed Action and Alternatives) lists activity types, number of activities, and locations where these activities occur that involve physical stressors. Aircraft include fixed-wing and rotary-wing aircraft; munitions include small, medium, and large caliber non-explosive and explosive rounds, as well as rockets, missiles, and bombs; ground disturbance includes trampling (foot traffic) and bivouac training; and wildfires result from ignition of vegetation from munitions use. Aerial targets are used at high altitudes and away from land areas; therefore, the potential for strike of terrestrial animals is discounted and not analyzed further in this EIS/OEIS. These activities vary in location and potentially impact different species based on the species distribution, status within the training area, habitats within the training area, and the type of activity. Table 3.10-6 lists each substressor, where they occur, and what species potentially are impacted by the activity. Physical disturbance and strike of seabird and shorebird species (including ESA-listed) seabird species are addressed in Section 3.6.3.3 (Physical Stressors).

3.10.3.2.1 Impacts from Aircraft and Aerial Target Strike

Wildlife aircraft strikes are a serious concern for the Navy and Air Force because these incidents can harm aircrews as well as damage equipment and injure or kill wildlife (Bies et al. 2006). Since 1981, Naval Aviators reported 16,550 bird strikes at a cost of $350 million. About 90 percent of wildlife/aircraft collisions involve large birds or large flocks of smaller birds (Federal Aviation Administration 2003), and more than 70 percent involve gulls, waterfowl, or raptors.

Although bird strikes can occur anywhere aircraft are operated, Navy and Air Force data indicate they occur more often over land (Air Force Safety Center 2007; Navy Safety Center 2009; U.S. Department of Defense 2012). Potential for wildlife strike is greatest in foraging or resting areas, in migration corridors, and at low altitudes. For example, birds can be attracted to airports because they often provide foraging and nesting resources (Federal Aviation Administration 2003; U.S. Department of Defense 2012). Typical flight altitudes during air-to-surface bombing exercises are from 500 to 5,000 ft. (150 to 1,500 m) above ground level. Most fixed-wing aircraft flight hours (greater than 90 percent) occur at distances greater than 12 nm offshore. Approximately 95 percent of bird flight during migration occurs below 10,000 ft. (3,000 m), with the majority below 3,000 ft. (900 m) (Air Force Safety Center 2007; Navy Safety Center 2009; U.S. Department of Defense 2012). Bird and aircraft encounters are more likely to occur during aircraft takeoffs and landings than when the aircraft is engaged in level flight. In a study that examined 38,961 bird and aircraft collisions, Dolbeer (2006) found that the majority (74 percent) of collisions occurred below 500 ft. (150 m). Air Force data support this statistic, showing that approximately 70 percent of collisions at U.S. Air Force-administered airfields occur below 500 ft. (150 m) (U.S. Department of Defense 2012). Collisions, however, have been recorded at elevations as high as 12,139 ft. (3,700 m) (Buchannan 2011). The Micronesian megapode and Mariana fruit bat are not expected to occur above 500 ft. (152.4 m) above ground level; therefore, these species would not likely be impacted by aircraft overflights and are not carried forward for analysis at FDM.

Part of aviation safety during training and testing activities is the implementation of the Bird/Animal Aircraft Strike Hazard program. The Bird/Animal Aircraft Strike Hazard program manages risk by addressing specific aviation safety hazards associated with wildlife near airfields through coordination among all the entities supporting the aviation mission (U.S. Department of Defense 2012). The Bird/Animal Aircraft Strike Hazard program consists of, among other things, identifying the bird/animal species involved and the location of the strikes to understand why the species is attracted to a particular area of the airfield or training route. By knowing the species involved, managers can understand the habitat and food habits of the species. A Wildlife Hazard Assessment identifies the areas of the airfield that are attractive to the wildlife and provides recommendations to remove or modify the attractive feature. Recommendations may include removal of unused airfield equipment to eliminate perch sites, placement of anti-perching devices, wiring of streams and ponds, removal of brush/trees, use of pyrotechnics, and modification of the grass mowing program (U.S. Department of Defense 2012). Air Force Instruction 91-202 requires Andersen AFB to implement a Bird/Animal Aircraft Strike Hazard Plan. The Andersen AFB Bird/Animal Aircraft Strike Hazard plan provides guidance for reducing the incidents of bird strikes in and around areas where flight training is being conducted. At Andersen AFB, the only regular location of fixed-wing take offs and landings, a sound cannon is deployed on the runway to discourage birds from accumulating on or near the runway. The plan is reviewed annually and updated as needed. Bird/Animal Aircraft Strike Hazard plans are not required around Northwest Field and Orote Air Field on Guam, and North Field on Tinian. Several common bird species that might be present and pose a hazard to military aircraft include shorebirds, black drongos, Micronesian starlings, Eurasian tree sparrows, island collared doves, and Mariana fruit bats (U.S. Department of the Navy 2013a). Mariana fruit bats have been struck by aircraft at Andersen AFB; these animals are primarily active at night and are relatively less maneuverable than birds. Helicopter flights would occur closer to the shoreline where sheltering, roosting, and foraging of birds occur. Helicopters can hover and fly low and are used to tow electromagnetic devices as well as for other military activities at sea. This combination would increase the chances of a helicopter strike of a bird. Additional details on typical altitudes and characteristics of aircraft used in the Study Area are provided in Section 3.0.5.3 (Identification of Stressors for Analysis).

3.10.3.2.1.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include fixed- and rotary-wing aircraft overflights. Certain portions of the Study Area, such as areas near Navy and Air Force airfields, installations, and ranges are used more heavily by Navy and Air Force aircraft as described in further detail in Table 2.8-1 in Chapter 2 (Description of Proposed Action and Alternatives) and in Section 3.0.5.3 (Identification of Stressors for Analysis).

Exposures to birds and fruit bats to potential aircraft strikes would be relatively brief as an aircraft quickly passes. Birds actively avoid interaction with aircraft; however, disturbances or strike of various bird species may occur from aircraft on a site-specific basis. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the safety risk to personnel from a potential bird strike. Some bird and aircraft strikes and associated bird mortalities or injuries could occur in the Study Area under the No Action Alternative; however, no long-term or population-level impacts are expected. Mariana fruit bats would not likely be impacted by aircraft strike because of (1) the relatively low height this species typically transits between roost sites and foraging areas, and (2) the likelihood that Mariana fruit bats would avoid loud sound generated by aircraft by remaining in the forest canopy or moving away from the sound source. Mariana fruit bats that fly at altitudes above the cliffline at Andersen AFB would be within flight paths of planes on approach and take-off. However, the potential for strike is low (because of nocturnal activity of bats and the noise generated by approaching aircraft).

With the exception of the Mariana crow (which is likely extirpated), the only other native terrestrial birds species that occur at Andersen AFB are the Micronesian starling and the yellow bittern. As stated previously, this species is increasing in numbers at Andersen AFB. In the unlikely event of an aircraft strike, the death or injury of a low number of birds would not adversely impact the Micronesian starling bird population.

As described in Section 3.10.3.1.2 (Impacts from Aircraft Noise), low level helicopter training occurs at Fena Reservoir as part of helicopter bucket training. This activity occurs where Mariana common moorhens may be located; however, the noise of the activity would likely cause Mariana common moorhens to move away from the sound source. Therefore, although Mariana common moorhens would be likely disturbed by noise of helicopters, direct strike of a moorhen is unlikely. Based on the infrequent use of the Fena Reservoir area by Mariana fruit bats (as described previously), the primarily nocturnal activity of bats on Guam, and the lack of night-time helicopter flights, Mariana fruit bats would unlikely be struck by helicopter trainings at Naval Base Guam Munitions Site. Mariana swiftlets leave caves located on the facility primarily at dawn and return at night. Some swiftlets, however, may leave caves during nesting periods to incubate eggs and to feed hatchlings. Further, flight restrictions in place because of explosive safety arcs limit the location of low-level helicopter flights, which reduces the potential for low-level interactions with Mariana fruit bats, Mariana swiftlets, or birds otherwise protected by the MBTA.

At the Rota International Airport, combat search and rescue training occurs in areas adjacent to habitats used by Mariana crows and Mariana fruit bats. This training activity, however, is generally confined to the airfield where these species are unlikely to occur. Trainings may also occur in open areas in coordination with local authorities. The likelihood for aircraft strike during combat search and rescue training should be considered extremely low because of the infrequent occurrence of the training activity and the locations of where these training activities are actually scheduled. Night exercises would increase exposures to the Mariana fruit bats because fruit bats disperse from colonies or solitary roosts at night in search of foraging trees across the island. These night dispersions may co-occur with combat search and rescue low-level flights in open areas. Because the training activities that occur at night are infrequent, and the training activities are generally associated with open areas, the likelihood of injury or mortality of a Mariana fruit bat is discountable.

Table 3.10-6: Physical Disturbance and Strike Substressors in Land Training Areas and Terrestrial Resources Potentially Impacted

Substressor	Land Training Area	Terrestrial Resource Potentially Impacted
Aircraft and aerial target strike	Andersen AFB	Mariana fruit bat, Mariana crow (believed to be extirpated) Non-ESA listed forest birds (e.g., Micronesian starlings)
Aircraft and aerial target strike	Naval Base Guam Munitions Site/ Fena Reservoir	Mariana fruit bat Mariana common moorhen Mariana swiftlet Non-ESA listed forest birds e.g., Micronesian starlings)
Aircraft and aerial target strike	Rota (Rota International Airport)	Mariana fruit bat Mariana crow Non-ESA listed forest birds
Aircraft and aerial target strike	Tinian MLA	Micronesian megapode Non-ESA listed forest birds (e.g., Tinian monarch)
Aircraft and aerial target strike	FDM	Micronesian megapode Mariana fruit bat Non-ESA listed forest birds (e.g., Micronesian starlings, white-throated ground dove)
Military expended materials	FDM	Micronesian megapode Mariana fruit bat Non-ESA listed forest birds (e.g., Micronesian starlings, white-throated ground dove)
Ground disturbance (Pedestrian and vehicular traffic)	Naval Base Guam Munitions Site (Northern Land Navigation Area and Southern Land Navigation Area)	Mariana swiftlet Mariana common moorhen Mariana fruit bat Vegetation communities Non-ESA listed forest birds (e.g., yellow bittern)
Ground disturbance (Pedestrian and vehicular traffic)	Tinian MLA	Micronesian megapode Vegetation communities Non-ESA listed forest birds (e.g., Tinian monarch)
Ground disturbance (Pedestrian and vehicular traffic)	Marpi Maneuver Area (Saipan)	Nightingale reed-warbler Mariana fruit bat Micronesian megapode Vegetation communities Non-ESA listed forest birds (e.g., rufous fantail)
Ground disturbance (Pedestrian and vehicular traffic)	FDM	Micronesian megapode Mariana fruit bat Vegetation communities Non-ESA listed forest birds (e.g., Micronesian starlings, white-throated ground dove)
Wildfires	FDM	Micronesian megapode Mariana fruit bat Vegetation communities Non-ESA listed forest birds (e.g., Micronesian starlings, white-throated ground dove)

Notes: Andersen AFB = Andersen Air Force Base, ESA = Endangered Species Act, FDM = Farallon de Medinilla, Tinian MLA = Tinian Military Lease Area

Low-level helicopter flights may also occur over the Tinian MLA. Flight restrictions are in place for intact limestone forest locations and wetland areas of the Tinian MLA to minimize disturbance to the Micronesian megapodes and Mariana common moorhens. These birds transit between habitats within the Tinian MLA and between Tinian and other islands; therefore, these birds could be struck by aircraft. The likelihood of strike of these birds is small because moorhens and megapodes would likely respond to aircraft noise and avoid the collision.

Pursuant to the ESA, aircraft and aerial target strikes during training activities under the No Action Alternative will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam rail, Guam Micronesian kingfisher, nightingale reed-warbler, Mariana crow. Aircraft and aerial target strikes during training activities under the No Action Alternative may affect, but not likely adversely affect, the Mariana fruit bat, the Micronesian megapode, Mariana common moorhen, or Mariana swiftlet.*

Critical Habitats on Guam or Rota will not be affected by potential aircraft and aerial target strikes.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), aircraft and aerial target strikes under the No Action Alternative will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

There are no testing activities that occur on land. Therefore, there are no potential impacts on terrestrial species or habitats.

3.10.3.2.1.2 Alternative 1 and Alternative 2

Training Activities

Training activities under Alternative 1 and Alternative 2 would increase fixed- and rotary-wing aircraft overflights throughout the Study Area. No new land training areas are proposed for overflights under Alternative 1 or Alternative 2. As with the No Action Alternative, most helicopter training would occur adjacent to areas at Naval Base Guam Apra Harbor, Andersen AFB, Tinian landing beaches, and some transits to FDM and to training areas and drop zones at sea. Most increases would occur at FDM with a five-fold increase in the number of sorties associated with bombing exercises during strike warfare training. Most of these flights, however, would be at high altitudes where wildlife species, including ESA-listed species, would not co-occur with aircraft.

Pursuant to the ESA, aircraft and aerial target strikes during training activities under Alternative 1 and Alternative 2 will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam rail, Guam Micronesian kingfisher, nightingale reed-warbler, or Mariana crow. Aircraft and aerial target strikes during training activities under the No Action Alternative may affect, but not likely adversely affect, the Mariana fruit bat, the Micronesian megapode, Mariana common moorhen, or Mariana swiftlet.*

Critical Habitats on Guam or Rota will not be affected by potential aircraft and aerial target strikes. Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), aircraft and aerial target strikes under Alternative 1 and Alternative 2 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

Under Alternative 1 and Alternative 2, there are no testing activities that would involve aircraft overflights over land. Therefore, potential aircraft strikes of terrestrial species or habitats during testing activities would not occur.

3.10.3.2.2 Impacts from Military Expended Materials Including Explosive Munitions Fragments

This section analyzes the strike potential to birds of the following categories of military expended materials: (1) non-explosive practice munitions, and (2) fragments from high-explosive munitions. Expended materials other than ordnance, such as sonobuoys, vessel hulks, and expendable targets, are not used in terrestrial habitats, and are therefore not included in the analysis. Live-fire training occurs on contained ranges, breacher houses, and MOUT-type training facilities within the Study Area's land training areas; however, these areas contain berms or bullet traps that would prevent small arms munitions from entering into terrestrial habitats. At-sea ranges, such as small arms training for boarding exercises, occur sufficiently far from land and do not warrant analysis for impacts to terrestrial species and habitats. Munitions are only dropped on FDM; therefore, only activities that expend munitions that occur at FDM are included for analysis.

At FDM, there is potential for munitions to strike the Micronesian megapode. As stated in Section 3.10.2.3.8 (Micronesian Megapode/Sasangat (*Megapodius laperouse laperouse*)]), FDM supports a number of Micronesian megapodes and, therefore, concentrations of birds at different times of year are likely to co-occur with training exercises. Megapodes on FDM have persisted on FDM through various phases of intense bombardment of the island from the 1970s to the present. The history of the military use of FDM is summarized in Section 3.10.2.1.5 (Farallon de Medinilla), and a brief summary of human exploitation prior to military use of the island is provided in Section 3.6.2.5 (Rookery Locations and Breeding Activities within the Mariana Islands Training and Testing Study Area). In the range area on FDM where ordnance is restricted to inert munitions, vertical vegetation structure and surface cover is greater than in range areas where high explosive ordnance is permitted (U.S. Department of the Navy 2008c). Micronesian megapodes have been observed within the inert munitions area, although at lower densities relative to areas north of the "special use area" where no live-fire training occurs (U.S. Department of the Navy 2008c).

As stated previously, the potential for injury to Micronesian megapodes on FDM, and potentially Mariana fruit bats that may occur on the island, associated with direct strike from inert munitions is considerably lower than the potential for blast effects associated with explosive munitions. This is especially true with heavy weight munitions. By way of example, a single Mk 84 (2,000 lb. explosive bomb) has a hazardous fragment distance of over 1,000 ft. (300 m) (U.S. Department of Defense 2004). This will result in an area, within which animals could be injured or killed and habitat disturbed, of approximately 60 ac. (24 ha). For a single Mk 48 (25 lb. non-explosive practice bomb), an animal would need to be directly struck, or in very close proximity to the area of impact. Allowing for a conservative estimate of an injury zone to be defined as 3 ft. from the impact, the resultant area would be just over 9 square feet ($ft.^2$) (0.8 m^2). For a 20 millimeter projectile, the zone of potential injury would be a smaller area, conservatively estimated at 0.5 $ft.^2$ (0.05 m^2). Hundreds of thousands of 20 millimeter projectiles would need to be expended at a single time and evenly distributed over a given area to equal the impact footprint of a single Mk 84 heavyweight bomb.

3.10.3.2.2.1 No Action Alternative

Training Activities

Under the No Action Alternative, use of inert and live-fire target areas on FDM is expected to impact Micronesian megapodes. Most of these impacts are associated with the use of explosive munitions described above in Section 3.10.3.1.1 (Impacts from Explosions and Weapons Firing). Approximately five pairs of Micronesian megapodes (extrapolated from survey data) may be using the area around the inert and live-fire target areas on FDM and are at risk for a direct strike from ordnance (U.S. Department of the Navy 2009; U.S. Fish and Wildlife Service 2010a). Mariana fruit bats are not likely to be struck by munitions because bats are expected to occur only in the relatively closed-canopy forests in the "special use area" where ordnance is not used. FDM is also believed to be rarely used by foraging bats transiting between lands (U.S. Fish and Wildlife Service 2010a). The possibility of injury to or mortality of individual transient fruit bats may be low, but is not negligible.

The Navy's range manual for the use of FDM contains training restrictions that reduce the potential for direct strike by munitions. For instance, reducing the potential for direct strike from munitions of megapodes and transiting fruit bats is achieved by implementing targeting and weapons restrictions for the northern portion of FDM. Use constraints include targeting restrictions on missile, firing, gunnery exercises, and other amphibious assault exercises. No weapons system is targeted north of the designated "No Fire Line." Bombing exercise restrictions include: (1) targeting three impact areas (only two are for live ordnance) located on the interior plateau of the island and the southern peninsula (the impact areas total approximately 34 ac. (114 ha), which accounts for 20 percent of the island's area); (2) prohibiting cluster bombs and fuel-air explosives or incendiary devices; and (3) placement of targets away from the most sensitive areas, such as seabird nests, and potential roosting sites for transient Mariana fruit bats.

There are a few terrestrial bird species that visit the island, such as the fork-tailed swiftlet, Micronesian starling, Eurasian tree-sparrow, and cattle egret. Breeding for these and other terrestrial bird species is unlikely due to the limited amount of habitat available. While visiting FDM, or using FDM as stopover habitat along migration routes, these birds would be exposed to direct strike by munitions on FDM from strike warfare and firing exercises. Some birds may be killed or injured during these activities, or expend energy stores needed for migration to avoid perturbations generated by weapons firing.

There are a number of protective measures for FDM that minimize potential adverse impacts associated with weapons firing to Micronesian megapodes and habitats used by megapodes and other terrestrial animals. The protective measures were included in the 2010 USFWS Biological Opinion for the Navy's use of FDM (U.S. Fish and Wildlife Service 2010a). The measures include maintaining prohibitions on targeting the northern end of the island (which continues to support higher stature trees), placing of targets within impact areas, and maintaining prohibitions on the use of cluster bombs, bombs greater than 2,000 lb. NEW, fuel-air explosives, and incendiary devices.

Pursuant to the ESA, munitions strike on FDM during training activities under the No Action Alternative will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam rail, Guam Micronesian kingfisher, nightingale reed-warbler, Mariana common moorhen, Mariana crow, or Mariana swiftlet. Munitions strike may affect, and are likely to adversely affect, the Micronesian megapode and Mariana fruit bat on FDM.*

Critical Habitats on Guam or Rota will not be affected by munitions strike.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), munitions strike on FDM under the No Action Alternative will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

There are no testing activities that occur on land. Therefore, there are no potential impacts on terrestrial species or habitats.

3.10.3.2.2.2 Alternative 1

Training Activities

Table 3.0-22 lists the number of bombs, projectiles, missiles, and rockets that may be dropped on FDM under Alternative 1. The activities and type of military expended materials under Alternative 1 would be expended in the same geographic locations as the No Action Alternative.

Specifically at FDM, the number of bombs, projectiles, missiles, and rockets targeting range portions of the island would increase by a factor of five. Most of these increases are associated with small caliber rounds (an increase from 2,900 under the No Action Alternative to 42,000 under Alternative 1). While increased ordnance use may increase exposure to direct strike, percussive force, and the direct and indirect effects of wild land fire, limiting ordnance use to existing impact areas (totaling 34 ac. [114 ha]) would minimize effects to Micronesian megapodes and transient Mariana fruit bats. Limiting explosive ordnance use to existing and defined impact areas will minimize effects on vegetation composition and structure outside of the impact zones. Therefore, impacts for the Micronesian megapode and the Mariana fruit bat are the same under Alternative 1 as with the No Action Alternative.

As described above, a few terrestrial bird species visit FDM, such as the fork-tailed swiftlet, Eurasian tree-sparrow, and cattle egret. While visiting FDM, or using FDM as stopover habitat along migration routes, exposure to munitions strike would increase under Alternative 1. Some birds may be killed or injured during these activities, or expend energy stores needed for migration to avoid perturbations generated by weapons firing. Breeding for these species does not occur on FDM, and these species are relatively common in other areas within the Mariana Islands. The death, injury, or disturbance of a few individuals of these species visiting FDM would not adversely affect populations.

Pursuant to the ESA, munitions strike on FDM during training activities under Alternative 1 would have no effect on the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam Micronesian kingfisher, nightingale reed-warbler, Mariana common moorhen, Mariana crow, or Mariana swiftlet. Munitions strikes may affect, and are likely to adversely affect, the Micronesian megapode and Mariana fruit bat on FDM.*

Critical Habitats on Guam or Rota will not be affected by munitions strike.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), munitions strike on FDM under Alternative 1 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

Under Alternative 1, there are no testing activities that would involve weapons firing on land or toward land-based targets. Therefore, there would be no potential strike of wildlife or plant species from weapons firing during testing activities under Alternative 1.

3.10.3.2.2.3 Alternative 2

Training Activities

Appendix A (Training and Testing Activities Descriptions) lists the training and testing activities that use ordnance on FDM. The number of ordnance use on FDM is summarized for Alternative 2 in Table 3.0-22. The activities and type of military expended materials under Alternative 2 and would be expended in the same geographic locations as the No Action Alternative.

As with Alternative 1, the number of bombs, projectiles, missiles, and rockets targeting range portions of FDM would increase by a factor of five. Alternative 2 differs from Alternative 1 in that 579 more bombs up to 2,000 lb. NEW would be dropped on FDM. As with Alternative 1, most of these increases in ordinance use on FDM are associated with small caliber rounds (an increase from 2,900 under the No Action Alternative to 42,000 under Alternative 2). Limiting explosive ordnance use to existing and defined impact areas will minimize effects on vegetation composition and structure outside of the impact zones. Therefore, impacts on the Micronesian megapode and the Mariana fruit bat are the same under Alternative 2 as with the No Action Alternative.

As described above, a few terrestrial bird species visit FDM, such as the fork-tailed swiftlet, Eurasian tree-sparrow, cattle egret. While visiting FDM, or using FDM as stopover habitat along migration routes, exposure to munitions strike would increase under Alternative 2. These birds would be exposed to more bomb fragments under Alternative 2, relative to Alternative 1. Some birds may be killed or injured during these activities, or expend energy stores needed for migration to avoid perturbations generated by weapons firing. Breeding for these species does not occur on FDM, and these species are relatively common in other areas within the Mariana Islands. The death, injury, or disturbance of a few individuals of these species visiting FDM would not adversely affect populations.

Pursuant to the ESA, munitions strike on FDM during training activities under Alternative 2 would have no effect on the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam Micronesian kingfisher, nightingale reed-warbler, Mariana common moorhen, Mariana crow, or Mariana swiftlet. Munitions strikes may affect, and are likely to adversely affect, the Micronesian megapode and Mariana fruit bat on FDM.*

Critical Habitats on Guam or Rota will not be affected by munitions strike.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), munitions strike on FDM under Alternative 2 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

Under Alternative 2, there are no testing activities that would involve weapons firing on land or toward land-based targets. Therefore, there would be no potential strike of wildlife or plant species from weapons firing during testing activities under Alternative 2.

3.10.3.2.3 Impacts from Ground Disturbance

This section assesses the potential of ground disturbing activities, such as vehicular and pedestrian movements as part of land navigation training and field training exercises. As shown in Table 2.8-1, these exercises may occur on Guam (Southern Land Navigation Area and Northern Land Navigation Area within Naval Base Guam Munitions Site), within Tinian MLA, within the Marpi Maneuver Area on Saipan, and north of the no-fire line on FDM (associated with direct action tactical air control training activities).

3.10.3.2.3.1 No Action Alternative

Training Activities

Under the No Action Alternative, ground disturbance could result from vehicular movements and pedestrian foot traffic as part of field training exercises, airfield seizure activities, and airfield expeditionary training activities. See Table 2.8-1 for a list of these training activities and locations within the Study Area, and the annual estimate of how many exercises would occur under the No Action Alternative.

Field training exercises would occur in areas known to support foraging swiftlets and their roosting and nesting caves. However, the Navy does not train within 328.1 ft. (100 m) of a cave entrance on Guam, and no training will occur within or near caves on Saipan. No foraging habitat (forests or grasslands in which they fly over to capture insects) will be removed due to training, and overflight restrictions are in place to minimize disturbance to fruit bats, moorhens, and swiftlets. The use of incendiary training materials is limited such that fires in forested habitats are unlikely.

On Tinian, non-ESA listed forest birds use limestone forests and tangantangan thickets within the Tinian MLA. Micronesian megapode habitat is found in relatively intact limestone forest areas and in associated edge habitats. Megapode detections are rare on Tinian, and the first megapode sighting in recent years occurred in the spring of 2013 (U.S. Department of the Navy 2013a). A subsequent survey on Tinian in the winter of 2014 did not detect megapodes. Any megapodes utilizing Tinian habitats are most likely transients. The very rare sightings of megapodes on Tinian during surveys makes any potential adverse effects unlikely. There are also a number of bird species not listed under the ESA that reside on Tinian. The rufous fantail, Micronesian starling, Tinian monarch, and bridled white-eye nest within the Tinian MLA in both tangantangan thickets and mature limestone forests found along cliffs. As most field training exercises are expected to occur on hardened surfaces, impacts to vegetation communities and species using these areas as habitats are not expected. Some field exercises, however, may occur in tangantangan forests surrounding the airfield. Further, there are training area restrictions that prohibit military training activities in ecologically sensitive areas (e.g., Hagoi and other wetlands within the Tinian MLA), where Mariana common moorhens nest and forage, along with other native terrestrial birds, migrants, and potential Mariana fruit bats in the vegetation surrounding the wetlands and in intact limestone forests (U.S. Department of the Navy 2013a).

On Saipan, the nightingale reed-warbler and non-ESA listed forest bird species may utilize portions adjacent to or within pedestrian maneuver areas for army reserve units. Training within the Marpi tract is expected to be infrequent and limited to pedestrian land navigation training in open areas. Training restrictions during peak breeding periods (April through June and October through December) will be implemented to the maximum extent practical. Non-ESA listed forest birds described in Section 3.10.2.1.4 (Saipan Marpi Maneuver Area) will not be impacted because of the infrequent use of the area by military personnel.

On FDM, limited pedestrian traversing would occur near the helicopter landing zone, as part of direct action tactical air control training activities. Under the No Action Alternative, three direct action activities would occur on FDM. Because traversing the site would be limited between the control tower and the landing zone, it is unlikely that this limited pedestrian traffic would cause any ground disturbance or damage vegetation. Micronesian megapodes north of the no-fire line would likely experience temporary behavioral impacts (moving away from personnel), but the disturbance would likely have already occurred due to the approach and departure of the helicopter transporting the direct action personnel. Because of the limited nature of the ground disturbance activities associated with this direct action training type, and the infrequent occurrence of the activity on FDM, impacts are expected to be limited to temporary behavioral impacts with no injury or mortality to megapodes.

Pursuant to the ESA, ground disturbance resulting from land and field training exercises under the No Action Alternative will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam Micronesian kingfisher, Mariana crow, Mariana common moorhen, or Mariana fruit bat. Ground disturbance may affect, but not likely adversely affect, the Mariana swiftlet, Micronesian megapode, and the nightingale reed-warbler.*

Critical Habitats on Guam or Rota will not be affected by ground disturbing activities.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), ground disturbance resulting from land and field training exercises under the No Action Alternative will not result in significant adverse effects on terrestrial bird populations.

<u>Testing Activities</u>

Under the No Action Alternative, no testing events would occur on land or impact terrestrial species or habitats.

3.10.3.2.3.2 Alternative 1 and Alternative 2

Under both Alternatives 1 and 2, direct action trainings on FDM would increase to 18 per year. This would increase exposures of megapodes and fruit bats to pedestrian traffic; however, traversing the site would be limited to the area surrounding the helicopter landing zone, north of the "no fire line." Because of the limited nature of the ground disturbance activities associated with this direct action training type, and the infrequent occurrence of the activity on FDM, impacts are expected to be limited to temporary behavioral impacts with no injury or mortality to megapodes.

Pursuant to the ESA, ground disturbance resulting from land and field training exercises under Alternative 1 or Alternative 2 would have no effect on the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam Micronesian kingfisher, Mariana crow, Mariana common moorhen, or Mariana fruit bat. Ground disturbance may affect, but not likely adversely affect, the Mariana swiftlet, Micronesian megapode, and the nightingale reed-warbler.*

Critical Habitats on Guam or Rota will not be affected by ground disturbing activities.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), ground disturbance resulting from land and field training exercises under Alternative 1 or Alternative 2 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

There are no testing activities that involve ground disturbance; therefore, testing activities will have no impact on terrestrial species or habitats.

3.10.3.2.4 Impacts from Wildfires

This section provides an assessment of wildfire potential associated with training activities in land training areas within the Study Area, and how wildfires could impact species and habitats. There is minimal risk for training activities to start wildfires on Guam, Rota, Tinian, or Saipan. Training activities that occur here follow restrictions in COMNAVMARIANASINST 3500.4A to minimize the potential for wildfires. Live ordnance use on FDM has created burnovers of vegetation areas within the impact areas.

Training (foot and vehicle land navigation, sniper training, small field exercises) in the Northern Land Navigation Area and other areas of the Naval Base Guam Munitions Site, as well as with field training exercises within the Andersen AFB, Tinian MLA, and Saipan Marpi Maneuver Area, could start a wildfire; however, the use of incendiary training materials is limited such that fires in forested habitats are unlikely. A fire management plan was developed by the U.S. Forest Service to minimize impacts associated with wildland fires (U.S. Department of the Navy 2009). To date, no wildland fires have been ignited within the Naval Base Guam Munitions Site due to military activity. Fires that have burned areas within the Naval Base Guam Munitions Site originated off DoD properties and were generally associated with trash burning (U.S. Department of the Navy 2009). In addition, the existing configuration of firebreaks and road networks generally confines fires to upland savanna portions of the Naval Base Guam Munitions Site so they do not reach wetland habitats (U.S. Department of the Navy 2009). Wildfires on Andersen AFB are less frequent, and none have been attributed to training exercises (U.S. Department of the Navy 2009).

The Tinian MLA, particularly around Tinian North Field, is composed of large areas of tangantangan, secondary forest, and open fields. Grass fires are common on Tinian and are more likely to occur during the dry season. Most fires are intentionally lit. Fires initiated in open fields have the potential to persist when forest habitat is reached, resulting in a direct threat to federally listed species (U.S. Department of the Navy 2009). Incidental sightings of intentionally set fires have occurred in the Tinian MLA. Some speculate the fires may have been started by locals to facilitate collection of coconut crabs or scrap metal (U.S. Department of the Navy 2013a).

The potential impacts of wildfire on terrestrial species and habitats will focus on FDM, where the use of live fire and explosive munitions is authorized. Fire season should be considered year-round at FDM; however, fuel loading (the amount of flammable vegetation) and ignition potential would increase during the dry season. Fire danger increases during the dry season (February through April) and decreases in the wet season (July through October). Wildland fires can set back succession within vegetation communities and facilitate establishment of fire-tolerant species, which may alter the composition and structure of vegetation communities. Fires may cause direct mortality of birds and nests in vegetated areas with fuel loadings sufficient to carry fire, and indirect mortality through exposure to smoke or displacement of nest predators into nesting habitats.

Fire can indirectly affect wildlife at FDM by changing the physical and biological characteristics of the area, which subsequently degrades habitats and reduces the forage base. Physical features that will be exposed to heat and flames include soil structure and microclimate conditions. Fire has been shown to increase soil temperatures, alter soil moisture holding capacity, and modify soil rainfall infiltration (Neary et al. 2005). These physical features are indirectly exposed to post-fire erosion and alterations of light and shade, temperature, humidity, and wind as a result of vegetation destruction. Light levels, temperatures, and wind speeds will increase with destruction of canopy plants, and relative humidity will decrease (Hoffmann et al. 2003). Because vegetation cover affects erosion rate, soil erosion may occur after fire except where rapid establishment of non-native invasive grasses are prevalent. Grass invasion may occur following removal of shrub and tree canopy (D'Antonio and Vitousek 1992; Tunison et al. 2001). Chemical features that will be exposed to heat, flames, smoke, and ash include soil nutrients and water, which will be indirectly exposed to post-fire changes in content and cycling rates. Soil nutrient availability will be altered through volatilization of certain elements to the atmosphere in smoke (e.g., carbon, nitrogen, and sulfur), conversion to more available forms in the ash (e.g., potassium, phosphorus, and divalent cations), wind dispersal of the ash, and surface erosion (Agee 1993).

Biotic features of the habitat that will be exposed to heat, flames, smoke, and ash include all living organisms in the exposure area, litter layers on the forest floor, organic matter within the surface soil horizon, and seeds within the litter and surface soil. These types of organic matter are typically used in megapode nests for incubation of eggs via heat from decomposition. Forage organisms will be directly exposed to injury or death, and seeds, litter, and organic matter will be directly exposed to destruction and loss (Cochrane 2003). These effects, in turn, will indirectly expose soil to long-term changes in fertility and structure as a result of disrupted decomposition and nutrient cycling processes, reduced nutrient and water retention by organic matter, increased nutrient losses in runoff and leaching, and reduced ecosystem primary production due to loss of leaf area and photosynthesis (Cochrane 2003).

As discussed in Section 3.10.2.1.5 (Farallon de Medinilla) and evidenced in Figure 3.10-4, military bombardment has reduced forested portions of FDM, primarily within impact areas. Forests can continue to degrade as ground cover loses canopy closure, thereby reducing fuel moisture content in vegetation and facilitating fires spreading into areas outside the impact areas. Further, invasive herbaceous vegetation can quickly colonize the newly opened habitats, which increases fine fuel loading and the ability of fires to spread. The potential for military bombardment of FDM to alter vegetation composition and structure was noted during post-bombardment surveys conducted in August 1997. These surveys revealed 25 to 50 fresh bomb craters and a large section of the island burned to bare earth (Lusk et al. 2000; U.S. Fish and Wildlife Service 1998).

Based on surveys conducted in 1974 (as discussed in Section 3.10.2.1.5, Farallon de Medinilla), recent assessments in 2000 (Lusk et al. 2000), and current surveys of FDM's avifauna and knowledge of FDM's vegetation community status (U.S. Department of the Navy 2013a), the vegetation and avian communities have changed significantly since 1974. Prior to intensive military use of the island, the presence of more trees with a higher canopy resulted in a higher number of terrestrial birds and tree nesting seabirds (Lusk et al. 2000).

3.10.3.2.4.1 No Action Alternative, Alternative 1, and Alternative 2

Training Activities

Training activities that involve high explosive detonations on FDM introduce the potential for wildfires on the island. The number of training activities using explosives at FDM is presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Although the use of ordnance with high explosives increases from the No Action Alternative to Alternative 1, and from the No Action Alternative to Alternative 2, the potential for wildfire is the same for all alternatives.

Cluster bombs, live cluster weapons, live scatterable munitions, fuel-air explosives, incendiary devices, and bombs greater than 2,000 lb. are prohibited on FDM. It should be noted that some munitions contain a small amount of phosphorous for spotting charges, and smoke markers are used in some direct action training activities. Phosphorous is not a main constituent to any munitions used on FDM. The live-fire weapons allowed are only used in impact areas authorized for live and inert ordnance. The areas for target placement only support low growing vegetation because of long-term training with explosives. Due to the lack of fuels in the area, explosions have not resulted in wildfires. Dense vegetation grows on the northern portion of the island within the special use area, which could create a wildfire if weapons are misfired. However, this dense vegetation and shaded canopy of trees in the northern portion of the island likely increases the moisture content of vegetation, thereby decreasing the ability of fires to spread into the special use area.

Mariana fruit bat sightings are very rare on FDM—the last sighting, of a single fruit bat, was reported in 2008 (U.S. Department of the Navy 2013a). Catastrophic events within the Mariana archipelago may temporarily cause populations of fruit bats to fluctuate on different islands, although some movement between islands seems to be a natural occurrence. These events may result from typhoons, poaching, or volcanic eruptions. Catastrophic events and other factors may cause Mariana fruit bat populations on FDM to temporarily increase, thereby exposing transient and permanent resident bats to potential harassment and harm associated with live-fire training. FDM may support a small number of year-round residents, and Mariana fruit bats can be assumed to utilize FDM as a resting point for longer inter-island movements. Due to infrequent transient use of FDM by Mariana fruit bats, and the location of likely foraging and roosts confined to the northern portion of the island (within the special use area), impacts associated with wildfires occurring primarily in the central portion of the island would be unlikely.

As described above, munitions use on FDM can ignite wildfires. Wildfire intensity may vary based on the amount and type of munitions, wind speed, levels of humidity, seasonal variation in vegetation thickness and composition, and successional state of vegetation. Micronesian megapodes on FDM would be expected to fly away from smoke, but exposure to smoke inhalation would result in some form of respiratory distress (U.S. Fish and Wildlife Service 2010a). Direct mortality of megapodes could result from intensive respiratory distress or encirclement of burning vegetation. Megapode eggs, even in burrows, would not likely survive a wildfire overburn on FDM. Likewise, any fledglings within a burn area would be expected to suffer intensive respiratory distress, unable to flee smoke or burning vegetation. As stated above, fires are unlikely to spread to the northern portion of FDM; therefore, the northern portion of the island would continue to serve as refugia for Micronesian megapodes that either reside in this area or for megapodes able to flee smoke and flames from target areas.

Pursuant to the ESA, wildfires resulting from explosive munitions and bombardment of FDM under the No Action Alternative, Alternative 1 or Alternative 2 will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam Micronesian kingfisher, Mariana crow, Mariana common moorhen, Mariana swiftlet, or nightingale reed-warbler. Wildfires may affect, but not adversely affect the Mariana fruit bat. Wildfires may affect and are likely to adversely affect, Micronesian megapodes on FDM.*

Critical Habitats on Guam or Rota will not be affected by wildfires.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), wildfires resulting from explosive munitions and bombardment of FDM under the No Action Alternative, Alternative 1 or Alternative 2 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

No testing activities are included under the No Action Alternative. No testing activities for Alternative 1 or Alternative 2 involve munitions use at FDM. There are no impacts to terrestrial species and habitats from testing activities that use munitions.

3.10.3.3 Secondary Stressors

This section summarizes how secondary stressors (stressors that are not directly part of activities) can potentially impact terrestrial habitats and species. Specifically, this section addresses the potential of water quality stressors, air quality stressors, and for training activities to degrade island habitats within the Marianas through the accidental introduction of invasive species. Section 3.10.3.3.1 (Impacts from Invasive Species Introductions) discusses potential introduction pathways of invasive species associated with training activities described in this EIS/OEIS.

3.10.3.3.1 Impacts from Invasive Species Introductions

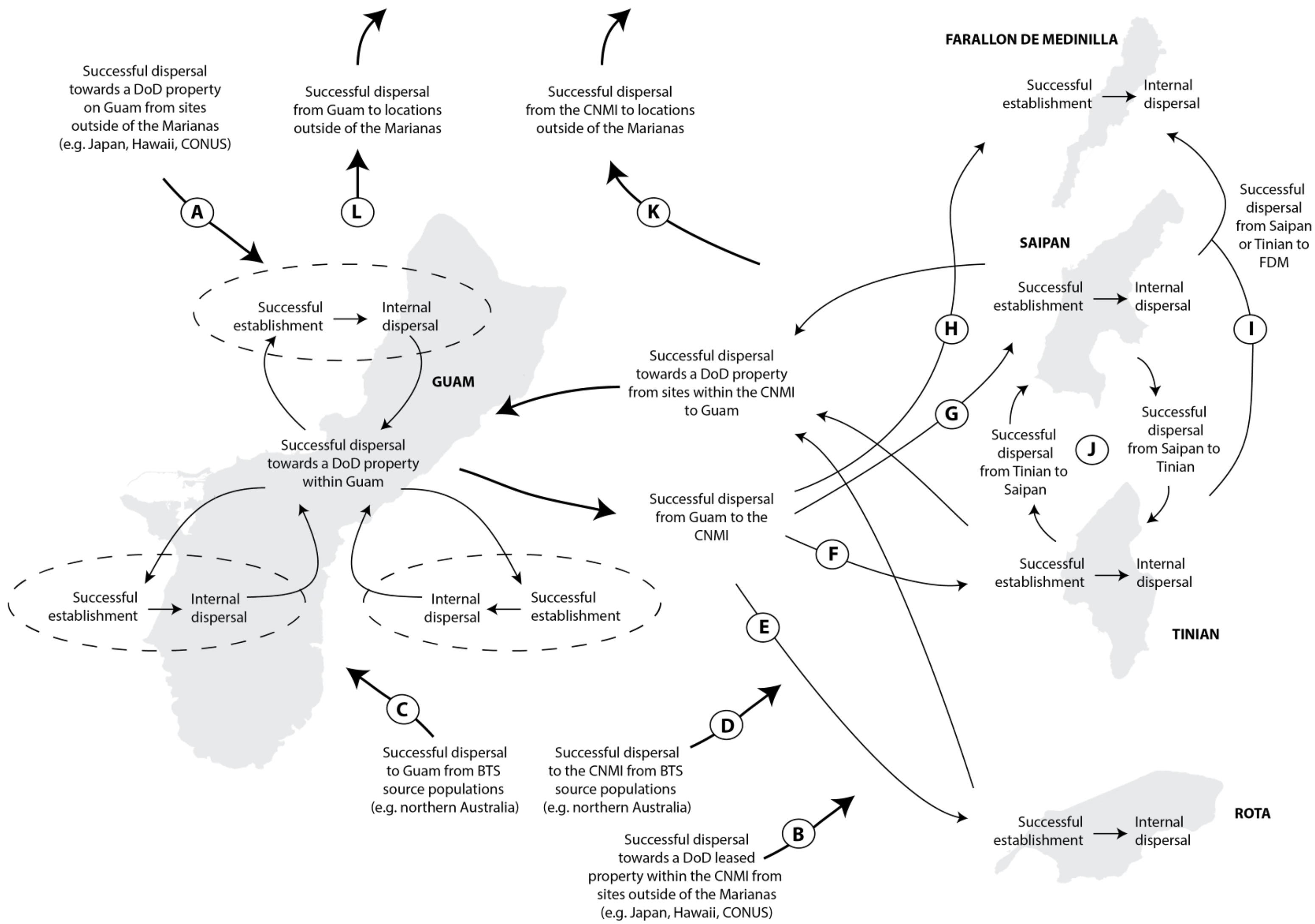
In general, a species introduction to terrestrial environments on Guam and the CNMI may be described in stages. First, species established in other areas or from their native ranges enter into dispersal pathways. As an example, pathways may include transportation modes (such as landing gear of airplanes or within cabin or cargo holds) or commercial pathways (trade in seeds, plant material, or animals). A second stage of the invasion process is the live release of species which, depending on the mode of introduction, is important because most species do not survive the transport (Thompson and Davis 2011). A third stage of invasion is that populations of species establish and adapt to new environments (Davis 2009). Figure 3.10-10 shows the general steps involved in the establishment and spread of invasive species associated with military training in the Marianas.

Pathways of invasive species associated with military training activities include various transport modes, such as marine transport (e.g., ballast water releases, biofouling of ship hulls), air transport (organisms transported in aircraft cabins, cargo holds, or landing gear), or land transports during intra-island movements (e.g., transporting of organisms from one training area to another attached to unclean vehicles). Personnel movements can also present introduction pathways. For instance, organisms (such as seed or other plant materials) can be transported on clothing or in gear. Figure 3.10-11 shows the potential introduction pathways of invasive species to terrestrial habitats associated with each warfare area identified in Chapter 2 (Description of Proposed Action and Alternatives).

Introduction pathways that originate on Guam and end on Rota, Tinian, Saipan, FDM, and other locations outside of the Mariana Islands present a potential hazard for brown treesnake dispersal. Also, pathways that carry equipment, material, munitions, and personnel from northern Australia to the Mariana Islands also present a potential danger for brown treesnake introduction. The Brown Tree Snake Control and Interdiction Requirements is included in the COMNAVMARIANASINST 3500.4A (dated 8 October 2013). This document describes roles and responsibilities for exercise planners to interdict and control brown treesnakes and to disseminate information to participants throughout the chain of command. Other policies and instructions associated with military training activities and potential invasive species introductions include Office of the Chief of Naval Operations Instruction 5090.1D (updated in 2013), Armed Forces Pest Management Board Technical Guide 31 (Armed Forces Pest Management Board 2012). Table 3.10-7 provides descriptions of potential invasive species pathways shown in Figure 3.10-10, as well as countermeasures and policies to reduce the number of potential species within pathways or to eliminate the potential for introduction though interdiction. In general, the military's strategy for addressing invasive species issues within the Marianas includes analyses of critical control points along potential introduction pathways, coordination with local and regional stakeholders, authoring exercise-specific interdiction plans, funding research for landscape-level control of invasive species (e.g., aerial bait drops for brown treesnake control), and regional participation in biosecurity planning.

The Navy cooperates with the USFWS, the U.S. Department of Agriculture Animal and Plant Health Inspection Service, and the U.S. Department of Agriculture Wildlife Services, as well as other government agencies and working groups to identify pathways associated with military activities in the Marianas. After identifying pathways associated with a particular activity, risks are reduced by implementing policies and procedures to reduce the likelihood of species to occur within a particular introduction pathway. For instance, all troops involved in training activities in land areas of the Study Area conduct self inspections to avoid potential introductions of invasive species to Guam and the CNMI. Troops inspect all gear and clothing (e.g., boots, bags, weapons, and pants) for soil accumulations, seeds, invertebrates, and possible inconspicuous stowaway brown treesnakes). The intent of this measure is to minimize the number of potentially invasive species in introduction pathways (U.S. Department of the Navy 2009; U.S. Fish and Wildlife Service 2010a).

The Navy also complies with DoD Transportation Regulations, Chapter 505 protocols, by implementing a 100 percent inspection of all outgoing vessels and aircraft with dog detection teams to meet 100 percent inspection goals for large-scale training activities (U.S. Department of Defense 2011). To mitigate the limited inspection capability of the U.S. Department of Agriculture Wildlife Service, the Navy notifies point of destination port or airport authorities in the event military units, vehicles, and equipment leave Guam without inspection.



Notes: CNMI = Commonwealth of the Northern Mariana Islands. DoD = Department of Defense. Arrows represent conceptual introduction pathways. Letters correspond to descriptions provided in Table 3.10-7. Islands are not drawn to scale.

Figure 3.10-10: Conceptual Model of Potential Invasive Species Pathways Associated with Military Training Activities

Table 3.10-7: Description of Potential Invasive Species Pathways and Interdiction Measures

Potential Introduction Pathway				Interdiction or Prevention Measure[4]
Origin and Destination	**Letter[1]**	**Pathway Description[2]**	**Brown Treesnake Pathway?[3]**	
Outside of the Mariana Islands to Guam	**A**	All personnel pathways and transport modes.	No	Policy described in OPNAVINST 5090.1D Chapter 22-10.3 (ballast water), 5090.1D Chapter 22-13.2.1.2 (hull husbandry), and 5090.1D Chapter 24 (invasive plants, pest, and animal protocols). Adherence with AFPMB Technical Guide 31 protocols on vehicle/equipment washdown procedures and other APHIS PPQ inspection procedures for deployments and redeployments.
Outside of the Marianas to CNMI	**B**		No	
Northern Australia to Guam	**C**		**Yes**	
Northern Australia to CNMI	**D**		**Yes**	
Guam to Rota	**E**	All personnel pathways and some transport modes (e.g., ballast water, hull husbandry, food stores, landing gear, cabin and cargo holds).	**Yes**	Funding USDA-WS for interdiction of BTS at NBG Main Base and Andersen AFB (e.g., BTS trapping at piers, wharfs, flight lines) with goal of 100% inspections departing Guam. JRM funds interdiction at both installations. Coordination with appropriate regional stakeholders for exercise-specific measures, including redundant inspections on Rota, Tinian, and Saipan. Development of exercise-specific BTS interdiction implementation plans when exercises require transport of assets and personnel from Guam to CNMI. Funding of landscape-level research and pilot projects for BTS source population control on Guam.
Guam to Tinian	**F**	All personnel pathways and transport modes.	**Yes**	
Guam to Saipan	**G**	All personnel pathways and transport modes.	**Yes**	
Guam to FDM	**H**	Some personnel pathways (e.g., training gear, humans as disease vectors, consumables), and some transportation modes (helicopter cabins).	**Yes**	
Tinian/Saipan to FDM	**I**		No	5090.1D Chapter 24 (invasive plants, pest, and animal protocols).

Table 3.10-7: Description of Potential Invasive Species Pathways and Interdiction Measures (continued)

Potential Introduction Pathway				Interdiction or Prevention Measure[4]
Origin and Destination	Letter[1]	Pathway Description[2]	Brown Treesnake Pathway?[3]	
Saipan to/from Tinian	**J**	All personnel pathways and transport modes.	No	OPNAVINST 5090.1D Chapter 24 (invasive plants, pest, and animal protocols).
CNMI to locations outside of Mariana Islands	**K**		No	Same as pathway A and B.
Guam to locations outside of the Marianas	**L**		**Yes**	Funding interdiction of BTS on DoD lands (e.g., BTS trapping at piers, wharfs, flight lines) with goal of 100% inspections departing Guam. Funding of landscape-level research and pilot projects for BTS source population control on Guam.

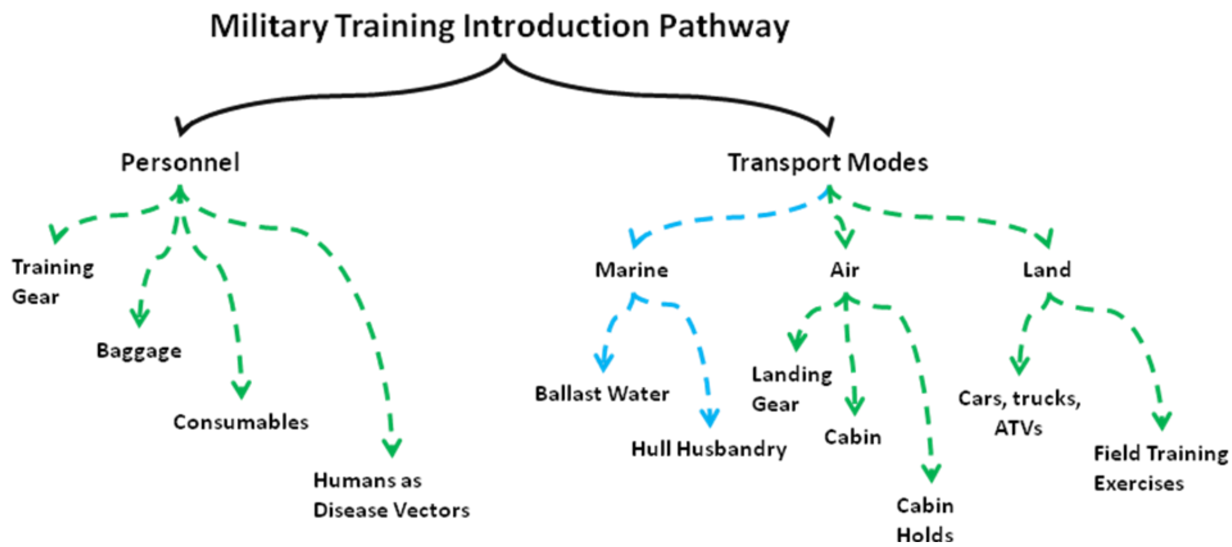
[1] Introduction pathway letter corresponds to the conceptual map of potential pathways shown in Figure 3.10-10.

[2] Pathway description corresponds to potential pathway diagram from military training activities shown in Figure 3.10-11.

[3] Only pathways originating from Guam or from northern Australia are considered potential pathways for brown treesnake dispersal.

[4] Interdiction and control measures for brown treesnakes are included in Commander, U.S. Naval Forces Marianas Instruction 3500.4A. The JRM INRMP addresses brown treesnake control for conservation purposes.

Notes: AFPMB = Armed Forces Pest Management Board, BTS = brown treesnake, CNMI = Commonwealth of the Northern Mariana Islands, DoD = Department of Defense, FDM = Farallon de Medinilla, INRMP = Integrated Natural Resources Management Plan, JRM = Joint Region Marianas, NBG = Naval Base Guam, OPNAVINST = Office of the Chief of Naval Operations Instruction



Source: Adapted from Lodge et al. (2006)

Figure 3.10-11: Potential Introduction Pathways of Invasive Species Associated with Military Training in the Marianas

In addition, the Navy routes inbound personnel and cargo for tactical approach exercises that require an uninterrupted flow of events direct to CNMI training locations to avoid Guam seaports and airfields to the extent possible. For example, a Hawaii-based unit destined to Tinian for anti-terrorism/urban warfare type training will travel direct to Tinian and only through Guam on the outbound journey.

Further, the Navy provides extensive funding for brown treesnake eradication efforts and research by other agencies. The Navy is also establishing quarantine areas for outbound cargo traveling from Guam to CNMI and locations outside the MITT Study Area.

3.10.3.3.1.1 No Action Alternative, Alternative 1, and Alternative 2

Training Activities

The No Action Alternative, Alternative 1, and Alternative 2 do not introduce additional pathways for invasive species to enter, establish, and spread from DoD installations and ranges within the Study Area. Further, protective biosecurity measures employed by the Navy reduce the number of invasive species within existing potential introduction pathways. In conclusion, training activities under the No Action Alternative, Alternative 1, or Alternative 2 would not increase risks to vegetation communities, wildlife resources, or ESA-listed species or habitats within the Study Area.

Pursuant to the ESA, secondary stressors associated with the potential introduction of invasive species to terrestrial habitats resulting from training activities under the No Action Alternative, Alternative 1, or Alternative 2 will not affect the Serianthes *tree,* Osmoxylon mariannense*,* Nesogenes rotensis*, Rota bridled white-eye, Guam Micronesian kingfisher, Mariana crow, Mariana common moorhen, Mariana fruit bat, Mariana swiftlet, nightingale reed-warbler, or Micronesian megapode.*

Secondary stressors will not affect Critical Habitats on Guam or Rota.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), secondary stressors associated with the potential introduction of invasive species to terrestrial habitats resulting from training activities under the No Action Alternative, Alternative 1, or Alternative 2 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

Because there are no testing activities associated with land-based training, testing activities would not introduce secondary stressors in terrestrial habitats and would not impact terrestrial biological resources.

3.10.3.3.2 Impacts from Water and Air Quality Stressors

The potential for water and air quality stressors associated with training and testing activities to indirectly affect terrestrial biological resources as secondary stressors were analyzed. The assessment of potential water and air quality stressors are in Section 3.1 (Sediments and Water Quality) and Section 3.2 (Air Quality); the assessment addresses specific activities in local environments that may affect terrestrial species and habitats.

3.10.3.3.2.1 No Action Alternative, Alternative 1, and Alternative 2

Training Activities

As noted in Section 3.1 (Sediments and Water Quality) and Section 3.2 (Air Quality), implementation of the No Action Alternative, Alternative 1, or Alternative 2 on Guam, Rota, Tinian, and Saipan would not adversely affect sediments, water, or air quality. Therefore, military activities would not indirectly impact terrestrial species or habitats on these islands. Within impact areas on FDM where explosive munitions are permitted, further erosion of soils may inhibit the long-term establishment of vegetation. The degradation of habitat associated with secondary stressors, therefore, may limit the natural succession of vegetation establishment if military use of FDM ceases in the future. Limiting the ability of damaged areas to recover would limit the recovery potential of the Micronesian megapode on FDM.

Pursuant to the ESA, secondary stressors associated with impacts to water and air quality resulting from training activities under the No Action Alternative, Alternative 1, or Alternative 2 will not affect the Serianthes tree, Osmoxylon mariannense, Nesogenes rotensis, Rota bridled white-eye, Guam Micronesian kingfisher, Mariana crow, Mariana common moorhen, Mariana swiftlet, nightingale reed-warbler, or Micronesian megapode. Secondary stressors may affect and are likely to adversely affect, Micronesian megapodes on FDM.

Secondary stressors will not affect Critical Habitats on Guam or Rota.

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), secondary stressors associated with impacts to water and air quality resulting from training activities under the No Action Alternative, Alternative 1, or Alternative 2 will not result in significant adverse effects on terrestrial bird populations.

Testing Activities

Because there are no testing activities associated with land-based training, testing activities would not introduce secondary stressors in terrestrial habitats and would not impact terrestrial biological resources.

3.10.4 Summary of Potential Impacts on Terrestrial Species and Habitats

3.10.4.1 Combined Impacts of All Stressors

As described in Section 3.0.5 (Overall Approach to Analysis), this section evaluates the potential for combined impacts of all stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the analyses of each stressor in the sections above and are summarized in Section 3.10.4.2 (Endangered Species Act Determinations).

There are generally two ways a terrestrial biological resource could be exposed to multiple stressors. The first would be if, for example, an animal were exposed to multiple sources of stress from a single activity or activities (e.g., an amphibious landing activity may include an amphibious vessel that would introduce potential acoustic and physical strike stressors). The potential for a combination of these impacts from a single activity would depend on the range of effects from each of the stressors and the response or lack of response to that stressor. Most activities as described in the Proposed Action involve multiple stressors; therefore, it is likely that if a receptor were within the potential impact range of those activities, it may be impacted by multiple stressors simultaneously. This would be more likely to occur during large-scale exercises or activities that span a period of days or weeks (such as a sinking exercise or composite training unit exercise).

Secondly, an individual animal could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where training and testing activities are more concentrated (e.g., air to ground ordnance drops at FDM, aircraft take offs and landings at Andersen AFB, and routine activity locations) and in areas that individual animals frequent because it is within the animal's home range, migratory route, breeding area, or foraging area. Except for the few concentrated areas mentioned above, combinations are unlikely to occur because training and testing activities are generally separated in space and time in such a way that it would be very unlikely that any individual animal would be exposed to stressors from multiple activities. However, animals with a small home range intersecting an area of concentrated military activity have elevated exposure risks relative to animals that simply transit the area through a migratory route. The majority of the proposed training and testing activities has few participants, and are of a short duration (the order of a few hours or less).

Multiple stressors may also have synergistic effects. For example, terrestrial animals that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Animals that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple military stressors, the synergistic impacts from the combination of military stressors on terrestrial animals are difficult to predict.

Although potential impacts on certain bird species from the Proposed Action could include injury or mortality, impacts are not expected to decrease the overall fitness or result in long-term population-level impacts of any given population. In cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to reduce the potential impacts are discussed in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring). Potential impacts anticipated from the Proposed Action are summarized in Section 3.10.4.2 (Endangered Species Act Determinations).

3.10.4.2 Endangered Species Act Determinations

Based on the type of activities in the various land training areas of the MITT Study Area, the Navy presents the following summary of effects determinations to ESA-listed species and Critical Habitats.

3.10.4.2.1 Critical Habitats

3.10.4.2.1.1 Critical Habitats on Guam

Critical Habitat designations on Guam for the Mariana crow, Mariana fruit bat, and Micronesian kingfisher are confined to the terrestrial portions of the Guam National Wildlife Refuge fee simple portion (Ritidian Unit). Because training does not occur within the Ritidian Unit and there is no need for training to access the portion of the road that descends Ritidian Cliff to the Ritidian Unit, the Navy concludes that training and testing activities would have no effect on designated Critical Habitat on Guam.

3.10.4.2.1.2 Critical Habitats on Rota

Critical Habitat designations on Rota for the Mariana crow and Rota bridled white-eye occur entirely within areas where the Navy does not train; therefore, the Proposed Action would have no effect on or result in an adverse modification to the designated Critical Habitat units on Rota and would not disturb the various primary constituent elements. The Navy concludes that the designated Critical Habitat avoidance, invasive species interdiction, and control measures (described in Chapter 5) are sufficient to not affect designated Critical Habitat on Rota.

3.10.4.2.2 Summary of Endangered Species Act Effects Determinations

In 2010, the USFWS Pacific Islands Fish and Wildlife Office issued a Biological Opinion, pursuant with Section 7 of the ESA, on proposed training activities within the MIRC. The Biological Opinion concluded that training activities within the Study Area would have no effect on the *Serianthes nelsonii*, *Osmoxylon mariannense*, *Nesogenes rotensis*, Guam Micronesian kingfisher, Guam rail, Mariana crow, Rota bridled white-eye, or critical habitat units on Guam and Rota. The Biological Opinion also concluded that training activities may affect, but are not likely to adversely affect, the nightingale reed warbler, Mariana swiftlet, and Mariana common moorhen. The Biological Opinion concluded that training activities may affect, and are likely to adversely affect, the Micronesian megapode and the Mariana fruit bat. The Action Area (the area considered in the Section 7 ESA consultation, subject to direct and indirect effects) for the Biological Opinion issued by the USFWS in 2010 is the same area considered for analysis in this EIS/OEIS. In early 2015, the Navy completed Section 7 ESA consultation for activities proposed in this EIS/OEIS with the issuance of a new Biological Opinion. Table 3.10-8 summarizes the ESA determinations for each substressor analyzed in this EIS/OEIS.

The Navy also conducted an analysis of potential effects for species considered to be candidates for ESA listing. These species include the 22 species included in the USFWS Federal Register publication in September 2014. These species do not co-occur with military training activities described in this EIS/OEIS, either because the species has been extirpated from military training areas or because the species is confined to habitats within military properties or lease areas where training does not occur. Therefore, military training activities described in this EIS/OEIS will have no effect on species considered to be candidates for ESA listing.

3.10.4.3 Migratory Bird Treaty Act Determinations

Under the MBTA regulations applicable to military readiness activities (50 C.F.R. Part 21), the stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations. While this determination is applicable to all terrestrial birds that occur in the Study Area, the Navy carried out a focused analysis for native land birds known to breed within the Study Area.

Pursuant with the DoD’s obligations under 50 C.F.R. Part 21, the DoD will continue to implement training restrictions on FDM (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring), monitoring of bird populations on FDM, and other natural resource projects described in the Joint Region Marianas Integrated National Resources Management Plan specifically designed to benefit native terrestrial birds (U.S. Department of the Navy 2013a).

Table 3.10-8: Summary of Endangered Species Act Effects Determinations for Endangered Species Act-Listed Terrestrial Species

Navy Activities and Stressors	Hayun Lagu (*Serianthes* tree)	Ko'ko' (Guam rail)	Sihek (Guam Micronesian kingfisher)	Pulattat (Mariana common moorhen)	Aga (Mariana crow)	Fanihi (Mariana fruit bat)	Yayaguak (Mariana swiftlet)	Sasangat (Micronesian megapode)	Ga'ga' Karisu (nightingale reed-warbler)	Nosa Luta (Rota bridled white-eye)
Acoustic Stressors										
Explosives, weapons firing, launch, and impact noise	NE	NE	NE	NE	NE	LAA	NE	LAA	NE	NE
Aircraft noise	NE	NE	NE	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NE
Physical Stressors										
Aircraft and aerial target strike	NE	NE	NE	NLAA	NE	LAA	NE	LAA	NE	NE
Military expended materials	NE	NE	NE	NE	NE	NLAA	NE	LAA	NE	NE
Ground disturbance	NE	NE	NE	NE	NE	NE	NLAA	LAA	NLAA	NE
Wildfires	NE	NE	NE	NE	NE	LAA	NE	LAA	NE	NE

Notes: NE = No effect; NLAA = May affect, not likely to adversely affect; LAA = May affect, likely to adversely affect

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3.11 Cultural Resources

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3.11 CULTURAL RESOURCES

CULTURAL RESOURCES SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following were analyzed for impacts on cultural resources.

- Acoustic (underwater explosives)
- Physical disturbance (ground disturbance, use of towed in-water devices, deposition of military expended materials, and use of seafloor devices)

Preferred Alternative (Alternative 1)

- Acoustic and Physical Disturbance: Acoustic and physical stressors would not adversely affect submerged historic resources within United States territorial waters and National Register of Historic Places-eligible resources on Guam and the Commonwealth of the Northern Mariana Islands in accordance with Section 106 of the National Historic Preservation Act because measures were previously implemented to protect these resources and will continue to be implemented according to the conservation measures and procedures identified and described in the 2009 Mariana Islands Range Complex Programmatic Agreement. In accordance with Section 402 of the National Historic Preservation Act, no World Heritage Sites would be affected.
- The Programmatic Agreement identifies 13 No Training areas (eight on Guam and five on Tinian) and 35 Limited Training areas (20 on Guam and 15 on Tinian). Limited Training areas are defined as pedestrian traffic areas with vehicular access limited to designated roadways and/or the use of rubber-tired vehicles. No pyrotechnics, demolition, or digging is allowed without prior consultation with the appropriate Historic Preservation Office. In addition to establishing No Training and Limited Training areas, stipulations for additional cultural resources investigations in unsurveyed areas, archaeological monitoring and conditions documentation of military use of ingress and egress paths and training areas, and preparation of field reports were also implemented.

3.11.1 INTRODUCTION

Cultural resources are found throughout the Mariana Islands Training and Testing (MITT) Study Area (Study Area). The approach for the assessment of cultural resources includes defining the resource; presenting the regulatory requirements for the identification, evaluation, and treatment within established jurisdictional parameters; establishing the specific resources subtypes in the Study Area; identifying the data used to define the current conditions; and providing the method for impact analysis (see Section 3.0, Introduction).

Cultural resources are defined as any district, landscape, site, structure, or object, as well as other physical evidence of human activity, that are considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources include archaeological resources, historical architectural resources, and traditional cultural properties related to pre-contact (prior to European contact) and post-contact or historic periods.

Archaeological resources include pre-contact and post-contact locations or sites where human actions resulted in detectable changes. Archaeological resources can have a surface component, a subsurface component, or both. Archaeological resources also include human remains, which may be considered sacred. Post-contact archaeological resources are those resources dating from after European contact. They may include subsurface features such as wells, cisterns, or privies. Other historical archaeological resources include artifact concentrations and building remnants (e.g., foundations). Submerged cultural resources include historic shipwrecks and other submerged historic materials, such as sunken airplanes and pre-contact cultural remains. Architectural resources are elements of the built environment. These resources include existing buildings; dams; bridges; and other structures of historic, engineering, or artistic significance. Factors in determining a resource's significance are its age, integrity, design, and association with important events or persons. Traditional cultural resources are resources associated with beliefs and cultural practices of a living culture, subculture, or community. These beliefs and practices must be rooted in the group's history and must be important in maintaining the cultural identity of the group. Pre-contact archaeological sites and artifacts, historic and contemporary locations of traditional events, sacred places, landscapes, and resource collection areas, including fishing, hunting or gathering areas, may be traditional cultural resources.

Cultural resources are officially known as historic properties when they meet the specific criteria of the National Historic Preservation Act and its associated regulations. The cultural resources discussed in this section are historic properties unless otherwise noted (e.g., sovereign resources).

3.11.1.1 Identification, Evaluation, and Treatment of Cultural Resources

Procedures for the identification, evaluation, and treatment of cultural resources within United States (U.S.) territorial waters (within 12 nautical miles [nm]) are contained in a series of federal laws and regulations. Cultural resources are protected by a variety of laws and their implementing regulations: the National Historic Preservation Act of 1966 as amended in 2006; the Archeological and Historic Preservation Act of 1974; the Archaeological Resources Protection Act of 1979; the American Indian Religious Freedom Act of 1978; the Native American Graves Protection and Repatriation Act of 1990; the Submerged Lands Act of 1953; the Abandoned Shipwreck Act of 1987; and the Sunken Military Craft Act of 2004. The Advisory Council on Historic Preservation further guides treatment of archaeological and architectural resources through the regulations, *Protection of Historic Properties* (36 Code of Federal Regulations [C.F.R.] 800). Historic properties, as defined by the National Historic Preservation Act, represent the subset of cultural resources listed in or eligible for inclusion in the National Register of Historic Places.

National Historic Landmarks are cultural resources of national historical importance and are automatically listed in the National Register of Historic Places. Under the implementing regulations for Section 106 of the National Historic Preservation Act (36 C.F.R. Part 800.10) and in accordance with the Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act (63 Federal Register, 24 April 1998) (Section 110 Guidelines), special consideration to minimize harm to National Historic Landmarks is required, special emphasis on the public interest in the National Historic Landmarks and the proposed undertaking should be considered, and both the Advisory Council on Historic Preservation and the Secretary of the Interior are consulted if any adverse effects are likely to occur to such resources.

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their actions on historic properties which are defined as cultural resources listed in or eligible for inclusion in the National Register of Historic Places. The regulations implementing Section 106 (36 C.F.R.

Part 800) specify a consultation process to assist in satisfying this requirement. Consultation with the appropriate State Historic Preservation Offices, the Advisory Council on Historic Preservation, individuals and organizations with a demonstrated interest in the undertaking, and state and federal agencies as required by Section 106 of the National Historic Preservation Act will be accomplished as part of the National Environmental Policy Act (NEPA) process for this Environmental Impact Statement (EIS)/Overseas EIS (OEIS) for the portion of the Proposed Action within U.S. territorial waters (within 12 nm).

Additional regulations and guidelines for submerged historic resources include 10 U.S. Code (U.S.C.) 113, Title XIV for the Sunken Military Craft Act; the Abandoned Shipwreck Guidelines prepared by the National Park Service (National Park Service 2007); and the Guidelines for Archaeological Research Permit Applications on Ship and Aircraft Wrecks under the Jurisdiction of the U.S. Department of the Navy (Navy) (36 C.F.R. 4, Part 767) overseen by the Naval History and Heritage Command. The Sunken Military Craft Act does not apply to actions taken by, or at the direction of, the United States. In accordance with the Abandoned Shipwreck Act, abandoned shipwrecks in state waters are considered the property of the U.S. Government (Barnette 2010). Warships or other vessels used for military purposes at the time of their sinking retain sovereign immunity (e.g., Japanese freighters). According to the principle of sovereign immunity, foreign warships sunk in U.S. territorial waters are protected by the U.S. Government, which acts as custodian of the sites in the best interest of the sovereign nation (Neyland 2001). In addition, the federal archaeological program, developed by the National Park Service by Presidential Order, includes a collection of historical and archaeological resource protection laws to which federal managers adhere.

The addendum to the National Historic Preservation Act (54 U.S.C. §307101(e): International Federal activities affecting historic properties) requires an assessment by federal agencies of project effects to resources located outside U.S. territorial waters that are identified on the World Heritage List. The Rock Island Southern Lagoon in Palau, inscribed on the World Heritage List in 2012, is located within the Study Area. The Rock Island Southern Lagoon consists of numerous large and small forested limestone islands, scattered within a marine lagoon protected by a barrier reef. The marine site covers 100,200 hectares and is characterized by coral reefs and a diversity of other marine habitats, as well as 445 coralline limestone islands. The Rock Island Southern Lagoon represents an extremely high habitat complexity, including the highest concentration of marine lakes in the world, which continue to yield discoveries of new species. The terrestrial environment also supports numerous endemic and endangered species. Although presently uninhabited, the islands were once home to Palauan settlements, and Palauans continue to use the area and its resources for cultural and recreational purposes. The islands contain a significant set of cultural remains relating to an occupation that lasted approximately 5,000 years and ended in abandonment (United Nations Educational, Scientific, and Cultural Organization 2012). Even though the Rock Island Southern Lagoon World Heritage Site occurs within the Study Area, it is within the territorial waters of Palau, and no proposed activities would occur in this area.

No specific procedures for the identification and protection of cultural resources within the open ocean have been defined by the international community (Zander and Varmer 1996). No treaty offering comprehensive protection of submerged cultural resources has been developed and implemented; however, a few international conventions prepared by the United Nations Educational, Scientific, and Cultural Organization are applicable to submerged cultural resources including the 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage, the 1982 Convention on the Law of the Sea, and the 2001 Convention on the Protection of the

Underwater Cultural Heritage. Only the 1970 and 1972 conventions have been fully ratified by the United States.

3.11.1.2 Methods

3.11.1.2.1 Approach

The approach for establishing current conditions is based on different regulatory parameters defined by geographical location. Within 12 nm of the U.S. coastline (defined as U.S. territorial waters), the National Historic Preservation Act and NEPA are the guiding mandates.

Under the NEPA, an EIS/OEIS must consider the adverse and beneficial effects of a proposed federal action on historical and cultural resources (40 C.F.R. §1508.8). Under the implementing regulations of Section 106 of the National Historic Preservation Act, federal agencies must take into account the effects that an action would have on cultural resources listed in or eligible for inclusion in the National Register of Historic Places. As mentioned previously, the term “historic properties” is synonymous with National Register of Historic Places-eligible or -listed archaeological, architectural, or traditional resources. Cultural resources not formally evaluated may also be considered potentially eligible (i.e., a Consensus Determination in consultation with the State Historic Preservation Office) and, as such, are afforded the same regulatory consideration as those resources listed in the National Register of Historic Places. Evaluations and determinations of historic properties within the Study Area is the responsibility of the federal agency in consultation with the Historic Preservation Offices.

Historic properties are defined in the National Historic Preservation Act (54 U.S.C. §300308) as any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register, including artifacts, records, and material remains related to such a property or resource. Properties are evaluated for nomination to the National Register of Historic Places and for evaluating eligibility of resources using the following criteria (36 C.F.R. §60.4[a]–[d]):

- Criterion A – Be associated with events that have made a significant contribution to the broad patterns of American history
- Criterion B – Be associated with the lives of persons significant in the American past
- Criterion C – Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction
- Criterion D – Yield, or may be likely to yield, information important in prehistory or history

A historic property also must possess several of the seven aspects of integrity (location, design, setting, materials, workmanship, feeling, and association) to convey its significance and qualify it for the National Register of Historic Places. To retain integrity, a property will always possess several, and usually most, of these aspects.

The following are defined as cultural resources within U.S. territorial waters:

- Resources listed in or eligible for listing in the National Register of Historic Places (Section 106 of the National Historic Preservation Act)
- Resources entitled to sovereign immunity (e.g., Japanese transport ships or *marus*)

3.11.1.2.2 Data Sources

Cultural resources information was obtained from Naval Facilities Engineering Command Pacific/Marianas cultural resources personnel; the National Register of Historic Places (National Register Information System); Guam Register of Historic Places; and the Commonwealth of the Northern Mariana Islands (CNMI) listings for National Register of Historic Places-listed or -eligible resources on Rota, Saipan, and Tinian. Primary summary information on cultural resources was derived from a variety of management plans, archaeological and architectural survey reports, archaeological testing reports, cultural landscape studies, and traditional cultural properties reports.

The online National Register Information System was reviewed to identify National Register of Historic Places-listed resources, historic districts, and National Historic Landmarks. Appropriate information from the Historic Preservation Offices was obtained and online databases reviewed for information on the location of submerged resources, type, and eligibility for listing in National Register of Historic Places.

3.11.1.2.3 Cultural Context

The chronology, or historical sequence for the Mariana Islands, is detailed in the Integrated Cultural Resource Management Plan for Guam (U.S. Department of the Navy 2005b) and Tinian (U.S. Department of the Navy 2003), as well as in the cultural resources synthesis for Guam (U.S. Department of the Navy 2005a) and *The Archaeology of Micronesia* (Rainbird 2004).

The pre-Latte Period (1500 B.C.–A.D. 1000) consists of the Early, Middle, and Late Unai phases and the Huyong phase. The Early Unai phase (1500–900 B.C.) is characterized by the highly decorated Lapita pottery which represents the earliest evidence of occupation in the Mariana Islands (Rainbird 2004). The Early Unai phase sites are located on the sandy beaches along the coastlines on Tinian and Saipan. The Middle Unai phase (900–400 B.C.) is characterized by a simpler bold-line decoration on the ceramics. Middle Unai phase sites are located at several sandy and rocky beaches, coastal rock shelters, and a few inland caves in the islands of Guam, Rota, Tinian, and Saipan. The Late Unai phase (400 B.C.–A.D. 400) is characterized by large thick-walled shallow pan-like ceramic vessels. Late Unai sites occur throughout coastal and inland areas of Guam, Rota, Tinian, and Saipan and include both surface and subsurface scatters of artifacts and midden in diverse settings. The Huyong phase (A.D. 400–1000) exhibits a continuation of large flat-bottomed pans which declines in frequency as pots with rounded bases and slightly incurved rims become more common. Surface and subsurface scatters of pottery and midden have been reported in both coastal and inland settings of Guam, Rota, Tinian, and Saipan.

The *Latte* Period (A.D. 1000–1668) is characterized by *latte* which are quarried and shaped columns and capstones that once supported house structures. Nearly all of these columns and capstones were made from quarried limestone, but some (especially in the farthest northern islands) include basalt elements. *Latte* sets include paired rows of upright slab-like columns, arranged in rectangles. *Lusong* (grinding mortars in basalt or limestone) and *lummok* (stone pounders) are common during this time indicating an increased reliance of pounded food processing. Rice agriculture most likely occurred during this period as evidenced by the presence of rice impressions in ceramic pottery. The latter part of the *Latte* Period coincides with the early Spanish period. The early Spanish period refers to an extended period of Spanish contact with minimized direct impact on native Chamorro culture. This period begins with Magellan's arrival in the region in 1521, and it ends with the arrival of Spanish missionaries and soldiers intent on making radical changes and a long-term Spanish colony in 1668.

In the Spanish Period (A.D. 1668–1898), the nature of contact between Chamorro and Spanish populations changed radically after the arrival of Father Diego Luis de Sanvitores and his party. The missionaries quickly began converting the Chamorro people to the Christian religion, also bringing many other social changes. The Spanish efforts that began in 1668 quickly led to conflict and violence, and the following few decades involved rapid and devastating impacts on the Chamorro people. Under Spanish influence, maize was introduced, and it soon became the staple food crop. Maize processing implements (*manos* and *metates*) replaced older food-pounders and mortars. Cattle, carabao (water buffalo), pigs, goats, and deer were also introduced and created new economic opportunities. In the early 1800s, the Manila galleons stopped their annual circuit across the Pacific, as the Spanish colonies in the Americas gained independence from Spain. The Philippines assumed Spanish administrative control of the Mariana Islands in 1817. Whaling ships were common at Guam between 1823 and 1853. During this time, approximately 30 ships provisioned at Guam each year. Between 1815 and 1820, canoe-loads of Carolinian Islander refugees requested permission from the Spanish governor to resettle in the Mariana Islands. In exchange for services rendered to the government, many of these refugees were allowed to settle in Saipan. In the 1880s, more Carolinian Islanders immigrated to the Mariana Islands. Carolinian communities were established throughout the islands.

The Pre-War Naval Administration (A.D. 1898–1941) on Guam and the Japanese Colonial/Pre-War Period for the Northern Mariana Islands reflects early U.S., German, and then Japanese control of the northern Marianas. In June 1898, during the Spanish-American War, the U.S. cruiser *Charleston* arrived at Apra Harbor to take control of Guam from Spain. Spain ceded Guam to the United States in 1899, and the Navy was given responsibility for the administration of Guam. Under U.S. rule before 1941, Guam served as a fueling station for ships between the United States and Asia, the site of the trans-Pacific cable station, the base of a strategic Naval radio station, and a landing place for the Pan American trans-Pacific air clippers flying between San Francisco and Hong Kong.

As part of an agreement at the end of the Spanish-American War, Spain decided to dispose of all remaining colonies in the Pacific and sold the Mariana Islands north of Guam along with the Caroline Islands to Germany. The end of the Spanish-American War resulted in the political separation of the Mariana Islands and the islands' inhabitants that still continues today. These colonial and political decisions, except for the CNMI covenant, were not made by the inhabitants of the islands. The Germans were interested in developing an agricultural cash crop economy in the Northern Marianas, based on copra production. Vast coconut plantations were started, but two typhoons in 1905 devastated the young coconut trees. In October 1914, a Japanese naval squadron seized control of Saipan and other German possessions in Micronesia. Saipan was placed under military jurisdiction, and German nationals were expelled. In 1921, the League of Nations awarded the Mariana Islands, except Guam, officially to Japan.

The Japanese Mandated Islands included more than the Northern Mariana Islands. A separate treaty included the non-fortification provision (these islands would not be fortified for military use) which applied to both Japanese and U.S. occupations on Guam. In 1922, the Nan'yō Kōhatsu Kabushiki Kaisha/Nankō (NKK, the South Seas Development Company) was established in Saipan to develop large-scale sugarcane production. Extensive plantations and settlements were developed in Saipan, Tinian, Rota, and Aguijan, vastly transforming the landscapes of these islands. Smaller-scale Japanese land use occurred at the various smaller islands in the Northern Marianas.

The World War II (A.D. 1941–1945) period covers Japanese occupation and U.S. liberation of the Mariana Islands. On 8 December 1941, Japanese planes attacked Guam, a few hours after the attack at Pearl Harbor on the O'ahu Island of Hawai'i. The Navy administration in Guam had not engaged in any substantial military build-up, despite being surrounded by Japanese-controlled islands of the Japanese

Mandate. After just 2 days, Japanese forces landed at Guam, and the Navy commander surrendered just 2 hours later. Throughout 1942 and 1943, Japanese Navy forces occupied Guam and brutalized the native population. Beginning in March 1944, with the increased threat of a U.S. military invasion, Japanese reinforcements landed at Guam. The Japanese Army assumed control of Guam and began to fortify the likely invasion landing beaches. The local population was forced to provide labor and eventually forced into internment camps. During just a few years, large-scale Japanese defensive constructions had greatly transformed sections of Guam and Saipan, and less extensive transformations occurred in Rota and Tinian. Camouflaged bunkers, carved tunnels, and various gun emplacements were numerous. The United States began its attack on Japanese-controlled Saipan on 15 June 1944, with air strikes that destroyed 150 Japanese planes. The U.S. Liberation of Guam commenced on 21 July 1944. From Saipan, U.S. forces began a bombardment of Tinian ending with a landing invasion on 24 July. Guam, Saipan, and Tinian then served as the staging base for B-29 bombers (Twentieth Air Force) on missions to the Japanese mainland, including the atomic bombing of Hiroshima and Nagasaki that effectively ended World War II.

The U.S. Post-War (A.D. 1945–present) Period represents continued administration of the Mariana Islands by the United States. Guam was established as a U.S. flag territory and was governed separately under Navy administration. A civilian government was established in 1949, and Guam was made a U.S. territory in 1950. Still, the U.S. military presence has remained significant in Guam. Many of the World War II facilities continued to be used, and additional facilities were added in response to military needs associated with the Cold War, Korean War, and Vietnam War.

In 1947, a congressional resolution established the Trust Territory of the Pacific Islands and was signed into law by President Truman who then officially handed control over Micronesia to the Navy. The Northern Mariana Islands became part of the post-World War II United Nations' Trust Territory of the Pacific Islands. The United States became the administering authority under the terms of a trusteeship agreement (first under the Navy in 1947 and then under the Department of Interior in 1951). In 1976, Congress approved the mutually negotiated Covenant to Establish a CNMI in Political Union with the United States. The CNMI Government adopted its own constitution in 1977, and the constitutional government took office in January 1978.

3.11.1.3 Methods of Impact Analysis

Impact analysis for cultural resources is based on different parameters defined by geographical location. Within U.S. territorial waters, Section 106 of the National Historic Preservation Act and NEPA evaluation are the guiding mandates. In general, impacts are assessed by the importance of the resource; the sensitivity of the resource to proposed activities; and the duration of the effects on the environment (see Section 3.0, Introduction).

3.11.2 Affected Environment

Several types of cultural resources are associated with the MITT Study Area: pre-contact (pre-A.D. 1521) archaeological sites, historic archaeological sites including submerged historic resources and man-made obstructions, historic architectural resources, and traditional cultural properties.

3.11.2.1 Guam

3.11.2.1.1 Cultural Resources Eligible for or Listed in the National Register of Historic Places

Over 540 cultural resources associated with Guam are considered eligible for or listed in the National Register of Historic Places including 8 individual resources listed in the National Historic of Historic Places, 6 listed in the Guam Register of Historic Places only but may most likely be considered eligible for the National Register of Historic Places as well, and 348 pre-contact sites, 36 multicomponent sites, 117 historic archaeological sites, 18 buildings, and 66 structures (Table 3.11-1).

Table 3.11-1: Cultural Resources Eligible for and Listed in the National Register of Historic Places, and National Historic Landmarks, Guam

Location	Resource	Description	Guam Register of Historic Places	National Register of Historic Places	Reference
Commercial Harbor	2 submerged historic resources	*SMS Cormoran*, German ship, World War I	Listed	Listed	Guam Register of Historic Places 2008; National Register Information System 2008a
		Tokai Maru, Japanese passenger-cargo freighter, World War II	Listed	Listed	Guam Register of Historic Places 2008; National Register Information System 2008
Naval Base Guam Polaris Point, Naval Base Guam Apra Harbor, Delta/Echo Fuel Piers, Sasa Valley Tank Farm, Tenjo Vista Tank Farm	3 historic sites	Cable Station Remains	Listed	Listed	Guam Register of Historic Places 2008; National Register Information System 2008a
		Japanese Midget Submarine	Listed	Likely eligible	Guam Register of Historic Places 2008; National Register Information System 2008a
		Sumay Cemetery	Listed	Likely eligible	Guam Register of Historic Places 2008

Table 3.11-1: Cultural Resources Eligible for and Listed in the National Register of Historic Places, and National Historic Landmarks, Guam (continued)

Location	Resource	Description	Guam Register of Historic Places	National Register of Historic Places	Reference
Naval Base Guam Polaris Point, Naval Base Guam Apra Harbor, Delta/Echo Fuel Piers, Sasa Valley Tank Farm, Tenjo Vista Tank Farm	Pre-contact rock shelter and petroglyphs, historic fort, steps, and well complex	Orote Historical Complex	Listed	Listed	Guam Register of Historic Places 2008; National Register Information System 2008a; Athens 2009
	16 pre-contact sites and 9 multicomponent sites	Middle and Late Unai occupations; Huyong occupations; *Latte* period sites; Late *Latte* period villages		Eligible	U.S. Department of the Navy 2005b; Athens 2009
	55 historic archaeological sites	Spanish period site Fort San Luis; Pre-War Naval Administration period Cable Station Superintendent's Building; Japanese trenches, foxholes, pillboxes, heavy caliber weapons, and Camp Bright		Eligible	U.S. Department of the Navy 2005b; Dixon et al. 2011

Table 3.11-1: Cultural Resources Eligible for and Listed in the National Register of Historic Places, and National Historic Landmarks, Guam (continued)

Location	Resource	Description	Guam Register of Historic Places	National Register of Historic Places	Reference
Naval Base Guam Polaris Point, Naval Base Guam Apra Harbor, Delta/Echo Fuel Piers, Sasa Valley Tank Farm, Tenjo Vista Tank Farm	13 buildings and 23 structures	Administration, shop, and office buildings, fallout shelter, sheds, floating dry docks, piers, breakwater, wharves, beach fortifications, Japanese bunkers, seaplane ramp, bridge, and reservoir		Eligible	U.S. Department of the Navy 2005b; Mason Architects, Inc. and Weitze Research 2010
Naval Base Guam Munitions Site	2 cave and rock shelter complexes	Middle Unai Phase, Pre-*Latte* and *Latte* Periods	Listed	Likely eligible	Guam Register of Historic Places 2008; National Register Information System 2008a
	Latte Period deposits; World War II massacre of Chamorro by the Japanese	Fena Massacre Site	Listed	Likely eligible	Guam Register of Historic Places 2008
	263 pre-contact sites; 27 multicomponent sites	Middle Unai, Late Unai, Huyong, and *Latte* Period sites		Eligible	U.S. Department of the Navy 2005b

Table 3.11-1: Cultural Resources Eligible for and Listed in the National Register of Historic Places, and National Historic Landmarks, Guam (continued)

Location	Resource	Description	Guam Register of Historic Places	National Register of Historic Places	Reference
Naval Base Guam Munitions Site	46 historic archaeological sites	Airplane crash location, a baseball field, water supply features, depressions, concrete blocks, Japanese fortifications, and artifact scatters		Eligible	U.S. Department of the Navy 2005b
	5 buildings; 39 structures	ARMCO buildings, abandoned magazines, storehouses, revetments, reservoirs, and bridges		Eligible	U.S. Department of the Navy 2005b
Naval Base Guam Telecommunications Site	2 pre-contact sites	Late Unai and *Latte* Period sites	Listed	Listed	Guam Register of Historic Places 2008; National Register Information System 2008a; U.S. Department of the Navy 2005a
	21 pre-contact sites	Middle Unai, Late Unai, Huyong, *Latte* Period sites		Eligible	U.S. Department of the Navy 2005a

Table 3.11-1: Cultural Resources Eligible for and Listed in the National Register of Historic Places, and National Historic Landmarks, Guam (continued)

Location	Resource	Description	Guam Register of Historic Places	National Register of Historic Places	Reference
Naval Base Guam Telecommunications Site	1 historic archaeological site	Cave used by Navy radioman to evade capture during World War II		Eligible	U.S. Department of the Navy 2005a
Naval Base Guam Barrigada	2 historic archaeological sites	Barrigada Battlefield and Well, and Officers Country		Eligible	U.S. Department of the Navy 2005b
Andersen Air Force Base	World War II airfield	Northwest Field		Listed	U.S. Air Force 2011
	Cold War era airfield	North Field		Eligible	National Park Service 2012
	Pati Point Complex	Chamorro village with caves, stone structures, possible *latte* stones, and dense midden deposits	Listed	Likely eligible	U.S. Air Force 2011
	Tarague Beach Historic District	139 archaeological localities including rock alignments, artifact scatters, rock shelters, rock mounds, bedrock mortars, and trails	Listed	Likely eligible	April 2006; U.S. Air Force 2011
	48 pre-contact sites	Including the Lafac site		Eligible	U.S. Air Force 2011; Athens 2009; Dixon and Walker 2011; Griffin et al. 2011

Table 3.11-1: Cultural Resources Eligible for and Listed in the National Register of Historic Places, and National Historic Landmarks, Guam (continued)

Location	Resource	Description	Guam Register of Historic Places	National Register of Historic Places	Reference
Andersen Air Force Base	14 historic archaeological sites	Spanish oven and well, a stone pier, a farmhouse, water catchment features, Japanese defensive sites, and traditional farms		Eligible	U.S. Air Force 2011; Dixon and Walker 2011
	3 historic structures	Two reservoirs and a well		Eligible	U.S. Air Force 2004

Notes: ARMCO = American Rolling Mill Company, U.S. = United States

A total of 13 possible traditional cultural properties have been identified on Guam installations, including 6 archaeological sites, another 6 nonarchaeological (natural features) sites, and 1 property bearing both archaeological and non-archaeological characteristics, all associated with the Chamorro. Three traditional cultural properties are listed in the National Register of Historic Places as archaeological sites: Haputo Beach, Latte Stone Park, and Sumay Cemetery (Griffin et al. 2010a).

3.11.2.1.2 Known Wrecks, Obstructions, or Occurrences (within the United States Territorial Waters)

Previous archival research and literature reviews conducted to identify submerged resources around Guam indicate at least 84 submerged historic resources, including 63 documented shipwrecks dating between 1520 and 1941 (Carrell et al. 1991). However, only the locations of about 60 known wrecks, obstructions, or occurrences (e.g., shipwrecks, aircraft, and military equipment) have been determined (Figure 3.11-1), including one World War II-era amphibious tractor in Agat Bay and 31 submerged wrecks, obstructions, or occurrences in the Guam Commercial Harbor (work and fishing boats; barges; tugs; landing craft utility vessels; a British passenger ship ("CS Scotia"); World War II Japanese freighters or transport ships ("Tokai Maru," "Kitsugawa Maru," and "Nichiyu Maru"); and three Japanese planes from World War II commonly referred to as Val, Jake, and Hufe) (Carrell et al. 1991; Lotz 1998). Additional offshore resources include amphibious tractor treads, American landing vehicles tracked, World War II debris and ordnance fields, a Japanese Zero (airplane), and the "Aratama Maru" (Carrell et al. 1991; Lotz 1998). Most obstructions are usually found to be modern debris.

3.11.2.1.3 World Heritage Sites

The World Heritage List was reviewed, and no World Heritage sites are located in or around Guam.

3.11.2.1.4 Resources with Sovereign Immunity

As a result of World War I and, particularly, World War II, ships were bombed or torpedoed and sunk within 12 nm of Guam. The German ship, "SMS Cormoran" (PacificWreck.com 2011) and several Japanese freighters, the "Tokai Maru," "Kitsugawa Maru," "Nichiyu Maru," and the "Aratama Maru" retain sovereign immunity.

3.11.2.2 Commonwealth of the Northern Mariana Islands

3.11.2.2.1 Farallon de Medinilla

A preliminary archaeological field survey of Farallon de Medinilla (FDM) was conducted in 1996 (Welch 2010). No archaeological sites or isolated non-modern artifacts were observed. Only modern debris associated with the military use of the island was observed.

3.11.2.2.2 Tinian

3.11.2.2.2.1 Cultural Resources Eligible for or Listed in the National Register of Historic Places

Over 340 cultural resources associated with Tinian are considered eligible for or listed in the National Register of Historic Places including 1 National Historic Landmark, 1 individually listed resource (the Unai Dankulo Petroglyph site), 90 pre-contact sites, and 257 historic archaeological sites (Table 3.11-2).

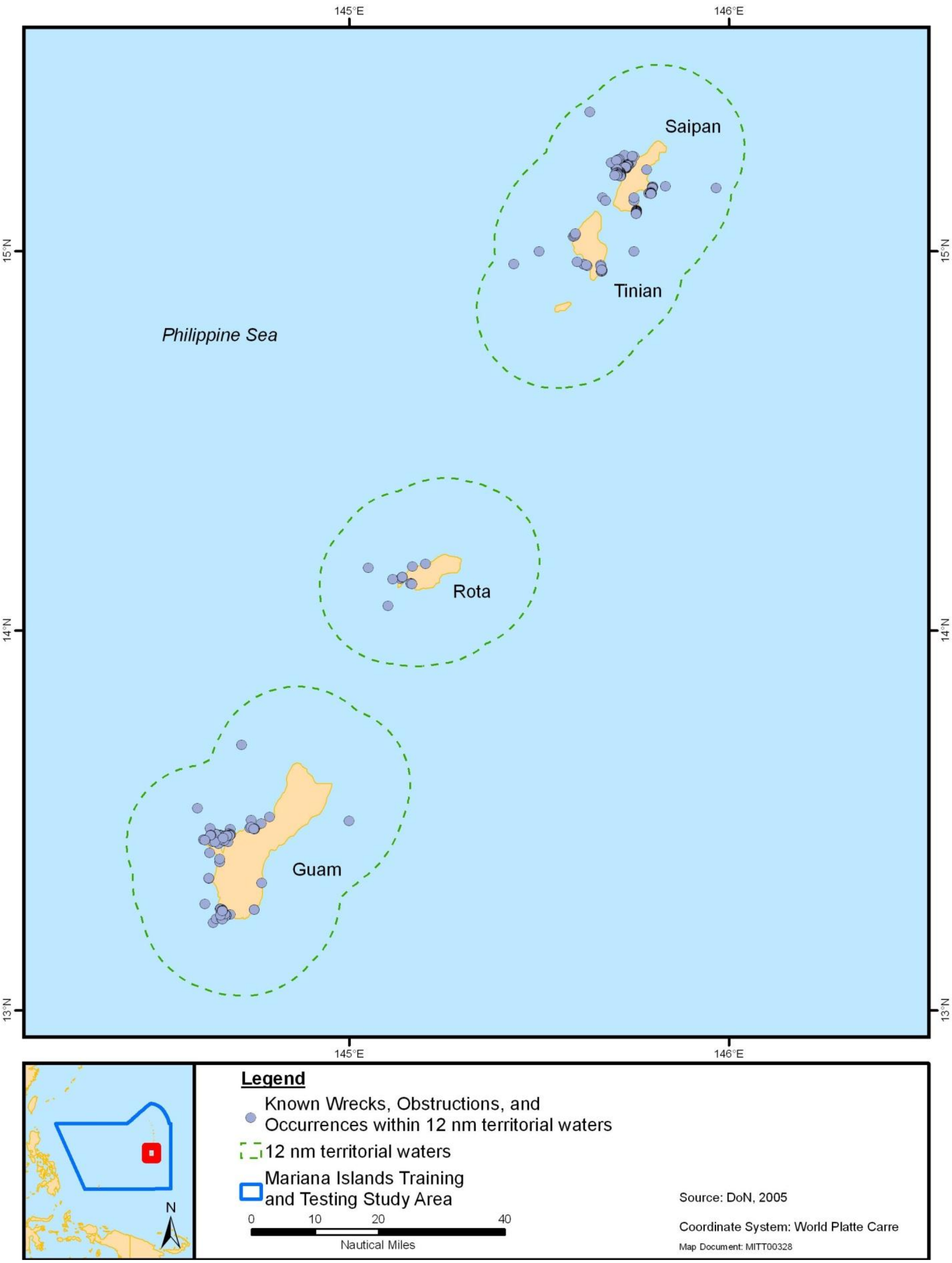

Figure 3.11-1: Known Wrecks, Obstructions, or Occurrences within the United States Territorial Waters

Table 3.11-2: Cultural Resources Eligible for and Listed in the National Register of Historic Places, and National Historic Landmarks, Tinian

Resource	Description	CNMI Register of Historic Places	National Register of Historic Places	National Historic Landmark/ Monument	Reference
Tinian Landing Beaches, Ushi Point Field, and North Field	Landing beaches White 1 and White 2 (Unai Babui and Unai Chulu) and landing craft and craft fragments; the Japanese pillbox at Beach White 2; the Japanese service apron, air administration building, air operations building, and two air raid shelters at former Ushi Point Field; and a complex of runways, aprons and parking areas at North Field	Listed	Listed	Listed	Commonwealth of the Northern Mariana Islands 2008; National Register Information System 2008b; U.S. Department of the Navy 2003; U.S. Department of the Navy 2010
Unai Dankulo Petroglyph Site	Unai Dankulo Petroglyph Site	Listed	Eligible		Commonwealth of the Northern Mariana Islands 2008; National Register Information System 2008b
90 pre-contact sites	Middle Unai, Late Unai, Huyong, *Latte* Period sites		Eligible		Rainbird 2004; U.S. Department of the Navy 2003
257 historic sites	Japanese civilian or colonial, post-war Chamorro, and U.S. occupations		Eligible		U.S. Department of the Navy 2003

Notes: CNMI = Commonwealth of the Northern Mariana Islands, U.S.= United States

A total of 13 possible traditional cultural properties have been identified on Tinian and all are archaeological sites; nine are associated with the Chamorro and four are associated with the Japanese (Griffin et al. 2010b).

3.11.2.2.2.2 Known Wrecks, Obstructions, or Occurrences (within the United States Territorial Waters)

Previous archival research and literature reviews conducted to identify submerged resources around Tinian indicate the possibility of numerous submerged historic resources (Carrell et al. 1991). However, only nine known wrecks, obstructions, or occurrences have been located during nearshore underwater surveys, including the “Mitakesan Maru” and the “Seizan Maru” (Figure 3.11-1). Most obstructions are usually found to be modern debris. No nearshore activities will be conducted around Tinian that will affect submerged resources.

3.11.2.2.2.3 World Heritage Sites

The World Heritage List was reviewed, and no World Heritage sites are located in or around Tinian.

3.11.2.2.2.4 Resources with Sovereign Immunity

As a result of World War II, ships were bombed or torpedoed and sunk within 12 nm of Tinian. Japanese freighters, the “Mitakesan Maru” and the “Seizan Maru,” retain sovereign immunity.

3.11.2.2.3 Saipan

The Saipan Army Reserve Center was constructed in 2006 (Donato 2006). The building is not considered a historic architectural resource. Leased pier space on Saipan consists of approximately 100 acres (40.5 hectares) in the Wharf area. Even though this area is highly developed, intact cultural resources could occur. However, no ground-disturbing activities will occur within the leased pier space. The east side of north Saipan is used by the Army Reserves who conduct land navigation training on non-Department of Defense land.

3.11.2.2.3.1 Known Wrecks, Obstructions, or Occurrences (within the United States Territorial Waters)

Previous archival research and literature reviews conducted to identify submerged resources around Saipan indicate the possibility of numerous submerged historic resources (Carrell et al. 1991). However, only 36 known wrecks, obstructions, or occurrences have been located during nearshore underwater surveys, including the “Keiyo Maru,” the “Taian Maru,” a floating boat, a float plane, a harbor dredge, tanks, Japanese landing barges, American landing vehicles tracked, World War II debris fields, and railroad cars (Carrell et al. 1991; Lotz 1998) (Figure 3.11-1). Most obstructions are usually found to be modern debris. No nearshore activities will be conducted around Saipan.

3.11.2.2.3.2 World Heritage Sites

The World Heritage List was reviewed, and no World Heritage sites are located in or around Saipan.

3.11.2.2.3.3 Resources with Sovereign Immunity

As a result of World War II, ships were bombed or torpedoed and sunk within 12 nm of Saipan. Two Japanese freighters, the “Keiyo Maru” and the “Taian Maru,” retain sovereign immunity.

3.11.2.2.4 Rota

Leased pier space on Rota includes the use of Angyuta Island seaward of Song Song’s West Harbor as a Forward Staging Base/overnight bivouac site. The island is adjacent to the commercial port facility that is used for boat refueling and maintenance. No historic properties were identified during a visual field inspection of Angyuta Island in February 2009.

3.11.2.2.4.1 Known Wrecks, Obstructions, or Occurrences (within the United States Territorial Waters)

Previous archival research and literature reviews conducted to identify submerged resources around Rota indicate the possibility of numerous submerged historic resources (Carrell et al. 1991). However, only seven known wrecks, obstructions, or occurrences have been located during nearshore underwater surveys (Figure 3.11-1), including the “Shotoku Maru,” the “Shoun Maru,” and Japanese submarine chasers 54 and 56 (Carrell et al. 1991; Lotz 1998). Most obstructions are usually found to be modern debris.

3.11.2.2.4.2 World Heritage Sites

The World Heritage List was reviewed, and no World Heritage sites are located in or around Rota.

3.11.2.2.4.3 Resources with Sovereign Immunity

As a result of World War II, ships were bombed or torpedoed and sunk within 12 nm of Rota. Japanese freighters, the "Shotoku Maru," the "Shoun Maru," and Japanese submarine chasers 54 and 56 retain sovereign immunity.

3.11.2.3 Mariana Islands Training and Testing Transit Corridor

The length and variable width of the MITT transit corridor is such a vast area that it precludes systematic survey for submerged historic resources. In addition, waters along the MITT transit corridor are deep, sometimes over 18,000 feet (ft.) (5,486 meters [m]); as a consequence, identification of submerged historic resources on the sea floor at these depths is prohibitive. However, in accordance with the addendum to the National Historic Preservation Act (54 U.S.C. §307101(e)) regarding international federal activities affecting historic properties, the World Heritage List was reviewed, and no cultural resources on the list were identified within the MITT transit corridor.

3.11.2.4 Current Requirements, Practices, and Protective Measures

3.11.2.4.1 Avoidance of Obstructions

The military routinely avoids locations of known obstructions which include submerged cultural resources such as historic shipwrecks. Known obstructions are avoided to prevent damage to sensitive equipment and vessels, and to ensure the accuracy of training and testing exercises.

3.11.2.4.2 Mariana Islands Range Complex Programmatic Agreement

A Programmatic Agreement was negotiated for all military training activities proposed under the Preferred Alternative for the Mariana Islands Range Complex (MIRC) based on consultations with the Guam State Historic Preservation Office, CNMI Historic Preservation Office, Advisory Council on Historic Preservation, and the National Park Service. The training constraints map identifies 13 No Training areas (eight on Guam and five on Tinian) and 35 Limited Training areas (20 on Guam and 15 on Tinian), refined from the previous Military Operations Area constraints map boundaries (U.S. Department of Defense 2009). Limited Training areas are defined as pedestrian traffic areas with vehicular access limited to designated roadways and/or the use of rubber-tired vehicles. No pyrotechnics, demolition, or digging is allowed without prior consultation with the appropriate Historic Preservation Office. In addition to establishing No Training and Limited Training areas, stipulations for additional cultural resources investigations in unsurveyed areas; archaeological monitoring and conditions documentation of military use of ingress and egress paths and training areas; and preparation of field reports were also implemented.

3.11.2.4.3 Guam and Commonwealth of the Northern Mariana Islands Military Relocation Programmatic Agreement

A Programmatic Agreement was executed on 14 March 2011 for all undertakings, such as establishing new training areas, base housing, and office areas; maintenance, rehabilitation, repair, construction and demolition of buildings, structures, and roads; and installing, repairing, and updating utilities and infrastructure on Guam and the CNMI, associated with the Joint Guam and CNMI Build Up project (U.S. Department of Defense 2011). The Programmatic Agreement provides stipulations for the identification and evaluation of historic properties through cultural resources field investigations; project review based on probability of occurrence and type of effects to cultural resources (i.e., No

Effect, Potential Effect, No Adverse Effect, and Adverse Effect); preparation and implementation of work plans and data recovery; and other mitigation measures including updating existing preservation plans, public interpretation of specific resources, preparation of general documents for public dissemination, preparation of a cultural landscape report, curation of archaeological collections and documentation; and access to traditional cultural properties for indigenous peoples and organizations.

3.11.3 Environmental Consequences

This section presents the analysis of potential impacts on cultural resources from implementation of the project alternatives, including the No Action Alternative, Alternative 1, and Alternative 2. As stated in Section 3.11.1.2.1 (Approach), NEPA and Section 106 of the National Historic Preservation Act are the guiding mandates and apply to U.S. territorial waters (within 12 nm). In accordance with an addendum to the National Historic Preservation Act, only potential impacts to World Heritage sites will be addressed in areas beyond 12 nm.

The stressors vary in intensity, frequency, duration, and location within the Study Area. Some activities, such as sinking exercises, would occur at locations greater than 50 nm from shore. The stressors applicable to cultural resources in the study area and analyzed below include the following:

- Acoustic (underwater explosives)
- Physical disturbance and strike (ground disturbance, use of towed in-water devices, deposition of military expended materials, and use of seafloor devices)

The specific analysis of the training and testing activities presented in this section considers the relevant components and associated data within the geographic location of the activity (see Tables 2.8-1 and 2.8-4) and the resource.

The use of sonar does not affect the structural elements of historic shipwrecks; therefore, no further analysis is required for cultural resources in this document. Archaeologists use multi-beam sonar and side-scan sonar as a regular practice in effectively exploring shipwrecks without disturbance. Based on the physics of underwater sound, the shipwreck would need to be very close (less than 22 ft. [7 m]) to the sonar sound source for the shipwreck to potentially experience any slight oscillations from the induced pressure waves. Any oscillations experienced at less than 22 ft. (7 m) would be negligible up to less than a few yards from the sonar source. This distance is smaller than the typical safe navigation and operating depth for most sonar sources and therefore is not expected to impact historic shipwrecks.

Given the limited extent of sonar maintenance and testing, pierside locations have been eliminated from detailed consideration in the analysis of impacts on cultural resources because of the extremely limited potential for active sonar to damage adjacent submerged historic resources.

Office of Naval Research testing activities proposed at the North Pacific Acoustic Laboratory involve the use of an acoustic tomography array, a distributed vertical line array, and moorings deployed in the deep-water environment of the northwestern Philippine Sea. These acoustic experiments use non-explosive acoustic sources; therefore, these activities do not generate shock (pressure) waves from underwater explosions or create cratering on the seafloor that could impact submerged historic resources. Although some acoustic experiments employ in-water devices, these types of activities are conducted in areas where the sea floor is deeper than the length of the tow lines, and vessel and in-water device strikes on submerged historic resources on the seafloor would not occur. No military expended materials are created from the acoustic experiments. Because the Navy routinely avoids locations of known obstructions, which include submerged historic resources, it is unlikely that these resources were disturbed by the deployment of moorings associated with the existing use of the North Pacific Acoustic Laboratory. The acoustic experiments proposed by the Office of Naval Research at the North Pacific Acoustic Laboratory would not affect submerged historic resources or World Heritage Sites; therefore, no further analysis of cultural resources is required in this document for activities at this location.

3.11.3.1 Acoustic Stressors

Acoustic stressors that have the potential to impact cultural resources are shock (pressure) waves and vibrations from underwater explosions and cratering created by underwater explosions. A shock wave and oscillating bubble pulses resulting from any kind of underwater explosion, such as explosive torpedoes, missiles, bombs, projectiles, airguns, and mines could impact the exposed portions of submerged historic resources if such resources were located in the vicinity. Shock (pressure) waves generated from underwater explosions would be episodic rather than continuous and could create overall structural instability and eventual collapse of architectural features of submerged historic resources. The amount of damage would depend on factors such as size of the charge, distance from the historic shipwreck, water depth, and topography of the seafloor. No shock (pressure) waves, vibrations, or cratering from explosions will occur in nearshore waters surrounding Tinian, Saipan, or Rota. Therefore, no submerged historic resources will be affected by acoustic stressors in these areas.

3.11.3.1.1 Impacts from Explosives – Shock (Pressure) Waves from Underwater Explosions

Explosions associated with bombs, missiles, and projectiles occur at or immediately below the ocean surface (within 1 m [3.3 ft.]). In addition, some explosions associated with torpedoes and certain mine warfare activities may occur deeper in the water column. These types of explosions are within the water column and shock (pressure) waves would not reach submerged historic resources on the seafloor. Underwater detonations (UNDETs) of explosives from other mine warfare activities would occur near or on the seafloor. Shock (pressure) waves have the potential to damage architectural features of submerged historic resources if such resources are located in the vicinity.

3.11.3.1.1.1 No Action Alternative

Training Activities

Under the No Action Alternative, current training activities and the level of activity would remain the same and would continue within existing designated areas within the MITT Study Area. Current training activities would continue to be conducted in accordance with existing Section 106 compliance documents: the *Programmatic Agreement for the MIRC* (U.S. Department of Defense 2009) to protect National Register of Historic Places-listed or -eligible cultural resources.

In addition to the military training agreement documents, recorded cultural resources would continue to be managed in accordance with procedures identified in the *Updated Cultural Resources Management Plan for the Tinian Military Lease Area (MLA)* (U.S. Department of the Navy 2003), the *Regional Integrated Cultural Resources Management Plan for COMNAVREG Marianas Lands, Volume I: Guam* (U.S. Department of the Navy 2005b), and the *Integrated Cultural Resources Management Plan for Andersen Air Force Base, Guam, 2008 Update* (U.S. Air Force 2011).

Testing Activities

Under the No Action Alternative, no testing activities creating shock waves from underwater explosions with a potential to affect submerged historic resources would occur.

3.11.3.1.1.2 Alternative 1

Training Activities

Under Alternative 1, Limpet Mine Neutralization System/Shock Wave Generator activities and associated explosive rounds would increase from no activities under the No Action Alternative to 40 activities in the MITT Study Area. Training activities using explosives would not typically occur within approximately 3 nm from shore; however, explosives up to 20 pounds (lb.) net explosive weight (NEW) would occur at the Agat Bay Floating Mine Neutralization Site. At Piti Point Floating Mine Neutralization Site and Apra Harbor UNDET Site (located within Outer Apra Harbor), the maximum NEW would remain the same as with the No Action Alternative (a maximum allowable threshold of 10 lb. NEW). As with the No Action Alternative, 20 activities involving explosive detonations within Agat Bay and Apra Harbor are proposed under Alternative 1. For activities that occur in nearshore environments and further from shore, the military routinely avoids locations of known obstructions which include submerged historic resources. It is unlikely that these resources could be disturbed or destroyed from shock waves created by underwater explosions used during mine warfare activities or other training activities that use explosives. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no training activities would occur at that location.

Testing Activities

Under Alternative 1, torpedo testing activities and associated explosive munitions (use of up to eight explosive munitions) would increase from no activities under the No Action Alternative to two activities, and mine countermeasure mission package testing activities with use of up to 24 explosive munitions would increase from no activities in the No Action Alternative to 32 activities within the MITT Study Area. These activities would be conducted greater than 3 nm from shore. The military routinely avoids locations of known obstructions which include submerged historic resources. It is unlikely that these resources could be disturbed or destroyed from shock waves created by underwater explosions used during torpedo testing and mine countermeasure mission package testing activities. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no testing activities would occur at that location.

3.11.3.1.1.3 Alternative 2

Training Activities

Under Alternative 2, Limpet Mine Neutralization System/Shock Wave Generator activities and associated explosive rounds would increase from no activities under the No Action Alternative to 40 activities in the MITT Study Area, the same as Alternative 1. Training activities using explosives would not typically occur within approximately 3 nm from shore; however, explosives up to 20 lb. NEW would occur at the Agat Bay Floating Mine Neutralization Site. At Piti Point Floating Mine Neutralization Site and Apra Harbor UNDET Site (located within Outer Apra Harbor), the maximum NEW would remain the same as with the No Action Alternative (a maximum allowable threshold of 10 lb. NEW). Because the military routinely avoids locations of known obstructions which include submerged historic resources, it is unlikely that these resources could be disturbed or destroyed from shock waves created by underwater explosions during mine warfare activities.

Testing Activities

Under Alternative 2, torpedo testing activities and associated explosive munitions (use of up to eight explosive munitions) would increase from no activities in the No Action Alternative to two activities, and mine countermeasure mission package testing activities with use of up to 28 explosive munitions would increase from no activities in the No Action Alternative to 36 activities within the MITT Study Area. These activities would be conducted greater than 3 nm from shore. The military routinely avoids locations of known obstructions which include submerged historic resources. It is unlikely that these resources could be disturbed or destroyed from shock waves created by underwater explosions used during torpedo testing and mine countermeasure mission package testing activities. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no testing activities would occur at that location.

3.11.3.1.2 Impacts from Explosives – Cratering

Underwater explosions near or on the sea floor could create sediment displacement in the form of cratering and could affect submerged historic resources at or near the explosive impact. Cratering of unconsolidated soft bottom habitats would result from charges set on or near the bottom. For a specific explosive charge size, crater depths and widths would vary depending on depth of the charge and sediment type. However, crater dimensions generally decrease as bottom depth increases. Cratering could disrupt the horizontal patterning and vertical stratigraphy of submerged historic resources, and could subsequently destroy those characteristics that would make them eligible for listing in the National Register of Historic Places. It is unlikely that these resources could be disturbed or destroyed from cratering created by underwater explosions during mine warfare activities because the military routinely avoids locations of known obstructions that include submerged historic resources.

3.11.3.1.2.1 No Action Alternative

Training Activities

Under the No Action Alternative, current mine warfare training activities and the level of activity would remain the same and would continue within existing designated areas within the MITT Study Area. Current training activities would continue to be conducted in accordance with existing Section 106 compliance documents: the *Programmatic Agreement for the MIRC* (U.S. Department of Defense 2009) to protect National Register of Historic Places-listed or -eligible cultural resources.

In addition to the military training agreement documents, recorded cultural resources would continue to be managed in accordance with procedures identified in the *Updated Cultural Resources Management Plan for the Tinian Military Lease Area (MLA)* (U.S. Department of the Navy 2003), the *Regional Integrated Cultural Resources Management Plan for COMNAVREG Marianas Lands, Volume I: Guam* (U.S. Department of the Navy 2005a), and the *Integrated Cultural Resources Management Plan for Andersen Air Force Base, Guam, 2008 Update* (U.S. Air Force 2011).

Testing Activities

Under the No Action Alternative, no testing activities creating cratering of the seafloor by deep underwater explosions with a potential to affect submerged historic resources would occur.

3.11.3.1.2.2 Alternative 1

Training Activities

Under Alternative 1, Mine Neutralization Remotely Operated Vehicle Sonar activities and associated explosive rounds with cratering created by deep underwater explosions would increase from no activities under the No Action Alternative to four activities in the MITT Study Area. Training activities using explosives would not typically occur within approximately 3 nm from shore; however, explosives up to 20 lb. NEW would occur at the Agat Bay Floating Mine Neutralization Site. At Piti Point Floating Mine Neutralization Site and Apra Harbor UNDET Site (located within Outer Apra Harbor), the maximum NEW would remain the same as with the No Action Alternative (a maximum allowable threshold of 10 lb. NEW). Because the military routinely avoids locations of known obstructions which include submerged historic resources, it is unlikely that these resources could be disturbed or destroyed from cratering created by deep underwater explosions.

Testing Activities

Under Alternative 1, torpedo testing and Mine Countermeasure Mission Package testing activities that employ explosive munitions would increase from 0 activities under the No Action Alternative to 34 combined activities (with up to 32 explosive events) within the MITT Study Area. Torpedo testing activities would be conducted greater than 3 nm from shore, whereas the Mine Countermeasure Mission Package testing could occur anywhere within the MITT Study Area. The military routinely avoids locations of known obstructions, which include submerged historic resources. It is unlikely that these resources could be disturbed or destroyed from shock waves created by underwater explosions used during torpedo testing or Mine Countermeasure Mission Package testing activities. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no testing activities would occur at that location.

3.11.3.1.2.3 Alternative 2

Training Activities

Under Alternative 2, Mine Neutralization Remotely Operated Vehicle Sonar activities and associated explosive rounds with cratering created by deep underwater explosions would increase from no activities under the No Action Alternative to four activities, the same impact as Alternative 1. Training activities using explosives would not typically occur within approximately 3 nm from shore; however, explosives up to 20 lb. NEW would occur at the Agat Bay Floating Mine Neutralization Site. At Piti Point Floating Mine Neutralization Site and Apra Harbor UNDET Site (located within Outer Apra Harbor), the maximum NEW would remain the same as with the No Action Alternative (a maximum allowable threshold of 10 lb. NEW). Because the military routinely avoids locations of known obstructions which include submerged historic resources, it is unlikely that these resources could be disturbed or destroyed from cratering created by deep underwater explosions. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no training activities would occur at that location.

Testing Activities

Under Alternative 2, torpedo testing and Mine Countermeasure Mission Package testing activities that employ explosive munitions would increase from 0 activities under the No Action Alternative to 38 combined activities (with up to 36explosive events) within the MITT Study Area. Torpedo testing activities would be conducted greater than 3 nm from shore, whereas the Mine Countermeasure Mission Package testing could occur anywhere within the MITT Study Area. The military routinely avoids locations of known obstructions, which include submerged historic resources. It is unlikely that these resources could be disturbed or destroyed from shock waves created by underwater explosions used during torpedo testing or Mine Countermeasure Mission Package testing activities. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no testing activities would occur at that location.

3.11.3.1.3 Regulatory Conclusions of Acoustic Stressors

Acoustic stressors resulting from underwater explosions creating shock (pressure) waves or cratering of the seafloor during training or testing activities would not adversely affect submerged historic resources within U.S. territorial waters because the military routinely avoids known submerged obstructions. In accordance with Section 402 of National Historic Preservation Act, no World Heritage Sites would be affected.

3.11.3.2 Physical Disturbance and Strike Stressors

Any physical disturbance of the ground surface such as construction or training activities with tracked vehicles, cratering and soil displacement from high explosive strikes, increased pedestrian access, and physical disturbance on the sea floor, such as targets or mines resting on the ocean floor, moored mines, bottom-mounted tripods and low-flying unmanned underwater vehicles could inadvertently damage or destroy submerged historic resources if such resources are located within the MITT Study Area. Expended materials, such as chaff, flares, projectiles, casings, target fragments, missile fragments, non-explosive practice munitions, munitions fragments, rocket fragments, ballast weights, sonobuoys, torpedo launcher accessories, and mine shapes can be deposited on the ocean bottom on or in the vicinity of submerged historic resources. Heavier expended materials have the potential to damage intact fragile shipwreck features if they land on this resource type with velocity. However, it is unlikely these resources could be disturbed or destroyed because the military routinely avoids locations of known obstructions that include submerged historic resources.

3.11.3.2.1 Impacts from Ground Disturbance

Physical disturbance to archaeological sites may occur through tracked vehicle use during training and testing activities, cratering and soil displacement from high explosive strikes, and disturbance or removal of archaeological materials from temporary or permanent increased access to sites by military personnel. In accordance with existing Section 106 compliance documents, all known sites are avoided and mitigation measures are in place to prevent and reduce disturbance. No ground-disturbing activities will occur within the leased pier space on Saipan.

3.11.3.2.1.1 No Action Alternative

Training Activities

Under the No Action Alternative, current training activities and the level of activity would remain the same and would continue within existing designated areas within the MITT Study Area on Guam and the Commonwealth of the Northern Mariana Islands. Current training activities would continue to be conducted in accordance with existing Section 106 compliance documents: the *Programmatic Agreement for the MIRC* (U.S. Department of Defense 2009) to protect National Register of Historic Places-listed or -eligible cultural resources.

In addition to the military training agreement documents, cultural resources would continue to be managed in accordance with procedures identified in the *Updated Cultural Resources Management Plan for the Tinian Military Lease Area (MLA)* (U.S. Department of the Navy 2003), the *Regional Integrated Cultural Resources Management Plan for COMNAVREG Marianas Lands, Volume I: Guam* (U.S. Department of the Navy 2005a), and the *Integrated Cultural Resources Management Plan for Andersen Air Force Base, Guam, 2008 Update* (U.S. Air Force 2011).

Testing Activities

Under the No Action Alternative, no testing activities creating ground disturbance with a potential to affect cultural resources have been identified.

3.11.3.2.1.2 Alternative 1

Training Activities

Under Alternative 1, the number of training activities and the number of high explosive rounds, such as bombing exercises, would increase from the No Action Alternative and create ground disturbance (see Table 3.0-22) for a summary of ordnance use on FDM for each alternative). These activities, however, are located on FDM which contains no cultural resources. The number of training activities associated with Amphibious Raid-Special Purposed Marine Air Ground Task Force would increase on the Tinian Beaches; however, training activities would continue to follow established protocol for limited training areas and to avoid established off limit areas (no training permitted) (U.S. Department of Defense 2009); therefore, no National Register of Historic Places-eligible resources would be adversely affected.

Testing Activities

Under Alternative 1, no testing activities creating ground disturbance with a potential to affect cultural resources have been identified.

3.11.3.2.1.3 Alternative 2

Training Activities

Under Alternative 2, the number of training activities and the number of high explosive rounds, such as Strike Warfare, would increase from the No Action Alternative and Alternative 1 and create ground disturbance; however, these activities are located on FDM which contains no cultural resources. The number of training activities associated with Amphibious Raid-Special Purposed Marine Air Ground Task Force would increase on the Tinian Beaches; however, training activities would continue to follow established protocol for limited training areas and to avoid established off limit areas (no training permitted) (U.S. Department of Defense 2009); therefore, no National Register of Historic Places-eligible resources would be adversely affected.

Testing Activities

Under Alternative 2, no testing activities creating ground disturbance with a potential to affect cultural resources have been identified.

3.11.3.2.2 Impacts from Vessel and In-Water Device Strikes

In-water devices as discussed in this analysis are unmanned vehicles, such as remotely operated vehicles, unmanned surface vehicles and unmanned undersea vehicles, and towed devices. These devices are self-propelled and unmanned or towed through the water from a variety of platforms, including helicopters and surface ships. The use of towed systems would not affect submerged cultural resources because these types of activities are conducted in areas where the sea floor is deeper than the length of the tow lines. Prior to deploying a towed device, there is a standard operating procedure to search the intended path of the device for any floating debris (e.g., driftwood) or other potential surface obstructions, since they have the potential to cause damage to the device. The use of in-water devices would not impact submerged historic resources because these devices are designed and operated within the water column and they do not contact the seafloor.

3.11.3.2.2.1 No Action Alternative

Training Activities

Under the No Action Alternative, current training activities using in-water devices and the level of activity would remain the same and would continue within existing designated areas within the MITT Study Area. Current training activities would continue to be conducted in accordance with existing Section 106 compliance documents: the *Programmatic Agreement for the MIRC* (U.S. Department of Defense 2009) to protect National Register of Historic Places-listed or -eligible cultural resources.

In addition to the military training agreement documents, cultural resources would continue to be managed in accordance with procedures identified in the *Updated Cultural Resources Management Plan for the Tinian Military Lease Area (MLA)* (U.S. Department of the Navy 2003), the *Regional Integrated Cultural Resources Management Plan for COMNAVREG Marianas Lands, Volume I: Guam*

(U.S. Department of the Navy 2005a), and the *Integrated Cultural Resources Management Plan for Andersen Air Force Base, Guam, 2008 Update* (U.S. Air Force 2011).

Testing Activities

Under the No Action Alternative, no testing activities using in-water devices with a potential to affect cultural resources have been identified.

3.11.3.2.2.2 Alternative 1

Training Activities

Under Alternative 1, the number of training activities using in-water devices would increase from 174 activities under the No Action Alternative to 1,175 activities in the MITT Study Area. The use of in-water devices would not impact submerged historic resources because these devices are designed and operated within the water column and they do not contact the seafloor. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no training activities would occur at that location.

Testing Activities

Under Alternative 1, the number of testing activities using in-water devices would increase from one activity under the No Action Alternative to 66 activities in the MITT Study Area. The use of in-water devices would not impact submerged historic resources because these devices are operated within the water column and they do not contact the seafloor. The Rock Island Southern Lagoon World Heritage Site is within the territorial waters of Palau, and no testing activities would occur at that location.

3.11.3.2.2.3 Alternative 2

Training Activities

Under Alternative 2, the number of training activities using in-water devices would increase from 174 activities under the No Action Alternative to 1,185 activities. Alternative 2 would increase training activities that use seafloor devices by 10 activities over Alternative 1. The use of in-water devices would not impact submerged historic resources because these devices are operated within the water column and they do not contact the seafloor. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no training activities would occur at that location.

Testing Activities

Under Alternative 2, the number of testing activities using in-water devices would increase from one activity under the No Action Alternative to 73 activities in the MITT Study Area. The increase proposed under Alternative 2 is seven more activities than proposed under Alternative 1. As with Alternative 1, the use of in-water devices would not impact submerged historic resources because these devices are operated within the water column and they do not contact the seafloor. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no testing activities would occur at that location.

3.11.3.2.3 Impacts from Military Expended Materials

Deposition of non-explosive practice munitions, sonobuoys, and military expended materials other than ordnance may affect submerged cultural resources through possible sudden impact of resources on the seafloor or the simple settling of military expended materials on top of submerged cultural resources. These potential impacts are combined in this discussion.

The locations of 112 known wrecks, obstructions, occurrences, or sites noted as "unknown" have been determined within U.S. territorial waters in the MITT Study Area. It is likely that the majority of these wrecks, obstructions, occurrences, or sites do not qualify as historic properties based on the results of previous underwater studies in the areas. Most anticipated expended munitions would be small objects and fragments that would slowly drift to the seafloor after striking the ocean surface. Larger and heavier objects such as non-explosive practice munitions could strike the ocean surface with velocity, but their trajectory would be slower as they move through the water.

If expended materials should sink in the vicinity of or on a submerged cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged historic resource that contribute to its eligibility for the National Register of Historic Places or the World Heritage List. However, the likelihood of expended materials either impacting or landing on submerged historic resources is very low because the Navy routinely avoids known submerged obstructions.

3.11.3.2.3.1 No Action Alternative

Training Activities

Under the No Action Alternative, training activities would continue within existing designated areas in the MITT Study Area. Expended materials could be deposited on the seafloor on or in the vicinity of submerged historic resources. If they should sink in the vicinity of a cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged historic resource. However, due to the size of the MITT Study Area and because the military routinely avoids known submerged obstructions, it is unlikely these materials would come into contact with a submerged historic resource.

Testing Activities

Under the No Action Alternative, no testing activities with the potential to expend military materials that could be deposited on the seafloor on or in the vicinity of submerged known historic resources have been identified.

3.11.3.2.3.2 Alternative 1

Training Activities

Under Alternative 1, the number of expended items from training activities would increase from the No Action Alternative. Expended materials could be deposited on the seafloor on or in the vicinity of submerged cultural resources if such resources occurred within the training areas and were not avoided. If they should sink in the vicinity of a cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged historic resource. However, it is unlikely these materials would come into contact with a submerged historic resource since known resource locations are routinely avoided.

Testing Activities

Under Alternative 1, the number of expended items from testing activities would increase from the No Action Alternative. Expended materials could be deposited on the seafloor on or in the vicinity of submerged historic resources. If they should sink in the vicinity of this type of cultural resource, the expended materials would not affect the archaeological and historic characteristics of the submerged historic resource. However, it is unlikely these materials would come into contact with a submerged historic resource since known resource locations are routinely avoided.

3.11.3.2.3.3 Alternative 2

Training Activities

Under Alternative 2, the number of expended items from training activities would increase from the No Action Alternative and Alternative 1. Expended materials could be deposited on the seafloor on or in the vicinity of submerged historic resources. If they should sink in the vicinity of this type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged historic resource. However, it is unlikely these materials would come into contact with a submerged historic resource since known resource locations are routinely avoided.

Testing Activities

Under Alternative 2, the number of expended items from testing activities would increase from the No Action Alternative and Alternative 1. Expended materials could be deposited on the seafloor on or in the vicinity of submerged historic resources. If they should sink in the vicinity of either this of cultural resource, the expended materials would not affect the archaeological and historic characteristics of the submerged historic resource. However, it is unlikely that these materials would come into contact with a submerged historic resource since known resource locations are routinely avoided.

3.11.3.2.4 Impacts from Seafloor Devices

Seafloor devices include moored mine shapes, anchors, and bottom-placed instruments. Seafloor devices are either stationary or move very slowly along the bottom. Stationary devices are specifically placed within the Study Area. Divers are used to set bottom and moored mine anchors (blocks of concrete weighing several hundred pounds) in water less than 150 ft. (45.7 m) deep and routinely avoid known obstructions, which include historic resources. Any physical disturbance on the continental shelf and seafloor could inadvertently damage or destroy submerged historic resources if such resources are located within the MITT Study Area and are not avoided. However, it is unlikely these resources could be disturbed by the use of seafloor devices because the military routinely avoids locations of known obstructions that include submerged historic resources.

3.11.3.2.4.1 No Action Alternative

Training Activities

Under the No Action Alternative, current mine warfare training activities using seafloor devices, such as moored mine shapes, would continue to be conducted within the MITT Study Area. Current training activities would continue to be conducted in accordance with existing Section 106 compliance documents: the *Programmatic Agreement for the MIRC* (U.S. Department of Defense 2009) to protect National Register of Historic Places-listed or -eligible cultural resources.

In addition to the military training agreement documents, recorded cultural resources would continue to be managed in accordance with procedures identified in the *Updated Cultural Resources Management Plan for the Tinian Military Lease Area (MLA)*, the *Regional Integrated Cultural Resources Management Plan for COMNAVREG Marianas Lands, Volume I: Guam* (U.S. Department of the Navy 2005a), and the *Integrated Cultural Resources Management Plan for Andersen Air Force Base, Guam, 2008 Update* (U.S. Air Force 2011).

Testing Activities

Under the No Action Alternative, current testing activities using seafloor devices, such as the North Pacific Acoustic Lab Philippine Sea 2018–19 Experiment, would continue and the level of activity would remain the same within the MITT Study Area.

3.11.3.2.4.2 Alternative 1

Training Activities

Under Alternative 1, mine warfare training activities using seafloor devices such as moored mine shapes would be conducted within the Mariana littorals and Inner and Outer Apra Harbor, representing an increase of 92 events over the No Action Alternative. Because the military routinely avoids locations of known obstructions which include submerged historic resources, it is unlikely that these resources could be disturbed by the use of seafloor devices. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no training activities would occur at that location.

Testing Activities

Under Alternative 1, the number of testing activities using seafloor devices, such as mine countermeasure mission package testing activities, would increase from one event under the No Action Alternative to 64 events under Alternative 1. Because the military routinely avoids locations of known obstructions which include submerged historic resources, it is unlikely that these resources could be disturbed by the use of seafloor devices. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no testing activities would occur at that location.

3.11.3.2.4.3 Alternative 2

Training Activities

Under Alternative 2, mine warfare training activities using seafloor devices such as moored mine shapes would be conducted within the Mariana littorals and Inner and Outer Apra Harbor, representing an increase of 92 events over the No Action Alternative and would be the same as Alternative 1. Because the military routinely avoids locations of known obstructions which include submerged historic resources, it is unlikely that these resources could be disturbed by the use of seafloor devices. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no training activities would occur at that location.

Testing Activities

Under Alternative 2, the number of testing activities using seafloor devices, such as mine countermeasure mission package testing activities, would increase from the No Action Alternative and Alternative 1 for a total of 68 events. Because the military routinely avoids locations of known obstructions which include submerged historic resources, it is unlikely that these resources could be disturbed by the use of seafloor devices. The Rock Island Southern Lagoon World Heritage Site is situated within the territorial waters of Palau, and no testing activities would occur at that location.

3.11.3.2.5 Regulatory Conclusions of Physical Disturbance and Strike Stressors

Physical stressors resulting from vessel strikes and use of in-water devices would not adversely affect submerged resources because these devices are operated within the water column and they do not contact the seafloor. The use of seafloor devices during training and testing activities under Alternative 1 and Alternative 2 would not adversely affect submerged historic resources because the military routinely avoids locations of known submerged obstructions and would continue to follow established protocol for limited training areas and to avoid established off limit areas (no training permitted) as defined in the 2009 Programmatic Agreement (U.S. Department of Defense 2009). Ground disturbance associated with existing training activities on Guam and the Commonwealth of the Northern Mariana Islands, and with increased amphibious training activities on Tinian would continue to follow established protocol for limited training areas and to avoid established off limit areas (no training permitted) as defined in the 2009 Programmatic Agreement (U.S. Department of Defense 2009); therefore, no National Register of Historic Places-eligible resources would be adversely affected. In accordance with Section 402 of National Historic Preservation Act, no World Heritage Sites would be affected.

3.11.4 Summary of Potential Impacts on Cultural Resources

3.11.4.1 Combined Impact of All Stressors

3.11.4.1.1 No Action Alternative

Training activities associated with acoustic and physical stressors would not impact cultural resources because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement (U.S. Department of Defense 2009).

3.11.4.1.2 Alternative 1

Changes in the number and type of training and testing activities from the No Action Alternative would occur under Alternative 1. Training and testing activities associated with acoustic and physical stressors would not impact cultural resources because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement (U.S. Department of Defense 2009).

3.11.4.1.3 Alternative 2

Changes in the number and type of training and testing activities would occur under Alternative 2. Training and testing activities associated with acoustic and physical stressors would not impact cultural resources because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement (U.S. Department of Defense 2009).

3.11.4.2 Regulatory Determinations

Table 3.11-3 summarizes the potential effects of the Proposed Action on cultural resources. The MIRC Programmatic Agreement is in effect and satisfies the requirement for consultation as long as the stipulations in that Programmatic Agreement are followed.

Table 3.11-3: Summary of Effects of Training and Testing Activities on Cultural Resources

Alternative and Stressor	Effects of Training and Testing Activities
No Action Alternative	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock (pressure) waves and cratering of the sea floor would not adversely affect submerged historic resources within U.S. territorial waters because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.
Physical Disturbance and Strike Stressors	Physical disturbance and strike stressors including vessel strikes, use of towed in-water devices, use of seafloor devices, and ground disturbance during training and testing activities would not adversely affect submerged historic resources within U.S. territorial waters and National Register of Historic Places-eligible resources on Guam and the Commonwealth of the Northern Mariana Islands because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.
Regulatory Determination	***No adverse effects would occur to submerged historic resources or National Register of Historic Places-eligible resources on Guam and the Commonwealth of the Northern Mariana Islands because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.***
Alternative 1	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock (pressure) waves and cratering of the seafloor would not adversely affect submerged historic resources within U.S. territorial waters because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.
Physical Disturbance and Strike Stressors	Physical disturbance and strike stressors including vessel strikes, use of towed in-water devices, use of seafloor devices, and ground disturbance during training and testing activities would not adversely affect submerged historic resources within U.S. territorial waters and National Register of Historic Places-eligible resources on Guam and the Commonwealth of the Northern Mariana Islands because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.
Regulatory Determination	***Alternative 1 includes increases in the number of training and testing activities. Adverse effects would not occur to submerged historic resources within U.S. territorial waters and National Register of Historic Places-eligible resources on Guam and the Commonwealth of the Northern Mariana Islands because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.***

Table 3.11-3: Summary of Effects of Training and Testing Activities on Cultural Resources (continued)

Alternative and Stressor	Effects of Training and Testing Activities
Alternative 2	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock (pressure) waves and cratering of the seafloor would not adversely affect submerged historic resources within U.S. territorial waters because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.
Physical Disturbance and Strike Stressors	Physical disturbance and strike stressors including vessel strikes, towed in-water devices, use of seafloor devices, and ground disturbance during training and testing activities would not adversely affect submerged historic resources within U.S. territorial waters and National Register of Historic Places-eligible resources on Guam and the Commonwealth of the Northern Mariana Islands because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.
Regulatory Determination	***Alternative 2 includes increases in the number of training and testing activities compared to the No Action Alternative. Adverse effects would not occur to submerged historic resources within U.S. territorial waters and National Register of Historic Places-eligible resources on Guam and the Commonwealth of the Northern Mariana Islands because measures have been previously implemented to protect these resources and would continue to be implemented according to the conservation measures and procedures identified and described in the 2009 MIRC Programmatic Agreement.***

Notes: MIRC = Mariana Islands Range Complex, U.S. = United States

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3.12 Socioeconomic Resources

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3.12 Socioeconomic Resources

SOCIOECONOMIC RESOURCES SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following have been analyzed for socioeconomic resources:

- Accessibility (limiting access to the ocean and the air)
- Physical disturbance and strike (aircraft, vessels, in-water devices, and military expended materials)
- Airborne acoustics (weapons firing, aircraft, and vessel noise)
- Secondary (availability of resources)

Preferred Alternative (Alternative 1)

- Accessibility: Accessibility stressors may result in impacts on commercial and recreational fishing, subsistence use, or tourism when areas of co-use are made temporarily inaccessible to ensure public safety during military training and testing activities. No impacts on commercial transportation and shipping are anticipated. The military will continue to collaborate with local communities to enhance existing means of communication with the public that are intended to reduce the potential effects of limiting accessibility to areas designated for use by the military.
- Physical Disturbance and Strike: Physical disturbance and strike stressors are not expected to result in impacts on commercial and recreational fishing, subsistence use, or tourism because the vast majority of military training and testing activities would occur in areas of the Study Area far from the locations of these socioeconomic activities. Furthermore, the large size of the Study Area over which these types of military activities would be distributed, and adherence to the Navy's standard operating procedures, would further reduce any potential for impacts.
- Airborne Acoustics: Airborne acoustic stressors are not expected to result in impacts to tourism or recreational activities, because the vast majority of military training and testing activities would occur in areas of the Study Area that are far out to sea and far from tourism and recreation locations.
- Secondary: Secondary stressors are not expected to result in impacts to commercial or recreation fishing, subsistence use, or tourism, based on the level of impacts described in other resources sections.

3.12.1 Introduction and Methods

This section provides an overview of the characteristics of socioeconomic resources in the Mariana Islands Training and Testing (MITT) Study Area and describes in general terms the methods used to analyze potential impacts on these resources from the Proposed Action.

Regulations from the President's Council on Environmental Quality implementing the National Environmental Policy Act (NEPA) state that "when an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the Environmental Impact Statement will discuss all of these effects on the human environment" (40 Code of Federal Regulations [C.F.R.] 1508.14). The Council on Environmental Quality regulations state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." To the extent that the ongoing and proposed United States (U.S.) military training and testing activities in the MITT Study Area could affect the economic or social and natural or physical environment, the socioeconomic analysis evaluates how elements of the human environment might be affected. The U.S. Department of the Navy (Navy) identified four broad socioeconomic elements based on their association with human activities and livelihoods in the MITT Study Area (Chapter 2, Description of Proposed Action and Alternatives, and Figure 3.12-1). Each of these socioeconomic resources is an aspect of the human environment that involves economics (i.e., employment, income, or revenue) and social conditions (i.e., enjoyment and quality of life) associated with the marine environment of the MITT Study Area. This evaluation considered potential impacts on four socioeconomic elements in the MITT Study Area:

- Commercial transportation and shipping
- Commercial and recreational fishing
- Subsistence use
- Tourism

These four elements were chosen as the focus of the analysis in this chapter because of their importance to the local economy and the way of life on the Commonwealth of the Northern Mariana Islands (CNMI) and the potential for these elements to be impacted from military activities. As described below, the ports in the CNMI and Guam serve as an important link for commercial transit between Japan, Asia, and the United States. Fishing continues to be both a way of life and a source of revenue, either directly or indirectly, for many if not most residents of the CNMI and Guam (Kerr 2011; Western Pacific Regional Fishery Management Council 2009). In addition, tourists visiting the Marianas archipelago also take part in recreational fishing activities. Being dependent on the resources of the marine environment to obtain the necessities of life (e.g., food, shelter) is what is meant by subsistence use in this section. Although, resources (e.g., fisheries) of the marine environment were essential to the ancestors of the Chamorro for survival, other sources of income mitigate the dependence on harvesting natural resources (Amesbury and Hunter-Anderson 2003; van Beukering et al. 2007). The military recognizes the cultural and economic value of these activities and their dependence on having access to areas of the marine environment essential to preserving local culture and sustaining the local economy. Access to marine areas important to fishers, both for commercial and recreational use, is, and has been, a concern of the local population. Access to the same or other areas is also important for subsistence as well as tourism (e.g., fishing and whale watching). The Navy strives to address these concerns in this chapter.

With the collapse of the garment industry from approximately 2006 to 2009, tourism is widely recognized as the major industry in the Marianas archipelago (Aldan-Pierce 2011; First Hawaiian Bank 2011). As indicated in Chapter 2 (Description of Proposed Action and Alternatives), implementation of the Proposed Action would have no impact on land-based agricultural activities or on lease back areas. The baseline for identifying the socioeconomic conditions in the MITT Study Area was derived using relevant published information from sources that included federal, state, regional and local government agencies and databases, academic institutions, conservation organizations, technical and professional organizations, and private groups. Previous environmental studies were also reviewed for relevant information.

The alternatives were evaluated based upon the potential and the degree to which training and testing activities could impact socioeconomics. The potential for impacts depends on the likelihood that the training and testing activities would interface with public activities or infrastructure. The analysis considered both temporal and spatial scales when evaluating potential interfaces between the public or infrastructure and military training and testing. To estimate the degree to which interface could impact socioeconomics, the potential for impacts on livelihood, quality of experience, resource availability, income, or employment are considered. If there is no expected potential for the public to interface with an activity, the impacts would be considered negligible.

3.12.2 Affected Environment

The area of interest for assessing potential impacts on socioeconomic resources is the international waters south of Guam to north of Pagan and from the Pacific Ocean east of the Mariana Islands to the Philippine Sea to the west. This section describes the four most relevant socioeconomic topics associated with human activities and livelihoods in the MITT Study Area.

3.12.2.1 Commercial Transportation and Shipping

Commercial transport is a vital part of the economy of Guam and the CNMI and includes the shipping of goods as well as the transport of residents and tourists. Current military and civilian use of the offshore sea space and air space is compatible. Navy ships account for 6 percent of the total ship presence out to 200 nautical miles (nm) (Mintz and Filadelfo 2011). The military conducts training and testing activities in operating areas away from commercially used waterways and inside special use airspace (SUA). Scheduled activities are published for access by all vessels and operators by use of Notices to Mariners issued by the U.S. Coast Guard and Notices to Airmen issued by the Federal Aviation Administration (FAA). In addition, the U.S. Navy Hydrographic Office in the Pacific will issue a HydroPac, which is a warning of navigational danger, prior to conducting an activity requiring such an announcement (e.g., training activity using explosives).

The Department of Defense (DoD) also publishes separate Notices to Airmen about runway closures, missile launches, special traffic management procedures, and malfunction of navigational aids. The U.S. Coast Guard retains publication of Notices to Mariners, which advises mariners of important matters affecting navigational safety, including new hydrographic discoveries, changes in channels and navigational aids, hazards to navigation, and other items of marine information of interest to mariners on the waters of the United States.

3.12.2.1.1 Ocean Traffic

Ocean traffic is the transit of commercial, private, or military vessels at sea, including submarines. The ocean traffic flow in congested waters, especially near coastlines, is controlled by the use of directional shipping lanes for large vessels, including cargo, container ships, and tankers. Traffic flow controls are also implemented to ensure that harbors and ports-of-entry remain as uncongested as possible. There is less control on open-ocean traffic involving recreational boating, sport fishing, commercial fishing, and activity by naval vessels. In most cases, the factors that govern shipping or boating traffic include the following: adequate depth of water, weather conditions (primarily affecting recreational vessels), availability of fish, and water temperature. Higher water temperatures are correlated with an increase in recreational boat traffic, jet skis, and scuba diving activities. Most shipping lanes are located close to the coast but those that are trans-oceanic start and end to the northwest of Guam.

Areas of surface water within the MITT Study Area are designated as danger zones and restricted areas as described in the C.F.R., Title 33 (Navigation and Navigable Waters), Part 334 (Danger Zone and Restricted Area Regulations) and established by the U.S. Army Corps of Engineers (USACE). Danger zones are areas used for target practice, bombing, rocket firing, or other especially hazardous training operations. A danger zone may be closed to the public full-time or on an intermittent basis, as stated in the regulations. A restricted area is designated for the purpose of prohibiting or limiting public access to an area. Restricted areas generally provide security for government property and protection to the public from risks of damage or injury arising from government activities occurring in the area (33 C.F.R. 334.2). A detailed discussion of danger zones and restricted areas located in the MITT Study Area is provided in Chapter 2 (Description of Proposed Action and Alternatives, Figure 2.7-1 and Table 2.7-1).

3.12.2.1.1.1 Guam

In the western Pacific Ocean, four waterways used by commercial vessels link Guam and the CNMI with major ports to both the east and west (Figure 3.12-1). Guam contains one commercial port located within Apra Harbor. The Port of Guam is the largest U.S. deepwater port in the Western Pacific and handles approximately 2 million tons (1,814,369,480 kilograms [kg]) of cargo a year (Port Authority of Guam 2011). The United States provides some 60 percent of Guam's imported goods, with the balance of Guam's trade coming from the Asian and Pacific markets of Japan, Taiwan, the Philippines, Hong Kong, and—to a lesser extent—Australia, New Zealand, and the islands of Micronesia (Port Authority of Guam 2011). Apra Harbor also provides economical transshipment services from the United States, Hawaii, and East Asia to the entire western Pacific.

Federally regulated nearshore areas in Guam waters include Danger Zones, Restricted Areas, Safety Zones, and Anchorages. These areas are established to maintain security, public and maritime safety.

- The Orote Point Small Arms Range danger zone extends west of Orote Point and is located south of the entrance to Apra Harbor (33 C.F.R. 334.1420) (see Chapter 2, Description of Proposed Action and Alternatives, Figure 2.1-5).
- The USACE has designated a restricted area in the waters of Inner Apra Harbor and adjacent waters of Outer Apra Harbor prohibiting all swimmers, vessels, and other craft except public vessels of the United States from entering the area without prior permission (33 C.F.R. 334.1430).
- The U.S. Coast Guard has designated two safety zones (Safety Zone A for commercial Wharf H, and Safety Zone B for Naval Wharf Kilo) in Apra Harbor (33 C.F.R. 165.1401). During times when these safety zones are in effect, entry into these zones is prohibited unless authorized by the Captain of the Port, Guam.
- The U.S. Coast Guard has designated Naval anchorage areas in Apra Harbor (33 C.F.R. 110.238) (see Chapter 2, Description of Proposed Action and Alternatives, Figure 2.1-5).

In these areas, the military may request that the USACE and the U.S. Coast Guard enforce these rules by requesting that unauthorized personnel leave the area.

Surface exclusion zones are defined as temporary hazard areas associated with explosive ordnance disposal (EOD) activities. The U.S. Coast Guard may establish temporary safety zones around exclusion zones in nearshore waters. Training and testing sites with exclusion zones in nearshore waters located within 3 nm of Guam include the Piti Floating Mine Neutralization Site, the Agat Bay Mine Neutralization Site, the Outer Apra Harbor Underwater Detonation Site, and the Pati Point EOD Range (see Chapter 2, Description of Proposed Action and Alternatives, Figures 2.1-9 and 2.7-1). Exclusion zones that are

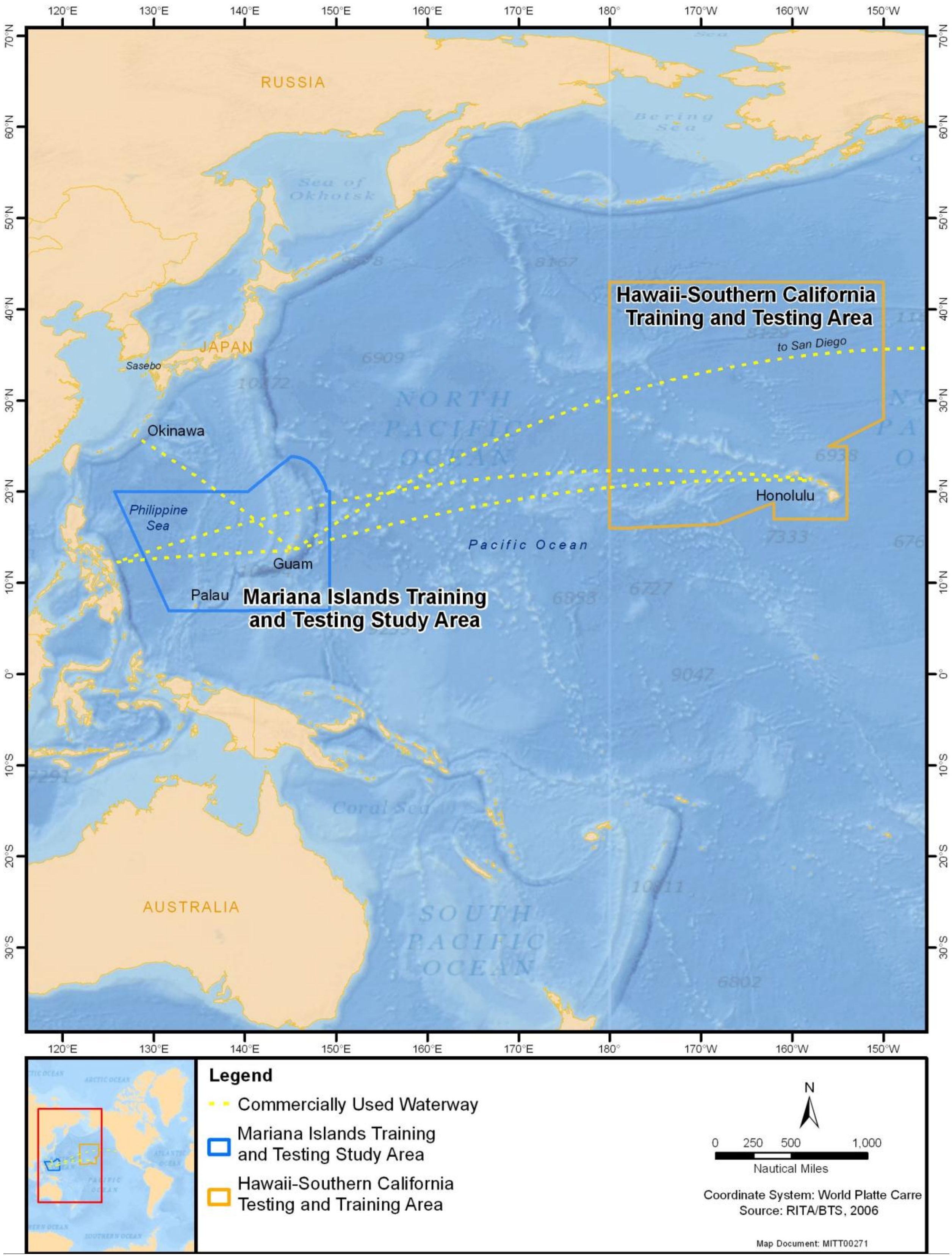


Figure 3.12-1: Shipping Lanes within the Mariana Islands Training and Testing Study Area

associated with divers conducting underwater detonations will have a minimum surface exclusion zone radius of 2,100 feet (ft.) (640 meters [m]); however, the final determination of exclusion zone size is made prior to each event and is dependent of the specifics of the event. The public is notified by local Notices to Mariners of events using danger zones, nearshore exclusion zones, and U.S. Coast Guard designated temporary safety zones.

3.12.2.1.1.2 Commonwealth of the Northern Mariana Islands

The CNMI is a 14-island chain that features the three main islands of Saipan, Tinian, and Rota. There are three ports within the CNMI. The Port of Rota, or Rota West Harbor, is located on the southwestern tip of the island. It is classified as a very small port by the World Port Source which also describes the harbor as small and poorly sheltered (World Port Source 2012a). The port includes a jetty or wharf with a pierside water depth of 6 to 10 ft. (2 to 3 m) which limits the size of vessels that can access the pier. The Port of Rota is mainly used as a port for ferry boats transporting tourists and residents from its sister island, Tinian. The Commonwealth Ports Authority is seeking funding to dredge the harbor and upgrade the port facilities in preparation for possible future development on the island (Commonwealth Ports Authority 2005). The Port of Tinian is described by the World Port Source as a small port offering excellent shelter, which is provided by a coastal breakwater. Three finger piers and a small boat ramp are available at the port. Pierside water depth ranges from 26 to 30 ft. (7.1 to 9 m), allowing relatively large vessels to dock. Mobile Oil operates a fuel plant at the port, and a ferry service transports tourists from Saipan to the hotel and casino, which is one of the main attractions on Tinian (Commonwealth Ports Authority 2005; World Port Source 2012b).

The Port of Saipan is the largest and most advanced of the three ports, but is nevertheless described as a small seaport with poor shelter by the World Port Source. A number of facilities and services are available at the port, including a cargo terminal with pierside water depth ranging from 16 to 20 ft. (4.9 to 6.1 m) and an oil terminal with a 21 to 25 ft. (6.4 to 7.6 m) depth range (World Port Source 2012c). In addition, approximately 2,600 linear ft. (790 m) of berthing space, cranes and lifts capable of handling loads over 100 tons, and a 22-acre (ac.) (8.9-hectare [ha]) container yard enabled the port to transfer over 338,000 tons of cargo in 2009 (Commonwealth Ports Authority 2005, 2010).

There are two sections to the Port of Saipan; one is the Garapan Anchorage which is located in the outer harbor, and the other is the Puetton Tanapeg harbor which is sheltered by a barrier reef to the north and considered the inner harbor. The port of Saipan is on the southwest shore and houses commercial ships, small local boats or ferries, and military vessels.

Farallon de Medinilla (FDM) and the nearshore waters have been leased to the United States for military purposes since 6 January 1983 (U.S. Department of the Navy 2009), specifically for use as a live-fire naval gunfire and air warfare air strike training range. FDM and nearshore waters extending to 3 nm from the island are restricted to all personnel both civilian and military due to safety concerns over unexploded ordnance. The lease agreement between the CNMI and the United States notes in Article 12 of the lease: "FDM: Public access to FDM Island and the waters of the Commonwealth immediately adjacent thereto shall be permanently restricted for safety reasons." The restriction around FDM and nearshore areas prohibits the entry of all personnel, civilian and military, to the island without specific permission from Commander, Joint Region Marianas (Commonwealth of the Northern Mariana Islands 1983).

The Mariana Islands Range Complex Airspace Environmental Assessment (EA)/Overseas EA (OEA) analyzed establishing a 12 nm danger zone surrounding FDM, congruent with restricted area airspace

R-7201A discussed in Section 3.12.2.1.2 (Air Traffic) (U.S. Department of the Navy 2013). The analysis supports the establishment of the Danger Zone under the authority of the USACE (C.F.R., Title 33 Part 334) to restrict all private and commercial vessels from entering the area during hazardous training and testing activities. Additional information on danger zones and restricted areas in the MITT Study Area is provided in Chapter 2 (Description of Proposed Action and Alternatives).

3.12.2.1.1.3 Transit Corridor

Major commercial shipping vessels use the shipping lanes for shipping goods between Hawaii, the continental United States, and Asia. However, there are no direct routes between Guam and the United States; stops are made in Asia, and usually Japan or Korea, before continuing on to either Hawaii or the continental United States. Vessels using shipping lanes are outside of military training areas and typically follow all U.S. Coast Guard maritime regulations. The total number of vessels transiting through the Port of Guam has steadily decreased from 2,924 in 1995 to 1,022 in 2008 (U.S. Department of the Navy 2010a). The decrease is most pronounced in the number of barges and fishing vessels that transit through the Port. From 1995 to 2008 the number of barges decreased from a high of 169 to a low of 17, and the number of fishing vessels decreased from 2,161 to 586. However, the number of container ships has increased from a low of 103 in 2003 to a high of 165 in 2008. The Port of Guam handled over 99,000 containers in fiscal years (FY) 2007 and 2008. FY 2009 through 2011 saw a decrease in the number of containers to 96,000 (Port Authority of Guam 2012). Most other types of cargo passing through the Port of Guam, including break-bulk cargo (e.g., cargo packed in cases, drums, and bales, etc.), bulk cargo, and roll-on-roll-off cargo (e.g., automobiles) has decreased substantially from a high of 477 in 1995 to 171 (the second-lowest annual total) in 2008 (U.S. Department of the Navy 2010a).

3.12.2.1.2 Air Traffic

Air traffic refers to movements of aircraft through airspace. Safety and security factors dictate that use of airspace and control of air traffic be closely regulated. Accordingly, regulations applicable to all aircraft are promulgated by the FAA to define permissible uses of designated airspace, and to control that use. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general aviation.

The system of airspace designation uses various definitions and classifications of airspace in order to facilitate control. Airspace can be generally categorized as "controlled airspace" or "uncontrolled" airspace.

- "Victor Routes" are the networks of airways serving commercial aviation operations up to 18,000 ft. (5,486 m) above mean sea level (MSL).
- Class A is controlled airspace extending from 18,000 ft. (5,486 m) above MSL up to and including 60,000 ft. (18,288 m) above MSL and includes designated airways for commercial aviation operations at those altitudes.
- Class B is controlled airspace extending from the surface to 10,000 ft. (3,048 m) above ground level surrounding the nation's busiest airports.
- Class C and D airspace are controlled areas around certain airports, tailored to the specific airport.
- Class E is controlled airspace not included in Classes A, B, C, or D.
- Class F airspace is not used in the United States.
- Class G is uncontrolled airspace (i.e., not designated as Class A–E).

Special use airspace consists of both controlled and uncontrolled airspace and has defined dimensions where flight and other activities are confined because of their nature and the need to restrict or prohibit non-participating aircraft for safety reasons. Special use airspace is established under procedures outlined in 14 C.F.R. Part 73.1. The majority of SUA is established for military flight activities and, with the exception of prohibited areas (e.g., over the White House) may be used for commercial or general aviation when not reserved for military activities. There are multiple types of SUA, including prohibited, restricted, warning, alert, and military operations areas (Federal Aviation Administration 2009). One type of SUA of particular relevance to the MITT Study Area is a warning area, which is defined in 14 C.F.R. Part 1 as follows:

> "A warning area is airspace of defined dimensions, extending from 3 nm outward from the coast of the United States that contains activity that may be hazardous to non-participating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."

Warning areas are established to contain a variety of hazardous aircraft and non-aircraft activities, such as aerial gunnery, air and surface missile firings, bombing, aircraft carrier operations, and naval gunfire. When these activities are conducted in international airspace, the FAA regulations may warn against, but do not have the authority to prohibit, flight by non-participating aircraft. A restricted area, such as R-7201, is a type of SUA within which nonmilitary flight activities are closely restricted.

3.12.2.1.2.1 Guam

Military Air Transit

Military aircraft originating from Guam would most often transit to one of the three warning areas located south of Guam (Figure 3.12-2). Warning Area (W)-517 overlays deep ocean waters and is located south-southwest of Guam. The northernmost boundary of W-517 is approximately 8 nm from the southern tip of Guam (Figure 3.12-2). W-517 provides a large SUA area extending from surface to unlimited altitude (Table 3.12-1). W-517 is constrained by commercial air traffic lanes to the east and west. W-11A/B is located east of W-517 and also overlays deep ocean waters. The northernmost boundary of W-11 is approximately 30 nm south-southeast of the southern tip of Guam. W-12 is adjacent to the southern boundary of W-517 and extends SUA approximately 30 nm farther south. The northernmost boundary of W-12 is approximately 120 nm from southern Guam.

Open ocean Air Traffic Control Assigned Airspace (ATCAA) within the MITT Study Area is used for military training and testing activities, from unit-level training to major joint exercises. ATCAAs 5 and 6, as depicted in Figure 3.12-2, have been pre-assigned in agreements between Guam Air Route Traffic Control Center; Commander, U.S. Naval Forces Marianas (COMNAVMAR); and 36th Operations Group. COMNAVMAR is designated as the scheduling and using agency for W-517 and ATCAAs 5 and 6. Guam Air Route Traffic Control Center is designated as the Controlling Agency. The Guam Air Route Traffic Control Center works with COMNAVMAR and 36th Wing to modify or configure new ATCAAs as required for training and testing activities. Preconfigured ATCAAs 5 and 6 encompass 25,800 square nautical miles (nm^2), extending from south of Guam to north of Saipan, and to the east of Guam (Table 3.12-1).

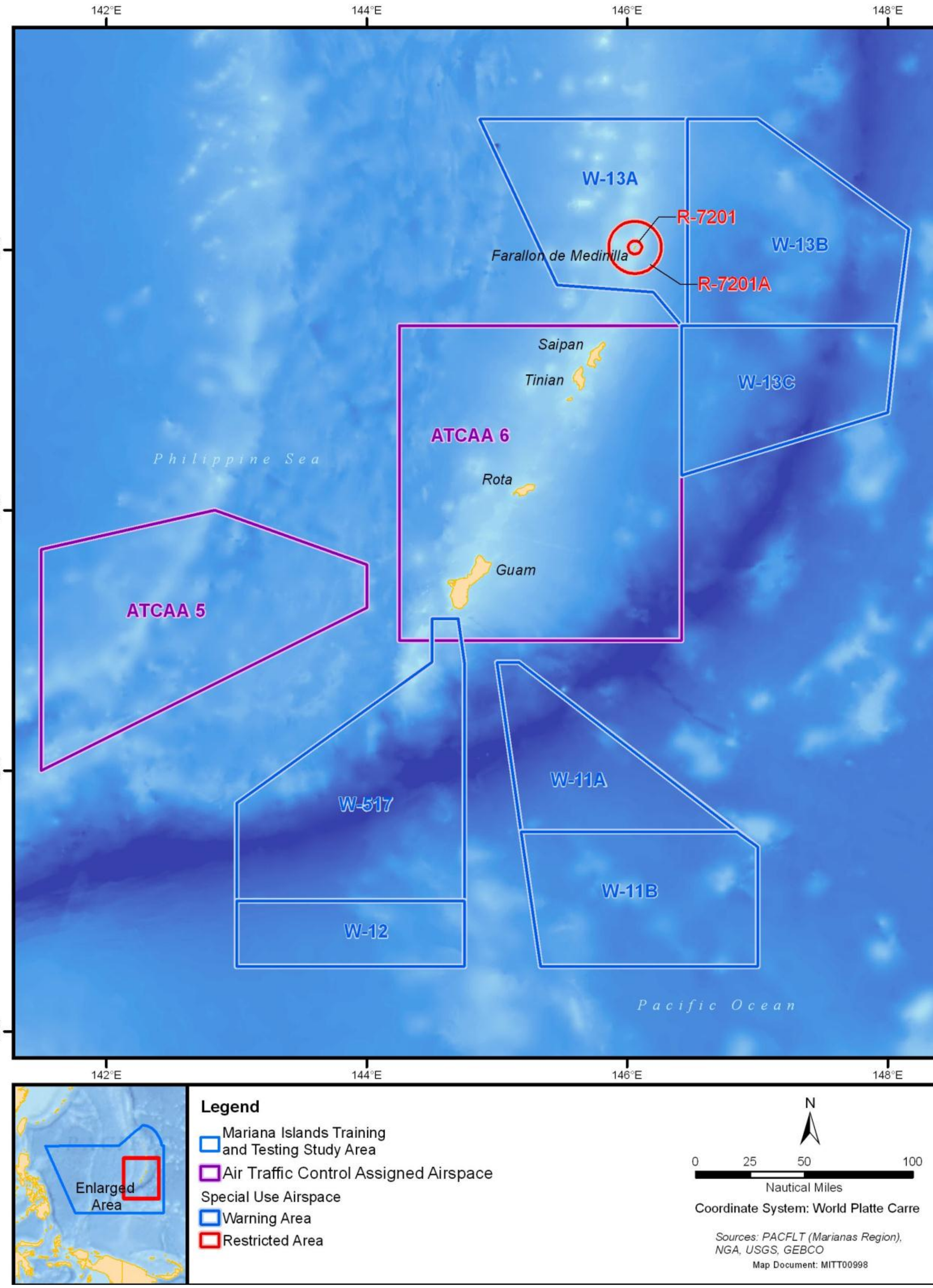


Figure 3.12-2: Mariana Islands Training and Testing Study Area Airspace

Table 3.12-1: Warning Areas, Restricted Airspace, and Air Traffic Control Assigned Airspace in the Mariana Islands Training and Testing Study Area

MITT Study Area Airspace				
Airspace	**Surface Area (nm^2)**	**Lower Altitude Limit (ft.)**	**Upper Altitude Limit (ft.)**	**Over Land?**
W-11A	4,165	Surface	30,000	No
W-11B	6,306	Surface	30,000	No
W-517	8,353	Surface	Unlimited	No
W-12	3,093	Surface	Unlimited	No
W-13A Low	5,940	Surface	35,000	No, except for FDM
W-13A High		35,000	60,000	
W-13B Low	7,724	Surface	30,000	No
W-13B High		30,000	60,000	
W-13C Low	5,064	Surface	30,000	No
W-13C High		30,000	60,000	
R-7201	28	Surface	60,000	No, except for FDM
R-7201A	424	Surface	60,000	No
ATCAA 5	10,394	Surface	30,000	No
ATCAA 6	18,271	39,000	43,000	No, except for Guam, CNMI[1]

[1] ATCAA 6 is primarily over water, but Guam, Rota, Tinian, and Saipan lie beneath it.
Notes: ATCAA = Air Traffic Control Assigned Airspace, ft. = feet, nm^2 = square nautical miles, R = Restricted Area, W = Warning Area

ATCAAs are activated for short periods to cover the time frames of training and testing activities. COMNAVMAR coordinates ATCAA requests with the FAA and 36th Wing. If the preconfigured ATCAA 5 or 6 do not meet the need for a special event, then event-specific ATCAAs in the location, size, and altitude for the time frame needed may be requested contingent on agreement of the FAA and coordination with COMNAVMAR and 36th Wing.

Andersen Air Force Base contains one airfield, Main Base, which is approximately 4,500 ac. (1,821.1 ha). Airspace over Main Base supports takeoffs and landings of all types of aircraft up to and including the C-5. Andersen Air Force Base airspace is controlled by Air Force air traffic control.

Commercial and General Aviation

Guam International Air Terminal is the only civilian air transportation facility on Guam. It is operated by Guam International Airport Authority, a public corporation and autonomous agency of the Government of Guam. Guam International Air Terminal contains two runways and facilities that are part of the now-closed Naval Air Station Agana. Eight major airlines operate out of Guam International Air Terminal, making it a hub of air transportation for Micronesia and the Western Pacific (Figure 3.12-3).

3.12.2.1.2.2 Commonwealth of the Northern Mariana Islands

Military Air Transit

ATCAA 6 overlies both the Guam and the CNMI (see Figure 3.12-2). On Tinian, the military conducts aviation training in the military lease area by delivering personnel and cargo to maneuver areas, and providing various support functions to forces already on the ground, such as cargo delivery, firefighting, and search and rescue. An important feature in the Exclusive Military Use Area is North Field, a large abandoned World War II era airfield. Although improvements are needed to ensure that the facilities on North Field meet safety and operational requirements, the airfield can be used as a contingency land airfield to support fixed-wing and helicopter training activities. North Field's four runways, taxiways, and parking aprons provide various tactical scenarios without interfering with commercial and community activities south of the military lease area. The remote area is suitable for a variety of aviation support training. Use of North Field would also reduce or eliminate the need to share West Tinian Airport with commercial flight activity.

W-13A/B/C is located approximately 20 nm north-northeast of the northern tip of Saipan. W-13 extends from the surface to an upper altitude of 60,000 ft. (18,288 m) (see Table 3.12-1). W-13A overlays FDM and surrounds R-7201 and R-7201A (see Figure 3.12-2). On FDM, R-7201 is a restricted airspace with a 3 nm radius surrounding the island, and R-7201A is an adjacent restricted airspace extending from 3nm out to 12 nm from FDM (Figure 3.12-4). The surface area defined by the 3 nm radius encompasses 28 nm^2, and the surface area defined by the 12 nm radius encompasses 452 nm^2. Published Notices to Mariners and Notices to Airmen will occasionally advise out to and beyond a 12 nm radius depending on the nature of the training activities being conducted. The altitude limits for both R-7201 and R-7201A are surface to 60,000 ft. (18,288 m). The FDM range supports live-fire and inert training activities such as surface-to-ground and air-to-ground gunnery exercises, bombing exercises, missile exercises, Fire Support, and Precision Weapons. Additional information on restricted airspace in the MITT Study Area is provided in Chapter 2 (Description of Proposed Action and Alternatives).

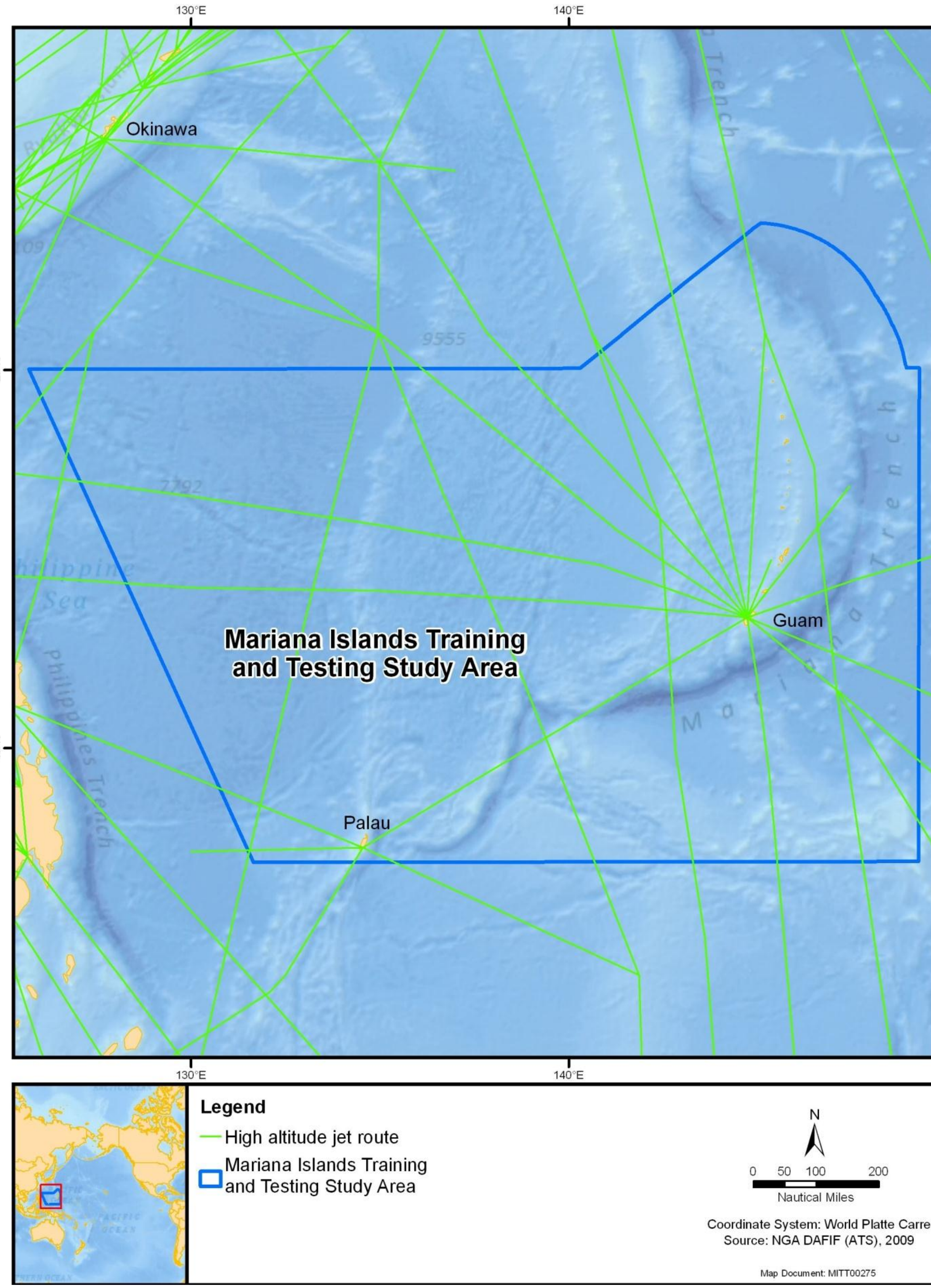


Figure 3.12-3: Commercial Airways within the Mariana Islands Training and Testing Study Area

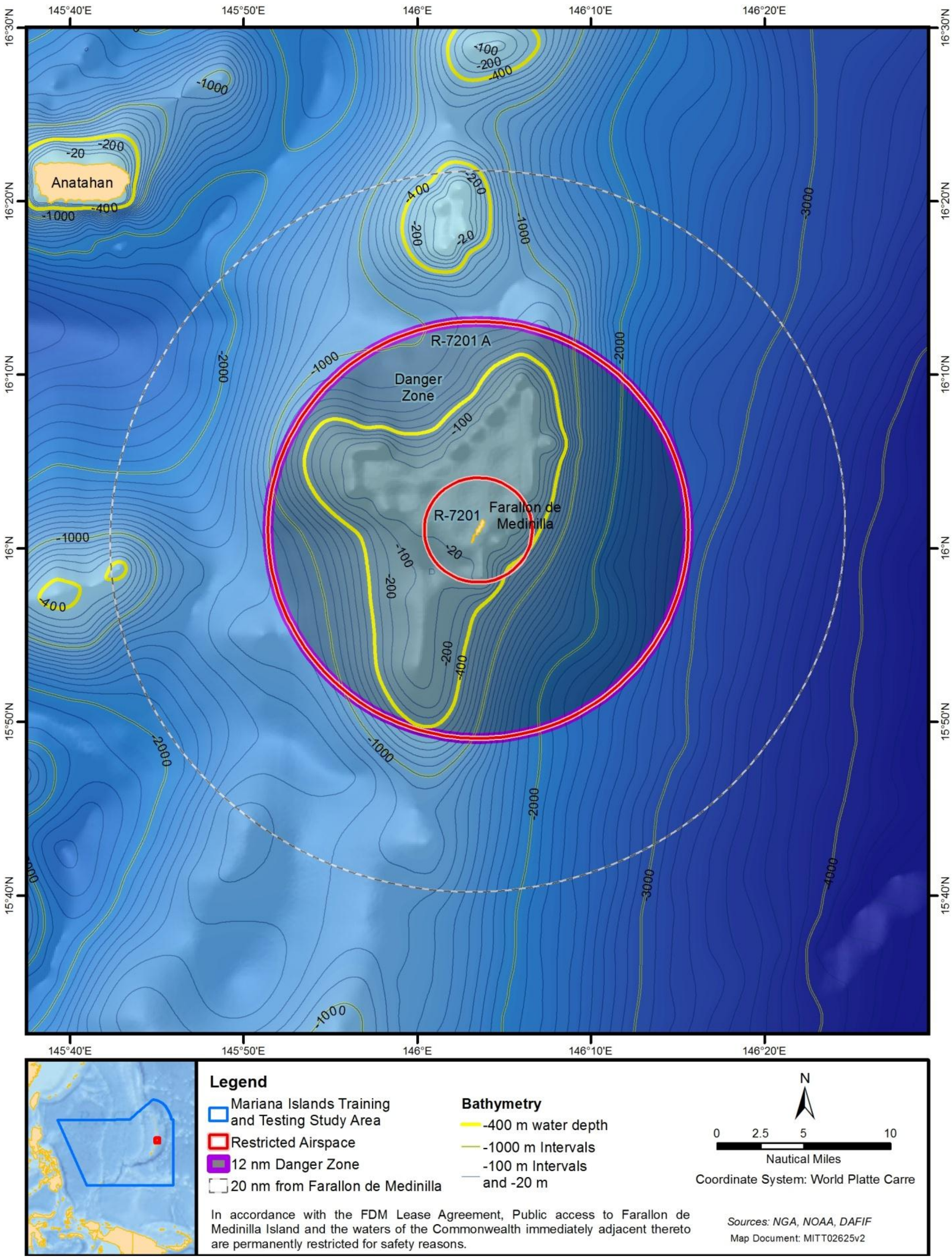


Figure 3.12-4: Farallon de Medinilla Restricted Area and Pending 12 nm Danger Zone

Commercial and General Aviation

Saipan International Airport is the largest commercial airport in the CNMI, and is the main gateway for commercial air traffic into the CNMI (Commonwealth Ports Authority 2005). The airport has an 8,700 ft. (approximately 2,700 m) runway with adjacent taxiways and can accommodate wide-body aircraft. Direct flights are available from major cities in Japan, Korea, China, and Guam. A commuter terminal services Tinian and Rota islands. On Tinian, all commercial flights fly into West Tinian Airport (or Tinian International Airport). The airport has one runway that is 8,600 ft. (approximately 2,600 m) by 150 ft. (46 m). Renovations to a departure terminal in support of direct flights to China are planned (Commonwealth Ports Authority 2005). The airport is equipped with a navigational light system for nighttime operations, but has no control tower or additional navigational aids. Rota International Airport has a 6,000 ft. (approximately 1,800 m) runway capable of handling Boeing 757 or 727 aircraft, but with load restrictions. Tinian and Rota airports primarily support inter-island flights between Tinian, Saipan, Rota, and Guam. All three airports are FAA certified.

On FDM, there is no civilian use of airspace around the island because it is a restricted area and available only to military traffic. Notices to Airmen usually advise of a 12 nm radius around FDM to be used exclusively by the military (Figure 3.12-4).

3.12.2.1.2.3 Transit Corridor

There are commercial air routes over the MITT transit corridor. However, commercial aircraft typically fly above 30,000 ft. (9,144 m) in this area. These air routes are controlled by the FAA.

3.12.2.2 Commercial and Recreational Fishing

Fishing is an integral part of the culture and way of life in the CNMI and Guam. Most fishers do not fish exclusively for commercial, recreational, or subsistence benefit but rather for some combination of the three (Hospital and Beavers 2012; Tibbats and Flores 2012). Commercial fishing takes place throughout the MITT Study Area from nearshore waters adjacent to Guam and the CNMI, offshore banks, and pelagic waters. Sportfishing peaks in summer (June through August) when popular sport fish, including blue marlin and yellowfin tuna, are most abundant. Skipjack tuna are present year round, but are also most abundant in summer.

Mahi-mahi arrive in January and reach peak abundance in February or March, while wahoo typically have two peak abundances during the year in spring and fall. Jacks, snapper, and grouper are fished for off of reef flats surrounding the island (Schultz 2000).

Fishers in the CNMI typically fish in waters that are less than 500 ft. (152 m) deep and target the red-gilled emperor (Western Pacific Regional Fishery Management Council, n.d.). Fishing peaks in summer, but occurs year round in some locations (e.g., leeward side of the islands) where conditions are usually calmer. Some small-scale commercial fishing takes place in waters deeper than 500 ft. (152 m) and focuses on snapper and grouper species (Western Pacific Regional Fishery Management Council 2009).

3.12.2.2.1 Guam

Commercial and recreational fishing on Guam is typically divided into three types: bottom fishing, coral reef fishing, and pelagic fishing. A 2011 survey of 147 small boat fishers on Guam revealed the traditional and cultural importance of fishing to the people of Guam. Fishers responding to the survey reported having fished from boats for an average of 20 years (Hospital and Beavers 2012). Although 70 percent of fishers reported selling a portion (on average 24 percent) of their catch, the motivation was not to supplement their income, but mainly to defray some of the costs associated with fishing trips (e.g., fuel costs). Even though fishing is no longer the primary source of income for many fishers, it is an important part of the social and cultural history of the people of Guam, and it remains a vital part of local communities. This point is illustrated by the manner in which fishers distribute their catch. Respondents to the survey (Hospital and Beavers 2012) reported consuming 29 percent of their catch at home, giving away 42 percent of their catch, and selling 24 percent of their catch. The remaining balance was either released or used to barter for other goods.

Shore-based fishing accounts for most of the fish and invertebrate harvest from coral reefs. More than 100 species of fish are available in the waters around Guam. Fishing by hook and line is the most popular method of shore-based fishing, but other methods, including thrown net, gill net, drag net, and snorkel spear fishing are also used (Tibbats and Flores 2012). Reef fishing from small boats included bottom fishing and trolling as well as the use of nets and spear fishing. Eight-two percent of the fish caught on reefs were a combination of atulai (or bigeye scad), emperors, trevallys (members of the jack family), rabbitfish, surgeon fish, and miscellaneous reef fish (Tibbats and Flores 2012). However, many of the nearshore reefs around Guam appear to have been badly degraded due to sedimentation, tourist overuse, and overharvesting (Western Pacific Regional Fishery Management Council 2009).

According to the Western Pacific Regional Fishery Management Council, charter fishing has accounted for 15–20 percent of all bottomfishing trips from 1995 through 2004 (Western Pacific Regional Fishery Management Council 2009). These trips are generally to the same areas, 2–4 hours per day, with as many as 35 patrons per trip, and the majority of the catch is released back to the ocean (Western Pacific Regional Fishery Management Council 2009). Guam fishing for the crustacean fishery occurs for subsistence and recreation in inshore territorial waters.

Both commercial and recreational fishing activities generally originate from one of the three principal harbors located on the west coast and southern tip of the island. However, the following public boat launch sites are available (Figure 3.12-5):

- Agana Boat Basin – centrally located on the western leeward coast. Used for fishing areas off the central and northern leeward coasts and the northern banks
- Merizo Boat Ramp – provides access to the southern coasts, Cocos Lagoon, and the southern banks
- Seaplane Ramp in Apra Harbor – provides access to the southern coasts, Apra Harbor, Cocos Lagoon, and the southern banks
- Agat Marina – provides access to the southern coasts, Apra Harbor, Cocos Lagoon, and the southern banks
- Ylig Bay – provides access to the east (Pacific Ocean) side of the island
- Umatac Boat Ramp – located just north of Merizo Boat Ramp along the southwestern coast. Provides access to the Umatac Bay and the southern banks

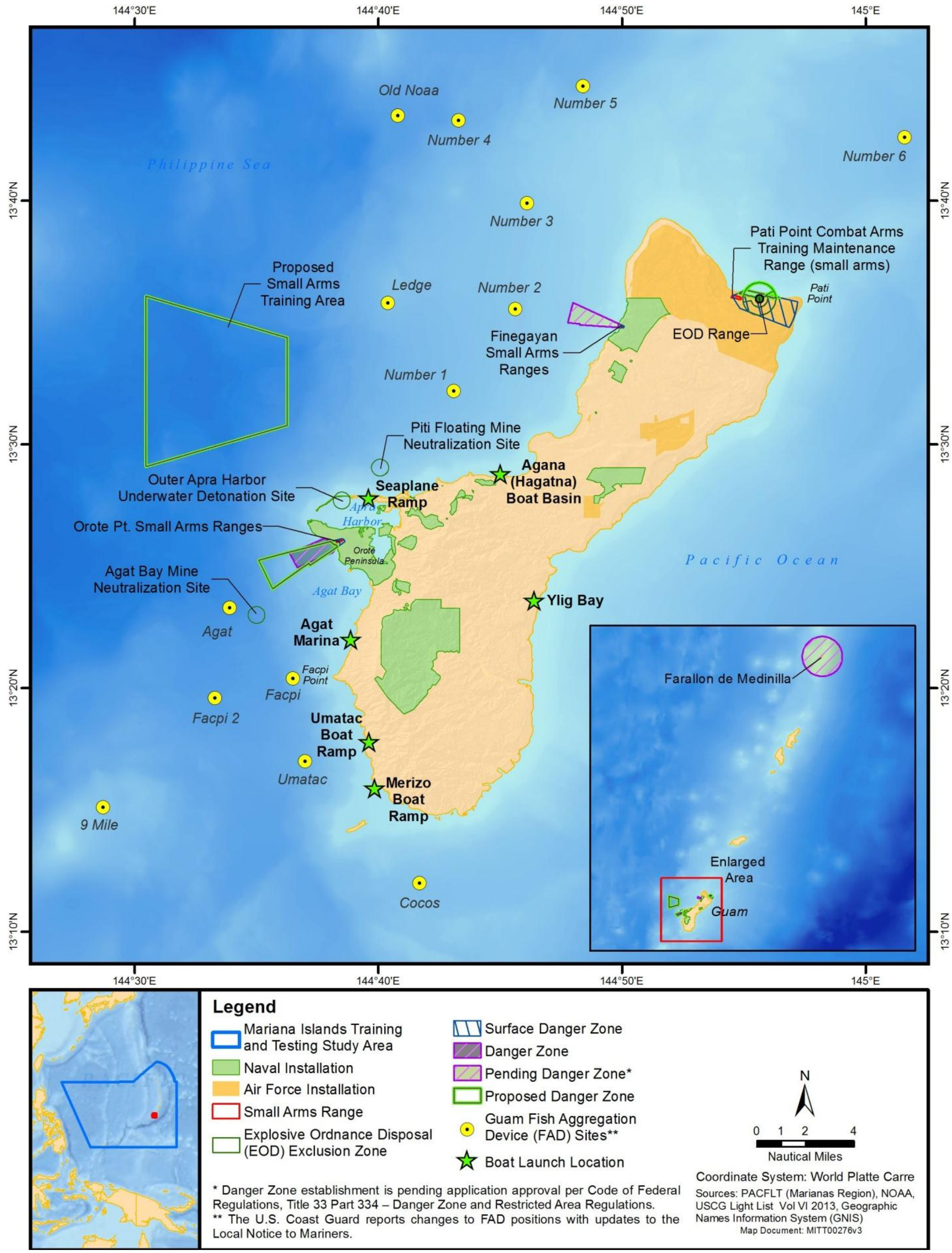


Figure 3.12-5: Guam Public Boat Launch Locations and Fish Aggregating Devices

The Guam bottomfish fishery is a combination of subsistence, recreation, and commercial fishing. The majority of vessels used for bottom fishing are less than 25 ft. (7.6 m) long and operate in shallow waters (< 500 ft. [152 m]) (Hospital and Beavers 2012). Bottom fishing on Guam is conducted in two areas: shallow water (< 500 ft. [152 m]) and deep water (> 500 ft. [152 m]). Smaller operator-owned boats tend to target shallow water, while the commercial fishers tend to target the deeper water. Less than 20 percent of shallow water harvests are taken beyond 3 nm from shore. This is largely due to deeper water and stronger currents farther out to sea (Western Pacific Regional Fishery Management Council 2009). Bottom fishing charters account for 15–20 percent of bottom fishing trips since 1995 and they have increasingly become catch-and-release activities (Western Pacific Regional Fishery Management Council 2009). Fish aggregating devices (FADs) are located off the western coast of Guam and are popular bottom fishing sites (Figure 3.12-5).

Pelagic fishing started on Guam during the 1950s along with the growth of the tourist industry. The five most common pelagic fish caught on Guam waters are mahi-mahi, wahoo, skipjack tuna, yellowfin tuna, and Pacific blue marlin. From year to year, there have been large fluctuations in the number of these species caught. Pelagic fish tend to be highly migratory and at the top trophic level of oceanic predators. The pelagic fishing fleet numbered 386 boats in 2006 (Allen and Bartram 2008). Approximately 7 percent of this fleet is comprised of charter boats with the remainder comprised of Guam residents using owner-operated boats, mostly towed to launch sites, as opposed to semi-permanent marina docking (Allen and Bartram 2008). The charter industry is most widely used by tourists and U.S. military personnel. Pelagic charter trips totaled roughly 2,000 in 2006, with an estimated 67,000 pounds (lb.) (30,400 kg) of catch with mahi-mahi, skipjack, and wahoo accounting for the top three species (Allen and Bartram 2008).

Annual commercial landings data for all fish types in Guam from 2005 to 2009 shows a fluctuation in the amount of pounds caught, and subsequently the revenue generated from these commercial fishing activities (Table 3.12-2). The 2008 Pacific Islands Fisheries Science Center released an administrative report titled *Guam as a Fishing Community* that notes that, although in some cases commercial fishing contributes substantially to household income, nearly all of Guam's domestic fishers hold jobs outside the fishery (Hospital and Beavers 2012; Allen and Bartram 2008; Myers 1993). Commercial fisheries have made a relatively minor contribution to Guam's economy. According to the Western Pacific Fisheries Information Network (WPacFIN), between 1980 and 2009, the ex-vessel value of domestic commercial landings ranged from about $179,000 in 1980 to $1.33 million in the year 2000 (Western Pacific Fisheries Information Network 2011). Since the late 1970s, the most important commercial fisheries activity in Guam has been the territory's role as a major regional fish transshipment center and resupply base for domestic and foreign tuna fishing fleets.

Table 3.12-2: Guam Commercial Fishery Landings

Year	Annual Total (lb.)	Value
2005	357,965	$748,036
2006	334,729	$726,296
2007	422,153	$889,221
2008	287,213	$692,809
2009	270,922	$711,463
TOTAL	**1,672,982**	**$3,767,825**

Note: lb. = pounds

Sources: Guam Division of Aquatic and Wildlife Resources and the Western Pacific Fisheries Information Network 2007, 2008, 2009, 2010, 2011

In Guam, lobster is harvested out to 3 nm from shore and primarily for personal consumption. The commercial trade is relatively low with only 1,168 lb. (529.8 kg) caught and sold for $4,329 in 2008 (Guam Division of Aquatic and Wildlife Resources and the Western Pacific Fisheries Information Network 2010). Shrimp and crab harvests have been attempted commercially, but are not of a reportable volume. Strong currents, rough bottom topography, and water depth where species occur result in high fishing gear loss when attempting to harvest these species. Four permits have been issued for crustacean harvest in the exclusive economic zone (EEZ) around Guam, but the results of the harvest are unknown.

Three prime, offshore fishing areas are located south-southwest of Guam along the northwestern boundary of W-517: Galvez Bank, Santa Rosa Reef, and White Tuna Banks (Figure 3.12-6). Galvez Bank is the closest of the three areas, located approximately 15 nm from the southern tip of Guam. Its greater accessibility (fishers from Guam would pass Galvez Bank in order to reach the other two areas) make Galvez Bank the most popular of the three areas. Galvez Bank is outside of W-517; however, the most direct route from Guam would cross the northernmost tip of W-517. Santa Rosa Reef is located on the western boundary of W-517 approximately 25 nm from Guam. As with Galvez Bank, Santa Rosa Reef is outside of W-517, but the most direct transit route would require transiting through W-517. White Tuna Banks is the farthest of the three fishing areas, located approximately 28 nm from Guam.

Trolling and bottomfishing are used at all three offshore fishing areas (Allen and Bartram 2008). At the Galvez Bank and Santa Rosa Reef, bottomfish are caught by a combination of recreational vessels (< 25 ft. [7.6 m]) and larger commercial vessels (> 25 ft. [7.6 m]) (Moffitt et al. 2007). Galvez Bank is fished most heavily because it is closest to shore, while Santa Rosa Reef and White Tuna Banks are fished only during the most favorable weather conditions, which usually occur between May and September. In 2005, personnel from the Coral Reef Ecosystem Division, Pacific Islands Fisheries Council, and National Marine Fisheries Service (NMFS) conducted coral reef assessments and monitoring at Galvez Bank and Santa Rosa Reef as part of the National Oceanic and Atmospheric Administration's (NOAA's) Coral Reef Conservation Program (Pacific Islands Fisheries Science Center 2006). The survey revealed the presence of very few large (> 50 centimeters total length) fish at Santa Rosa Reef. Only 39 individual large fish were seen during 5 days of surveys. Fish species diversity and abundance were also low at the bank. The most abundant species was the twin-spot snapper (Pacific Islands Fisheries Science Center 2006). Surveys at Galvez Bank were inhibited by strong currents, preventing divers from conducting in-water surveys. Steep drop-offs in bottom topography limited the use of underwater cameras. Additional surveys of Galvez Bank, Santa Rosa Reef, and White Tuna Banks are needed to better characterize species abundance and diversity.

Commercial vessels, which are generally longer than 25 ft. (7.6 m), often concentrate their efforts in deeper waters (> 500 ft. [152 m]), such that Galvez Bank is fished more often by commercial vessels than nearshore areas with similar bathymetric features. White Tuna Banks, Santa Rosa Reef, and Rota Banks are fished less often than Galvez Bank, because they are more remote requiring longer transit times, greater fuel costs, and because of concerns over safety, particularly for smaller boats, should there be a need to reach shore quickly. The offshore banks are subject to strong currents and are only accessible during exceptionally good weather. Local fishers have reported that up to 10 commercial boats use these banks when the weather permits. Less than 20 percent of the total shallow-water marine resources harvested in Guam are located beyond 3 nm from shore. (Western Pacific Regional Fishery Management Council 2009).

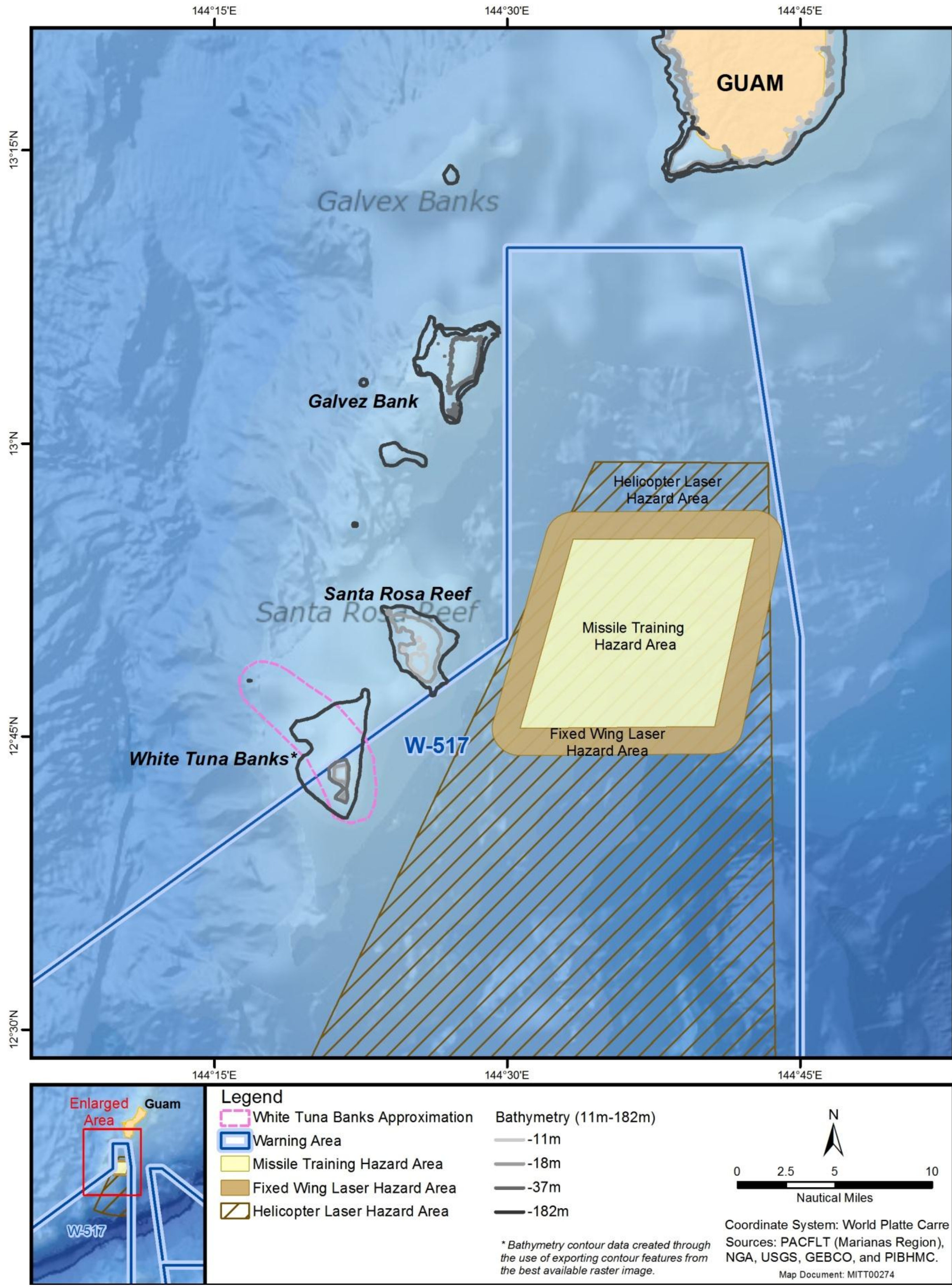


Figure 3.12-6: Galvez Bank and Santa Rosa Reef Adjacent to W-517

Guam has five marine preserves: Pati Point, Tumon Bay, Piti Bomb Holes, Sasa Bay, and the Achang Reef Flat Preserves (Figure 3.12-7). Public Law 24-21 was implemented to create the preserves and make changes to Guam's fishing regulations in an effort to preserve the fisheries (Guam Legislature 1997). Within the preserves, the taking of aquatic animals is restricted. All types of fishing, shell collecting, use of gaffs, and the removal of sand and rocks are prohibited unless specifically authorized. Limited inshore fishing is allowed within the Pati Point and Tumon Bay Preserves. Limited offshore fishing is also allowed in all the preserves.

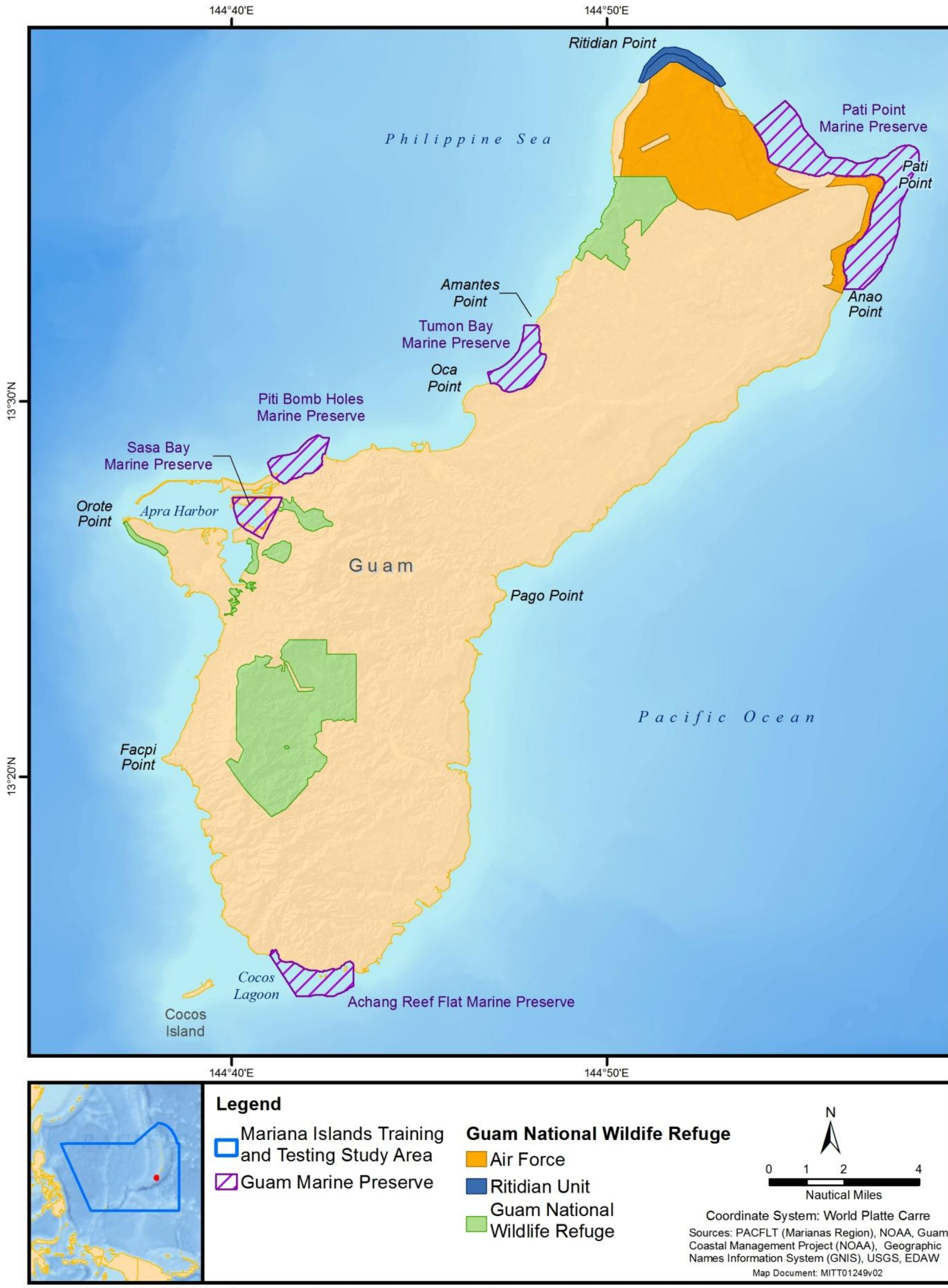
3.12.2.2.2 Commonwealth of the Northern Mariana Islands

Fishing is part of the traditional and cultural heritage for the people of the CNMI and is practiced as much as a way of life than it is for recreation or a primary source of income (MacDuff and Roberto 2012). Both finfish and invertebrates are caught using a variety of techniques, including hook and line, cast netting, spear fishing, trolling, and bottom fishing. Shore-based and boat-based reef fishing is both popular on the CNMI. From boats, emperor fish make up the majority of the catch, and from shore, jacks, followed by emperor fish, comprise the majority of the catch (MacDuff and Roberto 2012).

For the CNMI, the Pacific Islands Fisheries Science Center published data for 2008 that was then compiled by the CNMI Division of Fish and Wildlife and the Western Pacific Fisheries Information Network in August 2010. The Division of Fish and Wildlife collected data through a dealer invoicing system on a monthly basis. Estimates since 1982 indicate that more than 90 percent of the commercial landings have been recorded in Saipan, although the data represents 100 percent coverage (Guam Division of Aquatic and Wildlife Resources and the Western Pacific Fisheries Information Network 2010). In order to commercially fish in the CNMI's EEZ in a 25–50 ft. (7.6–15 m) boat (over 5 net tons), a commercial fishing license is required and issued annually. The NOAA Pacific Islands Fisheries Science Center issues approximately four commercial fishing licenses on an annual basis (Pacific Islands Fisheries Science Center 2011). There has been a relatively stable catch from 2005 through 2009; however, associated revenues have been steadily decreasing. In 2009, the CNMI produced a low of 331,506 lb. (150,369 kg) of fish worth $709,985 The 5-year high of 536,724 lb. (247,453.9 kg) of fish worth $1,058,804 was recorded in 2006 (Table 3.12-3). The resultant average over this 5-year period was 440,025 lb. (199,592 kg) of fish worth an average of $891,314.

The CNMI bottomfish fishery occurs around the islands and banks from Rota Island to Zealandia Bank north of Sarigan in both the shallow water (100–500 ft. [30–152 m]) and the deep water (> 500 ft. [152 m]) fishing zones (MacDuff and Roberto 2012). Fishing in deeper waters is mainly conducted by larger, commercial vessels. Subsistence and recreational fishing occurs in the shallower waters. In 2004, the CNMI's Department of Fish and Wildlife reported 43 vessels recorded commercial landings in the bottomfish fishery (Western Pacific Regional Fishery Management Council 2005). Only eight of these vessels were reported to be larger commercial vessels, ranging in length from 29 to 70 ft. (8.8 to 21 m), and the remaining vessels were among the smaller, approximately 150 skiffs, measuring less than 24 ft. (7.3 m). The skiffs are generally restricted to use during daylight hours and within a 40 nm radius of Saipan because of their size (Western Pacific Regional Fishery Management Council 2005; MacDuff and Roberto 2012).

A study conducted by the Pacific Islands Fisheries Science Center on fishing activity in the Islands Unit of the Marianas Trench Marine National Monument reports that fishers have historically traveled from the southern Mariana Islands to the northern islands (now referred to as the Islands Unit) to fish for both commercial benefit and subsistence (Kotowicz and Richmond 2013). Between 1979 and 2009, an average of 3.8 trips were made annually to the Islands Unit. Out of the 117 trips, fishing was the primary



On May 16, 1997, Guam Public Law 24-21 was implemented creating 5 marine preserves and making changes to Guam's fishing regulations. These marine preserves were set up to restrict certain activities such as fishing to protect coral reef habitats and aquatic animals such as fish.

Figure 3.12-7: Marine Preserves on Guam

purpose for 73 trips; however, fishing took place on 98 percent of all trips. Other primary purposes for trips to the Islands Unit were research, transport of supplies, exploration, and chartered trips.

The waters surrounding FDM have been and continue to be an important area for local fishers. The pending establishment of a 12 nm danger zone coincident with the existing 12 nm restricted airspace (R-1701 A) and the associated potential restrictions on accessibility is a concern expressed by the public; however, the specific locations of popular fishing sites that may be encompassed by the danger zone are not available. To conduct a more meaningful analysis of potential impacts on accessibility to these fishing sites, areas where the water depth is less than 400 m are considered as potential fishing sites (Figure 3.12-4).

Fishing gear used by recreational and subsistence fishers in the CNMI bottomfish fishery includes hand lines, home fabricated hand reels, and electric reels. Larger commercial vessels commonly use electric reels and hydraulics. There are no known commercial vessels with ice-making or freezer capabilities (Western Pacific Regional Fishery Management Council 2005). Bottomfishing is the most productive boat-based fishing method in the CNMI (MacDuff and Roberto 2012).Little information is available on the CNMI precious coral fishery. The steep topography around the islands limits the available habitat for precious coral (i.e., black, pink, gold, and bamboo corals). Some species of precious corals prefer shallow (30 to 100 m [approximately 90 to 300 ft.]), nearshore habitat, while other species are known to grow in deeper waters (300 to 1,500 m [approximately 1,000 to 4,900 ft.]) farther from shore. Since World War II, no known harvests of precious corals have occurred in the CNMI EEZ (Western Pacific Regional Fishery Management Council 2009). In September 2008, NMFS issued a 5-year moratorium on harvesting gold corals (*Gerardia* spp., *Callogorgia gilberti, Narella* spp., *Calyptrophora* spp.) to protect against the threat of overharvesting (50 C.F.R. 665.469). On 29 May 2013, NMFS extended the moratorium through 30 June 2018 to encourage continued research on gold corals, which are long-lived and grow slowly, and, consequently, are vulnerable to overharvesting (78 Federal Register [FR] 32181). The NMFS has also proposed quotas for harvesting other species of precious corals (77 FR No. 1, Tuesday 3 January 2012). In Guam, a limit of 700 kg (1,543 lb.) of black coral can be harvested annually, and all other precious corals are limited to a combined total of 1,000 kg (2,205 lb.). In the CNMI, the limit on black corals is 2,100 kg (4,630 lb.) per year, and the limit on all other corals is 1,000 kg (2,205 lb.) (MacDuff and Roberto 2012).

Table 3.12-3: Commonwealth of the Northern Mariana Islands Commercial Fishery Landings

Year	Annual Total (lb.)	Value ($)
2005	432,790	$911,059
2006	536,724	$1,058,804
2007	510,680	$952,903
2008	388,426	$823,821
2009	331,506	$709,985
TOTAL	**1,868,620**	**$4,456,572**

Note: lb. = pound

Sources: Guam Division of Aquatic and Wildlife Resources and the Western Pacific Fisheries Information Network (2007, 2008, 2009, 2010, 2011)

The CNMI bottomfish fishery gear for recreational and subsistence fishers include hand lines, home fabricated hand reels, and electric reels. Larger commercial vessels commonly use electric reels and hydraulics. There are no known commercial vessels with ice-making or freezer capabilities (Western Pacific Regional Fishery Management Council 2005). Trolling is the most common fishing method.

3.12.2.2.3 Transit Corridor

There is no data on commercial or recreational fishing within the transit corridor area because of the distance from land. Due to the distance from land and lack of rich fishing grounds within the corridor, there is limited to no commercial and recreational fishing activity within the transit corridor.

3.12.2.3 Subsistence Use

The U.S. Environmental Protection Agency (USEPA) considers subsistence fishers to be people who rely on noncommercial fish as a major source of protein. Subsistence fishers tend to consume noncommercial fish or shellfish at higher rates than other fishing populations, and for a greater percentage of the year, because of cultural or economic factors. There are very few studies in the United States that have focused specifically on subsistence fishers. The United States has issued no regulations to determine what or who would be considered a subsistence fisher. However, on 3 July 2013 a final rule proposed by the NMFS went into effect allowing non-commercial fishers who are residents of Guam or the CNMI to fish within the boundaries of the Marians Trench National Monument and to “exchange” their catch for goods and services (78 FR 32996). Within the terms of the final rule, an “exchange” is defined as,

> “[T]he non-market exchange of marine resources between fishermen and community residents for goods, and/or services for cultural, social, or religious reasons, and which may include cost recovery through monetary reimbursements and other means for actual trip expenses (ice, bait, food, or fuel) that may be necessary to participate in fisheries in the western Pacific.”

Concerns over potential abuse of the non-market exchange leading to commercial market sales and competition for commercial fishers has been voiced by Global Ocean Legacy and Pew Charitable Trusts (The Samoa News 2013).

In addition, in the United States, there are no particular criteria or thresholds (such as income level or frequency of fishing) that definitively describe subsistence fishers. The USEPA issued guidance to state that at least 10 percent of licensed fishers in any area will be subsistence fishers (U.S. Environmental Protection Agency 2002). Because the 10 percent estimate is not based on actual subsistence fishing data, the number may be an overestimate or underestimate.

Subsistence fishing is an important part of the cultural and historical identity of indigenous peoples and Asian immigrant communities living in Guam and in the CNMI. Lower income communities are also more likely to engage in subsistence fishing (Allen and Bartram 2008; Office of Environmental Health Hazard Assessment 1997). An important part of the cultural heritage of local communities practicing subsistence fishing is sharing the catch. An estimated 96 percent of fishers share their catch with immediate family and close friends. Fifty-three percent of fishers do not typically share their catch outside of this close social circle, with the notable exception of contributing to church functions (e.g., fiestas) (Allen and Bartram 2008).

The fishing gear and larger vessels needed for offshore fishing are considerably more expensive than the smaller boats and fishing gear appropriate for nearshore fishing. Low-income populations would have limited means and opportunity to travel offshore into federal waters for fishing. Thus, it is assumed that the majority of subsistence fishing would occur in waters close to the coastline. Traditional fishing customs are also associated with fishing on nearshore reefs. Inshore fishing usually occurs within sight of the shoreline in bays, flats, and marshes or under piers, bridges, or near the jetties (Allen and Bartram 2008; Orange Beach Fishing Charters 2011). The water is usually less than 100 ft. (30 m) deep.

3.12.2.3.1 Guam

Most shallow water fishing out to 3 miles (mi.) (4.8 kilometers [km]) from shore is recreational and subsistence fishing typically conducted by vessels less than 25 ft. (7.6 m) long. Crustacean harvest occurs in inshore territorial waters also for recreational and subsistence purposes. The native Chamorros fish for a combination of recreational, subsistence, and cultural purposes. Sales of fish may occur to cover expenses, but the primary purpose is subsistence and cultural activities that include donations to assist each other and celebration of life events. A high value is placed on sharing one's fish catch with relatives and friends. The social obligation to share one's fish catch extends to part-time and full-time commercial fishers (Amesbury and Hunter-Anderson 1989). In 2005, Guam households purchased 51 percent of the fish consumed at a store or restaurant, approximately 24 percent was caught by a family member, 14 percent was caught by a family friend or extended family member, and 9 percent was purchased at a flea market or from a roadside stand (van Beukering et al. 2007). Domestic fishing on Guam supplements family subsistence, which is not just limited to fishing but is a combination of small-scale gardening, ranching, and wage work as well (Allen and Bartram 2008; Amesbury and Hunter-Anderson 1989).

3.12.2.3.2 Commonwealth of the Northern Mariana Islands

Both the CNMI and Guam are categorized as "fishing communities" by the Western Pacific Regional Fishery Management Council. This designation is given due to considerations such as the portion of the population that is dependent upon fishing for subsistence, the economic importance of fishery resources to the islands, and the geographic, demographic, and cultural attributes of the communities (Western Pacific Regional Fishery Management Council 2009). Recreational and subsistence fishing activities on CNMI primarily occur in the shallow water (< 500 ft. [< 152 m]) and are limited to daylight hours within a 30 mi. (48.2 km) radius of Saipan. These limitations are associated with the distances to nearby ports and the typical size of the vessels (usually less than 24 ft. [7.3 m] in length) (Western Pacific Regional Fishery Management Council 2005). This type of fishing is conducted without fathometers or nautical charts as the fishers rely on land features for guidance to a fishing area (Pacific Islands Fisheries Science Center 2011). In 2005, Division of Fish and Wildlife reported 150 vessels were being used for subsistence fishing (Western Pacific Regional Fishery Management Council 2005).

The lobster harvest occurs exclusively within 3 nm from shore. This harvest is for personal consumption, and volume is not reported. There is no information available regarding the subsistence or recreational harvest of coral reef resources inshore; however, a survey program is being established. Saipan Lagoon is thought to be heavily harvested by subsistence and recreational fishers; however, coral reefs are not believed to be used with any frequency by subsistence or recreational fishers. Poaching by foreign boats is believed to occur on coral reefs (Western Pacific Regional Fishery Management Council 2005).

3.12.2.3.3 Transit Corridor

It is assumed that there is limited to no subsistence fishing activity within the transit corridor because of the distance from land to the transit corridor and because the majority of subsistence use occurs nearshore.

3.12.2.4 Tourism

Coastal tourism and recreation can be defined as the full range of tourism, leisure, and recreationally oriented activities that take place in the coastal zone and the offshore coastal waters. These activities include coastal tourism development (e.g., hotels, resorts, restaurants, food industry, vacation homes, second homes, etc.), and the infrastructure supporting coastal development (e.g., retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, recreational fishing facilities, etc.). Also included is ecotourism and recreational activities such as recreational boating, cruises, swimming, recreational fishing, snorkeling and diving (National Oceanic and Atmospheric Administration 1998).

3.12.2.4.1 Guam

Visitors to Guam enjoy clear waters with excellent visibility extending out as far as 150 ft. (46 m), depending on the season. Diving and snorkeling are popular activities that may also include underwater photography, spear fishing, and exploring wrecks and reefs. Jet skiing, wind surfing, sea kayaking, water tours, dolphin watching, and submarine and semisubmersible tours are also available to tourists (and locals) on Guam.

In 2003, according to the Guam Economic Development Authority, the major revenue sources in Guam were tourism (60 percent), military and federal spending (30 percent), and “other” revenue (10 percent) (Guam Economic Development Authority 2008). In 2010, Guam welcomed approximately 1.2 million visitors. Japan accounted for approximately 76 percent of Guam’s visitors, people traveling from Korea accounted for 10 percent, the United States accounted for 5 percent, and the smaller markets of Hong Kong, China, Australia, the Philippines, Micronesia, and Russia made up approximately 5 percent of visitors (Guam Visitors Bureau 2010). In 2006, Guam supported an estimated 20,000 tourism related jobs, approximately 35 percent of the total number of jobs available on the island (Allen and Bartram 2008).

Tumon Bay, halfway between Apra Harbor and the northern part of the island, is the premier resort destination on Guam. Luxury hotels line the beachfront with access to white sand and crystal clear, warm waters ideal for swimming and snorkeling. A few hotels are also located in the southern and central parts of the island.

Guam’s warm waters offer dives for all skill levels with numerous opportunities for the uncertified diver as well as the most skilled. Diving is available from either a boat or the shore. Guam boasts that it is the only site in the world that has shipwrecks from both World War I and World War II, from two different countries, which can be visited at the same time: the Tokai Maru and the SMS Cormoran (Guam Visitors Bureau 2006). Figure 3.12-8 shows many of the popular dive sites in nearshore waters of Guam and the CNMI. The vast majority of mapped dive sites are not located in close proximity to military danger zones.

3.12.2.4.2 Commonwealth of the Northern Mariana Islands

The CNMI is a 14-island chain that features the three main islands of Saipan, Tinian, and Rota. With an average temperature of 84 degrees Fahrenheit (°F) and average humidity of 79 percent, these islands offer an attractive climate for a variety of tourism activities including sky diving, jungle tours, venues that offer dances of the Pacific Islanders, resort stays, golf, scuba diving (including historic ship and aircraft wrecks), touring historic sites, music, arts and crafts, Eurobungy trampoline, climbing walls, and gambling. With the ocean temperature averaging 82°F, other tourist activities include snorkeling, parasailing, water skiing, submarine tours, and sea walker tours (a 3 m [10 ft.]) dive for the non-scuba

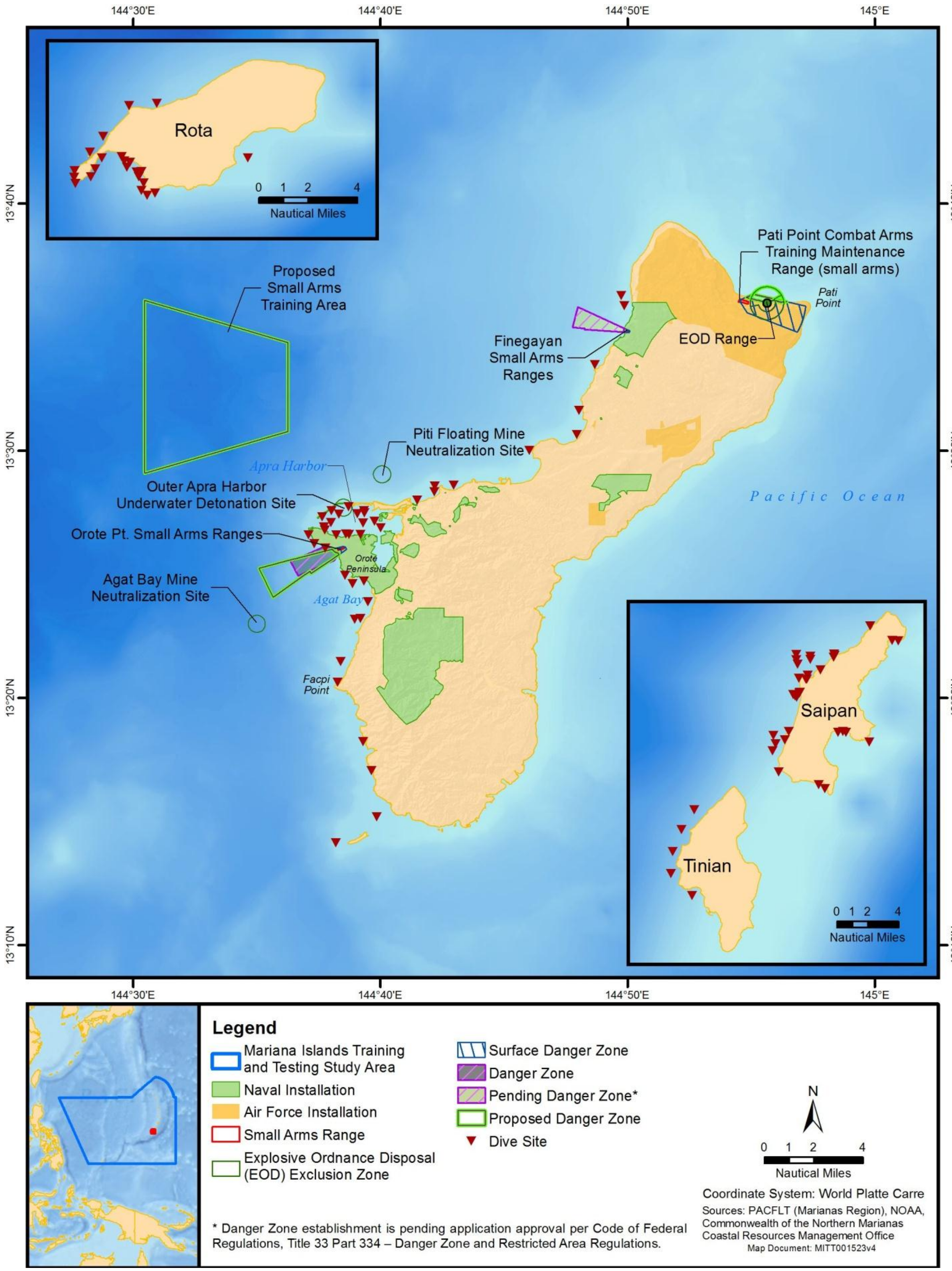


Figure 3.12-8: Popular Dive Sites Within the Mariana Islands Training and Testing Study Area

certified tourist), banana boat rides (a non-motorized boat pulled by a motor boat), bird watching, deep sea fishing, flora and fauna tours, glass bottom boats, and cultural festivals featuring native food, arts, and crafts.

Tourism is the largest industry in the CNMI. There have been serious declines in tourism due to the Asian financial crisis, Severe Acute Respiratory Syndrome, and the 9/11 attacks on the United States (Cohen 2006). Between 1988 and 1996, the tourism industry grew by 15 percent annually. After a sharp decline in 1997 and 1998, a modest recovery had begun before the 11 September 2001 terrorist attacks. After the 2001 attacks, the tourism trade declined by 1.4 percent (Pacific Business Center Program – University of Hawaii 2008). Tourism continues to face economic difficulties, including increased labor costs associated with the $2 per hour increase in the CNMI minimum wage standards (from $3.05 an hour in 2007 to $5.05 an hour in 2010), with proposed subsequent wage increases of $0.50 a year until the CNMI reaches the federal minimum wage standards of $7.25 an hour (Eugenio 2010). The result is a short-term imbalance in the economy caused by the increased operating costs in the tourism industry and exacerbated by lagging tourist numbers.

The withdrawal of Japan Air Lines from scheduled flights between Japan and Saipan reduced the CNMI Japanese tourist population from 40 percent of the total tourism to 29 percent in 2005 (Cohen 2006). In July 2011, the Marianas Visitors Authority reported 27,203 visitors traveled to the CNMI, which is down by 23 percent compared with the total for July 2010 (Tenorio 2011). Visitor arrivals from Japan continue to fall, with a 17 percent decrease in fiscal year 2011, and there has been no growth in the Korean tourism market from 2010 to 2011 because of reductions in direct flights by airlines in Japan and Korea. However, the CNMI has seen an increase in tourism from secondary markets. While Japanese and Korean tourism has decreased or remained flat, Chinese tourism has increased by 9 percent over 2010 totals, and Russian tourism is up by 19 percent compared with 2010. In addition, with direct flights from Hong Kong, the CNMI has experienced a 9 percent increase in visitors from Hong Kong between July 2010 and July 2011 (Tenorio 2011).

The island of Tinian has a total land area of approximately 39 square miles ($mi.^2$) (101.01 square kilometers [km^2]), but only about 13 $mi.^2$ (33.7 km^2) of the island is outside the DoD-leased lands. Local government and the accommodation (e.g., hotel) industry are the island's largest employers (U.S. Department of the Navy 2010b). Tinian is the only populated island in the Mariana Islands that has not experienced dramatic economic development over the last 15 years. Most retail establishments are located in San Jose, and include a large hotel and casino, nightclubs, convenience stores, gas stations, small restaurants, bakeries, and banks (National Park Service 2001). The accommodations industry, including the Tinian Dynasty Casino Hotel, employs approximately 670 people, or about 40 percent of the island's total employed population. Local government has approximately 270 employees, or about 17 percent of the total employed, and the education industry employs approximately 130 people, which is about 8 percent of the total number of employed people. In 2008, Tinian's unemployment rate was approximately 17 percent (U.S. Department of the Navy 2010b). Although gambling is the most profitable tourist attraction, the World War II historic sites and wildlife viewing also attract tourists to the island and encourage longer stays. Most of the historic sites are located within the exclusive military use area.

The island of Rota is the smallest of the three major islands in the CNMI with a land area of approximately 33 $mi.^2$ (85.5 km^2). The island primarily offers outdoor recreation and sightseeing, including a famous swimming hole on the western side of the island, a limestone quarry used by ancient Chamorros, and a seabird sanctuary providing habitat for thousands of seabirds.

3.12.2.4.3 Transit Corridor

It is assumed that there is limited to no tourism activity within the transit corridor because of the distance from land to the transit corridor and because the majority of tourism activity occurs nearshore.

3.12.3 Environmental Consequences

This section presents the analysis of potential impacts on socioeconomic resources, from implementation of the project alternatives, including the No Action Alternative, Alternative 1, and Alternative 2. In the sections below, each socioeconomic resource stressor (i.e., an external stimulus or multiple stimuli that causes stress to a resource) is introduced, analyzed by alternative, and analyzed for training and testing activities.

Potential impacts to socioeconomic resources are not analyzed beyond 12 nm from shore, because EO 12114, which establishes environmental policy beyond 12 nm, does not apply to socioeconomics. Table F-3 in Appendix F (Training and Testing Activities Matrices) shows the warfare areas and associated stressors that were considered for analysis of socioeconomic resources.

The stressors vary in intensity, frequency, duration, and location within the MITT Study Area. The stressors applicable to socioeconomic resources in the MITT Study Area and analyzed below include the following:

- Accessibility (limiting access to the ocean and the air)
- Airborne acoustics (weapons firing, aircraft, and vessel noise)
- Physical disturbance and strike (aircraft, vessels and in-water devices, military expended materials)
- Secondary (availability of resources)

Secondary stressors resulting in indirect impacts to socioeconomic resources are discussed in Section 3.12.3.4 (Secondary Impacts from Availability of Resources). A secondary stressor, as used in this section, is a stressor that has the potential to affect a socioeconomic resource as a result of a direct effect on another non-socioeconomic resource. For example, if a training activity has the potential to affect certain species of fish, and those species also constituted an economically important fishery, then the effect of the stressor on those fish species could have an indirect, or secondary, effect on the socioeconomic resource of recreational fishing.

Analysis of economic impacts evaluates the impacts of the alternatives on the economy of the region of influence, while analysis of social impacts considers the change to human populations and how the action alters the way individuals live, work, play, relate to one another, and function as members of society. Because the proposed training and testing activities take place predominantly offshore, socioeconomic impacts would be associated with economic activity, employment, income, and social conditions (i.e., livelihoods) of industries or operations that use the ocean resources within the MITT Study Area. Although there are no permanent population centers in the region of influence and the typical socioeconomic considerations such as population, housing, and employment are not applicable, this section will analyze the potential for fiscal impacts on marine-based activities and coastal communities. When considering impacts on recreational activities such as fishing, boating, and tourism, both the economic impact associated with revenue from recreational tourism and public enjoyment of recreational activities is considered.

The proposed training and testing activities were evaluated to identify specific components that could act as stressors by having direct or indirect effects on the resources of commercial transportation and shipping, commercial and recreational fishing, subsistence use, and tourism. For each of the three stressors listed above, a discussion of impacts on the relevant resources is included for each alternative. All five resources are not affected by each of the three stressors. For example, the resource of air traffic is not impacted by the stressors of physical disturbance and strike. Potential impacts to air traffic are addressed under the accessibility stressor.

3.12.3.1 Accessibility (to the Ocean and Airspace)

Military training and testing activities have the potential to temporarily limit access to areas of the ocean for a variety of human activities associated with commercial transportation and shipping, commercial recreation and fishing, subsistence use, and tourism in the MITT Study Area.

Danger zones and restricted areas located within 12 nm from shore in the MITT Study Area are well established and clearly marked on navigational charts used by commercial and recreational vessels. These areas do limit access to fishing grounds potentially of interest to commercial, recreational, and subsistence fishers and to dive sites that may be of interest to residents and tourists.

When training or testing activities are scheduled that require specific areas to be free of non-participating vessels to ensure public safety, the military requests that the U.S. Coast Guard issue Notices to Mariners.

As specified in Title 33 C.F.R. Subpart 72.01, Notices to Mariners, the U.S. Coast Guard issues information to the public concerning maritime navigation. There are three categories of Notices to Mariners: the Local Notice to Mariners (LNM), the Notice to Mariners (NTM), and the maritime Broadcast Notice to Mariners (BNM).

The LNM is published weekly by each U.S. Coast Guard district or more often if there is a need to notify mariners of local waterway information. The LNM reports changes to and deficiencies in aids to navigation that are established or maintained and operated by or under the authority of the U.S. Coast Guard, and any other information pertaining to the waterways within each U.S. Coast Guard district that is of interest to the mariner, to include advisories for public safety. The LNM is available for viewing on the Coast Guard Navigation Center website.[1] Any person may apply to the Coast Guard Navigation Center to receive automatic notices via e-mail when new editions of the LNM are available.

The NTM is published weekly by the National Geospatial-Intelligence Agency, and is prepared jointly by the U.S. Coast Guard, the National Ocean Service, and the National Geospatial-Intelligence Agency. The NTM is intended to advise mariners of new hydrographic discoveries, changes in channels and navigational aids, and information concerning the safety of navigation. The NTM contains updates to the latest editions of charts and publications of the National Geospatial-Intelligence Agency, National Ocean Service, USACE, and U.S. Coast Guard; selected information from the LNM issued and published by the Coast Guard districts; and information compiled from foreign notices to mariners, ship reports, and similar cooperating observer reports. The NTM may be accessed through the National Geospatial-Intelligence Agency's website[2] under "Notice to Mariners."

[1] http://www.navcen.uscg.gov/?pageName=lnmMain
[2] http://msi.nga.mil/NGAPortal/MSI.portal

The maritime BNM is a radio broadcast issued by the U.S. Coast Guard using its own radio stations. These stations broadcast warnings within naval areas defined by the Worldwide Navigational Warning Service. Within the Mariana Islands naval area, the approved method for receiving these warnings are from the U.S. Coast Guard Guam's Global Maritime Distress and Safety System (GMDSS) broadcast service. The GMDSS broadcast service provides rapid dissemination of information critical to navigation and the safety of life at sea. BNM are issued regularly and contain information about persons in distress, or objects and events that pose an immediate hazard to navigation.

The U.S. Coast Guard Guam GMDSS broadcast service issues BNM warnings using multiple radio broadcast systems and frequencies. Local and coastal BNM warnings are broadcast out to 20 nm on VHF-FM radio channel 16. After a preliminary safety signal is broadcast on VHF-FM channel 16, broadcast stations are shifted to VHF-FM channel 22A for warning information. Out to 100 nm, the Coast Guard NAVTEXT broadcast system provides BNM warnings that are received by NAVTEXT radios using the MF frequency 518 kilohertz. For broadcast coverage beyond 100 nm, BNM warnings are issued via HydroPac using HF radio frequencies.

The military also requests that the FAA issue Notices to Airmen to warn the public of upcoming military activities requiring the exclusive use of airspace. Military training and testing areas and SUA are identified on nautical and aeronautical charts to inform surface vessels and aircraft that military activities occur in the area.

The restricted airspace, R-7201, overlays FDM and the waters surrounding the island out to a distance of 3 nm. Airspace R-7201A extends from 3 nm out to 12 nm measured from the center of FDM (Figure 3.12-2 and Figure 3.12-4). R-7201 and R-7201A support live-fire and inert engagements such as surface-to-ground and air-to-ground gunnery, bombing, and missile exercises, all of which require that access to the area be permanently restricted to ensure the safety of the public. Even when live-fire or other potentially hazardous activities are not occurring at FDM, the threat of unexploded ordnance is always present. No commercial or recreational activities occur or are permitted on or near the island, and aircraft and marine vessels are restricted from entering within 3 nm of FDM. Notices to Airmen and Notices to Mariners are issued at least 72 hours in advance of potentially hazardous training or testing activities. Notices to Airmen and Notices to Mariners may also advise restrictions out to 12 nm as needed for certain training or testing events to ensure the safety and protection of the public and the military during some training and testing activities.

The 2013 Mariana Islands Range Complex Airspace EA/OEA analyzed the establishment of a 12 nm danger zone surrounding FDM (congruent with restricted airspace R-7201A). The analysis supports the establishment of the Danger Zone under the authority of the USACE (C.F.R., Title 33 Part 334) to restrict all private and commercial vessels from entering the area during hazardous training and testing activities. When no training or testing activities are scheduled, the waters within the pending 12 nm danger zone (but not within 3 nm) are accessible to the public. To help mariners better plan fishing and boating activities that involve accessing the waters around FDM (waters between 3 and 12 nm), the Navy notifies mariners of time periods when FDM will not be in use for several consecutive days. Announcing in advance when FDM will be in use and when it will not be in use for an extended period of time will facilitate the use of waters around FDM by the public for recreational activities.

The Mariana Islands Range Complex EIS/OEIS analyzed the impacts from establishing a small arms danger zone for the existing Finegayan Small Arms Range, located in nearshore waters off of the Naval Base Guam Telecommunications Site and extending seaward from Haputo Point.

In addition to issuing Notices to Airmen and Notices to Mariners to announce scheduled training and testing events, upcoming events are communicated to stakeholders (e.g., local mayors, resources agencies, and fishers) using a telephone tree and e-mail distribution developed by Joint Region Marianas with stakeholder input. Notices are also sent to the NOAA, local cable channels, and emergency management offices.

Establishing two new danger zones and modifying an existing danger zone is proposed under Alternatives 1 and 2 (see Chapter 2, Description of Proposed Action and Alternatives, Section 2.7 and Section 2.8).

- A danger zone would be established over nearshore waters, approximately 0.5 nm seaward of the Pati Point Combat Arms Training and Maintenance Range and Pati Point EOD Range, located at Pati Point on the northeastern tip of Guam, to support existing small arms training and explosives ordnance range activity.
- A danger zone would be established to support small arms training located west of Guam, beyond 3 nm from shore and within the territorial waters of Guam. The danger zone would be located within an existing Navy "Firing Danger Area" charted on NOAA Chart 81048, Guam. The area is currently used by military crews to conduct small arms training.
- The existing danger zone off Orote Point (33 C.F.R. Part 334.1420) would be modified to support .50 caliber sniper training by extending the range to 2.7 miles from shore (see Figure 2.1-5 in Chapter 2, Description of Proposed Action and Alternatives).

Once established, restrictions associated with these zones would be codified in 33 C.F.R. 334, and activities occurring at these locations would be announced in advance through Notices to Mariners to reduce conflicts with recreational, commercial, and subsistence activities. To ensure public safety, access to waters within C.F.R. Part 334, Danger Zoneswill be controlled in accordance with USACE rule making. Military activities utilizing the danger zone would be halted until the danger zone is cleared of transiting vessels.

Potential impacts to mariners attempting to access a site (e.g., a fishing site) within a temporarily closed danger zone could include incurring additional fuel costs, expending more time transiting to an alternate site, or rescheduling a trip. The extent of the impact would mainly be dependent on the length of the route to an alternate site, but could also include the expense and inconvenience associated with rescheduling a trip. Although accessibility to waters within the proposed danger zones would be restricted during specified times, the restrictions are temporary, and the military will continue to notify the maritime community of scheduled closures. The vast majority of the MITT Study Area, including a number of FADs, would remain accessible to the public.

Data are available on Notices to Mariners issued from 2010 through 2012 for FDM and W-517. An average of 39 Notices to Mariners were issued per year for FDM and 34 for W-517 warning vessels of military activities and temporarily restricting access to waters in these areas to ensure public safety (Table 3.12-4). Over the 3-year period, access to waters around FDM was restricted for an average of 159 days per year (access to waters within 3 nm of FDM is restricted at all times), and access to waters within W-517 was restricted for an average of 95 days per year. When issued, Notices to Mariners specify how long waters are restricted, which can range from a few hours to the entire day.

Table 3.12-4: Notices to Mariners Issued for Military Activities Occurring at Farallon de Medinilla and Warning Area 517 from 2010 through 2012

Year	Location	Number of Notices to Mariners Issued	Number of Days Affected
2010	FDM	32	107
	W-517	34	73
2011	FDM	42	170
	W-517	38	116
2012	FDM	44	201
	W-517	30	97
3-Year Average	**FDM**	**39**	**159**
	W-517	**34**	**95**

Notes: FDM = Farallon de Medinilla, W-517 = Warning Area 517

Specifically for FDM, data recorded from October to December 2011 show that Notices to Mariners issued for 14 days in October restricted access for an average of 11.3 hours per day. In November, Notices to Mariners were issued for 15 days, and on those days waters around FDM were restricted for an average of 7.4 hours. Notices to Mariners were issued for 20 days in December, resulting in waters being restricted for an average of 16 hours per day; however, the December average is skewed because for 6 out of the 20 days the waters were restricted for the entire day (i.e., 24 hours). Excluding those 6 days, waters around FDM were restricted for an average of 12.6 hours per day.

The military has also requested that the U.S. Coast Guard issue Notices to Mariners to announce when plans to use an area change (e.g., W-517), and access to the area will no longer be restricted (as previously published) and will now be accessible. Actions like notifying mariners when plans change are intended to reduce potential impacts to accessibility and improve communication between the military and local communities. The Navy also announces time periods when FDM will not be in use for several consecutive days, allowing mariners to plan activities (e.g., fishing) in waters beyond 3 nm from FDM.

A 2011 survey of small boat fishers on Guam attempted to assess the impacts of restricting access to waters within W-517 during military activities (Hospital and Beavers 2012). The fishers were asked if military activities ever affected their fishing trips. Of the 139 respondents, 54 percent reported that in the past 12 months at least one “pelagic fishing” trip was affected in some way by military activities, 42 percent reported that at least one “bottomfishing” trip had been affected, and 31 percent reported that military activities had affected one or more “reef fishing” trips. The data were organized by the type of fishing trip (i.e., pelagic fishing, bottomfishing, and reef fishing). The survey did not ask how the trips were affected by restricting access to W-517.

In response to the question, “In the past 12 months, what percent of your fishing trips were affected by military exercises?” respondents reported that an average of 17 percent of pelagic fishing trips had been affected in the 12 months, 14 percent of bottomfishing trips had been affected, and 10 percent of reef fishing trips had been affected, in some way, by military activities in the past 12 months (Hospital and Beavers 2012). Again, the survey did not ask how the fishing trips were affected.

The researchers speculated that potential effects could include increased travel costs to launch a vessel, increased search costs associated with not fishing in familiar and productive fishing grounds, a change in targeting methods to more fuel-intensive methods such as trolling, and inability to fish at all that day.

Fishers were given an opportunity to provide comments as part of the survey, and although the survey indicates that temporarily restricting access to waters within W-517 can affect fishing activities, the comments mention military activities only twice. One commenter asked if an alternate location for “target practice” was available, and a miscellaneous comment listed “military interference” as a concern. Of the other 49 comments, the majority focused on marine protected areas, FADs (needing more and replacing lost ones), the need for better infrastructure (e.g., boat ramps), and fishing regulations (Hospital and Beavers 2012).

In an effort to respond to local community concerns, the military has been limiting access restrictions only to portions of W-517 needed during certain military training activities (to ensure public safety, some activities would still necessitate restricting access to all of W-517). This allows fishers access to popular fishing areas located adjacent to the northern portion of W-517 while military training activities are being conducted farther south in W-517. If restricting access to only a portion of W-517 is feasible, a Notice to Mariners would be issued specifying the areas (latitudes) within W-517 that would be temporarily restricted for the purpose of ensuring public safety during military training or testing activities. The remaining areas of W-517 would be accessible to the public. This allows areas within W-517 to be open to non-military vessels for fishing and transit to Galvez Bank, Santa Rosa Reef, and White Tuna Banks. Additionally, W-11, W-12, and W-13 provide the military with more flexibility to utilize areas other than W-517 for activities requiring exclusive use of airspace, which would further reduce time periods when the northern portion of W-517 is inaccessible. All warning areas in the MITT Study Area overlie primarily deep ocean waters far from land and the nearshore waters that are most frequently used by the public.

The changes in accessibility to areas of the ocean would be an impact if it directly contributed to loss of income, revenue, or employment. Disturbance to human activities that result in impacts on payrolls, revenue, or employment is quantified by the amount of time the activity may be halted or the amount of time expended for the activity to be rerouted and the ability for the activity to take place in another location. Air Traffic Control Assigned Airspace and warning areas are restricted for short periods of time (typically on the order of hours) to cover the timeframes of training and testing activities. Airspace designated for military use (e.g., R-7201 and R-7201A) is identified on aeronautical charts, and the Navy posts Notices to Airmen when restrictions are in place to accommodate a training or testing activity. Prior to initiating a training or testing activity, the military would follow standard operating procedures to visually scan an area to ensure that non-participants are not present. If non-participants are present, the military delays, moves, or cancels its activity. Public accessibility is no longer restricted once the activity concludes.

Stressors to accessibility, that is restrictions to the availability of ocean space or air space, would be temporary, with the exception of access to C.F.R.-designated permanent danger zones. Mariners have a responsibility to be aware of conditions on the ocean, including when access to military warning areas and danger zones is restricted; however, it is not expected that direct conflicts in accessibility would frequently occur. The locations of restricted areas are published and available to mariners, who typically review such information before boating in any area. Restricted areas are typically avoided by experienced mariners.

The military will continue to engage the public on issues associated with accessibility to the ocean and airspace within the MITT Study Area.

3.12.3.1.1 Socioeconomic Activities

3.12.3.1.1.1 Commercial Transportation and Shipping

The offshore and nearshore areas of the MITT Study Area include the established Mariana Island Range Complex used for military training and testing activities and a transit corridor extending to the east towards the United States. Commercial vessels entering the MITT Study Area, including established restricted areas and danger zones, operate under maritime regulations and are not limited by military activities. Potential disruptions to commercial shipping are limited or avoided by requesting that the U.S. Coast Guard issue Notices to Mariners. Notices to Mariners advise commercial ship operators, commercial fisherman, recreational boaters, and other users of the area that the military will be operating in a specific area, allowing them to plan their activities accordingly. Additionally, for certain activities the Navy Hydrographic office will issue HydroPacs prior to an activity. These temporary limitations on access are established and implemented for the safety of the public and have been employed regularly over time with negligible socioeconomic impacts on commercial shipping activities.

Air Traffic Control Assigned Airspace is activated for short periods of time (typically on the order of hours) to cover the timeframes of training and testing activities. Warning areas and other SUA (e.g., W-517 south of Guam) are established for military use and are identified on aeronautical charts (see Figure 3.12-2 and Figure 3.12-4). The Navy posts Notices to Airmen when restrictions are in place to accommodate training or testing activity. Air traffic routes for commercial and general aviation flights departing and arriving at Guam International Air Terminal, the only commercial or civilian airport on Guam, are established such that overlap with military aircraft activities would be avoided.

Military air traffic in the CNMI takes place in airspace over the island of Tinian. Tinian's North Field has four runways, taxiways, and parking aprons providing various tactical scenarios without interfering with commercial and community activities south of the military lease area. However, North Field is in need of improvements before it can be fully utilized for training activities. Saipan International Airport is the largest commercial airport in the CNMI, and is the main gateway for commercial air traffic into the CNMI (Commonwealth Ports Authority 2005). Direct flights are available from major cities in Japan, Korea, China, and Guam. A commuter terminal services Tinian and Rota islands.

The Navy coordinates use of ATCAA with the Guam FAA and the FAA for international routes beyond the region. The coordinated effort has and will continue to maintain safe separation of military activities from commercial and general aviation flights and to limit times when airspace is temporarily inaccessible.

3.12.3.1.1.2 Commercial and Recreational Fishing

Commercial and recreational fishing activities contribute to the overall economy and cultural heritage in the CNMI and on Guam. The military has conducted training and testing activities within this region in the past and has not barred fishing or recreational uses, except in select nearshore areas, as described above, where the military has published rules in place through the USACE and U.S. Coast Guard. With the exception of these designated areas where published federal rules are in place, commercial and recreational interests such as fishing, boating, and beach use are not restricted. Public access to surrounding areas is not limited.

Training or testing activities requiring a temporary safety zone to prevent non-participating vessels from entering a potentially dangerous area (e.g., during an activity using explosives) have the potential to affect commercial and recreational fishing activities when the location and timing of the activities coincide with planned military activities. In the event this situation arises, a temporary safety zone would be enforced for a brief period (hours) while the activity takes place. Typically, a zone extends over a circular area with a radius of a couple of miles (depending on the activity). Commercial and recreational fishing activities could occur in the area before and after the temporary restriction. Should the military find non-participants present in a temporary safety zone, the military would halt or delay (and reschedule, if necessary) all potentially hazardous activity until the non-participants have exited the safety zone (Section 3.13, Public Health and Safety).

The public is notified via Notices to Mariners and HydroPacs of upcoming activities requiring a temporary safety zone. These measures provide mariners with advance notice of areas being used by the military for hazardous training and testing activities, and allow mariners to plan accordingly by selecting an alternate destination without appreciable effect to their activities. Furthermore, the military makes every effort to avoid conducting activities requiring a temporary safety zone in areas where non-participating vessels are present or are likely to be present.

The Notices to Mariners and HydroPacs are intended to prevent fishers from expending time and fuel resources transiting to a temporarily closed location. Effective and efficient communication will enable fishers to be better informed of military activities, and will reduce the number of unanticipated scheduling conflicts between fishing activities and military activities. A recent survey conducted by the Navy of fishers who use waters in the Southern California Range Complex off of California resulted in several recommendations that the Navy is or has implemented and would implement within the Marianas Islands Range Complex, including, (1) regular and up to date broadcasts of scheduled closures on Very High Frequency radio, (2) frequent updates to websites on upcoming ranges closures, (3) establishing a single Navy point of contact with the most up to date information on closures for fishers without website access, and (4) specifying whether a scheduled Navy activity requires a complete closure or if fishing can occur simultaneously with the Navy activity (Naval Undersea Warfare Center 2009). The military’s intent is to maintain efficient and effective communication with fishers and other non-participants preceding and during military training and testing activities.

Upon completion of training or testing activities, restriction on certain areas (e.g., Apra Harbor small arms firing range) are lifted and fishers would be able to return to fish and transit through the area. To help manage competing demands and maintain public access in the MITT Study Area, the military conducts its offshore operations in a manner that minimizes restrictions to commercial fisherman. Military ships, fishers, and recreational users operate within the area together, and keep a safe distance between each other. Military participants would relocate as necessary to avoid conflicts with non-participants (U.S. Department of the Navy 2007). Only specific areas within MITT Study Area have been designated as danger zones or restricted areas (see Figure 3.12-2, Figure 3.12-4, and Figure 3.12-6).

As described in Section 3.12.2.2.2 (Commonwealth of the Northern Mariana Islands), the specific locations of popular fishing sites around FDM are not available, and areas where the water depth is less than 400 m are used as proxy locations for possible fishing sites. Establishing a 12 nm danger zone around FDM would encompass waters with depths less than 400 m adjacent to the island (Figure 3.12-4). Access to these areas would be restricted during activities requiring a 12 nm danger zone to ensure public safety. At other times, the waters beyond 3 nm from FDM would be accessible to the public, providing access to waters shallower than 20 m. In addition, two shallow water areas (or banks) with water depths less than 400 m are located beyond 12 nm from FDM and would always be accessible. One area is located approximately 15–20 nm north of FDM, and the other area is located approximately 20–23 nm west of FDM (Figure 3.12-4).

Amphibious Warfare training activities proposed for nearshore waters off of Tinian, Rota, and Guam (see Chapter 2, Description of Proposed Action and Alternatives, Table 2.8-1) have the potential to temporarily limit access to nearby fishing sites. The duration of these activities could be from hours to several days (see Appendix A, Training and Testing Activity Descriptions). These activities would occur five or six times per year in waters off of Tinian, Rota, Guam, or elsewhere in the MIRC, limiting the probability for interruptions to fishing activities at any single location.

Transiting to the Islands Unit from Guam, Saipan, Tinian, or other islands located to the south of FDM would potentially be impacted by limiting access to the 12 nm danger zone around FDM. Considering that an average of 3.8 trips per year has occurred over the past 30 years, the probability of military activities interfering with trips to the Islands Unit is low. Furthermore, the military will announce when FDM is not in use in addition to notifying mariners of planned activities at FDM, which will enable mariners to better plan trips to the Islands Unit.

When a temporary safety zone is established, temporarily limiting commercial and recreational fishing in that specific area, other areas in the MITT Study Area would remain open to commercial and recreational fishing. Fish aggregating devices have been deployed around Guam outside of military warning areas and restricted areas to create alternate fishing sites that are not subject to limitations on accessibility associated with military training and testing activities (Figure 3.12-5). A temporary closure of the danger zone at the Finegayan Small Arms Range would restrict public access to fishing sites when activated, but vessels would be permitted to transit through the danger zone. The Navy will request C.F.R. regulations defining the danger zone that would state expeditious transiting through the active danger zone is allowed. For example, a vessel moving along the coast to FADs located northwest of Guam would be permitted to transit through the danger zone while it is temporarily active; however, vessels would not be permitted to anchor or loiter within the danger zone while it is active. Range activities would be halted until all vessels are cleared from the danger zone. Vessels are permitted to use waters within the danger zone for fishing or other activities when the range is not active.

As described in Section 3.12.3.1 (Accessibility [to the Ocean and Airspace]), Notices to Mariners have been issued for R-7201, surrounding FDM, and W-517 temporarily restricting access to these areas. An average of 39 Notices to Mariners were issued per year for FDM and 34 for W-517 to ensure public safety (Table 3.12-4). Over a 3-year period from 2010 through 2012, access to waters around FDM was restricted for an average of 159 days per year (access to waters within 3 nm of FDM is restricted at all times), and access to waters within W-517 was restricted for an average of 95 days per year (Table 3.12-4). When issued, Notices to Mariners specify how long waters are restricted, which can range from a few hours to the entire day.

The military has been conducting training and testing activities within the MITT Study Area for decades, and has taken and will continue to take measures to prevent interruption of commercial and recreational fishing activities. The military does not limit fishing activities from occurring in areas of the MITT Study Area that are not being used for training and testing activities. To minimize potential military/civilian interactions, the Navy will continue to publish scheduled operation times and locations on publicly accessible Navy websites and through U.S. Coast Guard issued Notices to Mariners up to 6 months in advance of planned events. When feasible, the military will use these same means of communication to notify the public of changes to previously published restrictions. These efforts are intended to ensure that commercial and recreational users are aware of the military's plans and allow commercial and recreational users to plan their activities to avoid scheduled training and testing activities. Advanced planning on behalf of the military and effective communication of the military's plans should minimize limits on accessibility to desirable fishing locations and, consequently, have only a minor effect on commercial and recreational fishing activities. The Navy will continue to engage with the public and the local fisherman on issues affecting commercial and recreational fishing in order to limit potential impacts associated with military activities.

3.12.3.1.1.3 Subsistence Use

Subsistence uses typically occur from the shore or from small vessels within 3 nm or closer to shore. The majority of military training and testing activities occur in offshore waters (beyond 3 nm and in many cases beyond 12 nm) where subsistence fishing typically does not occur. Some training activities are proposed in nearshore areas of Apra Harbor on Guam, on selected beaches on Tinian (for Amphibious Warfare activities), Rota (e.g., Rota airport), and Saipan. With the notable exception of Naval Special Warfare training activities, most activities occurring in nearshore waters take place approximately five times per year (see Chapter 2, Description of Proposed Action and Alternatives). The number of Naval Special Warfare activities and "Other Activities" proposed to occur in nearshore waters of Guam and the CNMI varies widely from 3 to 100 times per year. Nevertheless, no impacts on subsistence activities (e.g., fishing) from conducting the proposed training and testing activities in the MITT Study Area are anticipated, because only those federally designated areas would be restricted from public access.

3.12.3.1.1.4 Tourism

Tourism activities make an appreciable contribution to the overall economy within the MITT Study Area. The establishment of temporary exclusion zones, for safety purposes, has the potential to adversely affect some tourism activities. For example, a visitor who is in the CNMI for only a few days may not be able to reschedule an activity if the establishment of an exclusion zone conflicts with the activity and no alternate site for the activity is suitable. An occurrence of this type is anticipated to be low, because displacement would be brief (hours), and the temporary exclusion zones are created in areas where tourism activities do not typically occur. The military temporarily limits public access only to areas where there is a risk of injury or property damage and publishes scheduled activities through the use of Notices to Mariners and Notices to Airmen. The military strives to conduct its operations in a manner that is compatible with tourism by minimizing temporary access restrictions. Published notices allow recreational users to adjust their routes to avoid danger zones and temporary safety zones. If civilian vessels are located within a danger zone or temporary safety zone at the time of a scheduled testing or training activity, the military would suspend operations until the area is cleared of non-participating vessels. Operations would only continue where and when it is safe and possible to avoid the non-participating vessels. If avoidance is not safe or possible, the military activity would be halted and may relocate or be delayed. In some instances where safety requires exclusive use of a specific area, non-participants in the area are asked to relocate to a safer area for the duration of the military activity.

The military may request that the U.S. Coast Guard or USACE enforce restrictions to public access at the designated areas in Apra Harbor, which prohibit public access during certain times (33 C.F.R. 334 and 33 C.F.R. 165).

In addition, the 12 nm Danger Zone surrounding FDM Island restricts all commercial and recreational vessels from approaching the island without permission from the Navy. The island serves as a bombing range for both explosive and non-explosive munitions training and testing. No tourism activities occur on or in the vicinity of the island for safety reasons.

3.12.3.1.2 No Action Alternative

3.12.3.1.2.1 Training Activities

Under the No Action Alternative, potential accessibility impacts to socioeconomic activities would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, and naval special warfare activities. Training activities would continue at current levels and within established ranges and training locations. There would be no anticipated impacts on commercial transportation and shipping. Some impacts on commercial and recreational fishing, subsistence use, or tourism, may occur when areas of co-use are made temporarily inaccessible to ensure the safety of the public. Considering the military's standard operating procedures, the anticipated infrequent and short-term restrictions on access to areas of co-use, and the large expanse of the MITT Study Area that would be available to the public, significant impacts on accessibility are not anticipated.

The military will continue to collaborate with local communities to enhance existing means of communications with the aim of reducing the potential effects of limiting access to areas designated for use by the military.

3.12.3.1.2.2 Testing Activities

Only one testing activity occurs under the No Action Alternative, the North Pacific Acoustic Lab Philippine Sea 2018–19 Experiment (Deep Water), as shown in Chapter 2 (Description of Proposed Action and Alternatives, Table 2.8-4). No impacts to accessibility are anticipated from this testing activity because it takes place in deep, offshore waters.

3.12.3.1.3 Alternative 1

3.12.3.1.3.1 Training Activities

Training activities and associated stressor components as described under the No Action Alternative would continue and would increase over the No Action Alternative. There would be no changes to the military's current standard operating procedures defining safety precautions and actions taken by the military to protect the public during hazardous training activities on the ocean. Under Alternative 1, potential impacts affecting accessibility to areas of the MITT Study Area would be the same as those associated with the No Action Alternative. Despite the increase in tempo of training activities and the expansion of the MITT Study Area, impacts from Alternative 1 activities on commercial transportation and shipping are not anticipated. Some impacts on commercial and recreational fishing, subsistence use, or tourism may occur when training activities require restrictions on access to areas of co-use to ensure the safety of the public during scheduled training activities. Considering the military's standard operating procedures, the anticipated infrequent and short-term restrictions on access to areas of co-use, and the large expanse of the MITT Study Area that would be available to the public, significant impacts on accessibility are not anticipated.

3.12.3.1.3.2 Testing Activities

Under Alternative 1, testing activities and associated stressor components would increase over the No Action Alternative. As described above for training activities, some impacts on commercial and recreational fishing, subsistence use, or tourism may occur when testing activities require restrictions on access to areas of co-use to ensure the safety of the public during scheduled testing activities. However, the frequency of temporary restrictions on access would be less for testing activities than for training activities, because fewer testing activities are proposed in the EIS/OEIS (see Chapter 2, Description of Proposed Action and Alternatives, Tables 2.8-2 to 2.8-4).

3.12.3.1.4 Alternative 2

3.12.3.1.4.1 Training Activities

Training activities and associated stressor components would continue and would increase over the No Action Alternative and Alternative 1. There would be no changes to the military's current standard operating procedures defining safety precautions and actions taken by the military to protect the public during hazardous training activities on the ocean. Despite the increase in tempo of training activities, impacts from Alternative 2 activities on commercial transportation and shipping are not anticipated. Some impacts on commercial and recreational fishing, subsistence use, or tourism may occur when training activities require restrictions on access to areas of co-use to ensure the safety of the public during scheduled training activities. Considering the military's standard operating procedures, the anticipated infrequent and short-term restrictions on access to areas of co-use, and the large expanse of the MITT Study Area that would be available to the public, significant impacts on accessibility are not anticipated.

3.12.3.1.4.2 Testing Activities

Under Alternative 2, testing activities and associated stressor components would increase over the No Action Alternative and Alternative 1. As described above for training activities, some impacts on commercial and recreational fishing, subsistence use, or tourism may occur when testing activities require restrictions on access to areas of co-use to ensure the safety of the public during scheduled testing activities. However, the frequency of temporary restrictions on access would be less for testing activities than for training activities, because fewer testing activities are proposed in the EIS/OEIS (see Chapter 2, Description of Proposed Action and Alternatives, Tables 2.8-2 to 2.8-4).

3.12.3.2 Airborne Acoustics

As an environmental stressor, loud noises, sonic booms, and vibrations generated from military training and testing activities such as weapons firing, in-air explosions, and aircraft transiting have the potential to disrupt wildlife and humans in the MITT Study Area.

3.12.3.2.1 Socioeconomic Activities

3.12.3.2.1.1 Tourism and Recreational Activities

Noise interference could decrease public enjoyment of recreational activities. These effects would occur on a temporary basis, only when weapons firing, in-air explosions, and aircraft transiting occur. Of these activities, military training and testing activities involving weapons firing and in-air explosions would only occur when the military can confirm the area is clear of non-participants, reducing the likelihood that noise from these activities would disturb tourists. Most naval training would occur well out to sea, while tourism and civilian recreational activities are largely conducted within a few miles of shore. Tourism and recreational activity revenue is not expected to be impacted by airborne noise.

3.12.3.2.2 No Action Alternative

3.12.3.2.2.1 Training Activities

Under the No Action Alternative, potential airborne noise impacts would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities would continue at current levels and within established ranges and training locations. There would be no anticipated impacts on tourism because (1) most military training occurs well out to sea, while most tourism and recreational activities occur near shore; and (2) military training activities producing airborne noise are normally short term and temporary. Therefore, airborne noise impacts on tourism would be negligible.

3.12.3.2.2.2 Testing Activities

Only one testing activity occurs under the No Action Alternative, the North Pacific Acoustic Lab Philippine Sea 2018–19 Experiment (Deep Water), as shown in Chapter 2 (Description of Proposed Action and Alternatives, Table 2.8-4). No impacts to tourism from airborne acoustics would occur from this testing activity, because no aircraft or other airborne platforms would be used.

3.12.3.2.3 Alternative 1

3.12.3.2.3.1 Training Activities

Under Alternative 1, potential airborne noise would be the same as that associated with the No Action Alternative. Training activities and associated stressor components would continue and would increase over the No Action Alternative. Similar to the No Action Alternative and despite the increase in tempo, there would be no anticipated impacts on tourism because (1) most military training occurs well out to sea, while most tourism and recreational activities occur near shore; and (2) military training activities producing airborne noise are normally short term and temporary. Therefore, airborne noise impacts on tourism would be negligible.

3.12.3.2.3.2 Testing Activities

Under Alternative 1, testing activities and associated stressor components would increase over the No Action Alternative. Impacts associated with airborne acoustics would be negligible for the same reasons stated for training activities above. In addition, far fewer testing than training activities are proposed (see Chapter 2, Description of Proposed Action and Alternatives, Tables 2.8-2 to 2.8-4).

3.12.3.2.4 Alternative 2

3.12.3.2.4.1 Training Activities

Under Alternative 2, potential airborne noise would be the same as that associated with the No Action Alternative. Training activities would continue but with an increase in tempo within the MITT Study Area. Similar to Alternative 1, there would be no anticipated impacts on tourism because (1) most military training occurs well out to sea, while most tourism and recreational activities occur near shore; and (2) military training activities producing airborne noise are normally short term and temporary. Therefore, airborne noise impacts on tourism would be negligible.

3.12.3.2.4.2 Testing Activities

Under Alternative 2, testing activities and associated stressor components would increase over the No Action Alternative and Alternative 1. Impacts associated with airborne acoustics would be negligible for the same reasons stated for training activities above. In addition, far fewer testing than training activities are proposed (see Chapter 2, Description of Proposed Action and Alternatives, Tables 2.8-2 to 2.8-4).

3.12.3.3 Physical Disturbance and Strike Stressors

The evaluation of impacts on socioeconomic resources from physical disturbance and strike stressors focuses on direct physical encounters or collisions with objects moving through the water or air (e.g., vessels, aircraft, unmanned devices, and towed devices), dropped or fired into the water (non-explosive practice munitions, other military expended materials, and ocean bottom deployed devices), or resting on the ocean floor (anchors, mines, targets) that may damage or encounter civilian equipment. Physical disturbances that damage equipment and infrastructure could disrupt the collection and transport of products, which may impact industry revenue or operating costs.

Though highly unlikely, it is possible that military training and testing equipment and vessels moving through the water could collide with non-military vessels and equipment. Most of the training and testing activities involve vessel movement and use of towed devices. However, the likelihood that a military vessel would collide with a non-military vessel is remote because of the prevalent use of navigational aids or buoys separating vessel traffic, shipboard lookouts, radar, and marine band radio communications by both military and civilians. Therefore, the potential to impact commercial transportation and shipping by physical disturbance and strike stressors is negligible and requires no further analysis.

Aircraft conducting training or testing activities in the MITT Study Area operate in designated military SUA (e.g., warning areas). All aircraft, military and civilian, are subject to FAA regulations, which define permissible uses of designated airspace, and are implemented to control those uses. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general aviation. By adhering to these regulations, the likelihood of civilian aircraft coming into contact with military aircraft is remote. In addition, military aircraft follow procedures outlined in air operations manuals, which are specific to a warning area or other SUA, and which describe procedures for operating safely when civilian aircraft are in the vicinity.

Military expended materials can physically interact with civilian equipment and infrastructure. Almost all training and testing activities produce military expended materials such as chaff, flares, projectiles, casings, target fragments, missile fragments, rocket fragments, and ballast weights. The vast majority of these expended materials sink to the sea floor after use, and in most cases are used in deep waters located 3 nm from shore and beyond. Training and testing activities occurring in nearshore waters most often use simulated rounds or do not use ordnance (see Chapter 2, Description of Proposed Action and Alternatives, for details).

3.12.3.3.1 Socioeconomic Activities

3.12.3.3.1.1 Commercial and Recreational Fishing/Subsistence Use

The majority of commercial and recreational fishing in the MITT Study Area takes place in nearshore waters (less than 3 nm from shore), where the military conducts limited training and testing activities. Therefore, most recreational fishing would occur away from physical disturbance and strike stressors associated with training and testing activities. Some commercial and recreational fishing occurs beyond 3 nm in areas where the military trains and tests and could be indirectly affected by the proposed activities if physical disturbance and strike stressors were to disrupt fisheries in those areas to such an extent that commercial fishers would no longer be able to find their target species. As described in Section 3.9.3 (Environmental Consequences), the behavioral responses that could occur from various types of physical stressors associated with training and testing activities would not compromise the general health or condition of fish and, therefore, would not result in associated impacts to commercial or recreational fishing resources.

Commercial fishing activities have the potential to interact with equipment placed in the ocean or on the ocean floor for use during proposed military training and testing activities. This equipment could include ship anchors, moored or bottom mounted targets, mines and mine shapes, tripods, and use of towed system and attachment cables. Many different types of commercial fishing gear are used in the MITT Study Area, including gillnets, longline gear, troll gear, trawls, seines, and traps or pots. Commercial bottom fishing activities that use these types of gear have a greater potential to be affected by interaction with military training and testing equipment, resulting in the loss of or damage to both the military equipment and the commercial fishing gear. The military recovers many of the targets (e.g., mines and mine shapes) and target fragments used in training and testing activities, and would continue to do so to minimize the potential for interaction with fishing gear and fishing vessels (as well as other vessels). Unrecoverable items are typically small, constructed of soft materials (such as target cardboard boxes or tethered target balloons), or are intentionally designed to sink to the bottom after serving their purpose (such as expended 55-gallon steel drums), so that they would not represent a collision risk to vessels, including commercial fishing vessels.

3.12.3.3.1.2 Tourism

While military training and testing activities can occur throughout the MITT Study Area, most (especially hazardous) activities occur well out to sea. The exception being activities occurring in designated areas of Apra Harbor and at the bombing range on FDM as well as smaller areas described in detail in Chapter 2 (Description of Proposed Action and Alternatives). Most tourist activities engaged in by both visitors and residents take place within a few miles of land. No tourist activities occur on FDM, and the danger zones and restricted areas in Apra Harbor are open to the public except when training or testing activities are scheduled.

Snorkeling and diving take place primarily at known recreational sites, including shipwrecks and reefs. Temporary exclusion zones may be established for safety purposes, and would not adversely affect tourism activities because displacement is brief (hours) and the activity would typically not take place in areas where tourists are common. The military notifies the public of temporary limits on public access to certain areas when there is a risk of injury or property damage through the use of Notices to Mariners, HydroPacs, and Notices to Airmen. Published notices allow recreational users to adjust their routes to avoid temporary exclusion zones. If civilian vessels transit into an exclusion zone at the time of a scheduled activity, military personnel may continue the activity if it is safe and possible to do so. If avoidance is not safe or possible, the activity may relocate or be delayed. In some instances where safety requires exclusive use of a specific area, non-participants in the area are asked to relocate to a safer area for the duration of the activity. Because military training and testing activities vary in location, are typically not coincident with popular tourist areas, and are primarily short-term in duration, impacts on tourism resulting from rerouting or delaying tourist activities, while they may occur, would be negligible.

Other tourism activities such as whale watching, boating, or use of other watercraft may occur farther offshore and are conducted by boat, aircraft, or from land. These activities would be conducted with boats that are typically well marked and visible to military ships conducting training and testing activities. Individual boaters engaged in tourism activities, such as whale watching, plan and monitor navigational information to avoid military training and testing areas. Vessels are responsible for being aware of designated danger zones and restricted areas in surface waters and any Notices to Mariners that are in effect. Operators of recreational or commercial vessels have a duty to abide by maritime requirements as administered by the U.S. Coast Guard. At the same time, military vessels ensure that an area is clear of non-participants prior to testing and training exercises. As a result, conflicts between military training and testing activities in offshore areas and whale watching or other offshore recreational use are unlikely to occur. Changes to current offshore tourism activities in the MITT Study Area would not be expected from the proposed training and testing activities. Therefore, loss of revenue or employment associated with tourism would not occur.

The military would continue to recover many of the targets (e.g., mines and mine shapes) and target fragments used in training and testing activities so that they would not pose a collision risk to vessels. Unrecoverable items are typically small, constructed of soft materials (such as target cardboard boxes or tethered target balloons), or are intentionally designed to sink to the bottom after serving their purpose (such as expended 55-gallon steel drums), so that they would not represent a collision risk to vessels.

3.12.3.3.2 No Action Alternative

3.12.3.3.2.1 Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives, Section 2.6), under the No Action Alternative, potential physical disturbance and strike stressors would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities would continue at current levels and within established ranges and training locations.

There would be no anticipated impacts on commercial and recreational fishing, subsistence use, or tourism because of the large size of the MITT Study Area, the limited areas of operations, and implementation of the military's standard operating procedures, which includes ensuring that an area is clear of all non-participating vessels before training activities take place. In addition, the military provides advance notification of training activities to the public through Notices to Mariners and HydroPacs. Damage to or loss of commercial fishing gear from interaction with military equipment or other expended materials is unlikely. The military recovers many practice munitions (e.g., mines and mine shapes) for reuse following the activity. The military also recovers larger floating objects or materials, such as targets or target fragments, to avoid having them become hazards to navigation. Smaller objects that remain in the water column would be unlikely to pose a risk to fishing gear. Considering the expansive size of the Navy's Operating Areas, the disbursement of Military Expended Materials over these large areas, and the effect of the military's standard operation procedures and mitigation measures (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring), impacts from physical disturbance and strike stressors on commercial and recreational fishing, subsistence use, or tourism would be negligible.

3.12.3.3.2.2 Testing Activities

Only one testing activity occurs under the No Action Alternative, the North Pacific Acoustic Lab Philippine Sea 2018–19 Experiment (Deep Water), as shown in Chapter 2 (Description of Proposed Action and Alternatives, Table 2.8-4). No impacts to commercial and recreational fishing, subsistence use, and tourism are anticipated from this testing activity because it takes place in deep, offshore waters.

3.12.3.3.3 Alternative 1

3.12.3.3.3.1 Training Activities

Under Alternative 1, potential physical disturbance and strike stressors would be the same as those associated with the No Action Alternative. Training activities and associated stressor components would increase, and there would be an associated increase in the quantity of Military Expended Materials released within the MITT Study Area. There would be no changes to the military's standard operating procedures for hazardous training activities performed in the MITT Study Area. The expansive size of the MITT Study Area, the disbursement of Military Expended Materials over this large area, and implementation of the military's standard operating procedures and mitigation measures (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) ensure that impacts from physical disturbance and strike stressors would be negligible. The advance public release of Notices to Mariners and HydroPacs would inform the public of upcoming activities, and enable them to plan to avoid the area. Therefore, impacts from physical disturbance and strike stressors on commercial and recreational fishing, subsistence use, and tourism would be negligible.

3.12.3.3.3.2 Testing Activities

Under Alternative 1, testing activities and associated stressor components would increase over the No Action Alternative. The impact associated with physical disturbance and strike stressors would be negligible for the same reasons stated for training activities above. In addition, far fewer testing than training activities are proposed (see Chapter 2, Description of Proposed Action and Alternatives, Tables 2.8-2 to 2.8-4).

3.12.3.3.4 Alternative 2

3.12.3.3.4.1 Training Activities

Under Alternative 2, potential physical disturbance and strike stressors would be the same as those associated with the No Action Alternative. Training activities and associated stressor components would continue and would increase over the No Action Alternative and Alternative 1, and there would be an associated increase in the quantity of Military Expended Materials released within the MITT Study Area. There would be no changes to the military's standard operating procedures for hazardous training activities performed in the MITT Study Area. The expansive size of the Navy's Operating Areas, the disbursement of Military Expended Materials over these large areas, and implementation of the military's standard operating procedures and mitigation measures (Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring) ensure that impacts from physical disturbance and strike stressors would be negligible. The advance public release of Notices to Mariners and HydroPacs would inform the public of upcoming activities, and enable them to plan to avoid the area. Therefore, impacts from physical disturbance and strike stressors on commercial and recreational fishing, subsistence use, or tourism would be negligible.

3.12.3.3.4.2 Testing Activities

Under Alternative 2, testing activities and associated stressor components would increase over the No Action Alternative and Alternative 1. The impact associated with physical disturbance and strike stressors would be negligible for the same reasons stated for training activities above. In addition, far fewer testing than training activities are proposed (see Chapter 2, Description of Proposed Action and Alternatives, Tables 2.8-2 to 2.8-4).

3.12.3.4 Secondary Impacts from Availability of Resources

Socioeconomics could be impacted if the proposed activities led to changes to physical and biological resources to the extent that they would alter the way industries (e.g., fishing) can utilize those resources. The secondary stressor of resource availability pertains to the potential for loss of fisheries resources within the MITT Study Area.

Fishing, subsistence use, and tourism could be impacted if the proposed activities altered fish population levels to such an extent that these activities would no longer be able to find their target species. Similarly, disturbances to marine mammal populations could impact the whale watching industry. Analyses in Sections 3.4 (Marine Mammals), 3.8 (Marine Invertebrates), and 3.9 (Fish) determined, however, that no population level impacts on marine species are anticipated from the proposed training and testing activities. For these reasons, there would be no indirect impacts on commercial or recreational fishing, subsistence use, or tourism.

3.12.4 Summary of Potential Impacts (Combined Impacts of All Stressors) on Socioeconomics

Stressors described in this EIS/OEIS that have the potential to impact socioeconomic resources include, accessibility to areas within the MITT Study Area, airborne acoustics, physical disturbance and strike, and secondary stressors resulting from impacts on marine species populations. Under the No Action Alternative, Alternative 1, or Alternative 2, these activities would be widely dispersed throughout the MITT Study Area. Such activities also are dispersed temporally (i.e., few stressors would operate at the same time). Therefore, no greater impacts from the combined operation of more than one stressor are expected. The aggregate impact on socioeconomics would not observably differ from existing conditions.

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3.13 Public Health and Safety

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3.13 Public Health and Safety

PUBLIC HEALTH AND SAFETY SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following have been analyzed for public health and safety:

- Underwater energy
- In-air energy
- Physical interactions
- Secondary (impacts associated with sediments and water quality)

Preferred Alternative (Alternative 1)

- Underwater Energy: Because of the military's safety procedures, the potential for training and testing activities using underwater energy to impact public health and safety would be unlikely.
- In-Air Energy: Because of the military's safety procedures for use of lasers and electronic warfare, the potential for training and testing activities to impact public health and safety would be negligible
- Physical Interactions: Because of the military's implementation of operating procedures that protect public health and safety the potential for physical interactions to impact public health and safety would be negligible.
- Secondary: No Guam, CNMI, or federal standards or guidelines would be violated. Because these standards and guidelines are structured to protect human health, and the proposed activities do not violate them, no secondary impacts on public health and safety would result from the proposed training and testing activities.

3.13.1 Introduction and Methods

3.13.1.1 Introduction

This section analyzes potential impacts on public health and safety within the Mariana Islands Training and Testing (MITT) Study Area (Study Area). Unlike military training and testing activities conducted within the boundaries of a fenced land installation, public access to ocean areas or to the overlying airspace cannot be physically controlled. The United States (U.S.) Department of the Navy (Navy) coordinates use of these areas through the scheduling of activities, and issues warnings and notices to the public prior to conducting potentially hazardous activities (Section 3.13.2.2, Safety and Inspection Procedures). Sensitivity to public health and safety concerns within the Study Area is heightened in areas where the public may be close to certain activities (e.g., pierside testing or littoral training).

Generally, the greatest potential for a proposed activity to affect the public is near the coast because that is where public activities are concentrated. These coastal areas could include dive sites or other recreational areas where the collective health and safety of groups of individuals that could be exposed to the hazards of training and testing would be of concern. Most commercial and recreational marine activities are close to the shore and are usually limited by the capabilities of the boat used. Commercial and recreational fishing may extend as far out as 100 nautical miles (nm) from shore but are concentrated near the coast.

3.13.1.2 Methods

Baseline public health and safety conditions were derived from the current training and testing activities. Existing procedures for ensuring public health and safety and other elements of the baseline (e.g., restricted areas) were derived from federal regulations, Department of Defense (DoD) directives, and Navy instructions for training and testing. The directives and instructions provide specifications for mission planning and execution that describe criteria for public health and safety considerations. These directives and instructions include criteria for public health and safety considerations for training and testing planning and execution.

The alternatives were evaluated based on two factors: the potential for a training or testing activity to impact public health and safety, and the degree to which those activities could have an impact. The likelihood that the public would be near a training or testing activity determines the potential for exposure to the activity. If the potential for exposure exists, the degree of the potential impacts on public health and safety, including increased risk of injury or loss of life, is determined. If the potential for exposure were zero, then public health and safety would not be affected. Isolated incidents and other conditions that affect single individuals, although important for safety awareness, may not rise to the level of a public health or safety issue and are not considered in this assessment (e.g., airborne noise effects are not addressed in this section).

3.13.2 Affected Environment

3.13.2.1 Overview

The area of interest for assessing potential impacts on public health and safety is the U.S. Territorial Waters of the island of Guam and the islands of the Commonwealth of the Northern Mariana Islands (CNMI) (seaward of the mean high water line to 12 nm). Military, commercial, institutional, and recreational activities take place simultaneously in the Study Area (Figure 3.13-1) and have coexisted safely for decades. These activities coexist because established rules and practices lead to safe use of the waterway and airspace. The following paragraphs briefly discuss the rules and practices for recreational, commercial, and military use in sea surface areas and airspace.

Figure 3.13-1: Simultaneous Activities within the Mariana Islands Training and Testing Study Area

3.13.2.1.1 Sea Space

Most of the sea space in the Study Area is accessible to recreational and commercial activities. However, some activities are prohibited or restricted in certain areas (e.g., danger zones and restricted areas) in accordance with Title 33 Code of Federal Regulations (C.F.R.) Part 334 (Danger Zone and Restricted Area Regulations). These restrictions can be permanent or temporary. Nautical charts issued by the National Oceanic and Atmospheric Administration include these federally designated zones and areas. Operators of recreational and commercial vessels have a duty to abide by maritime regulations administered by the U.S. Coast Guard.

Marine preserve areas (MPAs) were established and approved by the Guam Legislature at five locations in Guam: Tumon Bay, Piti Bomb Holes, Sasa Bay, Achang Reef Flat, and Pati Point. Fishing is prohibited at these MPAs, except at Tumon Bay and Pati Point. At Tumon Bay, cast-netting and hook and line fishing from shore are allowed but only for certain species of fish. Hook and line fishing from shore is also allowed at Pati Point, although public access is limited. A report prepared by the National Institute for Occupational Safety and Health in 2010 indicates that the risk of drowning for fishermen increased after the MPAs were enforced in 2001 (National Institute for Occupational Safety and Health 2010). Chamorro fishermen, who mainly fish for subsistence, began fishing more heavily on the more dangerous waters off the east coast of Guam and were more susceptible to drowning.

As specified in Title 33 C.F.R. Subpart 72.01, Notices to Mariners, the U.S. Coast Guard issues information to the public concerning maritime navigation. There are three categories of Notices to Mariners: the Local Notice to Mariners (LNM), the Notice to Mariners (NTM), and the Marine Broadcast Notice to Mariners (BNM).

The LNM is published weekly, or more often if there is a need, by each U.S. Coast Guard district to notify mariners of local waterway information. The LNM reports changes to and deficiencies in aids to navigation that are established or maintained and operated by or under the authority of the U.S. Coast Guard, and any other information pertaining to the waterways within each U.S. Coast Guard district that is of interest to the mariner, including advisories for public safety. The LNM is available for viewing on the Coast Guard Navigation Center Web site.[1] Any person may apply to the Coast Guard Navigation Center to receive automatic notices via e-mail when new editions of the LNM are available.

The NTM is published weekly by the National Geospatial-Intelligence Agency, and is prepared jointly by the U.S. Coast Guard, the National Ocean Service, and the National Geospatial-Intelligence Agency. The NTM is intended to advise mariners of new hydrographic discoveries, changes in channels and navigational aids, and information concerning the safety of navigation. The NTM contains updates to the latest editions of charts and publications of the National Geospatial-Intelligence Agency, National Ocean Service, U.S. Army Corps of Engineers, and U.S. Coast Guard; selected information from the LNM issued and published by the Coast Guard districts; and information compiled from foreign Notices to Mariners, ship reports, and similar cooperating observer reports. The NTM may be accessed through the National Geospatial-Intelligence Agency's Web site.[2]

The maritime BNM is a radio broadcast issued by the U.S. Coast Guard using its own radio stations. These stations broadcast warnings within naval areas defined by the Worldwide Navigational Warning Service. Within the Mariana Islands naval area, the approved method for receiving these warnings are from the U.S. Coast Guard Guam's Global Maritime Distress and Safety System (GMDSS) broadcast service. The GMDSS broadcast service provides rapid dissemination of information critical to navigation and the safety of life at sea. BNM are issued regularly and contain information about persons in distress, or objects and events that pose an immediate hazard to navigation.

The U.S. Coast Guard Guam GMDSS broadcast service issues BNM warnings using multiple radio broadcast systems and frequencies. Local and coastal BNM warnings are broadcast out to 20 nm on Very High Frequency (VHF)-FM radio channel 16. After a preliminary safety signal is broadcast on VHF-FM channel 16, broadcast stations are shifted to VHF-FM channel 22A for warning information. Out to 100 nm, the Coast Guard Navigational Telex (NAVTEXT) broadcast system provides BNM warnings that are received by NAVTEXT radios using the MF frequency 518 kilohertz (kHz). For broadcast coverage beyond 100 nm, BNM warnings are issued via HydroPac using high-frequency radio frequencies.

3.13.2.1.2 Airspace

Most of the airspace in the Study Area is accessible to general aviation (recreational, private, corporate) and commercial aircraft. Like waterways, however, some areas are temporarily off limits to civilian and commercial use. The Federal Aviation Administration (FAA) has established Special Use Airspace—airspace of defined dimensions wherein activities must be confined because of their nature or wherein limitations may be imposed upon aircraft operations that are not part of those activities (U.S. Department of Transportation Federal Aviation Adminstration 2013). Additional discussion on airspace is provided in Section 3.12 (Socioeconomic Resources). Special Use Airspace in the Study Area includes:

- **Restricted Airspace:** Areas where aircraft are restricted because of unusual (often invisible) hazards to aircraft (e.g., release of ordnance). Some areas are under strict control of the DoD, and some are shared with nonmilitary agencies.

[1] http://www.navcen.uscg.gov/?pageName=lnmMain
[2] http://msi.nga.mil/NGAPortal/MSI.portal); look for "Notice to Mariners"

- **Warning Areas:** Areas of defined dimensions, beyond 3 nm from the coast of the United States, which warn nonparticipating aircraft of potential danger.
- **Air Traffic Controlled Assigned Airspace:** Airspace that is defined by the FAA and is not over an existing operating area. This airspace is used to contain specified activities, such as military flight training, that are segregated from other instrument flight rules air traffic. Air traffic controlled assigned airspace is not classified as special use airspace in accordance with FAA definition and airspace classification.

Notices to Airmen are created and transmitted by government agencies and airport operators to alert aircraft pilots of any hazards en route to or at a specific location. The FAA issues Notices to Airmen to disseminate information on upcoming or ongoing military exercises with airspace restrictions. Civilian aircraft are responsible for being aware of restricted airspace and any Notices to Airmen that are in effect. Pilots have a duty to abide by aviation rules as administered by the FAA.

Weather conditions dictate whether aircraft (general aviation, commercial, or military) can fly under visual flight rules or whether instrument flight rules are required. Under visual flight rules, the weather is favorable and the pilot is required to remain clear of clouds by specified distances to ensure separation from other aircraft under the concept of see and avoid. Pilots flying under visual flight rules must be able to see outside of the cockpit, control the aircraft's altitude, navigate, and avoid obstacles and other aircraft based on visual cues. Pilots flying under visual flight rules assume responsibility for their separation from all other aircraft, and are generally not assigned routes or altitudes by air traffic control.

During unfavorable weather, pilots must follow instrument flight rules. Factors such as visibility, cloud distance, cloud ceilings, and weather phenomena cause visual conditions to drop below the minimums required to operate by visual flight referencing. Instrument flight rules are the regulations and restrictions a pilot must comply with when flying in weather conditions that restrict visibility. Pilots can fly under instrument flight rules in visual flight rules weather conditions; however, pilots cannot fly under visual flight rules in instrument flight rules weather conditions.

3.13.2.2 Safety and Inspection Procedures

During training and testing, the military services have policies in place to ensure the safety and health of personnel and the general public. The military services achieve these conditions by considering location when planning activities, scheduling and notifying potential users of an area, and ensuring that an area is clear of nonparticipants. The military services also have a proactive and comprehensive program of compliance with applicable standards and implementation of safety management systems.

As previously stated, the greatest potential for a training or testing activity to affect the public is in coastal areas because of the concentration of public activities. When planning a training or testing activity, the military services consider proximity of the activity to public areas in choosing a location. Important factors considered include the ability to control access to an area; schedule (time of day, day of week); frequency, duration, and intensity of activities; range safety procedures; operational control of activities or events; and safety history.

The Navy's Fleet Area Control and Surveillance Facilities actively manage assigned airspace, operating areas, ranges, and training and testing resources to enhance combat readiness of U.S. Pacific Fleet units. The Navy schedules activities through the Fleet Area Control and Surveillance Facilities, which coordinate air and surface use of the training areas with the FAA which issue Notices to Airmen, and the U.S. Coast Guard which issue LNMs, NTMs, and BNMs.

During training and testing activities in the Study Area, the military services ensure that the appropriate safety zone is clear of nonparticipants before engaging in certain activities, such as firing weapons. Inability to obtain a “clear range” could cause an event to be delayed, cancelled, or relocated. Military procedures ensure public safety during military activities that otherwise could harm nonparticipants. Military practices employ the use of sensors and other devices (e.g., radar) to ensure public health and safety while conducting training and testing activities. The following subsections outline the current requirements and practices for human safety as they pertain to range safety procedures, range inspection procedures, exercise planning, and scheduling and coordinating procedures for the military services.

Active management of assigned airspace, operating areas, ranges, and training and testing resources to enhance combat readiness of U.S. military service units in all warfare areas in the Study Area are provided by the Mariana Islands Range Complex (MIRC) Operations, in coordination with the FAA, Naval Base Guam Security or 36th Wing Operations Group (Andersen Air Force Base). Training participants comply with published safety procedures in the Joint Region Marianas Instruction 3500.4A (Marianas Training Manual) (U.S. Department of the Navy 2011a) for training and testing activities in the Study Area. These guidelines apply to range users as follows:

- Military personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of underwater ordnance must be coordinated with submarine operational authorities. The coordination also applies to towed sound navigation and ranging (sonar) arrays and torpedo decoys.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the Range Safety Officer for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Aircraft carrying ordnance to or from ranges shall avoid populated areas to the maximum extent possible.
- Strict on-scene procedures include the use of ship sensors, visual surveillance of the range from aircraft and range safety boats, and radar and acoustic data to confirm the firing range and target area are clear of civilian vessels, aircraft, or other nonparticipants.

Testing activities have their own comprehensive safety planning instructions (U.S. Department of the Navy 2011a). These instructions provide guidance on how to identify the hazards, assess the potential risk, analyze risk control measures, and review safety procedures. They apply to all testing activities, including ground, waterborne, and airborne testing activities involving personnel, aircraft, inert minefields, equipment, and airspace. The guidance applies to system program managers, program engineers, test engineers, test directors, and aircrews that are responsible for incorporating safety planning and review when conducting test programs.

The following safety and inspection procedures are implemented for training activities. Each commanding officer is responsible for implementing safety and inspection procedures for activities inside and outside established ranges. In the absence of specific guidance on matters of safety, the military follows the most prudent course of action. The following contains information on the military's program of compliance with applicable standards and implementation of safety management systems.

3.13.2.2.1 Aviation Safety

Navy procedures on planning and managing Special Use Airspace are provided in the Chief of Naval Operations Instruction 3770.2K, *Airspace Procedures and Planning Manual* (U.S. Department of the Navy 2007). Navy and Air Force aircraft operating over the high seas comply with DoD Directive 4540.1, *Use of Airspace by U.S. Military Aircraft and Firings Over the High Seas*, and Chief of Naval Operations Instruction 3770.4A, *Use of Airspace by U.S. Military Aircraft and Firing Over the High Seas*, which specify procedures for conducting aircraft maneuvers and for firing missiles and projectiles. The missile and projectile firing areas are to be selected "so that trajectories are clear of established oceanic air routes or areas of known surface or air activity" (U.S. Department of Defense 1981).

Aircrews involved in a training or testing exercise must be aware that nonparticipating aircraft and ships are not precluded from entering the area and may not comply with Notices to Airmen or LNMs, NTMs, and BNMs. Aircrews are required to maintain a continuous lookout for nonparticipating aircraft while operating in warning areas under visual flight rules. In general, aircraft carrying ordnance are not allowed to fly over surface vessels.

Part of aviation safety during training and testing activities is the implementation of the Bird/Animal Aircraft Strike Hazard program. The Bird Aircraft Strike Hazard program manages risk by addressing specific aviation safety hazards associated with wildlife near airfields through coordination among all the entities supporting the aviation mission (U.S. Department of Defense 2012). The Bird Aircraft Strike Hazard program strives to effectively minimize secondary consequences of strikes, such as damage to aircraft, environmental cleanup due to aircraft crashes, and impairment of training (U.S. Department of Defense 2012), at the same time precluding potential impacts to public health and safety. The Bird Aircraft Strike Hazard program is defined in the Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance (Commander, Navy Installations Command Instruction 3700) (U.S. Department of Defense 2012) and the Bird/Animal Aircraft Strike Hazard Manual (U.S. Department of the Navy 2010).

The Bird Aircraft Strike Hazard program consists of, among other things, identifying the bird/animal species involved and the location of the strikes to understand why the species is attracted to a particular area of the airfield or training route. By knowing the species involved, managers can understand the habitat and food habits of the species. A Wildlife Hazard Assessment identifies the areas of the airfield that are attractive to the wildlife and provides recommendations to remove or modify the attractive feature. Recommendations may include the removal of unused airfield equipment to eliminate perch sites, placement of anti-perching devices, wiring of streams and ponds, removal of brush/trees, use of pyrotechnics, and modification of the grass mowing program (U.S. Department of Defense 2012).

3.13.2.2.2 Submarine Navigation Safety

Submarine crews use various methods to avoid collisions while they are surfaced, including visual and radar scanning, acoustic depth finders, and state-of-the-art satellite navigational systems. When transiting submerged, submarines use all available ocean navigation tools, including inertial navigational charts that calculate position based on the submerged movements of the submarine. Areas with surface vessels can then be avoided to protect both the submarines and surface vessels.

3.13.2.2.3 Surface Vessel Navigational Safety

The Navy practices the fundamentals of safe navigation. While in transit, Navy surface vessel operators are alert at all times, use extreme caution, use state-of-the-art satellite navigational systems, and are trained to take proper action if there is risk. Surface vessels are also equipped with trained and qualified Navy lookouts. Individuals trained as lookouts have the necessary skills to detect objects or activity in the water that could potentially be a risk for the vessel.

For specific testing activities, like unmanned surface vehicle testing, a support boat would be used near the testing to ensure safe navigation. Before firing or launching a weapon or radiating a non-eyesafe laser, Navy surface vessels are required to determine that all safety criteria have been satisfied. When applicable, the surface vessel would use aircraft and other boats to aid in navigation. In accordance with Navy instructions presented in this chapter, safety and inspection procedures ensure public health and safety.

3.13.2.2.4 Sound Navigation and Sounding (Sonar) Safety

Surface vessels and submarines may use active sonar in the pierside locations listed in Chapter 2 (Description of Proposed Action and Alternatives) and during transit to the training or testing exercise location. To ensure safe and effective sonar use, the Navy applies the same safety procedures for pierside sonar use as described in Section 3.13.2.2 (Safety and Inspection Procedures).

Naval Sea Systems Command Instruction 3150.2, Appendix 1A, *Safe Diving Distances from Transmitting Sonar*, is the Navy's governing document for protecting divers during active sonar use (U.S. Department of the Navy 2011b). This instruction provides procedures for calculating safe distances from active sonar. These procedures are derived from experimental and theoretical research conducted at the Naval Submarine Medical Research Laboratory and the Navy Experimental Diving Unit. Safety distances vary based on conditions that include diver attire, type of sonar, and duration of time in the water. Some safety procedures include onsite measurements during testing activities to identify an exclusion area for nonparticipating swimmers and divers.

3.13.2.2.5 Electromagnetic Energy Safety

All frequencies (or wavelengths) of electromagnetic energy are referred to as the electromagnetic spectrum, and they include electromagnetic radiation and radio frequency radiation. Communications and electronic devices such as radar, electronic warfare devices, navigational aids, two-way radios, cell phones, and other radio transmitters produce electromagnetic radiation. While such equipment emits electromagnetic energy, some of these systems are the same as, or similar to, civilian navigational aids and radars at local airports and television weather stations. Radio waves and microwaves emitted by transmitting antennas are a form of electromagnetic energy, collectively referred to as radio frequency radiation. Radio frequency energy includes frequencies ranging from 0 to 3,000 gigahertz. Exposure to radio frequency energy of sufficient intensity at frequencies between 3 kHz and 300 gigahertz can adversely affect people, ordnance, and fuel.

To avoid excessive exposures from electromagnetic energy, military aircraft are operated in accordance with standard operating procedures that establish minimum separation distances between electromagnetic energy emitters and people, ordnance, and fuels (U.S. Department of Defense 2009a). Thresholds for determining hazardous levels of electromagnetic energy to humans, ordnance, and fuel have been determined for electromagnetic energy sources based on frequency and power output, and current practices are in place to protect the public from electromagnetic radiation hazards

(U.S. Department of Defense 2002, 2009a). These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct exposure, posting warning signs, establishing safe operating levels, activating warning lights when radar systems are operational, and not operating some platforms that emit electromagnetic energy within 15 nm of shore. Safety planning instructions provide clearance procedures for nonparticipants in operational areas prior to conducting training and testing (U.S. Department of the Navy 2011a) activities that involve underwater electromagnetic energy (e.g., mine warfare).

Mine warfare devices are analyzed under other resources in this Environmental Impact Statement (EIS)/Overseas EIS (OEIS) because they emit electromagnetic energy. The electromagnetic impacts from mine warfare devices are very local, unlike radars and radios. Measures to avoid public interaction with mine warfare devices are effective in protecting the public from these impacts. As discussed in Section 3.0.5.3.3.2 (Kinetic Energy Weapon), electromagnetic fields generated by kinetic energy weapon testing would likely be shielded and contained on the vessel as to not affect other shipboard systems. Therefore, there will be no impacts to the public from testing of the kinetic energy weapon.

3.13.2.2.6 Laser Safety

Lasers produce light energy. The military uses tactical lasers for precision range finding, as target designation and illumination devices for engagement with laser-guided weapons, and for mine detection and mine countermeasures. Laser safety procedures for aircraft require an initial pass over the target prior to laser activation to ensure that target areas are clear. The military observes strict precautions, and has written instructions in place for laser users to ensure that nonparticipants are not exposed to intense light energy. During actual laser use, aircraft run-in headings are restricted to avoid unintentional contact with personnel or nonparticipants. Personnel participating in laser training activities are required to complete a laser safety course (U.S. Department of the Navy 2008).

3.13.2.2.7 High-Explosive Ordnance Detonation Safety

Pressure waves from underwater detonations can pose a physical hazard in surrounding waters. Before conducting an underwater training or testing activity, Navy personnel establish an appropriately sized exclusion zone to avoid exposure of nonparticipants to the harmful intensities of pressure. Naval Sea Systems Command Instruction 3150.2, Chapter 2, *Safe Diving Distances from Transmitting Sonar*, provides procedures for determining safe distances from underwater explosions (U.S. Department of the Navy 2011b). In accordance with training and testing procedures for safety planning related to detonations (Section 3.13.2.2.8, Weapons Firing and Ordnance Expenditure Safety), the Navy uses the following general and underwater detonation procedures:

- Navy personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of underwater ordnance must be coordinated with submarine operational authorities.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the Range Safety Officer or Test Safety Officer for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Detonation activities will be conducted during daylight hours.

3.13.2.2.8 Weapons Firing and Ordnance Expenditure Safety

In accordance with safety and inspection procedures (U.S. Department of the Navy 2011a), any unit firing or expending ordnance shall ensure that all possible safety precautions are taken to prevent accidental injury or property damage. The officer conducting the exercise shall permit firing or jettisoning of aerial targets only when the area is confirmed to be clear of nonparticipating units, both civilian and military.

Safety is a primary consideration for all training and testing activities. The range must be able to safely contain the hazard area of the weapons and equipment employed. The hazard area is based on the size and net explosive weight of the weapon. The type of activity determines the size of the buffer zone. For activities with a large hazard area, special sea and air surveillance measures are implemented to make sure that the area is clear before activities commence. Before aircraft can drop ordnance, they are required to make a preliminary pass over the intended target area to ensure that it is clear of boats, divers, or other nonparticipants. Aircraft carrying ordnance are not allowed to fly over surface vessels.

Training and testing activities are delayed, moved, or cancelled if there is any question about the safety of the public. Target areas must be clear of nonparticipants before conducting training and testing. When using ordnance with flight termination systems (which terminate the flight of airborne missiles or launch vehicles when they veer from their targeted path), the military is required to follow standard operating procedures to ensure public health and safety. In those cases where a weapons system does not have a flight termination system, the size of the target area that needs to be clear of nonparticipants is based on the flight distance of the weapon plus an additional distance beyond the system's performance capability.

3.13.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) could impact public health and safety. In this section, each public health and safety stressor is introduced, analyzed by alternative, and analyzed for training activities and testing activities. Tables 2.8-1 through 2.8-4 present the baseline and proposed training and testing activity locations for each alternative (including the number of events and ordnance expended). The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to public health and safety and analyzed below include the following:

- Underwater energy
- In-air energy
- Physical interactions
- Secondary (impacts associated with sediments and water quality)

Alternatives 1 and 2 include the expansion of the Study Area boundary to the west and north of the existing MIRC to encompass the Marianas Trench Marine National Monument (to include both the Islands and Trench Units) and the Transit Corridor from the MIRC to Hawaii. While Alternatives 1 and 2 would adjust locations and tempo of training and testing activities, including the establishment of danger zones around existing training areas, existing safety procedures and standard operating procedures would be employed such that no new or additional impacts to public health and safety would occur. In addition, the establishment of danger zones that would result in the exclusion of the public from these training areas on a full-time or intermittent basis would be a beneficial impact in terms of public health and safety. Therefore, expansion of the Study Area boundary and establishment of danger zones will not be addressed further in the analysis below.

Potential public health and safety impacts were evaluated assuming continued implementation of the military's current safety procedures for each training and testing activity or group of similar activities. Generally, the greatest potential for the proposed activities to be co-located with public activities would be in coastal areas because most commercial and recreational activities occur close to the shore.

Training and testing activities in the Study Area are conducted in accordance with the Marianas Training Manual (U.S. Department of the Navy 2011a). The Marianas Training Manual provides operational and safety procedures for all normal range activities. The Manual also provides information to range users that is necessary to operate safely and avoid affecting non-military activities, such as shipping, recreational boating, diving, and commercial or recreational fishing. Ranges are managed in accordance with standard operating procedures that ensure public health and safety. Current requirements and practices (e.g., standard operating procedures) designed to prevent public health and safety impacts are identified in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

As part of its continuing improvement of training, the U.S. military services generate an After Action Report (as required in the Marianas Training Manual) at the end of a training or testing activity primarily to track ordnance and training area usage, and at the same time identify problems encountered, provide solutions to the problem, and solicit suggestions for improvement.

3.13.3.1 Underwater Energy

Underwater energy can come from acoustic sources or electromagnetic devices. Active sonar, underwater explosions, airguns, and vessel movements all produce underwater acoustic energy. Sound will travel from air to water during aircraft overflights. Electromagnetic energy can enter the water from mine warfare training devices and unmanned underwater systems. The potential for the public to be exposed to these stressors would be limited to individuals, such as recreational swimmers or self-contained underwater breathing apparatus (SCUBA) divers, who are underwater and within unsafe proximity of a training or testing activity.

Many of the proposed activities generate underwater acoustic energy; however, not all sources rise to the level of consideration in this EIS/OEIS. Swimmers or divers might intermittently hear ship noise or underwater acoustic energy from aircraft overflights if they are near a training or testing event, but public health and safety would not be affected because these events would be infrequent and short in duration. Pierside integrated swimmer defenses are tested with underwater airguns during swimmer defense and diver deterrent training and testing activities; public health and safety would be ensured for these localized activities because access to pierside locations by nonparticipants is controlled for safety and security reasons. Because of the infrequency and short duration of the events, underwater acoustic energy from vessel movements, aircraft overflights, and airguns is not analyzed in further detail. Active sonar and underwater explosions are the only sources of underwater acoustic energy evaluated for potential impacts on public health and safety.

The proposed activities that would result in underwater acoustic energy include activities such as amphibious warfare, anti-surface warfare, anti-submarine warfare, mine warfare, surface warfare testing, and sonar maintenance. A limited amount of active sonar would be used during transit between range complexes and training and testing locations.

The effect of active sonar on humans varies with the sonar frequency. Of the four types of sonar (very high-, high-, mid-, and low-frequency), mid-frequency and low-frequency sonar have the greatest potential to impact humans due to the range of human hearing. Underwater explosives cause a physical shock front that compresses the explosive material, and the pressure wave then passes into the surrounding water. Generally, the pressure wave would be the primary cause of injury. The effects of an underwater explosion depend on several factors, including the size, type, and depth of the explosive charge and where it is in the water column.

Systems like the Towed Influence Mine Sweep emit an electromagnetic field and sound to simulate the presence of a ship. Unmanned underwater vehicles, some unmanned surface vehicles, and towed devices use electromagnetic energy. Electronic warfare activities involve aircraft, surface ship, and submarine crews attempting to control portions of the electromagnetic spectrum to degrade or deny the enemy's ability to take defensive actions. An electromagnetic signal dissipates quickly with increasing distance from its source. The literature lacks evidence to conclude that any adverse health effects result from exposure to electromagnetic energy, which is why no federal standards have been set for occupational exposures to this type of energy. Because standard operating procedures require an exercise area to be clear of participants, the public would not be exposed to electromagnetic energy the way a worker could experience long-term, occupational exposures. In the unlikely event that the public was exposed, the level of electromagnetic energy associated with the Proposed Action would not be enough to pose a health or safety risk.

As previously stated, the potential for the public to be exposed to these stressors would be limited to divers within unsafe proximity of an event. SCUBA diving is a popular recreational activity that is typically concentrated around known dive attractions such as reefs and shipwrecks. In general, recreational divers should not exceed 130 feet (40 meters) (Professional Association of Diving Instructors 2011). This depth limit typically limits this activity's distance from shore. Therefore, training and testing activities closest to shore have the greatest potential to co-occur with the public.

Swimmers and recreational SCUBA divers are not expected to be near Navy pierside locations because access to these areas is controlled for safety and security reasons. Locations of popular offshore diving spots are well documented, and dive boats (typically well marked) and diver-down flags would be visible from the ships conducting the training and testing. Therefore, co-occurrence of recreational divers and Navy activities is unlikely. Swimmers and recreational divers are not expected to be near training and testing locations where active sonar, underwater explosions, and electromagnetic activities would occur because of the strict procedures for clearance of nonparticipants before conducting activities.

The U.S. Navy Dive Manual (U.S. Department of the Navy 2011b) prescribes safe distances from active sonar sources and underwater explosions. Safety precautions for use of electromagnetic energy are specified in DoD Instruction 6055.11, *Protecting Personnel from Electromagnetic Fields* (U.S. Department of Defense 2002, 2009b) and Military Standard 464A, *Electromagnetic Environmental Effects: Requirements for Systems* (U.S. Department of Defense 2002). These distances would be used as the standard safety buffers for underwater energy to protect public health and safety. If unauthorized personnel are detected within the exercise area, the activity would be temporarily halted until the area was again cleared and secured. Therefore, the public is unlikely to be exposed to underwater energy at Navy pierside locations, in training or testing areas, or in ports.

3.13.3.1.1 No Action Alternative

3.13.3.1.1.1 Training Activities

Under the No Action Alternative, active sonar training activities such as anti-submarine warfare, mine warfare, and sonar maintenance would continue at current levels and at current locations. Navy training exercises would be confined within the Study Area in offshore areas and within Naval Base Guam Apra Harbor. See Figure 2.1-5 for locations of training areas and facilities associated with Naval Base Guam Apra Harbor. Most Navy training activities involving active sonar under the No Action Alternative would be conducted well out to sea; however, most civilian activities are conducted within a few miles of the coast of Guam, the islands of the CNMI, and other island nations close to the Study Area.

Activities involving underwater explosions, such as anti-surface warfare and mine warfare, would also continue at current levels and at current locations. Target areas would be cleared of nonparticipants prior to conducting training, so the only public health and safety concern would be on the rare occasion when an activity exceeds the safety area boundaries. Safety hazard areas would be determined prior to conducting training, and the public would not be allowed into the safety training areas. Standard operating procedures would be followed at all times. This separation decreases the potential for conflicts of military and civilian activities, and reduces the potential for incidents from underwater energy that could threaten the safety of civilians.

The military would continue to temporarily limit public access to areas where training activities involving underwater explosions would occur and would coordinate with the U.S. Coast Guard in issuing LNMs, NTMs, or BNMs, as appropriate. Public safety would continue to be enhanced by providing the public with information that would let them take an active role in avoiding interactions with military training involving sonar and underwater explosives and ensuring their own safety.

The analysis indicates that no impact on public health and safety would result from training activities using underwater energy, based on the military's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving underwater energy. Because of the military's safety procedures, the potential for training activities using underwater energy to impact public health and safety under the No Action Alternative would be unlikely.

3.13.3.1.1.2 Testing Activities

Under the No Action Alternative, the Navy would continue conducting deep water sound propagation and temperature-sound velocity profiles of the water column in the Study Area (refer to Table 2.4-4 for a complete description). Research vessels, acoustic test sources, side scan sonars, ocean gliders, existing moored acoustic tomographic array and distributed vertical line array, and other oceanographic data collection equipment are used to collect information. Under the No Action Alternative, this activity would continue within the Study Area. Because of the Navy's safety procedures, the potential for this testing activity using underwater energy to impact public health and safety would be unlikely.

3.13.3.1.2 Alternative 1

3.13.3.1.2.1 Training Activities

Active sonar training activities would continue to occur at current locations under Alternative 1; however, the potential areas for these activities are expanded under Alternative 1. While Alternative 1 would adjust the locations and tempo of active sonar training activities, the Navy would continue to implement standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

Activities involving underwater explosions, such as anti-surface warfare and mine warfare, would also continue within established ranges and training locations, as described under the No Action Alternative. While Alternative 1 would adjust locations and tempos of underwater explosives training activities to include the expanded area of the Study Area and the designation of danger zones around underwater detonation sites, the military would continue to implement standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. Public health and safety would be enhanced by the designation of danger zones around underwater detonation zones and associated restrictions on public access.

Mine warfare activities using electromagnetic energy include airborne mine countermeasures (e.g., Mine Countermeasure Exercise—Towed Sonar). While Alternative 1 would adjust locations and tempos of training activities with electromagnetic energy, the military would continue to implement standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

The military's safety procedures would ensure that the potential for training activities to impact public health and safety under Alternative 1 would be unlikely.

3.13.3.1.2.2 Testing Activities

Under Alternative 1, the Navy would continue conducting deep water sound propagation and temperature-sound velocity profiles of the water column in the Study Area and include other testing activities. The proposed testing activities include testing of anti-surface warfare and anti-submarine warfare systems. They would also include swimmer defense testing and testing of mission packages (anti-surface warfare, anti-submarine warfare, and mine countermeasure) (Tables 2.8-2 and 2.8-3). These proposed testing activities would occur within Navy-controlled and established ranges and locations. The Navy would implement standard operating and safety procedures similar to those used during training activities; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. Public health and safety would be enhanced by the designation of danger zones around underwater detonation zones and associated restrictions on public access.

Because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be unlikely.

3.13.3.1.3 Alternative 2

3.13.3.1.3.1 Training Activities

Alternative 2 is similar to Alternative 1 in the increase in active sonar, underwater explosions, and electromagnetic activities over the No Action Alternative. Alternative 2 is identical to Alternative 1 in the proposed locations for these activities. As concluded under Alternative 1, because of the military's safety procedures, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.13.3.1.3.2 Testing Activities

Under Alternative 2, the same testing activities identified in Alternative 1 would be conducted. The Navy would continue conducting deep water sound propagation and temperature-sound velocity profiles of the water column in the Study Area. The proposed testing activities identified under Alternative 1 would increase slightly under Alternative 2 (Tables 2.8-2 and 2.8-3). These testing activities would occur within Navy-controlled and established ranges and locations and would not impact public health and safety. The Navy would implement the standard operating and safety procedures similar to those used during training activities; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. Public health and safety would be enhanced by the designation of danger zones around underwater detonation zones and associated restrictions on public access. Because of the military's safety procedures, the potential for underwater testing activities to impact public health and safety under Alternative 2 would be negligible.

3.13.3.2 In-Air Energy

In-air energy stressors include sources of electromagnetic energy and lasers. The sources of electromagnetic energy include radar, navigational aids, and electronic warfare systems. These systems operate similarly to other navigational aids and radars at local airports and television weather stations throughout the U.S. Electronic warfare systems emit electromagnetic energy similar to that from cell phones, hand-held radios, commercial radio stations, and television stations. Current practices are in place to protect military personnel and the public from electromagnetic energy hazards. These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct human exposure, posting warning signs, establishing safe operating levels, and activating warning lights when radar systems are operational. Procedures also are in place to limit public and participant exposure from electromagnetic energy emitted by military aircraft. As stated in Section 3.13.3.1 (Underwater Energy), the level of electromagnetic energy associated with the Proposed Action would not be enough to pose a health or safety risk to the public.

A comprehensive safety program exists for the use of lasers. Current DoD and Navy practices protect individuals from the hazard of severe eye injury caused by laser energy. Laser safety requires pilots to verify that target areas are clear before commencing an exercise. In addition, during actual laser use, the aircraft run-in headings are restricted to preclude inadvertent lasing of areas where the public may be present.

Training and testing activities involving electromagnetic energy include electronic warfare activities that use airborne and surface electronic jamming devices to defeat tracking and communications systems. Training activities involving low-energy lasers include anti-surface warfare, mine warfare, and Homeland Security/Anti-Terrorism Force Protection with Unmanned Aerial Vehicles. Proposed testing activities that involve low-energy lasers include mine countermeasure mission package testing.

3.13.3.2.1 No Action Alternative

3.13.3.2.1.1 Training Activities

Under the No Action Alternative, electronic warfare training activities involving electromagnetic energy sources would continue at current levels and current locations within the MIRC. Laser targeting activities and mine detection activities using lasers also would continue at current levels and within established ranges and training locations within the MIRC.

The public would not likely be exposed to electromagnetic energy sources or lasers under the No Action Alternative. Based on the military's strict safety procedures for use of lasers and electronic warfare, these activities would not likely be conducted close enough to the public to pose an increased risk. Because of the military's safety procedures, the potential for these training activities to impact public health and safety under the No Action Alternative would be negligible.

3.13.3.2.1.2 Testing Activities

Under the No Action Alternative, the Navy would continue conducting the North Pacific Acoustic Lab Philippine Sea Experiment in deep water in the Study Area (refer to Table 2.4-4 for a complete description). This testing activity does not involve any in-air energy source; therefore, there would be no impact on public health and safety from in-air energy sources.

3.13.3.2.2 Alternative 1

3.13.3.2.2.1 Training Activities

Under Alternative 1, the number of training activities that use electromagnetic energy would increase (Table 2.8-1) and would continue to occur within established ranges and training locations, as described under the No Action Alternative. Laser targeting activities and mine detection activities using lasers would increase but would also occur within established ranges and training locations.

While Alternative 1 would increase locations and tempo of training activities involving electromagnetic energy and lasers, the military would continue to implement standard operating and safety procedures. Therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

3.13.3.2.2.2 Testing Activities

Under Alternative 1, proposed testing activities that use electromagnetic energy and lasers would occur within established ranges and testing locations. Locations proposed under this alternative include ocean areas of the MIRC and to the west and north of the MIRC.

The Navy would implement standard operating and safety procedures similar to those used during training activities; therefore, the potential for impacts on public health and safety from testing activities under Alternative 1 would be unlikely.

3.13.3.2.3 Alternative 2

3.13.3.2.3.1 Training Activities

Alternative 2 is similar to Alternative 1 in the increase in electromagnetic energy and laser training activities over the No Action Alternative. Alternative 2 is identical to Alternative 1 in the proposed locations for these activities. As concluded under Alternative 1, impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

While Alternative 2 would adjust locations and tempo of training activities involving electromagnetic energy and lasers, the military would continue implementation of standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

3.13.3.2.3.2 Testing Activities

Similar to the analysis under Alternative 1, Alternative 2 would involve an increase in testing activities that use electromagnetic energy and lasers. Electromagnetic energy would occur in established location and ranges in the Study Area. Changes in the locations and tempo of testing activities that use electromagnetic energy and lasers would not impact public health and safety because safety procedures would be in place.

While Alternative 2 would adjust locations and tempo of testing activities involving electromagnetic energy and lasers, the military would implement standard operating and safety procedures similar to those used during training activities; therefore, the potential for impacts on public health and safety from testing activities under Alternative 2 would be unlikely to increase.

3.13.3.3 Physical Interactions

Public health and safety could be impacted by direct physical interactions with military training and testing activities. Military aircraft, vessels, targets, munitions, towed devices, seafloor devices, and other training and testing expended materials could have a direct physical encounter with recreational, commercial, institutional, and governmental aircraft, vessels, and users such as swimmers, divers, and anglers, as well as wildlife.

Both military and public aircraft operate under visual flight rules requiring them to observe and avoid other aircraft. In addition, Notices to Airmen advise pilots about when and where Navy and Air Force training and testing activities are scheduled. Finally, Navy and Air Force personnel are required to verify that the range is clear of nonparticipants before initiating any potentially hazardous activity. Together, these procedures would minimize the potential for adverse interactions between Navy, Air Force, and nonparticipant aircraft. Standard operating procedures of the Navy and the Air Force ensure that private and commercial aircraft traversing the Study Area during training or testing activities do not interact with Navy and Air Force aircraft, ordnance, and aerial targets.

Wildlife in the area is also subject to interactions with Navy and Air Force aircraft during training and testing activities. The military installations in the Study Area have an ongoing comprehensive Bird Aircraft Strike Hazard program to discourage wildlife from occupying areas of the airfield and adjacent areas. The program would minimize the occurrence of adverse interactions between military aircraft and wildlife, particularly bird/animal aircraft strikes.

Military and public vessels operate under maritime navigational rules requiring them to observe and avoid other vessels. In addition, LNMs, NTMs, and BNMs advise vessel operators about when and where military training and testing activities are scheduled. Finally, military personnel are required to verify that the range is clear of nonparticipants before initiating any potentially hazardous activity. Similar knowledge and avoidance of popular fishing areas, such as the Galvez and Santa Rosa banks, would minimize interactions between military training and testing activities and recreational and commercial fishing. Together, these procedures would minimize the potential for adverse interactions between military and nonparticipant vessels. The military’s standard operating procedures ensure that private and commercial vessels traversing the Study Area during training or testing activities do not interact with military vessels, ordnance, or surface targets.

Recreational diving within the Study Area takes place primarily at known diving sites such as shipwrecks and reefs. The locations of these popular dive sites are well documented, dive boats are typically well marked, and diver-down flags are visible from a distance. As a result, ships conducting training or testing activities would easily avoid dive sites. Interactions between training and testing activities and recreational divers thus would be minimized, reducing the potential for collisions or ship strikes. Similar knowledge and avoidance of popular fishing areas would minimize interactions between training and testing activities and recreational fishing.

Commercial and recreational fishing activities could encounter military expended materials that could entangle fishing gear and pose a safety risk. The military would continue to recover targets at or near the surface that were used during training or testing to ensure they would not pose a collision risk. Unrecoverable pieces of military expended materials are typically small (such as sonobuoys), constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intended to sink to the bottom after their useful function was completed, so they would not be a collision risk to civilian vessels or equipment. Thus, these targets do not pose a safety risk to individuals using the area for recreation because the public would not likely be exposed to these items before they sank to the seafloor.

As discussed in Section 3.1 (Sediments and Water Quality), a west coast study categorized types of marine debris collected by a trawler during a groundfish survey. Military expended materials were categorized as plastic, metal, fabric and fiber, and rubber comprising 7.4, 6.2, 13.2, and 4.7 percent of the total count of items collected, respectively. Military expended materials are items used during training and testing activities and may include non-explosive munitions and targets, and accessories related to the carriage or release of these items. They do not include military debris such as wreckage from World War II. The footprint of military expended materials in the Study Area is discussed in Section 3.3 (Marine Habitats). Given the small percentage of items in the survey that were military expended materials, it is unlikely the public would encounter military expended materials during recreational or commercial fishing activities in the Study Area.

Section 3.1 (Sediments and Water Quality) also discussed the low failure rates of munitions, which indicate that most munitions function as intended. While fishing activities may encounter undetonated ordnance lying on the ocean floor, such an encounter would be unlikely given the large size of the Study Area and because the density of munitions in the Study Area is low. The Army Corps of Engineers prescribes the following procedure if military munitions are encountered: recognize when you may have encountered a munition, retreat from the area without touching or disturbing the item, and report the item to local law enforcement by calling 911 or the U.S. Coast Guard.

The analysis focuses on the potential for a direct physical interaction with an aircraft, vessel, target, or expended training item. All proposed activities have some potential for a direct physical interaction that could pose a risk to public health or safety, so the following analysis is not activity specific. While some of the activities may not pose a potential for a direct physical interaction (like pierside activities), the platforms associated with the activity (aircraft, vessel, towed devices) could have a direct physical interaction that could pose a risk. The greatest potential for a physical interaction would be along the coast because of the high concentration there of public activities.

3.13.3.3.1 No Action Alternative

3.13.3.3.1.1 Training Activities

Under the No Action Alternative, training activities would continue at current levels and within current established locations. The potential for a direct physical interaction between the public and aircraft, vessels, targets, or expended materials would not change from existing conditions. The military implements strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area prior to commencing training activities.

The analysis indicates that public health and safety would not be affected by physical interactions with training activities, based on the military's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving physical interactions. Because of the military's safety procedures, the potential for training activities to impact public health and safety under the No Action Alternative would be negligible.

3.13.3.3.1.2 Testing Activities

Under the No Action Alternative, the Navy would continue conducting deep water sound propagation and temperature-sound velocity profiles of the water column in the Study Area (refer to Table 2.4-4 for a complete description). Research vessels, acoustic test sources, side scan sonars, ocean gliders, existing moored acoustic tomographic array and distributed vertical line array, and other oceanographic data collection equipment are used to collect information. Under the No Action Alternative, this activity would continue within the Study Area. Because of the Navy's safety procedures and the relatively remote location of this testing activity, the potential for this testing activity to impact public health and safety from physical interactions would be negligible.

3.13.3.3.2 Alternative 1

3.13.3.3.2.1 Training Activities

Under Alternative 1, the number of training activities would increase but would continue within established locations. However, the increased number of aircraft and vessel movements or use of targets and expended materials would be conducted under the same safety and inspection procedures as under the No Action Alternative. While Alternative 1 would adjust locations and tempo of training activities, the military would continue to implement standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be negligible.

3.13.3.3.2.2 Testing Activities

Under Alternative 1, proposed testing activities involving aircraft and vessel movement or use of targets and expended materials would be conducted under the same safety and inspection procedures during training. Because the potential for a physical interaction is not activity-specific or location-specific, the analysis for the training activities above applies to testing activities under Alternative 1. As concluded above, because of the military's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be negligible.

3.13.3.3.3 Alternative 2

3.13.3.3.3.1 Training Activities

Under Alternative 2, the number of training activities would increase. The potential for a direct physical interaction between the public and aircraft, vessels, targets, or expended materials would also increase. While Alternative 2 would adjust locations and tempo of training activities, the military would continue to implement standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be negligible.

3.13.3.3.3.2 Testing Activities

The potential for a physical interaction is not activity-specific or location-specific, so the analysis for the training activities above applies to testing activities under Alternative 2. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 2 would be negligible.

3.13.3.4 Secondary Impacts

Public health and safety could be impacted if sediment or water quality were degraded. Section 3.1 (Sediments and Water Quality) considered the impacts on marine sediments and water quality of explosions and explosive byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). The analysis determined that no Guam, CNMI, or federal standards or guidelines would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because these standards and guidelines are structured to protect human health, and the proposed activities do not violate them, no secondary impacts on public health and safety would result from the training and testing activities proposed under the No Action Alternative, Alternative 1, or Alternative 2.

3.13.4 Summary of Potential Impacts (Combined Impacts of All Stressors) on Public Health and Safety

Activities described in this EIS/OEIS that could affect public health or safety include those that release underwater energy, in-air energy, or physical interactions, or that have indirect impacts from changes in sediment or water quality. Under the No Action Alternative, Alternative 1, or Alternative 2, these activities would be widely dispersed throughout the Study Area. Such activities also are dispersed temporally (i.e., few stressors would be present at the same time). For these reasons, no greater impacts from the combined operation of more than one stressor are expected. The aggregate impact on public health and safety would not observably differ.

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4 Cumulative Impacts

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4 CUMULATIVE IMPACTS

4.1 INTRODUCTION

The analysis of cumulative impacts (or cumulative effects)[1] presented in this section follows the requirements of the National Environmental Policy Act (NEPA) and Council on Environmental Quality guidance (Council on Environmental Quality 1997). The Council on Environmental Quality regulations (40 Code of Federal Regulations [C.F.R.] §§1500-1508) provide the implementing regulations for NEPA. The regulations define cumulative impacts as

> "…the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 C.F.R. §1508.7)."

While a single project may have minor impacts, overall impacts may be collectively significant when the project is considered together with other projects on a regional scale. A cumulative impact is the additive effect of all projects in the geographic area. The Council on Environmental Quality provides guidance on cumulative impacts analysis in *Considering Cumulative Impacts under the National Environmental Policy Act* (Council on Environmental Quality 1997). This guidance further identifies cumulative impacts as those environmental impacts resulting "from spatial and temporal crowding of environmental perturbations. The impacts of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the impacts of the first perturbation." This guidance observes that "no universally accepted framework for cumulative impacts analysis exists" while noting that certain general principles have gained acceptance. The Council on Environmental Quality provides guidance on the extent to which agencies of the federal government are required to analyze the environmental impacts of past actions when they describe the cumulative environmental effect of an action. This guidance provides that an analysis of cumulative impacts might encompass geographic boundaries beyond the immediate area of an action and a timeframe that includes past actions and foreseeable future actions. Thus, the Council on Environmental Quality guidelines observe, "[it] is not practical to analyze cumulative impacts of an action on the universe; the list of environmental impacts must focus on those that are truly meaningful."

4.2 APPROACH TO ANALYSIS

4.2.1 OVERVIEW

Cumulative impacts were analyzed for each resource addressed in Chapter 3 (Affected Environment and Environmental Consequences) for the No Action Alternative, Alternative 1, and Alternative 2 (the alternatives) in combination with past, present, and reasonably foreseeable future actions. The cumulative impacts analysis included the following steps, described in more detail below:

1. Identify appropriate level of analysis for each resource.
2. Define the geographic boundaries and timeframe for the cumulative impacts analysis.
3. Describe current resource conditions and trends.
4. Identify potential impacts of each alternative that might contribute to cumulative impacts.

[1] Council on Environmental Quality Regulations provides that the terms "cumulative effects" and "cumulative impacts" are synonymous (40 C.F.R. §1508.8[b]); the terms are used interchangeably by various sources, but the term "cumulative impacts" is used in this document, except for quotations, for continuity.

5. Identify past, present, and other reasonably foreseeable future actions that affect each resource.
6. Analyze potential cumulative impacts.

4.2.2 IDENTIFY APPROPRIATE LEVEL OF ANALYSIS FOR EACH RESOURCE

In accordance with Council on Environmental Quality guidance (Council on Environmental Quality 1997), the cumulative impacts analysis focused on impacts that are "truly meaningful." The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The rationale for the level of analysis applied to each resource is described in Section 4.4 (Resource-Specific Cumulative Impacts).

4.2.3 DEFINE THE GEOGRAPHIC BOUNDARIES AND TIMEFRAME FOR ANALYSIS

The geographic boundary for the cumulative impacts analysis includes, but is not limited to, the entire Mariana Islands Training and Testing (MITT) Study Area (Study Area) (Figure 2.1-1). The geographic boundaries for marine mammals and sea turtles were expanded to include activities outside the MITT Study Area that might impact migratory animals. Primary considerations from outside the Study Area include impacts associated with maritime traffic (e.g., vessel strikes and underwater noise) and commercial fishing (e.g., bycatch and entanglement).

Determining the timeframe for the cumulative impacts analysis requires estimating the length of time the impacts of the Proposed Action would last (Council on Environmental Quality 1997) and considering the specific resource in terms of its history of degradation. The Proposed Action includes ongoing and anticipated future training and testing activities. While the United States (U.S.) military training and testing requirements change over time in response to world events and several other factors, the general types of activities addressed by this Environmental Impact Statement (EIS)/Overseas EIS (OEIS) are expected to continue into the reasonably foreseeable future, along with the associated impacts. Likewise, some non-military activities addressed in this cumulative impacts analysis (e.g., oil and gas production, maritime traffic, commercial fishing) are expected to continue into the reasonably foreseeable future. Therefore, the cumulative impacts analysis is not bounded by a specific future timeframe. For past actions, the cumulative impacts analysis only considers those actions or activities that have ongoing impacts.

While the cumulative impacts analysis is not limited by a specific timeframe, it should be recognized that available information, uncertainties, and other practical constraints limit the ability to analyze cumulative impacts for the indefinite future. Navy environmental planning and compliance for training and testing activities is an ongoing process. The Navy intends to submit applications to the National Marine Fisheries Service (NMFS) for Marine Mammal Protection Act (MMPA) authorizations supported by this EIS/OEIS. The anticipated effective dates for these MMPA authorizations would be a 5-year period from May 2015 through April 2020. Future environmental planning documents will include cumulative impacts analysis based on information available at that time.

4.2.4 DESCRIBE CURRENT RESOURCE CONDITIONS AND TRENDS

The Affected Environment sections of Chapter 3 (Affected Environment and Environmental Consequences) describe current resource conditions and trends; these sections also discuss how past and present human activities influence each resource. The current aggregate impacts of past and present actions are reflected in the baseline information presented in Chapter 3 (Affected Environment and Environmental Consequences). This information is used in the cumulative impacts analysis to understand how past and present actions are currently impacting each resource and to provide the context for the cumulative impacts analysis.

4.2.5 Identify Potential Impacts of the Preferred Alternative That Might Contribute to Cumulative Impacts

Direct and indirect impacts of the alternatives, presented in Chapter 3 (Affected Environment and Environmental Consequences), were reviewed to identify impacts relevant to the cumulative impacts analysis. Key factors considered included the current status and sensitivity of the resource and the intensity, duration, and spatial extent of the impacts for each stressor. In general, long-term rather than short-term impacts and widespread rather than localized impacts were considered more likely to contribute to cumulative impacts. For example, for biological resources, population-level impacts were considered more likely to contribute to cumulative impacts than were individual-level impacts. Negligible impacts were not considered further in the cumulative impacts analysis. For marine mammals, any stressor that is expected to result in Level A harassment or Level B harassment, as defined by MMPA, was considered in the cumulative impacts analysis. For Endangered Species Act (ESA)-listed species, any stressor that may affect and is likely to adversely affect the species was considered in the cumulative impacts analysis. Stressors that were determined by the Navy to have no effect or that may affect but are not likely to adversely affect ESA-listed species were not analyzed in detail in the cumulative impacts analysis. A determination of may affect, not likely to adversely affect indicates that the impacts would be discountable (extremely unlikely) or insignificant.

4.2.6 Identify Other Actions and Other Environmental Considerations That Affect Each Resource

A list of other actions was compiled for the Study Area and surrounding areas based on information obtained during the scoping process (Appendix E, Public Participation), communications with other agencies, a review of other military activities, literature review, and previous NEPA analyses for some of the other actions, and other available information. Identified future actions were reviewed to determine if they should be considered further in the cumulative impacts analysis. Factors considered when identifying other actions to be included in the cumulative impacts analysis included the following:

- Whether the other action is likely or probable (i.e., reasonably foreseeable), rather than merely possible or speculative.
- The timing and location of the other action in relationship to proposed training and testing activities.
- Whether the other action and the preferred alternative would affect the same resources.
- The current conditions, trends, and vulnerability of resources affected by the other action.
- The duration and intensity of the impacts of the other action.
- Whether the impacts have been truly meaningful, historically significant, or identified previously as a cumulative impact concern.

In addition to identifying reasonably foreseeable future actions, other environmental considerations for the cumulative impacts analysis were identified and described. These other considerations include major environmental stressors or issues (e.g., ocean pollution, ocean noise, coastal development, etc.) that tend to be widespread and arise from routine human activities and multiple past, present, and future actions. Including these other environmental considerations allows an analysis of the current aggregate impacts of past and present actions, as well as reasonably foreseeable actions.

4.2.7 Analyze Potential Cumulative Impacts

The current impacts of past and present actions and the anticipated impacts of reasonably foreseeable future actions were characterized and summarized. The incremental impacts of each alternative were then added to the combined impacts of all other actions to describe the cumulative impacts that would result if the No Action Alternative, Alternative 1, or Alternative 2 were implemented. The cumulative impacts analysis considered additive, synergistic, and antagonistic impacts. A qualitative analysis was conducted in cases based on the available information. The analysis in Chapter 3 (Affected Environment and Environmental Consequences) indicates that the direct and indirect impacts of the No Action Alternative, Alternative 1, and Alternative 2 would be similar for many of the stressors. Therefore, much of the cumulative impacts discussion applies to all three alternatives. Specific differences between the alternatives are discussed when appropriate.

4.3 Other Actions Analyzed in the Cumulative Impacts Analysis

4.3.1 Overview

Table 4.3-1 lists the other actions and other environmental considerations identified for the cumulative impacts analysis. Descriptions of each action and environmental consideration carried forward for analysis are provided in the following sections.

4.3.2 Oil and Natural Gas Exploration, Extraction, and Production

4.3.2.1 Oil Pipeline

The Commonwealth Utilities Corporation is planning on constructing an 8-inch (20.3-centimeter) aboveground receiving pipeline that delivers fuel to the Commonwealth Utilities Corporation power plants 1 and 2 in Lower Base from the Mobile Oil Facility. This facility is located on the central western coast of Saipan.

The design is complete; however, the company needs more funding to begin construction and finish the project. A judge for the U.S. District Court for the Northern Mariana Islands ordered the Commonwealth Utilities Corporation to issue a notice to proceed by 4 November 2013 to all three contractors, and by 30 November 2013 to hold a pipeline construction contractor kickoff meeting and project review and begin construction planning. They were also directed to prepare and execute change orders by 6 January 2014, to begin pipeline construction by 28 February 2014, and to complete construction and commence pipeline testing and commissioning by 3 July 2014. By 17 July 2014, the judge said the pipeline shall be commissioned, and by 30 August 2014, the Commonwealth Utilities Corporation shall complete demolition of the old pipeline and project certification and close out (Ferdie de la Torre 2013).

As of 6 November 2013, in order to comply with the Order in the most expeditious manner, Commonwealth Utilities Corporation brought an emergency petition to seek $1,841,000 to complete the replacement of the existing diesel oil transportation and requested that notice provisions by the U.S. District Court for the Northern Mariana Islands be suspended. From the available information, it is inferred that the construction activities associated with this project may contribute to the cumulative impacts on terrestrial species and habitats in the Study Area.

4.3.2.2 Seismic Surveys

Seismic surveys are typically accomplished by towing a sound source such as an airgun array that emits acoustic energy in timed intervals behind a research vessel. The transmitted acoustic energy is reflected and received by an array of hydrophones. This acoustic information is processed to provide information about geological structure below the seafloor. The oil and gas industry uses seismic surveys to search for new hydrocarbon deposits. In addition, academic geologists use them to study plate tectonics and other topics. The underwater sound produced by these surveys could affect marine life, including marine mammals. For example, the potential exists to expose some animals to sound levels exceeding 180 decibels (dB) referenced to (re) 1 micropascal (μPa) root mean square, which would, in turn, potentially allow temporary or permanent loss of hearing (Bureau of Ocean Energy Management 2011). All seismic surveys conducted by U.S. vessels are subject to the MMPA authorization process administered by the NMFS, as well as the NEPA process associated with issuing MMPA authorizations. Currently, there are several MMPA authorizations for seismic surveys near the Study Area, including one for the territorial waters of the Commonwealth of the Northern Mariana Islands (CNMI).

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis

#	Name of Action	Lead Agency or Proponent	Marine or Terrestrial	Timeframe	Retained for Further Analysis?
Oil and Natural Gas Exploration, Extraction, Production, and Offshore Energy Generation					
1	Oil pipeline construction	Commonwealth Utilities Corporation	Terrestrial	Present	Retained.
2	Seismic surveys	Bureau of Ocean Energy Management, oil and gas industry, National Science Foundation, and academic institutions	Marine	Past, present, and future	Retained.
3	Wave and tidal energy plants	Bureau of Ocean Energy Management	Marine	Future	Dismissed because action is speculative.
Port Improvements, Dredge Disposal, Beach Nourishment, and Mining					
4	Offshore dredge disposal program	U.S. Army Corps of Engineers, U.S. Environmental Protection Agency	Marine	Past, present, and future	Dismissed because of negligible minor impacts on resources impacted by the Proposed Action.
5	New Landfill Dandan	Department of Public Works	Terrestrial	Future	Dismissed because of negligible minor impacts on resources impacted by the Proposed Action.
6	Pagan Mining	CNMI Government Administration	Terrestrial	Past, present, and future	Dismissed because of negligible minor impacts on resources impacted by the Proposed Action.
7	Relocation of Landfill	Department of Public Works	Terrestrial	Present and future	Dismissed because of negligible minor impacts on resources impacted by the Proposed Action.
8	Deep Seabed Minerals Project	Nauru Ocean Resources	Marine	Future	Dismissed because of negligible minor impacts on resources impacted by the Proposed Action.
9	Commercial Port Improvements East of Hotel Wharf	Port Authority of Guam	Marine	Future	Dismissed because of negligible minor impacts on resources impacted by the Proposed Action.
10	Harbor Rehabilitation Project	Commonwealth Ports Authority	Marine	Present	Dismissed because action only pertains to improvements on existing structures.
Other Military Activities					
11	Army and Air Force Exchange Service on Guam Environmental Assessment	Department of Defense	Terrestrial	Past	Retained.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

Other Military Activities (continued)					
12	Guam and CNMI Military Relocation EIS/Guam CNMI Military Relocation (2012 Roadmap Adjustments) Supplemental EIS	U.S. Navy	Terrestrial	Future	Retained.
13	Surveillance Towed Array Sensor System Low Frequency Active Sonar Environmental Impact Statement	U.S. Navy	Marine	Past, present, and future	Retained.
14	X-Ray Wharf Environmental Assessment	U.S. Navy	Marine	Past, present, and future	Retained.
15	Commonwealth of the Northern Mariana Islands (CNMI) Joint Military Training (CJMT) EIS/OEIS	Department of Defense	Marine/Terrestrial	Future	Retained.
16	Portable Joint Threat Emitter in Mariana Islands Range Complex Environmental Assessment	Department of Defense	Terrestrial	Future	Dismissed because it is not a viable project at this time and is not ripe for analysis.
17	Wind Turbines for Naval Base Guam Environmental Assessment	Naval Facilities Engineering Command	Terrestrial	Future	Dismissed because it is not a viable project at this time and is not ripe for analysis.
18	Environmental Impact Statement for Divert Activities and Exercises	U.S. Air Force	Terrestrial	Future	Retained.
Environmental Regulations and Planning					
19	Draft Safe Harbor Agreement	U.S. Fish and Wildlife Service	Marine	Past, present, and Future	Dismissed because action involves only planning and policy-related activities; specific future actions are speculative.
20	Coastal and marine spatial planning	Regional Ocean Commissions	Marine	Future	Dismissed because action involves only planning and policy-related activities (see Chapter 6, Additional Regulatory Considerations).

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

Environmental Regulations and Planning (continued)					
21	Marine Mammal Protection Act incidental take authorizations	National Marine Fisheries Service	Marine	Past, present, and future	Retained.
22	5-year review of species under the Federal Endangered Species Act	U.S. Fish and Wildlife Service	Marine and Terrestrial	Past, present, and future	Dismissed because action involves only planning and policy-related activities; specific future actions are speculative.
23	Avian and Avifauna Conservation Plans	Not applicable	Terrestrial	Past, present and future	Dismissed because action involves only planning and policy-related activities; specific future actions are speculative.
24	Reforestation of Masso Reservoir	GovGuam and U.S. Navy	Terrestrial	Past, present, and future	Dismissed because of negligible minor impacts on resources impacted by the Proposed Action.
Other Environmental Considerations					
25	Commercial fishing and fishery management plans	National Marine Fisheries Service and private industry	Marine	Past, present, and future	Retained.
26	Maritime traffic	Not applicable	Marine	Past, present, and future	Retained.
27	Development of Coastal Lands	Not applicable	Marine and terrestrial	Past, present, and future	Retained.
28	Ocean noise	Not applicable	Marine	Past, present, and future	Retained.
29	Ocean pollution (including marine debris, nonpoint source pollution, and cruise ship discharges)	Not applicable	Marine	Past, present, and future	Retained.
30	Commercial and general aviation	Not applicable	Marine and Terrestrial	Past, present, and future	Retained from greenhouse gas emission analysis.
31	Transportation Improvements	Not applicable	Marine and Terrestrial	Past, present, and future	Retained.
32	Climate Change	Not applicable	Marine and Terrestrial	Past, present, and future	Retained.

Notes: CNMI = Commonwealth of the Northern Mariana Islands, EIS = Environmental Impact Statement, OEIS = Overseas Environmental Impact Statement, U.S. = United States

4.3.3 OTHER MILITARY ACTIONS

4.3.3.1 Army and Air Force Exchange Service on Guam

In September 2008, the Army and Air Force Exchange Service opened a 181,000-square-foot (ft.^{2}) (16,815.4-square-meter [m^2]) Shopping Complex on Andersen Air Force Base. This facility has 81,000 ft.^{2} (7,525.1 m^2) of retail space, which is triple the size of the old Exchange. This project may contribute to the cumulative impacts on terrestrial species and habitats in the Study Area.

4.3.3.2 Guam and Commonwealth of the Northern Mariana Islands Military Relocation/Guam Commonwealth of the Northern Mariana Islands Military Relocation (2012) Roadmap Adjustments)

In September 2010, the Navy signed a Record of Decision (ROD) regarding the 2010 Final EIS for the *Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation; Relocating Marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force*. The ROD documented the Navy's decision to implement the preferred alternatives identified in the 2010 Final EIS for the main base (cantonment), aviation, and waterfront operations to support relocation of approximately 8,600 Marines and approximately 9,000 dependents from Okinawa to Guam. The ROD deferred a decision on the development of a live-fire training range complex along Route 15 in the northeastern part of Guam. The 2010 Final EIS concluded that activities on Guam could significantly impact noise, land/submerged land ownership and use, recreation, offbase roadways, socioeconomics, public health and safety, and environmental justice and protection of children. On Tinian, the project was found to potentially have significant impacts on land/submerged land, socioeconomics, and environmental justice and protection of children. Therefore, this project may contribute to the cumulative impacts on socioeconomic resources in the Study Area.

In February 2012, the Navy initiated a Supplemental EIS to evaluate the environmental consequences of establishing a live-fire training range complex on Guam in support of the relocation of Marine Corps forces to Guam. Scoping meetings for the Supplemental EIS were held in March 2012. On 27 April 2012, the U.S.-Japan Security Consultative Committee issued a joint statement announcing its decision to adjust the plans outlined in the May 2006 Realignment Roadmap document. In accordance with the adjustments (the "2012 Roadmap Adjustments"), the Department of Defense adopted a new force posture in the Pacific which provided a substantially smaller Marine Corps relocation to Guam. As a result of the 2012 Roadmap Adjustments, the Navy expanded the scope of the Supplemental EIS to also evaluate the potential environmental consequences from construction and operation of a main cantonment area, including family housing, and associated infrastructure to support the relocation of a substantially reduced number of Marines than previously analyzed. The Draft Supplemental EIS was released in April 2014 and supplements the 2010 Final EIS for the Guam and CNMI Military Relocation, and is expected to be completed in 2015.

4.3.3.3 Surveillance Towed Array Sensor System Low Frequency Active Sonar

In August 2012, the Navy released a Record of Decision for employing the Surveillance Towed Array Sensor System Low Frequency Active Sonar. The Navy currently plans to operate up to four Surveillance Towed Array Sensor System Low Frequency Active Sonar systems for routine training, testing, and military operations. Based on current Navy national security and operational requirements, routine training, testing, and military operations using these sonar systems could occur in the Pacific Ocean (including the Study Area), Atlantic Ocean, Indian Ocean, and Mediterranean Sea. The underwater sound produced by this project may contribute to the cumulative impacts on marine mammals and sea turtles in the Study Area.

4.3.3.4 Commonwealth of the Northern Mariana Islands Joint Military Training Environmental Impact Statement/Overseas Environmental Impact Statement

The CNMI Joint Military Training EIS/OEIS will evaluate the potential impacts associated with alternatives for meeting U.S. Pacific Command Service Components' unfilled unit level training and combined level of military training requirements in the Western Pacific. The proposed action would establish a series of live-fire and maneuver ranges and training areas within the CNMI and include amphibious operations on Tinian. The proposed action is to expand existing ranges and training areas (RTAs) and construct new RTAs within the CNMI. The Notice of Intent to complete the EIS/OEIS was published in the Federal Register on 14 March 2013.

4.3.3.5 X-Ray Wharf Environmental Assessment

Construction of improvements to the existing main supply wharf within Naval Base Guam to accommodate two berths for the Navy's new class of supply ships. The Final Environmental Assessment (EA) was completed and a Finding of No Significant Impact signed on 29 May 2014. This project proposes dredging activities that could possibly contribute to the cumulative impacts on marine habitats, marine vegetation, marine invertebrates, and sediments and water quality in the Study Area.

4.3.3.6 Divert Activities and Exercises

The U.S. Air Force proposes improvements to an existing airfield or airfields on U.S. territory near the Philippine Sea in support of expanding mission requirements in the western Pacific. In addition, divert capabilities for current, emerging, and future training activities are proposed. A Draft EIS analyzing environmental impacts associated with the divert activities and exercises was published in June 2012. The Draft EIS found that there could be major adverse effects from the construction phase of the project on cultural, resources, socioeconomics and environmental justice, and human health and safety within the project area. The Draft EIS also states that the implementation phase could result in major adverse effects on cultural and natural resources on Saipan (Nightingale Reed Warbler), but resource impacts on Tinian were limited to minor impacts to cultural resources (primarily historic). Adverse effects could also occur on noise, and socioeconomic and environmental justice resources. Beneficial effects could also occur on socioeconomic resources at both Tinian and Saipan. Therefore, this project may contribute to the cumulative impacts on natural, noise, cultural and socioeconomic resources in the Study Area.

4.3.4 Environmental Regulations and Planning

4.3.4.1 Coastal and Marine Spatial Planning

Dismissed because action involves only planning and policy-related activities (discussed in Chapter 6, Additional Regulatory Considerations).

4.3.4.2 Marine Mammal Protection Act Incidental Take Authorizations

The MMPA generally prohibits "take" of marine mammals in U.S. waters by any person and by U.S. citizens in international waters. The National Marine Fisheries Service can authorize "take" for specific activities. In the MITT Study Area, the only active Incidental Take Authorization is for the Surveillance Towed Array Sensor System Low Frequency Active Sonar, discussed in Section 4.3.3.3.

4.3.5 Other Environmental Considerations

4.3.5.1 Commercial Fishing

Commercial fishing constitutes an important and widespread use of the ocean resources throughout the Study Area. Commercial fishing can adversely affect fish populations, other species, and habitats.

Potential impacts of commercial fishing include overfishing of targeted species and bycatch, both of which negatively affect fish stocks and other marine resources. Bycatch is the capture of fish, marine mammals, sea turtles, marine birds, and other nontargeted species that occurs incidental to normal fishing operations. Use of mobile fishing gear, such as bottom trawls, disturbs the seafloor and reduces structural complexity. Indirect impacts of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats and have the potential to entangle or be ingested by marine mammals.

Commercial fishing can have a profound influence on individual fish populations. In a study of retrospective data, Jackson et al. (2001) analyzed paleoecological records of marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before the present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer-term data and information, Jackson et al. (2001) concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance of coastal ecosystems, including pollution and anthropogenic climatic change. Fisheries bycatch has been identified as a primary driver of population declines in several groups of marine species, including sharks, mammals, marine birds, and sea turtles (Wallace et al. 2010). Therefore, commercial fishing may contribute to the cumulative impacts on marine mammals, sea turtles, fish, and marine habitats in the Study Area.

4.3.5.2 Maritime Traffic

Portions of the Study Area are heavily traveled by commercial, recreational, and government marine vessels, with several commercial ports occurring in or near the Study Area. Section 3.12 (Socioeconomic Resources) provides additional information for marine vessel traffic in the Study Area. Primary concerns for the cumulative impacts analysis include vessels striking marine mammals and sea turtles, introduction of non-native species through ballast water, and underwater sound from ships and other vessels. Therefore, maritime traffic may contribute to the cumulative impacts on marine mammals and sea turtles in the Study Area.

4.3.5.3 Development of Coastal Lands

Coastal development intensifies use of coastal resources, resulting in potential impacts on water quality, marine habitat, and air quality. Coastal land development in the Study Area is both intensive and extensive. Development continues to impact coastal resources through point and nonpoint source pollution, concentrated recreational use, and intensive ship traffic using major port facilities. The Study Area coastline also includes coastal tourism development (e.g., hotels, resorts, restaurants, food industry, vacation homes, second homes) and the infrastructure supporting coastal development (e.g., retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, recreational fishing facilities).

Coastal development is regulated by states and territories through the Coastal Zone Management Act and associated state and local programs. Chapter 6 (Additional Regulatory Considerations) provides additional information on coastal zone management in the Study Area.

4.3.5.4 Ocean Noise

Anthropogenic sources of noise that are most likely to contribute to increases in ocean noise are vessel noise from commercial shipping and general vessel traffic, oceanographic research, oil and gas exploration, underwater construction, and naval and other use of sound navigation and ranging. Therefore, ocean noise may contribute to the cumulative impacts on marine mammals and sea turtles in the Study Area.

Any potential for cumulative impact should be put into the context of recent changes to ambient sound levels in the world's oceans as a result of anthropogenic activities. However, there is a large and variable natural component to the ambient noise level as a result of events such as earthquakes, rainfall, waves breaking, and lightning hitting the ocean as well as biological noises such as those from snapping shrimp and the vocalizations of marine mammals.

Andrew et al. (2002) compared ocean ambient sound from the 1960s to the 1990s from a receiver off the California coast. The data showed an increase in ambient noise of approximately 10 dB in the frequency ranges of 20–80 Hertz (Hz) and 200–300 Hz, and about 3 dB at 100 Hz over a 33-year period. Each 3 dB increase is noticeable to the human ear and a doubling in sound level. A possible explanation for the rise in ambient noise is the increase in shipping noise. There are approximately 11,000 supertankers worldwide, each operating 300 days per year, producing constant broadband noise at source levels of 198 dB (Hildebrand 2004). Generally, the most energetic regularly operated sound sources are seismic airgun arrays from approximately 90 vessels with typically 12–48 individual guns per array, firing about every 10 seconds (Hildebrand 2004).

Appendix I (Acoustic and Explosives Primer) provides additional information about sources of anthropogenic sound in the ocean and other background information about underwater noise. This section describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for individual animals and populations. A variety of impacts may result from exposure to sound-producing activities. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences. The major categories of potential impacts are behavioral reactions, physiological stress, auditory fatigue, auditory masking, and direct trauma.

4.3.5.5 Ocean Pollution

Pollution is the introduction of harmful contaminants that are outside the norm for a given ecosystem. Ocean pollution has and will continue to have serious impacts on marine ecosystems. Common ocean pollutants include toxic compounds such as metals, pesticides, and other organic chemicals; excess nutrients from fertilizers and sewage; detergents; oil; plastics; and other solids. Pollutants enter oceans from nonpoint sources (e.g., storm water runoff from watersheds), point sources (e.g., wastewater treatment plant discharges), other land-based sources (e.g., windblown debris), spills, dumping, vessels, and atmospheric deposition. Therefore, ocean pollution may contribute to the cumulative impacts on marine mammals, sea turtles, fish, marine invertebrates, sea birds, and marine habitats in the Study Area.

4.3.5.5.1 Non-Point Sources, Point Sources, and Atmospheric Deposition

Polluted runoff, or non-point source pollution, is considered the major cause of impairment of ocean waters. Stormwater runoff from coastal urban areas and beaches carries waste such as plastics and Styrofoam into coastal waters. Sewer outfalls are a point source type of ocean pollution. Sewage can be treated to eliminate potentially harmful releases of contaminants; however, releases of untreated sewage occur due to malfunctions or overloads to the infrastructure, resulting in releases of bacteria usually associated with feces, such as *Escherichia coli* and *Enterococci spp*. Bacteria levels are used routinely to determine the quality of water at recreational beaches and as indicators of the possible presence of other harmful microorganisms. In the past, toxic chemicals have been released into sewer systems. While such dumping has long been forbidden by law, the practice left ocean outflow sites contaminated. Sewage treatment facilities generally do not treat or remove persistent organic pollutants, such as polychlorinated biphenyl (PCB) and dichlorodiphenyltrichloroethane (DDT), or other toxins.

Hypoxia (low dissolved oxygen concentration) is a major impact associated with point and non-point sources of pollution. Hypoxia occurs when waters become overloaded with nutrients such as nitrogen and phosphorus, which enter oceans from non-point source runoff, wastewater treatment plants, and atmospheric deposition. Too many nutrients can stimulate algal blooms—the rapid expansion of microscopic algae (phytoplankton). When excess nutrients are consumed, the algae population dies off and the remains are consumed by bacteria. Bacterial consumption causes dissolved oxygen in the water to decline to the point where marine life that depends on oxygen can no longer survive (Boesch et al. 1997). Harmful algal blooms are proliferations of marine and freshwater algae (including cyanobacteria and non-photosynthetic algae-like organisms) that can produce toxins, causing human illness and massive animal mortalities. They also can accumulate in sufficient numbers to alter ecosystems in detrimental ways.

Non-point sources, point sources, and atmospheric deposition also contribute toxic pollutants such as metals, pesticides, and other organic compounds to the marine environment. Toxic pollutants may cause lethal or sublethal effects if present in high concentrations, and can build up in tissues over time and suppress immune system function, resulting in disease and death.

4.3.5.5.2 Marine Debris

Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned that enters the marine environment (National Marine Fisheries Service 2006). Common types of marine debris include various forms of plastic and abandoned fishing gear. Marine debris degrades marine habitat quality and poses ingestion and entanglement risks to marine life and birds (National Marine Fisheries Service 2006).

Plastic debris is a major concern because it degrades slowly and many plastics float. The floating debris is transported by currents throughout the oceans and has been discovered accumulating in oceanic gyres (Law et al. 2010). Additionally, plastic waste in the ocean chemically attracts hydrocarbon pollutants such as PCB and DDT, which accumulate up to one million times more in plastic than in ocean water (Mato et al. 2001). Fish, marine animals, and birds can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. In the North Pacific Subtropical Gyre it is estimated that the fishes in this area are ingesting 12,000–24,000 U.S. tons (10,886,216–21,772,433 kilograms [kg]) of plastic debris a year (Davison and Asch 2011).

4.3.5.6 Commercial and General Aviation

Commercial and general aviation are retained for analysis and discussion due to associated emissions from aviation activities and effects on greenhouse gas. An analysis of greenhouse gas is presented in Section 4.4.2.1 (Greenhouse Gases).

4.3.5.7 Transportation Improvements

Saipan Department of Public Works Route 1 Feasibility Study will look into the prospect of passenger and vehicle ferry services between Tinian and Saipan. Service had formerly been provided between the two islands but was suspended in March 2010 due to a need for repairs. The Feasibility Study is needed to prove the economic benefits of the passenger and vehicle ferry services between the two islands and to determine any environmental impacts (Saipan Tribune 2012). Therefore, this project may contribute to the cumulative impacts on socioeconomics within the Study Area.

4.3.5.8 Climate Change

The Intergovernmental Panel on Climate Change (2007) reports that physical and biological systems on all continents and in most oceans are already being affected by recent climate changes. Global-scale assessment of observed changes shows that it is likely that anthropogenic warming over the last three decades has had a discernible influence on many physical and biological systems. Some of the major potential concerns for the marine environment include:

- Sea temperature rise
- Melting of polar ice
- Rising sea levels
- Changes to major ocean current systems
- Ocean acidification

Climate change may contribute to the cumulative impacts on the following resources in the Study Area: marine mammals, sea turtles, fish, seabirds, fish, marine vegetation, marine invertebrates, and socioeconomics.

4.4 Resource-Specific Cumulative Impacts

In accordance with Council on Environmental Quality guidance (Council on Environmental Quality 2010), the cumulative impacts analysis focused on impacts that are "truly meaningful." The level of cumulative analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The analysis below focused on the following resources:

- Marine mammals (Section 4.4.4)
- Sea turtles (Section 4.4.5)
- Terrestrial species and habitats (Section 4.4.10)
- Socioeconomic resources (Section 4.4.12)

While each of the following resources is discussed in below, detailed analysis of cumulative impacts was not necessary for these resources as the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low; therefore, further analysis of cumulative impacts is not warranted on the following resources:

- Sediments and water quality (Section 4.4.1)
- Air quality (Section 4.4.2)
- Marine habitats (Section 4.4.3)
- Marine birds (Section 4.4.6)
- Marine vegetation (Section 4.4.7)
- Marine invertebrates (Section 4.4.8)
- Fish (Section 4.4.9)
- Cultural Resources (Section 4.4.11)
- Public health and safety (Section 4.4.12.4)

4.4.1 Sediments and Water Quality

The analysis in Section 3.1 (Sediments and Water Quality) indicates that the Preferred Alternative could result in local, short- and long-term changes in sediment and water quality. However, chemical, physical, or biological changes to sediments or water quality would be below applicable standards, regulations, and guidelines and would be within existing conditions or designated uses (Section 3.1.1.2, Methods, lists applicable standards, regulations, and guidelines). The short-term impacts would arise from explosions and the byproducts of explosions and combusted propellants. It is unlikely these short-term impacts would overlap in time and space with other future actions that produce similar constituents. Therefore, the short-term impacts described in Section 3.1 (Sediments and Water Quality) are not expected to contribute to cumulative impacts.

The long-term impacts would arise from unexploded ordnance, noncombusted propellant, metals, and other materials. Long-term impacts of each alternative would be cumulative with other actions that cause increases in similar constituents. However, the incremental contribution of the No Action Alternative, Alternative 1 (Preferred Alternative), or Alternative 2 to long-term cumulative impacts would be negligible because:

- Most training and testing activities are widely dispersed in space and time;
- Most components of expended materials are inert or corrode slowly;
- Numerically, most of the metals expended are small- and medium-caliber projectiles, metals of concern comprise a small portion of the alloys used in expended materials, and metal corrosion is a slow process that allows for dilution;
- Most of the components are subject to a variety of physical, chemical, and biological processes that render them benign; and
- Potential areas of impacts would be limited to small zones immediately adjacent to the explosive, metals, or chemicals other than explosives.

Furthermore, none of the alternatives would result in long-term and widespread changes in environmental conditions, such as nutrient loading, turbidity, salinity, or pH (a measure of the degree to which a solution is either acidic [pH less than 7.0] or basic [pH greater than 7.0]). Based on the analysis presented in Section 3.1 (Sediments and Water Quality) and the reasons summarized above, the changes in sediment and water quality would be measurable, but would still be below applicable standards and guidelines; therefore, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low and further analysis of cumulative impacts is not warranted.

4.4.2 Air Quality

As detailed in Section 3.2 (Air Quality), training and testing activities conducted under Alternatives 1 and 2 would result in increased criteria pollutant emissions and hazardous air pollutant emissions throughout the Study Area. Sources of the emissions would include vessels and aircraft and, to a lesser extent, munitions. Potential impacts include localized and temporarily elevated pollutant concentrations. Recovery would occur quickly as emissions disperse. The impacts of Alternatives 1 or 2 would be cumulative with other actions that involve criteria air pollutant and hazardous air pollutant emissions. However, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be low for the following reasons:

- Most training and testing-related emissions are projected to occur at distances greater than 3 nautical miles (nm) from shore.

- Few stationary offshore air pollutant emission sources exist within the Study Area and few are expected in the foreseeable future.
- International regulations by the International Maritime Organization required commercial shipping vessels to switch to lower-sulfur fuel near U.S. and international coasts beginning in 2012 (National Oceanic and Atmospheric Administration 2011). The Department of Defense has released the *Operational Energy Strategy: Implementation Plan* which will reduce demand, diversify energy sources, and integrate energy consideration into planning (Department of Defense 2012). The U.S. Department of the Navy policy commits to a reduction of oil consumption by 50 percent by 2015; 40 percent of the Navy's total energy will come from fossil fuel alternatives and 50 percent of its onshore energy will come from renewable sources by 2020 (Environmental and Energy Study Institute 2009; Paige 2009).

Based on the analysis presented in Section 3.2 (Air Quality) and the reasons summarized above, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be negligible.

4.4.2.1 Greenhouse Gases

Greenhouse gases are compounds that contribute to the greenhouse effect. The greenhouse effect is a natural phenomenon in which these gases trap heat within the surface-troposphere (lowest portion of the earth's atmosphere) system, causing heating (radiative forcing) at the surface of the earth. Scientific evidence indicates a trend of increasing global temperature over the past century due to an increase in greenhouse gas emissions from human activities (U.S. Environmental Protection Agency 2012). Without greenhouse gases the planet's surface would be about 60 degrees Fahrenheit (°F) cooler than present, according to the National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration data the average surface temperature has increase by about 1.2 to 1.4°F since 1900. If greenhouse gases continue to increase, models predict that the average temperature at the earth's surface could increase from 2.0 to 11.5°F above the 1990 levels by the end of this century (Le Treut et al. 2007).

Predictions of long-term negative environmental impacts due to global warming include sea level rise, changes in ocean pH and salinity, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems (including the potential loss of species), shrinking glaciers and sea ice, thawing permafrost, a longer growing season, and shifts in plant and animal ranges. Climate change is likely to negatively impact the Study Area and adjacent regions.

Over the next several decades, temperatures are projected to rise. The projected warming and more extensive climate-related changes could dramatically alter the region's economy, landscape, character, and quality of life (Le Treut et al. 2007).

In 2009, the U.S. generated about 6,633.2 teragrams (Tg) (or million metric tons) of carbon dioxide (CO_2) equivalents (U.S. Environmental Protection Agency 2012). The 2009 inventory data (U.S. Environmental Protection Agency 2012) show that CO_2, methane (CH_4), and nitrous oxide (N_2O) contributed from fossil fuel combustion processes of mobile and stationary sources (all sectors) include approximately:

- 5,505.2 Tg of CO_2
- 686.3 Tg CH_4
- 295.6 Tg N_2O

The 6,633.2 Tg CO_2 equivalent (CO_2 Eq) generated in 2009 is a decrease from the 7,263.4 Tg CO_2 Eq generated in 2007 (U.S. Environmental Protection Agency 2011). Among domestic transportation sources, light-duty vehicles (including passenger cars and light-duty trucks) represented 64 percent of CO_2 emissions, medium- and heavy-duty trucks 20 percent, commercial aircraft 6 percent, and other sources 9 percent. Across all categories of aviation, CO_2 emissions decreased by 21.6 percent (38.7 Tg) between 1990 and 2009. This includes a 59 percent (20.3 Tg) decrease in emission from domestic military operations. To place military aircraft in context with other aircraft CO_2 emissions, in 2009, commercial aircraft generated 111.4 Tg CO_2 Eq, military aircraft generated 14.1 Tg CO_2 Eq, and general aviation aircraft generated 13.3 Tg CO_2 Eq Military aircraft represent roughly 10 percent of emissions from the overall jet fuel combustion category (U.S. Environmental Protection Agency 2012).

This section begins by providing the background and regulatory framework for greenhouse gases. It then provides a quantitative evaluation of changes in greenhouse gas emissions that would occur under the Proposed Action and analyzes the cumulative impacts of greenhouse gas emissions.

4.4.2.1.1 Regulatory Framework

Federal agencies address emissions of greenhouse gases by reporting and meeting reductions mandated in laws, executive orders (EOs), and policies. Specific guidance is offered to federal agencies by the Council on Environmental Quality on how to address and consider greenhouse gases in NEPA analyses (Council on Environmental Quality 2014). On March 15, 2015, EO 13693, *Planning for Federal Sustainability in the Next Decade*, establishes executive agency policy to increase efficiency and improve agency environmental performance with the expressed goal to reduce agency direct greenhouse emissions by at least 40 percent over the next decade. EO 13693 (1) establishes greenhouse gases as the integrating metric for tracking progress in federal sustainability, (2) requires a deliberative planning process, and (3) links budget allocations and Office of Management and Budget scorecards to ensure goal achievement.

The targets for reducing greenhouse gas emissions are discussed in EO 13693 for Scope 1 targets (direct greenhouse gas emissions from sources that are owned or controlled by a federal agency) and Scope 2 targets (direct greenhouse gas emissions resulting from the generation of electricity, heat, or steam purchased by a federal agency) for reductions of greenhouse gas from the 2008 baseline by 2025. Scope 3 targets include greenhouse gas emissions from sources not owned or directly controlled by a federal agency but related to agency activities such as vendor supply chains, delivery services, and employee travel and commuting).

On December 18, 2014, the Council on Environmental Quality released revised draft guidance for public comment that describes how Federal departments and agencies should consider the effects of greenhouse gas emissions and climate change in their NEPA reviews. The revised draft guidance supersedes the draft greenhouse gas and climate change guidance released by Council on Environmental Quality in February 2010. This guidance explains that agencies should consider both the potential effects of a proposed action on climate change, as indicated by its estimated greenhouse gas emissions, and the implications of climate change for the environmental effects of a proposed action. The guidance also emphasizes that agency analyses should be commensurate with projected greenhouse gas emissions and climate impacts, and should employ appropriate quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations (Council on Environmental Quality 2014). The guidance states that "if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of carbon dioxide equivalent (CO_2

Eq) greenhouse gas emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public."

The Navy is committed to improving energy security and environmental stewardship by reducing reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will increase use of alternative energy and help conserve the world's resources for future generations. The Department of Defense Climate Change Roadmap identifies actions the Environmental Readiness Division is taking to implement EO 13693 (Department of Defense 2014). The Navy's Task Force Energy is responding to the Secretary of the Navy's energy goals through energy security initiatives that reduce the Navy's carbon footprint. The Climate Change Roadmap (5-year roadmap) action items, objectives, and desired impacts are organized to focus on strategies, policies and plans; operations and training; investments; strategic communications and outreach; and environmental assessment and prediction.

4.4.2.1.2 Cumulative Greenhouse Gas Impacts

Climate change is a global issue, and greenhouse gas emissions are a concern from a cumulative perspective because individual sources of greenhouse gas emissions are not large enough to have an appreciable impact on climate change. This greenhouse gas analysis considers the incremental contribution of Alternatives 1 and 2 to total estimated U.S. greenhouse emissions and their significance on climate change as compared to the No Action Alternative.

To estimate total greenhouse gas emissions, each greenhouse gas is assigned a global warming potential; that is, the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO_2, which has a value of 1. For example, CH_4 has a global warming potential of 21, which means that it has a global warming effect 21 times greater than CO_2 on an equal-mass basis (Intergovernmental Panel on Climate Change 2007). To simplify greenhouse gas analyses, total greenhouse gas emissions from a source are often expressed as CO_2 Eq. The CO_2 Eq is calculated by multiplying the emissions of each greenhouse gas by its global warming potential and adding the results together to produce a single, combined emission rate representing all greenhouse gases. While CH_4 and N_2O have much higher global warming potentials than CO_2, CO_2 is emitted in much higher quantities, so it is the overwhelming contributor to CO_2 Eq from both natural processes and human activities. Global warming potential-weighted emissions are presented in terms of equivalent emissions of CO_2, using units of Tg (1 million metric tons, or 1 billion kg) of Tg CO_2 Eq.

Greenhouse gas emissions were calculated for ships and aircraft (Table 4.4-1), which contribute the majority of emissions associated with training and testing in the Study Area. Greenhouse gas emissions from minor sources such as munitions, weapons platforms, and auxiliary equipment are considered negligible and were not calculated. Ship greenhouse gas emissions were estimated by determining annual ship fuel (typically diesel) use based on proposed activities and multiplying total annual ship fuel consumption by the corresponding emission factors for CO_2, CH_4, and N_2O. Aircraft greenhouse gas emissions were calculated by multiplying jet fuel use rates by the total operating hours, by the corresponding jet fuel emission factors for CO_2, CH_4, and N_2O, and by the total annual sorties.

Table 4.4-1: Greenhouse Gas Emissions from Ship and Aircraft Training and Testing Activities in the Mariana Islands Training and Testing Study Area

Alternative	Annual Emissions (Teragrams)			
	CO_2	N_2O	CH_4	CO_2 Eq
No Action Alternative	0.21	0.00	0.00	0.21
Alternative 1 (Preferred Alternative)	0.74	0.00	0.00	0.75
Increase in emissions for Alternative 1 compared to No Action Alternative	0.53	0.00	0.00	0.54
Alternative 2	0.81	0.00	0.00	0.82
Increase in emissions for Alternative 2 compared to No Action Alternative	0.60	0.00	0.00	0.61

Notes: CH_4 = methane, CO_2 = carbon dioxide, CO_2 Eq = carbon dioxide equivalent, N_2O = nitrous oxide

Ship and aircraft greenhouse gas emissions are compared to U.S. 2009 greenhouse gas emissions in Table 4.4-2; calculations are included in Appendix D (Air Quality Calculations and Record of Non-Applicability). The estimated CO_2 Eq emissions from the No Action Alternative are 0.0032 percent of the total CO_2 Eq emissions generated by the United States in 2009. The estimated CO_2 Eq emissions from Alternatives 1 and 2 would increase because of increased training and testing activities to about 0.0113 and 0.0124 percent of the total CO_2 Eq emissions, respectively, generated by the United States in 2009.

Based on the analysis presented in Section 3.2 (Air Quality) and the reasons summarized above, the changes in air quality would be measurable, but would still be below applicable standards and guidelines; therefore, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low and further analysis of cumulative impacts is not warranted.

Table 4.4-2: Comparison of Ship and Aircraft Greenhouse Gas Emissions to United States 2009 Greenhouse Gas Emissions

Alternative	Annual Greenhouse Gas Emissions (CO_2 Eq)	Percentage of U.S. 2009 Greenhouse Gas Emissions
No Action Alternative	0.22	0.0032
Alternative 1 (Preferred Alternative)	0.72	0.0113
Alternative 2	0.81	0.0124
U.S. 2009 greenhouse gas emissions	6,633.2	

Note: CO_2 Eq = carbon dioxide equivalent
Source: U.S. Environmental Protection Agency 2011

4.4.3 Marine Habitats

The analysis presented in Section 3.3 (Marine Habitats) indicates that marine habitats could be affected by acoustic stressors (underwater detonations) and physical disturbance or strikes (interactions with military expended materials or seafloor devices). Potential impacts include localized disturbance of the seafloor, cratering of soft bottom sediments, and structural damage to hard bottom habitats. Impacts on soft bottom habitats would be short term, and impacts on hard bottom would be long term. The impacts of each alternative would be cumulative with other actions that cause similar disturbances. The current aggregate impacts of past, present, and reasonably foreseeable future actions described in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) may potentially affect, but are not likely to adversely affect marine habitats. Aggregate impacts from vessel strikes, dredging, and other stressors associated with other actions discussed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) and Table 4.3-1 may result in alterations of marine habitats. Alternative 1 could also result in alterations of marine habitats from underwater explosions and strikes. Although this EIS/OEIS does address some of these other actions in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis), many of these other actions, and their cumulative impacts on marine habitats, cannot be determined with any specificity or certainty at this time. However, it can reasonably be assumed that there may be marine habitats that could be affected by these other actions, but with no specific details regarding the individual impacts or effects. For the CJMT action, direct and indirect impacts could occur on Tinian, specifically permanent direct loss of coral and habit loss for fish and sea turtles. Alterations to marine habitats that might occur under Alternative 1 and Alternative 2 would be additive to those associated with these other actions. However, the relative contribution of Alternatives 1 and 2 to the overall alterations of marine habitats within the Study Area would be low compared to the other actions for the following reasons:

- The area of hard bottom potentially impacted represents a negligible percentage (less than 1 percent as analyzed in Section 3.3, Marine Habitats) of the total hard bottom habitat in the Study Area.
- Impacts would be confined to a limited area, and recovery of soft bottom habitats would occur quickly.

Based on the analysis presented in Section 3.3 (Marine Habitats) and the reasons summarized above, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be negligible. Further analysis of cumulative impacts to marine habitats is not warranted.

4.4.4 MARINE MAMMALS

4.4.4.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.4 (Marine Mammals), impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on marine mammals include mortality, injury (Level A harassment under the MMPA), and disturbance or behavioral modification (MMPA Level B harassment). Mortality or injury could be caused by underwater explosions or vessel strikes. Injury, in the form of permanent threshold shift (PTS), could also be caused by sonar use. Underwater explosions, swimmer defense air guns, and sonar use would result in disturbance that meets the definition of MMPA Level A and B harassment. The remaining stressors analyzed in Section 3.4 (Marine Mammals) are not expected to result in mortality or Level A or B harassment. The incremental contribution of these remaining stressors to cumulative impacts on marine mammals would be negligible. These stressors are discussed in Section 4.4.5.2 (Impacts of Other Actions) below. The impacts of Alternatives 1 and 2 considered in the cumulative impacts analysis are summarized in Chapter 3, Section 3.4 (Marine Mammals).

4.4.4.2 Impacts of Other Actions

4.4.4.2.1 Overview

The potential impacts of other actions that are relevant to the cumulative impact analysis for marine mammals include the following:

- Mortality associated with vessel strikes, bycatch in fisheries, and entanglement in fishing and other gear
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound

- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with water pollution

Most of the other actions and considerations retained for analysis in Table 4.3-1 would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and planning. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels, including use of explosives for oil rig removal, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as “other environmental considerations” in the maritime traffic (Section 4.4.5.2.3) and ocean noise (Section 4.4.5.2.4) subsections. Similarly, many of the actions would result in water pollution. The aggregate impacts of water pollution are addressed below in the ocean pollution section (Section 4.4.5.2.5). Bycatch is associated with commercial fishing, and the primary cause of entanglement is commercial fishing. Therefore, these stressors are discussed below in the commercial fishing section (Section 4.4.5.2.7).

4.4.4.2.2 Other Military Actions

As discussed in Section 4.3.3.3 (Surveillance Towed Array Sensor System Low Frequency Active Sonar), marine mammals have the potential to be impacted from the Surveillance Towed Array Sensor System Low Frequency Active Sonar operations in the Study Area. Impacts from this action include (1) nonauditory injury, (2) permanent loss of hearing, (3) temporary loss of hearing, (4) behavioral change, and (5) masking. The potential effects from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations on any stock of marine mammals from injury (nonauditory or permanent loss of hearing) are considered negligible, and the potential effects on the stock of any marine mammal from temporary loss of hearing or behavioral change (significant change in a biologically important behavior) are considered minimal. Any auditory masking in marine mammals due to low-frequency active sonar signal transmissions is not expected to be severe and would be temporary. The operation of Surveillance Towed Array Sensor System Low Frequency Active Sonar with monitoring and mitigation would result in no mortality. The likelihood of low-frequency active sonar transmissions causing marine mammals to strand is negligible (U.S. Department of the Navy 2011).

4.4.4.2.3 Maritime Traffic and Vessel Strikes

A review of the impacts of vessel strikes on marine mammals is presented in Section 3.4.4.4 (Physical Disturbance and Strike Stressors). In particular, certain large whales, such as the blue whale, are more prone to vessel strikes (Berman-Kowalewski et al. 2010; Betz et al. 2011). The most vulnerable marine mammals are thought to be those that spend extended periods at the surface or species whose unresponsiveness to vessel sound makes them more susceptible to vessel collisions (Gerstein 2002; Laist and Shaw 2006; Nowacek et al. 2004). Marine mammals such as dolphins, porpoises, and pinnipeds that can move quickly throughout the water column are not as susceptible to vessel strikes. Most vessel strikes of marine mammals reported involve commercial vessels and occur over or near the continental shelf (Laist et al. 2001). The literature review by Laist et al. (2001) concluded that vessel strikes likely have a negligible impact on the status of most whale populations, but that for small populations, vessel strikes may have considerable population-level impacts. The conservation status and abundance of the species struck would determine in large part whether the injury would have population-level impacts on that species (Laist et al. 2001; Vanderlaan and Taggart 2009).

4.4.4.2.4 Ocean Noise

As summarized by the National Academies of Science, the possibility that anthropogenic noise could harm marine mammals or significantly interfere with their normal activities is an issue of concern (National Research Council of the National Academies 2005). Noise is of particular concern to marine mammals because many species use sound as a primary sense for navigating, finding prey, and communicating with other individuals. Noise can cause behavioral disturbances, mask other sounds (including their own vocalizations), result in injury, and in some cases, even lead to death (Tyack 2009a, b; Würsig and Richardson 2008). Human-caused noises in the marine environment come from shipping, seismic and geologic exploration, military training, and other types of pulses produced by government, commercial, industry, and private sources. In addition, noise from whale-watching vessels near marine mammals has received a great deal of attention (Wartzok 2009).

Assessing whether a noise may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present near the noise, and the effects that sound may have on the physiology and behavior of those marine mammals. Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council of the National Academies 2003, 2005), there are many unknowns in assessing the specific effects and significance of responses by marine mammals to sound exposures such as what activity the animal is engaged in at the time of the exposure (Nowacek et al. 2007; Southall et al. 2007). Potential impacts on marine mammals from ocean noise include behavioral reactions, hearing loss in the form of temporary threshold shift (TTS) or PTS, auditory masking, injury, and mortality. Section 3.4.3.1 (Acoustic Stressors) discusses these and other possible impacts of ocean noise on marine mammals.

4.4.4.2.5 Ocean Pollution

As discussed in Sections 4.3.5.5 (Ocean Pollution) and 3.4.2.4 (General Threats), pollutants from multiple sources are present in, and continue to be released into, the oceans. Elevated concentrations of certain compounds have been measured in tissue samples from marine mammals. Long-term exposure to pollutants poses potential risks to the health of marine mammals, although for the most part, the impacts are just starting to be understood (Reijnders et al. 2008). Section 3.4.2.4 (General Threats) provides an overview of these potential impacts.

If the health of an individual marine mammal were compromised by long-term exposure to pollutants, it is possible that this condition could alter the animal's expected response to stressors associated with Alternatives 1 and 2. The behavioral and physiological responses of any marine mammal to a potential stressor, such as underwater sound, could be influenced by a number of other factors, including disease, dietary stress, body burden of toxic chemicals, energetic stress, percentage body fat, age, reproductive state, size, and social position. Synergistic impacts are also possible. For example, animals exposed to some chemicals may be more susceptible to noise-induced loss of hearing sensitivity (Fechter 2005). While the response of a previously stressed animal might be different than the response of an unstressed animal, there are no data available at this time to accurately predict how stress caused by various ocean pollutants would alter a marine mammal's response to stressors associated with Alternatives 1 and 2.

4.4.4.2.6 Climate Change

The global climate is changing and having impacts on some populations of marine mammals (Salvadeo et al. 2010; Simmonds and Eliott 2009). Climate change can affect marine mammal species directly through habitat loss (especially for species that depend on ice or terrestrial areas) and indirectly via impacts on prey, changing prey distributions and locations, and changes in water temperature. Changes in prey can impact marine mammal foraging success, which in turn affects reproductive success and survival. Climate change also may influence marine mammals through effects on human behavior, such as increased shipping and oil and gas extraction, resulting from sea ice loss (Simmons et al. 2010); see Section 3.4 (Marine Mammals) for more information on impacts on marine mammals.

4.4.4.2.7 Commercial Fishing

Several commercial fisheries operate in the Study Area. Potential impacts from these activities include marine mammal injury and mortality from bycatch and entanglement. Fisheries have also resulted in profound changes to the structure and function of marine ecosystems that adversely affect marine mammals.

Between 1990 and 1999, the annual mean bycatch of marine mammals in U.S. fisheries was more than 6,000 animals, and most of these were killed in gill-net fisheries (Read et al. 2006). The impacts of bycatch on marine mammal populations vary based on removal rates, population size, and reproductive rates. Small populations with relatively low reproductive rates are most susceptible. Bycatch rates for about 12 percent of U.S. marine mammal stocks (almost all cetaceans) exceed their potential biological removal levels (Read 2008). The potential biological removal level is the number of animals that can be removed each year without preventing a stock from reaching or maintaining its optimal sustainable population level.

As discussed in Section 3.4.4.5 (Entanglement Stressors), entanglement in fishing gear is another major threat to marine mammals in the Study Area. In addition, overfishing of many fish stocks has resulted in significant changes in trophic structure, species assemblages, and pathways of energy flow in marine ecosystems (Jackson et al. 2001; Myers and Worm 2003; Pauly et al. 1998). These ecological changes may have important and likely adverse consequences for populations of marine mammals (DeMaster et al. 2001).

In summary, future commercial fishing activities in the Study Area are expected to result in significant impacts on some marine mammal species based on the relatively high injury and mortality rates associated with bycatch and entanglement. This mortality could result in or contribute to population declines for some species. Ecological changes brought about by commercial fishing are also expected to adversely impact marine mammals in the Study Area.

4.4.4.3 Cumulative Impacts on Marine Mammals

The current aggregate impacts of past, present actions, and reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal species in the Study Area. The impacts are considered significant because vessel strikes, bycatch, and entanglement associated with other actions are expected to result in relatively high rates of injury and mortality that could cause population declines in some species. Alternatives 1 and 2 could also result in injury and mortality to individuals of some marine mammal species from underwater explosions, sonar, and vessel strikes. Injury and mortality that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative contribution of the Proposed Action to the overall injury and mortality would be low compared to other actions. While quantitative estimates of marine mammal mortality from other actions are not available, bycatch for cetaceans and pinnipeds in the United States accounted for 4,146 mortalities in 1999 (Read et al. 2006).

Ocean noise associated with other actions and acoustic stressors (underwater explosions and sonar) associated with Alternatives 1 and 2 could also result in additive behavioral impacts on marine mammals. Other future actions such as construction and operation of liquefied natural gas terminals, and wave and tidal energy facilities would be expected to result in MMPA Level B harassment. However, it is unlikely that these actions and underwater explosions or sonar use would overlap in time and space because these activities are dispersed and the sound sources are intermittent. Furthermore, most of these other actions are not compatible with or could interfere with training and testing activities that involve underwater explosions and sonar use. The Navy takes appropriate coordination and scheduling steps (described in Section 3.12, Socioeconomic Resources) to avoid activities that interfere with or are not compatible with training and testing.

It is likely that distant shipping noise, which is more universal and continuous, and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on marine mammals.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with Alternatives 1 and 2 to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal.

In summary, the current aggregate impacts of past and present actions and reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal species in the Study Area. Therefore, cumulative impacts on marine mammals would be significant without consideration of the impacts of Alternatives 1 and 2. Alternatives 1 and 2 would contribute to and increase cumulative impacts, but the relative contribution would be low compared to other actions.

4.4.5 Sea Turtles

4.4.5.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on sea turtles include mortality, injury, and short-term disturbance or behavioral modification. Mortality or injury could be caused by underwater explosions or vessel strikes. Injury, in the form of PTS, could also be caused by sonar use. Noninjurious impacts of underwater explosions and sonar use would include short-term disturbance or behavioral modification. The Navy's ESA determinations presented in Table 3.5-13 are "no effect" or "may affect, not likely to adversely affect" for the remaining stressors analyzed in Section 3.5 (Sea Turtles). The incremental contribution of these remaining stressors to cumulative impacts on sea turtles would be negligible. Therefore, these stressors are not considered further in the cumulative impacts analysis.

4.4.5.2 Impacts of Other Actions

The potential impacts of other actions that are relevant to the cumulative impact analysis for sea turtles include the following:

- Mortality associated with vessel strikes, bycatch in fisheries, entanglement, and stressors associated with coastal development and human use of coastal environments
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise

- Reduced animal fitness associated with ocean pollution
- Habitat loss related to coastal development

Most of the other actions and considerations retained for analysis in Section 3.5 (Sea Turtles) include operation of marine vessels. Exceptions include the actions listed under environmental regulations and planning. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as "other environmental considerations" in maritime traffic (Section 4.4.6.3, Maritime Traffic and Vessel Strikes) and ocean noise (Section 4.4.6.4, Ocean Noise). Similarly, many of the actions could result in ocean pollution. The aggregate impacts of water pollution are addressed below in the ocean pollution section (Section 4.4.6.5, Ocean Pollution). Bycatch is associated with commercial fishing, and the primary cause of entanglement is commercial fishing. Therefore, these stressors are discussed below in the commercial fishing section (Section 4.4.6.6, Commercial Fishing).

4.4.5.2.1 Other Military Actions

As discussed in Section 4.3.3.3 (Surveillance Towed Array Sensor System Low Frequency Active Sonar), sea turtles have the potential to be impacted from the Surveillance Towed Array Sensor System Low Frequency Active Sonar operations in the Study Area. Sea turtles could be affected if they are inside the mitigation zone (180 dB sound field) during a Surveillance Towed Array Sensor System Low Frequency Active Sonar transmission. However, because received levels from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations would be below 180 dB sound pressure level within 12 nm or greater distance of any coastlines and offshore biologically important areas, effects on a sea turtle stock could occur only if a significant portion of the stock encountered the Surveillance Towed Array Sensor System Low Frequency Active Sonar vessel in the open ocean. The potential for Surveillance Towed Array Sensor System Low Frequency Active Sonar operations to expose sea turtle stocks to injurious (nonauditory or PTS) sound levels or to cause TTS or behavioral changes is considered negligible because (U.S. Department of the Navy 2011):

- Most sea turtle species inhabit the earth's oceanic temperate zones, where sound propagation is predominantly characterized by downward refraction (higher transmission loss, shorter range), rather than ducting (lower transmission loss, longer range), which is usually found in cold-water regimes.
- Sea turtle distribution and density are generally low at ranges greater than 12 nm from the coast.
- The Surveillance Towed Array Sensor System Low Frequency Active Sonar signal has a narrow bandwidth (approximately 30 Hz).
- The ship is always moving, and the system has a low duty cycle (estimated 7.5 percent), which means sea turtles would have less opportunity to be in the mitigation zone during a transmission.
- Visual monitoring mitigation is incorporated into the Preferred Alternative.

As discussed in Section 4.3.3.4 (Commonwealth of the Northern Mariana Islands Joint Military Training Environmental Impact Statement/Overseas Environmental Impact Statement), amphibious operations would continue and possibly increase on Tinian. Therefore, increased impacts to sea turtles and sea turtle habitat could occur.

4.4.5.2.2 Maritime Traffic and Vessel Strikes

Maritime traffic has increased over the past 50 years, and continued increases are expected in the future. Vessel strikes have been and will continue to be a cause of sea turtle mortality and injury throughout portions of the Study Area where sea turtles regularly occur. Because of the wide dispersal of large vessels in open ocean areas and the widespread, scattered distribution of turtles at sea, strikes during open-ocean transits are unlikely.

Some vessel strikes would cause temporary reversible impacts, such as diverting the turtle from its previous activity or causing minor injury. A National Research Council report qualitatively ranked the relative importance of various mortality factors for sea turtles. Vessel strikes were ranked 10th, behind leading factors of shrimp trawling and other fisheries (National Research Council 1990). Major strikes would cause permanent injury or death from bleeding, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a turtle’s recovery from a strike may be influenced by its age, reproductive state, and general condition. Much of what is written about recovery from vessel strikes is inferred from observing individuals sometime after a strike. Numerous living sea turtles bear scars that appear to have been caused by propeller cuts or collisions with vessel hulls (Hazel et al. 2007; Lutcavage et al. 1997), suggesting that not all vessel strikes are lethal. Conversely, fresh wounds on some stranded animals may strongly suggest a vessel strike as the cause of death. The actual incidence of recovery versus death is not known, given available data.

4.4.5.2.3 Ocean Noise

Potential impacts on sea turtles from ocean noise include behavioral reactions, hearing loss in the form of TTS or PTS, auditory masking, injury, and mortality. Section 3.5.3.1 (Acoustic Stressors) discusses these and other possible impacts of ocean noise on sea turtles.

4.4.5.2.4 Ocean Pollution

Marine debris can also be a problem for sea turtles through entanglement or ingestion. Sea turtles can mistake debris for prey; one study found 37 percent of dead leatherbacks to have ingested various types of plastic (Mrosovsky et al. 2009). Other marine debris, including abandoned fishing gear and cargo nets, can entangle and drown turtles in all life stages.

4.4.5.2.5 Commercial Fishing

Bycatch is one of the most serious threats to the recovery and conservation of sea turtle populations (National Research Council 1990; Wallace et al. 2010). Among fisheries that incidentally capture sea turtles, certain types of trawl, gillnet, and longline fisheries generally pose the greatest threat. One comprehensive study estimated that worldwide, 447,000 turtles are killed each year from bycatch in commercial fisheries (Wallace et al. 2010).

Other fisheries that result in sea turtle bycatch in the Study Area include pelagic fisheries for swordfish, tuna, shark, and billfish; purse seine fisheries for tuna; commercial and recreational rod and reel fisheries; gillnet fisheries for shark; driftnet fisheries; and bottom longline fisheries (National Marine Fisheries Service 2009).

4.4.5.2.6 Coastal Development

Coastal development and increased human populations in coastal areas will continue to have impacts on sea turtles such as nesting beach habitat degradation, beach vehicular driving, beach lighting, power plant entrainment, and degradation of nearshore water quality and seagrass beds (see Section 3.5, Sea Turtles, for more information on impacts on sea turtles).

4.4.5.2.7 Climate Change

Climate change will have impacts on sea turtles such as rising sea level, decreasing nesting beach habitat, increasing ocean temperatures, and acidification degrading water quality and seagrass beds (see Section 3.5, Sea Turtles, for more information on impacts on sea turtles).

4.4.5.3 Cumulative Impacts on Sea Turtles

The current aggregate impacts of past, present, and reasonably foreseeable future actions are expected to result in significant impacts on sea turtles. These aggregate impacts include those from bycatch, vessel strikes, entanglement, and other stressors associated with other actions which are expected to result in high rates of injury and mortality that could cause population declines to ESA-listed species or inhibit species recovery. The Preferred Alternative could also result in injury and mortality to individual sea turtles from underwater explosions, sonar, and vessel strikes. Injury and mortality that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative contribution of Alternatives 1 and 2 to the overall injury and mortality would be low compared to other actions. No sea turtle mortalities are estimated for Alternatives 1 and 2 (see Section 3.5.3.1.7.1, Model-Predicted Impacts).

Ocean noise associated with other actions and sound associated with acoustic stressors (underwater explosions and sonar) associated with Alternatives 1 and 2 could also result in additive behavioral impacts on sea turtles. Other future actions such as construction and operation of liquefied natural gas terminals, and wave and tidal energy facilities would be expected to result in similar impacts. However, it is unlikely that these actions and underwater explosions or sonar use would overlap in time and space because all of these activities are widespread and the sources are intermittent. Furthermore, most of these other actions are not compatible with or could interfere with training and testing activities that involve underwater explosions and sonar use. The Navy takes appropriate steps to avoid activities that interfere with or are not compatible with training and testing.

It is likely that distant shipping noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on sea turtles.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with Alternatives 1 and 2 to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a sea turtle affected by ocean pollution would be more susceptible to stressors associated with Alternatives 1 and 2.

In summary, the current aggregate impacts of past and present actions and reasonably foreseeable future actions are expected to result in impacts on sea turtles. Therefore, impacts on sea turtles would be significant without consideration of the impacts of Alternatives 1 and 2. Alternatives 1 and 2 would contribute to and increase cumulative impacts, but the relative contribution would be low compared to other actions.

4.4.6 MARINE BIRDS

The analysis in Section 3.6 (Marine Birds) indicates that birds could potentially be impacted by acoustic stressors (sonar and other active acoustic sources, underwater explosions, weapons firing noise, aircraft noise, vessel noise), energy stressors (electromagnetic devices), physical disturbance and strikes (aircraft, aerial targets, vessels and in-water devices, military expended materials), and ingestion (military expended materials). Potential responses would include a startle response, which includes short-term behavioral (e.g., movement) and physiological components (e.g., increased heart rate). Recovery from the impacts of most stressor exposures would occur quickly, and impacts would be localized. Some stressors, including underwater explosions, physical strikes, and ingestion of plastic military expended materials, could result in mortality. However, the number of individual birds affected is expected to be low, and no population-level impacts are expected. The impacts of Alternatives 1 and 2 would be cumulative with other actions that cause short-term behavioral and physiological impacts and mortality to birds. However, the incremental contribution of Alternatives 1 and 2 to cumulative impacts on birds would be low for the following reasons:

- Most of the proposed activities would be widely dispersed in offshore areas, where bird distribution is patchy and concentrations of individuals are often low. Therefore, the potential for interactions between birds and training and testing activities is low.
- It is unlikely that training and testing activities would influence nesting because most activities take place in water and away from nesting habitats on land. Alternatives 1 and 2 would not result in destruction or loss of nesting habitat.
- For most stressors, impacts would be short term and localized, and recovery would occur quickly.
- While a limited amount of mortality could occur, no population-level impacts would be expected.
- The Preferred Alternative is not likely to adversely affect ESA-listed bird species.

Based on the analysis in Section 3.6 (Marine Birds), and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be negligible. Further analysis of cumulative impacts on birds is not warranted.

4.4.7 MARINE VEGETATION

The analysis presented in Section 3.7 (Marine Vegetation) indicates that marine vegetation could be affected by acoustic stressors (underwater explosions) and physical stressors (interactions with vessels and in-water devices, military expended materials, or seafloor devices). Potential impacts include localized disturbance and mortality. Recovery would occur quickly, and population-level impacts are not anticipated. The impacts of Alternatives 1 and 2 would be cumulative with other actions that cause disturbance and mortality of marine vegetation.

The current aggregate impacts of past, present, and reasonably foreseeable future actions presented in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) may have an effect on marine vegetation. Aggregate impacts from vessel strikes, increased sedimentation, and other stressors associated with other actions discussed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) and Table 4.3-1 could result in injury and mortality. Although this EIS/OEIS does address some of these projects, developments and actions listed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis), many of these other actions and their associated cumulative impacts on marine vegetation cannot be determined with any specificity or certainty at this time.

However, it can reasonably be assumed that there may be marine vegetation that could be affected by these actions, but with no specific details regarding the individual impacts or effects. Alternatives 1 and 2 could also result in injury and mortality to marine vegetation from underwater explosions and strikes. Injury and mortality that might occur under the Preferred Alternative would be additive to injury and mortality associated with other actions. However, the relative contribution of Alternatives 1 and 2 to the overall injury and mortality would be low compared to other actions for the following reasons:

- Most training and testing activities would occur in areas where seagrasses and other attached marine vegetation do not grow.
- Impacts would be localized, recovery would occur quickly, and no population-level impacts would be expected.
- Proposed training and testing activities would not result in impacts that have historically affected marine vegetation. For example Alternatives 1 and 2 would not increase nutrient loading, which can cause algal blooms, decrease light penetration, and impact photosynthesis of seagrasses.

Alternatives 1 and 2 would not result in long-term or widespread changes in environmental conditions such as turbidity, salinity, pH, or water temperature that could impact marine vegetation. Based on the analysis presented in Section 3.7 (Marine Vegetation) and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be negligible. Further analysis of cumulative impacts on marine vegetation is not warranted.

4.4.8 Marine Invertebrates

The analysis presented in Section 3.8 (Marine Invertebrates) indicates that marine invertebrates could be affected by acoustic stressors (sonar and other active acoustic sources, underwater explosions, weapons firing noise, aircraft noise, vessel noise), energy stressors (electromagnetic devices), physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices), entanglement (fiber optic cables and guidance wires, decelerator/parachutes), and ingestion (military expended materials).

The current aggregate impacts of past, present, and reasonably foreseeable future actions presented in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) may have an effect on marine invertebrates. Aggregate impacts from vessel strikes, dredging, and other stressors associated with other actions discussed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) and Table 4.3-1 could result in injury and . Although this EIS/OEIS does address some of these other actions listed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis), many of these actions and their associated cumulative impacts on marine invertebrates cannot be determined with any specificity or certainty at this time. However, it can reasonably be assumed that there may be marine invertebrates that could be affected by these actions, but with no specific details regarding the individual impacts or effects. Alternatives 1 and 2 could also result in injury and mortality to marine invertebrates from underwater explosions, entanglement, and strikes. Injury and mortality that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative contribution of Alternatives 1 and 2 to the overall injury and mortality would be low compared to other actions for the following reasons:

- Most potential impacts would be short-term behavioral and physiological responses.
- Any impacts from the Proposed Action resulting injury or mortality would be to a relatively small number of individuals.

- No population-level impacts are anticipated.

Based on the analysis presented in Section 3.8 (Marine Invertebrates) and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be negligible. Further analysis of cumulative impacts on marine invertebrates is not warranted.

4.4.9 Fish

The analysis presented in Section 3.9 (Fish) indicates that fish could be affected by acoustic stressors (sonar and other active acoustic sources, explosives, swimmer defense airguns; weapons firing, launch, and impact noise; aircraft noise; and vessel noise), energy (electromagnetic devices), physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices), entanglement (fiber optic cables and guidance wires, decelerator/parachutes), and ingestion (munitions, military expended materials other than munitions).

The current aggregate impacts of past, present, and reasonably foreseeable future actions presented in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) may potentially affect fish. Aggregate impacts associated with the other actions discussed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) and Table 4.3-1 could result in injury and mortality . Although this EIS/OEIS does address some of these other actions listed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis), many of these actions and their associated cumulative impacts on fish, cannot be determined with any specificity or certainty at this time. However, it can reasonably be assumed that there may be fish that could be affected by these other actions, but with no specific details regarding the individual impacts or effects. For the CJMT action, direct and indirect impacts could occur on Tinian, specifically permanent direct loss of coral and habitat loss for fish. Alternatives 1 and 2 could also result in injury and mortality to fish from underwater explosions, entanglement, and strikes. Injury and mortality that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative contribution of Alternatives 1 and 2 to the overall injury and mortality would be low compared to other actions for the following reasons:

- Most potential impacts would be short-term behavioral and physiological responses.
- Any impacts from the Proposed Action resulting injury or mortality would be to a relatively small number of individuals.
- No population-level impacts are anticipated.

Based on the analysis presented in Section 3.9 (Fish) and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be negligible. Further analysis of cumulative impacts to fish is not warranted.

4.4.10 Terrestrial Species and Habitats

4.4.10.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on terrestrial species and habitats include acoustic stressors (explosions, aircraft noise, and weapons firing noise), physical disturbance or strikes (aircraft, munitions strike, ground disturbance, and wildfires), and secondary stressors. Potential responses would include a startle response, which includes short-term behavioral (e.g., movement) and physiological components (e.g., increased heart rate). Recovery from the impacts of most stressor exposures would occur quickly, and impacts would be localized. Based on the type of activities in the various land training areas of the MITT Study Area, the Navy presents the following summary of effects determinations to ESA-listed species and critical habitats:

- Critical habitat is designated on Guam for the Mariana crow, Mariana fruit bat, and Micronesian kingfisher. The critical habitat designations for these species are confined to the terrestrial portions of the Guam National Wildlife Refuge fee simple portion (Ritidian Unit). Because training does not occur within the Ritidian Unit and there is no need for training to access the portion of the road that descends down Ritidian Cliff to the Ritidian Unit, the Navy concludes that training and testing activities will not affect critical habitat designated on Guam.
- Critical habitat is designated on Rota for the Mariana crow and Rota bridled white-eye. The Navy does not train in these areas; therefore, the Proposed Action will not affect or result in an adverse modification to the designated critical habitat units on Rota and will not disturb the various primary constituent elements. The Navy concludes that the avoidance of designated critical habitat and measures designed for habitat protections described in Section 3.10.1.2 (Migratory Bird Treaty Act and 50 Code of Federal Regulations Part 21.15 Requirements) are sufficient to not affect designated critical habitat on Rota.

4.4.10.2 Impacts of Other Actions

The other actions presented in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) with the potential to contribute to cumulative impact to terrestrial species and habitats include the oil pipeline construction (Section 4.3.2.1), Army and Air Force Exchange Service on Guam (Section 4.3.3.1), Guam and CNMI Military Relocation/Guam CNMI Military Relocation (2012 Roadmap Adjustments) (Section 4.3.3.2), Commonwealth of the Northern Mariana Islands Joint Military Training Environmental Impact Statement/Overseas Environmental Impact Statement (Section 4.3.3.4), Divert Activities and Exercises (Section 4.3.3.6), and the development of coastal lands (Section 4.3.5.3). The potential impacts of other actions that are relevant to the cumulative impact analysis for terrestrial species and habitats include the introduction of invasive species and habitat loss related to coastal development activities and other construction activities.

4.4.10.3 Cumulative Impacts on Terrestrial Species and Habitats

The current aggregate impacts of past, present, and reasonably foreseeable future actions presented in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) may have an effect on terrestrial species and habitats on islands where military training activities described in this EIS/OEIS also occur. Guam and Tinian may experience construction associated with military activities in the future, while Saipan may experience future growth particularly in the tourism industry. Aggregate impacts from construction activities and the potential for invasive species introductions associated with the other actions discussed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) and Table 4.3-1 are expected to impact terrestrial species and habitats. Although this EIS/OEIS does address some of these other actions listed in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis), many of these actions and their associated cumulative impacts on terrestrial species and habitats, specifically introductions of invasive species, cannot be determined with any specificity or certainty at this time. However, it can reasonably be assumed that terrestrial species and habitats may be affected by these other actions, but with no specific details regarding the individual impacts or effects. In summary, the current aggregate of past and present actions and reasonably foreseeable future actions are expected to result in increased adverse impacts on terrestrial species. These impacts on terrestrial species would occur without consideration of the impacts of Alternatives 1 and 2. Alternatives 1 and 2 would contribute to and increase cumulative impacts, but the relative contribution would be low compared to other actions.

Although military training activities on Farallon de Medinilla (FDM) described in this EIS/OEIS would have impacts on the Micronesian megapodes and the Mariana fruit bat on FDM, no other activities would overlap temporally or spatially with the military's use of FDM. Because of the military's exclusive use of FDM specified in the lease agreement between the governments of the United States and CNMI, there are no other activities or actions that would occur on FDM.

The Navy has completed Section 7 consultation with the U.S. Fish and Wildlife Service, pursuant with the Navy's obligations to comply with Section 7 of the ESA. This consultation has resulted in a number of conservation measures that are included in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of this EIS/OEIS. Some of these conservation measures will assist with minimizing risk of other activities to species and habitats in areas where the Navy trains. For instance, the Navy's active participation in regional biosecurity planning and response will help counter the threat of invasive species introductions associated with activities not included in this EIS/OEIS. Figure 3.10-10 shows a conceptual model of potential introduction pathways of invasive species that addresses introduction, establishment, and dispersal of potentially invasive species within the Mariana Islands and to other locations outside of the archipelago. Not all potentially invasive species introductions can be attributed to military training activities. The military's biosecurity program, however, would minimize the number of species within military-associated pathways, thereby reducing the potential for spread once these species became established.

4.4.11 Cultural Resources

As discussed in Section 3.11 (Cultural Resources), Alternatives 1 and 2 could impact submerged historic resources if certain training and testing activities are conducted where these resources occur and are not avoided. Stressors that could impact cultural resources include acoustic (underwater explosions at depth) and physical disturbance (cratering from underwater detonations at depth, use of in-water devices, deposition of military expended materials, and use of ocean-bottom-deployed devices). However, the Navy routinely avoids locations of known obstructions, which includes submerged historic resources, to prevent damage to sensitive Navy equipment and vessels and to ensure the accuracy of training and testing exercises.

The current aggregate impacts of past, present, and reasonably foreseeable future actions presented in Section 4.3 (Other Actions Analyzed in the Cumulative Impacts Analysis) may have an effect on cultural resources. With a few exceptions, most of the other actions retained for cumulative impacts analysis (see Table 4.3-1) would involve some form of disturbance to the ocean bottom. Exceptions include seismic surveys, environmental regulations and planning actions, ocean pollution, and most forms of ocean noise. Actions that would disturb the ocean bottom could impact submerged cultural resources if those resources are not avoided. Any physical disturbance on the ocean floor could inadvertently damage or destroy submerged historic resources if avoidance and mitigation measures are not implemented.

Other actions that result in ocean bottom disturbance require some form of federal authorization or permitting. Therefore, requirements of the National Historic Preservation Act apply to actions in territorial waters. Federal agency procedures have been implemented to identify cultural resources, avoid impacts, and mitigate impacts that cannot be avoided. For example, the Bureau of Ocean Energy Management has procedures in place to identify the probability of the presence of submerged historic resources shoreward from the 148-foot (45-meter) isobath. It also has procedures for project redesign or relocation to avoid identified resources (Minerals Management Service 2007). Nonetheless, inadvertent impacts could occur if submerged cultural resources are present. However, inadvertent impacts are greatly reduced when avoidance and mitigation measures are put in place.

Impacts on submerged cultural resources from other actions would typically be avoided or mitigated through implementation of federal agency programs. However, impacts could occur if avoidance or mitigation measures are not implemented or if inadvertent disturbance or destruction of resources occurs. Disturbance or destruction of submerged historic sites, including shipwrecks, would diminish the overall record for these resources and decrease the potential for meaningful research on these resources. When considered with other actions, Alternatives 1 and 2 would not contribute to cumulative impacts on submerged historic resources because the Navy routinely avoids locations of known obstructions, which includes submerged historic resources. Further analysis of cumulative impacts on cultural resources is not warranted.

4.4.12 Socioeconomic Resources

4.4.12.1 Impacts of Alternatives 1 and 2 That Might Contribute to Cumulative Impacts

As discussed in Section 3.12 (Socioeconomic Resources), Alternatives 1 and 2 could contribute to impacts on accessibility to nearshore areas popular for commercial and recreational fishing, certain tourism activities, and subsistence fishing. However, limits on accessibility to these areas are not expected to significantly impact these resources, because restrictions would be temporary and of short duration (hours). Furthermore, with the exception of the 3 nm danger zone surrounding FDM, surface danger zones and temporary exclusion areas would be accessible to the public for fishing or other activities when military activities are not utilizing the associated range area. To ensure public safety, access to waters within danger zones and exclusion areas would be limited during military training and testing activities. During these times, mariners would be permitted to transit directly through a danger zone to a destination outside of the danger zone, but would not be allowed to anchor or loiter within the danger zone. Military activities utilizing the danger zone or exclusion area would be halted until the danger zone or exclusion area is cleared of transiting vessels. Access to FDM and the 3 nm danger zone surrounding FDM is permanently restricted for safety reasons.

Cumulative impacts on fishing may occur as a result of the proposed restricted areas and danger zones in the MITT Study Area; although, these effects can be mitigated by establishing effective communication between the public and military personnel who manage these assets. Examples of open communication and efforts by the military to alleviate impacts on accessibility to fishing sites include leaving the northern portion of W-517 open while training and testing activities are conducted in the southern portion of the warning area and informing the public of extended periods of time when the restricted area surrounding FDM will remain accessible. The military has and will continue to collaborate with local communities to enhance existing means of communications with the aim of reducing the potential effects of limiting access to areas designated for use by the military.

4.4.12.2 Impacts of Other Actions

4.4.12.2.1 Other Military Actions

An influx of military personnel associated with the movement of marines from Okinawa, Japan to Guam is anticipated to increase the population of the island by approximately two percent. Both adverse and beneficial socioeconomic effects would occur. Potential adverse effects relevant to resources analyzed in Section 3.12 (Socioeconomics) of the MITT EIS/OEIS would include increased demand on public services, including infrastructure (e.g. access to boat ramps), access to recreational areas (e.g., fishing sites), competition for tourism related activities (e.g. whale watching), and potential competition between recreational and subsistence fishers at popular nearshore sites. Beneficial effects of the population increase would be increased demand and potentially greater revenue for tourism related and commercial fishing businesses as well as local retail business, which could lead to an increase in employment opportunities.

As new military ships are brought to Guam and military missions change, there is always the potential for an increase in military marine traffic. Commercial traffic around Guam and the CNMI is a function of population and general economic health of the islands. The number of non-military vessels visiting the Port of Guam would be based on the need to service the population and economic growth. Recently completed projects on Guam (e.g., the Kilo Wharf Extension, Agat Marina Dock A Repair & Renovation, Romeo Wharf Improvements) have the potential to contribute to beneficial cumulative effects related to commercial transportation to and from Guam, because they are port improvement projects. Projects resulting in an increase in population may increase the shipping of goods to and from Guam and the CNMI. On-going projects including improvements to the Gregorio D. Perez Marina and dock will benefit both recreational activities and commercial shipping by improving accessibility to marine resources. One reasonably foreseeable future project, construction of the X-Ray Wharf, is anticipated to result in a beneficial cumulative effect to marine transportation on Guam.

Other military actions in the area are proposing to establish Army Corps of Engineers 33 C.F.R. Danger Zones, which could restrict access to fishing and recreational areas. These areas would be accessible to the public for fishing or other activities when military activities are not utilizing the associated range area. Impacts on fishing may occur with the proposed danger zones; however, these effects can be mitigated by establishing effective communication between the public and the military personnel who manage these assets.

4.4.12.2.2 Commercial Shipping

Although the volume of goods transported to Guam and to a lesser extent the CNMI may increase as a result of increases in the military population, the anticipated increase in commercial shipping activities is considerably lower than shipping experienced in the late 1990s. The Port of Guam is not at risk of being unable to meet the anticipated increases in demand. Increases in the population of Guam and any associated increased in commercial shipping may have a secondary beneficial effect on the CNMI by increasing the transport of goods between Guam and the CNMI (specifically Tinian, Saipan, and Rota).

4.4.12.3 Cumulative Impacts on Socioeconomic Resources

Cumulative effects on socioeconomic resources may have short-term impacts on accessibility to public services, fishing sites, and tourism resources, but they are not expected to have long-term negative impacts on these resources or the economy of Guam and the CNMI, because, over time, economic adjustments to meet the additional demands of a larger population would be expected. Continued efforts by the military to communicate with mariners about temporary restrictions on accessing fishing sites should minimize impacts to recreational, commercial, and subsistence fishing. The influx of additional military personnel and their families is expected to have a positive effect on the local economy, as a result of increases in commercial and retail sales, tourism, recreation, and transport between Guam and the CNMI.

4.4.12.4 Public Health and Safety

The analysis presented in Section 3.13 (Public Health and Safety) indicates that the impacts of Alternatives 1 and 2 on public health and safety would be negligible. Alternatives 1 and 2 are not expected to contribute incrementally to cumulative health and safety impacts. Therefore, further analysis of cumulative impacts on public health and safety is not warranted.

4.5 Summary and Conclusions

Marine mammals, sea turtles, terrestrial species, and socioeconomics are the primary resources of concern for cumulative impacts analysis:

- Past human activities have impacted these resources to the extent that several marine mammal species and terrestrial species, and all sea turtles species occurring in the Study Area are ESA-listed. Several marine mammal species and stocks are also classified as strategic stocks under MMPA.
- Several native forest-dwelling birds have been extirpated or suffered extinction in the Mariana Islands, primarily on Guam because of predation by introduced invasive species. These resources would be impacted by multiple ongoing and future actions.
- The use of sonar and other non-impulsive sound sources under the No Action Alternative, Alternative 1, and Alternative 2 has the potential to disturb or injure marine mammals and sea turtles.
- Explosive detonations under the No Action Alternative, Alternative 1, and Alternative 2 have the potential to disturb, injure, or kill marine mammal, terrestrial and sea turtle species.
- Explosive detonations and other military training activities on FDM under the No Action Alternative, Alternative 1, and Alternative 2 have the potential to disturb, injure, or kill the Mariana fruit bat, Micronesian megapode, and seabirds that nest or visit FDM.
- Under Alternative 1 and Alternative 2, proposed danger zones could potentially restrict access to fishing and recreational areas when ranges are in use.

The aggregate impacts of past, present, and other reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal, terrestrial, all sea turtle species resources in the Study Area. The No Action Alternative, Alternative 1, or Alternative 2 would contribute to cumulative impacts, but the relative contribution would be low compared to other actions. Marine mammal and sea turtle mortality and injury from bycatch, commercial vessel ship strikes, entanglement, ocean pollution, and other human causes are estimated to be orders of magnitude greater (hundreds of thousands of animals versus tens of animals) than potential mortality, strandings, or injury resulting from military training and testing activities. (Culik 2004; International Council for the Exploration of the Sea 2005; Read et al. 2006).

The analysis presented in this chapter and Chapter 3 (Affected Environment and Environmental Consequences) indicates that the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts on sediments and water quality, air quality, marine habitats, marine birds, marine vegetation, marine invertebrates, fish, cultural resources, socioeconomic resources, and public health and safety would be negligible. When considered with other actions, the No Action Alternative, Alternative 1, or Alternative 2 might contribute to cumulative impacts on submerged prehistoric and historic resources, if such resources are present in areas where bottom-disturbing training and testing activities take place. The No Action Alternative, Alternative 1, or Alternative 2 would also make an incremental contribution to greenhouse gas emissions, representing approximately 0.005 percent of U.S. 2009 greenhouse gas emissions.

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5 Standard Operating Procedures, Mitigation, and Monitoring

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5 STANDARD OPERATING PROCEDURES, MITIGATION, AND MONITORING

This chapter describes the United States (U.S.) Department of the Navy's (Navy) at-sea and terrestrial (land-based) standard operating procedures, mitigation measures, and species monitoring and reporting efforts. This chapter also discusses mitigation measures and procedures for cultural resources within the Mariana Islands Training and Testing (MITT) Study Area (Study Area). Standard operating procedures are essential to maintaining safety and mission success, and in many cases have the added benefit of reducing potential environmental impacts. Mitigation measures are designed to help reduce or avoid potential impacts on marine, terrestrial, and cultural resources. Species monitoring efforts are designed to track compliance with take authorizations, evaluate the effectiveness of mitigation measures, and improve understanding of the effects training and testing activities have on biological resources within the MITT Study Area.

5.1 STANDARD OPERATING PROCEDURES – AT SEA

Effective training, maintenance, research, development, testing, and evaluation (hereafter referred to collectively as the Proposed Action) require that participants utilize their sensors and weapon systems to their optimum capabilities as required by the activity objectives. The Navy currently employs standard practices to provide for the safety of personnel and equipment, including vessels and aircraft, as well as the success of the training and testing activities. For the purpose of this document, the Navy will refer to standard practices as standard operating procedures. Because of their importance for maintaining safety and mission success, standard operating procedures have been considered as part of the Proposed Action under each alternative, and therefore are included in the Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses for each resource.

Navy standard operating procedures have been developed and refined over years of experience, and are broadcast via numerous naval instructions and manuals, including the following sources:

- Ship, submarine, and aircraft safety manuals
- Ship, submarine, and aircraft standard operating manuals
- Fleet area Control and Surveillance Facility range operating instructions
- Fleet exercise publications and instructions
- Naval Sea Systems Command test range safety and standard operating instructions
- Navy instrumented range operating procedures
- Naval shipyard sea trial agendas
- Research, development, test and evaluation plans
- Naval gunfire safety instructions
- Navy planned maintenance system instructions and requirements
- Federal Aviation Administration regulations

In many cases there are incidental environmental, socioeconomic, and cultural benefits resulting from standard operating procedures. Standard operating procedures serve the primary purpose of providing for safety and mission success, and are implemented regardless of their secondary benefits. This is what distinguishes standard operating procedures, which are a component of the Proposed Action, from mitigation measures, which are designed entirely for the purpose of reducing environmental impacts resulting from the Proposed Action. Because standard operating procedures are crucial to safety and mission success, the Navy will not modify them as a way to further reduce impacts on environmental resources. Rather, mitigation measures will be used as the tool for avoiding and reducing potential environmental impacts. Standard operating procedures that are recognized as providing a potential secondary benefit are provided below.

5.1.1 VESSEL SAFETY

For the purposes of this chapter, the term "ship" is inclusive of surface ships and surfaced submarines. The term "vessel" is inclusive of ships and small boats (e.g., rigid hull inflatable boats [RHIBs]).

Ships operated by or for the Navy, have personnel assigned to stand watch at all times, day and night, when moving through the water (underway). Watch personnel undertake extensive training in accordance with the U.S. Navy Lookout Training Handbook or civilian equivalent, including on-the-job instruction and a formal Personal Qualification Standard Program (or equivalent program for supporting contractors or civilians), to certify that they have demonstrated all necessary skills (such as detection and reporting of floating or partially submerged objects). Watch personnel are composed of officers and enlisted men and women, and civilian equivalents. Their duties may be performed in conjunction with other job responsibilities, such as navigating the ship or supervising other personnel. While on watch, personnel employ visual search techniques, including the use of binoculars, using a scanning method in accordance with the U.S. Navy Lookout Training Handbook, or civilian equivalent. After sunset and prior to sunrise, watch personnel employ night visual search techniques, which could include the use of night vision devices.

A primary duty of watch personnel is to detect and report all objects and disturbances sighted in the water that may be indicative of a threat to the ship and its crew, such as debris, a periscope, surfaced submarine, or surface disturbance. Per safety requirements, watch personnel also report any marine mammals sighted that have the potential to be in the direct path of the ship, as a standard collision avoidance procedure. Because watch personnel are primarily posted for safety of navigation, range clearance, and man-overboard precautions, they are not normally posted while ships are moored to a pier. When anchored or moored to a buoy, a watch team is still maintained but with fewer personnel than when underway. When moored or at anchor, watch personnel may maintain security and safety of the ship by scanning the water for any indications of a threat (as described above).

While underway, Navy ships (with the exception of submarines) greater than 65 feet (ft.) (20 meters [m]) in length have at least two watch personnel; Navy ships less than 65 ft. (20 m) in length, surfaced submarines, and contractor ships, have at least one watch person. While underway, watch personnel are alert at all times and have access to binoculars. Due to limited manning and space limitations, small boats do not have dedicated watch personnel, and the boat crew is responsible for maintaining the safety of the boat and surrounding environment.

All vessels use extreme caution and proceed at a "safe speed" so they can take proper and effective action to avoid a collision with any sighted object or disturbance, and can be stopped within a distance appropriate to the prevailing circumstances and conditions.

5.1.2 AIRCRAFT SAFETY

Pilots of military aircraft make every attempt to avoid large flocks of birds in order to reduce the safety risk involved with a potential bird strike.

5.1.3 Laser Procedures

The following procedures are applicable to lasers of sufficient intensity to cause human eye damage.

5.1.3.1 Laser Operators

Only properly trained and authorized personnel operate lasers.

5.1.3.2 Laser Activity Clearance

Prior to commencing activities involving lasers, the operator ensures that the area is clear of unprotected or unauthorized personnel in the laser impact area by performing a personnel inspection or a flyover. The operator also ensures that any personnel within the area are aware of laser activities and are properly protected.

5.1.4 Weapons Firing Procedures

5.1.4.1 Notice to Mariners

A Notice to Mariners is routinely issued in advance of missile firing activities. A notice is also issued in advance of explosive bombing activities when they are conducted in an area that does not already have a standing Notice to Mariners. For activities involving large caliber gunnery, the Navy evaluates the need to publish a Notice to Mariners based on the scale, location, and timing of the activity. More information on the Notices to Mariners is found in Section 3.13 (Public Health and Safety).

5.1.4.2 Weapons Firing Range Clearance

The weapons firing hazard range must be clear of non-participating vessels and aircraft before firing activities will commence. The size of the firing hazard range is based on the farthest firing range capability of the weapon being used. All missile and rocket firing activities are carefully planned in advance and conducted under strict procedures that place the ultimate responsibility for range safety on the Officer Conducting the Exercise or civilian equivalent. All weapons firing is secured when cease fire orders are received from the Range Safety Officer or when the line of fire is endangering any object other than the designated target.

Pilots of military aircraft are not authorized to expend ordnance, fire missiles, or drop other airborne devices through extensive cloud cover where visual clearance of the air and surface area is not possible. The two exceptions to this requirement are: (1) when operating in the open ocean, air, and surface clearance through visual means or radar surveillance is acceptable; and (2) when the operational commander conducting the exercise accepts responsibility for the safeguarding of airborne and surface traffic.

During activities that involve recoverable targets (e.g., aerial drones) the military recovers the target and any associated decelerator/parachutes to the maximum extent practicable consistent with operational requirements and personnel safety.

5.1.4.3 Target Deployment Safety

Firing exercises involving the integrated maritime portable acoustic scoring system are typically conducted in daylight hours in Beaufort number 4 conditions or better to ensure safe operating conditions during buoy deployment and recovery. The Beaufort sea state scale is a standardized measurement of the weather conditions, based primarily on wind speed. The scale is divided into levels from 0 to 12, with 12 indicating the most severe weather conditions (e.g., hurricane force winds). At Beaufort number 4, wave heights typically range from 3.5 to 5 ft. (1.1 to 1.5 m).

5.1.5 Swimmer Defense Testing Procedures

5.1.5.1 Notice to Mariners

A Notice to Mariners is issued in advance of all swimmer defense testing.

5.1.5.2 Swimmer Defense Testing Clearance

A daily in situ calibration of the source levels is used to establish a clearance area to the 145 decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa) sound pressure level threshold for non-participant personnel safety. A hydrophone is stationed during the calibration sequences in order to confirm the clearance area. Small boats patrol the 145 dB re 1 µPa sound pressure level area during all test activities. Boat crews are equipped with binoculars and remain vigilant for non-participant divers and boats, swimmers, snorkelers, and dive flags. If a non-participating swimmer, snorkeler, or diver is observed entering into the area of the swimmer defense system, the power levels of the defense system are reduced. An additional 100-yard (yd.) (91) buffer is applied to the initial sighting location of the non-participant as an additional precaution. If the area cannot be maintained free of non-participating swimmers, snorkelers, and divers, testing will cease until the non-participant has moved outside the area.

5.1.6 Unmanned Aerial and Underwater Vehicle Procedures

For activities involving unmanned aerial and underwater vehicles, the military evaluates the need to publish a Notice to Airmen or Mariners based on the scale, location, and timing of the activity. Unmanned aerial vehicles and unmanned aerial systems are operated in accordance with Federal Aviation Administration air traffic organization policy as issued in Office of the Chief of Naval Operations Instructions 3710, 3750, and 4790.

5.1.7 Towed In-Water Device Procedures

Prior to deploying a towed device from a manned platform, there is a standard operating procedure to search the intended path of the device for any floating debris (e.g., driftwood) or other potential obstructions (e.g., concentrations of animals), which have the potential to cause damage to the device.

5.1.8 Amphibious Assault and Amphibious Raid Procedures

All established harbor navigation rules are observed during amphibious assault and amphibious raid training activities, when applicable. The Navy conducts a hydrographic survey prior to amphibious assault and amphibious raid training activities involving beach landings by large amphibious vehicles (e.g., Air Cushioned Landing Craft [LCACs]). During the surveys, personnel identify and designate vessel traffic lanes that are free of coral, hard bottom substrate, and obstructions that could present personnel and equipment safety concerns. The Navy does not conduct hydrographic surveys for beach landings with small boats, such as RHIBs, which have a much smaller draft than large amphibious vehicles. Large amphibious vehicle beach landings and departures are scheduled at high tide, and vehicles stay fully on cushion or hover when over shallow reefs to avoid corals, hard bottom, and other substrate that could potentially damage equipment.

5.2 INTRODUCTION TO MITIGATION

The Navy recognizes that the Proposed Action has the potential to impact the environment. Unlike standard operating procedures, which are established for reasons other than environmental benefit, mitigation measures are modifications to the Proposed Action that are implemented for the sole purpose of reducing a specific potential environmental impact on a particular resource. The procedures discussed in this chapter, most of which are currently or were previously implemented as a result of past environmental compliance documents, Endangered Species Act (ESA) Biological Opinions, Marine Mammal Protection Act (MMPA) Letters of Authorization, or other formal or informal consultations with regulatory agencies, are being coordinated with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) through the consultation and permitting processes.

5.2.1 REGULATORY REQUIREMENTS FOR MITIGATION

An Environmental Impact Statement (EIS) must analyze the affected environment, discuss the environmental impacts of the Proposed Action and each alternative, and assess the significance of the impacts on the environment. Mitigation measures are designed to help reduce the severity or intensity of impacts of the Proposed Action. Assessment of mitigation measures can occur early in the planning process. An agency may choose not to take the action or to move the location of the action. Mitigation measure development also occurs throughout the analysis process whenever an impact is minimized by limiting the degree or magnitude of the action or its implementation. Mitigation measures can also include actions that repair, rehabilitate, or restore the affected environment or reduce impacts over time through constant monitoring and corrective adjustments.

In accordance with the National Environmental Policy Act (NEPA) requirement, the environmental benefit of all Navy-recommended mitigation measures will apply to all alternatives analyzed in this Final EIS, and, according to Navy policy, will also apply to the Final Overseas Environmental Impact Statement (OEIS) where applicable and appropriate. Additionally, the White House Council on Environmental Quality issued guidance for mitigation and monitoring on 14 January 2011. This guidance affirms that federal agencies, including the Navy, should:

- commit to mitigation in decision documents when they have based environmental analysis upon such mitigation (by including appropriate conditions on grants, permits, or other agency approvals, and making funding or approvals for implementing the Proposed Action contingent on implementation of the mitigation commitments);
- monitor the implementation and effectiveness of mitigation commitments;
- make information on mitigation and monitoring available to the public, preferably through agency web sites; and
- remedy ineffective mitigation when the federal action is not yet complete.

The Council on Environmental Quality guidance encourages federal agencies to develop internal processes for post-decision monitoring to ensure the implementation and effectiveness of the mitigation. It also states that federal agencies may use adaptive management as part of an agency’s action. Adaptive management, when included in the NEPA analysis, allows for the agency to take alternate mitigation actions if mitigation commitments originally made in the planning and decision documents fail to achieve projected environmental outcomes. Adaptive management generally involves four phases: plan, act, monitor, and evaluate. This process allows the use of the results to update knowledge and adjust future management actions accordingly. Through implementing mitigation measures from the Navy's previous planning, consultations, permits, and monitoring of those efforts, the Navy has collected data to further refine its recommended mitigation measures.

Through the planning, consultation, and permitting processes, federal regulatory agencies suggested that the Navy analyze additional mitigation measures for inclusion in this Final EIS/OEIS and associated consultation and permitting documents. Proposals for additional mitigation measures were based on the federal agency's assessment of the likelihood that such measures will contribute to a notable reduction of the environmental impact. As additional measures were identified, the effectiveness and operational assessment protocols discussed in Section 5.3 (Mitigation Assessment) were applied to determine whether the Navy would recommend the additional measures for implementation. The final suite of mitigations resulting from the ongoing planning, consultation, and permitting processes will be documented in the Navy and NMFS Records of Decision, the MMPA Letters of Authorization, and the ESA Biological Opinions.

5.2.2 Overview of Mitigation Approach

This section describes the approach that the Navy took to develop its recommended mitigation measures. The Navy's overall approach to assessing potential mitigation measures was based on two principles: (1) mitigations will be effective at reducing potential impacts on the resource; and (2) from a military perspective, the mitigations are practical to implement, executable, and personnel safety and readiness will not be impacted. The assessment process involved using information directly from Chapter 3 (Affected Environment and Environmental Consequences) and assessing all existing mitigation and proposals for new or modified mitigation in order to determine if recommending a mitigation measure for implementation would be appropriate.

This document organized, and where appropriate, analyzed training and testing activities separately. This separation was needed because the training and testing communities perform activities for differing purposes, and in some cases, with different personnel and in different locations. For example, there is a fundamental difference between the testing of a new mine warfare system with civilian scientists and engineers, and the eventual training of sailors and aviators with that same system. As such, mitigations that the Navy recommends for both training and testing activities are presented together, while mitigations that are designed for and executable only by the training or testing community will be presented separately.

5.2.2.1 Lessons Learned from Previous Environmental Impact Statements/Overseas Environmental Impact Statements

In an effort to improve upon past processes, the Navy considered all mitigations previously implemented and adapted its mitigation assessment approach based on lessons learned from previous EISs, ESA Biological Opinions, MMPA Letters of Authorizations, and other formal or informal consultations with regulatory agencies. For example, one lesson learned during the development of the MITT EIS/OEIS was that visual surveys conducted for all testing activities using laser line scan, light imaging detection, and ranging lasers was not necessary. Per Navy standard operating procedures, only trained personnel operate lasers, and visual observation of the area is conducted to ensure human safety. The Navy determined that this procedure as a mitigation measure was not necessary because: (1) it is currently a standard operating procedure conducted for human safety, and (2) the environmental consequences analysis suggests that impacts on resources from laser activities are not expected.

Navy planners, scientists, and the operational community assessed the effectiveness of a full suite of potential mitigation measures (a portion of which were specific mitigation areas) on a case-by-case basis, using information and lessons learned from the Navy's internal adaptive management process. The resulting assemblage of recommended measures is comprised of currently implemented measures, modifications of currently implemented measures, and newly proposed measures. Details on the assessment methods are provided in Section 5.2.3 (Assessment Method). The rationale for recommending, modifying, adding, or discontinuing each measure is provided in Section 5.3 (Mitigation Assessment).

5.2.2.2 Protective Measures Assessment Protocol

The Protective Measures Assessment Protocol is a decision support and situational awareness software tool that the Navy uses to facilitate compliance with mitigation measures when conducting certain training and testing activities at sea. The Navy runs the Protective Measures Assessment Protocol program during the event planning process to ensure that personnel involved in the activity are aware of the mitigation requirements and to help ensure that all mitigations are implemented appropriately. In addition to providing notification of the required mitigation, the tool also provides a visual display of the activity location, unit's position in relation to the target area, and any relevant environmental data. The final suite of mitigation measures contained in the Navy and NMFS Records of Decision, the MMPA Letters of Authorization, and the ESA Biological Opinions will be integrated into the Protective Measures Assessment Protocol.

Section 5.3.1.1.1.1 (United States Navy Afloat Environmental Compliance Training Series) contains information about the newly developed Protective Measures Assessment Protocol training module.

5.2.3 Assessment Method

As shown in Figure 5.2-1, the Navy undertook an effectiveness assessment and operational assessment for each potential mitigation measure to ensure its compatibility with Section 5.2.2 (Overview of Mitigation Approach). The Navy used information from published and readily available sources, as well as Navy after-action and monitoring reports. When available, these data were used when they represented the best available science and if they were generally accepted by the scientific community to ensure that they were applicable and contributed to the analysis.

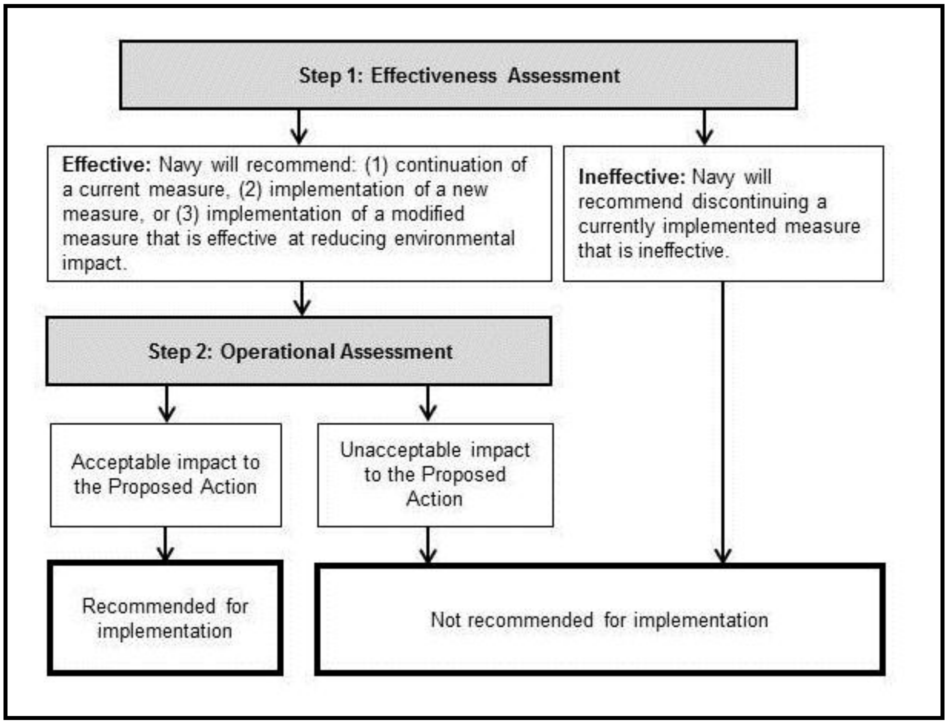

Figure 5.2-1: Flowchart of Process for Determining Recommended Mitigation Measures

5.2.3.1 Effectiveness Assessment

5.2.3.1.1 Procedural Measures

Procedural measures could involve employing techniques or technology during a training or testing activity in order to avoid or reduce a potential impact on a particular resource. For the purposes of organization, procedural measures are discussed within two subcategories: Lookouts and mitigation zones.

A proposed procedural measure was deemed effective if implementing the measure was likely to result in avoidance or reduction of an impact on a resource. The level of avoidance or reduction of the impact gained from implementing a procedural measure was weighed against the potential for a shift in impacts resulting from the activity modification. For example, if predictive modeling results indicate that the use of underwater explosives could cause unacceptable impacts on a particular resource; those impacts could possibly be reduced by substituting non-explosive activities for explosive activities. However, if the increased use of non-explosive activities would consequently produce an unacceptable impact on habitats due to an associated physical disturbance or strike risk from military expended materials, the measure would not necessarily be justifiable.

A proposed procedural measure was deemed ineffective if its implementation would not result in avoidance or reduction of an impact on a resource, or if an unacceptable impact will simply be shifted from one resource to another. For ineffective procedural measures that are currently being implemented, the rationale for terminating, modifying, or continuing to carry out the measure is included in the discussion.

5.2.3.1.2 Mitigation Areas

In order to avoid or reduce a potential impact on a particular resource the Navy would either limit the time of day or duration in which a particular activity could take place, or move or relocate a particular activity outside of a specific geographic area. Within mitigation areas, the measures would only apply to the specific activity that resulted in the requirement for mitigation, and would not prevent or restrict other activities from occurring during that time or in that area.

A proposed mitigation area was deemed effective if implementing the measure would likely result in avoidance or reduction of the impact on the resource. The specific season, time of day, or geographic area must be important to the resource. In determining importance, special consideration was given to time periods or geographic areas having characteristics such as especially high overall density or percent population use, seasonal bottlenecks for a migration corridor, and identifiable key foraging and reproduction areas.

Avoidance or reduction of the impact in the specific time period or geographic area was weighed against the potential for causing new impacts in alternative time periods or geographic areas. For example, if the use of underwater explosives was predicted to cause unacceptable impacts on a particular resource in a known foraging location, those impacts could possibly be reduced by relocating those activities to a new location. However, if the use of explosives at the new location would consequently produce an unacceptable impact on the same or a different resource at the new location, the measure would not necessarily be justifiable.

A proposed mitigation area was deemed ineffective if implementing the measure would not result in avoidance or reduction of an impact on a resource, or if an unacceptable impact would simply be shifted from one time period or location to another. For ineffective mitigation areas that are currently being implemented, the rationale for terminating, modifying, or continuing to carry out the measure is included in the discussion.

5.2.3.2 Operational Assessment

The Navy conducted the operational assessment for procedural measures and mitigation areas using the criteria described below. The Navy deemed procedural and mitigation area measures to have acceptable operational impacts on a particular proposed activity if the following four conclusions were reached:

1. Implementation of the measure will not increase safety risks to Navy personnel and equipment.

2. Implementation of the measure is practical. Practicality was defined by the following factors:

    - The measure does not result in an unacceptable increase in resource requirements (e.g., wear and tear on equipment, additional fuel, additional personnel, increased training or testing requirements, or additional reporting requirements).
    - The measure does not result in an unacceptable increase in time away from homeport for Navy personnel.
    - The measure does not result in national security concerns. Should national security require conducting more than the designated number of activities, or a change in how the Navy conducts those activities, the Navy reserves the right to provide the regulatory federal agency with prior notification and include the information in any associated exercise or monitoring reports.

- The measure is consistent with Navy policy. Navy policy requires that mitigation measures are developed through consultation with regulatory agencies (e.g., the MMPA and ESA processes), would likely result in avoidance or reduction of an impact on a resource as determined by the effectiveness assessment, and would not negatively impact training and testing fidelity. This policy applies to the full suite of potential mitigation measures that the Navy assessed, including measures that were considered but eliminated, and, as appropriate, to currently implemented measures that the Navy is no longer recommending to implement.

3. Implementation of the measure will not result in an unacceptable impact on the effectiveness of the military readiness activity. A primary factor that was considered for all mitigation measures is that the measure must not modify the activity in a way that no longer allows the activity to meet the intended objectives, and ultimately must not interfere with the Navy meeting all of its military readiness requirements. Specifically, for mitigation area measures, the following additional factors were considered:

    - The activity is not dependent on a specific range or range support structure within the mitigation area and there are alternate areas with the necessary environmental conditions (e.g., oceanographic conditions).
    - The mitigation area does not hold any current or foreseeable future readiness value. This assessment will be revisited if Navy operations or national security interests conclude that training or testing needs to occur within the proposed mitigation area.
    - Implementation of the measure will not prohibit conducting shipboard maintenance, repair, and testing pierside prior to at-sea operations.

4. The Navy has legal authority to implement the measure.

If all four of the conditions above can be achieved, then the Navy will recommend the mitigation measure for implementation.

5.3 Mitigation Assessment – At Sea

The effectiveness and operational assessments resulted in potential mitigation measures for at-sea activities being organized into the following four sections:

- Section 5.3.1 (Lookout Procedural Measures) includes recommended measures specific to the use of Lookouts or trained marine species observers.
- Section 5.3.2 (Mitigation Zone Procedural Measures) includes recommended measures specific to visual observations with a mitigation zone.
- Section 5.3.3 (Mitigation Areas) includes recommended measures specific to particular locations.
- Section 5.3.4 (Mitigation Measures Considered but Eliminated) includes measures that the Navy does not recommend for implementation due to the measure being ineffective at reducing environmental impacts, having an unacceptable operational impact, or being incompatible with Section 5.2.2 (Overview of Mitigation Approach).

A summary of the Navy recommended measures for at-sea activities is provided in Table 5.4-1.

5.3.1 Lookout Procedural Measures

As described in Section 5.1 (Standard Operating Procedures), ships have personnel assigned to stand watch at all times while underway. Watch personnel may perform watch duties in conjunction with job responsibilities that extend beyond looking at the water or air (such as supervision of other personnel). This section will introduce Lookouts who perform similar duties to watch personnel and whose duties satisfy safety of navigation and mitigation requirements.

The Navy will have two types of Lookouts for the purposes of conducting visual observations: (1) those positioned on ships, and (2) those positioned in aircraft or on small boats. Lookouts positioned on ships will be dedicated solely to diligent observation of the air and surface of the water. They will have multiple observation objectives, which include but are not limited to detecting the presence of biological resources and recreational or fishing boats, observing the mitigation zones described in Section 5.3.2 (Mitigation Zone Procedural Measures), and monitoring for vessel and personnel safety concerns.

Due to aircraft and small boat manning and space restrictions, Lookouts positioned in aircraft or on small boats may include the aircraft crew, pilot, or boat crew. Lookouts positioned in aircraft and small boats may be responsible for tasks in addition to observing the air or surface of the water (e.g., navigation of a helicopter or small boat). However, aircraft and small boat Lookouts will, considering personnel safety, practicality of implementation, and impact on the effectiveness of the activity, comply with the observation objectives described above for Lookouts positioned on ships.

The procedural measures described below primarily consist of having Lookouts during specific training and testing activities.

5.3.1.1 Specialized Training

5.3.1.1.1 Training for Navy Personnel and Civilian Equivalents

5.3.1.1.1.1 United States Navy Afloat Environmental Compliance Training Series

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue implementing the Marine Species Awareness Training for watch personnel and Lookouts, and to add the requirement for additional Navy personnel and civilian equivalents to complete one or more environmental training modules.

The Navy has developed the U.S. Navy Afloat Environmental Compliance Training Series to help ensure Navy-wide compliance with environmental requirements, and to help Navy personnel gain a better understanding of their personal roles and responsibilities. The training series contains four interactive multimedia training modules. Personnel will be required to complete all modules identified in their career path training plan.

The first module is the Introduction to the U.S. Navy Afloat Environmental Compliance Training Series. The introduction module provides information on environmental laws (e.g., ESA and MMPA) and responsibilities relevant to Navy training and testing activities. The material is put into context of why environmental compliance is important to the Navy, from the most junior sailor to Commanding Officers. All personnel completing the U.S. Navy Marine Species Awareness Training will also be required to take this module.

The second module is the U.S. Navy Marine Species Awareness Training. Consistent with current requirements, all bridge watch personnel, Commanding Officers, Executive Officers, maritime patrol aircraft aircrews, anti-submarine warfare helicopter crews, civilian equivalents, and Lookouts will successfully complete the Marine Species Awareness Training prior to standing watch or serving as a Lookout. The module contained within the U.S. Navy Environmental Compliance Training Series is an update to Marine Species Awareness Training version 3.1. The updated training is designed to improve the effectiveness of visual observations for marine resources, including marine mammals and sea turtles. The Marine Species Awareness Training provides information on sighting cues, visual observation tools and techniques, and sighting notification procedures.

The third module is the U.S. Navy Protective Measures Assessment Protocol. The Protective Measures Assessment Protocol is a decision support and situational awareness software tool that the Navy uses to facilitate compliance with worldwide mitigation measures during the conduct of training and testing activities at sea. The module provides instruction for generating and reviewing Protective Measures Assessment Protocol reports. Section 5.2.2.2 (Protective Measures Assessment Protocol) contains additional information on the benefits of the software tool.

The fourth module is the U.S. Navy Sonar Positional Reporting System and marine mammal incident reporting. The Navy developed the Sonar Positional Reporting System as its official record of underwater sound sources (e.g., active sonar) used under its MMPA permits. Marine mammal incidents include vessel strikes and animal strandings. The module provides instruction on the reporting requirements and procedures for both the Sonar Positional Reporting System and marine mammal incident reporting.

Effectiveness and Operational Assessment

Navy personnel undergo extensive training in order to stand watch. Standard training includes on-the-job instruction under the supervision of experienced personnel, followed by completion of the Personal Qualification Standard program. The Personal Qualification Standard program certifies that personnel have demonstrated the skills needed to stand watch, such as detecting and reporting floating or partially submerged objects.

The U.S. Navy Afloat Environmental Compliance Training Series, including the updated Marine Species Awareness Training, is a specialized multimedia training program designed to help Navy operational and test communities best avoid potentially harmful interactions with marine species. The program provides training on how to sight marine species, focusing on marine mammals. The training also includes instruction for visually identifying sea turtles, jellyfish aggregations, and flocks of seabirds, which are often indicators of marine mammal or sea turtle presence (aggregation of sargassum or floating vegetation are also indicators; however, they are not present in the MITT Study Area). The Marine Species Awareness Training also addresses the role that watch personnel and Lookouts play in helping the Navy maintain compliance with environmental protection requirements, as well as supporting Navy environmental stewardship commitments.

In summary, the Navy believes that the U.S. Navy Afloat Environmental Compliance Training Series, including the updated Marine Species Awareness Training, is the best and most appropriate forum for teaching watch personnel and Lookouts about their responsibilities for helping reduce impacts on the marine environment. The Marine Species Awareness Training provides the Navy with invaluable training for a relatively large number of personnel. Constantly shifting personnel assignments presents a real challenge; however, the format and structure of the U.S. Navy Afloat Environmental Compliance Training Series will help the Navy reduce costs during fiscally constrained periods and provide constant access to training. Overall, the Marine Species Awareness Training is an effective tool for improving the potential for Lookouts to detect marine species while on duty.

Implementation of the Marine Species Awareness Training has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.1.2 Lookouts

The Navy proposes to use one or more Lookouts during the training and testing activities described below, which are organized by stressor category. A comparison of the currently implemented mitigation measures and recommended mitigation measures are provided where applicable. The effectiveness and operational assessments are discussed for all Lookout measures collectively in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts) and Section 5.3.1.2.5 (Operational Assessment for Lookouts). A number of training and testing activities involve the participation of multiple vessels and aircraft, which could ultimately increase the cumulative number of personnel standing watch per standard operating procedures or Lookouts posted in the vicinity of the activity (e.g., sinking exercises). The following sections discuss the minimum number of Lookouts that the Navy will use during each activity.

5.3.1.2.1 Acoustic Stressors – Non-Impulse Sound

5.3.1.2.1.1 Low-Frequency and Hull Mounted Mid-Frequency Active Sonar

Mitigation measures do not currently exist for low-frequency active sonar sources analyzed in this Final EIS/OEIS or new platforms or systems, such as the Littoral Combat Ship. The Navy is proposing to (1) add mitigation measures for low-frequency active sonar and new platforms and systems, and (2) maintain the number of Lookouts currently implemented for ships using hull-mounted mid-frequency active sonar. The recommended measures are provided below.

Ships using low-frequency or hull-mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea (with the exception of ships less than 65 ft. [20 m] in length, and ships that are minimally manned) will have two Lookouts at the forward position. For the purposes of this document, low-frequency active sonar does not include Surveillance Towed Array Sensor System Low-Frequency Active Sonar.

While using low-frequency or hull-mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea, ships less than 65 ft. (20 m) in length, and ships that are minimally manned will have one Lookout at the forward position due to space and manning restrictions.

Ships conducting active sonar activities while moored or at anchor (including pierside) will maintain one Lookout.

5.3.1.2.1.2 High-Frequency and Non-Hull Mounted Mid-frequency Active Sonar

Mitigation measures do not currently exist for high-frequency active sonar activities associated with anti-submarine warfare and mine warfare, or for new platforms, such as the Littoral Combat Ship; therefore, the Navy is proposing to add a new measure for these activities or platforms. The Navy is proposing to continue using the number of Lookouts currently implemented for ships or aircraft conducting non-hull mounted mid-frequency active sonar, such as helicopter dipping sonar systems. The recommended measure is provided below.

The Navy will have one Lookout on ships or aircraft conducting high-frequency or non-hull mounted mid-frequency active sonar activities associated with anti-submarine warfare and mine warfare activities at sea.

5.3.1.2.2 Acoustic Stressors – Explosives and Impulse Sound

5.3.1.2.2.1 Improved Extended Echo Ranging Sonobuoys

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have one Lookout in aircraft conducting improved extended echo ranging sonobuoy activities.

5.3.1.2.2.2 Explosive Sonobuoys Using >0.5–2.5 Pound Net Explosive Weight

Lookout measures do not currently exist for explosive sonobuoy activities using >0.5–2.5 pound (lb.) net explosive weight. The Navy is proposing to add this measure. Aircraft conducting explosive sonobuoy activities using >0.5–2.5 lb. net explosive weight will have one Lookout.

5.3.1.2.2.3 Anti-Swimmer Grenades

Lookout measures do not currently exist for activities using anti-swimmer grenades. The Navy is proposing to add this measure. The Navy will have one Lookout on the vessel conducting anti-swimmer grenade activities.

5.3.1.2.2.4 Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

As background mine countermeasure and neutralization activities can be divided into two main categories: (1) general activities that can be conducted from a variety of platforms and locations, and (2) activities involving the use of diver-placed charges that typically occur close to shore. When either of these activities are conducted using a positive control firing device, the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation.

Lookout measures do not currently exist for general mine countermeasure and neutralization activities (those not involving diver-placed charges) using positive control firing devices. The Navy is proposing to add this measure. During general mine countermeasure and neutralization activities using up to a 20 lb. net explosive weight detonation (bin E6 and below), vessels greater than 200 ft. (61 m) will have two Lookouts, while vessels less than 200 ft. (61 m) or aircraft will have one Lookout.

The Navy is proposing to clarify the number of Lookouts implemented for mine neutralization activities involving positive control diver-placed charges using up to a 20 lb. net explosive weight detonation. A charge with a 20 lb. net explosive weight is the maximum net explosive weight proposed for activities involving diver-placed charges in the Study Area. The recommended measures are below.

- During activities involving diver-placed charges under positive control, activities using up to a 20 lb. net explosive weight (bin E6) detonation will have a total of two Lookouts (one Lookout positioned on two small boats, or one small boat in combination with a helicopter).
- All divers placing the charges on mines will support the Lookouts while performing their regular duties. The Lookouts, divers, and any other personnel who may spot marine mammals and sea turtles will report all marine mammal and sea turtle sightings to their dive support vessel or Range Safety Officer.

5.3.1.2.2.5 Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices

As background, when mine neutralization activities using diver placed charges (up to a 20 lb. net explosive weight) are conducted with a time-delay firing device, the detonation is fused with a specified time-delay by the personnel conducting the activity and is not authorized until the area is clear at the time the fuse is initiated. During these activities, the detonation cannot be terminated once the fuse is initiated due to human safety concerns.

Current mitigation involves the use of six Lookouts and three small boats (two Lookouts positioned in each of the three boats) for mitigation zones equal to or larger than 1,400 yd. (1,280 m), or four Lookouts and two small boats for mitigation zones smaller than 1,400 yd. (1,280 m). The Navy is proposing to modify the number of Lookouts currently used for mine neutralization activities using diver-placed time-delay firing devices because the measure is impractical to implement and is currently resulting in an unacceptable impact on military readiness. The Navy does not have the resources to maintain six Lookouts and three small boats during mine neutralization activities using diver-placed time-delay firing devices. Due to a lack of personnel and small boats available for this activity, the requirement for six Lookouts and three small boats would require reassigning personnel from other assigned duties or training activities, thus impacting the ability of the reassigned personnel to complete his or her assigned duties or other training requirements. Therefore, the Navy is currently unable to conduct the activities that require six Lookouts and three small boats, which is reducing the Navy's ability to maintain military readiness for these activities. Four Lookouts and two small boats represent the maximum level of effort that the Navy can commit to observing mitigation zones for this activity given the number of personnel and assets available. To prevent these unacceptable impacts, the Navy recommends the following measures:

During activities using up to a 20 lb. net explosive weight (bin E6) detonation, the Navy will have four Lookouts and two small boats (two Lookouts positioned in each of the two boats). In addition, when aircraft are used, the pilot or member of the aircrew will serve as an additional Lookout. All divers placing the charges on mines will support the Lookouts while performing their regular duties. The divers will report all marine mammal and sea turtle sightings to their supporting small boat or Range Safety Officer.

5.3.1.2.2.6 Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target

Lookout measures do not currently exist for small-and medium-caliber gunnery exercises using a surface target. The Navy is proposing to add this measure. The Navy will have one Lookout on the vessel or aircraft conducting small- and medium-caliber gunnery exercises against a surface target.

5.3.1.2.2.7 Gunnery Exercises – Large-Caliber Using a Surface Target

The Navy is proposing to clarify the number of Lookouts currently implemented for this activity. The Navy will have one Lookout on the ship conducting large-caliber gunnery exercises against a surface target.

5.3.1.2.2.8 Missile Exercises (Including Rockets) Up to 250 Pound Net Explosive Weight Using a Surface Target

The Navy is proposing to clarify the number of Lookouts currently implemented for this activity. When aircraft are conducting missile exercises up to 250 lb. net explosive weight against a surface target, the Navy will have one Lookout positioned in an aircraft.

5.3.1.2.2.9 Missile Exercises Using >250–500 Pound Net Explosive Weight Using a Surface Target

Lookout measures do not currently exist for missile exercises using >250–500 lb. net explosive weight. The Navy is proposing to add this measure. When aircraft are conducting missile exercises using

>250–500 lb. net explosive weight against a surface target, the Navy will have one Lookout positioned in an aircraft.

5.3.1.2.2.10 Bombing Exercises

The Navy is proposing to clarify the number of Lookouts currently implemented for this activity. The Navy will have one Lookout positioned in an aircraft conducting bombing exercises.

5.3.1.2.2.11 Torpedo (Explosive) Testing

Lookout measures do not currently exist for torpedo (explosive) testing. The Navy is proposing to add this measure. The Navy will have one Lookout positioned in an aircraft during torpedo (explosive) testing.

5.3.1.2.2.12 Sinking Exercises

The Navy is proposing to continue using the number of Lookouts currently implemented for this activity. The Navy will have two Lookouts (one positioned in an aircraft and one on a surface vessel) during sinking exercises.

5.3.1.2.2.13 Weapons Firing Noise During Gunnery Exercises – Large-Caliber

The Navy is proposing to clarify the number of Lookouts currently implemented for this activity. The Navy will have one Lookout on the ship conducting explosive and non-explosive large-caliber gunnery exercises. This may be the same Lookout described in Section 5.3.1.2.2.7 (Gunnery Exercises – Large-Caliber Using a Surface Target) or Section 5.3.1.2.3.3 (Non-Explosive Practice Munitions – Small-, Medium-, and Large-Caliber Gunnery Exercises Using a Surface Target) when the large-caliber gunnery exercise is conducted from a ship against a surface target.

5.3.1.2.3 Physical Disturbance and Strike

5.3.1.2.3.1 Vessels

The Navy is proposing to clarify the mitigation measures currently implemented for this activity (including full power propulsion testing). While underway, surface vessels (including full power propulsion testing) and surfaced submarines shall have at least one Lookout.

5.3.1.2.3.2 Towed In-Water Devices

The Navy is proposing to clarify the number of Lookouts currently implemented for activities using towed in-water devices (e.g., towed mine neutralization). The Navy will have one Lookout during activities using towed in-water devices when towed from a manned platform.

5.3.1.2.3.3 Non-Explosive Practice Munitions – Small-, Medium-, and Large-Caliber Gunnery Exercises Using a Surface Target

The Navy is proposing to continue the number of Lookouts currently implemented for these activities. The Navy will have one Lookout during activities involving non-explosive practice munitions (e.g., small-, medium-, and large-caliber gunnery exercises) against a surface target.

5.3.1.2.3.4 Non-Explosive Practice Munitions – Bombing Exercises

The Navy is proposing to continue the number of Lookouts currently implemented for these activities. The Navy will have one Lookout positioned in an aircraft during non-explosive bombing exercises.

5.3.1.2.3.5 Non-Explosive Practice Munitions – Missile Exercises (Including Rockets) Using a Surface Target

The Navy is proposing to continue using the number of Lookouts currently implemented for these activities. When aircraft are conducting non-explosive missile exercises (including exercises using rockets) against a surface target, the Navy will have one Lookout positioned in an aircraft.

5.3.1.2.4 Effectiveness Assessment for Lookouts

Personnel standing watch in accordance with Navy standard operating procedures have multiple job responsibilities. While on duty, these standard watch personnel often conduct marine species observation in addition to their primary job duties (e.g., aiding in the navigation of a vessel). By having one or more Lookouts dedicated solely to observing the air and surface of the water during certain training and testing activities, the Navy increases the likelihood that marine species will be detected. It is also important to note that a number of training and testing activities involve multiple vessels and aircraft, thereby increasing the cumulative number of Lookouts or watch personnel that could potentially be present during a given activity.

Although using Lookouts is expected to increase the likelihood that marine species will be detected at the surface of the water, it is unlikely that using Lookouts will be able to help avoid impacts on all species entirely due to the inherent limitations of sighting marine mammals and sea turtles, as discussed in the sections below. The probability of visually detecting a marine animal is dependent upon two things. An animal must be present in an area to be seen (known as the availability bias), and an animal that is present in the area of observation must be positioned or behaving in a way that will allow for a visual detection. For example, an animal may not be visually detectable if it is swimming entirely under the water at a relatively far distance from a boat. Second, the observer must perceive the animal when the animal is in a position to be detected. Refer to Section 3.4.3.3 (Implementing Mitigation to Reduce Sound Exposures) for a quantitative discussion on the Navy's effectiveness assessment for Lookouts during sound-producing activities.

Pursuant to Phase I (e.g., Hawaii Range Complex EIS/OEIS) and in cooperation with NMFS, the Navy has undertaken monitoring efforts to track compliance with take authorizations, help evaluate the effectiveness of implemented mitigation measures, and gain a better understanding of the impacts of the Navy activities on marine resources. In 2010, the Navy initiated a study designed to evaluate the effectiveness of the Navy Lookout team. The University of St. Andrews, Scotland, under contract to the U.S. Navy, developed an initial data collection protocol for use during the study. Beginning in 2010, trained Navy marine mammal observers collected data during field trials. The initial embarks were considered a "proof of concept" phase where the methods were refined into a statistically valid protocol for quantitatively analyzing the effectiveness of Lookouts during Navy training exercises. Field trials have been conducted in the Hawaii Range Complex, Southern California Range Complex, and Jacksonville Range Complex with a total of sixteen embarks through March 2015. Data collection is ongoing, and analysis will be conducted when the data set is large enough to produce statistically significant results. The Navy plans to conduct four embarks per year until the data set is sufficient, which at current estimates may require 4-8 more years of effort[1].

[1] Collection of a large enough data set to be statistical significant will partially be a function of the number of marine mammals in a given area available for sighting at the time of any embark. Therefore, the length of time needed to complete this study cannot be more precisely determined.

5.3.1.2.4.1 Detection Probabilities of Marine Mammals in the Study Area

Until the results of the Navy's Lookout effectiveness study are available, the Navy must rely on the best available science to determine detection probabilities of marine mammals by Navy Lookouts. To do so, the Navy has compiled the results of available literature on line-transect analyses, which are typically used to estimate cetacean abundance. In line-transect analyses, the factors affecting the detection of an animal or group of animals directly on the transect line may be probabilistically quantified as g(0). As a reference, a g(0) value of 1 indicates that animals on the transect line are always detected. Table 5.3-1 provides detection probabilities for cetacean species based largely on g(0) values derived from shipboard and aerial surveys in the Study Area, which vary widely based on g(0) derivation factors (e.g., species, sighting platforms, group size, and sea state conditions). Refer to Section 3.4.3.3 (Implementing Mitigation to Reduce Sound Exposures) for additional background on g(0) and a discussion of how the Navy used g(0) to quantitatively assess the effectiveness of Lookouts during sound-producing activities.

Table 5.3-1: Detection Probability g(0) Values for Marine Mammal Species in the Mariana Islands Training and Testing Study Area

Species/Stocks	Family	Vessel Sightability	Aircraft Sightability
Baird's Beaked Whale	Ziphidae	0.96	0.18
Blainville's Beaked Whale	Ziphidae	0.40	0.074
Blue Whale, Fin Whale; Omura's Whale; Sei Whale	Balaenopteridae	0.921	0.407
Bottlenose Dolphin, Fraser's Dolphin	Delphinidae	0.808	0.96
Bryde's Whale	Balaenopteridae	0.91	0.407
Cuvier's Beaked Whale; Ginkgo-toothed Beaked Whale	Ziphidae	0.23	0.074
Dwarf Sperm Whale, Pygmy Sperm Whale, *Kogia* spp.	Kogiidae	0.35	0.074
False Killer Whale, Melon-headed Whale	Delphinidae	0.76	0.96
Humpback Whale	Balaenopteridae	0.921	0.495
Killer Whale	Delphinidae	0.91	0.96
Longman's Beaked Whale, Pygmy Killer Whale	Ziphidae, Delphinidae	0.76	0.074
Mesoplodon spp.	Ziphiidae	0.34	0.11
Minke Whale	Balaenopteridae	0.856	0.386
Northern Right Whale Dolphin	Delphinidae	0.856	0.96
Pantropical Spotted/Risso's/Rough Toothed/Spinner/Striped Dolphin	Delphinidae	0.76	0.96
Short-finned Pilot Whale	Delphinidae	0.76	0.96
Sperm Whale	Physeteridae	0.87	0.495

Note: For species having no data, the g(0) for Cuvier's aircraft value (where g(0)=0.074) was used; or in cases where there was no value for vessels, the g(0) for aircraft was used as a conservative underestimate of sightability following the assumption that the availability bias from a slower moving vessel should result in a higher g(0). Some g(0) values in the tables above are estimates of perception bias only, some are estimates of availability bias only, and some reflect both, depending on the species and data that are currently available.
Sources: Barlow and Forney 2007; Carretta et al. 2000

Several variables that play into how easily a marine mammal may be detected by a dedicated observer are directly related to the animal: including its external appearance and size; surface, diving and social behavior; and life history. The following is a generalized discussion of the behavior and external appearance of the marine mammals with the potential to occur in the Study Area as these characters relate to the detectability of each species. The species are grouped loosely based on either taxonomic relatedness or commonalities in size and behavior, and include large whales, cryptic species, and delphinids. Not all statements may hold true for all species in a grouping, and exceptions are mentioned where applicable. The information presented in this section may be found in Jefferson et al. (2008) and sources within unless otherwise noted (Jefferson et al. 2008).

Large Whales

Species of large whales found in the Study Area include all the baleen whales and the sperm whale. Baleen whales are generally large, with adults ranging in size from 30 to 89 ft. (9 to 27 m), often making them immediately detectable. Many species of baleen whales have a prominent blow ranging from 10 ft. (3 m) to as much as 39 ft. (12 m) above the surface. However, there are at least two species (Bryde's whale and common minke whale) that often have no visible blow. Baleen whales tend to travel singly or in small groups ranging from pairs to groups of five. The exception to this is the fin whale, which is known to travel in pods of seven or more individuals. All species of baleen whales are known to form larger-scale aggregations in areas of high localized productivity or on breeding grounds. Baleen whales may or may not fluke at the surface before they dive; some species fluke regularly (e.g., the humpback whale), some fluke variably (e.g., the blue whale and fin whale) and some rarely fluke (e.g., the sei whale, common minke whale, and Bryde's whale). Baleen whales may remain at the surface for extended periods of time as they forage or socialize. Humpback whales are known to corral prey at the surface. Dive behavior varies amongst species, as well. Many species will dive and remain at depth for as long as 30 minutes. Some will adjust their diving behavior according to the presence of vessels (e.g., the humpback whale and fin whale). Sei whales are known to sink just below the surface and remain there between breaths.

Sperm whales also belong to the large whales, with adult males reaching as much as 50 ft. (18 m) in total length. Sperm whales at the surface would likely be easy to detect. They have a prominent, 16 ft. (5 m) blow, and may remain at the surface for long periods of time. They are known to raft (i.e., loll at the surface) and to form surface-active groups when socializing. Sperm whales may travel or congregate in large groups of as many as 50 individuals. Although sperm whales engage in conspicuous surface behavior such as fluking, breaching, and tail-slapping, they are long, deep divers and may remain submerged for over 1 hour.

Cryptic Species

Cryptic and deep-diving species are those that do not surface for long periods of time and are often difficult to see when they surface, which ultimately limits the ability of observers to detect them even in good sighting conditions (Barlow et al. 2006). Cryptic species include beaked whales (family Ziphiidae), dwarf and pygmy sperm whales (*Kogia* species), and harbor porpoises. Beaked whales are notoriously difficult to detect at sea. In the Study Area, beaked whales may occur in a variety of group sizes, ranging from single individuals to groups of as many as 22 individuals (MacLeod and D'Amico 2006). Beaked whale diving behavior in general consists of long, deep dives that may last for nearly 90 minutes followed by a series of shallower dives and intermittent surfacings (Tyack et al. 2006, Baird et al. 2008). Some individuals remain at the surface for an extended period of time (perhaps 1 hour or more) or make shorter dives (MacLeod and D'Amico 2006). Detection of beaked whales is further complicated because beaked whales often dive and surface in a synchronous pattern and they travel below the surface of the water (MacLeod and D'Amico 2006).

Dwarf and pygmy sperm whales (referred to broadly as *Kogia* species) are small cetaceans (10–13 ft. [3–4 m] adult length) that are not commonly seen. *Kogia* species are some of the most commonly stranded species in some areas, which suggests that sightings are not indicative of their overall abundance. This supports the idea that they are cryptic, perhaps engaging in inconspicuous surface behavior or actively avoiding vessels. When *Kogia* species are sighted, they are typically seen in groups of no more than five to six individuals. They have no visible blow, do not fluke when they dive, and are known to log (i.e., lie motionless) at the surface. When they do dive, they often will sink out of sight with no prominent behavioral display.

Delphinids

Delphinids are some of the most likely species to be detected at sea by observers. Many species of delphinids engage in very conspicuous surface behavior, including leaping, spinning, bow riding, and traveling along the surface in large groups. Delphinid group sizes may range from 10 to 10,000 individuals, depending upon the species and the geographic region. Species such as pilot whales, rough-toothed dolphins, white-beaked dolphins, white-sided dolphins, bottlenose dolphins, stenellid dolphins, common dolphins, and Fraser's dolphins are known to either actively approach and investigate vessels, or bow ride along moving vessels. Fraser's dolphins and common dolphins form huge groups that travel quickly along the surface, churning up the water and making them visible from a great distance. Delphinids may dive for as little as 1 minute to more than 30 minutes depending upon the species.

5.3.1.2.4.2 Detection Probabilities of Sea Turtles in the Study Area

Sea turtles spend a majority of their time below the surface and are difficult to sight from a vessel until the animal is at close range (Hazel et al. 2007). Sea turtles often spend over 90 percent of their time underwater and are not visible more than 6.5 ft. (2 m) below the surface (Mansfield 2006). Sea turtles are generally much smaller than cetaceans, so while shipboard surveys designed for sighting marine mammals are adequate for detecting large sea turtles (e.g., adult leatherbacks), they are usually not adequate for detecting the smaller-sized turtles (e.g., juveniles and Kemp's ridleys). Juvenile sea turtles may be especially difficult to detect. Aerial detection may be more effective in spotting sea turtles on the surface, particularly in calm seas and clear water, but it is possible that the smallest age classes are not detected even in good conditions (Marsh and Saalfeld 1989). Visual detection of sea turtles, especially small turtles, is further complicated by their startle behavior in the presence of vessels. Turtles on the surface may dive below the surface of the water in the presence of a vessel before it is detected by shipboard or aerial observers (Kenney 2005). The detection probability of sea turtles is generally lower than that of cetaceans. The use of Lookouts for visual detection of sea turtles is likely effective only at close range, and is thought to be less effective for small individuals than large individuals.

5.3.1.2.4.3 Summary of Lookout Effectiveness

Due to the various detection probabilities, levels of Lookout experience, and variability of sighting conditions, Lookouts will not always be effective at avoiding impacts on all species. However, Lookouts are expected to increase the overall likelihood that certain marine mammal species and some sea turtles will be detected at the surface of the water, when compared to the likelihood that these same species would be detected if Lookouts are not used. The Navy believes the continued use of Lookouts contributes to helping reduce potential impacts on these species from training and testing activities.

5.3.1.2.5 Operational Assessment for Lookouts

As written, implementation of the mitigation measures recommended in Section 5.3.1.2 (Lookouts) has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activities, and Navy policy. The number of Lookouts recommended for each measure often represents the maximum Lookout capacity based on limited resources (e.g., space and manning restrictions).

5.3.2 Mitigation Zone Procedural Measures

Safety zones described in Section 5.1 (Standard Operating Procedures) are zones designed for human safety, whereas this section will introduce mitigation zones. A mitigation zone is designed solely for the purpose of reducing potential impacts on marine mammals and sea turtles from training and testing activities. Mitigation zones are measured as the radius from a source. Unique to each activity category, each radius represents a distance that the Navy will visually observe to help reduce injury to marine species. Visual detections of applicable marine species will be communicated immediately to the appropriate watch station for information dissemination and appropriate action. If the presence of marine mammals is detected acoustically, Lookouts posted in aircraft and on vessels will increase the vigilance of their visual observation. As a reference, aerial surveys are typically made by flying at 1,500 ft. (457 m) altitude or lower at the slowest safe speed.

Many of the proposed activities have mitigation measures that are currently being implemented, as required by previous environmental documents or consultations. Most of the current Phase I (e.g., Mariana Islands Range Complex [MIRC] EIS/OEIS) mitigation zones for activities that involve the use of impulse and non-impulse sources were originally designed to reduce the potential for onset of temporary threshold shift (TTS). For the MITT EIS/OEIS, the Navy updated the acoustic propagation modeling to incorporate updated hearing threshold metrics (i.e., upper and lower frequency limits), updated density data for marine mammals, and factors such as an animal's likely presence at various depths. An explanation of the acoustic propagation modeling process can be found in the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Mariana Islands Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report (Marine Species Modeling Team 2013).

As a result of the updates to the acoustic propagation modeling, in some cases, the ranges to onset of TTS effects are much larger than those output by previous Phase I models. Due to the ineffectiveness and unacceptable operational impacts associated with mitigating these large areas, the Navy is unable to mitigate for onset of TTS for every activity. In this MITT analysis, the Navy developed each recommended mitigation zone to avoid or reduce the potential for onset of the lowest level of injury, permanent threshold shift (PTS), out to the predicted maximum range. In some cases where the ranges to effects are smaller than previous models estimated, the mitigation zones were adjusted accordingly to provide consistency across the measures. Mitigating to the predicted maximum range to PTS consequently also mitigates to the predicted maximum range to onset mortality (1 percent mortality), onset slight lung injury, and onset slight gastrointestinal tract injury, since the maximum range to effects for these criteria are shorter than for PTS. Furthermore, in most cases, the predicted maximum range to PTS also consequently covers the predicted average range to TTS. Table 5.3-2 summarizes the predicted average range to TTS, predicted average range to PTS, predicted maximum range to PTS, and recommended mitigation zone for each activity category, based on the Navy's acoustic propagation modeling results.

The activity-specific mitigation zones are based on the longest range for all the functional hearing groups (based on the hearing threshold metrics described in Section 3.4, Marine Mammals, and Section 3.5, Sea Turtles). The mitigation zone for a majority of activities is driven by either the high-frequency cetacean or the sea turtle functional hearing groups. Therefore, the mitigation zones are even more protective for the remaining functional hearing groups (i.e., low-frequency cetaceans and mid-frequency cetaceans) and likely cover a larger portion of the potential range to onset of TTS.

In some instances, the Navy recommends mitigation zones that are larger or smaller than the predicted maximum range to PTS based on the effectiveness and operational assessments. The recommended mitigation zones and their associated assessments are provided throughout the remainder of this section. The recommended measures are either currently implemented, modifications of current measures, or new measures.

Table 5.3-2: Predicted Range to Effects and Recommended Mitigation Zones

Activity Category	Representative Source (Bin)*	Predicted Average (Longest) Range to TTS	Predicted Average (Longest) Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
Non-Impulse Sound					
Low-Frequency and Hull Mounted Mid-Frequency Active Sonar	SQS-53 ASW hull-mounted sonar (MF1)	3,821 yd. (3.5 km) for one ping	100 yd. (91 m) for one ping	Not Applicable	6 dB power down at 1,000 yd. (914 m); 4 dB power down at 500 yd. (457 m); and shutdown at 200 yd. (183 m)
	Low-frequency sonar (LF4)**	3,821 yd. (3.5 km) for one ping	100 yd. (91 m) for one ping	Not Applicable	200 yd. (183 m)**
High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar	AQS-22 ASW dipping sonar (MF4)	230 yd. (210 m) for one ping	20 yd. (18 m) for one ping	Not applicable	200 yd. (183 m)
Explosive and Impulse Sound					
Improved Extended Echo Ranging Sonobuoys	Explosive sonobuoy (E4)	434 yd. (397 m)	156 yd. (143 m)	563 yd. (515 m)	600 yd. (549 m)
Explosive Sonobuoys using >0.5–2.5 lb. NEW	Explosive sonobuoy (E3)	290 yd. (265 m)	113 yd. (103 m)	309 yd. (283 m)	350 yd. (320 m)
Anti-swimmer Grenades	Up to 0.5 lb. NEW (E2)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m)
Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices	NEW dependent (see Table 5.3-3)				
Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices	Up to 20 lb. NEW (E6)	407 yd. (372 m)	98 yd. (90 m)	102 (93 m) yd.	1,000 yd. (914 m)
Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target	40 mm projectile (E2)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m)
Gunnery Exercises – Large-Caliber Using a Surface Target	5 in. projectiles (E5 at the surface***)	453 yd. (414 m)	186 yd. (170 m)	526 yd. (481 m)	600 yd. (549 m)
Missile Exercises (Including Rockets) up to 250 lb. NEW Using a Surface Target	Maverick missile (E9)	949 yd. (868 m)	398 yd. (364 m)	699 yd. (639 m)	900 yd. (823 m)
Missile Exercises from >250 to 500 lb. NEW Using a Surface Target	Harpoon missile (E10)	1,832 yd. (1,675 m)	731 yd. (668 m)	1,883 yd. (1,721 m)	2,000 yd. (1.8 km)
Bombing Exercises	MK-84 2,000 lb. bomb (E12)	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2,500 yd. (2.3 km)****
Torpedo (Explosive) Testing	MK-48 torpedo (E11)	1,632 yd. (1.5 km)	697 yd. (637 m)	2,021 yd. (1.8 km)	2,100 yd. (1.9 km)

Table 5.3-2: Predicted Range to Effects and Recommended Mitigation Zones (continued)

Activity Category	Representative Source (Bin)*	Predicted Average Range to TTS (Longest)	Predicted Average Range to PTS (Longest)	Predicted Maximum Range to PTS	Recommended Mitigation Zone
Explosive and Impulse Sound					
Sinking Exercises	Various sources up to the MK-84 2,000 lb. bomb (E12)	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2.5 nm****

* This table does not provide an inclusive list of source bins; bins presented here represent the source bin with the largest range to effects within the given activity category.

** The representative source bin and mitigation zone applies to sources that cannot be powered down (e.g., bins LF4 and LF5).

*** The representative source bin E5 has different range to effects depending on the depth of activity occurrence (at the surface or at various depths).

**** Recommended mitigation zones are larger than the modeled injury zones to account for multiple types of sources or charges being used.

Notes: ASW = anti-submarine warfare, km = kilometers, lb.= pound(s), m = meters, mm = millimeters, NEW = net explosive weight, nm = nautical miles, PTS = Permanent Threshold Shift, TTS = Temporary Threshold Shift, yd. = yards

Table 5.3-3: Predicted Range to Effects and Mitigation Zone Radius for Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

Charge Size Net Explosive Weight (Bins)	General Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices*				Mine Countermeasure and Neutralization Activities Using Diver-Placed Charges under Positive Control**			
	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
>2.5–5 lb. (E4)	434 yd. (397 m)	197 yd. (180 m)	563 yd. (515 m)	600 yd. (549 m)	545 yd. (498 m)	169 yd. (155 m)	301 yd. (275 m)	350 yd. (320 m)
>5–10 lb. (E5)	525 yd. (480 m)	204 yd. (187 m)	649 yd. (593 m)	800 yd. (732 m)	587 yd. (537 m)	203 yd. (185 m)	464 yd. (424 m)	500 yd. (457 m)
>10–20 lb. (E6)	766 yd. (700 m)	288 yd. (263 m)	648 yd. (593 m)	800 yd. (732 m)	647 yd. (592 m)	232 yd. (212 m)	469 yd. (429 m)	500 yd. (457 m)

* These mitigation zones are applicable to all mine countermeasure and neutralization activities conducted in all locations that Tables 2.8-1 through 2.8-5 specifies.

** These mitigation zones are only applicable to mine countermeasure and neutralization activities involving the use of diver-placed charges. These activities are conducted in shallow water and the mitigation zones are based only on the functional hearing groups with species that occur in these areas (mid-frequency cetaceans and sea turtles).

Notes: lb. = pounds, m = meters, PTS = Permanent Threshold Shift, TTS = Temporary Threshold Shift, yd. = yards

5.3.2.1 Acoustic Stressors

5.3.2.1.1 Non-Impulse Sound

5.3.2.1.1.1 Low-Frequency and Hull Mounted Mid-Frequency Active Sonar

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for low-frequency active sonar sources analyzed in this Final EIS/OEIS, or new platforms or systems. The Navy is proposing to (1) add mitigation measures for low-frequency active sonar, (2) continue implementing the current measures for mid-frequency active sonar, and (3) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are below.

Training and testing activities that involve the use of low-frequency and hull-mounted mid-frequency active sonar (including pierside) will use Lookouts for visual observation from a ship immediately before and during the activity. With the exception of certain low-frequency sources that are not able to be powered down during the activity (e.g., low-frequency sources within bin LF4 and LF5), mitigation will involve powering down the sonar by 6 dB when a marine mammal or sea turtle (low-frequency sources only) is sighted within 1,000 yd. (914 m), and by an additional 4 dB when sighted within 500 yd. (457 m) from the source, for a total reduction of 10 dB. If the source can be turned off during the activity, active transmissions will cease if a marine mammal or sea turtle (low-frequency sources only) is sighted within 200 yd. (183 m).

Active transmission will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of course, speed, and the relative motion between the animal and the source; (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes; (4) the ship has transited more than 2,000 yd. (1.8 kilometers [km]) beyond the location of the last sighting; or (5) the ship concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave (and there are no other marine mammal sightings within the mitigation zone). Active transmission may resume when dolphins are bow riding because they are out of the main transmission axis of the active sonar while in the shallow-wave area of the vessel bow.

If the source is not able to be powered down during the activity (e.g., low-frequency sources within bins LF4 and LF5), mitigation will involve ceasing active transmission if a marine mammal or sea turtle is sighted within 200 yd. (183 m). Active transmission will recommence if any one of the following conditions is met: (1) the animal is observed existing the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of course, speed, and the relative motion between the animal and the source; (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes; or (4) the ship has transited more than 400 yd. (366 m) beyond the location of the last sighting.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted average range to onset of PTS for low-frequency and hull-mounted mid-frequency active sonar sources is 100 yd. (91 m) for one ping. This range was determined by the high-frequency cetacean functional hearing group. The distance for all other marine mammal functional hearing groups is less than 80 yd. (73 m) for one ping, so the mitigation zone will provide further protection from injury (PTS) for these species. Therefore, implementation of the 200 yd. (183 m) shutdown zone will reduce the potential for exposure to higher levels of energy that would result in injury (PTS) and large threshold shifts that are recoverable (i.e., TTS) when individuals are sighted. Implementation of the 500 yd. (457 m) and 1,000 yd. (914 m) sonar power reductions will further reduce the potential for injury (PTS) and larger threshold shifts that would result in recovery (i.e., TTS) to occur when individual marine mammals are sighted within these zones, especially in cases where the ship and animal are approaching each other.

The mitigation zones the Navy has developed are within a range for which Lookouts can reasonably be expected to maintain situational awareness and visually observe during most conditions. Since the predicted average range to onset of TTS is 3,821 yd. (3.5 km), the entire predicted range to TTS is not reasonably observable. By establishing mitigation zones that can be realistically maintained from ships, Lookouts will be more effective at sighting individual animals. By keeping Lookouts focused within the ranges where exposure to higher levels of energy is possible, the effectiveness at reducing potential impacts on marine mammals and sea turtles will increase. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances. Observations for sea turtles are required only during low-frequency active sonar activities because hull-mounted mid-frequency active sonar is not within the primary sea turtle hearing range.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.1 (Impacts from Sonar and Other Active Acoustic Sources) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 minutes would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities to detect submarines, objects, or other exercise targets as would be required in a real world combat situation, reduce the sonar operator's situational awareness of the environment where the training or testing is occurring, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.1.2 High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for all high-frequency and non-hull mounted mid-frequency active sonar activities (i.e., new sources or sources not previously analyzed). The Navy is proposing to (1) continue implementing the current mitigation measures for activities currently being executed, such as dipping sonar activities; (2) extend the implementation of its current mitigation to all other activities in this category; and (3) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Mitigation will include visual observation from a vessel or aircraft (with the exception of platforms operating at high altitudes) immediately before and during active transmission within a mitigation zone of 200 yd. (183 m) from the active sonar source. For activities involving helicopter-deployed dipping sonar, visual observation will commence 10 minutes before the first deployment of active dipping sonar. If the source can be turned off during the activity, active transmission will cease if a marine mammal or sea turtle (for MF8, MF9, MF10, and MF12 only) is sighted within the mitigation zone. Active transmission will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes for an aircraft-deployed source, (4) the mitigation zone has been clear from any additional sightings for a period of 30 minutes for a vessel-deployed source, (5) the vessel or aircraft has repositioned itself more than 400 yd. (366 m) away from the location of the last sighting, or (6) the vessel concludes that dolphins are deliberately closing in to ride the vessel's bow wave (and there are no other marine mammal sightings within the mitigation zone).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted average range to onset of PTS for high-frequency and non-hull mounted mid-frequency active sonar sources is 20 yd. (18 m) for one ping. This range was determined by the high-frequency cetacean functional hearing group. The predicted average range to onset of TTS across all functional hearing groups is 230 yd. (210 m) for one ping. Implementation of the 200 yd. (183 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury (PTS) and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. Lookouts often visually observe either close aboard a vessel or from directly above the source by aircraft (i.e., helicopters). Exceptions include when sonobuoys are deployed and when sources are deployed from high altitude aircraft. When sonobuoys are used, the sonobuoy field may be dispersed over a large distance. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances. This measure should be effective at reducing the risk to all marine mammals and sea turtles that are available to be observed within the mitigation zone. Observations for sea turtles are required only during non-hull-mounted mid-frequency active sonar activities within bins MF8, MF9, MF10, and MF12 because high-frequency active sonar and other bins of mid-frequency sonar are not within the primary sea turtle hearing range.

The post-sighting wait periods are designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-minute wait period for vessel-deployed sources more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving species. However, the analysis in Section 3.4.4.1.3 (Predicted Impacts from Sonar and Other Active Acoustic Sources) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur, with the exception of *Kogia* species. Requiring additional delay beyond 30 minutes for vessel-deployed sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities to detect submarines, objects, or other exercise targets that would be required during a real world combat situation and reduce the sonar operator's situational awareness of the environment where the training or testing is occurring, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-minute wait period for aircraft-deployed sources covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period for aircraft-deployed sources is based on fuel restrictions for the types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 minutes for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities to detect submarines, objects, or other exercise targets as would be required during a real world combat situation and reduce the sonar operator's situational awareness of the environment where the training or testing is occurring, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2 Explosives and Impulse Sound

5.3.2.1.2.1 Improved Extended Echo Ranging Sonobuoys

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by reducing the marine mammal and sea turtle mitigation zone from 1,000 yd. (914 m) to 600 yd. (549 m), and (2) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Mitigation will include pre-exercise aerial observation and passive acoustic monitoring, which will begin 30 minutes before the first source/receiver pair detonation and continue throughout the duration of the exercise within a mitigation zone of 600 yd. (549 m) around an Improved Extended Echo Ranging sonobuoy. The pre-exercise aerial observation will include the time it takes to deploy the sonobuoy pattern (deployment is conducted by aircraft dropping sonobuoys in the water). Explosive detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes.

Passive acoustic monitoring would be conducted with Navy assets, such as sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to Lookouts posted in aircraft and on vessels in order to increase vigilance of their visual observation.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for Improved Extended Echo Ranging sonobuoys is approximately 563 yd. (515 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 434 yd. (397 m). Implementation of the 600 yd. (549 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. The sonobuoy field may be dispersed over a large distance. As discussed in section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances.

The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.2 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 minutes for aircraft-deployed Improved Extended Echo Ranging sonobuoys would modify the activity in a way that it would no longer meet its intended objective. The 30-minute wait period represents the maximum wait period acceptable for the type of aircraft involved in this activity (e.g., maritime patrol aircraft) based on fuel restrictions. Any additional delay would result in an unacceptable increased risk to personnel safety, require aircraft to depart the activity location to refuel, eliminate opportunities to detect submarines as would be required in a real world combat situation, and reduce the aircrew's situational awareness of the environment where the activity is occurring, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.2 Explosive Sonobuoys Using >0.5–2.5 Pound Net Explosive Weight

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for this activity. The Navy is proposing to add the recommended measures provided below.

Mitigation will include pre-exercise aerial monitoring during deployment of the field of sonobuoy pairs (typically up to 20 minutes) and continuing throughout the duration of the exercise within a mitigation zone of 350 yd. (320 m) around an explosive sonobuoy. Explosive detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes.

Passive acoustic monitoring will also be conducted with Navy assets, such as sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to Lookouts posted in aircraft in order to increase vigilance of their visual observation.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for explosive sonobuoys using >0.5–2.5 lb. net explosive weight is 309 yd. (283 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 290 yd. (265 m). Implementation of the 350 yd. (320 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and large threshold shifts that are recoverable (i.e., TTS) when individuals are sighted. The sonobuoy field may be dispersed over a large distance. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the likelihood of sighting individual animals, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 10-minute wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period for aircraft-deployed sources is based on fuel restrictions for the types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 minutes for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities to detect and track submarines or other exercise targets as would be required in a real world combat situation, reduce the sonar operator's situational awareness of the environment where the training or testing is occurring, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.3 Anti-Swimmer Grenades

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for this activity. The Navy is proposing to add the recommended measures provided below.

Mitigation will include visual observation from a small boat immediately before and during the exercise within a mitigation zone of 200 yd. (183 m) around an anti-swimmer grenade. Explosive detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes, or (4) the activity has been repositioned more than 400 yd. (366 m) away from the location of the last sighting.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for anti-swimmer grenades is approximately 182 yd. (167 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 190 yd. (174 m). Implementation of the 200 yd. (183 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shift that would result in recovery (i.e., TTS) when individuals are sighted. Since the Lookout is visually observing close aboard the boat, this measure should be effective at reducing the risk to all marine mammals and sea turtles that are available to be observed.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.2 (Impacts from Explosives) shows that injury to deep diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 minutes would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities for maritime security forces to detect, respond, to, and defend against enemy scuba divers as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.4 Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

Recommended Mitigation and Comparison to Current Mitigation

As background, mine countermeasure and neutralization activities can be divided into two main categories: (1) general activities that can be conducted from a variety of platforms and locations, and (2) activities involving the use of diver-placed charges that typically occur close to shore. When either of these activities are conducted using a positive control firing device, the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation. Refer to Section 5.3.3.1.1.1 (Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials with shallow coral reef, live hardbottom, artificial reef, and shipwreck mitigation areas.

Mitigation measures do not currently exist for general mine countermeasures and neutralization activities. The Navy is proposing to use the mitigation zones outlined in Table 5.3-3 during general mine countermeasure activities using positive control firing devices. General mine countermeasure and neutralization activity mitigation will include visual observation from small boats or aircraft beginning 30 minutes before, during, and 30 minutes after (when helicopters are not involved in the activity) or 10 minutes before, during, and 10 minutes after (when helicopters are involved in the activity) the completion of the exercise within the mitigation zones around the detonation site. Explosive detonations will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Detonations will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes, when helicopters are not involved in the activity or (4) the mitigation zone has been clear from any additional sightings for a period of 10 minutes when helicopters are involved in the activity.

For activities involving positive control diver-placed charges, the Navy is proposing to (1) modify the currently implemented mitigation measures for activities involving up to a 20 lb. net explosive weight detonation, and (2) clarify the conditions needed to recommence an activity after a sighting. For comparison, the currently implemented mitigation zone for general mine countermeasure and neutralization is 700 yd. (640 m) when using up to a 20 lb. net explosive weight charge. The recommended measures for activities involving positive control diver-placed activities are provided below.

The Navy is proposing to use the mitigation zones outlined in Table 5.3-3 during activities involving positive control diver-placed charges. Visual observation will be conducted by either two small boats, or one small boat in combination with one helicopter. Boats will position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius and human safety zone) and travel in a circular pattern around the detonation location. When using two boats, each boat will be positioned on opposite sides of the detonation location, separated by 180 degrees. If used, helicopters will travel in a circular pattern around the detonation location. The conditions needed to recommence an activity after a sighting described above for general mine countermeasure and neutralization activities will also apply to activities using diver-placed charges.

Navy divers involved with underwater detonation in the Mariana Islands Range Complexes will visually observe to the best extent practicable for hammerhead sharks prior to initiating detonation as part of the diver's normal underwater training procedures. If hammerhead sharks are observed within the immediate area, then detonation will be delayed until the shark is no longer observed in the immediate area.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. The predicted range to effects shown in Table 5.3-3 for general mine countermeasure and neutralization activities using positive control firing devices were determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had shorter ranges to onset of PTS, so the mitigation zones will provide further protection for these species. Implementation of the mitigation zones outlined in Table 5.3-3 will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

As described in Section 5.3.1 (Lookout Procedural Measures), Lookouts positioned in aircraft or small boats may be responsible for tasks in addition to observing the air or surface of the water. For example, a Lookout for this activity may also be responsible for navigation or assistance with mine countermeasure and neutralization deployment. Similarly, Lookouts posted in aircraft during mine countermeasure and neutralization activities will, by necessity, focus their attention on the water surface below and surrounding the training location. Due to the nature of this activity (e.g., aircraft maintaining a relatively steady altitude and circling the training location), Lookouts will be able to observe a larger area. Observation of an area beyond what the Navy is proposing to implement for mine countermeasure and neutralization activities is not practical and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal. Implementation of the mitigation zone will allow for a focused survey effort, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles.

As described in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), the ability of a Lookout to detect an animal can vary greatly based on what observing platform is being used. For large ranges, aerial observation is more effective. In addition, when observing from a small boat, sea turtle and cryptic marine mammal species can be very difficult to detect beyond a few meters. However, this measure should be effective at reducing potential impacts for individuals that are sighted.

Mine neutralization activities involving diver-placed charges occur primarily close to shore and in shallow water. The range to effects shown in Table 5.3-3 for mine neutralization activities involving diver-placed charges under positive control were determined by the sea turtle functional hearing group. The mid-frequency hearing group had shorter ranges to onset of PTS, so the mitigation zones will provide further protection for these species. However, mitigation would be implemented for any species observed within the mitigation zone.

Implementation of the mitigation zones outlined in Table 5.3-3 will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. The decrease in mitigation zone size for activities using diver-placed charges (up to 20 lb. net explosive weight charges) will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller area, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals.

During activities using diver-placed charges, Lookouts are visually observing from small boats or helicopters. As discussed above, aerial observation (and observations from shore-based platforms with high vantage points) is more effective than observation from a small boat. Since small boats do not have a very elevated observing platform, the distance over which animals can be observed is much shorter. Sea turtles and cryptic marine mammal species would be very difficult to detect further than a few meters away from the boat.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.2 (Impacts from Explosives) shows that injury to deep diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 minutes (when helicopters are not involved in the activity) would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities to detect, identify, evaluate, and neutralize mines as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-minute wait period (when helicopters are involved in the activity) covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period is based on helicopter fuel restrictions. Requiring additional delay beyond 10 minutes for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities to detect, identify, evaluate, and neutralize mines, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to most marine mammal species; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.5 Mine Neutralization Diver-Placed Mines Using Time-Delay Firing Device

Recommended Mitigation and Comparison to Current Mitigation

As background, when mine neutralization activities using diver-placed charges (up to a 20 lb. net explosive weight) are conducted with a time-delay firing device, the detonation is fused with a specified time-delay by the personnel conducting the activity and is not authorized until the area is clear at the time the fuse is initiated. During these activities, the detonation cannot be terminated once the fuse is initiated due to human safety concerns. Refer to Section 5.3.2.1.2.4 (Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices) for a general discussion of mitigation measures applicable to mine neutralization activities using diver-placed mines. This section will specify unique mitigation zones and observation methods for diver placed mine activities that use time-delay firing devices. Refer to Section 5.3.3.1.1.1 (Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef, live hardbottom, artificial reef, and shipwreck mitigation areas.

The Navy is proposing to (1) modify the mitigation zones and observation requirements currently implemented for mine countermeasure and neutralization activities using diver-placed time-delay firing devices, and (2) clarify the conditions needed to recommence an activity after a sighting. For comparison, the current mitigation zones are based on size of charge and length of time-delay, ranging from a 1,000 yd. (914 m) mitigation zone for a 5 lb. net explosive weight charge using a 5-minute time-delay to a 1,500 yd. (1,372 m) mitigation zone for a 10 lb. net explosive weight charge using a 10-minute time-delay. The current requirement is six Lookouts in three boats (two in each boat) for larger than 1,400 yd. (1,280 m) and four Lookouts in two small boats to be used for observation in mitigation zones that are less than 1,400 yd. (1,280 m). The recommended measures for activities involving diver-placed time-delay firing devices are provided below.

The Navy recommends one mitigation zone for all net explosive weights and lengths of time-delay. Mine neutralization activities involving diver-placed charges will not include time-delay longer than 10 minutes. Mitigation will include visual observation from small boats or aircraft commencing 30 minutes before, during, and until 30 minutes after the completion of the exercise within a mitigation zone of 1,000 yd. (914 m) around the detonation site. During activities using time-delay firing devices involving up to a 20 lb. net explosive weight charge, visual observation will take place using two small boats. In addition, when aircraft are involved (e.g., during deployment of divers), the pilot or member of the aircrew will serve as an additional Lookout. The fuse initiation will cease if a marine mammal or sea turtle is sighted within the water portion of the mitigation zone (i.e., not on shore). Fuse initiation will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes.

Survey boats will position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius/human safety zone) and travel in a circular pattern around the detonation location. One Lookout from each boat will look inward toward the detonation site and the other Lookout will look outward away from the detonation site. Each boat will be positioned on opposite sides of the detonation location, separated by 180 degrees. If available for use, helicopters will travel in a circular pattern around the detonation location.

Navy divers involved with underwater detonation in the Mariana Islands Range Complex will visually observe to the best extent practicable for hammerhead sharks prior to initiating detonation as part of the diver's normal underwater training procedures. If hammerhead sharks are observed within the immediate area, then detonation will be delayed until the shark is no longer observed in the immediate area.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for mine neutralization diver-placed mines using time-delay firing devices is 102 yd. (93 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 407 yd. (372 m). The time-delay firing device mitigation zone was determined by including additional distance on top of the predicted maximum range to onset of PTS to account for a portion of the time that a marine mammal or sea turtle could enter the mitigation zone during the time-delay. Implementation of the 1,000 yd. (914 m) mitigation zone will reduce the potential for exposure of energy out to the predicted average range to TTS.

A 1,000 yd. (914 m) mitigation zone represents the maximum distance that the Lookouts on small boats can adequately observe given the number of personnel that will be involved. As discussed in Section 5.3.1.2.2.5 (Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices), the use of more than two small boats for observation during this activity presents an unacceptable impact on readiness due to limited personnel resources. Since small boats do not have an elevated observing platform, the distance over which animals can be observed is much shorter. Sea turtles and cryptic marine mammal species would be very difficult to detect further than a few meters away from the boat.

Sighting a sea turtle is only likely if a helicopter is participating in the activity. In addition, even with the extended mitigation zone to account for as much of the time-delay as possible, there is still a remote chance that animals may swim into the area after the charge is already set.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.2 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. The 30-minute wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. Requiring additional delay beyond 30 minutes would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would eliminate opportunities to detect, identify, evaluate, and neutralize mines as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of injury to most marine mammal species; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.6 Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for small- and medium-caliber gunnery using a surface target. Refer to Section 5.3.3.1.1.1 (Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

Mitigation will include visual observation from a vessel or aircraft immediately before and during the exercise within a mitigation zone of 200 yd. (183 m) around the intended impact location. Vessels will observe the mitigation zone from the firing position. When aircraft are firing, the aircrew will maintain visual watch of the mitigation zone during the activity. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes for a firing aircraft, (4) the mitigation zone has been clear from any additional sightings for a period of 30 minutes for a firing vessel, and (5) the intended target location has been repositioned more than 400 yd. (366 m) away from the location of the last sighting.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for small-and medium-caliber gunnery is 182 yd. (167 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 190 yd. (174 m). Implementation of the 200 yd. (183 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

Small- and medium-caliber gunnery exercises involve the participating vessel or aircraft firing munitions at a target location that may be up to 4,000 yd. (3.7 km) away, although typically much closer than this. Therefore, it is necessary for the Lookout to be able to visually observe the mitigation zone from varying distances. Large vessel or aircraft platforms would provide a more effective observation platform for Lookouts than small boats. However, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 4,000 yd. (3.7 km). However, this measure is likely effective at reducing the risk of injury to marine mammals that may be observed from the typical target distances. This measure may be ineffective at reducing the risk of injury to sea turtles at large target distances; however, it does reduce the risk for those individuals that may be observed at closer distances. In addition, it is more likely that sea turtles will be observed when exercises involve aircraft versus vessels.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-minute wait period for a firing vessel more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.2 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 minutes for a firing vessel would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-minute wait period for a firing aircraft covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period is based on fuel restrictions for the types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 minutes for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities and reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to some marine mammal species; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.7 Gunnery Exercises – Large-Caliber Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue using the currently implemented mitigation zone for this activity, (2) clarify the conditions needed to recommence an activity after a sighting, and (3) modify the seafloor habitat mitigation area. Refer to Section 5.3.3.1.1.1 (Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

Mitigation will include visual observation from a ship immediately before and during the exercise within a mitigation zone of 600 yd. (549 m) around the intended impact location. Ships will observe the mitigation zone from the firing position. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for large caliber gunnery is approximately 526 yd. (481 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 453 yd. (414 m). Implementation of the 600 yd. (549 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shift that would result in recovery (i.e., TTS) when individuals are sighted. Per the Navy's current reporting requirements, any injured or dead marine mammals or sea turtles will be reported as appropriate.

Large-caliber gunnery exercises involve the participating ship firing munitions at a target location from ranges up to 6 nautical miles (nm) away. Therefore it is necessary for the Lookout to be able to visually observe the mitigation zone from this distance. Although the Lookout will observe for all marine mammals or sea turtles in the area, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen. Although this measure is likely ineffective at reducing the risk of injury to sea turtles and some species of marine mammals, it does reduce the risk for those individuals that may be observed.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.2 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 minutes would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to some marine mammal species; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.8 Missile Exercises (Including Rockets) up to 250 Pound Net Explosive Weight Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 1,800 yd. (1.6 km) to 900 yd. (823 m), (2) clarify the conditions needed to recommence an activity after a sighting, and (3) modify the platform of observation to eliminate the requirement to observe when ships are firing. Refer to Section 5.3.3.1.1.1 (Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

When aircraft are firing, mitigation will include visual observation by the aircrew or supporting aircraft prior to commencement of the activity within a mitigation zone of 900 yd. (823 m) around the deployed target. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes or 30 minutes (depending on aircraft type).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a missile exercise ([including rockets] up to 250 lb. net explosive weight [bin E9]) is approximately 699 yd. (639 m). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 949 yd. (868 m). Implementation of the 900 yd. (823 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted. The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles.

Missile exercises involve the participating ship or aircraft firing munitions at a target location typically up to 15 nm away and infrequently include ranges up to 75 nm away. When an aircraft is firing, the aircraft can travel close to the intended impact area so that it can be visually observed. Because this type of observation is not possible for a ship, visual observation is not suitable for activities that involve a ship-fired missile. Even with aircraft firing, there is a chance that animals could enter the impact area after the visual observations have been completed and the activity has commenced. Therefore, this measure is not effective at reducing the risk of injury to animals once the firing has begun; however, it does reduce the risk for those individuals that may be observed prior to commencement of the activity when aircraft are firing.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. The 30-minute wait period represents the maximum wait period acceptable for certain types of aircraft involved in this activity (e.g., maritime patrol aircraft) based on their specific fuel restrictions. Requiring additional delay beyond 30 minutes for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-minute wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period is based on the specific fuel restrictions for the other types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 minutes for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.9 Missile Exercises from >250 to 500 Pound Net Explosive Weight Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for missile exercises using >250–500 lb. net explosive weight missiles. The recommended measures are provided below. Refer to Section 5.3.3.1.1.1 (Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas.

When aircraft are firing, mitigation will include visual observation by the aircrew or supporting aircraft prior to commencement of the activity within a mitigation zone of 2,000 yd. (1.8 km) around the intended impact location. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes or 30 minutes (depending on aircraft type).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a missile exercise using 250–500 lb. net explosive weight (bin E10) is 1,883 yd. (1.7 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 1,832 yd. (1.7 km). Implementation of the 2,000 yd. (1.8 km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

Missile exercises involve the participating ship or aircraft firing munitions at a target location typically up to 15 nm away and infrequently include ranges up to 75 nm away. When an aircraft is firing, the aircraft can travel close to the intended impact area so that it can be visually observed. Because that type of observation is not possible for a ship, visual observation is not suitable for activities that involve a ship-fired missile. Even with aircraft firing, there is a chance that animals could enter the impact area after the visual observations have been completed and the activity has commenced. Therefore, this measure is not effective at reducing the risk of injury to animals once the firing activity has begun; however, it does reduce the risk for those individuals that may be observed prior to commencement of the activity when aircraft are firing.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. The 30-minute wait period represents the maximum wait period acceptable for certain types of aircraft involved in this activity (e.g., maritime patrol aircraft) based on their specific fuel restrictions. Requiring additional delay beyond 30 minutes for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-minute wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period is based on the specific fuel restrictions for the other types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 minutes for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles;

and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity readiness, and Navy policy.

5.3.2.1.2.10 Bombing Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by increasing the mitigation zone from 1,000 yd. (914 m) to 2,500 yd. (2.3 km), and (2) clarify the conditions needed to recommence an activity after a sighting. Refer to Section 5.3.3.1.1.1 (Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas. The recommended measures are provided below.

Mitigation will include visual observation from the aircraft immediately before the exercise and during target approach within a mitigation zone of 2,500 yd. (2.3 km) around the intended impact location. Bombing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Bombing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for bombing exercises is 2,474 yd. (2.3 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. For example, the predicted maximum range to onset of PTS to mid-frequency of cetaceans is less than 500 yd. (457 m). The predicted average range to onset of TTS across all functional hearing groups is 2,513 yd. (2.3 km). Implementation of the 2,500 yd. (2.3 km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

The predicted maximum range to onset mortality across all functional hearing groups is less than 250 yd. (229 m). Therefore, this measure will be effective at reducing potential mortality to all marine mammals and sea turtles when individuals are sighted. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 2,500 yd. (2.3 km) near the perimeter of the mitigation zone. However, this measure is likely effective at reducing the risk of injury to marine mammals and sea turtles that may be observed from the smaller distances within the mitigation zone.

As described in Section 5.3.1 (Lookout Procedural Measures), Lookouts positioned in aircraft may be responsible for tasks in addition to observing the air or surface of the water. For example, a Lookout for this activity may also be responsible for navigation of the aircraft. Having a Lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Similarly, Lookouts posted in aircraft during bombing activities will, by necessity, focus their attention on the water surface below and surrounding the location of bomb deployment. Due to the nature of this activity (e.g., aircraft maintaining a relatively steady altitude of approximately 1,500 ft. [457 m] and approaching the intended impact location), Lookouts will be able to observe a larger area during bombing activities than other proposed activities that involve the use of Lookouts positioned in aircraft (e.g., Improved Extended Echo Ranging sonobuoy activities). However, observation of an area beyond what the Navy is proposing to implement for bombing activities is not practical and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal.

While the increase in mitigation zone size will not mitigate for exposures to lower levels of potential onset of TTS, it will allow for a more focused survey effort over a larger survey distance and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 10-minute wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period is based on fuel restrictions (factoring in the typical activity locations) for the types of aircraft involved in this activity (e.g., F/A-18). Requiring additional delay beyond 10 minutes for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and deliver bombs as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.11 Torpedo (Explosive) Testing

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for torpedo (explosive) testing. The Navy is recommending the measures provided below and removing the requirement to review remotely sensed sea surface temperature maps prior to conducting the activity.

Mitigation will include visual observation by aircraft (with the exception of platforms operating at high altitudes) immediately before, during, and after the exercise within a mitigation zone of 2,100 yd. (1.9 km) around the intended impact location. Firing will cease if a marine mammal, sea turtle, or aggregation of jellyfish is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes or 30 minutes (depending on aircraft type).

In addition to visual observation, passive acoustic monitoring would be conducted with Navy assets, such as passive ships sonar systems or sonobuoys, already participating in the activity. Passive acoustic observation would be accomplished through the use of remote acoustic sensors or expendable sonobuoys, or via passive acoustic sensors on submarines when they participate in the Proposed Action. These assets would only detect vocalizing marine mammals within the frequency bands monitored by

Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to the Lookout posted in the aircraft in order to increase vigilance of the visual observation and to the person in control of the activity for their consideration in determining when the mitigation zone is determined free of visible marine mammals.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for explosive torpedoes is approximately 2,021 yd. (1.8 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. The predicted average range to onset of TTS across all functional hearing groups is 1,632 yd. (1.5 km). Implementation of the 2,100 yd. (1.9 km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

The predicted maximum range to onset mortality across all functional hearing groups is less than 600 yd. (549 m). Therefore, this measure will be effective at reducing potential mortality to all marine mammals and sea turtles when individuals are sighted. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 2,100 yd. (1.9 km) near the perimeter of the mitigation zone. However, this measure is likely effective at reducing the risk of injury to marine mammals and sea turtles that may be observed from the smaller distances within the mitigation zone. Observation for indicators of marine mammal and sea turtle presence (e.g., jellyfish aggregations) will further help avoid impacts on marine mammals and sea turtles.

As described in Section 5.3.1 (Lookout Procedural Measures), Lookouts positioned in aircraft may be responsible for tasks in addition to observing the air or surface of the water. For example, a Lookout for this activity may also be responsible for navigation of the aircraft. Having a Lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Observation of an area beyond what the Navy is proposing to implement for torpedo (explosive) testing activities is not practical and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30 min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. The 30-min. wait period represents the maximum wait period acceptable for certain types of aircraft involved in this activity (e.g., maritime patrol aircraft) based on their specific fuel restrictions. Requiring additional delay beyond 30 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch torpedoes as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10 min. wait period is based on the specific fuel restrictions for the other types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 minutes for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and deliver bombs as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The original intent of the measure requiring the review of remotely sensed sea surface temperature maps was to help predict areas in which protected species could occur. However, while the presence of sea surface temperature fronts may indicate suitable habitat for marine species and may sometimes lead observers to pay more attention to an area of the ocean likely to be associated with a marine species, sea surface temperature fronts alone are insufficient to locate and prevent avoidance of marine species during this type of exercise.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.12 Sinking Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the mitigation measures currently implemented for this activity by increasing the mitigation zone from 2.0 nm to 2.5 nm, (2) clarify the conditions needed to recommence an activity after a sighting, and (3) adopt the marine mammal and sea turtle mitigation zone size for aggregations of jellyfish for ease of implementation. The recommended measures are provided below.

Mitigation will include visual observation within a mitigation zone of 2.5 nm around the target ship hulk. Sinking exercises will include aerial observation beginning 90 minutes before the first firing, visual observations from vessels throughout the duration of the exercise, and both aerial and vessel observation immediately after any planned or unplanned breaks in weapons firing of longer than 2 hours. Prior to conducting the exercise, the Navy will review remotely sensed sea surface temperature and sea surface height maps to aid in deciding where to release the target ship hulk.

The Navy will also monitor using passive acoustics during the exercise. Passive acoustic monitoring would be conducted with Navy assets, such as passive ships sonar systems or sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to Lookouts posted in aircraft and on vessels in order to increase vigilance of their visual observation. Lookouts will also increase observation vigilance before the use of torpedoes or unguided ordnance with a net explosive weight of 500 lb. or greater, or if the Beaufort sea state is a 4 or above.

The exercise will cease if a marine mammal, sea turtle, or aggregation of jellyfish is sighted within the mitigation zone. The exercise will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes. Upon sinking the vessel, the Navy will conduct post-exercise visual observation of the mitigation zone for 2 hours (or until sunset, whichever comes first).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential impacts they are designed to reduce. During a sinking exercise, multiple weapons sources may be used (projectiles, missiles, bombs, torpedoes), the largest of which is the 2,000 lb. bomb. The recommended mitigation zone is approximately double the predicted maximum range to onset of PTS of the largest weapon source, and is designed to account for multiple detonations during the activity. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a bombing exercise is approximately 2,474 yd. (2.3 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter predicted range to onset of PTS, so the mitigation zone will provide further protection for these species. For example, the predicted maximum range to onset of PTS to mid-frequency of cetaceans is less than 500 yd. (457 m). The predicted average range to onset of TTS across all functional hearing groups is 2,513 yd. (2.3 km). Implementation of the 2.5 nm mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and larger threshold shifts that would result in recovery (i.e., TTS) when individuals are sighted.

The predicted maximum range to onset mortality across all functional hearing groups is less than 250 yd. (229 m). Therefore, this measure will be effective at reducing potential mortality to all marine mammals and sea turtles when individuals are sighted. As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 2.5 nm near the perimeter of the mitigation zone. However, this measure is likely effective at reducing the risk of injury to marine mammals and sea turtles that may be observed from the smaller distances within the mitigation zone.

As described in Section 5.3.1 (Lookout Procedural Measures), Lookouts positioned in aircraft or vessels may be responsible for tasks in addition to observing the air or surface of the water. For example, a Lookout for this activity may also be responsible for navigation of the aircraft. Having a Lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Similarly, Lookouts posted in aircraft during sinking activities will, by necessity, focus their attention on the water surface below and surrounding the training location. Due to the nature of this activity (e.g., aircraft maintaining a relatively steady altitude and circling the training location), Lookouts will be able to observe a larger area during sinking activities than other proposed activities that involve the use of Lookouts positioned in aircraft (e.g., Improved Extended Echo Ranging sonobuoy activities). However, observation of an area beyond what the Navy is proposing to implement for sinking activities is not practical and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal.

While the increase in mitigation zone size to 2.5 nm will not mitigate for exposures to lower levels of potential onset of TTS, it will allow for a more focused survey effort over a larger survey distance, and will consequently increase the likelihood of avoidance of injury and larger threshold shifts that would result in recovery (i.e., TTS) to marine mammals and sea turtles.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.2 (Impacts from Explosives) shows that injury to deep-diving marine mammals (e.g., sperm whales and beaked whales) is not expected to occur. Requiring additional delay beyond 30 minutes would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the ship and aircrews' abilities to coordinate attack tactics on a seaborne target as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise. Although activities involving certain types of aircraft (e.g., helicopters) typically employ a 10-minute wait period due to fuel restrictions, the Navy is able to make an exception for this particular activity due to the large variation and rotation of assets that could participate in this type of exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.1.2.13 Weapons Firing Noise During Gunnery Exercises – Large-Caliber

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) modify the currently implemented mitigation measure to clarify that the mitigation zone is only on the firing side of the ship, and (2) clarify the conditions needed to recommence an activity after a sighting.

For all explosive and non-explosive large-caliber gunnery exercises conducted from a ship, mitigation will include visual observation immediately before and during the exercise within a mitigation zone of 70 yd. (64 m) within 30 degrees on either side of the gun target line on the firing side. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes, or (4) the ship has repositioned itself more than 140 yd. (128 m) away from the location of the last sighting.

Effectiveness Assessment

The mitigation zone is designed to reduce the potential for injury from weapons firing noise during large-caliber gunnery exercises conducted from a ship. The majority of the energy that an animal could be exposed to would occur on the firing side of the vessel and would follow in the direction of fire. It is not operationally feasible to have Lookouts stationed on all sides of the ship to visually observe for marine mammals and sea turtles due to limited resources (e.g., manning restrictions). Since the Lookout is positioned aboard the firing ship and is visually observing nearby the ship (70 yd. [64 m]), this measure should be effective at reducing the risk to all marine mammals and sea turtles that are available to be observed.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period more than covers the average dive times of most marine mammal species but may not be sufficient for sea turtles. However, the analysis in Section 3.4.4.2.5 (Impacts from Weapons Firing, Launch, and Impact Noise) shows that injury to marine mammals is not expected to occur. Requiring additional delay beyond 30 minutes would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2 Physical Disturbance and Strike

5.3.2.2.1 Vessels and In-Water Devices

5.3.2.2.1.1 Vessels

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue using the mitigation measures currently implemented. The recommended measures are provided below.

Vessels will avoid approaching marine mammals head on and will maneuver to maintain a mitigation zone of 500 yd. (457 m) around observed whales, and 200 yd. (183 m) around all other marine mammals (except bow-riding dolphins), providing it is safe to do so.

Effectiveness and Operational Assessments

Since the Lookout is visually observing within a reasonable distance of the vessel (within 500 yd. [457 m]), this measure should be effective at reducing the risk to marine mammals that are available to be observed. However, as discussed above in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), large whales and pods of dolphins are more likely to be seen than other more cryptic species, such as beaked whales.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to marine mammals; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2.1.2 Towed In-Water Devices

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue to implement the recommended measures provided below.

The Navy will ensure that towed in-water devices being towed from manned platforms avoid coming within a mitigation zone of 250 yd. (229 m) around any observed marine mammal, providing it is safe to do so.

Effectiveness and Operational Assessments

Since the Lookout is visually observing within a reasonable distance of the vessel (250 yd. [229 m]), this measure should be effective at reducing the risk to marine mammals that are available to be observed. However, as discussed above in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), large whales and pods of dolphins are more likely to be seen than other more cryptic species such as beaked whales.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to marine mammals; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2.2 Non-Explosive Practice Munitions

5.3.2.2.2.1 Gunnery Exercises – Small-, Medium-, and Large-Caliber Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue using the mitigation measures currently implemented for this activity, and (2) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Mitigation will include visual observation from a vessel or aircraft immediately before and during the exercise within a mitigation zone of 200 yd. (183 m) around the intended impact location. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes for a firing aircraft, (4) the mitigation zone has been clear from any additional sightings for a period of 30 minutes for a firing vessel, or (5) the intended target location has been repositioned more than 400 yd. (366 m) away from the location of the last sighting.

Effectiveness and Operational Assessments

The mitigation zone is designed to reduce the potential for direct strike from a non-explosive projectile. Large-caliber gunnery exercises involve the participating ship firing munitions at a target location from ranges up to 6 nm away. Small- and medium-caliber gunnery exercises involve the participating vessel or aircraft firing munitions at a target location from up to 2 nm away, although typically closer. Therefore, it is necessary for the Lookout to be able to visually observe the mitigation zone from these distances. Although the Lookout will observe for all marine mammals or sea turtles in the area, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for Lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at distances closer to 6 nm or 2 nm at the furthest target distances. Although this measure is likely ineffective at reducing the risk of injury to sea turtles and some species of marine mammals, it does reduce the risk for those individuals that may be observed.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. A 30-minute wait period when vessels are firing more than covers the average dive times of most marine mammal species but may not be for sea turtles. However, the analysis in Section 3.4.4.4.3 (Impacts from Military Expended Materials) shows that injury to marine mammals and sea turtles is not expected to occur. Requiring additional delay beyond 30 minutes for a firing vessel would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10-minute wait period for a firing aircraft covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period is based on fuel restrictions for the types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 minutes for these sources would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would eliminate opportunities and reduce the gun crews' abilities to engage surface targets and practice defensive marksmanship as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to some species of marine mammals; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2.2.2 Bombing Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to (1) continue using the mitigation measures currently implemented for this activity, and (2) clarify the conditions needed to recommence an activity after a sighting. The recommended measures are provided below.

Mitigation will include visual observation from the aircraft immediately before the exercise and during target approach within a mitigation zone of 1,000 yd. (914 m) around the intended impact location. Bombing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Bombing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes.

Effectiveness and Operational Assessments

The mitigation zone is designed to reduce the potential for direct strike from a non-explosive bomb. The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 10-minute wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-minute wait period is based on fuel restrictions for the types of aircraft involved in this activity (e.g., F/A-18). Requiring additional delay beyond 10 minutes for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and deliver bombs as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to marine mammals or sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.2.2.2.3 Missile Exercises (Including Rockets) Using a Surface Target

Mitigation measures do not currently exist for non-explosive missile exercises (including rockets). The recommended measures are provided below. Refer to Section 5.3.3.1.1.1 (Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) for information on mitigation designed to avoid or reduce potential impacts from military expended materials within shallow coral reef mitigation areas.

When aircraft are firing, mitigation will include visual observation by the aircrew or supporting aircraft prior to commencement of the activity within a mitigation zone of 900 yd. (823 km) around the deployed target. Firing will cease if a marine mammal or sea turtle is sighted within the mitigation zone. Firing will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, or (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes or 30 minutes (depending on aircraft type).

Effectiveness and Operational Assessments

The mitigation zone is designed to reduce the potential for direct strike from a non-explosive projectile. Activities using non-explosive missiles (including rockets) involve the participating ship or aircraft firing munitions at a target location typically up to 15 nm away and infrequently include ranges up to 75 nm away. When an aircraft is firing, the aircraft can travel close to the intended impact area so that it can be visually observed. Because that type of observation is not possible for a ship, visual observation is not suitable for activities that involve a ship-fired missile. Even with aircraft firing, there is a chance that animals could enter the impact area after the visual observations have been completed and the activity has commenced. Therefore, this measure is not effective at reducing the risk of injury to animals once the firing activity has begun; however, it does reduce the risk for those individuals that may be observed prior to commencement of the activity when aircraft are firing.

The post-sighting wait period is designed to give any animals that are sighted an opportunity to leave the area before the exercise recommences but will only be employed if one of the other conditions has not already been met. The 30-min. wait period more than covers the average dive times of most marine mammal species but may not be sufficient for some deep-diving marine mammal species or for sea turtles. However, the analysis in Section 3.4.4.4.3 (Impacts from Military Expended Materials) shows that injury to marine mammals and sea turtles is not expected to occur. The 30-min. wait period represents the maximum wait period acceptable for certain types of aircraft involved in this activity (e.g., maritime patrol aircraft) based on their specific fuel restrictions. Requiring additional delay beyond 30 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The 10 min. wait period covers a portion of the average marine mammal and sea turtle dive times but may not be sufficient to cover the average dive times of all species. The 10-min. wait period is based on the specific fuel restrictions for the other types of aircraft involved in this activity (e.g., helicopters). Requiring additional delay beyond 10 min. for these platforms would modify the activity in a way that it would no longer meet its intended objective. Any additional delay would result in an unacceptable increased risk to personnel safety or would require aircraft to depart the activity location to refuel, which would reduce the aircrews' abilities to approach surface targets and launch missiles as would be required in a real world combat situation, and would therefore have an unacceptable impact on the realism and effectiveness of the exercise.

The Navy proposes implementing the recommended measure described above because (1) it is likely to result in avoidance or reduction of injury to marine mammals and sea turtles; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.3 Mitigation Areas

5.3.3.1 Seafloor Resources

5.3.3.1.1 Marine Habitats and Cultural Resources

5.3.3.1.1.1 Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks

The Navy is proposing to: (1) modify some of the mitigation measures for seafloor habitats and shipwrecks, and (2) discontinue the currently implemented measures for medium- and large-caliber gunnery exercises and missile exercises using airborne targets.

The shipwreck data documented in the Marine Habitat chapter were refined to only accurate positions using the following criteria: (1) not an obstruction, sounding, unknown (non-wreck), dump site, mooring buoy, sewer outfall, piling, or rock; (2) high or medium accuracy location; (3) not disproved; (4) not an approximate position (applied to medium accuracy only); and (5) source information provided.

To aid in the implementation of these measures, the Navy will include maps of known or surveyed shallow coral reefs, artificial reefs, and shipwrecks, in the Protective Measures Assessment Protocol. For mitigation, the term "surveyed" refers to habitat features where the available data indicate the natural boundary of the feature at a generally constant accuracy. Data that are generalized within large geometric areas (e.g., grid cells) are not included.

The Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities (except in existing anchorages as well as near-shore training areas around Guam and within Apra Harbor) within 350 yd. (320 m) of surveyed shallow coral reefs, live hardbottom, artificial reefs, and shipwrecks.

The Navy will not conduct explosive or non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target, explosive missile exercises using a surface target, or explosive and non-explosive bombing exercises within 350 yd. (320 m) of surveyed shallow coral reefs.

Effectiveness and Operational Assessments

The Navy's currently implemented seafloor habitats and shipwreck mitigation zones are based off the range to effects for marine mammals or sea turtles, which are driven by hearing thresholds. The Navy's recommended measures are modified to focus on reducing potential physical impacts on seafloor habitats and shipwrecks from explosives and physical strike military expended materials. The recommended 350 yd. (320 m) mitigation zone is based off the estimated maximum seafloor impact zone for explosions discussed in Section 3.3 (Marine Habitats). The use of non-explosive military expended materials would result in a smaller footprint of potential impact; however, the Navy recommends applying the explosive mitigation zone to all explosive and non-explosive activities as listed above for ease of implementation. This standard mitigation zone will consequently result in an additional protection buffer during the non-explosive activities listed above.

It is not possible to definitively predict or to effectively monitor where the military expended materials from airborne gunnery and missile exercises using aerials targets would be likely to strike seafloor habitats and shipwrecks. The potential debris fall zone can only be predicted within tens of miles for long range events, which can be in excess of 80 nm from the firing location during some missile exercises, and thousands of yards for shorter events, which can occur within several thousand yards of the firing location.

Live hardbottom, shallow water coral reefs, artificial reefs, and shipwrecks fulfill important ecosystem functions. Avoiding or minimizing physical disturbance and strike of these resources will likely reduce the impact on these resources. This measure is only effective with regard to surveyed resources since the Navy needs specific locations to restrict the specified activities. It is not possible for the Navy to avoid these seafloor features when their exact locations are unknown.

The Navy proposes implementing the recommended measures described above because (1) they are likely to result in avoidance or reduction of physical disturbance and strike to seafloor habitats and shipwrecks; and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.3.4 Mitigation Measures Considered but Eliminated

A number of mitigation measures were suggested during the public comment periods of previous Navy environmental documents and throughout the development of the Final EIS/OEIS. As a result of the assessment process identified in Section 5.2 (Introduction to Mitigation), the Navy determined that some of the suggested measures would likely be ineffective at reducing environmental impacts, have an unacceptable operational impact based on the operational assessment, or be incompatible with Section 5.2.2 (Overview of Mitigation Approach). The measures that the Navy does not recommend for implementation are discussed in Section 5.3.4.1 (Previously Considered by Eliminated) and Section 5.3.4.2 (Previously Accepted but Now Eliminated). There is a distinction between effective and feasible observation procedures for data collection and measures employed to prevent impacts or otherwise serve as mitigation. The discussion below is in reference to those procedures meant to serve as mitigation measures.

5.3.4.1 Previously Considered but Eliminated

5.3.4.1.1 Reducing Amount of Training and Testing Activities

Reducing training and testing for the purpose of mitigation would result in an unacceptable impact on readiness for the following reasons:

The requirements to train are designed to provide the experience needed to ensure Sailors are properly prepared for operational success. Training requirements have been developed through many years of iteration and are designed to ensure Sailors achieve the levels of readiness needed to properly respond to the many contingencies that may occur during an actual mission. The Proposed Action does not include training beyond levels required for maintaining satisfactory levels of readiness due to the need to efficiently use limited resources (e.g., fuel, personnel, and time). Therefore, any reduction of training would not allow Sailors to achieve satisfactory levels of readiness needed to accomplish their mission.

The requirements to test systems prior to their implementation in military activities are identified in Department of Defense (DoD) Directive 5000.1. This directive states that test and evaluation support is to be integrated throughout the defense acquisition process. The Navy rigorously collected data during the developmental stages of this EIS/OEIS to accurately quantify test activities necessary to meet requirements of DoD Directive 5000.1. These testing requirements are designed to determine whether systems perform as expected and are operationally effective, suitable, survivable, and safe for their intended use. Any reduction of testing activities would not allow the Navy to meet its purpose and need to achieve requirements set forth in DoD Directive 5000.1.

5.3.4.1.2 Replacing Training and Testing with Simulated Activities

Replacing training and testing activities with simulated activities for the purpose of mitigation would result in an unacceptable impact on readiness for the reasons below.

As described in Section 2.5.1.3 (Simulated Training and Testing), the Navy currently uses computer simulation for training and testing whenever possible. Computer simulation can provide familiarity and complement live training; however, it cannot provide the fidelity and level of training necessary to prepare naval forces for deployment.

The Navy is required by law to operationally test major platforms, systems, and components of these platforms and systems in realistic combat conditions before full-scale production can occur. Substituting simulation for live training and testing fails to meet the purpose of and need for the Proposed Action and therefore was eliminated from consideration as a mitigation measure.

5.3.4.1.3 Reducing Sonar Source Levels and Total Number of Hours

Active sonar is only used when required by the mission since it has the potential to alert opposing forces to the sonar platform's presence. Passive sonar and all other sensors are used in concert with active sonar to the maximum extent practicable when available and when required by the mission. Reducing active sonar source levels and the total number of active sonar hours used during training and testing activities for the purpose of mitigation would adversely impact the effectiveness of military readiness activities and increase safety risks to personnel for the reasons below.

Sonar operators need to train as they would operate during real world combat situations. Operators of sonar equipment are always cognizant of the environmental variables affecting sound propagation. In this regard, sonar equipment power levels are always set consistent with mission requirements. Reducing sonar source levels for the purpose of mitigation precludes sonar operators from learning to operate the sonar systems with their entire range of capabilities throughout the extremely diverse range of environmental conditions they may encounter. Failure to train with the entire range of capabilities will reduce the effectiveness of the sonar operators should their skills be required during real world events. Not only would they not develop the skills necessary to identify and track submarines at the maximum distances of their systems capabilities, they would not learn how to use their systems' capabilities during the entire range of environmental conditions they may encounter. Likewise, they would not develop the knowledge of how to fully integrate multiple anti-submarine warfare capabilities, including other ships and aircraft into an integrated anti-submarine warfare team.

Failure to train with the entire range of capabilities also compromises training by reducing the ability for a sonar operator to detect, track, and hold an enemy target, mine, or other object, and by reducing the realism of other training scenarios (e.g., navigation training). Particularly during a strike group exercise, sonar operators need to learn to handle real world combat situations (e.g., the ability to manage sonar operations during periods of mutual interference, which can occur when more than one sonar system is operating simultaneously). Training with reduced sonar source levels would ultimately condition Sailors to expect conditions that they would not experience in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the strike group's ability to achieve mission success. The Navy must test its systems in the same way they would be used for military readiness activities. Reducing sonar source levels during testing would impact the ability to determine whether systems are operationally effective, suitable, survivable, and safe. Ultimately, reducing sonar source levels would reduce training and testing realism. Reducing the total number of sonar hours used during training and testing would prevent the Navy from meeting its military readiness qualification standards.

5.3.4.1.4 Implementing Active Sonar Ramp-Up Procedures During Training

Implementing active sonar ramp-up procedures (slowly increasing the sound in the water to necessary levels) in an attempt to clear the range prior to conducting activities for the purpose of mitigation during training activities would result in an unacceptable impact on readiness and would not necessarily be effective at reducing potential impacts on marine species for the following reasons:

Ramp-up procedures would alert opponents to the participants' presence. This would consequently negatively affect the realism of training because the target submarine could detect the searching unit before the searching unit could detect the target submarine, enabling the target submarine to take evasive measures. This is not representative of a real-world situation and thereby would impact training realism and effectiveness. Training with reduced realism would alter sailors' abilities to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the sonar operator's ability to achieve mission success.

Although ramp-up procedures have been used for some testing activities, effectiveness at avoiding or reducing impacts on marine mammals has not been demonstrated. Until evidence suggests that ramp-up procedures are effective means of avoiding or reducing potential impacts on marine mammals, the Navy will not implement this measure for training activities and is also proposing to eliminate its implementation for testing activities as part of the Proposed Action (Section 5.3.4.2.1, Implementing Active Sonar Ramp-Up Procedures During Testing).

5.3.4.1.5 Reducing Vessel Speed

As described in Section 5.1.1 (Vessel Safety), as a standard operating procedure, Navy personnel are required to use extreme caution and operate at a slow, safe speed consistent with mission and safety. These standard operating procedures are designed to allow a vessel to take proper and effective action to avoid a collision with any sighted object or disturbance (which may include a marine mammal), and to stop within a distance appropriate to the prevailing circumstances and conditions. Implementing widespread reductions in vessel speed throughout the Study Area for the purpose of mitigation would be impractical with regard to military readiness activities, and result in an unacceptable impact on readiness for the reasons below.

Vessel operators need to be able to react to changing tactical situations and evaluate system capabilities in training and testing as they would in actual combat. Widespread speed restrictions would not allow the Navy to properly test vessel capabilities, for example, during full power propulsion testing during sea trials. Training with reduced realism would alter Sailors' abilities to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the vessel operator's ability to achieve mission success.

5.3.4.1.6 Limiting Access to Training and Testing Locations

Limiting training and testing activities to specific locations for the purpose of mitigation would be impractical with regard to implementation, would adversely impact the effectiveness of military readiness activities, and would increase safety risks to personnel for the reasons below.

As described in Section 2.5.1.1 (Alternative Training and Testing Activity Locations), the ability to use the diverse and multidimensional capabilities of each range complex and testing range results in the Navy's ability to develop and maintain high levels of readiness. Major exercises using integrated warfare components require large areas of the littorals, open ocean, and certain nearshore areas for realistic and safe training. Limiting training and testing (including the use of sonar and other active acoustic sources or explosives) to specific locations (e.g., abyssal waters and surveyed offshore waters) and avoiding areas (e.g., embayments or large areas of the littorals and open ocean) would be impractical to implement with regard to the need to conduct activities in proximity to certain facilities and range complexes. These restrictions would also adversely impact the safety of the training and testing activities by requiring activities to take place in more remote areas where safety support may be limited.

Training and testing activities require continuous access to large areas consisting potentially of thousands of square miles of ocean and air space to provide naval personnel the ability to train with and develop competence and confidence in their capabilities and their entire suite of weapons and sensors. Exercises may change mid-stream based on evaluators' assessments of performance and other conditions including weather or mechanical issues. These may preclude use of a permission scheme for access to water space. Threats to national security are constantly evolving and the Navy requires the ability to adapt training to meet these emerging threats as well as develop and test systems to effectively operate in these environments. Restricting access to limited locations would impact the ability of Navy training and testing to evolve as the threat evolves. Operational units already incorporate requirements for safety of personnel including air space and shipping routes. Safety restrictions may include limits on distance from military air fields during carrier flight operations and air traffic corridors for safety of military and civilian aviation. These types of limitations shape how exercise planners develop and implement training scenarios including those involving defense of aircraft carriers from submarines.

Therefore, limiting access to training and testing locations would reduce realism of training by restricting access to important real world combat situations, such as bathymetric features and varying oceanographic features. As described in Section 5.3.4.1.7 (Avoiding Locations Based on Bathymetry and Environmental Conditions), Sailors must be trained to handle bottom bounce, sound passing through changing currents, eddies, or across changes in ocean temperature, pressure, or salinity. Training in a few specific locations would alter Sailors' abilities to effectively operate in varying real world combat situations, thereby resulting in an unacceptable increased risk to personnel safety and the ability to achieve mission success.

5.3.4.1.7 Avoiding Locations Based on Bathymetry and Environmental Conditions

Avoiding locations for training and testing activities based on bathymetry and environmental conditions for the purpose of mitigation would increase safety risks to personnel and result in an unacceptable impact on readiness for the reasons below.

Areas where training and testing activities are scheduled to occur are carefully chosen to provide safety and allow realism of events. As described in Section 2.5.1.1 (Alternative Training and Testing Activity Locations), the varying environmental conditions of the Study Area (e.g., bathymetry and topography) maximize the training realism and testing effectiveness. Limiting training and testing (including the use of sonar and other active acoustic sources or explosives) to avoid steep or complex bathymetric features (e.g., submarine canyons and large seamounts) and oceanographic features (e.g., surface fronts and variations in sea surface temperatures) would reduce the realism of the military readiness activity. Systems must be tested in a variety of bathymetric and environmental conditions to ensure functionality and accuracy in a variety of environments. Sonar operators need to train as they would operate during real world combat situations. Because real world combat situations include diverse bathymetric and environmental conditions, Sailors must be trained to handle bottom bounce, sound passing through changing currents, eddies, or across changes in ocean temperature, pressure, or salinity. Training with reduced realism would alter Sailors' abilities to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the sonar operator's ability to achieve mission success.

5.3.4.1.8 Avoiding or Reducing Active Sonar at Night and During Periods of Low Visibility

Avoiding or reducing active sonar at night and during periods of low visibility for the purpose of mitigation would result in an unacceptable impact on readiness for the reasons below.

The Navy must train in the same manner as it will fight. Anti-submarine warfare can require a significant amount of time to develop the "tactical picture," or an understanding of the battle space (e.g., area searched or unsearched, identifying false contacts, and understanding the water conditions). Reducing or securing power in low-visibility conditions would affect a commander's ability to develop this tactical picture and would not provide the needed training realism. Training differently from what would be needed in an actual combat scenario would decrease training effectiveness, reduce the crew's abilities, and introduce an increased safety risk to personnel.

Mid-frequency active sonar training is required year-round in all environments, including night and low-visibility conditions. Training occurs over many hours or days, which requires large teams of personnel working together in shifts around the clock to work through a scenario. Training at night is vital because environmental differences between day and night affect the detection capabilities of sonar. Temperature layers that move up and down in the water column and ambient noise levels can vary significantly between night and day, which affects sound propagation and could affect how sonar systems are operated. Consequently, personnel must train during all hours of the day to ensure they identify and respond to changing environmental conditions, and not doing so would unacceptably decrease training effectiveness and reduce the crews' abilities. Therefore, the Navy cannot operate only in daylight hours or wait for the weather to clear before training.

The Navy must test its systems in the same way they would be used for military readiness activities. Reducing or securing power in adverse weather conditions or at night would impact the ability to determine whether systems are operationally effective, suitable, survivable, and safe. Additionally, some systems have a nighttime testing requirement. Therefore, Navy personnel cannot operate only in daylight hours or wait for the weather to clear before or during all test events.

5.3.4.1.9 Avoiding or Reducing Active Sonar during Strong Surface Ducts

Avoiding or reducing active sonar during strong surface ducts for the purpose of mitigation would increase safety risks to personnel, be impractical with regard to implementation of military readiness activities, and result in an unacceptable impact on readiness for the reasons below.

The Navy must train in the same manner as it will fight. Anti-submarine warfare can require a significant amount of time to develop the "tactical picture," or an understanding of the battle space such as area searched or unsearched, identifying false contacts, understanding the water conditions, etc. Surface ducting is a condition when water conditions (e.g., temperature layers, lack of wave action) result in little sound energy penetrating beyond a narrow layer near the surface of the water. Submarines have long been known to exploit the phenomena associated with surface ducting. Therefore, training in surface ducting conditions is a critical component to military readiness because sonar operators need to learn how sonar transmissions are altered due to surface ducting, how submarines may take advantage of them, and how to operate sonar effectively in this environment. Avoiding or reducing active sonar during surface ducting conditions would affect a commander's ability to develop this tactical picture and would not provide the needed training realism. Diminished realism would reduce a sonar operator's ability to effectively operate in a real world combat situation, thereby resulting in an unacceptable increased risk to personnel safety and the ability to achieve mission success.

Furthermore, avoiding surface ducting would be impractical to implement because ocean conditions contributing to surface ducting change frequently, and surface ducts can be of varying duration. Surface ducting can also lack uniformity and may or may not extend over a large geographic area, making it difficult to determine where to reduce power and for what periods.

5.3.4.1.10 Avoiding Locations Based on Distances from Isobaths or Shorelines

Avoiding locations for training and testing activities within the Study Area based on wide-scale distances from isobaths or the shoreline for the purpose of mitigation would be impractical with regard to implementation of military readiness activities, result in unacceptable impact on readiness, and would not be an effective means of mitigation, and would increase safety risks to personnel for the reasons below.

A measure requiring avoidance of mid-frequency active sonar within 13 nm of the 656 ft. (200 m) isobaths was part of the Rim of the Pacific Exercise 2006 authorization by NMFS. This measure, as well as similar measures of like distances, lacks any scientific basis when applied to the context of the MITT Study Area (e.g., bathymetry, sound propagation, and width of channels). There is no scientific analysis indicating this measure is protective and no known basis for these specific metrics. The Rim of the Pacific 2006 exercise mitigation measure precluded active anti-submarine training in the littoral region, which significantly impacted realism and training effectiveness (e.g., protecting ships from submarine threats during amphibious landings). This mitigation procedure had no observable effect on the protection of marine mammals during Rim of the Pacific 2006 exercises, and its value is unclear; however, its adverse effect on realistic training, as with all arbitrary distance from land restrictions, is significant.

Training in shallower water is an essential component to maintaining military readiness. Sound propagates differently in shallower water and operators must learn to train in this environment. Additionally, submarines have become quieter through the use of improved technology and have learned to hide in the higher ambient noise levels of the shallow waters of coastal environments. In real world events, it is highly likely Sailors would be working in, and therefore must train in, these types of areas.

Areas where training and testing activities are scheduled to occur are carefully chosen to provide safety and allow realism of events. The proximity to facilities, range complexes, and testing ranges is essential to the training and testing realism and effectiveness required to train and certify naval forces ready for combat operations. Limiting access to nearshore areas would restrict access to certain training and testing locations and would increase transit time for these activities, which would result in an increased risk to personnel safety, particularly for platforms with fuel restrictions (e.g., aircraft) or for certain activities such as mine countermeasures and neutralization activities using diver-placed mines.

The ability to use the diverse and multi-dimensional capabilities of each range complex and testing range results in the Navy's ability to develop and maintain high levels of readiness. Otherwise limiting training and testing (including the use of sonar and other active acoustic sources or explosives) to avoid arbitrary distances from isobaths or the shoreline would adversely impact the effectiveness of the training and testing. This includes avoiding conducting activities within 12 nm from shore, 25 nm from shore, between shore and the 20 m isobath, and 13 nm out from the 656 ft. (200 m) isobath. Operating in shallow water is essential in order to provide realistic training on real world combat conditions with regard to shallow water sound propagation.

5.3.4.1.11 Avoiding Marine Protected Areas

Avoiding marine protected areas for the purpose of mitigation would increase safety risks to personnel, be impractical with regard to implementation, and would not be warranted based on the discussions presented in Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses for biological resources and Section 6.1.2 (Marine Protected Areas).

Refer to Section 6.1.2 (Marine Protected Areas) for a discussion on the activities that are expected to occur within marine protected areas in the Study Area. Ultimately, limiting access to training and testing locations that overlap, are contained within, or are adjacent to marine protected areas would reduce realism of training by restricting access to important real world combat situations, such as bathymetric features and varying oceanographic features. As described in Section 2.5.1.1 (Alternative Training and Testing Locations), the ability to use the diverse and multidimensional capabilities of each range complex and testing range results in the Navy's ability to develop and maintain high levels of readiness. Major exercises using integrated warfare components require large areas of the littorals, open ocean, and certain nearshore areas for realistic and safe training. Limiting training and testing to specific locations and avoiding all marine protected areas would be impractical to implement with regard to the need to conduct activities in proximity to certain facilities, range complexes, and testing ranges. The Navy typically conducts activities in proximity to certain facilities, range complexes, and testing ranges in order to reduce travel time and funding required to conduct training away from a unit's home base. Activities involving the use of helicopters typically occur in proximity to shore or refueling stations due to fuel restrictions and personnel safety. Training and testing location limitations would also adversely impact the safety of the training and testing activities by requiring activities to take place in more remote areas where safety support may be limited. Refer to Section 5.3.4.1.6 (Limiting Access to Training and Testing Locations) for further discussion on the impacts of limiting access to training and testing locations on the Navy's ability to maintain military readiness.

5.3.4.1.12 Avoiding Marine Species Habitats

Navy has recommended measures within several marine habitat areas (Section 5.3.3.1.1.1, Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks) that have been well-documented as important habitats for particular species and in which implementation of mitigation would not result in unacceptable impacts on readiness. Otherwise avoiding all marine species habitats (e.g., foraging locations, reproductive locations, migration corridors, and locations of modeled takes) for the purpose of mitigation would be impractical with regard to implementation of military readiness activities, would result in unacceptable impact on readiness, and would increase safety risks to personnel for the following reasons:

As described in Section 5.3.4.1.6 (Limiting Access to Training and Testing Locations) and Section 5.3.4.1.7 (Avoiding Locations Based on Bathymetry and Environmental Conditions), areas where training and testing activities are scheduled to occur are carefully chosen to provide safety and allow realism of events, and the varying environmental conditions of these areas maximize the training realism and testing effectiveness. Activity locations inevitably overlap a wide array of marine species habitats, including foraging habitats, reproductive areas, and migration corridors. Otherwise limiting activities to avoid these habitats would adversely impact the effectiveness of the training or testing activity, and would therefore result in an unacceptable increased risk to personnel safety and the ability to achieve mission success.

As described in the *Determination of Acoustic Effects on Marine Mammals and Sea Turtles for the Mariana Islands Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement* technical report (Marine Species Modeling Team 2013), modeling locations were developed based on historical data and anticipated future needs. The model does not provide information detailed enough to analyze or compare locations based on potential take levels for each activity; therefore, applying the modeling results to inform development of mitigation areas would not be appropriate.

5.3.4.1.13 Increasing Visual and Passive Acoustic Observations

Increasing visual and passive acoustic observations for the purpose of mitigation would be impractical with regard to implementation of military readiness activities and result in unacceptable impact on readiness for the reasons below.

The Navy recommended mitigation measures already represent the maximum level of effort (e.g., numbers of Lookouts and passive sonobuoys) that the Navy can commit to observing mitigation zones given the number of personnel that will be involved and the number and type of assets and resources available. The number of Lookouts that the Navy recommends for each measure often represents the maximum capacity based on limited resources (e.g., space and manning restrictions). For example, platforms such as the Littoral Combat Ship are minimally manned and are therefore physically unable to accommodate more than one Lookout. Furthermore, training and testing activities are carefully planned with regard to personnel duties. Requiring additional Lookouts would either require adding personnel, for which there would be no additional space, or reassigning duties, which would divert Navy personnel from essential tasks required to meet mission objectives.

The Navy will conduct passive acoustic monitoring during several activities with Navy assets, such as sonobuoys, already participating in the activity (e.g., sinking exercises, torpedo [explosive] testing, and improved extended echo ranging sonobuoys). Refer to Section 5.3.2 (Mitigation Zone Procedural Measures) for additional information on the use of passive acoustics during training and testing activities. The Navy does not have the resources to construct and maintain additional passive acoustic monitoring systems for each training and testing activity.

5.3.4.1.14 Increasing the Size of Observed Mitigation Zones

Increasing the size of observed mitigation zones for the purpose of mitigation would be impractical with regard to implementation of military readiness activities and result in unacceptable impact on readiness for the reasons below.

The Navy developed activity-specific mitigation zones based on the Navy's acoustic propagation model. In this MITT analysis, the Navy developed each recommended mitigation zone to avoid or reduce the potential for onset of the lowest level of injury, PTS, out to the predicted maximum range. Mitigating to the predicted maximum range to PTS consequently also mitigates to the predicted maximum range to onset mortality (1 percent mortality), onset slight lung injury, and onset slight gastrointestinal tract injury, since the maximum range to effects for these criteria are shorter than for PTS. Furthermore, in most cases, the predicted maximum range to PTS also covers the predicted average range to TTS. In some instances, the Navy recommends mitigation zones that are larger or smaller than the predicted maximum range to PTS based on the associated effectiveness and operational assessments presented in Section 5.3.2 (Mitigation Zone Procedural Measures).

The Navy-recommended mitigation zones represent the maximum area the Navy can effectively observe based on the platform of observation, number of personnel that will be involved, and the number and type of assets and resources available. As mitigation zone sizes increase, the potential for reducing impacts decreases. For instance, if a mitigation zone increases from 1,000 to 4,000 yd. (914 to 3,658 m), the area that must be observed increases 16-fold. The Navy recommended mitigation measures balance the need to reduce potential impacts with the ability to provide effective observations throughout a given mitigation zone. Implementation of mitigation zones is most effective when the zone is appropriately sized to be realistically observed. The Navy does not have the resources to maintain additional Lookouts or observer platforms that would be needed to effectively observe mitigation zones of increased size. Further, as explained above, the number of Lookouts that the Navy recommends for each measure often represents the maximum capacity based on limited resources (e.g., space and manning restrictions). For example, platforms such as the Littoral Combat Ship are minimally manned and are therefore physically unable to accommodate more than one Lookout. Training and testing activities are carefully planned with regard to personnel duties. Requiring observation of mitigation zones of increased size would either require adding personnel, for which there would be no additional space or resources, or reassigning duties, which would divert Navy personnel from essential tasks required to meet mission objectives. For some activities, Lookouts are required to observe for indicators of potential marine mammal and sea turtle presence within the mitigation zone to further help reduce the potential for injury to occur.

5.3.4.1.15 Conducting Visual Observations Using Third-Party Observers

With limited exceptions, use of third-party observers (e.g., trained marine species observers) in air or on surface platforms in addition to existing Navy Lookouts for the purposes of mitigation would be impractical with regard to implementation of military readiness activities and result in unacceptable impact on readiness for the reasons below.

Navy personnel are extensively trained in spotting items on or near the water surface. Use of Navy Lookouts ensures immediate implementation of mitigation if marine species are sighted. A critical skill set of effective Navy training is communication. Navy Lookouts are trained to act swiftly and decisively to ensure that appropriate actions are taken. Additionally, multiple training and testing events can occur simultaneously and in various regions throughout the Study Area, and can last for days or weeks at a time. The Navy does not have the resources to maintain third-party observers to accomplish the task for every event.

The use of third-party observers would compromise security for some activities involving active sonar due to the requirement to provide advance notification of specific times and locations of Navy platforms. Reliance on the availability of third-party personnel would impact training and testing flexibility. The presence of other aircraft in the vicinity of naval activities would raise safety concerns for both the commercial observers and naval aircraft. Furthermore, vessels have limited passenger capacity. Training and testing event planning includes careful consideration of this limited capacity in the placement of personnel on ships involved in the event. Inclusion of non-Navy observers onboard these vessels would require that in some cases there would be no additional space for essential Navy personnel required to meet the exercise objectives.

The areas where training events will most likely occur in the Study Area cover approximately 1 million square nautical miles. Contiguous anti-submarine warfare events may cover many hundreds or even thousands of square miles. The number of civilian vessels or aircraft required to monitor the area of these events would be considerable. It is, thus, not feasible to survey or monitor the large exercise areas in the time required. In addition, marine mammals may move into or out of an area, if surveyed before an event, or an animal could move into an area after an event took place. Given that there are no adequate controls to account for these or other possibilities, there is little utility to performing extensive before or after event surveys of large exercise areas as a mitigation measure.

Surveying during an event raises safety issues with multiple, slow civilian aircraft operating in the same airspace as military aircraft engaged in combat training activities. In addition, many of the training and testing events take place far from land, limiting both the time available for civilian aircraft to be in the event area and presenting a concern should aircraft mechanical problems arise. Scheduling civilian vessels or aircraft to coincide with training events would impact training effectiveness, since exercise event timetables cannot be precisely fixed and are instead based on the free-flow development of tactical situations. Waiting for civilian aircraft or vessels to complete surveys, refuel, or be on station would slow the progress of the exercise and impact the effectiveness of the military readiness activity.

5.3.4.1.16 Adopt Mitigation Measures of Foreign Nation Navies

Adopting mitigation measures of foreign navies generally for the purpose of mitigation, such as expanding the mitigation zones to match those used by a particular foreign navy, would be impractical with regard to implementation of military readiness activities and result in unacceptable impact on readiness for the following reasons:

Mitigation measures are carefully customized for and agreed upon by each individual navy based on potential impacts of the activities on marine species and the impacts of the mitigation measures on military readiness. Therefore, the mitigation measures developed for one navy would not necessarily be effective at reducing potential impacts on marine species by all navies. Similarly, mitigation measures that do not cause an unacceptable impact on one navy may cause an unacceptable impact on another. For example, most other navies do not possess an integrated strike group and do not have integrated training requirements. The Navy's training is built around the integrated warfare concept and is based on the Navy's capabilities, the threats faced, the operating environment, and the overall mission. Implementing other navies' mitigation would be incompatible with U.S. Navy requirements. The

U.S. Navy's recommended mitigation measures have been carefully designed to reduce potential impacts on marine species while not causing an unacceptable impact on readiness.

5.3.4.1.17 Increasing Reporting Requirements

The Navy has extensive reporting requirements, including exercise, testing, and monitoring reporting designed to verify implementation of mitigation, comply with current permits, and improve future environmental assessments (Section 5.5.2, Reporting). Increasing the requirement to report marine species sightings to augment scientific data collection and to further verify the implementation of mitigation measures is unnecessary and would increase safety risks to personnel, be impractical with regard to implementation of military readiness activities, and result in unacceptable impact on readiness for the reasons below.

Vessels, aircraft, and personnel engaged in training and testing events are intensively employed throughout the duration of training and testing activities. Any additional workload assigned that is unrelated to their primary duty would adversely impact personnel safety and the effectiveness of the military readiness activity they are undertaking. Lookouts are not trained to make accurate species-specific identification and would not be able to provide the detailed information that the scientific community would use. Alternatively, the Navy has an integrated comprehensive monitoring program (Section 5.5, Monitoring and Reporting) that does provide information that is available and useful to the scientific community in annual monitoring reports.

5.3.4.2 Previously Accepted but Now Eliminated

5.3.4.2.1 Implementing Active Sonar Ramp-Up Procedures During Testing

Some testing activities have implemented active sonar ramp-up procedures (slowly increasing the sound in the water to necessary levels) in an attempt to clear the range prior to conduct of activities for the purpose of mitigation. Although ramp-up procedures have been used for some testing activities, the effectiveness at avoiding or reducing impacts on marine mammals has not been demonstrated. Until evidence suggests that ramp-procedures are an effective means of avoiding or reducing potential impacts on marine mammals, and for reasons discussed in section 5.3.4.1.4 (Implementing Active Sonar Ramp-Up Procedures During Training), the Navy is proposing to eliminate the implementation of this measure for testing activities as part of the Proposed Action.

5.3.4.2.2 Implementing a Mitigation Zone for Missile Exercises with Airborne Targets

Per current mitigation, a mitigation zone of 1,000 yd. (914 m) is observed around the expected expended material field. The Navy is proposing to eliminate the need for a Lookout to maintain a mitigation zone for missile exercises involving airborne targets. Most airborne targets are recoverable aerial drones, and missile impact with the target does not typically occur. Most anti-air missiles used in training are telemetry configured (i.e., they do not have an actual warhead). Impact of a target is unlikely because missiles are designed to detonate (simulated detonation for telemetry missiles) in the vicinity of the target and not as a result of a direct strike on the target. Given the speed of the missile and the target, the high altitudes involved, and the long ranges of missile travel possible, it is not possible to definitively predict or to effectively observe where the missile fragments will fall. The potential expended material fall zone can only be predicted within tens of miles for long range events, which can be in excess of 80 nm from the firing location, and thousands of yards for shorter events, which can occur within several thousand yards from the firing location. Establishment of a mitigation zone for activities involving airborne targets would be ineffective at reducing potential impacts.

Furthermore, the potential risk to any marine mammal or sea turtle from a missile exercise with an airborne target is a direct strike from falling expended material. Based on the extremely low potential for a target strike and associated expended material field to co-occur in space and time with a marine species at or near the surface of the water, the potential for a direct strike is negligible.

5.3.4.2.3 Implementing a Mitigation Zone for Medium- and Large-Caliber Gunnery Exercises with Airborne Targets

Per current mitigation, a mitigation zone is observed in the vicinity of the expected military expended materials field. The Navy is proposing to eliminate the need for a Lookout to observe the vicinity of the expected military expended materials for medium- and large-caliber gunnery exercises involving airborne targets. The potential military expended materials fall zone can only be predicted within thousands of yards, which can be up to 7 nm from the firing location. Establishment of a mitigation zone for activities involving airborne targets would be ineffective at reducing potential impacts.

Furthermore, the potential risk to any marine mammal or sea turtle from a gunnery exercise with an airborne target is a direct strike from falling military expended materials. Based on the extremely low potential for military expended materials to co-occur in space and time with a marine species at or near the surface of the water, the potential for a direct strike is negligible.

5.3.4.2.4 Implementing Measures for Laser Test Operations

Visual surveys would be conducted for all testing activities involving laser line scan, light imaging detection, and ranging lasers. Per Navy standard operating procedures, only trained personnel operate lasers and visual observation of the area is conducted to ensure human safety. The Navy is proposing to discontinue this procedure as a mitigation measure because: (1) it is currently a standard operating procedure conducted for human safety, and (2) the environmental consequences analysis suggests that impacts on resources from laser activities are not expected.

5.4 MITIGATION SUMMARY – AT SEA

Table 5.4-1 provides a summary of the Navy's recommended mitigation measures. For reference, currently implemented mitigation measures for each activity category are also summarized in the table. The process for developing each of these measures is detailed in Section 5.2.3 (Assessment Method) and involved: (1) an effectiveness assessment to determine if implementation of the measure will likely result in avoidance or reduction of an impact on a resource; and (2) an operational assessment to determine if implementation of the measures will have acceptable operational impacts on the Proposed Action with regard to personnel safety, practicability of implementation, readiness, and Navy policy. Measures are intended to meet applicable regulatory compliance requirements for NEPA, Executive Order 12114, and Council on Environmental Quality guidance. The Navy recommended mitigation measures were also developed consistent with resource-specific environmental requirements, as follows:

- Measures specifying marine mammals and indicators of marine mammal presence (flocks of seabirds) as the protection focus are intended to meet MMPA requirements.
- Measures specifying marine mammals, sea turtles, flocks of seabirds, jellyfish aggregations, or shallow coral reefs as the protection focus are intended to meet ESA requirements.
- Measures specifying shallow coral reefs, live hardbottom, artificial reefs, or shipwrecks as the protection focus are intended to meet Essential Fish Habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act.

- Measures specifying shipwrecks is an additional protection focus intended to meet Abandoned Shipwreck Act and National Historic Preservation Act requirements.

The measures presented in Table 5.4-1 are discussed in greater detail in Section 5.3.1 (Lookout Procedural Measures), Section 5.3.2 (Mitigation Zone Procedural Measures), and Section 5.3.3 (Mitigation Areas). As discussed in Section 5.2.2.2 (Protective Measures Assessment Protocol), the final suite of mitigations resulting from the ongoing planning for this Final EIS/OEIS, as well as the regulatory consultation and permitting processes, will be integrated into the Protective Measures Assessment Protocol for implementation purposes. Section 5.5 (Monitoring and Reporting) describes the monitoring and reporting efforts the Navy will undertake to investigate the effectiveness of implemented mitigation measures and to better understand the impacts of the Proposed Action on marine resources

Table 5.4-1: Summary of Recommended Mitigation Measures

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Specialized Training	Lookouts will complete the Introduction to the U.S. Navy Afloat Environmental Compliance Training Series and the U.S. Navy Marine Species Awareness Training or civilian equivalent.	The mitigation zones observed by Lookouts are specified for each Mitigation Zone Procedural Measure below.	Applicable personnel will complete the U.S. Navy Marine Species Awareness Training prior to standing watch or serving as a Lookout.
Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar during Anti-Submarine Warfare and Mine Warfare	2 Lookouts (general) 1 Lookout (minimally manned, moored, or anchored)	Sources that can be powered down: 1,000 yd. (914 m) and 500 yd. (457 m) power downs and 200 yd. (183 m) shutdown for marine mammals (hull-mounted mid-frequency and low-frequency) and sea turtles (low-frequency only). Sources that cannot be powered down: 200 yd. (183 m) shutdown for marine mammals and sea turtles.	Hull-mounted mid-frequency: 1,000 yd. (914 m) and 500 yd. (457 m) power downs and 200 yd. (183 m) shutdown for marine mammals and sea turtles Low-frequency: None
High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar	1 Lookout	200 yd. (183 m) for marine mammals (high-frequency and mid-frequency), sea turtles (bins MF8, MF9, MF10, and MF12 only)	Non-hull mounted mid-frequency: 200 yd. (183 m) for marine mammals High-frequency: None
Improved Extended Echo Ranging Sonobuoys	1 Lookout	600 yd. (549 m) for marine mammals and sea turtles Passive acoustic monitoring conducted with Navy assets participating in the activity.	1,000 yd. (914 m) for marine mammals and sea turtles Passive acoustic monitoring conducted with Navy assets participating in the activity.
Explosive Sonobuoys using >0.5–2.5 lb. NEW	1 Lookout	350 yd. (320 m) for marine mammals and sea turtles Passive acoustic monitoring conducted with Navy assets participating in the activity.	None
Anti-Swimmer Grenades	1 Lookout	200 yd. (183 m) for marine mammals and sea turtles	None

Table 5.4-1: Summary of Recommended Mitigation Measures (continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Mine Countermeasures and Mine Neutralization using Positive Control Firing Devices	General: 1 or 2 Lookouts (NEW dependent) Diver-placed: 2 Lookouts Lookouts will survey the mitigation zone prior to and after the detonation event.	NEW dependent for marine mammals, sea turtles, and scalloped hammerhead sharks.	None
Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices	4 Lookouts Lookouts will survey the mitigation zone prior to and after the detonation event.	Up to 10-minute time-delay using up to 20 lb. NEW: 1,000 yd. (915 m) for marine mammals, sea turtles, and scalloped hammerhead sharks.	10-minute time-delay on up to 10 lb. NEW: 1,500 yd. (1,372 m) for marine mammals and sea turtles
Explosive and Non-Explosive Gunnery Exercises – Small- and Medium-Caliber Using a Surface Target	1 Lookout	200 yd. (183 m) for marine mammals and sea turtles	None
Explosive and Non-Explosive Gunnery Exercises – Large-Caliber Using a Surface Target	1 Lookout	Explosive: 600 yd. (549 m) for marine mammals and sea turtles Non-Explosive: 200 yd. (183 m) for marine mammals and sea turtles Both: 70 yd. (64 m) within 30 degrees on either side of the gun target line on the firing side for marine mammals and sea turtles Both: 350 yd. (320 m) for surveyed shallow coral reefs	Explosive: 600 yd. (549 m) for marine mammals, sea turtles and surveyed shallow coral reefs Non-Explosive: 200 yd. (183 m) for marine mammals and sea turtles. Both: 70 yd. (64 m) around entire ship for marine mammals and sea turtles.

Table 5.4-1: Summary of Recommended Mitigation Measures (continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Non-Explosive Missile Exercises and Explosive Missile Exercises (Including Rockets) up to 250 lb. NEW using a Surface Target	1 Lookout	900 yd. (823 m) for marine mammals and sea turtles 350 yd. (320 m) for surveyed shallow coral reefs	1,800 yd. (1.7 km) for marine mammals, sea turtles
Explosive Missile Exercises (Including Rockets) from >250 to 500 lb. NEW using a Surface Target	1 Lookout	2,000 yd. (1.8 km) for marine mammals and sea turtles 350 yd. (320 m) for surveyed shallow coral reefs	None
Bombing Exercises, Explosive and Non-Explosive	1 Lookout	Explosive: 2,500 yd. (2.3 km) for marine mammals and sea turtles Non-Explosive: 1,000 yd. (914 m) for marine mammals and sea turtles Both: 350 yd. (320 m) for surveyed shallow coral reefs	Explosive: 1,000 yd. (914 m) for marine mammals, sea turtles Non-Explosive: 1,000 yd. (914 m) for marine mammals, sea turtles
Torpedo (Explosive) Testing	1 Lookout	2,100 yd. (1.9 km) for marine mammals and sea turtles and jellyfish aggregations Passive acoustic monitoring conducted with Navy assets participating in the activity.	None
Sinking Exercises	2 Lookouts	2.5 nm for marine mammals and sea turtles and jellyfish aggregations. Passive acoustic monitoring conducted with Navy assets participating in the activity.	2.0 nm for marine mammals, sea turtles, and jellyfish aggregations
Vessel Movements	1 Lookout	500 yd. (457 m) for whales 200 yd. (183 m) for all other marine mammals (except bow riding dolphins)	500 yd. (457 m) for whales 200 yd. (183 m) for all other marine mammals (except bow riding dolphins)
Towed In-Water Device Use	1 Lookout	250 yd. (229 m) for marine mammals	250 yd. (229 m) for marine mammals

Table 5.4-1: Summary of Recommended Mitigation Measures (continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Current Measure and Protection Focus
Precision Anchoring	No Lookouts in addition to standard personnel standing watch	Avoidance of precision anchoring within the anchor swing diameter of shallow coral reefs, live hardbottom, artificial reefs, and shipwrecks Except at existing anchorages as well as at near-shore training areas around Guam and in Apra Harbor, the Navy will not conduct precision anchoring activities within the anchor swing diameter of surveyed shallow coral reefs, live hardbottom, artificial reefs, and shipwrecks.	None
Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks	No Lookouts in addition to standard personnel standing watch	Except at existing anchorages as well as at near-shore training areas around Guam and in Apra Harbor, the Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities within 350 yd. (320 m) of surveyed shallow coral reefs, live hardbottom, artificial reefs, and shipwrecks. No explosive or non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target, explosive or non-explosive missile exercises using a surface target, and explosive and non-explosive bombing exercises within 350 yd. (320 m) of surveyed shallow coral reefs	Varying mitigation zone distances based on marine mammal ranges to effects

Notes: ft. = feet, km = kilometers, lb. = pounds, m = meters, NEW = net explosive weight, nm = nautical miles, yd. = yards

5.5 MONITORING AND REPORTING

5.5.1 APPROACH TO MONITORING

The Navy is committed to demonstrating environmental stewardship while executing its National Defense Mission and complying with the suite of Federal environmental laws and regulations. As a complement to the Navy's commitment to avoiding and reducing impacts of the Proposed Action through mitigation, the Navy will undertake monitoring efforts to track compliance with take authorizations, help evaluate the effectiveness of implemented mitigation measures, and gain a better understanding of the effects of the Proposed Action on marine resources. Taken together, mitigation and monitoring comprise the Navy's integrated approach for reducing environmental impacts from the Proposed Action. The Navy's overall monitoring approach will seek to leverage and build on existing research efforts whenever possible.

Consistent with the cooperating agency agreement with NMFS, mitigation and monitoring measures presented in this EIS/OEIS focus on the requirements for protection and management of marine resources. A well-designed monitoring program can provide important feedback for validating assumptions made in analyses and allow for adaptive management of marine resources. For example, based on the hydrographic and beach surveys performed prior to Amphibious Assault and Amphibious Raids, if boat lanes and beach landing areas are clear of obstructions, coral, or hard bottom substrate the activity could be conducted and crews would follow procedures to avoid obstructions to navigation, including coral reefs. However, if there is any potential for impacts on corals or hard bottom substrate, the Navy will coordinate with applicable resource agencies before conducting the activity (see Section 5.1.8, Amphibious Assault and Amphibious Raid Procedures).

Since monitoring will be required for compliance with the Letter of Authorization issued for the Proposed Action under the MMPA, details of the monitoring program will be developed in coordination with NMFS through the regulatory process. Discussions with resource agencies during the consultation and permitting processes may result in changes to the mitigation as described in this document. Such changes will be reflected in the Record of Decision, and consultation documents such as the ESA Biological Opinion.

5.5.1.1 Integrated Comprehensive Monitoring Program

The Integrated Comprehensive Monitoring Program is intended to coordinate monitoring efforts across all regions where the Navy trains and tests and to allocate the most appropriate level and type of effort for each range complex (U.S. Department of the Navy 2010). The current Navy monitoring program is composed of a collection of "range-specific" monitoring plans, each of which was developed individually as part of MMPA and ESA compliance processes as environmental documentation was completed. These individual plans establish specific monitoring requirements for each range complex or testing range and are collectively intended to address the Integrated Comprehensive Monitoring Plan top-level goals.

A 2010 Navy-sponsored monitoring meeting in Arlington, Virginia, initiated a process to critically evaluate the current Navy monitoring plans and begin development of revisions and updates to both existing region-specific plans as well as the Integrated Comprehensive Monitoring Plan. Discussions at that meeting as well as the following Navy and NMFS annual adaptive management meeting established a way ahead for continued refinement of the Navy's monitoring program. This process included establishing a Scientific Advisory Group of leading marine mammal scientists with the initial task of developing recommendations that would serve as the basis for a Strategic Plan for Navy monitoring. The Strategic Plan is intended to be a primary component of the Integrated Comprehensive Monitoring

Program, and provide a "vision" for Navy monitoring across geographic regions, and serve as guidance for determining how to most efficiently and effectively invest the marine species monitoring resources to address Integrated Comprehensive Monitoring Plan top-level goals and satisfy MMPA Letter of Authorization regulatory requirements.

The objective of the Strategic Plan is to continue the evolution of Navy marine species monitoring towards a single integrated program, incorporating Scientific Advisory Group recommendations, and establishing a more transparent framework for soliciting, evaluating, and implementing monitoring work across the range complexes and testing ranges. The Strategic Plan must consider a range of factors in addition to the scientific recommendations including logistic, operational, and funding considerations and will be revised regularly as part of the annual adaptive management process.

The Integrated Comprehensive Monitoring Plan establishes top-level goals that have been developed in coordination with NMFS (U.S. Department of the Navy 2010). The following top-level goals will become more specific with regard to identifying potential projects and monitoring field work through the Strategic Planning Process as projects are evaluated and initiated in the MITT Study Area.

- An increase in the understanding of the likely occurrence of marine mammals or ESA-listed marine species in the vicinity of the action (i.e., presence, abundance, distribution, and density of species);
- An increase in the understanding of the nature, scope, or context of the likely exposure of marine mammals and ESA-listed species to any of the potential stressor(s) associated with the action (e.g., tonal and impulse sound), through better understanding of one or more of the following: (1) the action and the environment in which it occurs (e.g., sound source characterization, propagation, and ambient noise levels), (2) the affected species (e.g., life history or dive patterns), (3) the likely co-occurrence of marine mammals and ESA-listed marine species with the action (in whole or part) associated with specific adverse impacts, or (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving or feeding areas);
- An increase in the understanding of how individual marine mammals or ESA-listed marine species respond (behaviorally or physiologically) to the specific stressors associated with the action (in specific contexts, where possible, e.g., at what distance or received level);
- An increase in the understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: (1) the long-term fitness and survival of an individual; or (2) the population, species, or stock (e.g., through impacts on annual rates of recruitment or survival);
- An increase in the understanding of the effectiveness of mitigation and monitoring measures;
- A better understanding and record of the manner in which the authorized entity complies with the Incidental Take Authorization and Incidental Take Statement;
- An increase in the probability of detecting marine mammals (through improved technology or methods), both specifically within the mitigation zone (thus allowing for more effective implementation of the mitigation) and in general, to better achieve the above goals; and
- A reduction in the adverse impact of activities to the least practicable level, as defined in the MMPA.

5.5.1.2 Scientific Advisory Group Recommendations

Navy established the Scientific Advisory Group in 2011 with the initial task of evaluating current Navy monitoring approaches under the Integrated Comprehensive Monitoring Plan and existing MMPA Letters of Authorization and developing objective scientific recommendations that would form the basis for the Strategic Plan. While recommendations were fairly broad and not prescriptive from a range complex perspective, the Scientific Advisory Group did provide specific programmatic recommendations that serve as guiding principles for the continued evolution of the Navy Marine Species Monitoring Program and provide a direction for the Strategic Plan to move this development. Key recommendations include:

- Working within a conceptual framework of knowledge, from basic information on the occurrence of species within each range complex, to more specific matters of exposure, response, and consequences.
- Facilitating collaboration among researchers in each region, with the intent to develop a coherent and synergistic regional monitoring and research effort.
- Striving to move away from a "box-checking" mentality. Monitoring studies should be designed and conducted according to scientific objectives, rather than on merely cataloging effort expended.
- Approach the monitoring program holistically and select projects that offer the best opportunity to advance understanding of the issues, as opposed to establishing range-specific requirements.

5.5.2 Reporting

The Navy is committed to documenting and reporting relevant aspects of training and testing activities in to verify implementation of mitigation, comply with current permits, and improve future environmental assessments. Navy reporting initiatives are described below.

5.5.2.1 Exercise, Testing, and Monitoring Reporting

The Navy will continue to submit annual exercise, testing, and monitoring reports to the Office of Protected Resources at NMFS. The exercise and testing reports will describe the level of training and testing conducted during the reporting period, and the monitoring reports will describe both the nature of the monitoring that has been conducted and the results of the monitoring. All of the details regarding the content of the annual reports will be coordinated with NMFS through the permitting process. All unclassified reports submitted to date can be found on the NMFS Office of Protected Resources webpage.

5.5.2.2 Stranding Response Plan

In coordination with NMFS, the Navy's existing stranding response plan will be periodically reviewed and updated. All of the details regarding the content of the stranding response plan will be coordinated with NMFS through the permitting process.

5.5.2.3 Bird Strike Reporting

The Navy will continue to report all damaging and non-damaging bird strikes to the Naval Safety Center.

5.5.2.4 Marine Mammal Incident Reporting

If any injury or death of a marine mammal is observed during training or testing activities, the Navy will immediately halt the activity and report the incident, including dead or injured animals, to NMFS or the USFWS, as appropriate.

5.6 Overview of Terrestrial Standard Operating Procedures and Mitigation Measures

On land, standard operating procedures and mitigation measures have been designed to avoid or reduce impacts associated with military training activities (there are no testing activities that occur on land). Conservation measures[2] have been developed in coordination with the USFWS through the Navy's compliance with Section 7(a)(2) of the ESA. Other measures may be proposed by the USFWS, local agencies, and other federal agencies through comments on NEPA documents, the development of Integrated Natural Resource Management Plans (INRMPs) and coordination mandated through the Sikes Act, or from recommendations made under Section 7(a)(1) of the ESA that are usually presented as conservation recommendations. Non-discretionary measures (measures that the Navy must comply with specified in agreements with the USFWS) and discretionary measures that are deemed feasible are codified in the Marianas Training Manual, which is updated periodically to contain the most recent implementing instructions to ensure the Navy's compliance obligations.

In 1998, the first measures designed to reduce the impact of military bombardment of Farallon de Medinilla (FDM) were adopted that contained targeting and ordnance restrictions (U.S. Fish and Wildlife Service 1998). Subsequent Section 7 ESA consultations with the USFWS developed additional measures for FDM and other islands within the Marianas where the military conducts training activities. In February 2015, the USFWS released the Biological Opinion (BO) for activities the Navy consulted on associated with this EIS/OEIS. The following subsections list and describe the most recent standard operating procedures and mitigation measures associated with activities proposed in this EIS/OEIS.

5.7 Standard Operating Procedures – Terrestrial

As described in Section 5.1 (Standard Operating Procedures – At Sea), the Navy employs standard operating procedures to provide for the safety of personnel and equipment as well as the success of training activities at sea. When applicable, the at-sea standard operating procedures will also be implemented for activities conducted in the terrestrial environment. Additional standard operating procedures that are recognized as providing a potential secondary benefit to terrestrial resources are provided below.

5.7.1 Amphibious Assault and Amphibious Raids

The Navy conducts a beach survey prior to amphibious assault and amphibious raid training activities involving beach landings by large amphibious vehicles (e.g., Air Cushioned Landing Craft [LCACs]). During the surveys, personnel identify and designate beach landing areas and cargo offload areas that are free of obstructions that could present personnel and equipment safety concerns. Large amphibious vehicles are landed and offloaded within the designated areas identified during the pre-event beach surveys.

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[2] The term "conservation measure" is used in Section 7 ESA practice. Conservation measures are implemented with the proposed activity, and are considered in a Biological Opinion (BO) as part of the proposed action. Conservation measures are discussed as mitigation measures in the context of this EIS/OEIS.

5.7.2 Fire Management Plan

All training activities that involve ground maneuvers on Guam, in the Tinian Military Lease Area (MLA), and in the Saipan Marpi Maneuver Area adhere to the Wildland Fire Prevention Plan.

5.7.3 Farallon de Medinilla Access Restrictions

Only personnel authorized by Joint Region Marianas Operations are allowed on Farallon de Medinilla (FDM) for the safety of personnel.

5.8 Mitigation Measures – Terrestrial

Refer to Section 5.2 (Introduction to Mitigation) for a discussion on the purpose of and regulatory requirements for mitigation. The mitigation measures discussed in the remainder of this chapter are adapted from currently implemented measures that resulted from past environmental compliance documents and ESA Biological Opinions, and have been coordinated with the USFWS through the consultation and permitting processes.

Terrestrial mitigation measures are organized into the following two sections:

- Section 5.8.1 (Invasive Species Control Measures) includes recommended measures specific to controlling the introduction or spread of invasive species.
- Section 5.8.2 (Mitigation Measures for Training Activities) includes recommended measures specific to aircraft overflights, small arms training, and other military readiness activities.

5.8.1 Invasive Species Control Measures

5.8.1.1 Regional Biosecurity Plan for Micronesia and Hawaii

The Navy contributed to the development of the Regional Biosecurity Plan for Micronesia and Hawaii. During plan development, Navy personnel participated in regional biosecurity working group meetings and worked cooperatively with stakeholders from the USFWS and U.S. Department of Agriculture to identify and develop solutions for biosecurity challenges caused by invasive species. Once completed, the Plan will be applicable to MITT training activities when such procedures do not unduly interfere with military training activities. A Regional Rapid Response Plan for Guam and the CNMI is being developed in parallel with the Regional Biosecurity Plan. Until completed, priority will be given to non-native invasive species that pose a high risk of being transported elsewhere due to MITT-related training actions.

5.8.1.2 Armed Forces Pest Management Board Technical Guide

Navy personnel will adhere to the Armed Forces Pest Management Board Technical Guide Number 31 (Armed Forces Pest Management Board 2012) when traveling to the Study Area or transiting to training locations within the Study Area. When applicable prior to starting or after completion of training activities, personnel will self-inspect their gear and clothing (e.g., boots, bags, weapons, pants) for soil accumulations, seeds, invertebrates, and vertebrates.

5.8.1.3 Pathway Risk Analysis

The Navy will conduct pathway risk analyses for training activities as appropriate to improve programmatic efficiency while preventing the spread or introduction of invasive species. The Navy will conduct analyses consistent with internationally-accepted planning methods, such as Hazard Analysis and Critical Control Point planning. For activities that have the potential to transport invasive species, the Navy will identify prevention protocols to reduce the risk of transport.

5.8.1.4 Brown Treesnake Control

The brown treesnake is an invasive species that occupies virtually all habitats on the island of Guam. The Navy is proposing to continue implementing the Brown Treesnake Control Plan (Brown Treesnake Technical Working Group 2008) within the Mariana Islands during training activities to help control the brown treesnake population and prevent its spread or introduction to other areas, including the Commonwealth of the Northern Mariana Islands (CNMI).

5.8.1.4.1 Interagency Coordination

The Navy will coordinate brown treesnake control measures with the USFWS and the CNMI Department of Land and Natural Resources. Coordination will include identifying inspection and interdiction protocols and establishing the number of trained quarantine officers and canine detection teams required to be used for each Navy training activity. The skills and standards required to certify personnel, including a canine inspection teams, as qualified will be agreed upon mutually by the Navy and the USFWS. Canine inspection teams may be supplemented with qualified personnel to meet 100 percent inspection goals for training activities. The Navy will develop plans to ensure that inspection personnel are available and all requirements can be met, and will identify the level of support needed for the inspections. When necessary, the Navy will coordinate the inspection and interdiction plans with the USFWS prior to carrying out a training activity.

5.8.1.4.2 Brown Treesnake Awareness Training

The Navy will provide an environmental education program for new personnel, including a location-specific welcome brief, a brown treesnake educational video, and a pocket guide containing information about the brown treesnake and personal inspection responsibilities. The education program is designed to ensure that all newly assigned personnel are aware that all levels within the chain of command, from the Commanding Officer to the most junior recruit, are responsible for brown treesnake control.

The Navy will also provide brown treesnake awareness training for military and contractor personnel prior to applicable training activities. Depending on the type and scale of the activity, the brown treesnake awareness training could include showing a brown treesnake educational video, briefing personnel on precautions and inspection procedures, or distributing informative pocket guides. Consistent with the environmental education program provided for new personnel, all subsequent awareness briefs will emphasize the importance of brown treesnake awareness at all personnel levels within the chain of command.

5.8.1.4.3 Aircraft, Cargo, and Equipment Inspection

The Navy will use trained brown treesnake personnel to complete a 100 percent inspection of aircraft, cargo, and equipment used for training activities departing Guam via vessel or aircraft for an off-island destination within the Study Area. Trained personnel may be assisted by DoD-designated canine detection teams and personnel with other pest control expertise upon completion of brown treesnake detection training. In the event military units, vehicles, or equipment accidentally leave Guam without an inspection, as soon as possible, the Navy will notify the qualified brown treesnake interdiction program, and the destination port or airport authorities. The Navy will work with the destination authority(ies) to resolve the issue. Urgency of notification is a priority so that rapid response or other actions can be implemented to reduce risk, if warranted.

5.8.1.4.4 Quarantine Areas

The Navy will establish brown treesnake-free quarantine areas (barriers) as deemed necessary by the Navy and the USFWS for aircraft, cargo, and equipment transiting from Guam to CNMI and locations outside of the Study Area. The Navy will use barriers if the volume of aircraft, cargo, and equipment requiring inspection exceeds the inspection capacity of the canine detection team. The brown treesnake-free quarantine areas will be subject to multiple day and night searches with one or more trained canine detection teams, visual inspection, and brown treesnake trapping. If temporary barriers are used, the Navy will construct and maintain them in a manner that assures their efficacy, and will provide training to the staff overseeing their construction, operation, and maintenance.

5.8.1.4.5 Tactical Approach Exercises

Tactical approach exercises are those that require an uninterrupted flow to allow realism of events. To the maximum extent practicable, the Navy will route inbound aircraft, cargo, and equipment for tactical approach exercises directly to the appropriate training locations, thus avoiding Guam seaports and airfields. If Guam cannot be avoided for tactical approaches, the Navy will work with the USFWS or other stakeholders to identify and implement appropriate interdiction (i.e., invasion prevention) protocols, which may include redundant inspections, multiple inspections, or barrier use on Guam. A brown treesnake canine detection team will complete a 100 percent inspection of aircraft, cargo, and equipment used during tactical approaches originating from areas containing a brown treesnake population.

All movements between Guam and FDM are considered tactical in nature; therefore, the Navy will work with stakeholders to determine the appropriate interdiction protocols. All aircraft, cargo, and equipment will be 100 percent inspected prior to departing Guam. Additional interdiction measures on Guam may be required after discussions with appropriate stakeholders.

5.8.1.4.6 Administrative and Logistical Movements

When necessary based on discussions with the appropriate stakeholders, the Navy will perform redundant inspections (e.g., one inspection at the departing port on Guam and one inspection at the receiving port on Rota, Saipan, or Tinian) for administrative and logistical movements that do not require a tactical approach to complete a training exercise. Stakeholders (e.g., USFWS, receiving port jurisdictions, or agencies with expertise in invasive species control) will ensure that Navy inspection coverage and methods are adequate, current, and updated as new techniques, technology, or data become available. Inspections at receiving ports will involve the most current quarantine and inspection protocols to the maximum extent possible. If the level of inspection coverage is inadequate, the Navy will provide additional inspection teams to allow for complete implementation of the quarantine and inspection protocols.

5.8.1.4.7 Brown Treesnake Sighting Response

MITT action proponents will provide support for a brown treesnake rapid response associated with a brown treesnake sighting within the Joint Region Marianas area of responsibility related to MIRC training activities.

5.8.2 Mitigation Measures for Training Activities

5.8.2.1 Activities on Guam

The mitigation measures for Guam are designed to avoid or reduce impacts from training activities on sea turtles (on shore), Mariana fruit bats, Mariana common moorhens, and Mariana swiftlets, and terrestrial habitats.

5.8.2.1.1 Aircraft Overflights

To minimize potential visual and acoustic disturbance on foraging or roosting Mariana fruit bats and bird species, and to reduce the risk of aircraft strike, the Navy will restrict fixed-wing aircraft training and testing activities (with the exception of takeoffs and landings) below 1,000 ft. (305 m) Above Ground Level (AGL). The Navy will implement the following helicopter flight restrictions (with the exception of takeoffs and landings): (1) below 1,000 ft. (305 m) AGL over Northwest Field north of the south runway, (2) below 2,500 ft. (762 m) AGL within 1 nm of the satellite tracking station, (3) below 1,000 ft. (305 m) AGL along Andersen Air Force Base (AFB) cifflines, and (4) below 500 ft. (150 m) AGL throughout the Naval Munitions Storage Site.

5.8.2.1.2 Amphibious Landings

Mitigation for activities that involve large amphibious vehicle beach landings will include visual observation for sea turtles and sea turtle nests on the beach prior to the start of the activity. Observations will occur no more than 6 hours before the start of an exercise, and may be conducted in conjunction with the standard beach surveys described in Section 5.6.1 (Amphibious Assaults and Amphibious Raids) to ensure that the designated vessel traffic lanes, beach landing areas, and cargo offload areas do not contain sea turtles or sea turtle nests.

For additional protection of nesting sea turtles, visual observation at the beach landing areas will continue for the duration of the exercise, when conducted at night on beaches where nesting is known to occur. The exercise will cease if a sea turtle or sea turtle nest is observed within the designated vessel traffic lanes, beach landing areas, or cargo offload areas. The exercise will recommence if the sea turtle is observed exiting these areas and once any nests have been flagged for avoidance.

Personnel will restore the beach topography using hand tools or other non-mechanized methods after the completion of the exercise.

The Navy will implement restrictions on landings and launches at beach and boat ramp locations to minimize impacts on sea turtles and their habitats. When possible, the Navy will use the concrete boat ramp at Sumay Cove, which will help avoid impacts on sea turtle nesting sites. The Navy will implement speed restrictions to avoid creating wakes in this area. Currently, training does not occur on other Guam beaches that support sea turtles. Should the Navy decide to use other Guam beaches for amphibious landings, the Navy will implement appropriate measures.

5.8.2.1.3 Ground Maneuvers

Navy personnel will adhere to all posted environmental signs (e.g., “No Wildlife Disturbance” and “No Training Areas”), which are posted at Naval Base Guam Orote Point, Naval Base Guam Munitions Site, and Andersen AFB Tarague Beach. The Navy will limit vegetation removal to maintaining existing bivouac areas. Ground maneuver units will remain tactical and not establish support camps.

No ground maneuver and navigation training will occur in riparian wetlands in the Southern Land Navigation Area to avoid potential impacts on the Mariana common moorhen, which has been detected in this area during biological studies. The Navy will conduct ground-disturbing training activities on previously used sites when possible to avoid disturbing new habitats. The Navy will clearly mark training areas and transit routes necessary to reach the training areas. Vehicle use, including off-road vehicles, will be restricted to designated areas (e.g., roads and established off-road trails).

5.8.2.1.4 Small Arms Training

Lighting used during nighttime small arms training at the Pati Point Combat Arms Training and Marksmanship range will be configured in a way that minimizes potential impacts on sea turtles and Mariana fruit bats at Tarague Beach or other nearby habitats. The lighting configuration includes four flood lights located below the tree canopy level that are directed inland and parallel to the coast.

5.8.2.2 Activities on Rota, Tinian, and Saipan

The mitigation measures for Rota, Tinian, and Saipan are designed to avoid or reduce impacts from training activities on sea turtles (on shore), Mariana fruit bats, Mariana common moorhens, Micronesian megapodes, Mariana crows, Rota bridled white-eyes, nightingale reed warblers, and terrestrial habitats.

5.8.2.2.1 Aircraft Overflights

To minimize potential visual and acoustic disturbance on Mariana fruit bats and bird species, and to reduce the risk of aircraft strike, the Navy will implement the following flight restrictions on Rota (with the exception of takeoffs and landings): (1) below 1,000 ft. (305 m) AGL, (2) within 1,000 ft. (305 m) of coastlines.

The Navy will avoid conducting aircraft overflights over Tinian wetland areas (i.e., Hagoi, Mahalang, and Bateha), which are known habitats for the Mariana common moorhen, and over Tinian limestone forests within the Tinian MLA, which are known habitats for the Micronesian megapode. If overflights are unavoidable, aircraft flying over Tinian wetland areas or limestone forests within the Tinian MLA will maintain a minimum altitude of at least 1,000 ft. (305 m) AGL.

5.8.2.2.2 Amphibious Landings

Mitigation for activities that involve large amphibious vehicle beach landings will include visual observation for sea turtles and sea turtle nests on the beach prior to the start of the activity. Observations will occur no more than 6 hours before the start of an exercise, and may be conducted in conjunction with the standard beach surveys described in Section 5.6.1 (Amphibious Assaults and Amphibious Raids) to ensure that the designated vessel traffic lanes, beach landing areas, and cargo offload areas do not contain and are not located within 6 ft. (1.8 m) of sea turtles or sea turtle nests.

For additional protection of nesting sea turtles, visual observation at the beach landing areas will continue for the duration of the exercise when conducted at night on beaches where nesting is known to occur, and will include the use of appropriate turtle-friendly beach lighting when possible. The exercise will cease if a sea turtle or sea turtle nest is observed within the designated vessel traffic lanes, beach landing areas, or cargo offload areas. The exercise will recommence if the sea turtle is observed exiting these areas and once any nests have been flagged for avoidance.

If an active nest has been discovered, night-training will not occur after 50 days of incubation within a mitigation zone of 30 ft. (9 m) around the active nest and down to the water until the nest has hatched.

This measure is intended to avoid potential impacts on sea turtle hatchlings. Further, if an active nest has been discovered, night-training will not occur within a mitigation zone of 30 ft. (9 m) around the active nest if a pre-hatch hole is detected. A pre-hatch hole indicates that the nest will hatch that evening. Night-training may resume 5 days after the pre-hatch hole is discovered.

Personnel will restore the beach topography using hand tools or other non-mechanized methods after the completion of the exercise.

The Navy will not designate Unai Chulu, Unai Babui, and Unai Dankulo as landing zones for mechanized amphibious vehicles at this time. Non-mechanized landings include combat swimmers coming ashore and small boats landing on the beach. Should mechanized amphibious vehicles (i.e., Amphibious Assault Vehicles and LCAC) landings on those beaches become necessary, Navy will reinitiate Section 7 ESA consultation for those activities with the USFWS.

5.8.2.2.3 Ground Maneuvers

Navy personnel will adhere to all posted environmental signs (e.g., “No Training Areas”), which are posted on Tinian at Hagoi and adjacent wetlands. The Navy will not conduct ground disturbance or vegetation removal of any kind in these areas (including the Bateha or Mahalang wetland areas), which are known habitats for the Mariana common moorhen.

The Navy will limit vegetation removal to maintaining existing bivouac areas. Ground maneuver units will remain tactical and not establish support camps. No ground maneuver and navigation training will occur in Tinian limestone forests within the Tinian MLA to avoid potential impacts on the Micronesian megapode, which is known to inhabit these areas.

The Navy will conduct ground-disturbing training activities on previously used sites when possible to avoid disturbing new habitats. The Navy will clearly mark training areas and transit routes necessary to reach the training areas. Vehicle use, including off-road vehicles, will be restricted to designated areas (e.g., roads and established off-road trails).

When planning ground maneuver and navigation training in the Saipan Marpi Maneuver Area, Joint Region Marianas will coordinate with the CNMI Department of Land and Natural Resources to retrieve pertinent ESA-listed species information (e.g., known locations of nightingale reed-warblers). If the CNMI Department of Land and Natural Resources is unable to fill the data request, Joint Region Marianas may provide in-house or contracted subject matter experts to conduct a biological survey if deemed necessary. If the Navy determines that it would be unable to conduct the training exercise in a way that would avoid impacts on ESA-listed species in the Saipan Marpi Maneuver Area, the Navy will contact the USFWS for ESA compliance coordination prior to conducting the training exercise.

5.8.2.2.4 Conservation Areas and Critical Habitat

The Navy will not conduct training activities within designated conservation areas on Rota (i.e., Sabana Heights Wildlife Conservation Area, Afatung Wildlife Management Area, Wedding Cake Mountain Conservation Area, and I’Chenchon Bird Sanctuary) or designated critical habitat for the Mariana crow or Rota bridled white-eye.

Prior to planning training activities on Rota outside of developed areas, the Navy will coordinate with the appropriate local officials to retrieve pertinent species information (e.g., known locations of Mariana crow and Rota bridled white-eye).

5.8.2.3 Activities on Farallon de Medinilla

The mitigation measures for FDM are designed to avoid or reduce impacts from training activities on endangered species, seabirds, birds, and terrestrial habitats.

5.8.2.3.1 Access and Targeting Restrictions

The Navy will continue to implement targeting and access restrictions, such as: (1) no targeting of the northern Special Use Area and no targeting of the narrow land bridge, (2) only targeting Impact Areas 1, 2, and 3 during air-to-ground bombing exercises and air-to-ground missile and gunnery exercises and Impact Area 1 (closest to the northern Special Use Area) is for inert ordnance only, (3) ship-based bombardment only fire from the west to avoid impacts of rookery locations on the eastern cliff of FDM, and (4) personnel are not authorized on FDM without approval from JRM Operations.

5.8.2.3.2 Ordnance Restrictions

The Navy will not use explosive ordnance in Impact Area 1. Explosive cluster weapons, scatterable munitions, fuel air explosives, incendiary munitions, depleted uranium rounds, and bombs greater than 2,000 lb. will not be used on FDM.

For training activities involving aircraft dropping explosive or non-explosive ordnance on a surface target, mitigation will include visual observation immediately before and during the exercise. Firing will cease if a sea turtle is observed (on shore) in the vicinity of the intended impact location. Firing will recommence if the sea turtle is observed exiting the vicinity of the intended impact location, or if the intended impact location has been repositioned to a new location (i.e., to where the sea turtle is no longer within the vicinity of the intended impact location).

5.8.3 Effectiveness and Operational Assessments for Terrestrial Mitigation

5.8.3.1 Invasive Species Control Measures

Invasive species are species whose introduction does or is likely to cause economic or environmental harm or harm to human health. An increase in training activities increases the risk of unintentional transport or introduction of invasive species to or within the Study Area; however, adherence to the recommendations set forth by the Regional Biosecurity Plan for Micronesia and Hawaii, protocols established by the Armed Forces Pest Management Board Technical Guide Number 31, and conduct of pathway risk analyses will help minimize the potential to transport invasive species during training in the Study Area. Although the Regional Biosecurity Plan is not finalized, the Navy will continue to work cooperatively with the USFWS and U.S. Department of Agriculture in the development of protocols for implementation of interdiction and control methods in accordance with recommendations contained in the Regional Biosecurity Plan aimed at controlling/preventing the transportation of brown treesnakes and other invasive species as related to military training within the MITT action area.

The Navy's commitment to brown treesnake education and inspections will help ensure that rapid responses or other appropriate actions can be implemented in response to a brown treesnake sighting. Coordination with stakeholders and authorities will improve the effectiveness and efficiency of the Navy's invasive species control measures. The Navy believes that the invasive species interdiction and control measures will help decrease the chance that invasive species will cause economic or environmental harm or harm to human health in the Study Area.

As written, implementation of the mitigation measures recommended in Section 5.7.1 (Invasive Species Control Measures) have been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activities, and Navy policy. Because training activities vary with regard to the number and type of participating vessels, aircraft, cargo, equipment, personnel, and logistics support capabilities, the recommended measures often represent the maximum capacity based on limited resources (e.g., trained inspectors and canine detection teams).

5.8.3.2 Measures for Guam, Rota, Tinian, Saipan, and Farallon de Medinilla

The mitigation measures are designed to reduce the potential for direct strike, acoustic or physical disturbance, and destruction of habitats important for ESA-listed species, migratory birds, and other wildlife resources on Guam, Rota, Tinian, Saipan, and FDM. Environmental benefits of the recommended mitigation measures include:

- Restrictions on aircraft overflight altitudes will reduce the risk of aircraft strike and minimize potential visual and acoustic disturbance on Mariana fruit bats and birds;
- Visual observation for sea turtles and sea turtle nests on the beach prior to the start of amphibious beach landing activities will avoid physical disturbance or strike of sea turtles and sea turtle nests, and restoration of beach topography will avoid disturbance to future nesting activities;
- Adherence to posted environmental signs, limiting vegetation removal, avoiding riparian wetlands on Guam and limestone forests on Tinian, and restricting activities to previously used and designated areas will avoid disturbing new habitats and habitats used by ESA-listed species during ground maneuver and navigation training;
- Use of special lighting configurations at the Pati Point Combat Arms Training and Marksmanship range will minimize potential impacts on sea turtles and Mariana fruit bats;
- Coordination with local authorities (e.g., USFWS, CNMI Department of Land and Natural Resources) regarding species locations will help avoid impacts on ESA-listed species in the Saipan Marpi Maneuver Area and undeveloped areas on Rota;
- Avoidance of designated conservation areas and critical habitats on Rota will avoid impacts on ESA-listed species and their critical habitats; and
- Restricting the locations and type of ordnance used, and avoidance of ordnance expenditure in the vicinity of a sea turtle on FDM will help reduce impacts on ESA-listed species, migratory birds, and terrestrial habitats.

The Navy proposes implementing the recommended measures in Section 5.7.2 (Mitigation Measures for Training Activities) because (1) they are likely to result in avoidance or reduction of injury or disturbance to terrestrial habitats and ESA-listed species, and (2) implementation has been analyzed as acceptable with regard to personnel safety, practicality of implementation, impact on effectiveness of the military readiness activity, and Navy policy.

5.9 Cultural Resources

Based on consultations with the Guam State Historic Preservation Officer, CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, and the National Park Service, a Programmatic Agreement was negotiated in 2009 for all military training activities proposed under the MIRC EIS/OEIS Preferred Alternative and included additional mitigation measures and procedures (U.S. Department of Defense 2009). Mitigation measures and procedures included in the 2009 Programmatic Agreement will be implemented to avoid and minimize impacts on cultural resources from training activities.

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6 Additional Regulatory Considerations

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6 ADDITIONAL REGULATORY CONSIDERATIONS

In accordance with the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA), federal agencies shall, to the fullest extent possible, integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively. This chapter summarizes environmental compliance for the Proposed Action, consistency with other federal, state, and local plans, policies, and regulations not considered in Chapter 3 (Affected Environment and Environmental Consequences); the relationship between short-term impacts; and the maintenance and enhancement of long-term productivity in the affected environment; irreversible and irretrievable commitments of resources, and energy conservation.

6.1 CONSISTENCY WITH OTHER APPLICABLE FEDERAL, STATE, AND LOCAL PLANS, POLICIES, AND REGULATIONS

Implementation of the Proposed Action for the Mariana Islands Training and Testing (MITT) Environmental Impact Statement (EIS)/Overseas EIS (OEIS) would comply with applicable federal, state, and local laws, regulations, and executive orders. The United States (U.S.) Department of the Navy (Navy) is consulting with and will continue to consult with regulatory agencies, as appropriate, during the NEPA process and prior to implementation of the Proposed Action to ensure that requirements are met. Table 6.1-1 summarizes environmental compliance requirements not considered in Chapter 3 (Affected Environment and Environmental Consequences) that were considered in preparing this EIS/OEIS (including those that may be secondary considerations in the resource evaluations). Section 3.0.1 (Regulatory Framework) provides brief excerpts of the primary federal statutes, executive orders, international standards, and guidance that form the regulatory framework for the resource evaluations. Documentation of consultation and coordination with regulatory agencies is provided in Appendix C (Agency Correspondence). Not all consultation documentation is included in Appendix C (Agency Correspondence) or on the website at this time, but all compliance will be completed prior to the signing of the Record of Decision for the Proposed Action.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Laws	
Abandoned Shipwreck Act (43 U.S.C. §§2101–2106)	The 1987 Abandoned Shipwreck Act establishes requirements for educational and recreational access to abandoned shipwrecks; the protection of such resources through the establishment of underwater parks and protected areas; the development of specific guidelines for management and protection in consultation with various stakeholders; defines the jurisdiction and responsibility of federal and state agencies; and explicitly states that the law of salvage and the law of finds do not apply. Under the Act, the Department of the Interior and National Park Service issued guidelines in 2007 to help states manage shipwrecks in their waters. The Act defines the federal government's title to any abandoned shipwreck that meets criteria for inclusion in the National Register of Historic Places within state submerged lands, with the stipulation that title to these shipwrecks will be transferred to the appropriate state. For abandoned shipwrecks in U.S. Territorial Waters, the federal government asserts title to the resource, the federal government then transfers title to the state, territory, or commonwealth whose submerged lands contain the shipwreck. See Section 3.11 (Cultural Resources) for assessment and conclusion that the Proposed Action is consistent with the Act.
Act to Prevent Pollution from Ships (33 U.S.C. §1901 et seq.)	Requirements associated with the Act to Prevent Pollution from Ships are implemented by the Navy Environmental and Natural Resources Program Manual and related Navy guidance documents governing waste management, pollution prevention, and recycling. At sea, the Navy complies with these regulations and operates in a manner that minimizes or eliminates any adverse effects to the marine environment.
Antiquities Act (16 U.S.C. §431)	The Proposed Action is consistent with the Act's objectives for protection of archaeological and historical sites and objects, preservation of cultural resources, and the public's access to them.
Coastal Zone Management Act (16 C.F.R. §1451 et seq.)	The Navy will continue compliance with the Coastal Zone Management Act. See Section 6.1.1 (Coastal Zone Management Act Compliance) below for discussion of Navy activities and compliance with the Coastal Zone Management Act.
Historic Sites Act (16 U.S.C. §§461–467)	The Proposed Action is consistent with the national policy for the preservation of historic sites, buildings, and objects of national significance.
National Fishery Enhancement Act (33 U.S.C. §2101 et seq.)	The Proposed Action is consistent with regulations administered by National Marine Fisheries Service and U.S. Army Corps of Engineers concerning artificial reefs in the navigable waters of the United States. See Section 3.9 (Fish) for the assessment.
National Marine Sanctuaries Act (16 U.S.C. §1431 et seq.)	There are no National Marine Sanctuary System designated sanctuaries within the MITT Study Area.
Rivers and Harbors Act (33 U.S.C. §401 et seq.)	In accordance with U.S. Army Corps of Engineers regulations, no permit is required under the Rivers and Harbors Act because no construction in navigable waterways is proposed.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Laws (continued)	
The Sikes Act of 1960 (16 U.S.C. §§670a-670o, as amended by the Sikes Act Improvement Act of 1997, Public Law No. 105-85), requires military installations with significant natural resources to prepare and implement Integrated Natural Resource Management Plans (INRMPs).	The Proposed Action would be implemented in accordance with the management and conservation criteria developed in the INRMPs for the Mariana Islands Range Complex. The Proposed Action and Alternatives will not result in a requirement for an update of INRMPs outside of their normal update schedule of every 5 years.
Submerged Lands Act of 1953 (43 U.S.C. §§1301–1315)	The Proposed Action is consistent with regulations concerning the Submerged Lands Act.
Sunken Military Craft Act (Public Law 108-375, 10 U.S.C. §113 Note and 118 Stat. 2094–2098)	The Proposed Action would have no adverse effects on sunken U.S. military ships and aircraft within the Study Area. If a site is determined to be eligible for the National Register of Historic Places, the State Historic Preservation Officer would be consulted to address potential effects. See Section 3.11 (Cultural Resources) for the assessment.
Military Munitions Rule	The Military Munitions Rule identifies when conventional and chemical military munitions are considered solid waste under the Resource Conservation and Recovery Act (42 U.S.C. §6901 et seq.). Military munitions are not considered solid waste based on two conditions stated at 40 C.F.R. §266.202(a)(1)(i-iii). These two conditions are when munitions are used for their intended purpose and when unused munitions or a component of are subject to materials recovery activities. These two conditions cover the uses of munitions included in the Proposed Action; therefore, the Resource Conservation and Recovery Act does not apply.
Executive Orders	
Executive Order 11990, *Protection of Wetlands*	Implementation of the Proposed Action would have no effect on wetlands as defined in Executive Order 11990.
Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	The Proposed Action would not result in any disproportionately high and adverse human health or environmental effects on minority or low-income populations. See Section 3.0.5.1.1 (Resources and Issues Not Carried Forward for More Detailed Discussion) for the assessment.
Executive Order 12962, *Recreational Fisheries*	The Proposed Action would have no effect on federal agencies' ability to fulfill certain duties with regard to promoting the health and access of the public to recreational fishing areas. See Section 3.12 (Socioeconomics) for the assessment.
Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*	The Proposed Action would not result in disproportionate environmental health or safety risks to children. See Section 3.0.5.1.1 (Resources and Issues Not Carried Forward for More Detailed Discussion) for the assessment.
Executive Order 13089, *Coral Reef Protection*	The Navy has prepared this EIS/OEIS in accordance with requirements for the protection of existing national system marine protected areas. See Section 3.8 (Marine Invertebrates) for the assessment.
Executive Order 13112, *Invasive Species*	The Navy has prepared this EIS/OEIS in accordance with requirements for the prevention of and eradication of invasive species. Naval vessels are exempt from 33 C.F.R. 151 Subpart D, *Ballast Water Management for Control of Non-indigenous Species in Waters of the United States*. See Section 3.10 (Terrestrial Species and Habitats) for the assessment.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Executive Orders (continued)	
Executive Order 13158, *Marine Protected Areas*	The Navy has prepared this EIS/OEIS in accordance with requirements for the protection of existing national system marine protected areas. See Section 6.1.2 (Marine Protected Areas) for more information.
Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*	The Proposed Action is consistent with the integrated strategy toward sustainability in the federal government and to making reduction of greenhouse gas emissions a priority for federal agencies.
Executive Order 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*	The Proposed Action is consistent with the comprehensive national policy for the *Stewardship of the Ocean, Our Coasts, and the Great Lakes.*
International Standards	
International Convention for the Prevention of Pollution from Ships	This standard prohibits certain discharges of oil, garbage, and other substances from vessels. The convention and its annexes are implemented by national legislation, including the *Act to Prevent Pollution from Ships* (33 U.S.C. §§1901–1915) and the *Federal Water Pollution Control Act* (33 U.S.C. §§1321–1322). The Proposed Action does not include vessel operation and discharge from ships; however, the Navy vessels operating in the Study Area would comply with the discharge requirements established in this program, minimizing or eliminating potential impacts from discharges from ships.

Notes: C.F.R. = Code of Federal Regulations, EIS/OEIS = Environmental Impact Statement/Overseas Environmental Impact Statement, INRMP = Integrated Natural Resource Management Plan, Navy = United States Department of the Navy, NMFS = National Marine Fisheries Service, U.S. = United States, U.S.C. = United States Code

6.1.1 Coastal Zone Management Act Compliance

The *Coastal Zone Management Act of 1972* (16 United States Code [U.S.C.] §1451, et seq.) encourages coastal states and territories to be proactive in managing coastal zone uses and resources. The act established a voluntary coastal planning program under which participating states submit a Coastal Management Plan to the National Oceanic and Atmospheric Administration for approval. Under the act, federal actions that have an effect on a coastal use or resource are required to be consistent, to the maximum extent practicable, with the enforceable policies of federally approved Coastal Management Plans. See Section 4.3.5.3 (Development of Coastal Lands) in Chapter 4 (Cumulative Impacts) for additional information regarding management of the coastal areas within the MITT Study Area.

The *Coastal Zone Management Act* defines the coastal zone as extending “to the outer limit of State title and ownership under the Submerged Lands Act” (i.e., 3 nautical miles [nm] or 9 nm from the shoreline, depending on the location). The extent of the coastal zone inland varies from state to state and territory to territory, but the shoreward extent is not relevant to this Proposed Action.

A Consistency Determination (CD) or a Negative Determination may be submitted for review of federal agency activities. A federal agency submits a CD when it determines that its activity may have either a direct or an indirect effect on a state coastal use or resource. In accordance with 15 Code of Federal Regulations (C.F.R.) §930.39, the CD will include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the management program. The CD should be based on evaluation of the relevant enforceable policies of the management program. In accordance with 15 C.F.R. §930.35, “if a Federal agency determines that there will not be coastal effects, then the Federal agency shall provide the State agencies with a negative determination for a Federal agency activity: (1) Identified by a State agency on its list, as described in §930.34(b), or through case-by-case monitoring of unlisted activities; or (2) Which is the same as or is similar to activities for which CDs have been prepared in the past; or (3) For which the Federal agency undertook a thorough consistency assessment and developed initial findings on the coastal effects of the activity." Thus, a negative determination must be submitted to a state if the agency determines no coastal effects and one or more of the criteria above is met.

6.1.1.1 Guam Coastal Management Program

The Guam Coastal Management Program was approved in 1979 and is overseen by the Bureau of Statistics and Plans. It has received 100 percent federal funding through the U.S. Department of Commerce, the National Oceanic and Atmospheric Administration, and annual formula grants since 1979. Guam's Coastal Management Program guides the use, protection, and development of land and ocean resources within Guam's coastal zone and entire land area, due to Guam's small size.

Guam's Coastal Management Program also helps to coordinate and direct a network of government agencies to ensure a balanced approach to coastal management. The greatest issues for the Coastal Management Program have been coral reef and watershed habitat degradation, water quality degradation, coastal hazards, and cultural and historic resource preservation.

On 4 June 2014, the Navy transmitted to the Bureau of Statistics and Plans a Federal CD addressing training and testing activities that may affect Guam's coastal zone. On 29 August 2014, the Bureau of Statistics and Plans provided concurrence on the Navy's determination that the training and testing activities are consistent to the maximum extent practicable with the enforceable policies of the Guam Coastal Management Program.

6.1.1.2 Commonwealth of the Northern Mariana Islands Coastal Zone Management Program

The Commonwealth of the Northern Mariana Islands (CNMI) Coastal Zone Management Act as established in 1983 and amended in 1990 and 1996, created a voluntary coastal zone enhancement grants program to encourage states and territories in the islands to improve program efforts.

Section 309 authorizes the U.S. Secretary of Commerce to make awards to the CNMI Coastal Resources Management Office for development and implementation of federally approved program changes in the coastal management programs that help support the one or more of the nine focal enhancement areas.

The Navy submitted a CD to the CNMI Division of Coastal Resources Management in July 2014 addressing training and testing activities that may affect the CNMI coastal zone. After consultations between the Navy and the CNMI Division of Coastal Resources Management, the Navy submitted a revised package on 11 September 2014. The Navy concluded that the Proposed Action is consistent to the maximum extent practicable with CNMI Coastal Management Policies.

6.1.2 Marine Protected Areas

Many areas of the marine environment have some level of federal, state, or local management or protection. Marine protected areas have conservation or management purposes, defined boundaries, and some legal authority to protect resources. Marine protected areas vary widely in purpose, managing agency, management approaches, level of protection, and restrictions on human uses. They have been designated to achieve objectives ranging from conservation of biodiversity, to preservation of sunken historic vessels, to protection of spawning habitats important to commercial and recreational fisheries.

Executive Order (EO) 13158*, Marine Protected Areas,* was created to "strengthen the management, protection, and conservation of existing marine protected areas and establish new or expanded marine protected areas; develop a scientifically based, comprehensive national system of marine protected areas representing diverse U.S. marine ecosystems, and the nation's natural and cultural resources; and avoid causing harm to marine protected areas through federally conducted, approved, or funded activities."

Executive Order 13158 requires each federal agency whose actions affect the natural or cultural resources that are protected by a national system of marine protected areas to identify such actions, and in taking such actions, avoid harm to those natural and cultural resources. Pursuant to Section 5 of EO 13158, agency requirements apply only to the natural or cultural resources specifically afforded protection by the site as described by the List of National System Marine Protected Areas. For sites that have both a terrestrial and marine area, only the marine portion and its associated protected resources are included on the List of National System Marine Protected Areas and subject to Section 5 of EO 13158. A full list and map of areas accepted in the National System of Marine Protected Areas is available from the National Marine Protected Areas Center.

The National Marine Protected Areas Center, which is federally managed through the National Oceanic and Atmospheric Administration, is tasked with implementing EO 13158. In order to meet the qualifications for the various terms within EO 13158, the National Marine Protected Areas Center developed a Marine Protected Areas Classification system. This system uses six criteria to describe the key features of most marine protected areas, as follows:

1. Primary conservation focus, such as natural heritage, cultural heritage, or sustainable production
2. Level of protection (e.g., no access, no impact, no take, zoned with no-take areas, zoned multiple use, or uniform multiple use)
3. Permanence of protection
4. Constancy of protection
5. Ecological scale of protection
6. Restrictions on extraction

The National Marine Protected Areas Center utilizes these criteria to evaluate marine protected areas for inclusion in the National System of Marine Protected Areas. Implementation of the National System of Marine Protected Areas is managed by the Department of Commerce and the Department of the Interior. Executive Order 13158 requires the Department of Commerce and the Department of the Interior to consult with other federal agencies about the inclusion of sites into the National System of Marine Protected Areas, including the Department of Defense (DoD). The National System of Marine Protected Areas includes marine protected areas managed under the following six systems:

National Marine Sanctuary System. Under the National Marine Sanctuaries Act, the National Oceanic and Atmospheric Administration established national marine sanctuaries for marine areas with special conservation, recreational, ecological, historical, cultural, archaeological, scientific, educational, or aesthetic qualities. There are no National Marine Sanctuary System designated sanctuaries within the MITT Study Area.

Marine National Monuments. Marine national monuments are designated through Presidential Proclamation under the authority of the Antiquities Act of 1906 (16 U.S.C. 431). Marine national monuments are often co-managed by state, federal, and local governments, in order to preserve diverse habitats and ecosystem functions. Within the MITT Study Area, there is one marine national monument, the Mariana Trench Marine National Monument (Proclamation No. 8335, 74 Federal Register 1557). In the proclamation designating the Monument, specific language was included that stated: “The prohibitions required by this proclamation shall not apply to activities and exercises of the Armed Forces (including those carried out by the United States Coast Guard).”

National Wildlife Refuge System. The U.S. Fish and Wildlife Service manage ocean and Great Lakes refuges for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats. There are three national wildlife refuge areas within the MITT Study Area, Guam National Wildlife Refuge, Mariana Arc of Fire National Wildlife Refuge, and Mariana Trench National Wildlife Refuge. The Guam National Wildlife Refuge is the only one included in the National System of Marine Protected Areas.

State and Local Marine Protected Areas. State and local governments have established marine protected areas for the management of fisheries, nursery grounds, shellfish beds, recreation, tourism, and other uses; these areas have a diverse array of conservation focuses, from protecting ecological functions, to preserving shipwrecks, to maintaining traditional or cultural interaction with the marine environment. There are 12 state or local marine protected areas (Table 6.1-2) within the MITT Study Area and they are not included in the National System of Marine Protected Areas.

National Parks System. The National Park System contains ocean and Great Lakes parks, including some national monuments, administered by the U.S. Department of the Interior National Park Service to conserve the scenery and the natural and historic objects and wildlife contained within. The War in the Pacific National Historical Park is within the MITT Study Area, but it is not included in the National System of Marine Protected Areas.

National Estuarine Research Reserve System. National Estuarine Research Reserve System sites protect estuarine land and water and provide essential habitat for wildlife, educational opportunities for students, teachers, the public, and living laboratories for scientists. There are no National Estuarine Research Reserve System sites within the MITT Study Area.

This EIS/OEIS has been prepared in accordance with requirements for natural or cultural resources protected under the National System of Marine Protected Areas. While several marine protected areas are located within the MITT Study Area (Figure 6.1-1 through Figure 6.1-3) and are included in the National System of Marine Protected Areas, it is important to note that the military rarely trains or tests in many of these areas. Training and testing activities within these marine protected areas abide by the regulations of the individual marine protected area; Table 6.1-2 provides information on the individual marine protected area regulations and the training and testing activities that occur in these areas. Figure 6.1-1 shows the Marine Protected Areas in Guam. Figure 6.1-2 shows the Marine Protected Areas in Saipan. Figure 6.1-3 shows the Mariana Trench Marine National Monument.

Figure 6.1-1: Marine Protected Areas in Guam

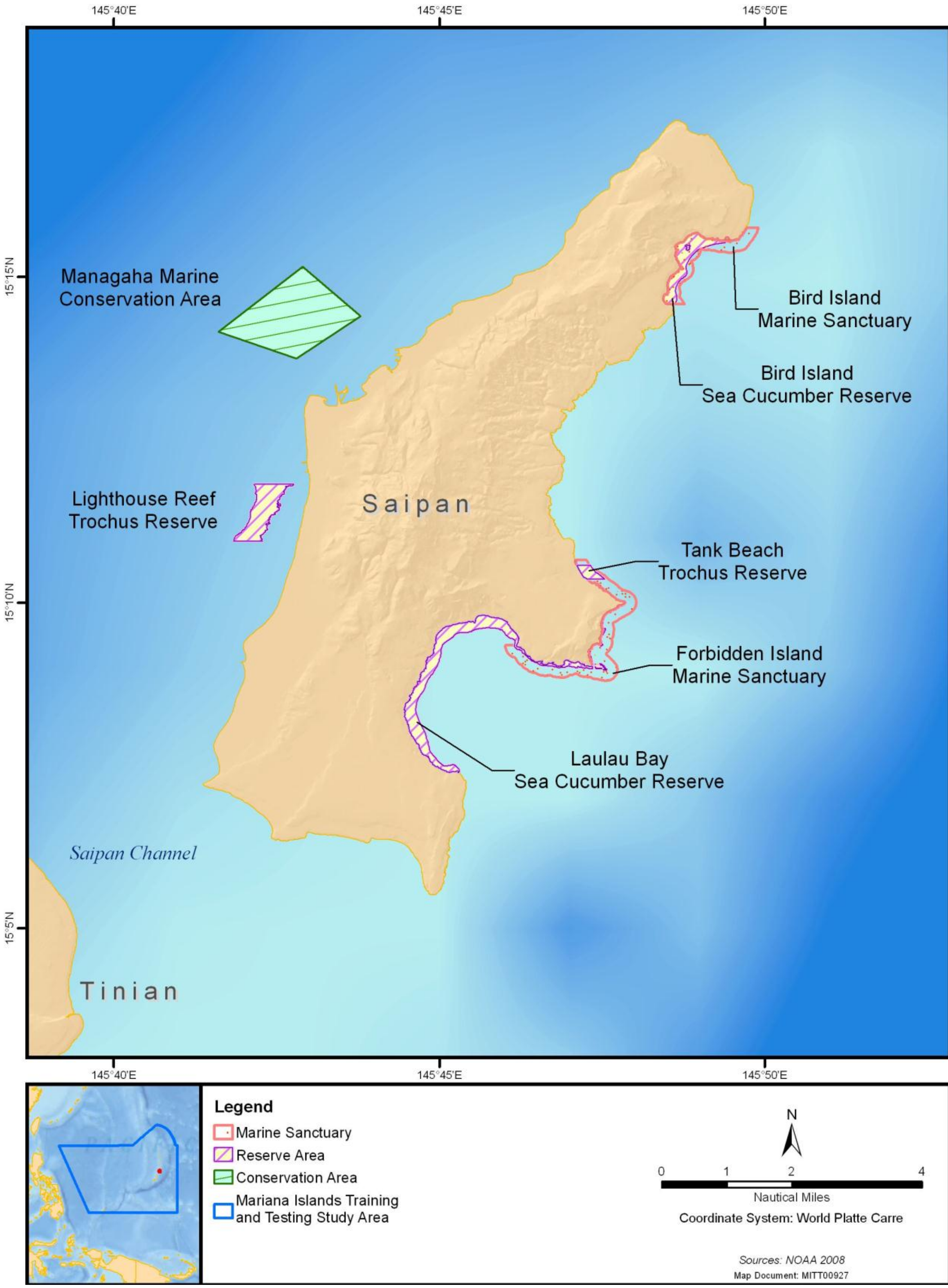

Figure 6.1-2: Marine Protected Areas in Saipan

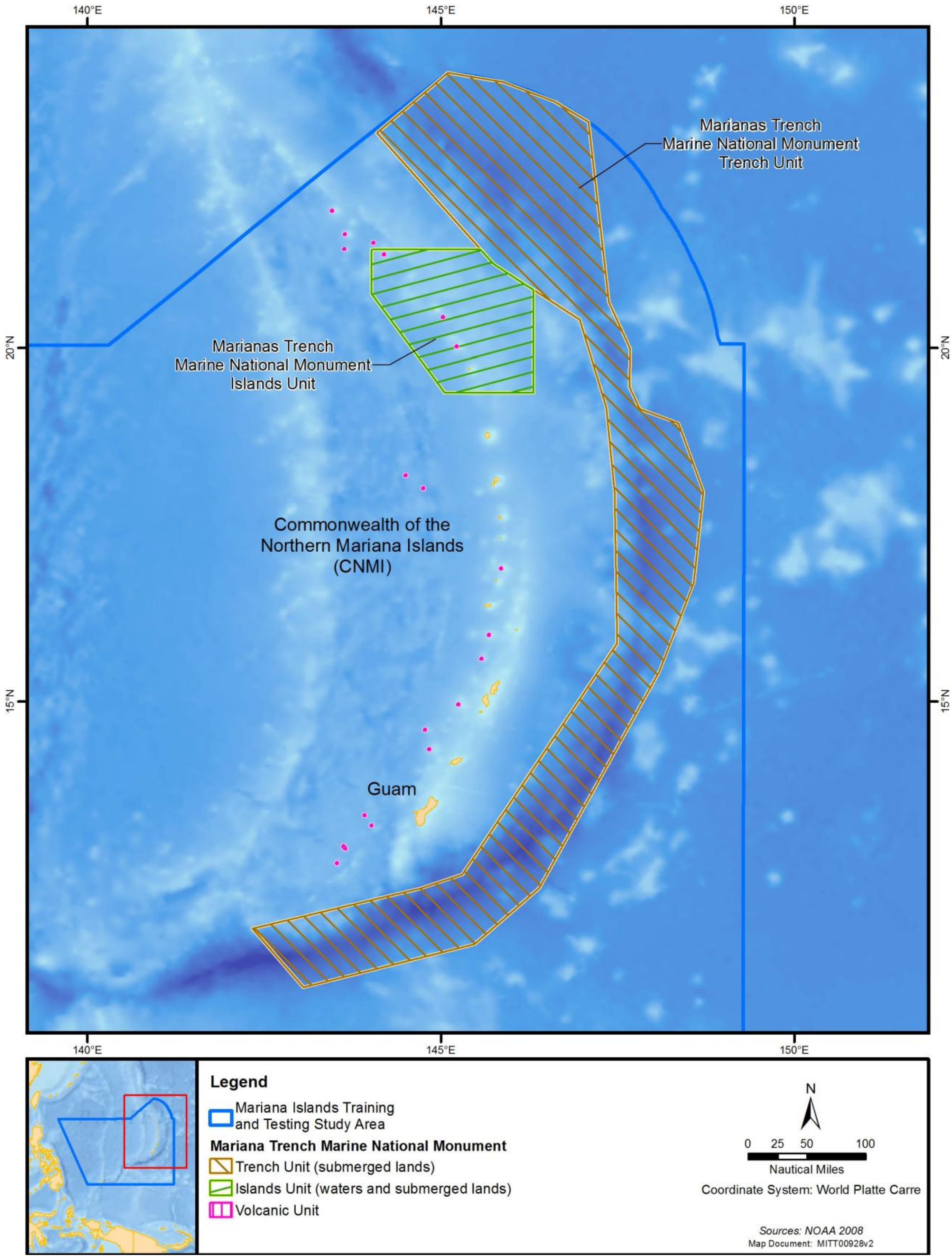

Figure 6.1-3: Mariana Trench Marine National Monument

Table 6.1-2: Marine Protected Areas within the Mariana Islands Training and Testing Study Area

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Training and Testing Activities and Potential Impacts
Guam National Wildlife Refuge	Guam	Ecosystem	Anchoring marine vessels in Refuge waters is strictly prohibited to protect coral Communities.	The military does not conduct anchoring or discharge activities in Refuge waters. Amphibious activities and insertion/extraction of personnel via small craft and divers is conducted in or near portions of the Refuge near Orote Point and Haputo Bay, and north Polaris Point Military Welfare and Recreation Beach, and Reserve Craft Beach. The Orote Point Known Distance and Small Arms Ranges danger zone extends over water near the Guam National Wildlife Refuge.
Eligible Marine Protected Areas				
Bird Island Marine Sanctuary	Saipan	Ecosystem	Destruction, harassment and/or removal of plants, and/or wildlife are prohibited within the confines of the sanctuary.	None
Forbidden Island Marine Sanctuary	Saipan	Ecosystem	Destruction, harassment and/or removal of plants, and/or wildlife are prohibited within the confines of the sanctuary.	None
Managaha Marine Conservation Area	Saipan	Ecosystem	Killing, harming, or harassing animals, fish coral or their live or dead parts; dumping, discharging, depositing, and littering on land and in water is prohibited.	None
War in the Pacific National Historical Park	Guam	Ecosystem/ Cultural Resources	U.S. National Park Service regulations apply to this Park area on both land and sea.	None
Not Eligible Marine Protected Areas				
Achang Reef Flat	Guam	Ecosystem	Actions that would negatively impact the reef should not occur in this area.	The military is not prohibited from conducting training or testing activity in or near Achang Reef Flat; however, none are specifically proposed to occur there.

Table 6.1-2: Marine Protected Areas within the Mariana Islands Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Training and Testing Activities and Potential Impacts
Aratama Maru	Guam	Ecosystem	The prohibitions that apply to this shipwreck do not apply to military activities.	The military is not prohibited from conducting training or testing activity in or near Aratama Maru; however, none are specifically proposed to occur there.
Bird Island Sea Cucumber Reserve	Saipan	Focal Resource	No sea cucumbers may be taken from this area except as permitted by the DFW Director.	None
Cormoran	Guam	Ecosystem	The prohibitions that apply to this shipwreck do not apply to military activities.	The military conducts Underwater Detonations in Apra Harbor near the Cormoran. This activity is conducted in accordance with JTREGMARIANAS Instruction 3500.4A (Marianas Training Manual) and without impact to the Cormoran.
Haputo Ecological Reserve Area	Guam	Ecosystem	Use of this area is restricted to persons with access to military bases. Ecological reserves are areas selected to preserve representative and special natural ecosystems, plant and animal species, features and phenomena. Scientific research and educational purposes are the principle uses of these reserves, and activities should reflect these goals in this area.	The Navy conducts Navy Special Warfare activities in the Reserve Area. This includes insertion/extraction of personnel by small craft and divers in and near Haputo Bay. Finegayan North Small Arms Range is located near the Reserve and has a surface danger zone that overlays part of the Reserve.
Laulau Bay Sea Cucumber Reserve	Saipan	Focal Resource	Fishing and other living resource extraction are prohibited. Therefore, activities should be restricted in this area based on preserving fish and other resources.	None
Lighthouse Reef Trochus Reserve	Saipan	Focal Resource	Fishing and all other living resource extraction are prohibited. Therefore, activities should be restricted in this area based on preserving fish and other resources.	None

Table 6.1-2: Marine Protected Areas within the Mariana Islands Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Training and Testing Activities and Potential Impacts
Mariana Arc of Fire National Wildlife Refuge	Mariana Arc	Ecosystem	This area has been designated to preserve and protect the unique geologic structure and associated marine life at 21 submerged volcanic features within the refuge; maintain the greatest diversity of seamount and hydrothermal vent life yet discovered, provide for the conservation, protection, management, and restoration of fish, wildlife, plants, coral reef communities and other resources associated with the submerged lands; provide opportunities for scientific research and exploration. Any and all activities should be aligned with these goals in this area.	The military is not restricted in what training or testing it may conduct within the waters of the Refuge, including sonar-related activities in the vicinity of this area.
Mariana Trench National Wildlife Refuge	Mariana Archipelago/ Mariana Arc	Ecosystem	This area has been designated to preserve and protect the deepest known habitat on the globe; maintain the natural biological diversity there; provide for conservation, protection, management, and restoration of fish, wildlife, plants, and other objects of scientific interest; as well as provide opportunities for national and international refuge related scientific exploration and research. Any and all activities should be aligned with these goals in this area.	The military is not restricted in what training or testing it may conduct within the waters above the Refuge, including sonar-related activities in the vicinity of this area.
Mariana Trench Marine National Monument	Mariana Archipelago/ Mariana Arc	Ecosystem	This monument consists of the submerged lands encompassing the coral reef ecosystem of the three northernmost islands, the Mariana trench, and active undersea volcanoes and thermal vents in the Mariana Volcanic arc and back arc. The prohibitions required by this proclamation [creating the monument] shall not apply to activities and exercises of the Armed Forces (including those carried out by the U.S. Coast Guard).	The military is not restricted in what training or testing it may conduct within the waters above the monument that extends into the MITT Study Area, including sonar-related activities in the vicinity of the Islands unit of the Mariana Trench Marine National Monument. No specific activities are proposed in the Islands unit.

Table 6.1-2: Marine Protected Areas within the Mariana Islands Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Training and Testing Activities and Potential Impacts
Orote Ecological Reserve Area	Guam	Ecosystem	Ecological reserves are areas selected to preserve representative and special natural ecosystems, plant and animal species, features and phenomena. Scientific research and educational purposes are the principle uses of these reserves, and activities should reflect these goals in this area.	The military does not conduct anchoring discharge activities in Reserve waters. Amphibious activities and insertion/extraction of personnel via small craft and divers are conducted in or near portions of the Refuge near Orote Point. The Orote Point. Known Distance and Small Arms Ranges surface danger zone extends overwater near the Reserve area.
Pati Point	Guam	Ecosystem	Any activities that would negatively impact coral reef habitats and aquatic animals should not occur in this area.	Small arms training is conducted at Air Force Pati Point Combat Arms and Training Maintenance Range. Ordnance is disposed of at the Air Force Pati Point. Explosive Ordnance Disposal range. Both ranges have danger zones which extend over the water into the Pati Point marine area. Navy vessels do not routinely conduct training in this area.
Piti Bomb Holes	Guam	Ecosystem	Any activities that would negatively impact coral reef habitats and aquatic animals should not occur in this area.	The military is not prohibited from conducting training and testing activity in or near Piti Bomb Holes; however, no specific activities are proposed to occur there.
Sasa Bay	Guam	Ecosystem	Any activities that would negatively impact coral reef habitats and aquatic animals should not occur in this area.	The military is not prohibited from conducting training and testing activity in or near Sasa Bay. The Navy conducts Navy Special Warfare, mine warfare, ordnance demolition training, and amphibious warfare activities in or near Sasa Bay. The Navy does not discharge into Sasa Bay or use explosive ordnance in Sasa Bay.
Sasanhaya Fish Reserve	Rota	Ecosystem	Any activities that would involve taking, fishing, and collecting, anchoring, feeding fish, walking on reef or damaging shipwrecks are prohibited in this area.	None
Tank Beach Trochus Reserve	Saipan	Focal Resource	Fishing and other living resource extraction are prohibited. Therefore, activities should be restricted in this area based on preserving fish and other resources.	None

Table 6.1-2: Marine Protected Areas within the Mariana Islands Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Training and Testing Activities and Potential Impacts
Tokai Maru	Guam	Ecosystem	The prohibitions that apply to this shipwreck do not apply to military activities.	The military conducts Underwater Detonations in Apra Harbor near the Tokai Maru. This activity is conducted in accordance with JTREGMARIANAS Instruction 3500.4A (Marianas Training Manual) and without impact to the Tokai Maru.
Tumon Bay	Guam	Ecosystem	The prohibitions that apply to this preserve do not apply to military activities.	The military is not prohibited from conducting training and testing activity in or near Tumon Bay; however, no specific activities are proposed for this area.

Notes: DFW = Division of Fish and Wildlife, U.S. = United States

6.2 Relationship Between Short-Term Use of The Environment and Maintenance and Enhancement of Long-Term Productivity

In accordance with the Council on Environmental Quality regulations (Part 1502), this EIS/OEIS analyzes the relationship between the short-term impacts on the environment and the effects those impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This means that choosing one option may reduce future flexibility in pursuing other options, or that committing a resource to a certain use may often eliminate the possibility for other uses of that resource. The Navy, in partnership with National Marine Fisheries Service (NMFS), is committed to furthering the understanding of marine resources and developing ways to lessen or eliminate the impacts training and testing activities may have on these resources. For example, the Navy and NMFS collaborate on the Integrated Comprehensive Monitoring Program for marine species to assess the impacts of training and testing activities on marine species and investigate population-level trends in marine species distribution, abundance, and habitat use in various range complexes and geographic locations where Navy training and testing occurs.

The Proposed Action could result in both short- and long-term environmental impacts. However, these are not expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or general welfare of the public. The Navy is committed to sustainable military range management, including co-use of the Study Area with the general public and commercial and recreational interests. This commitment to co-use of the Study Area will maintain long-term accessibility of the MITT EIS/OEIS training and testing areas. Sustainable range management practices are specified in range complex management plans under the Navy's Tactical Training Theater Assessment and Planning Program. Among other benefits, these practices protect and conserve natural and cultural resources and preserve access to training areas for current and future training requirements while addressing potential encroachments that threaten to impact range and training area capabilities.

6.3 Irreversible or Irretrievable Commitment of Resources

The NEPA requires that environmental analysis include identification of "any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented" (42 U.S.C. §4332). Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy or minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., the disturbance of a cultural site).

For the Proposed Action, most resource commitments would be neither irreversible nor irretrievable. Most impacts would be short term and temporary, or long lasting but within historical or desired conditions. Because there would be no building or facility construction, the consumption of material typically associated with such construction (e.g., concrete, metal, sand, fuel) would not occur. Energy typically associated with construction activities would not be expended and irretrievably lost.

Implementation of the Proposed Action would require fuels used by aircraft and vessels. Since fixed- and rotary-wing aircraft and ship activities could increase relative to the baseline, total fuel use would increase. Therefore, total fuel consumption would increase under the Proposed Action (Section 6.4, Energy Requirements and Conservation Potential of Alternatives and Mitigation Measures), and this nonrenewable resource would be considered irretrievably lost (see Chapter 4, Cumulative Impacts, and the following discussion on the Navy's Climate Change Roadmap).

6.4 Energy Requirements and Conservation Potential of Alternatives and Mitigation Measures

The federal government consumes 2 percent of the total U.S. energy share (Jean 2010). Of that 2 percent, the DoD consumes 93 percent. The Navy consumes one quarter of the total DoD share. The Navy consumes 1.2 billion to 1.6 billion gallons of fuel each year. The Navy expects a 25 percent increase in fuel consumption in the future because of new ships coming into the fleet and the growth in mission areas (Jean 2010).

Increased training and testing activities within the Study Area would result in an increase in energy demand over the No Action Alternative. The increased energy demand would arise from an increase in fuel consumption, mainly from aircraft and vessels participating in training and testing. Details of fuel consumption by training and testing activities on an annual basis are set forth in the air quality emissions calculation spreadsheets available on the project website. Vessel fuel consumption is estimated to increase by 1.06 million gallons per year under Alternative 1 and 1.3 million gallons per year under Alternative 2, when compared to the No Action Alternative. Aircraft fuel consumption is estimated to increase by 14.8 million gallons per year under Alternative 1 and 17.2 million gallons per year under Alternative 2, respectively, when compared to the No Action Alternative. Vehicle fuel consumption is estimated to increase by 70,647 gallons per year under either Alternative 1 or Alternative 2 when compared to the No Action Alternative. Conservative assumptions were made in developing the estimates, and therefore the actual amount of fuel consumed during training and testing activities may be less than estimated. Nevertheless, the demand for fuel consumption would increase from baseline levels, given the proposed increases in training and testing activities.

Energy requirements would be subject to any established energy conservation practices. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing activities. No additional conservation measures related to direct energy consumption by the proposed activities are identified.

The Navy is committed to improving energy security and environmental stewardship by reducing its reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will increase use of alternative energy and help conserve the world's resources for future generations. The Navy Climate Change Roadmap identifies actions the Environmental Readiness Division is taking to implement EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*. The Navy's Task Force Energy is responding to the Secretary of the Navy's Energy Goals through energy security initiatives that reduce the Navy's carbon footprint.

Two Navy programs—the Incentivized Energy Conservation Program and the Naval Sea Systems Command's Fleet Readiness, Research and Development Program—are helping the fleet conserve fuel via improved operating procedures and long-term initiatives. The Incentivized Energy Conservation Program encourages the operation of ships in the most efficient manner while conducting their mission and supporting the Secretary of the Navy's efforts to reduce total energy consumption on naval ships. The Naval Sea Systems Command's Fleet Readiness, Research, and Development Program includes the High-Efficiency Heating, Ventilating, and Air Conditioning and the Hybrid Electric Drive for DDG-51 class ships, which are improvements to existing shipboard technologies that will both help with fleet readiness and decrease the ships' energy consumption and greenhouse gas emissions. These initiatives are expected to greatly reduce the consumption of fossil fuels (see Section 3.2, Air Quality). Furthermore, to offset the impact of its expected near-term increased fuel demands and achieve its goals to reduce fossil fuel consumption and greenhouse gas emissions, the Navy plans to deploy by 2016 a green strike group (a "great green fleet") composed of nuclear vessels and ships powered by biofuel in local operations and with aircraft flying only with biofuels (Jean 2010).

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Jean, G. V. (2010). Navy's Energy Reform Initiatives Raise Concerns Among Shipbuilders. *National Defense*, 4. Retrieved from http://www.nationaldefensemagazine.org/archive/2010/April/Pages/NavyEnergyReformRaiseConcerns.aspx

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Appendix A: Training and Testing Activities Descriptions

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APPENDIX A TRAINING AND TESTING ACTIVITIES DESCRIPTIONS

The United States (U.S.) Department of the Navy (Navy), and the Air Force, Army, Marine Corps, Coast Guard and allies have conducted readiness activities throughout the Mariana Islands and the Pacific Ocean for decades. The tempo and types of training and testing activities have fluctuated within the Mariana Islands Training and Testing (MITT) Study Area (Study Area) due to changing requirements, the introduction of new technologies, the dynamic nature of international events, advances in warfighting doctrine and procedures, and force structure changes. Such developments have influenced the frequency, duration, intensity, and location of required training and testing.

A.1 TRAINING ACTIVITIES

The training activities are organized generally into eight primary mission areas and a miscellaneous category (other training) that includes those activities that do not fall within one of the eight primary mission areas, but are an essential part of training. Many of the activities described here may have a land component, or occur both at sea and on or over land.

In addition, because a number of activities are conducted within major range events, descriptions of those major range events are also included in this appendix. It is important to note that these major range events are comprised entirely of individual activities described in the primary mission areas.

A.1.1 ANTI-AIR WARFARE TRAINING

Anti-air warfare is the primary mission area that addresses combat operations by air and surface forces against hostile aircraft. Navy ships contain an array of modern anti-aircraft weapon systems, including naval guns linked to radar-directed fire-control systems, surface-to-air missile systems, and radar-controlled cannons for close-in point defense. Strike/fighter aircraft carry anti-aircraft weapons, including air-to-air missiles and aircraft cannons. Anti-air warfare training encompasses events and exercises to train ship and aircraft crews in employment of these weapons systems against simulated threat aircraft or targets. Anti-air warfare training includes surface-to-air gunnery, surface-to-air and air-to-air missile exercises, and aircraft force-on-force combat maneuvers.

A.1.1.1 Air Combat Maneuver

Activity Name	Activity Description
Anti-Air Warfare	
Air Combat Maneuver (ACM)	Aircrews engage in flight maneuvers designed to gain a tactical advantage during combat.
Long Description	Basic flight maneuvers where aircrew engage in offensive and defensive maneuvering against each other. During an air combat maneuver engagement, no ordnance is fired, countermeasures such as chaff and flares may be used. These maneuvers typically involve two aircraft; however, based upon the training requirement, air combat maneuver exercises may involve over a dozen aircraft. Participants typically are two or more aircraft. No weapons are fired.
Information Typical to the Event	**Platform:** Fixed-wing aircraft (e.g., F/A-18, F-35) **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–2 hours **Location:** Mariana Islands Training and Testing Study Area > 12 nm from land: Special Use Airspace/Air Traffic Control Assigned Airspace (ATCAA)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	None
Assumptions used for Analysis	No munitions fired. Flare and chaff may be used. All flare and chaff accounted for in flare exercise and chaff exercise events.

A.1.1.2 Air Defense Exercise (ADEX)

Activity Name	Activity Description
Anti-Air Warfare	
Air Defense Exercises (ADEX)	Aircrew and ship crews conduct defensive measures against threat aircraft or missiles.
Long Description	Aircrew and ship personnel perform measures designed to defend against attacking threat aircraft or missiles or reduce the effectiveness of such attack. This exercise involves full detection though engagement sequence. Aircraft operate at varying altitudes and speeds. This exercise may include Air Intercept Control exercises that involve aircraft controllers on vessels, in fixed-wing aircraft or at land based locations, use search radars to track and direct friendly aircraft to intercept the threat aircraft, and Detect to Engage exercises in which personnel on vessels use their search radars in the process of detecting, classifying, and tracking enemy aircraft or missiles up to the point of engagement.
Information Typical to the Event	**Platform:** Fixed-wing aircraft (e.g., F/A-18, F-35, E-2), surface vessels (all) **Systems:** None **Ordnance/Munitions:** None **Targets:** Other aircraft, unmanned drones **Duration:** 1–4 hours **Location:** Mariana Islands Training and Testing Study Area > 12 nm from land: Special Use Airspace/ATCAAs
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	None
Assumptions used for Analysis	No weapons fired.

A.1.1.3 Air Intercept Control (AIC)

Activity Name	Activity Description	
Anti-Air Warfare		
Air Intercept Control (AIC)	Aircrew and air controllers conduct aircraft intercepts of other aircraft.	
Long Description	Fighter jet aircrews maneuver to defend against threat aircraft. An event involves two or more fighter aircraft.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft (e.g., F/A-18C, F-35) **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–2 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land: Special Use Airspace/ATCAAs
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	No weapons fired.	

A.1.1.4 Gunnery Exercise (Air-to-Air) – Medium-Caliber

Activity Name	**Activity Description**	
Anti-Air Warfare		
Gunnery Exercise (Air-to-Air) Medium-Caliber **(GUNEX [A-A] – Medium-Caliber)**	Aircrews defend against threat aircraft with cannons (machine gun).	
Long Description	Fighter jet aircrews defend against threat aircraft with cannons (machine gun). An event involves two or more fighter aircrafts and a target banner towed by a contracted aircraft (e.g., Lear jet). The banner target is recovered after the event when possible.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft (e.g., F/A-18C, F-35) **Systems:** None **Ordnance/Munitions:** Medium-caliber projectile (non-explosive) **Targets:** Towed banner **Duration:** 1–2 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material (non-explosive projectile) strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Medium-caliber projectiles, casings	
Detailed Military Expended Material Information	Projectiles Casings	
Assumptions used for Analysis	Only non-explosive munitions used. Target is recovered when possible.	

A.1.1.5 Missile Exercise (Air-to-Air)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Air Warfare</td></tr>
<tr><td>Missile Exercise (Air-to-Air) (MISSILEX [A-A])</td><td colspan="2">Aircrews defend against threat aircraft with missiles.</td></tr>
<tr><td>Long Description</td><td colspan="2">An event involves two or more jet aircraft and a target. Missiles have either a high-explosive warhead or are non-explosive practice munitions. The target is either an unmanned aerial target drone (e.g.: BQM-34, BQM-74), a Tactical Air-Launched Decoy, or a parachute suspended illumination flare. Target drones deploy parachutes and are recovered by boat or helicopter when possible; Tactical Air-Launched Decoys and illumination flares are expended and not recovered. These events typically occur at high altitudes.
Anti-air missiles may also be employed when training against threat missiles.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed-wing aircraft (e.g., F/A-18C, F-35)
Systems: None
Ordnance/Munitions: Anti-air missiles (e.g., AIM-7, AIM-9, AIM-120, AIM-132 [non-explosive and high-explosive])
Targets: BQM-34, BQM-74 (Figure A-1), illumination flare (e.g., LUU-2) (Figure A-2), Tactical Air-Launched Decoy (Figure A-3)
Duration: 1–2 hours</td><td>Location:
Mariana Islands Training and Testing Study Area > 12 nm from land</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: Military expended material strike (target and missile fragment), aircraft strike (birds only)
Entanglement: Parachutes
Ingestion: Military expended materials (missile fragments, parachute, flare casing, target fragments)</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Missile and target fragments.
Parachutes.
Flare casings.</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">All missiles are explosive (Alternatives 1 and 2), and all missiles explode at high altitude.
All propellant and explosives are consumed.
Assume 1.5 flares per Missile Exercise event.</td></tr>
</table>

Figure A-1: BQM-74 (Aerial Target)

Figure A-2: LUU-2B/B Illuminating Flare (Aerial Target)

Figure A-3: Tactical Air-Launched Decoy (Aerial Target)

A.1.1.6 Gunnery Exercise (Surface-to-Air) – Large-Caliber

Activity Name	Activity Description	
Anti-Air Warfare		
Gunnery Exercise (Surface-to-Air) – Large-Caliber **(GUNEX [S-A]) – Large-Caliber)**	Surface ship crews defend against threat aircraft or missiles with guns.	
Long Description	Surface vessel personnel defend against threat aircraft or missile targets with guns to disable or destroy the threat. An event involves one vessel and a simulated threat aircraft or anti-vessel missile that is detected by the vessel's radar. Large-caliber guns fire projectiles, either non-explosive or high-explosive (configured to explode in air); to disable or destroy the threat before it reaches the vessel. The target is towed by a commercial air services jet.	
Information Typical to the Event	**Platform:** Surface combatant vessel (e.g., CG, DDG, FFG, Littoral Combat Ship), fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** Large-caliber (e.g., 5-inch gun, 76 mm, 57 mm [non-explosive] **Targets:** Towed banners behind aircraft **Duration:** 1–2 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, vessel noise, weapons firing noise, in-air explosives **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles), vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectile fragments, target fragments	
Detailed Military Expended Material Information	Projectiles Target fragments	
Assumptions used for Analysis	All projectiles are assumed to be non-explosive.	

A.1.1.7 Gunnery Exercise (Surface-to-Air) – Medium-Caliber

Activity Name	Activity Description	
Anti-Air Warfare		
Gunnery Exercise (Surface-to-Air) – Medium-Caliber **(GUNEX [S-A] – Medium-Caliber)**	Surface ship crews defend against threat aircraft or missiles with guns.	
Long Description	Surface vessel personnel defend against threat aircraft or missile targets with guns to disable or destroy the threat. An event involves one vessel and a simulated threat aircraft or anti-vessel missile that is detected by the vessel's radar. Medium-caliber guns fire projectiles, typically non-explosive, to disable or destroy the threat before it reaches the vessel. The target is towed by a commercial air services jet.	
Information Typical to the Event	**Platform:** Surface vessel, fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** Medium-caliber munitions (non-explosive) **Targets:** Towed banners behind aircraft **Duration:** 1–2 hours	**Location:** Mariana Islands Training and Testing Study Area, Special Use Airspace/ATCAAs > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles), vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectiles, casings	
Detailed Military Expended Material Information	Projectiles Casings	
Assumptions used for Analysis	All projectiles non-explosive. Close In Weapon System employed in all events. Routine Close In Weapon System maintenance related firing can occur throughout study area, as long as a clear range is established.	

A.1.1.8 Missile Exercise (Surface-to-Air)

Activity Name	Activity Description	
Anti-Air Warfare		
Missile Exercise (Surface-to-Air) **(MISSILEX [S-A])**	Surface ship defends against threat missiles and aircraft with missiles.	
Long Description	Surface vessel crews defend against threat missiles and aircraft with vessel launched missiles. The event involves a simulated threat aircraft or anti-ship missile that is detected by the vessel's radar. Vessel launched anti-air missiles are fired (high-explosive) to disable or destroy the threat. The target typically is a remote controlled drone. Anti-Air missiles may also be used to train against land attack missiles.	
Information Typical to the Event	**Platform:** Surface vessels **Systems:** None **Ordnance/Munitions:** Anti-air missiles (e.g., Sea Sparrow, Standard Missile SM-2, Rolling Airframe Missile [high-explosive]) **Targets:** Unmanned drones (e.g., BQM-34, BQM-74) **Duration:** 1–2 hours	**Location:** Mariana Islands Training and Testing Study Area, Special Use Airspace > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, weapons firing noise, in-air explosives **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (missile fragments), vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Missile fragments	
Detailed Military Expended Material Information	Missile fragments	
Assumptions used for Analysis	Assume all anti-air missiles are high-explosive. Missile explodes well above surface. All explosive and propellant consumed. Target typically not destroyed, unmanned drones are recovered when possible.	

A.1.2 Strike Warfare Training

Strike warfare includes training of fixed-wing fighter/attack aircraft or rotary-wing aircraft in delivery of precision guided munitions, non-guided munitions, rockets, and other ordnance against land targets in all weather and light conditions. Training events typically involve a simulated strike mission with a flight of four or more aircraft. The strike mission may simulate attacks on “deep targets” (i.e., those geographically distant from friendly ground forces), or may simulate close air support of targets within close range of friendly ground forces. Laser designators from aircraft or ground personnel may be employed for delivery of precision guided munitions. Some strike missions involve no-drop events in which prosecution of targets is simulated, but video footage is often obtained by onboard sensors.

A.1.2.1 Bombing Exercise (Air-to-Ground)

Activity Name	Activity Description	
Strike Warfare		
Bombing Exercise (Air-to-Ground) (BOMBEX [A-G])	Fixed-wing aircraft drop bombs against a land target.	
Long Description	Bombing exercise involves training of bomber or strike fighter aircraft delivery of ordnance against land targets in day or night conditions. The bombing exercise may involve close air support training in direct support of and in close proximity to forces on the ground, such as Navy or Marine forces engaged in training exercises on land, and may include the use of targeting laser.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft **Systems:** Targeting laser systems **Ordnance/Munitions:** Typical: MK-76, BDU-45, and BDU-45 (non-explosive), and MK-80 series bombs (explosive) **Targets:** Land targets **Duration:** 1–2 hours	**Location:** Farallon de Medinilla
Potential Impact Concerns (Information regarding deconstruct categories and stressors)	**Acoustic:** Aircraft noise, explosive noise **Energy:** Targeting laser **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Bombs are released in accordance with range standard operating procedures. Land targets only.	

A.1.2.2 Gunnery Exercise (Air-to-Ground)

Activity Name	Activity Description	
Strike Warfare		
Gunnery Exercise (Air-to-Ground) (GUNEX [A-G])	Helicopter crews fire guns at stationary land targets; fixed-winged aircraft also strafe land targets.	
Long Description	Fixed-wing aircraft and helicopter crews use guns to attack ground targets, day or night, with the goal of destroying or disabling enemy vehicles, structures, or personnel. Aircraft will fire a burst of rounds, then break off and reposition for another strafing run until each aircraft expends its exercise ordnance allowance. This exercise may include the use of targeting laser.	
Information Typical to the Event	**Platform:** Fixed-wing and rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** Small-, medium-, and large-caliber projectiles (e.g.,20/25/30 mm, 50-caliber and 7.63 mm, 105 mm) **Targets:** Land Targets **Duration:** 1 hour	**Location:** Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** Targeting laser **Physical Disturbance and Strike:** Air strike (birds only) **Entanglement:** None **Ingestion:** Projectile fragments and casings	
Detailed Military Expended Material Information	Projectile casings	
Assumptions used for Analysis	Land-based targets only.	

A.1.2.3 Missile Exercise

Activity Name	Activity Description	
Strike Warfare		
Missile Exercise (MISSILEX)	Missiles or rockets are launched against a land target.	
Long Description	Fixed-wing aircraft, helicopter, ship or submarine crews use missiles to attack ground targets, day or night, with the goal of destroying or disabling enemy vehicles, structures, or personnel.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, helicopters, ships, submarines **Systems:** Targeting laser systems **Ordnance/Munitions:** Missiles or rockets (explosive) **Targets:** Land targets **Duration:** 1–2 hours	**Location:** Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft and missile/rocket noise **Energy:** Targeting laser **Physical Disturbance and Strike:** Vessel strike**,** airstrike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Missile booster sections	
Assumptions used for Analysis	Land-based targets only	

A.1.2.4 Combat Search and Rescue

Activity Name	Activity Description	
Strike Warfare		
Combat Search and Rescue (CSAR)	CSAR units use helicopters, night vision and identification systems, and insertion and extraction techniques under hostile conditions to locate, rescue, and extract personnel.	
Long Description	An event involves two or more rescue aircraft.	
Information Typical to the Event	**Platform:** Helicopters **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–2 hours	**Location:** Mariana Islands Range Complex; Rota Airport
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	No weapons fired.	

A.1.3 Amphibious Warfare Training

Amphibious warfare is a type of naval warfare involving the utilization of naval firepower and logistics, and Marine Corps landing forces to project military power ashore. Amphibious warfare encompasses a broad spectrum of operations involving maneuver from the sea to objectives ashore, ranging from reconnaissance or raid missions involving a small unit, to large-scale amphibious operations involving over one thousand Marines and Sailors, and multiple ships and aircraft embarked in a Strike Group.

Amphibious warfare training includes tasks at increasing levels of complexity, from individual, crew, and small unit events to large task force exercises. Individual and crew training include the operation of amphibious vehicles and naval gunfire support training. Small-unit training operations include events leading to the certification of a Marine Expeditionary Unit as "deployment ready" or "special operations capable," depending on if Marine Special Forces are attached to the unit. Such training includes shore assaults, boat raids, airfield or port seizures, and reconnaissance. Larger-scale amphibious exercises involve ship-to-shore maneuver, shore bombardment and other naval fire support, and air strike and close air support training.

A.1.3.1 Naval Surface Fire Support Exercise – Land-Based Target

Activity Name	Activity Description	
Amphibious Warfare		
Naval Surface Fire Support Exercise – Land-Based Target (FIREX [Land])	Surface ship crews use large-caliber guns to fire on land-based targets in support of forces ashore.	
Long Description	One or more vessels position themselves offshore the target area and a land or air based spotter relays type and exact location of the target. After observing the fall of the shot, the spotter relays any adjustments needed to reach the target. Once the rounds are on target, the spotter requests a sufficient number to effectively destroy the target. This exercise occurs on land ranges where high-explosive and non-explosive practice ordnance is authorized and may be supported by target shapes on the ground.	
Information Typical to the Event	**Platform:** Surface combatant vessels (e.g., CG, DDG) **Systems:** None **Ordnance/Munitions:** large-caliber (explosive and non-explosive) **Targets:** Land targets **Duration:** 4–6 hours	**Location:** Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** Projectile fragments and casings	
Detailed Military Expended Material Information	Casings	
Assumptions used for Analysis	Land-based targets	

A.1.3.2 Amphibious Rehearsal, No Landing – Marine Air Ground Task Force

Activity Name	Activity Description	
Amphibious Warfare		
Amphibious Rehearsal, No Landing – Marine Air Ground Task Force	Amphibious shipping, landing craft, and aviation elements of the Marine Air Ground Task Force rehearse amphibious landing operations without conducting an actual landing on shore.	
Long Description	Amphibious vessels maneuver to position, flood well decks, and launch and recover landing craft including hovercraft, combat rubber raiding craft, armored amphibious craft, landing craft ship, and task force aircraft in assault landing rehearsals. Assault craft form landing waves and approach shore without landing.	
Information Typical to the Event	**Platform:** Amphibious shipping, amphibious assault craft, and fixed wing, rotary, and tilt rotor aircraft **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1–2 days	**Location:** Study Area and Nearshore
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Assault craft turn away before entering surf zone or landing zone. Typical event: 1–3 amphibious vessels (e.g., LHA or LHD, LPD, LSD); 2-8 landing craft (Landing Craft, Air Cushioned; Landing Craft, Utility); 4–14 amphibious assault vehicles; up to 22 aircraft (e.g., MH-53, H-46/MV-22, AH-1, UH-1, AV-8); a Marine Expeditionary Unit (2,200 Marines)	

A.1.3.3 Amphibious Assault

Activity Name	Activity Description	
Amphibious Warfare		
Amphibious Assault	Forces move ashore from ships at sea for the immediate execution of inland objectives.	
Long Description	Landing forces embarked in vessels, craft, or tilt-rotor and helicopters launch an attack from the sea onto a hostile shore. Amphibious assault is conducted for the purposes of prosecuting further combat operations, obtaining a site for an advanced naval or airbase, or denying the enemy use of an area. Unit Level Training exercises involve one or more amphibious vessels, and their associated watercraft and aircraft, to move personnel and equipment from vessel to shore without the command and control and supporting elements involved in a full scale event. The goal is to practice loading, unloading, and movement and to develop the timing required for a full-scale exercise.	
Information Typical to the Event	**Platform:** Amphibious and landing vessels (e.g., LHA, LHD, LPD, LSD), amphibious vehicles, fixed wing, rotary and tilt-rotor aircraft **Systems:** None **Ordnance/Munitions:** Blanks, Simunitions **Targets:** None **Duration:** Up to 2 weeks	**Location:** Mariana Islands Range Complex; Tinian; Guam
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only), vehicle strike (pedestrian), physical disturbance (coral, sea-turtle nests) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Typical event: 1–3 amphibious vessels (e.g., LHA or LHD, LPD, LSD); 2–8 landing craft (Landing Craft, Air Cushioned; Landing Craft, Utility); 4–14 amphibious assault vehicles; up to 22 aircraft (e.g., MH-53, H-46/MV-22, AH-1, UH-1, AV-8); a Marine Expeditionary Unit (2,200 Marines)	

A.1.3.4 Amphibious Raid

Activity Name	Activity Description	
Amphibious Warfare		
Amphibious Raid	Small unit forces move swiftly from ships at sea for a specific short term mission. These are quick operations with raids sized to the mission requirement and no larger.	
Long Description	Small unit forces swiftly move from amphibious vessels at sea into hostile territory for a specific mission, including a planned withdrawal. Raids are conducted to inflict loss or damage, secure information, create a diversion, confuse the enemy, or capture or evacuate individuals or material. Amphibious raid forces are sized to maximize stealth and speed of the operation. An event may employ assault amphibian vehicle units, small boat units, combat rubber raiding craft, and small unit live-fire and non-live-fire operations. Surveillance or reconnaissance unmanned surface and aerial vehicles may be used during this event.	
Information Typical to the Event	**Platform:** Amphibious assault vessels (e.g., LHA, LHD), amphibious transport dock and dock landing ships (e.g., LPD, LSD), amphibious vehicles (landing crafts, air cushioned, and amphibious assault vehicles), small boats (e.g., rigid-hull inflatable boats, combat rubber raiding craft) **Systems:** Unmanned surface and aerial vehicles **Ordnance/Munitions:** Blanks, Simunitions. **Targets:** None **Duration:** 4–8 hours	**Location:** Mariana Islands Range Complex; Tinian; Guam; Rota (no beach landings are contemplated for Rota)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, vehicle strike (pedestrian), physical disturbance (coral, sea-turtle nests) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Small-caliber weapons with training blanks and Simunitions. Firing of weapons at sea during these events accounted for in gunnery exercises, surface to surface activities.	

A.1.3.5 Urban Warfare Training

Activity Name	Activity Description	
Amphibious Warfare		
Urban Warfare Training	Forces sized from squad (13 Marines) to battalions (approximately 950) conduct training activities in mock urban environments.	
Long Description	Military units provide integrated and effective ground and air support for maneuver and battle in an urban environment	
Information Typical to the Event	**Platform:** Trucks, unmanned aerial vehicles, rotor and tilt-rotor aircraft, fixed-wing strike fighter or attack aircraft **Systems:** **Ordnance/Munitions:** Blanks, Simunitions **Targets:** None **Duration:** 8 days	**Location:** Mariana Islands Range Complex; Tinian; Guam
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike. **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Land-based activity.	

A.1.3.6 Noncombatant Evacuation Operation

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Amphibious Warfare</td></tr>
<tr><td>Noncombatant Evacuation Operation</td><td colspan="2">Military units evacuate noncombatants from hostile or unsafe areas or provide humanitarian assistance in times of disaster</td></tr>
<tr><td>Long Description</td><td colspan="2">Military units provide integrated and effective vessel, ground, and close air support, in support of task force operations to evacuate noncombatants.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessels, amphibious vessels, rotary-wing and tilt rotor aircraft, fixed-wing strike fighter or attack aircraft, unmanned aerial vehicles
Systems: None
Ordnance/Munitions: Blanks, Simunitions
Targets: None
Duration: 5 days</td><td>Location:
Mariana Islands Range Complex; Guam; Tinian; Rota</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: Aircraft strike, vessel strike
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Sea-, land-, and air-based activity.</td></tr>
</table>

A.1.3.7 Humanitarian Assistance Operations/Disaster Relief Operations

Activity Name	Activity Description	
Amphibious Warfare		
Humanitarian Assistance Operation/Disaster Relief Operations	Military units evacuate noncombatants from hostile or unsafe areas or provide humanitarian assistance in times of disaster.	
Long Description	Military units evacuate noncombatants from hostile or unsafe areas to safe havens or to provide humanitarian assistance in times of disaster. Non-Combatant Evacuation Operation is conducted by military units (generally Marine Corps) usually operating in conjunction with Navy ships and aircraft. Noncombatants are evacuated when their lives are endangered by war, civil unrest, or natural disaster. Marine Corps Marine expeditionary unit train for evacuations in hostile environments that require the use of force, though usually there is no opposition to evacuation from the host country. Helicopters and landing crafts could be expected to participate in this operation during day or night. No ordnance is used.	
Information Typical to the Event	**Platform:** Rotary, tilt-rotor and fixed-wing aircraft, amphibious vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Varies	**Location:** Mariana Islands Range Complex; Guam; Tinian; Rota
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike, vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Sea-, land-, and air-based activity.	

A.1.3.8 Unmanned Aerial Vehicle – Intelligence, Surveillance, and Reconnaissance

Activity Name	Activity Description	
Amphibious Warfare		
Unmanned Aerial Vehicles Ops (UAV OPS)	Military units employ unmanned aerial vehicles to launch, operate, and gather intelligence for specified amphibious missions.	
Long Description	Unmanned aerial vehicles may be launched from ships or ground and are used to gather tactical or theater level intelligence.	
Information Typical to the Event	**Platform:** Rotary and fixed-wing aircraft, vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Varies	**Location:** Mariana Islands Range Complex; Special Use Airspace
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike, vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Sea-, land-, and air-based activity.	

A.1.4 ANTI-SURFACE WARFARE TRAINING

Anti-surface warfare is a type of naval warfare in which aircraft, surface ships, and submarines employ weapons and sensors in operations directed against enemy surface ships or boats. Air-to-surface exercises are conducted by long-range attacks using air-launched cruise missiles or other precision guided munitions, or using aircraft cannon. Anti-surface warfare also is conducted by warships employing torpedoes, naval guns, and surface-to-surface missiles. Submarines attack surface ships using torpedoes or submarine-launched, anti-ship cruise missiles. Training in anti-surface warfare includes surface-to-surface gunnery and missile exercises, air-to-surface gunnery and missile exercises, and submarine missile or torpedo launch events. Gunnery and missile training generally involves expenditure of ordnance against a towed target. A sinking exercise is a specialized training event that provides an opportunity for ship, submarine, and aircraft crews to use multiple weapons systems to deliver high-explosive ordnance on a deactivated vessel, which is deliberately sunk.

Anti-surface warfare also encompasses maritime security, such as the interception of a suspect surface ship by a Navy ship for the purpose of boarding-party inspection or the seizure of the suspect ship. Training in these tasks is conducted in visit, board, search and seizure exercises.

A.1.4.1 Gunnery Exercise (Air-to-Surface) – Small-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise (Air-to-Surface) – Small-Caliber	**Short Description:** Helicopter aircrews, including embarked personnel, use small-caliber guns to engage surface targets.	
Long Description	Helicopters, carrying several air crewmen, fly a racetrack pattern around an at-sea target. Each gunner will engage the target with small-caliber weapons. Targets range from a smoke float, an empty steel drum, to high speed remote controlled boats and jet-skis.	
Information Typical to the Event	**Platform:** Helicopter **Systems:** None **Ordnance/Munitions:** Small-caliber (non-explosive) **Targets:** Recoverable or expendable floating target (stationary or towed), remote high speed target **Duration:** 1 hour	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, military expended material strike (projectiles, target fragments), aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectiles, target fragments, casings	
Detailed Military Expended Material Information	Projectiles, target fragments, casings	
Assumptions used for Analysis	One target used per event. Expendable smoke float (50 percent), stationary target (45 percent), or remote controlled target (5 percent).	

A.1.4.2 Gunnery Exercise (Air-to-Surface) – Medium-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise (Air-to-Surface) – Medium-Caliber	Fixed-wing and helicopter aircrews, including embarked personnel, use medium-caliber guns to engage surface targets.	
Long Description	Fighter and helicopter aircrew, including embarked personnel, engage surface targets with medium-caliber guns. Targets simulate enemy ships, boats, swimmers, and floating/near-surface mines. Fighter aircraft descend on a target firing high-explosive or non-explosive practice munitions medium-caliber projectiles. Helicopters, carrying several air crewmen, fly a racetrack pattern around an at-sea target. Crew will engage the target with medium-caliber weapons. Targets range from a smoke float, an empty steel drum, to high speed remote controlled boats and jet-skis.	
Information Typical to the Event	**Platform:** Fixed-wing (e.g., F/A-18, F-35); Helicopter (e.g., MH-60) **Systems:** None **Ordnance/Munitions:** Medium-caliber (non-explosive and explosive) **Targets:** Recoverable or expendable floating target (stationary or towed), Remote high speed target **Duration:** 1 hour	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land; Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions (E1), aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectile, target fragments), in-water device strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectile, casings and target fragments	
Detailed Military Expended Material Information	Projectiles, casings, projectile and target fragments One target used per event. Expendable smoke float (50 percent), stationary target (45 percent), or remote controlled target (5 percent).	
Assumptions used for Analysis	Most medium-caliber air-to-surface gunnery exercises will be with non-explosive training projectiles. High-explosive rounds will supplement when non-explosive training projectiles are not available.	

A.1.4.3 Missile Exercise (Air-to-Surface) – Rocket

Activity Name	Activity Description	
Anti-Surface Warfare		
Missile Exercise (Air-to-Surface) Rocket **(MISSILEX [A-S]) – Rocket)**	Fixed-wing and helicopter aircrew fire precision-guided/unguided rockets against surface targets.	
Long Description	Fighter, maritime patrol aircraft, and helicopter aircrews fire precision-guided/unguided rockets against surface targets. Aircraft involved may be unmanned. Fixed-wing aircraft (fighters or maritime patrol aircraft) approach an at-sea surface target from high altitude and launch precision guided/unguided rockets. Helicopters designate an at-sea surface target with a laser or optics for precision guided rockets.	
Information Typical to the Event	**Platform:** Fixed-wing (e.g., F/A18, F-35, P-8, P-3, unmanned aerial vehicle) Helicopters (MH-60, Fire Scout) **Systems:** None **Ordnance/Munitions:** Rockets (explosive) **Targets:** Recoverable floating target (stationary or towed) **Duration:** 1 hour	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions (E5), aircraft noise **Energy:** Target Laser **Physical Disturbance and Strike:** In-water device strike, military expended material strike (rocket, rocket and target fragments) **Entanglement:** None **Ingestion:** Target fragments, rocket fragments	
Detailed Military Expended Material Information	Rockets, rocket fragments Target fragments	
Assumptions used for Analysis	Assume all rockets are explosive and detonate in water.	

A.1.4.4 Missile Exercise (Air-to-Surface)

Activity Name	Activity Description	
Anti-Surface Warfare		
Missile Exercise (Air-to-Surface) **(MISSILEX [A-S])**	Fixed-wing and helicopter aircrews fire precision-guided missiles against surface targets.	
Long Description	Fighter, maritime patrol aircraft, and helicopter aircrews fire both precision-guided missiles and unguided rockets against surface targets. Aircraft involved may be unmanned. Fixed-wing aircraft (fighters or maritime patrol aircraft) approach an at-sea surface target from high altitude, and launch high-explosive precision guided missiles. Helicopters designate an at-sea surface target with a laser or optics for a precision guided high-explosive missile. Helicopter launched missiles typically pass through the target's "sail," and detonate at, or just below, the water's surface.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft and helicopters **Systems:** None **Ordnance/Munitions:** Missiles (high-explosive or non-explosive) **Targets:** Recoverable floating target (stationary or towed), Remotely operated target **Duration:** 2 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions (E6, E8, E10), aircraft noise, tow vessel noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, military expended material strike (missile fragment), aircraft strike (birds only) **Entanglement:** None **Ingestion:** Missile fragments, target fragments	
Detailed Military Expended Material Information	Missile fragments Target fragments	
Assumptions used for Analysis	Assume one explosive missile and one target per event. While missile could explode above water's surface after contacting target, analysis assumes all warheads explode at or just below surface.	

A.1.4.5 Laser Targeting (At Sea)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Laser Targeting (At Sea)</td><td colspan="2">Fixed-winged, helicopter, and ship crews illuminate enemy targets with lasers.</td></tr>
<tr><td>Long Description</td><td colspan="2">Fixed-winged and helicopter aircrew and shipboard personnel illuminate enemy targets with lasers for engagement by aircraft with laser guided bombs or missiles.
This exercise may be conducted alone or in conjunction with other events utilizing precision guided munitions, such as anti-surface missiles and guided rockets. Events where weapons are fired are addressed in the appropriate activity (e.g., air-to-surface missile exercise).
Lower powered lasers may also be used as non-lethal deterrents during maritime security operations (force protection).</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Vessels, fixed-wing aircraft, rotary-wing aircraft
Systems: None
Ordnance/Munitions: None unless conducted with other event (e.g., missile exercise)
Targets: Land targets, Remote-controlled surface targets
Duration: 1–2 hours</td><td>Location:
Mariana Islands Training and Testing Study Area > 12 nm from land</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Vessel noise, aircraft noise
Energy: In-air low energy lasers
Physical Disturbance and Strike: Vessel strike, aircraft strike (birds only)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Laser targeting for missile/rocket guidance will occur in areas where these events also occur.</td></tr>
</table>

A.1.4.6 Bombing Exercise (Air-to-Surface)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Bombing Exercise (Air-to-Surface)
(BOMBEX [A-S])</td><td colspan="2">Fixed-wing aircrews deliver bombs against surface targets.</td></tr>
<tr><td>Long Description</td><td colspan="2">Fixed-wing aircrews deliver bombs against surface targets.
Fixed-wing aircraft conduct a bombing exercise against stationary floating targets (e.g., MK-58 smoke buoy). An aircraft clears the area, deploys a smoke buoy or other floating target, and then delivers high-explosive or non-explosive practice munitions bomb(s) on the target. A range boat may be used to deploy targets for an aircraft to attack.
Exercises for strike fighters typically involve a flight of two aircraft delivering unguided or guided munitions that may be either high-explosive or non-explosive practice munitions. The following munitions may be employed by aircraft in the course of the bombing exercise: Typical unguided munitions: Non-explosive Sub Scale Bombs (MK-76 and BDU-45); explosive and non-explosive general purpose bombs (MK-80 series). Precision-guided munitions: Laser-guided bombs (explosive, non-explosive); Laser-guided Training Rounds (non-explosive); Joint Direct Attack Munition (explosive, non-explosive).</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed-wing
Systems: None
Ordnance/Munitions: Bombs (e.g., MK-76, BDU-45, MK-80 series [high-explosive, non-explosive])
Targets: Expendable floating target (e.g., smoke float)
Duration: 1 hour</td><td>Location:
Mariana Islands Training and Testing Study Area > 50 nm from land</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Underwater explosions (e.g., E12), aircraft noise
Energy: None
Physical Disturbance and Strike: Military expended material strike (non-explosive bomb), aircraft strike (birds only)
Entanglement: None
Ingestion: Bomb fragments, target fragments, smoke floats</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Bomb fragments
Target fragments
Smoke floats</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Explosive bombs are assumed to explode just beneath the surface.</td></tr>
</table>

A.1.4.7 Torpedo Exercise (Submarine-to-Surface)

Activity Name	Activity Description
Anti-Surface Warfare	
Torpedo Exercise (Submarine-to-Surface)	Submarine attacks a surface target using exercise or live-fire torpedoes.
Long Description	Submarines track and engage a surface target with non-explosive exercise torpedoes.
Information Typical to the Event	**Platform:** Submarine, helicopter or vessel torpedo retrieval craft **Systems:** None **Ordnance/Munitions:** Non-explosive exercise torpedo **Targets:** Surface vessel **Duration:** 2–4 hours **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, hull mounted sonar (MF3), heavyweight torpedo (TORP2), aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike **Entanglement:** Guidance wire **Ingestion:** None
Detailed Military Expended Material Information	Guidance wire
Assumptions used for Analysis	The exercise torpedo is recovered by a support craft or helicopter.

A.1.4.8 Missile Exercise (Surface-to-Surface)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Missile Exercise (Surface-to-Surface)
(MISSILEX [S-S])</td><td colspan="2">Surface vessel crews defend against surface vessel threats with missiles.</td></tr>
<tr><td>Long Description</td><td colspan="2">Surface vessels launch missiles at surface maritime targets with the goal of destroying or disabling enemy vessels or boats.
After detecting and confirming a surface threat, the vessel will fire precision guided anti-surface missile.
Events with destroyers and cruisers will involve long range (over the horizon) harpoon (or similar) anti surface missiles. While past harpoon events occurred during sinking exercises, requirement exists for non-sinking exercise events to certify ship crews. If a sinking exercise target is unavailable, towed sled would likely be used.
Events with Littoral Combat Ships may involve shorter range anti-surface missiles. Events with Littoral Combat Ships would be to certify vessel’s crew to defend against “close in” (less than 10 miles) surface threats.
These exercises are live fire, that is, a missile is fired down range. Anti-surface missiles could be equipped with either high-explosive or non-explosive warheads.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessels (e.g., CG, DDG, LCS)
Systems: None
Ordnance/Munitions: Anti-surface missiles, Harpoons (explosive and non-explosive)
Targets: High speed surface targets, towed sleds
Duration: 2–4 hours</td><td>Location:
Mariana Islands Training and Testing Study Area > 50 nm from land</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Underwater explosions (e.g., E6, E10), vessel noise, weapons firing noise
Energy: None
Physical Disturbance and Strike: Vessel and in-water device strike, military expended material strike (missile and target fragments)
Entanglement: None
Ingestion: Missile fragments, target fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Missiles, missile fragments
Target fragments</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Assume one missile and one target per event.
While missile could explode above water’s surface after contacting target, analysis assumes all warheads explode at or just below surface.</td></tr>
</table>

A.1.4.9 Gunnery Exercise (Surface-to-Surface) Ship – Large-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Ship) – Large-Caliber (GUNEX [S-S] Ship – Large-Caliber)	Ship crews engage surface targets with ship's large-caliber guns.	
Long Description	This exercise involves vessels' gun crews engaging surface targets at sea with their large-caliber (typically 57 mm, 76 mm, and 5-inch) guns. Targets may include the QST-35 (Figure A-5) seaborne powered target, high speed maneuverable surface target, or a specially configured remote controlled water craft. Some targets are expended during the exercise and are not recovered. The exercise proceeds with the target boat approaching from about 10 nm distance. The target is tracked by radar and when within a predetermined range, it is engaged first with "warning shots." As threats get closer all weapons may be used to disable the threat. This exercise may involve a single firing vessel, or be undertaken in the context of a coordinated larger exercise involving multiple ships, including a major training event. Large-caliber guns will also be fired during weapon certification events and in conjunction with weapon maintenance. During all events, either high-explosive or non-explosive rounds may be used. High explosive rounds can either be fused for detonation on impact (with water surface or target), or for proximity to the target (in air detonation).	
Information Typical to the Event	**Platform:** Surface combatant vessels **Systems:** None **Ordnance/Munitions:** Large-caliber (e.g., 57 mm, 76 mm, and 5-inch [high-explosive and non-explosive]) **Targets:** Remote controlled high speed targets **Duration:** Up to 3 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land; Transit corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions (e.g., E3, E5), vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, target strike, military expended material strike (projectile, target fragments) **Entanglement:** None **Ingestion:** Target fragments, projectile fragments	
Detailed Military Expended Material Information	Large-caliber projectiles and casings Target fragments Projectile fragments	
Assumptions used for Analysis	For analytical purposes assume all high-explosive rounds are fused to detonate upon impact with water surface or target. After impacting the water, the high-explosive rounds are expected to detonate within three feet of the surface. Non-explosive rounds and fragments from the high-explosive rounds will sink to the bottom of the ocean. Assume each non-explosive projectile will be up to 5-inch diameter.	

A.1.4.10 Gunnery Exercise (Surface-to-Surface) Ship – Small-Caliber and Medium-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Ship) – Small-Caliber and Medium-Caliber **(GUNEX [S-S] Ship – Small-Caliber and Medium-Caliber)**	Ship crews engage surface targets with ship's small- and medium-caliber guns.	
Long Description	This exercise involves vessel crews engaging surface targets at sea with small-caliber and medium-caliber weapons. Vessels use small- and medium-caliber weapons to practice defensive marksmanship, typically against a stationary floating target and high speed mobile targets. Some targets are expended during the exercise and are not recovered.	
Information Typical to the Event	**Platform:** Surface vessels **Systems:** None **Ordnance/Munitions:** Small-caliber (non-explosive); Medium-caliber (high-explosive or non-explosive). **Targets:** Recoverable and expendable floating target (stationary or towed), remote control high-speed targets **Duration:** 2–3 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land; Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E1), vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, target strike, military expended material strike (projectiles) **Entanglement:** None **Ingestion:** Small-caliber/Medium-caliber projectiles and casings, target fragments, projectile fragments	
Detailed Military Expended Material Information	Small- and medium-caliber projectiles and casings, target fragments, projectile fragments Approximately 200 small- and medium-caliber rounds per event One target used per event. Approximately 50 percent of targets are “Killer Tomatoes” (usually recovered). Approximately 35 percent are high-speed maneuvering targets, which are recovered. Approximately 15 percent of targets are other stationary targets such as a steel drum.	
Assumptions used for Analysis	None	

A.1.4.11 Sinking Exercise (SINKEX)

Activity Name	Activity Description
Anti-Surface Warfare	
Sinking Exercise (SINKEX)	Aircraft, ship, and submarine crews deliver ordnance on a seaborne target, usually a deactivated ship, which is deliberately sunk using multiple weapon systems.
Long Description	Ship personnel and aircrew deliver high-explosive ordnance on a seaborne target, (large deactivated vessel), which is deliberately sunk using multiple weapon systems. A sinking exercise is typically conducted by aircraft, surface vessels, and submarines in order to take advantage of the ability to fire high-explosive ordnance on a full size ship target. The target is typically a decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards. The location is greater than 50 nautical miles from shore and in water depths greater than 6,000 feet. Vessel, aircraft, and submarine crews attack with coordinated tactics and deliver live high-explosive ordnance to sink the target. Non-explosive practice munitions may be used during the initial stages to extend target life. Typically, the exercise lasts for 4–8 hours and possibly over 1–2 days, however it is unpredictable, and ultimately ends when the ship sinks.
Information Typical to the Event	**Platform:** Vessels, Aircraft, Submarines **Systems:** None **Ordnance/Munitions:** Potentially all available (explosive and non-explosive), torpedo **Targets:** Decommissioned ship made environmentally safe for sinking (according to U.S. Environmental Protection Agency standards) **Duration:** 4–8 hours, possibly over 1–2 days (unpredictable and ultimately ends when the ship sinks) **Location:** Mariana Islands Training and Testing Study Area > 50 nm from land in water depths > 6,000 feet
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions (e.g., E5, E8, E9, E11), vessel noise, aircraft noise, weapons firing noise **Energy:** In-air low energy lasers **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles, projectile fragments), vessel strike, aircraft strike (birds only) **Entanglement:** Guidance wires **Ingestion:** Munitions fragments, casings
Detailed Military Expended Material Information	Munitions fragments, non-explosive ordnance, guidance wires, casings Ship hulk (decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards)

Sinking Exercise (SINKEX) (continued)

Activity Name	Activity Description
Anti-Surface Warfare	
Assumptions used for Analysis *(Representative ordnance. Actual ordnance used will vary [typically less than shown])*	Greater than 50 nautical miles from shore and in water depths greater than 6,000 feet Typical participants and assets: • One full-size target ship hulk • One to five ships • One to 10 fixed-wing aircraft • One or two combatant helicopters • One Command and Control aircraft • One submarine • One to three range clearance aircraft • Nine to 42 explosive missiles • Two to 28 bombs • Fifty to 800 large caliber rounds • One to two heavyweight submarine-launched torpedo • One to four explosive demolitions • Assume 2 guidance wires expended per event

A.1.4.12 Gunnery Exercise (Surface-to-Surface) Boat – Small-Caliber and Medium-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Boat) – Small-Caliber and Medium-Caliber **(GUNEX [S-S] Boat)**	Small boat crews engage surface targets with small- and medium-caliber weapons.	
Long Description	Boat crews engage surface targets with small- and medium-caliber weapons. Boat crews may use high or low speeds to approach and engage targets simulating other boats, floating mines, or near shore land targets with small- and medium-caliber (up to and including 40mm) weapons. A commonly used target is an empty steel drum. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are mostly used to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include: small unit river craft, combat rubber raiding craft, rigid-hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.	
Information Typical to the Event	**Platform:** Boats **Systems:** None **Ordnance/Munitions:** Small- and medium-caliber (up to and including 40mm [explosive and non-explosive]) **Targets:** Recoverable or expendable floating target (Figure A-4) (stationary or towed) **Duration:** 1 hour	**Location:** Mariana Islands Training and Testing Study Area >12 nm [explosive rounds] Study Area > 3 nm from land [non-explosive rounds] Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions (E2), vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectile, target fragments), vessel and in-water device strike **Entanglement:** None **Ingestion:** Projectiles and target fragments, projectiles, casings	
Detailed Military Expended Material Information	Projectiles and target fragments, projectiles, casings One target used per event, typically a stationary target such as a 50-gallon (189-liter) steel drum.	
Assumptions used for Analysis	Assume all Alternatives 1 and 2 events include the use of some explosive rounds. Most events will involve boat crews training with MK 203 40mm grenade launcher.	

A.1.4.13 Maritime Security Operations (MSO)

Activity Name	Activity Description	
Anti-Surface Warfare		
Maritime Security Operations (MSO)	Helicopter and surface ship crews conduct a suite of Maritime Security Operations (e.g., Vessel, Search, Board, and Seizure; Maritime Interdiction Operations; Force Protection; and Anti-Piracy Operation).	
Long Description	Helicopter and surface ship crews conduct a suite of Maritime Security Operations (e.g., visit search, board, and seizure; maritime interdiction operations; force protection; and anti-piracy operation). These activities involve training of boarding parties delivered by helicopters and surface ships to surface vessels for the purpose of simulating vessel search and seizure operations. Various training scenarios are employed and may include small arms with non-explosive blanks and surveillance or reconnaissance unmanned surface and aerial vehicles, and anti-swimmer grenades. The entire exercise may last 2–3 hours. Vessel Visit, Board, Search, and Seizure: Military and U.S. Coast Guard personnel from vessels and aircraft board suspect vessels, potentially under hostile conditions. Maritime Interdiction Operations: Vessels and aircraft train in pursuing, intercepting, and ultimately detaining suspect vessels. Oil Platform Defense: Naval personnel train to defend oil platforms or other similar at sea structures. Warning Shot/Disabling Fire: Naval and U.S. Coast Guard personnel train in the use of weapons to force fleeing or threatening small boats (typically operating at high speeds) to come to a stop. Ship Force Protection: Vessel crews train in tracking multiple approaching, circling small craft, assessing threat potential, and communicating amongst crewmates and other vessels to ensure vessels are protected against attack. Anti-Piracy Training: Naval and U.S. Coast Guard personnel train in deterring and interrupting piracy activity. Training includes large vessels (pirate "mother ships"), and multiple small, maneuverable, and fast craft.	
Information Typical to the Event	**Platform:** Surface vessel (any), rotary-wing aircraft, small boats, high speed vessels, unmanned vehicles (surface and aerial) **Systems:** None **Ordnance/Munitions:** Small-caliber (non-explosive) and anti-swimmer grenades **Targets:** Range support vessel, high performance boats, remote controlled high speed targets towing surface targets **Duration:** Up to 3 hours	**Location:** Mariana Islands Training and Testing Study Area; Mariana Islands Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise, weapons firing noise, underwater explosion (E3) **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike, military expended material strike (projectile, target), **Entanglement:** None **Ingestion:** Small-caliber projectiles, casings, target fragments	
Detailed Military Expended Material Information	Small-caliber projectiles Target fragments Casings, grenade fragments	
Assumptions used for Analysis	Majority of events will occur proximate to NAVBASE Guam, including during times of transit in and out of port, as well as during major training events.	

Figure A-4: "Killer Tomato" Stationary Floating Target

Figure A-5: QST-35 Seaborne Powered Target

Figure A-6: High Speed Maneuvering Surface Target

A.1.5 ANTI-SUBMARINE WARFARE TRAINING

Anti-submarine warfare involves helicopter and maritime patrol aircraft, ships, and submarines. These units operate alone or in combination, in operations to locate, track, and neutralize submarines. Controlling the undersea battlespace is a unique naval capability and a vital aspect of sea control. Undersea battlespace dominance requires proficiency in anti-submarine warfare. Every deploying strike group and individual surface combatant must possess this capability.

Various types of active and passive sonar are used by the Navy to determine water depth, locate mines, and identify, track, and target submarines. Passive sonar "listens" for sound waves by using underwater microphones, called hydrophones, which receive, amplify, and process underwater sounds. No sound is introduced into the water when using passive sonar. Passive sonar can indicate the presence, character, and movement of submarines. However, passive sonar provides only a bearing (direction) to a sound-emitting source; it does not provide an accurate range (distance) to the source. Active sonar is needed to locate objects because active sonar provides both bearing and range to the detected contact (such as an enemy submarine). Active sonar is necessary to detect and track submarines that do not emit detectable levels of noise, either because of noise reduction design features or because of the presence of overwhelming background noise levels.

The Navy's anti-submarine warfare training plan, including the use of active sonar in at-sea training scenarios, includes multiple levels of training. Individual-level anti-submarine warfare training addresses basic skills such as detection and classification of contacts, distinguishing discrete acoustic signatures including those of ships, submarines, and marine life, and identifying the characteristics, functions, and effects of controlled jamming and evasion devices.

More advanced, integrated anti-submarine warfare training exercises involving active sonar is conducted in coordinated, at-sea operations during multi-dimensional training events involving submarines, ships, aircraft, and helicopters. This training integrates the full anti-submarine warfare continuum from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons. Training events include detection and tracking exercises against "enemy" submarine contacts; torpedo employment exercises against the target; and exercising command and control tasks in a multi-dimensional battlespace.

A.1.5.1 Tracking Exercise – Helicopter

Activity Name	**Activity Description**
Anti-Submarine Warfare	
Tracking Exercise – Helicopter	Helicopter crews search, track, and detect submarines.
Long Description	This exercise involves helicopters using sonobuoys and dipping sonar to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys are typically employed by a helicopter operating at altitudes below 3,000 feet (914 meters). Both passive and active sonobuoys are employed. The dipping sonar is employed from an altitude of about 50 feet (15 meters) after the search area has been narrowed based on the sonobuoy search. Both passive and active sonar are employed. The anti-submarine warfare target used for this exercise will likely be an Expendable Mobile Anti-submarine Warfare Training Target, a MK-30 recoverable exercise target or a live submarine if available. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event. The tracking exercise becomes a torpedo exercise when the helicopter launches an exercise torpedo. The exercise torpedo is recovered by a special recovery helicopter or small craft. The preferred range for this exercise is an instrumented range, but it may be conducted in other operating areas depending on training requirements and available assets.
Information Typical to the Event	**Platform:** Helicopters, surface vessels **Systems:** Mid-frequency helicopter dipping sonar, sonobuoys **Ordnance/Munitions:** Reusable exercise torpedoes (non-explosive) **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target or MK-30 recoverable target, or live submarine **Duration:** 2–4 hours **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land; Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Helicopter dipping sonar (MF4), sonobuoy (MF5), aircraft noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, aircraft strike (birds only), vessel and in-water device strike, seafloor devices (Portable Underwater Tracking Range) **Entanglement:** Parachutes **Ingestion:** Parachutes
Detailed Military Expended Material Information	One Expendable Mobile Anti-Submarine Warfare Training Target If target is air-dropped, one parachute per target Up to 20 sonobuoys per event (one parachute for each sonobuoy) Torpedo accessories (ballast weights, parachutes) Anchor ballast for tracking range transponders
Assumptions used for Analysis	Only Reusable Exercise Torpedoes used for this event. Tracking exercise can occur in all locations, torpedo exercise will not occur in Transit Corridor. Submarines may provide service as the target.

A.1.5.2 Torpedo Exercise – Helicopter

Activity Name	Activity Description	
Anti-Submarine Warfare		
Torpedo Exercise – Helicopter	Helicopter crews search, track, and detect submarines. Exercise torpedoes may be used during this event.	
Long Description	This exercise involves helicopters using sonobuoys and dipping sonar to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. The exercise may be conducted on a portable underwater tracking range. Sonobuoys are typically employed by a helicopter operating at altitudes below 3,000 feet (914 meters). Both passive and active sonobuoys are employed. The dipping sonar is employed from an altitude of about 50 feet (15 meters) after the search area has been narrowed based on the sonobuoy search. Both passive and active sonar are employed. The anti-submarine warfare target used for this exercise will likely be an Expendable Mobile Anti-submarine Warfare Training Target, a MK-30 recoverable exercise target or a live submarine if available. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event. The tracking exercise becomes a torpedo exercise when the helicopter launches an exercise torpedo. The exercise torpedo is recovered by a special recovery helicopter or small craft. The preferred range for this exercise is an instrumented range, but it may be conducted in other operating areas depending on training requirements and available assets.	
Information Typical to the Event	**Platform:** Helicopters, surface vessels **Systems:** Mid-frequency helicopter dipping sonar, sonobuoys; tracking range transponders **Ordnance/Munitions:** Exercise torpedoes (non-explosive) **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target or MK-30 recoverable target, or live submarine **Duration:** 2–4 hours	**Location:** Mariana Islands Training and Testing Study Area > 3 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Helicopter dipping sonar (MF4), sonobuoy (MF5), mid-frequency acoustic countermeasure (ASW4), lightweight torpedo [TORP1]), aircraft noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, aircraft strike (birds only), vessel and in-water device strike, seafloor devices (Portable Underwater Tracking Range) **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Material Information	One Expendable Mobile Anti-Submarine Warfare Training Target If target is air-dropped, one parachute per target Up to 20 sonobuoys per event (one parachute for each sonobuoy) Torpedo accessories (ballast weights, parachutes) Anchor ballast weight for tracking range transponders	
Assumptions used for Analysis	Submarines may provide service as the target.	

A.1.5.3 Tracking Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Submarine Warfare</td></tr>
<tr><td>Tracking Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys</td><td colspan="2">Maritime patrol aircraft crews search, detect and track submarines using explosive source sonobuoys or multistatic active coherent system.</td></tr>
<tr><td>Long Description</td><td colspan="2">This exercise involves fixed-wing maritime patrol aircraft employing Improved Extended Echo Ranging and Multistatic Active Coherent sonobuoy systems to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. The Improved Extended Echo Ranging events use the SSQ-110A sonobuoy as an impulsive source, while the Multistatic Active Coherent events utilize the SSQ-125 sonobuoy as a tonal source. Each exercise would include the use of approximately 10 SSQ-110A or SSQ-125 sonobuoys. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and ships, including a major range event.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Maritime Patrol Aircraft
Systems: Improved Extended Echo Ranging and Multistatic Active Coherent sonobuoy systems
Ordnance/Munitions: None
Targets: MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 recoverable target, or a live submarine
Duration: 2–8 hours</td><td>Location:
Mariana Islands Training and Testing Study Area > 3 nm from land</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Sonobuoy (ASW2), underwater explosives (E4), aircraft noise
Energy: None
Physical Disturbance and Strike: Aircraft strike (birds only), military expended material strike, seafloor devices (Portable Underwater Tracking Range)
Entanglement: Parachutes
Ingestion: Parachutes, Sonobuoy fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">One Expendable Mobile Anti-Submarine Warfare Training Target (MK-39); MK-30 are recovered.
Expended sonobuoys with parachutes
Anchor ballast for tracking range transponders</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">If target is air-dropped, one parachute per target.</td></tr>
</table>

A.1.5.4 Tracking Exercise – Maritime Patrol Aircraft

Activity Name	Activity Description
Anti-Submarine Warfare	
Tracking Exercise – Maritime Patrol Aircraft	Maritime patrol aircraft crews search, detect, and track submarines. Recoverable air launched torpedoes may be employed against submarine targets.
Long Description	This exercise involves fixed-wing maritime patrol aircraft employing sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys are typically employed by a maritime patrol aircraft operating at altitudes below 3,000 feet (914 meters), however, sonobuoys may be released at higher altitudes. Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. Depending on these two factors, these patterns will cover many different size areas. Both passive and active sonobuoys are employed. For certain sonobuoys, tactical parameters of use may be classified. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event. The tracking exercise becomes a torpedo exercise when the aircraft launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas depending on training requirements and available assets.
Information Typical to the Event	**Platform:** Fixed-wing aircraft (Maritime Patrol Aircraft [manned or unmanned]), surface combatant or small vessels **Systems:** Sonobuoys **Ordnance/Munitions:** Exercise torpedoes (non-explosive) **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 recoverable target, or a live submarine **Duration:** 2–8 hours **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonobuoys (MF5),vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only), vessel and in-water device strike, military expended material strike, seafloor devices (Portable Underwater Tracking Range) **Entanglement:** Parachutes **Ingestion:** Parachutes
Detailed Military Expended Material Information	One Expendable Mobile Anti-Submarine Warfare Training Target (MK-39) Torpedo accessories (ballast weights, parachutes) from reusable exercise torpedoes Expended sonobuoys with parachutes Anchor ballast for tracking range transponders
Assumptions used for Analysis	Submarine may provide service as the target. If target is air-dropped, one parachute per target.

A.1.5.5 Torpedo Exercise – Maritime Patrol Aircraft

Activity Name	Activity Description
Anti-Submarine Warfare	
Torpedo Exercise – Maritime Patrol Aircraft	Maritime patrol aircraft crews search, detect, and track submarines. Recoverable air launched torpedoes may be employed against submarine targets.
Long Description	This exercise involves fixed-wing maritime patrol aircraft employing sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. The exercise may be conducted on a portable underwater tracking range. Sonobuoys are typically employed by a maritime patrol aircraft operating at altitudes below 3,000 feet (914 meters), however, sonobuoys may be released at higher altitudes. Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. Depending on these two factors, these patterns will cover many different size areas. Both passive and active sonobuoys are employed. For certain sonobuoys, tactical parameters of use may be classified. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event. The tracking exercise becomes a torpedo exercise when the aircraft launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas depending on training requirements and available assets.
Information Typical to the Event	**Platform:** Fixed-wing aircraft (Maritime Patrol Aircraft [manned or unmanned]), surface combatant or small vessels **Systems:** Sonobuoys; tracking range transponders **Ordnance/Munitions:** Exercise torpedoes (non-explosive) **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 recoverable target, or a live submarine **Duration:** 2–8 hours **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonobuoys (MF5), lightweight torpedo (TORP1]), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only), vessel and in-water device strike, military expended material strike, seafloor devices (Portable Underwater Tracking Range) **Entanglement:** Parachutes **Ingestion:** Parachutes
Detailed Military Expended Material Information	MK-30 are recovered. Torpedo accessories (ballast weights, parachutes) from exercise torpedoes Expended sonobuoys with parachutes Anchor ballast for tracking range transponders
Assumptions used for Analysis	Submarine may provide service as the target. If target is air-dropped, one parachute per target.

A.1.5.6 Tracking Exercise – Surface

Activity Name	Activity Description
Anti-Submarine Warfare	
Tracking Exercise – Surface	Surface ship crews search, track, and detect submarines.
Long Description	Surface ships search, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine. A surface vessel operates at slow speeds while employing hull mounted and/or towed array sonar. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The target for this exercise is a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, or live submarine. This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The tracking exercise becomes a torpedo exercise when the ship launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas depending on training requirements and available assets.
Information Typical to the Event	**Platform:** Surface vessels **Systems:** Mid-frequency sonar, Nixie (countermeasure system) **Ordnance/Munitions:** Reusable exercise torpedoes (non-explosive torpedo exercise only) **Targets:** Submarine MK-30 or MK-39 Expendable Mobile Anti-Submarine Warfare Training Target **Duration:** 2–4 hours **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency acoustic countermeasure (ASW3), high-frequency sonar (HF6), hull mounted sonar (MF1, MF2, MF11), high duty cycle variable depth sonar (MF12), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike; military expended material strike, seafloor devices (Portable Underwater Tracking Range) **Entanglement:** None **Ingestion:** Torpedo accessories, Target fragments
Detailed Military Expended Material Information	MK-39 Expendable Mobile Anti-Submarine Warfare Training Target Torpedo accessories (ballast weights) from reusable exercise torpedoes Anchor ballast for tracking range transponders
Assumptions used for Analysis	Submarines may provide service as the target except for torpedo exercise events. Torpedoes are recovered.

A.1.5.7 Torpedo Exercise – Surface

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Submarine Warfare</td></tr>
<tr><td>Torpedo Exercise – Surface</td><td colspan="2">Surface ship crews search, track, and detect submarines. Exercise torpedoes may be used during this event.</td></tr>
<tr><td>Long Description</td><td colspan="2">Surface ships search, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine. The exercise may be conducted on a portable underwater tracking range.

A surface vessel operates at slow speeds while employing hull mounted and/or towed array sonar. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The target for this exercise is a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, or live submarine.

This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event.

The tracking exercise becomes a torpedo exercise when the ship launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas depending on training requirements and available assets.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessels
Systems: Mid-frequency sonar, Nixie (countermeasure system); tracking range transponders
Ordnance/Munitions: Exercise torpedoes (non-explosive torpedo exercise only)
Targets: Submarine MK-30 or MK-39 Expendable Mobile Anti-Submarine Warfare Training Target
Duration: 2–4 hours</td><td>Location:
Mariana Islands Training and Testing Study Area > 3 nm from land</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency acoustic countermeasure (ASW3), high-frequency sonar (HF6), hull mounted sonar (MF1, MF2, MF11), high duty cycle variable depth sonar (MF12), lightweight torpedo (TORP1), vessel noise
Energy: None
Physical Disturbance and Strike: Vessel and in-water device strike; military expended material strike, seafloor devices (Portable Underwater Tracking Range)
Entanglement: None
Ingestion: Torpedo accessories, Target fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">MK-39 Expendable Mobile Anti-Submarine Warfare Training Target
Torpedo accessories (ballast weights) from exercise torpedoes
Anchor ballast for tracking range transponders</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Submarines may provide service as the target except for torpedo exercise events.
Torpedoes are recovered.</td></tr>
</table>

A.1.5.8 Tracking Exercise – Submarine

Activity Name	Activity Description
Anti-Submarine Warfare	
Tracking Exercise – Submarine	Submarine crews search, track, and detect submarines and surface ships.
Long Description	The anti-submarine warfare tracking/torpedo exercise-submarine involves a submarine employing hull mounted and/or towed array sonar against an anti-submarine warfare target such as a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30, or another submarine. During this event, passive sonar is used almost exclusively; active sonar use is restricted because it would reveal the tracking submarine's presence to the target submarine. The preferred type of range for this exercise is an instrumented underwater training range with the capability to track the locations of submarines and targets, to enhance the after-action learning component of the training. This exercise may involve a single submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event.
Information Typical to the Event	**Platform:** Submarines, support craft **Systems:** Mid-frequency (primarily passive) and high-frequency sonar **Ordnance/Munitions:** None **Targets:** Submarine MK-30, MK-39 Expendable Mobile Anti-Submarine Warfare Training Target **Duration:** 8 hours **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land, Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency acoustic countermeasure (ASW4), hull-mounted sonar (MF3), high-frequency sonar (HF1, HF6), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike, air strike (birds only), seafloor devices (Portable Underwater Tracking Range) **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	Anchor ballast for tracking range transponders
Assumptions used for Analysis	Tracking exercise can occur in all locations > 3 nm from land in Mariana Islands.

A.1.5.9 Torpedo Exercise – Submarine

Activity Name	Activity Description	
Anti-Submarine Warfare		
Torpedo Exercise – Submarine	Submarine crews search, track, and detect submarines and surface ships. Exercise torpedoes may be used during this event.	
Long Description	The anti-submarine warfare tracking/torpedo exercise-submarine involves a submarine employing hull mounted and/or towed array sonar against an anti-submarine warfare target such as a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30, or another submarine. During this event, passive sonar is used almost exclusively; active sonar use is restricted because it would reveal the tracking submarine's presence to the target submarine. The preferred type of range for this exercise is an instrumented underwater training range with the capability to track the locations of submarines and targets, to enhance the after-action learning component of the training. This exercise may involve a single submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The tracking exercise becomes a torpedo exercise when the submarine launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other areas depending on training requirements and available assets.	
Information Typical to the Event	**Platform:** One or more submarines, support craft **Systems:** Mid-frequency (primarily passive) and high-frequency sonar; tracking range transponders **Ordnance/Munitions:** Exercise torpedoes (non-explosive torpedo exercise only) **Targets:** Submarine MK-30, MK-39 Expendable Mobile Anti-Submarine Warfare Training Target **Duration:** 8 hours	**Location:** Mariana Islands Training and Testing Study Area > 3 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency acoustic countermeasure (ASW4), hull-mounted sonar (MF3), high-frequency sonar (HF1, HF6), heavyweight torpedo (TORP2), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike, military expended material strike (torpedo accessories), seafloor devices (Portable Underwater Tracking Range) **Entanglement:** Guidance wires **Ingestion:** Torpedo accessories	
Detailed Military Expended Material Information	Anchor ballast for tracking range transponders	
Assumptions used for Analysis	Torpedoes are recovered. Guidance wire has a low breaking strength and breaks easily. Weights and flex tubing sink rapidly.	

A.1.6 Major Training Events

A major training event is comprised of several unit-level range operations conducted by several units operating together while commanded and controlled by a single commander. These exercises typically employ an exercise scenario developed to train and evaluate the Strike Group/Force in required naval tactical tasks. In a major training event, most of the operations and activities being directed and coordinated by the Strike Group commander are identical in nature to the operations conducted in the course in individual, crew, and smaller-unit training events. In a major range event, however, these disparate training tasks are conducted in concert, rather than in isolation.

A.1.6.1 Joint Expeditionary Exercise

Activity Name	Activity Description	
Major Training Events		
Joint Expeditionary Exercise	Typically a 10-day exercise that brings different branches of the U.S. military together in a joint environment that includes planning and execution efforts as well as military training activities at sea, in the air, and ashore.	
Long Description	Advanced joint level battle group and expeditionary amphibious warfare exercise designed to create a cohesive Carrier and Expeditionary Strike Group. Typically 15 surface ships, amphibious assault craft, helicopters, maritime patrol aircraft, strike fighter aircraft, two submarines, and various unmanned vehicles. More than 8,000 personnel may participate and could include the combined assets of a Carrier Strike Group and Expeditionary Strike Group, Marine Expeditionary Units, Army Infantry Units, and Air Force aircraft.	
Information Typical to the Event	**Platform:** Surface vessels, Fixed-wing aircraft, Helicopters, Unmanned vehicles, Submarines **Systems:** Anti-submarine warfare systems, anti-surface warfare and anti-air warfare gun and missile systems. **Ordnance/Munitions:** Numerous gun rounds, bombs, and missiles, all captured in specific events **Targets:** All surface, air, and anti-submarine warfare targets (e.g., MK-39 Expendable Mobile Anti-submarine Warfare Training Targets) **Duration:** 10 days	**Location:** Mariana Islands Training and Testing Study Area; Mariana Islands Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2, MF3, MF4, MF5, MF12, ASW2, ASW3), underwater explosions (e.g.,E4), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, vessel and in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, countermeasures, sonobuoy fragments	
Detailed Military Expended Material Information	One MK-39 Expendable Mobile Anti-submarine Warfare Training Targets Air deployed sonobuoy will have a parachute. Expended countermeasures	
Assumptions used for Analysis	All military expended materials, ordnance, explosives, and sonar use is included in individual events.	

A.1.6.2 Joint Multi-Strike Group Exercise

Activity Name	Activity Description
Major Training Events	
Joint Multi-Strike Group Exercise	Typically a 10-day Joint exercise, in which up to three carrier strike groups would conduct training exercises simultaneously.
Long Description	The Joint Multi-Strike Group Exercise demonstrates the Navy's ability to operate a large naval force of up to three Carrier Strike Groups in coordination with other Services. In addition to this joint warfare demonstration, it also fulfills the Navy's requirement to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The exercise would involve Joint assets engaging in a "free play" battle scenario, with U.S. forces pitted against a replicated opposition force. The exercise provides realistic in-theater training.
Information Typical to the Event	**Platform:** Multiple surface combatant vessels, Fixed-wing aircraft, Rotary-wing aircraft, unmanned vehicles, and submarines **Systems:** Anti-Submarine Warfare systems, Anti-Surface Warfare and Anti-Air Warfare gun and missile systems **Ordnance/Munitions:** Numerous gun rounds, bombs, and missiles, all captured in specific events **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, submarine **Duration:** 10 days **Location:** Mariana Islands Training and Testing Study Area > 12 nm from land; Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2, MF3, MF4, MF5, MF11, MF12, ASW2, ASW3, ASW4), high-frequency sonar (e.g.,HF1); underwater explosions (e.g., E4), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, vessel and in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, sonobuoy fragments
Detailed Military Expended Material Information	Anti-Submarine Warfare target: One MK-39 per event. If target is air-dropped, one parachute per target. Target remnants, chaff, flares Sonobuoys: (one parachute for each sonobuoy) Large-, medium- and small-caliber projectiles, bombs, missiles, rockets Expendable acoustic countermeasures
Assumptions used for Analysis	All military expended materials, ordnance, explosives, and sonar use is included in individual events.

A.1.6.3 Fleet Strike Group Exercise

Activity Name	**Activity Description**	
Major Training Events		
Fleet Strike Group Exercise	Typically a 7-day exercise focused on sustainment training for the forward deployed Carrier Strike Group that integrates joint training activities with the U.S. Air Force and U.S. Marine Corps. The exercise focuses on integrated joint training among U.S. military forces in the maritime environment with an ASW threat.	
Long Description	The Fleet Strike Group Exercise is a one week event focused on sustainment training for the forward deployed Carrier Strike Group and may integrate joint operations with the U.S. Air Force and U.S. Marine Corps in the Western Pacific. The exercise focuses on integrated joint training among U.S. military forces in the maritime environment with an ASW threat; enabling real-world proficiency in detecting, locating, tracking and engaging units at sea, in the air, and on land, in response to a range of mission areas.	
Information Typical to the Event	**Platform:** Surface ships, aircraft, submarines **Systems:** Anti-Submarine Warfare systems, Anti-Surface Warfare and Anti-Air Warfare gun and missile systems **Ordnance/Munitions:** Numerous gun rounds, bombs, and missiles, all captured in specific events **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, submarine **Duration:** 7 days	**Location:** Mariana Islands Training and Testing Study Area >12 nm from land; Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2, MF3, MF4, MF5, MF11, MF12, ASW2, ASW3, ASW4), high-frequency sonar (e.g., HF1); underwater explosions (e.g.,E4), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, vessel and in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, sonobuoy fragments	
Detailed Military Expended Material Information	Anti-Submarine Warfare target: One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) per event. If target is air-dropped, one parachute per target. Parachutes, sonobuoy fragments Sonobuoys: (one parachute for each sonobuoy) Large-, medium-, and small-caliber projectiles, bombs, missiles, rockets Expendable acoustic countermeasures	
Assumptions used for Analysis	All military expended material, ordnance, explosives, and sonar use is included in individual events.	

A.1.6.4 Integrated Anti-Submarine Warfare Exercise

Activity Name	Activity Description	
Major Training Events		
Integrated Anti-Submarine Warfare Exercise	Typically a 5-day exercise with multiple ships, aircraft and submarines integrating the use of their sensors, including sonobuoys, to search, detect, and track threat submarines.	
Long Description	This is an Anti-Submarine Warfare (ASW) exercise conducted by the forward deployed Navy Strike Groups to sustain and assess their ASW proficiency while located in the Seventh Fleet area of operations. The exercise is designed to assess the Strike Groups' ability to conduct ASW in the most realistic environment, against the level of threat expected, in order to effect changes to both training and capabilities (e.g., equipment, tactics, and changes to size and composition) of U.S. Navy Strike Groups. The Strike Group receives significant sustainment training value in ASW and other warfare areas, as training is inherent in all at-sea exercises.	
Information Typical to the Event	**Platform:** Surface vessels, fixed and rotary-wing aircraft, submarines, unmanned vehicles **Systems:** Hull mounted, towed array, dipping sonar, mid-frequency sonar, sonobuoys **Ordnance/Munitions:** Sonobuoys **Targets:** Expendable mobile anti-submarine warfare training targets **Duration:** 5 days	**Location:** Mariana Islands Training and Testing Study Area > 3 nm from land; Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2, MF3, MF4, MF5, MF11, MF12, ASW3, ASW4), high-frequency sonar (e.g., HF1); vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, vessel and in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, sonobuoy fragments	
Detailed Military Expended Material Information	Parachutes, sonobuoy fragments, expended countermeasures	
Assumptions used for Analysis	Air deployed sonobuoy will have a parachute.	

A.1.6.5 Ship Squadron Anti-Submarine Warfare Exercise

Activity Name	Activity Description
Major Training Events	
Integrated Anti-Submarine Warfare Exercise	Typically a 5-day exercise where the overall objective is to sustain and assess surface ship Anti-Submarine Warfare (ASW) readiness and effectiveness. The exercise typically involves multiple ships, submarines, and aircraft in several coordinated events, maximizing opportunities to collect high-quality data.
Long Description	The Ship Squadron ASW Exercise overall objective is to sustain and assess surface ship ASW readiness and effectiveness. The exercise typically involves multiple ships, submarines, and aircraft in several coordinated events over a period of a week or less. Maximizing opportunities to collect high-quality data to support quantitative analysis and assessment of operations is an additional goal of this training.
Information Typical to the Event	**Platform:** Surface vessels, fixed and rotary-wing aircraft, submarines, unmanned vehicles **Systems:** Hull mounted, towed array, dipping sonar, mid-frequency sonar, Sonobuoys **Ordnance/Munitions:** Sonobuoys **Targets:** Expendable mobile anti-submarine warfare training targets **Duration:** 5 days **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land; Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2, MF3, MF4, MF5, MF11, MF12, ASW3, ASW4), high-frequency sonar (e.g., HF1); vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, vessel and in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, sonobuoy fragments
Detailed Military Expended Material Information	Parachutes, sonobuoy fragments, expended countermeasures
Assumptions used for Analysis	Air deployed sonobuoy will have a parachute.

A.1.6.6 Marine Air Ground Task Force Exercise (Amphibious) – Battalion

Activity Name	Activity Description	
Major Training Events		
Marine Air Ground Task Force Exercise (Amphibious) – Battalion	Typically a 10-day exercise that conducts over the horizon, ship to objective maneuver for the elements of the Expeditionary Strike Group and the Amphibious Marine Air Ground Task Force. The exercise utilizes all elements of the Marine Air Ground Task Force (Amphibious), conducting training activities ashore with logistic support of the Expeditionary Strike Group and conducting amphibious landings.	
Long Description	This exercise conducts over the horizon, ship to objective maneuver of the elements of the Expeditionary Strike Group and the Amphibious Marine Air Ground Task Force. The exercise utilizes all elements of the task force to secure the battlespace (air, land, and sea), maneuver to and seize the objective, and conduct self-sustaining operations ashore with continual logistic support. Tinian is the primary training area for this exercise; however elements of the exercise may be rehearsed nearshore and on Guam. The landing force is supported by all of the battalions assigned to a Marine Expeditionary Unit.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft, fixed-wing, aircraft, amphibious ships and craft, combatant vessels, submarine **Systems:** Mid-frequency and high-frequency sonar, dipping sonar, high-frequency acoustic modems and tracking pingers, sonobuoys **Ordnance/Munitions:** blanks, Simunitions **Targets:** MK-30, MK-39 Expendable Mobile Anti-submarine Warfare Training Targets, submarine **Duration:** 10 days	**Location:** Mariana Islands Training and Testing Study Area to nearshore; Mariana Islands Range Complex; Tinian; Guam; Rota; Saipan; Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2, MF3, MF4, MF12, ASW3), high-frequency sonar (e.g., HF1); vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Material	One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) If target is air-dropped, one parachute per target. Sonobuoys: (one parachute for each sonobuoy)	
Assumptions Used for Analysis	All MEM, ordnance, explosives, and sonar use is included in individual events.	

A.1.6.7 Special Purpose Marine Air Ground Task Force Exercise

Activity Name	Activity Description	
Major Training Events		
Special Purpose Marine Air Ground Task Force Exercise	Typically a 10-day exercise similar to Marine Air Ground Task Force (Amphibious) – Battalion, but task organized to conduct a specific mission (e.g., Humanitarian Assistance, Disaster Relief, Noncombatant Evacuation Operations).	
Long Description	Special Purpose Marine Air Ground Task Force, operating in conjunction with Navy ships and aircraft, typically conduct humanitarian and disaster relief, or evacuation of noncombatants from foreign countries to safe havens or back to the United States when their lives are endangered by war, civil unrest, or natural disaster. Normally, there is no opposition from the host country; however Marine Corps Special Purpose Marine Air Ground Task Force or Marine Expeditionary Unit (Special Operations Capable) normally trains for evacuation under a circumstance that requires the use of force in a hostile environment. Much like a raid, the event involves the rapid introduction of forces, the evacuation of noncombatants, and a planned withdrawal. The activity is conducted during day or night. Guam is the primary training are for this exercise.	
Information Typical to the Event	**Platform:** Multiple rotary-wing aircraft, fixed-wing aircraft, amphibious vessels and craft **Systems:** None **Ordnance/Munitions:** Blanks, Simunitions **Targets:** None **Duration:** 10 days	**Location:** Mariana Islands Training and Testing Study Area to nearshore; Mariana Islands Range Complex; Tinian; Guam; Rota; Saipan
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Submarine strike, vessel strike, aircraft strike **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Material	Parachutes associated with insertion of forces, equipment.	
Assumptions Used for Analysis	All MEM is included in individual events.	

A.1.6.8 Urban Warfare Exercise

Activity Name	Activity Description	
Major Training Events		
Urban Warfare Exercise	A Marine Expeditionary Unit integration level exercise that is typically conducted over a period of weeks. Enhances the skills needed for military training activities in an urban environment.	
Long Description	A Marine Expeditionary Unit integration level exercise that is typically conducted over a period of weeks. Personnel enhance the skills needed for military operations in an urban environment. Events typically take place on Guam and utilize Finegayan, Andersen South, Barrigada Housing, and Northwest Field. Urban Warfare Exercise has been conducted in Saipan as part of the Joint Expeditionary Exercise. Urban Warfare Exercise on Tinian and Rota is also possible	
Information Typical to the Event	**Platform:** Multiple rotary-wing aircraft, fixed-wing aircraft, unmanned aerial vehicles **Systems:** None **Ordnance/Munitions:** Blanks, Simunitions **Targets:** None **Duration:** 7–21 days	**Location:** Mariana Islands Range Complex; Tinian; Guam; Rota; Saipan
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	Land event	

A.1.7 Electronic Warfare Training

Electronic warfare is the mission area of naval warfare that aims to control use of the electromagnetic spectrum and to deny its use by an adversary. Typical electronic warfare activities include threat avoidance training, signals analysis for intelligence purposes, and use of airborne and surface electronic jamming devices to defeat tracking systems.

A.1.7.1 Electronic Warfare Operations

Activity Name	Activity Description	
Electronic Warfare		
Electronic Warfare Operations (EW OPS)	Aircraft, surface ship, and submarine crews attempt to control portions of the electromagnetic spectrum used by enemy systems to degrade or deny the enemy's ability to take defensive actions.	
Long Description	Aircraft, surface ship, and submarine personnel attempt to control critical portions of the electromagnetic spectrum used by enemy systems to degrade or deny their ability to defend its forces from attack or recognize an emerging threat early enough to take defensive actions. Electronic Warfare Operations can be active or passive, offensive or defensive. Fixed-wing aircraft employ active jamming and deception against enemy search radars to mask the friendly inbound strike aircraft mission. Surface vessels and submarines detect and evaluate enemy electronic signals from enemy aircraft or missile radars, evaluate courses of action concerning the use of passive or active countermeasures, then use vessel maneuvers and either chaff, flares, active electronic countermeasures, or a combination of them to defeat the threat.	
Information Typical to the Event	**Platform:** Fixed and rotary-wing aircraft, Surface combatant vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** Land based fixed/mobile threat emitters **Duration:** 1–2 hours	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns (Information regarding deconstruct categories and stressors)	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	All chaff and flares involved in this event are covered under chaff exercise and flare exercises, respectively.	

A.1.7.2 Counter Targeting Flare Exercise – Aircraft

Activity Name	**Activity Description**	
Electronic Warfare		
Counter Targeting – Flare Exercise (FLAREX) – Aircraft	Fixed-winged aircraft and helicopters crews defend against an attack by deploying flares to disrupt threat infrared (IR) missile guidance systems.	
Long Description	Train fixed-winged aircraft and helicopter crews to deploy flares to disrupt threat infrared missile guidance systems to defend against an attack. Aircraft detect electronic targeting signals from threat radars or missiles or a threat missile plume when it is launched; dispense flares; and immediately maneuver to defeat the threat. This exercise trains aircraft personnel in the use of defensive flares designed to confuse infrared sensors or infrared homing missiles, thereby causing the sensor or missile to lock onto the flares instead of the real aircraft. Typically an aircraft will expend five flares in an exercise while operating above 3,000 feet. Flare exercises are often conducted with chaff exercises, rather than as a stand-alone exercise. Pyrotechnics are used on the range to simulate missile firings.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** Flares and pyrotechnics **Targets:** None **Duration:** 1–2 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft Noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** Expended components of flares (pistons)	
Detailed Military Expended Material Information	Flares and residuals from pyrotechnics	
Assumptions used for Analysis	Approximately five flares per aircraft	

A.1.7.3 Counter Targeting Chaff Exercise – Ship

Activity Name	Activity Description	
Electronic Warfare		
Counter Targeting Chaff Exercise (CHAFFEX) – Ship	Surface ships defend against an attack by deploying chaff, a radar reflective material, which disrupt threat targeting and missile guidance radars.	
Long Description	Surface vessel crews deploy chaff to disrupt threat targeting and missile guidance radars to defend against an attack. Surface vessel crews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile, and the vessel clears away from the threat. Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff is employed create a target from the chaff that will lure enemy radar and weapons system away from the actual friendly platform. Ships may also train with advanced countermeasure systems, such as the MK 53 Decoy Launching System (Nulka).	
Information Typical to the Event	**Platform:** Surface vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** MK 53 expendable decoys **Duration:** 1.5 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** Expended components of chaff (end caps, pistons, chaff)	
Detailed Military Expended Material Information	Chaff canisters Expended components of chaff (end caps, pistons, chaff) MK 53 expendable decoys	
Assumptions used for Analysis	None	

A.1.7.4 Counter Targeting Chaff Exercise – Aircraft

Activity Name	Activity Description	
Electronic Warfare		
Counter Targeting Chaff Exercise (CHAFFEX) – Aircraft	Fixed-winged aircraft and helicopter crews defend against an attack by deploying chaff, a radar reflective material, which disrupt threat targeting and missile guidance radars.	
Long Description	Fixed-winged aircraft and helicopter crews deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack. Fixed-winged aircraft and helicopter crews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile and the aircraft clears away from the threat. Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths used to lure an enemy radar and weapons system away from the actual friendly platform.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, rotary-wing aircraft **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1.5 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** Expended components of chaff (end caps, pistons, chaff)	
Detailed Military Expended Material Information	Chaff cartridges Plastic end caps Pistons	
Assumptions used for Analysis	Chaff is usually expended while conducting other training activities, such as air combat maneuvering.	

A.1.8 MINE WARFARE TRAINING

Mine warfare training is the naval warfare area involving the detection, avoidance, and neutralization of mines to protect Navy ships and submarines, and offensive mine laying in naval operations. A naval mine is a self-contained explosive device placed in water to destroy ships or submarines. Naval mines are deposited and left in place until triggered by the approach of, or a contact with an enemy ship, or are destroyed or removed. Naval mines can be laid by purpose-built minelayers, other ships, submarines, or airplanes. Mine warfare training includes mine countermeasures exercises and mine laying exercises.

A.1.8.1 Mine Laying

Activity Name	**Activity Description**	
Mine Warfare		
Mine Laying	Fixed-winged aircraft and vessel crews drop/launch non explosive mine shapes.	
Long Description	Fixed-winged aircraft or surface or submarine crews lay offensive or defensive mines for a tactical advantage for friendly forces. Crews lay a precise minefield pattern for specific tactical situations. An aircrew typically makes multiple passes in the same flight pattern, and drops one or more training shapes (four shapes total). Training shapes are non-explosive.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft, surface vessels, submarines **Systems:** None **Ordnance/Munitions:** Non-explosive mine shapes, “Quick-strike” mines **Targets:** None **Duration:** 1 hour	**Location:** MIRC Warning Areas
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive mine shapes), vessel strike, and aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Non-explosive mine shapes	
Assumptions used for Analysis	Similar to non-explosive bombing exercise. Assume mine shapes are not recovered for the analysis.	

A.1.8.2 Mine Neutralization – Explosive Ordnance Disposal (EOD)

Activity Name	**Activity Description**	
Mine Warfare		
Mine Neutralization – Explosive Ordnance Disposal (EOD)	Personnel disable threat mines. Explosive charges may be used.	
Long Description	Navy divers, typically explosive ordnance disposal personnel, disable threat mines with explosive charges to create a safe channel for friendly vessels to transit. Personnel detect, identify, evaluate, and neutralize mines in the water with an explosive device and may involve detonation of one or more explosive charges typically up to 20 pounds (lb.) of TNT equivalent. These operations are normally conducted during daylight hours for safety reasons.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft, small boats **Systems:** None **Ordnance/Munitions:** Underwater detonation charges **Targets:** Minefields **Duration:** Up to 4 hours	**Location:** Agat Bay underwater detonation site, 20 lb. net explosive weight (NEW) maximum charge. Piti and Outer Apra Harbor underwater detonation sites, 10 lb. NEW maximum.
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Under water explosions (e.g., E5, E6), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only), seafloor devices **Entanglement:** None **Ingestion:** Target fragments	
Detailed Military Expended Material Information	Target fragments	
Assumptions used for Analysis	Charge placed anywhere in water column, including bottom. Mine shapes will be recovered.	

A.1.8.3 Limpet Mine Neutralization System/Shock Wave Generator

Activity Name	Activity Description	
Mine Warfare (MIW)		
Limpet Mine Neutralization System/Shock Wave Generator	Navy divers place a small charge on a simulated underwater mine.	
Long Description	For shock wave generator training, a metal sheet containing a non-explosive limpet mine is lowered into the water, sometimes from the side of a small vessel, such as an LCM-8 craft. Divers place a single shock wave generator on the mine that is located mid-water column, within water depths of 10–20 feet (3–6 meters). A bag is placed over the mine to catch falling debris.	
Information Typical to the Event	**Platform:** None **Systems:** None **Ordnance/Munitions:** Less than 1 oz. explosive charge **Targets:** Metal sheet with limpet mine **Duration:** 2 hours	**Location:** Mariana littorals; Inner and Outer Apra Harbor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Less than E1 explosive charge **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** Mine detonation residue	
Detailed Military Expended Material	Minimal mine detonation residue (most materials are recovered after each event)	
Assumptions Used for Analysis	None	

A.1.8.4 Submarine Mine Exercise

Activity Name	Activity Description	
Mine Warfare (MIW)		
Submarine Mine Exercise	Submarine crews practice detecting mines in a designated area.	
Long Description	Submarine crews use active sonar to detect and avoid mines or other underwater hazardous objects, while navigating restricted areas or channels, such as while entering or leaving port. This event trains submarine crews to detect and avoid mines. Training utilizes simulated minefields constructed of moored or bottom mines, or instrumented mines that can record effectiveness of mine detection efforts. In a typical training exercise, submarine crews will use the AN/BQQ-10 high-frequency active sonar to locate and avoid the mine shapes. Each mine avoidance exercise involves one submarine operating the AN/BQQ-10 high-frequency sonar for 6 hours to navigate through the training minefield. During mine warfare exercises submarines will expend several submarine-launched expendable bathythermographs to determine water conditions affecting sonar performance.	
Information Typical to the Event	**Platform:** Submarine **Systems:** High-frequency sonar (navigation/mine detection sonar) **Ordnance/Munitions:** None **Targets:** Mine shapes **Duration:** 6 hours	**Location:** Mariana Islands Training and Testing Study Area; nearshore
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF1) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.8.5 Airborne Mine Countermeasure – Mine Detection

Activity Name	**Activity Description**	
Mine Warfare		
Airborne Mine Countermeasure – Mine Detection	Vessel crews and helicopter aircrews detect mines using towed or laser mine detection systems (e.g., AN/AQS-20, Airborne Laser Mine Detection System).	
Long Description	Helicopter crews use towed and airborne devices to detect, locate, and classify potential mines. Towed devices employ active acoustic sources, such as high frequency and side scanning sonar. These devices are similar in function to systems used to map the seafloor or locate submerged structures or items. Airborne devices utilize laser systems to locate mines located below the surface. Devices used include the AN/AQS-20/A, towed minehunting sonar used to detect and classify bottom and floating/moored mines in deep and shallow water, and the Airborne Laser Mine Detection System, developed to detect and classify floating and near-surface, moored mines.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft, Unmanned surface vehicles, Unmanned underwater vehicles **Systems:** Airborne Laser Mine Detection System (AN/AQS-20A, AN/AQS-24A) **Ordnance/Munitions:** None **Targets:** Existing minefields, temporary placed mines, or no targets (training to deploy/operate gear) **Duration:** Typically 1.5 hours, up to 4 hours	**Location:** Mariana Islands Training and Testing Study Area; nearshore
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mine detection sonar (HF4), vessel noise, aircraft noise **Energy:** In-air low energy laser **Physical Disturbance and Strike:** Vessel and in-water device strike, aircraft strike (birds only), seafloor device strike (bottom placed mine shapes) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Sonar mine detection systems towed from helicopters, vessels, unmanned surface vehicles. Use of airborne laser systems to detect mine shapes. Laser systems similar to commercial Light Detection And Ranging (LIDAR) systems. Mine shapes will be recovered when possible.	

A.1.8.6 Mine Countermeasure Exercise – Towed Sonar

Activity Name	**Activity Description**	
Mine Warfare		
Mine Countermeasure Exercise – Towed Sonar	Surface ship crews detect and avoid mines while navigating restricted areas or channels using towed active sonar.	
Long Description	Surface vessel crews detect and avoid mines or other underwater hazardous objects while navigating restricted areas or channels using active sonar. Littoral Combat Ship utilizes unmanned surface vehicles and remotely operated vehicles to tow mine detection (hunting) equipment. Systems will operate from shallow zone greater than 40 feet to deep water. Events could be embedded in major training events.	
Information Typical to the Event	**Platform:** Surface vessels (e.g., LCS), unmanned surface vehicles, unmanned aerial vehicles **Systems:** AN/AQS-20, remote mine hunting system, AN/AQS-24 **Ordnance/Munitions:** None **Targets:** Minefields, temporary placed mine (training to deploy or operate gear) **Duration:** 1.5–4 hours	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar and other acoustic sources (HF4), vessel noise, aircraft noise **Energy:** Sub-surface laser imaging **Physical Disturbance and Strike:** Vessel and in-water device strike, seafloor devices, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None Temporary placed mines will be recovered.	
Assumptions used for Analysis	No explosives used. Constraints: Assume system will be operated in areas free of obstructions, and will be towed well above the seafloor. Towed system will be operated in a manner to avoid entanglement and damage. Events will take place in water depths 40 feet and greater. Existing placed mine shapes to be used. Potential for temporary placement of mine shapes.	

A.1.8.7 Mine Countermeasure Exercise – Surface Sonar

Activity Name	Activity Description	
Mine Warfare		
Mine Countermeasure Exercise – Surface (SMCMEX) Sonar	Mine countermeasure ship crews detect, locate, identify, and avoid mines while navigating restricted areas or channels using active sonar.	
Long Description	This event trains mine countermeasure ship crews to detect mines for future neutralization or to alert other ships. Training utilizes simulated minefields constructed of moored or bottom mines, or instrumented mines that can record effectiveness of mine detection efforts. Ships will accurately fix their position while navigating through the restricted mine threat area at slow speeds of about 5 to 10 knots or less, while using active sonar to search the area ahead of the ship for moored mines or other hazards of navigation.	
Information Typical to the Event	**Platform:** Surface combatant vessel **Systems:** Sonar (e.g., AN/SQQ-32) **Ordnance/Munitions:** None **Targets:** None **Duration:** The exercise may last as long as 15 hours.	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mine detection sonar (HF4), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.8.8 Mine Neutralization – Remotely Operated Vehicle Sonar

Activity Name	Activity Description	
Mine Warfare		
Mine Neutralization – Remotely Operated Vehicle Sonar	Vessel or helicopter aircrews disable mines using remotely operated underwater vehicles.	
Long Description	Vessel and helicopter crews utilize remotely operated vehicles to neutralize potential mines. Remotely operated vehicles will use sonar and optical systems to locate and target mine shapes. Explosive mine neutralizers may be used during live fire events.	
Information Typical to the Event	**Platform:** Rotary-wing aircraft, surface combatant vessels **Systems:** Acoustic mine targeting system **Ordnance/Munitions:** High-explosive neutralizers **Targets:** Existing minefields, temporary placed mines **Duration:** Typically 1.5 hours, up to 4 hours	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mine hunting sonar (HF4), underwater explosions (E4), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike, seafloor device strike (bottom placed mine shapes), aircraft strike (birds only) **Entanglement:** Fiber optic cable **Ingestion:** Neutralizer fragments	
Detailed Military Expended Material Information	Neutralizer fragments Fiber optic cables	
Assumptions used for Analysis	Acoustic sources associated with remotely operated vehicle mine neutralization systems do not require quantitative analysis.	

A.1.8.9 Mine Countermeasure – Towed Mine Neutralization

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Mine Warfare</td></tr>
<tr><td>Mine Countermeasure – Towed Mine Neutralization</td><td colspan="2">Ship crews and helicopter aircrews tow systems (e.g., Organic and Surface Influence Sweep, MK 104/105) through the water that are designed to disable and/or trigger mines.</td></tr>
<tr><td>Long Description</td><td colspan="2">Naval helicopters and unmanned vessels use towed devices to clear minefields by triggering mines that sense and explode when they detect ships/submarines by engine/propeller sounds or magnetic (steel construction) signature. Towed devices can also employ cable cutters to detach floating moored mines.
Training will either be conducted against non-explosive training mine shapes, or, without any mine shapes. A high degree of pilot skill is required in deploying devices, safely towing them at relatively low speeds and altitudes, and then recovering devices.
Devices used include the following:
Organic Airborne and Surface Influence Sweep (OASIS). The Organic Airborne and Surface Influence Sweep is a towed device that imitates the magnetic and acoustic signatures of naval ships and submarines.
MK 105 sled: the MK 105 sled, similar to the Organic Airborne and Surface Influence Sweep, creates a magnetic field used to trigger mines. The MK 105 sled can also be used in conjunction with the MK 103 cable cutter system and the MK 104 acoustic countermeasure.
AN/SPU-1/W “Magnetic Orange Pipe”: As the name implies, the AN/SPU-1/W is a magnetic pipe that is used to trigger magnetically influenced mines.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessel (e.g., MCM, LCS), unmanned surface vehicle, unmanned underwater vehicles, rotary-wing aircraft
Systems: None
Ordnance/Munitions: Cable cutters (MK-103)
Targets: Existing minefields, temporary placed mines, or no targets (training to deploy/operate gear)
Duration: Typically 1.5 hours, up to 4 hours</td><td>Location:
Mariana Islands Training and Testing Study Area</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Vessel noise, aircraft noise
Energy: Electromagnetic influence sweep
Physical Disturbance and Strike: Vessel and in-water device strike, seafloor device strike (bottom placed mine shapes)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Mooring blocks</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Towed from helicopters, ships, unmanned surface vehicles and unmanned underwater vehicles.
Mechanical sweeping (cable cutting), acoustic, and magnetic influence sweeping
Cable cutters utilize an insignificant charge (similar to shotgun shell). Acoustic sweeps generate ship type noise via mechanical system.
Towing systems though minefields (or without mines, to train to deploy, tow, and recover). May involve instrumented mines (VIMS).</td></tr>
</table>

A.1.9 NAVAL SPECIAL WARFARE TRAINING

Naval special warfare and other special forces train to conduct military operations in five Special Operations mission areas: unconventional warfare, direct action, special reconnaissance, foreign internal defense, and counterterrorism. Naval special warfare training involves specialized tactics, techniques, and procedures, employed in training events that include: insertion/extraction operations using parachutes rubber boats, or helicopters; boat-to-shore and boat-to-boat gunnery; underwater demolition training; reconnaissance; and small arms training.

A.1.9.1 Personnel Insertion/Extraction

Activity Name	Activity Description	
Naval Special Warfare		
Personnel Insertion/Extraction	Military personnel train for covert insertion and extraction into target areas using helicopters, fixed-wing (insertion only), small boats, and submersibles.	
Long Description	Personnel train to approach or depart an objective area using various transportation methods and tactics. These operations train forces to insert and extract personnel and equipment day or night. Tactics and techniques employed include insertion from aircraft by parachute, by rope, or from low, slow-flying helicopters from which personnel jump into the water. Parachute training is required to be conducted on surveyed drop zones to enhance safety. Insertion and extraction methods also employ small inflatable boats.	
Information Typical to the Event	**Platform:** Fixed and rotary-wing aircraft, small craft, submersibles **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–8 hours	**Location:** Mariana Islands Range Complex; Guam; Tinian; Rota
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Physical disturbance (sea turtle nests) **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.9.2 Parachute Insertion

Activity Name	**Activity Description**	
Naval Special Warfare		
Parachute Insertion	Military personnel train for covert insertion into target areas using parachutes.	
Long Description	These operations will vary in length depending on the transportation method and systems being used. Target areas are parachute drop zones that may be at sea or on land.	
Information Typical to the Event	**Platform:** Sea, air, land delivery vehicle **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–8 hours	**Location:** Mariana Islands Range Complex parachute drop zones; Guam; Tinian; Rota
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, small craft noise **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.9.3 Embassy Reinforcement

Activity Name	Activity Description	
Naval Special Warfare		
Embassy Reinforcement	Special Warfare units train to provide reinforcement of an Embassy under hostile conditions.	
Long Description	Personnel integrate vessel, aircraft and ground assets to reinforce an embassy under assault	
Information Typical to the Event	**Platform:** Small boats, assault craft, helicopters, fixed-wing aircraft, unmanned aerial vehicles **Systems:** None **Ordnance/Munitions:** Blanks, Simunitions **Targets:** None	**Location:** Mariana Islands Range Complex; Guam; Tinian; Rota
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.9.4 Direct Action (Combat Close Quarters)

Activity Name	Activity Description	
Naval Special Warfare		
Direct Action (Combat Close Quarters)	Military personnel training for use of force, breaching doors and obstacles, and in close quarters combat.	
Long Description	Special Forces personnel use covert or overt small unit tactics against an enemy force to seize, damage, or destroy a target and/or capture or recover personnel or material. A squad or platoon size force are inserted into and later extracted from a hostile area by helicopter. Combat Rubber Raiding Craft, or other technique, and then use small-scale offensive actions to attack hostile forces or targets. These offensive actions can include: raids, ambushes, standoff attacks by firing from ground, air, or maritime platforms, designating or illuminating targets for precision-guided munitions, providing support for cover and deception operations, and sabotage.	
Information Typical to the Event	**Platform:** Small boats, rotor-wing craft **Systems:** None **Ordnance/Munitions:** Small arms, blanks, Simunitions **Targets:** None	**Location:** Mariana Islands Range Complex Combat Close Quarters Sites
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only), physical disturbance (sea turtle nests) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.9.5 Direct Action (Breaching)

Activity Name	**Activity Description**	
Naval Special Warfare		
Direct Action (Breaching)	Military personnel training for use of force, breaching doors and obstacles, and in close quarters combat.	
Long Description	This event is limited to the breaching of doors and obstacles at sites prepared for breaching by small explosive charge. It is an event conducted alone or can be planned with other events.	
Information Typical to the Event	**Platform:** None **Systems:** None **Ordnance/Munitions:** Small explosive charges for breaching doors **Targets:** None	**Location:** Mariana Islands Range Complex Explosive Breaching Sites (e.g., the Breacher House on Naval Base Guam Munitions Site)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Breach explosive noise **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.9.6 Direct Action (Tactical Air Control Party)

Activity Name	Activity Description	
Naval Special Warfare		
Direct Action (Tactical Air Control Party)	Military personnel train for controlling of combat support aircraft; providing airspace de-confliction and terminal control for Close Air Support.	
Long Description	Tactical Air Control personnel, once at FDM, participate in tactical air control training in conjunction with an Air-to-Ground bombing or missile exercise, They may also employ small arms, grenades, mortars, and crew served weapons in direct action against targets on the island.	
Information Typical to the Event	**Platform:** Small boats, rotor-wing and fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** Small-caliber rounds, explosive grenades and mortars **Targets:** None	**Location:** Farallon de Medinilla
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.9.7 Underwater Demolition Qualification/Certification

Activity Name	**Activity Description**	
Naval Special Warfare		
Underwater Demolition Qualification/Certification	Divers conduct training and certification in placing underwater demolition charges.	
Long Description	Underwater explosive charges, typically up to 20 lb. NEW, are placed on the bottom and detonated to complete training qualification or certification.	
Information Typical to the Event	**Platform:** Small boats, helicopters **Systems:** None **Ordnance/Munitions:** Explosive charges (up to 20 lb.) **Targets:** None	**Location:** Agat Bay underwater detonation site, 20 lb. NEW maximum charge. Piti and Outer Apra Harbor underwater detonation sites, 10 lb. NEW maximum.
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Under water explosions (e.g., E5, E6), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None. Detonation residue is depleted in event.	
Assumptions Used for Analysis	None	

A.1.9.8 Intelligence, Surveillance, Reconnaissance (ISR)

Activity Name	Activity Description	
Naval Special Warfare		
Intelligence, Surveillance, Reconnaissance (ISR)	Special Warfare units train to collect and report battlefield intelligence.	
Long Description	Personnel conduct event to evaluate the battlefield, enemy forces, and gather intelligence. For training of assault forces, "red cell" units may be positioned ahead of the assault force and permitted a period of time to conduct surveillance and prepare defenses to the assaulting force.	
Information Typical to the Event	**Platform:** Small boats, rotor-wing aircraft, unmanned aerial vehicles **Systems:** None **Ordnance/Munitions:** None **Targets:** None	**Location:** Mariana Islands Range Complex; Guam; Tinian; Rota; Saipan
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only), physical disturbance (sea turtle nests) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.9.9 Urban Warfare Training

Activity Name	Activity Description	
Naval Special Warfare		
Urban Warfare Training	Special Warfare units train in mock urban environments.	
Long Description	Patrols use advanced, offensive, close-quarters battle techniques to move through a hostile urban environment where noncombatants are or may be present and collateral damage must be kept to a minimum. Techniques used include: advanced breaching to enter buildings or clear rooms; clearing stairwells; selective target engagement to ensure noncombatants are not harmed; and dynamic assault techniques to ensure collateral damage is kept to a minimum.	
Information Typical to the Event	**Platform:** Rotor-wing aircraft, unmanned aerial vehicles **Systems:** None **Ordnance/Munitions:** Blanks, Simunitions **Targets:** None	**Location:** Mariana Islands Range Complex; Guam; Tinian; Rota; Saipan
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, weapon firing noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.9.10 Underwater Survey

Activity Name	**Activity Description**	
Naval Special Warfare		
Underwater Survey	Navy divers train in survey of underwater conditions and features in preparation for insertion, extraction, or intelligence, surveillance, and reconnaissance activities.	
Long Description	A survey of underwater terrain conditions near shore and a report of findings to provide precise analysis for amphibious landings. Personnel perform methodical reconnoitering of beaches and surf conditions during the day and night to find and clear underwater obstacles and determine the feasibility of landing an amphibious force on a particular beach.	
Information Typical to the Event	**Platform:** Small boats **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** None	**Location:** Mariana Islands Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.10 OTHER

A.1.11 SURFACE SHIP SONAR MAINTENANCE

Activity Name	Activity Description	
Other		
Surface Ship Sonar Maintenance	In-port and at-sea maintenance of sonar systems.	
Long Description	This scenario consists of surface combatant vessels performing periodic maintenance to the hull-mounted mid-frequency sonar while in port or at sea. This maintenance takes up to four hours. Surface vessels operate active sonar systems for maintenance while in shallow water near their homeport, however, sonar maintenance could occur anywhere as the system's performance may warrant.	
Information Typical to the Event	**Platform:** Surface combatant vessels **Systems:** Mid-frequency hull mounted sonar systems **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 4 hours	**Location:** Mariana Islands Training and Testing Study Area > 3 nm from land; Inner Apra Harbor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.1 Submarine Sonar Maintenance

Activity Name	Activity Description
Other-Maintenance	
Submarine Sonar Maintenance	In-port and at-sea maintenance of sonar systems.
Long Description	A submarine performs periodic maintenance on the AN/BQQ-10 and submarine high-frequency sonar systems while in port or at sea. Submarines conduct maintenance to their sonar systems in shallow water near their homeport however, sonar maintenance could occur anywhere as the system's performance may warrant
Information Typical to the Event	**Platform:** Submarines **Systems:** High-frequency submarine sonar system, AN/BBQ-10 **Ordnance/Munitions:** None **Targets:** None **Duration:** 45 minutes up to 1 hour **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land; Inner Apra Harbor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF3) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	None
Assumptions used for Analysis	None

A.1.11.2 Small Boat Attack

Activity Name	**Activity Description**	
Other		
Small Boat Attack	For this activity, one or two small boats or personal watercraft conduct attack activities on units afloat.	
Long Description	For this activity, one or two small boats or personal watercraft conduct attack activities on units afloat, training ship crews how to respond to small boat attack in harbors, restricted channels, and nearshore areas using non-lethal means or armament appropriate to the threat and location.	
Information Typical to the Event	**Platform:** Small boats or watercraft **Systems:** None **Ordnance/Munitions:** Small-caliber (non-explosive) **Targets:** High-performance small boats and unmanned vehicles **Duration:** None	**Location:** Mariana Islands Training and Testing Study Area > 3 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, weapon firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Blanks, Simunitions, or small-caliber projectiles	
Assumptions used for Analysis	None	

A.1.11.3 Submarine Navigation

Activity Name	Activity Description	
Other		
Submarine Navigation	Submarine crews locate underwater objects and ships while transiting out of port.	
Long Description	Submarine crews train to operate sonar for navigation. The ability to navigate using sonar is critical for object detection while transiting in and out of port during periods of reduced visibility. Submarine Navigation training activities conducted while transiting in and out of port are done so while surfaced, with bridge watches and a single lookout.	
Information Typical to the Event	**Platform:** Submarines **Systems:** High-frequency submarine sonar system **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 2 hours	**Location:** Apra Harbor and Mariana littorals
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Submarine sonar noise (e.g., MF3, HF1) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.4 Search and Rescue at Sea

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Other</td></tr>
<tr><td>Search and Rescue at Sea</td><td colspan="2">Vessels and aircraft conduct search and rescue of personnel and vessels at sea.</td></tr>
<tr><td>Long Description</td><td colspan="2">U.S. Coast Guard vessels, Navy vessels, and rotor-wing and fixed-wing aircraft coordinate on scene actions to search and conduct rescue and recovery of personnel or vessels at sea.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Ships, rotor-wing aircraft, fixed-wing aircraft, unmanned aerial vehicles
Systems: None
Ordnance/Munitions: None
Targets: None
Duration: Up to 3 days</td><td>Location:
Mariana Islands Test and Training Study Area</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Vessel noise, aircraft noise
Energy: None
Physical Disturbance and Strike: Vessel strike, aircraft strike (birds only)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">None</td></tr>
</table>

A.1.11.5 Precision Anchoring

Activity Name	**Activity Description**	
Other Training		
Precision Anchoring	Releasing of anchors in designated locations.	
Long Description	Vessels navigate to a pre-planned position and deploy the anchor. The vessel uses all means available to determine its position when anchor is dropped, to demonstrate calculating and plotting the anchor's position within 100 yards of center of planned anchorage.	
Information Typical to the Event	**Platform:** All surface vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 1 hour	**Location:** Mariana Islands anchorages
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, seafloor device strike (anchor) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.6 Maneuver (Convoy, Land Navigation)

Activity Name	**Activity Description**	
Other Training		
Maneuver (Convoy, Land Navigation)	Units conduct field maneuver training or convoy training.	
Long Description	Personnel participate in land navigation and convoy training. They practice convoy maneuvers to learn how to react if their vehicle comes under fire, hits a roadside bomb, or breaks down, and how to protect themselves if they are forced to abandon their vehicle.	
Information Typical to the Event	**Platform:** Convoy vehicles **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 1 hour	**Location:** Mariana Islands Range Complex; Guam; Tinian
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.7 Water Purification

Activity Name	Activity Description	
Other Training		
Water Purification	Units conduct water purification training using water purification equipment in field conditions.	
Long Description	Personnel utilize water purification equipment to purify salt water or fresh water from field sources and properly dispose of filters/filtered effluent. Water purification systems used in training vary in design, size, portability, output, and filtration systems, and not all systems produce an effluent. Individual systems may consist of a straw with in-line filter. Larger units supporting a squad or platoon may consist of a luggage-sized unit with a selectable combination of nanofilters/ultraviolet/reverse osmosis systems. Units supporting several hundred or more typically are reverse osmosis or evaporation systems that require portable generators and a disposal field/tank for effluent.	
Information Typical to the Event	**Platform:** None **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Several days to weeks, as required to support water purification training and other training events.	**Location:** Mariana Islands Range Complex; Guam; Tinian
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vehicle noise, generator noise **Energy:** None **Physical Disturbance and Strike:** Physical disturbance (sea turtles and nests) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Water purification activities within Tinian are regulated under the CNMI Water Quality Standards. Discharge of brine/wastewater must be discharged upland and not directly back into the ocean. As a result of these regulations, water purification operations involving brine/wastewater discharge are conducted at the Tinian Commercial Port.	

A.1.11.8 Field Training Exercise

Activity Name	Activity Description	
Other Training		
Field Training Exercise	Units train in securing an area, establishing a camp or post, and guarding and patrolling. Event typically lasts a week or a few days.	
Long Description	Units train in securing an area, establishing a camp or post, and guarding and patrolling. Event typically lasts a week or a few days.	
Information Typical to the Event	**Platform:** None **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–3 days	**Location:** Mariana Islands Range Complex; Guam; Tinian; Rota; Saipan
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Physical disturbance (camp footprint limited to areas not restricted to training) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.9 Force Protection

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Other Training</td></tr>
<tr><td>Force Protection</td><td colspan="2">Units train in providing force protection against a terror threat.</td></tr>
<tr><td>Long Description</td><td colspan="2">Force protection operations increase the physical security of military personnel in the region to reduce their vulnerability to attacks. Force protection training includes moving forces and building barriers, detection, and assessment of threats, delay, or denial of access of the adversary to their target, appropriate response to threats and attack, and mitigation of effects of attack. Force protection includes employment of offensive as well as defensive measures.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Rotor wing-aircraft
Systems: None
Ordnance/Munitions: Blanks, Simunitions
Targets: None
Duration: None</td><td>Location:
Mariana Islands Range Complex; Guam; Tinian; Rota</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Aircraft noise
Energy: None
Physical Disturbance and Strike: Aircraft strike (birds only)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">None</td></tr>
</table>

A.1.11.10 Anti-Terrorism

Activity Name	Activity Description	
Other Training		
Anti-Terrorism	Units train in providing force protection against a terror threat.	
Long Description	Anti-Terrorism operations concentrate on the deterrence of terrorism through active and passive measures, including the collection and dissemination of timely threat information, conducting information awareness programs, coordinated security plans, and personal training. The goal is to develop protective plans and procedures based upon likely threats and strike a reasonable balance between physical protection, mission requirements, critical assets and facilities, and available resources to include manpower.	
Information Typical to the Event	**Platform:** Rotor-wing aircraft **Systems:** None **Ordnance/Munitions:** Blanks, Simunitions **Targets:** None **Duration:** None	**Location:** Mariana Islands Range Complex; Guam; Tinian; Rota
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.11 Seize Airfield

Activity Name	**Activity Description**	
Other Training		
Seize Airfield	Train Naval Special Warfare, Navy Expeditionary Combat Command or Marine Corps personnel to seize control of an airfield or port for use by friendly forces.	
Long Description	Units use advanced, offensive, raid and close-quarters battle techniques to move through a hostile environment where noncombatants are or may be present and collateral damage must be kept to a minimum in order to be able to use the airfield facilities after they have been seized. Includes establishing a temporary forward operating base with supporting expeditionary logistic operations (e.g., cargo drop).	
Information Typical to the Event	**Platform:** Rotor-wing and fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** Blanks, Simunitions, pyrotechnics (smoke and flares) **Targets:** None **Duration:** Up to 2 weeks	**Location:** Mariana Islands Range Complex airfields (Orote Point Airfield, Guam; Northwest Airfield, Guam; North Airfield, Tinian)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, Generator noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only), physical disturbance and clearing (camp footprint limited to areas not restricted to training) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.12 Airfield Expeditionary

Activity Name	**Activity Description**	
Other Training		
Airfield Expeditionary	Units conduct training establishing, securing, maintaining, or operating an expeditionary airfield.	
Long Description	Conduct airfield operations in an expeditionary environment, providing force protection and repairs to facilities, while supporting airfield operations for forward deployed combat forces. Includes establishing a forward operating base with supporting expeditionary logistic operations (e.g., cargo drop).	
Information Typical to the Event	**Platform:** Fixed-wing and rotor-wing aircraft **Systems:** None **Ordnance/Munitions:** Blanks, Simunitions, pyrotechnics (smoke and flares) **Targets:** None **Duration:** Up to 4 weeks	**Location:** Mariana Islands Range Complex airfields (Orote Point Airfield, Guam; Northwest Airfield, Guam; North Airfield, Tinian)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, Generator noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only), physical disturbance and clearing (camp footprint limited to areas not restricted to training) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.13 Unmanned Aerial Vehicle Operation

Activity Name	Activity Description	
Other		
Unmanned Aerial Vehicle Operation	Units conduct training with unmanned aerial vehicles from airfields or in the battlefield.	
Long Description	Conduct unmanned aerial vehicle activity in support of tactical and theater requirements.	
Information Typical to the Event	**Platform:** Unmanned aerial vehicles **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** None	**Location:** Mariana Islands Training and Testing Study Area; Mariana Islands Range Complex airfields (Orote Point Airfield, Guam; Northwest Airfield, Guam; North Airfield, Tinian); Mariana Islands Special Use Airspace
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	None	

A.1.11.14 Land Demolitions (Improvised Explosive Device Discovery/Disposal)

Activity Name	Activity Description	
Other		
Land Demolitions (Improvised Explosive Device Discovery/Disposal)	Explosive Ordnance units conduct training detecting, isolating, or securing Improvised Explosive Devices or unexploded ordnance. No explosive ordnance is detonated in this event.	
Long Description	Explosive Ordnance Disposal detachments transit to the training site in trucks or other light wheeled vehicles, sometimes conducting convoy operations or employing other unit tactics proceeding to the site. A search of a suspect area is conducted to locate inert land mines or to locate a designated target for destruction. Buried land mines and unexploded ordnance require the detachment to employ probing techniques and metal detectors for locating the mine or object and the use of hand tools and digging equipment to excavate them.	
Information Typical to the Event	**Platform:** Ground vehicles **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** None	**Location:** Mariana Islands Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.1.11.15 Land Demolitions (Unexploded Ordnance) Discovery/Disposal

Activity Name	Activity Description	
Other		
Land Demolitions (Unexploded Ordnance) Discovery/Disposal	Explosive Ordnance units conduct disposal of unexploded ordnance at approved DoD sites. Training is incidental to the emergency disposal of unexploded ordnance.	
Long Description	Emergency disposal of unexploded ordnance, once exposed and/or properly identified, is conducted in a controlled environment at an approved site.	
Information Typical to the Event	**Platform:** None **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** None	**Location:** 200 events Navy Emergency Disposal Site; 36 events Air Force Explosive Ordnance Disposal Sites (Guam)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Explosive charge (on DoD property at approved sites). **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.2 NAVAL AIR SYSTEMS COMMAND TESTING ACTIVITIES

Naval Air Systems Command events will closely follow fleet primary mission areas, such as the testing of airborne mine warfare and anti-submarine warfare weapons and systems. Naval Air Systems Command events include, but are not limited to, the testing of new aircraft platforms, weapons, and systems that have not been integrated into fleet training events, such as directed energy weapons and the Joint Strike Fighter. In addition to testing new platforms, weapons, and systems, Naval Air Systems Command also conducts lot acceptance testing of airborne weapons and sonobuoys in support of the fleet. These types of events do not fall within one of the fleet primary mission areas; however, in general, most Naval Air Systems Command testing events in terms of their potential environmental effects are similar to Fleet training events.

While many of these systems will eventually be used by the fleet during normal training and will be addressed in this EIS/OEIS for those fleet activities, testing and development activities involving the same or similar systems as will be used by operational fleet units may be used in different locations and manners than when actually used by operational fleet units. Hence, the analysis for testing events and training of Fleet units may differ.

A.2.1 ANTI-SURFACE WARFARE TESTING

A.2.1.1 Air-to-Surface Missile Test

Activity Name	Activity Description	
Anti-Surface Warfare		
Air-to-Surface Missile Test	This event is similar to the training event missile exercise (air-to-surface). Test may involve both fixed-wing and rotary-wing aircraft launching missiles at surface maritime targets to evaluate the weapon system or as part of another systems integration test.	
Long Description	Similar to a missile exercise air-to-surface, an Air-to-Surface Missile Test for fixed-wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another integration test. Air-to-Surface Missile Tests can include high-explosive, non-explosive, or non-firing (captive air training missile) weapons. Both stationary and mobile targets would be utilized during testing; some operational tests would use missiles with explosive warheads and some missiles tested will have non-explosive warheads with a live motor.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft **Systems:** Missile systems **Ordnance/Munitions:** Harpoon **Targets:** Stationary and mobile surface marine targets **Duration:** 2–4 flight hours/event	**Location:** Mariana Islands Training and Testing Study Area > 50 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, weapons firing noise, underwater explosion (E10) **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (missiles), aircraft strike (birds only) **Entanglement:** None **Ingestion:** Missile fragments, target fragments	
Detailed Military Expended Material Information	Missile and target fragments	
Assumptions used for Analysis	One air-to-surface missile per event; 50 percent will be explosive.	

A.2.2 Anti-Submarine Warfare Testing

A.2.2.1 Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft (Sonobuoys)

Activity Name	Activity Description
Anti-Submarine Warfare	
Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft (Sonobouys)	This event is similar to the training event, Anti-Submarine Warfare Tracking Exercise–Maritime Patrol Aircraft. The test evaluates the sensors and systems used by maritime patrol aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements.
Long Description	Similar to an Anti-Submarine Warfare Tracking Exercise-Maritime Patrol Aircraft. Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications and meet operational requirements. P-3 or P-8A fixed-wing aircraft conduct Anti-Submarine Warfare testing using tonal sonobuoys (e.g., AN/SSQ-62 DICASS), explosive sonobuoys (e.g., AN/SSQ-110 Improved Extended Echo Ranging), passive sonobuoys (e.g., AN/SSQ-53), torpedoes (e.g., MK-46), smoke devices (e.g., MK-58), SUS devices (e.g., MK-61 SUS), missiles (e.g., harpoons), and flares. Targets (e.g., MK-39 Expendable Mobile Anti-Submarine Warfare Training Target) may also be employed during an Anti-Submarine Warfare scenario. Some Anti-Submarine Warfare Maritime Patrol Aircraft Tracking Test could be conducted as part of a Coordinated Event with fleet training activities.
Information Typical to the Event	**Platform:** Fixed-wing Maritime Patrol Aircraft (e.g., P-3, P-8A) **Systems:** Tonal sonobuoys (e.g., AN/SSQ-62 DICASS); passive sonobuoys (e.g., AN/SSQ-53); explosive sonobuoys (e.g., AN/SSQ-110 Improved Extended Echo Ranging), **Ordnance/Munitions:** Non-explosive, all recovered; other non-explosive class stores (1000 lb.) torpedoes, smoke devices, flares, missiles, SUS devices **Targets:** MK-39 or MK-30 **Duration:** 4–6 flight hours/event **Location:** Mariana Islands Training and Testing Study Area > 3 nm from land
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonobuoys (e.g., ASW2, MF5, MF6), underwater explosives (e.g., E3, E4), aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, Sonobuoy fragments, torpedo fragments
Detailed Military Expended Material Information	One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) If target air dropped, one parachute per target. 20–60 sonobuoys per event (one parachute per sonobuoy)
Assumptions used for Analysis	Torpedo, missile, flare use will be captured under Anti-submarine warfare Torpedo Test, Anti-surface Warfare Missile Test, and Flare Test, respectively; Chaff will also be captured under Flare Test. Analysis of these systems will not be conducted as part of this activity.

A.2.2.2 Anti-Submarine Warfare Torpedo Test

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Submarine Warfare</td></tr>
<tr><td>Anti-Submarine Warfare Torpedo Test</td><td colspan="2">This event is similar to the training event, Torpedo Exercise. Test evaluates Anti-submarine warfare systems onboard rotary-wing and fixed-wing aircraft and the ability to search for, detect, classify, localize, and track a submarine or similar target.</td></tr>
<tr><td>Long Description</td><td colspan="2">Similar to a Torpedo Exercise, an Anti-Submarine Warfare Torpedo Test evaluates Anti-Submarine Warfare systems onboard rotary-wing (e.g., MH-60R helicopter) and fixed-wing Marine Patrol Aircraft (e.g., P-8, P-3) aircraft and the ability to search for, detect, classify, localize, track, and attack a submarine or similar target (e.g., MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, or MK-30). The focus of the Anti-Submarine Warfare Torpedo test is on the torpedo and torpedoes (e.g., MK-46 or MK-54), but other Anti-Submarine Warfare systems are often used during the test, such as AN/AQS-22 dipping sonar (MH-60R) and sonobuoys (e.g., AN/SSQ-62). MK-39 or MK-30 targets simulate an actual submarine threat and are deployed at varying depths and speeds. This activity can be conducted in shallow or deep waters and aircraft can originate from a land base or from a surface ship. The Torpedo Test culminates with the release of an exercise torpedo against the target and is intended to evaluate the targeting, release, and tracking process of deploying torpedoes from aircraft. All exercise torpedoes used in testing are either running (EXTORP) or non-running (REXTORP). Non-explosive torpedoes are recovered. A parachute assembly and guidance wire used for aircraft-launched torpedoes is jettisoned and sinks. Ballast (typically lead weights) may be released from the torpedoes to allow for recovery and sink to the bottom.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed and rotary-wing aircraft (e.g., P-3/P-8, MH-60R), support vessels
Systems: Dipping sonar (e.g., AN/AQS-22); sonobuoys (e.g., AN/SSQ-62)
Ordnance/Munitions: Torpedoes (e.g., MK-46, MK-54, and MK-56; non-explosive)
Targets: MK-39 Expendable Mobile Anti-Submarine Warfare Training Target or MK-30
Duration: 2–6 flight hours/event</td><td>Location:
Mariana Islands Training and Testing Study Area > 3 nm from land</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency sonar (MF5, MF6), lightweight torpedoes (TORP1), aircraft noise, vessel noise
Energy: None
Physical Disturbance and Strike: Military expended material strike, aircraft strike (birds only), vessel strike
Entanglement: Parachutes, guidance wire
Ingestion: Parachutes, target fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Torpedo accessories (e.g., parachute assembly, guidance wire)
Sonobuoys
Ballast
Target & torpedo fragments</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Assume one torpedo accessory package (parachute, ballast, guidance wire) per torpedo.
Assume one target per torpedo.
Assume 12 sonobuoys per event.
Assume 15 percent of torpedoes are not recovered.</td></tr>
</table>

A.2.2.3 Broad Area Maritime Surveillance Testing – MQ-4C Triton

Activity Name	**Activity Description**	
Anti-Submarine Warfare		
Broad Area Maritime Surveillance (BAMS) Testing – MQ-4C Triton	The Broad Area Maritime Surveillance system will fill a complementary role to the P-8A aircraft, providing maritime reconnaissance support to the Navy.	
Long Description	The MQ-4C Triton BAMS system will be equipped with electro-optical/infrared sensors, can remain on station for 30 hours, and fly at approximately 60,000 feet (18,288 meters).	
Information Typical to the Event	**Platform:** Maritime Patrol Aircraft, MQ-4C Triton **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 30 hours	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.2.3 Electronic Warfare

A.2.3.1 Flare Test

Activity Name	Activity Description	
Electronic Warfare (EW)		
Flare Test	Flare tests evaluate newly developed or enhanced flares, flare dispensing equipment, or modified aircraft systems against flare deployment. Tests may also train pilots and aircrew in the use of newly developed or modified flare deployment systems. Flare tests are often conducted with other test events, and are not typically conducted as standalone tests. Chaff and flares are expended for this test event.	
Long Description	Flare tests are conducted to evaluate new flares, newly developed or modified flare deployment systems, to ensure that other newly enhanced aircraft systems are compatible with flare deployment, and to train pilots and aircrew in the use of newly developed or modified flare deployment systems. Flare tests are often conducted with other test events, and are not typically conducted as stand-alone tests. During a flare test, flares (and in some cases chaff) are deployed, but no weapons are typically fired. Fixed-wing aircraft deploy flares as a defensive tactic to disrupt the infrared missile guidance systems used by heat-seeking missiles, thereby causing the missile to lock onto the flare instead of onto the aircraft and enabling the aircraft to avoid the threat. In a typical scenario, an aircraft may detect the electronic targeting signals emitted from threat radars or missiles, or aircrew may visually identify a threat missile plume when a missile is launched. At a strategically appropriate time, the pilot dispenses flares and immediately maneuvers the aircraft to distract and defeat the threat. During a typical flare test, an aircraft will dispense flares 3,000 feet above mean sea level and flares are completely consumed while in the air. Aircraft flares use a magnesium extruded flare grain. Flare types commonly deployed during NAVAIR testing activities include but are not limited to: MJU-57, MJU-49, and MJU-38 for high speed aircraft and MJU-32 for low speed aircraft.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft **Systems:** Flares: MJU-57, MJU-49, and MJU-38 for high speed aircraft and MJU-32; Joint Allied Threat Assessment System/Common Infrared Countermeasures **Ordnance/Munitions:** None **Targets:** None **Duration:** 2–4 flight hours/event	**Location:** Offshore Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only) **Entanglement:** None **Ingestion:** End caps, chaff	
Detailed Military Expended Materials Information	Flares (end caps and pistons) Chaff	
Assumptions Used for Analysis	Flare use from all other events are captured under this activity. Estimated 30 flares per event. Estimated 60 chaff canisters per event.	

A.3 NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES

Naval Sea Systems Command testing activities are aligned with its mission of new ship construction, life cycle support, and weapon systems development. Each major category of Naval Sea Systems Command activities is described below.

A.3.1 LIFECYCLE ACTIVITIES

Testing activities are conducted throughout the lifecycle of a Navy ship to verify performance and mission capabilities.

A.3.1.1 Ship Signature Testing

Activity Name	Activity Description	
Lifecycle Activities		
Ship Signature Testing	Tests ship and submarine radars, electromagnetic, or acoustic signatures.	
Long Description	Radar cross signature testing of surface vessels is accomplished on new vessels and periodically throughout a vessel's lifecycle to measure how detectable the vessel is to radar. For example, Assessment Identification of Mine Susceptibility measurements are specific electromagnetic and passive acoustical tests performed on mine countermeasure vessels and on the Littoral Combat Ship mine countermeasure modules to determine their mine susceptibility. Additionally, measurements of deployed electromagnetic countermeasures are conducted during the new construction, post-delivery, and lifecycle phases of the acquisition process for submarines. Signature testing of all surface vessels and submarines verifies that each vessel's signature is within specifications, and may include the use of helicopter-deployed instrumentation, ship-mounted safety and navigation systems, fathometers, tracking devices, radar systems, and underwater communications equipment. Event duration includes all systems checks, including those that do not have active sonar.	
Information Typical to the Event	**Platform:** All surface vessel and submarine classes **Systems:** Navigation, underwater communication, sonar **Ordnance/Munitions:** None **Targets:** None **Duration:** None	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, underwater communications sonar (M3, MF9, and MF10), and hull-mounted sonar (MF2) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	None	

A.3.2 ANTI-SURFACE WARFARE/ANTI-SUBMARINE WARFARE TESTING

A.3.2.1 Kinetic Energy Weapon Testing

Activity Name	Activity Description	
Anti-Surface Warfare (ASUW)		
Kinetic Energy Weapon Testing	A kinetic energy weapon (e.g., rail gun) uses stored energy released in a burst to accelerate a projectile.	
Long Description	A kinetic energy weapon uses stored energy released in a burst to accelerate a non-explosive projectile or in-air explosive projectile to more than seven times the speed of sound to a range of up to 200 miles.	
Information Typical to the Event	**Platform:** Surface combatant **Systems:** Kinetic energy weapon **Ordnance/Munitions:** Large-caliber projectile (non-explosive, or in-air explosive) **Targets:** Recoverable or expendable floating or in-air target **Duration:** Event duration is 1 day.	**Location:** Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise, in-air explosives noise, vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectile or fragments), vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	50 events with no more than 40 large-caliber projectiles per event A one-time event only for this EIS/OEIS with 5,000 large-caliber projectiles Expendable target – 1 target per event	
Assumptions Used for Analysis	Assume one target per event. A one-time event with 5,000 projectiles would occur only once for this EIS/OEIS.	

A.3.2.2 Torpedo Testing

Activity Name	**Activity Description**	
Anti-Surface Warfare/Anti-Submarine Warfare Testing		
Torpedo Testing	Air, surface, or submarine crews employ (non-explosive and explosive) torpedoes against submarines, surface vessels, or artificial targets.	
Long Description	Non-explosive and explosive torpedoes (carrying a warhead) would be launched at a suspended target by a submarine and fixed- or rotary-winged aircraft or surface combatants. Torpedoes would detonate on an artificial target located at a depth between 200 and 700 feet below the water's surface.	
Information Typical to the Event	**Platform:** Submarine, surface combatant vessel, fixed-wing aircraft, rotary-wing aircraft, support craft/other **Systems:** None **Ordnance/Munitions:** Torpedoes (heavyweight and lightweight) (explosive and non-explosive) **Targets:** Stationary artificial targets (e.g., MK 28) **Duration:** 1–2 days during daylight hours. Only one heavyweight torpedo test could occur in 1 day; two heavyweight torpedo tests could occur on consecutive days. Two lightweight torpedo tests could occur in a single day.	**Location:** Mariana Islands Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosion (e.g., E8, E11), torpedo sonar (e.g., TORP1, TORP2), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only) **Entanglement:** Parachutes (sonobuoy and torpedo), guidance wire **Ingestion:** Target and torpedo fragments, parachutes (sonobuoy and torpedo), torpedo launch accessories	
Detailed Military Expended Material Information	Torpedo launch accessories o Lightweight/heavy weight torpedo launch accessories o Nose cap, suspension bands, air stabilizer, sway brace pad, arming wire, Fahnstock clip, wing kit, rocket booster, parachute, lead weights o Expended material is dependent upon torpedo fired and firing platform. Heavyweight torpedo launch accessories. Guidance wire, flex hose.	
Assumptions Used for Analysis	All sonobuoys have a parachute unless otherwise noted. 210 passive sonobuoys per event.	

A.3.2.3 Countermeasure Testing

Activity Name	Activity Description
Anti-Surface Warfare/Anti-Submarine Warfare Testing	
Countermeasure Testing	Various acoustic systems (e.g., towed arrays and defense systems) are employed to detect, localize, track, and neutralize incoming weapons.
Long Description	Countermeasure testing involves the testing of systems that would detect, localize, and track incoming weapons. At-sea testing of the Surface Ship Torpedo Defense systems includes towed acoustic systems, torpedo warning systems, and countermeasure anti-torpedo subsystems. Some countermeasure scenarios would employ torpedoes against targets released by secondary platforms (e.g., helicopter or submarine). While surface vessels are in transit, countermeasure systems will be used to identify false alert rates. Additionally, systems may be tested pierside to verify functionality.
Information Typical to the Event	**Platform:** Aircraft carrier, surface combatant, submarine, fixed-wing aircraft, helicopters **Systems:** Countermeasure systems **Ordnance/Munitions:** Lightweight torpedoes **Targets:** Torpedo test vehicle **Duration:** 4 hours to 10 days (depending on the countermeasure being tested) **Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF5), acoustic countermeasure (e.g., ASW3), torpedo sonar (e.g., TORP1), vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, In-water device strike, aircraft noise, aircraft strike (birds only), military expended material strike **Entanglement:** Parachute (torpedo) **Ingestion:** Torpedo launch accessories
Detailed Military Expended Material Information	Torpedo launch accessories (nose covers, parachutes, ram plates)
Assumptions Used for Analysis	None

A.3.2.4 At-Sea Sonar Testing

Activity Name	**Activity Description**	
Surface Warfare/Anti-Submarine Warfare Testing		
At-sea Sonar Testing	At-sea testing to ensure sonar systems are fully functional in an open ocean environment.	
Long Description	At-sea sonar testing is required to calibrate sonar systems while the vessel or submarine is in an open ocean environment. Tests consist of electronic support measurement, photonics, and sonar sensor accuracy testing. In some instances, a submarine's passive detection capability is tested when a second submarine utilizes its active sonar or is equipped with a noise augmentation system in order to replicate acoustic or electromagnetic signatures of other vessel types or classes.	
Information Typical to the Event	**Platform:** Surface combatant vessels, submarines **Systems:** Tactical sonar, acoustic countermeasures **Ordnance/Munitions:** None **Targets:** None **Duration:** 4 hours to 11 days	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency acoustic (e.g., HF1,HF6), mid-frequency acoustic (e.g., MF1, MF3, MF9, MF10, MF11), low-frequency acoustic (LF5, ASW1), acoustic modem (M3), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	Active sonar use is intermittent throughout the duration of the event. Acoustic countermeasures – 10 per event.	

A.3.3 SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING

A.3.3.1 Pierside Integrated Swimmer Defense

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Shipboard Protection Systems and Swimmer Defense Testing</td></tr>
<tr><td>Pierside Integrated Swimmer Defense</td><td colspan="2">Swimmer defense testing ensures that systems can effectively detect, characterize, verify, and engage swimmer/diver threats in harbor environments.</td></tr>
<tr><td>Long Description</td><td colspan="2">Swimmer defense testing includes testing of systems to determine if they can effectively detect, characterize, verify, and engage swimmer/diver threats in harbor environments. Swimmer and diver threats are detected with high frequency sonar. The threats are then warned to exit the water through the use of underwater voice communications. If the threat does not comply, non-lethal diver deterrent air guns are used against the threat. Surface loudhailers are also used during the test.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Support craft/other
Systems: Sonar, swimmer defense airguns surface loudhailers
Ordnance/Munitions: None
Targets: None
Duration: 28 days with intermittent periods of use for each system during this time.</td><td>Location:
Inner Apra Harbor</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Low-frequency sonar (e.g., LF4), mid-frequency sonar (e.g., MF8), swimmer defense sonar (e.g., SD1), airguns (e.g., AG), vessel noise, loudhailers (surface and underwater communications)
Energy: None
Physical Disturbance and Strike: Vessel strike
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material</td><td colspan="2">None</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">Other Sensors: Surface ship protection systems (e.g., communications systems, loudhailers, swimmer deterrents)</td></tr>
</table>

A.3.4 NEW SHIP CONSTRUCTION

Ship construction activities include the integration and testing of new mission packages.

A.3.4.1 Anti-Submarine Warfare Mission Package Testing

Activity Name	**Activity Description**	
New Ship Construction		
Anti-Submarine Warfare Mission Package Testing	Vessels and their supporting platforms (e.g., helicopters, unmanned aerial vehicles) detect, localize, and prosecute submarines.	
Long Description	Vessels conduct detect-to-engage operations against modern diesel-electric and nuclear submarines using airborne and surface assets (both manned and unmanned). Active and passive acoustic systems are used to detect and track submarine targets.	
Information Typical to the Event	**Platform:** Surface combatant vessels (e.g., Littoral Combat Ship); rotary-wing aircraft, Submarines **Systems:** Surface ship sonar, helicopter-deployed sonar, active sonobuoys **Ordnance/Munitions:** **Targets:** Motorized Autonomous Targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target) **Duration:** Event duration is approximately 1–2 weeks, with 4–8 hours of active sonar use with intervals of non-activity in between.	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (LF6), mid-frequency sonar (MF12), helicopter-deployed sonar (MF4), active sonobuoys (MF5), anti-submarine sonar (ASW1), countermeasures (ASW3), vessel noise and aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, towed in-water device strike, aircraft strike **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Material Information	Sonobuoys, parachutes	
Assumptions Used for Analysis	One target per event. All sonobuoys have a parachute unless otherwise noted. 2 sonobuoys per event.	

A.3.4.2 Mine Countermeasure Mission Package Testing

Activity Name	**Activity Description**	
New Ship Construction		
Mine Countermeasure Mission Package Testing	Vessels and associated aircraft conduct mine countermeasure operations.	
Long Description	Littoral Combat Ships conduct mine detection using unmanned submersible and aerial vehicles, magnetic and acoustic sensor systems deployed by vessel or support helicopters, and laser systems. Mines are then neutralized using magnetic, acoustic, and supercavitating systems.	
Information Typical to the Event	**Platform:** Surface combatant Ship, Unmanned Underwater Vehicles, rotary aircraft **Systems:** Towed sonar system **Ordnance/Munitions:** Mine neutralization systems (e.g., Airborne Mine Neutralization System) **Targets:** Floating/moored/bottom non-explosive, mines or passive mine simulation systems **Duration:** 1–2 weeks with intervals of mine countermeasure mission package use during this time.	**Location:** Mariana Islands Training and Testing Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Towed sonar systems (HF4), underwater explosions (E4), aircraft noise, vessel noise **Energy:** Electromagnetic devices, in-air low energy lasers **Physical Disturbance and Strike:** Vessel strike, in-water device strike, aircraft strike (birds only), seafloor devices (e.g., mine shapes, mine shape mooring anchor) **Entanglement:** fiber optic cable **Ingestion:** Fragments	
Detailed Military Expended Material Information	Neutralizer fragments	
Assumptions Used for Analysis	Four neutralizer charges/event	

A.3.4.3 Anti-Surface Warfare Mission Package Testing

Activity Name	Activity Description	
New Ship Construction		
Anti-Surface Warfare Mission Package Testing	Vessels and associated aircraft track and engage against surface targets	
Long Description	Littoral Combat Ships conduct surface warfare by detecting, tracking, and prosecuting surface vessel threats. The Surface Warfare Mission Package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and gun weapon systems.	
Information Typical to the Event	**Platform:** Littoral Combat Ship, unmanned aerial vehicles, rotary aircraft **Systems:** Missiles and large-, medium-, and small-caliber guns **Ordnance/Munitions:** Anti-surface vessel missile (e.g., Griffin); gun projectiles (e.g., 57mm, 30mm, and .50 cal.) **Targets:** Free floating or towed surface targets **Duration:** Conducted in intervals over 1–2 weeks	**Location:** Mariana Islands Training and Testing Study Area; Warning Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, weapon firing noise, aircraft noise, in-air explosives, underwater explosions (E1, E6) **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only), military expended material strike **Entanglement:** None **Ingestion:** Projectiles/projectile fragments; missile or rocket fragments	
Detailed Military Expended Material Information	Projectiles/projectile fragments, casings Missile or rocket fragments	
Assumptions Used for Analysis	500 small-caliber projectiles per event/510 explosive and 510 non-explosive medium-caliber rounds per event/980 explosive and 420 non-explosive large-caliber rounds per event/4 explosive missiles or rockets per event and 4 non-explosive missiles or rockets per event.	

A.4 Office of Naval Research and Naval Research Laboratory Testing Activities

As the Department of the Navy's Science and Technology provider, the Office of Naval Research and the Naval Research Laboratory provide technology solutions for Navy and Marine Corps needs. The Office of Naval Research's mission, as defined by law, is to plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the preservation of national security. Further, the Office of Naval Research manages the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test and evaluation.

The Ocean Battlespace Sensing Department explores science and technology in the areas of oceanographic and meteorological observations, modeling and prediction in the battlespace environment; submarine detection and classification (anti-submarine warfare); and mine warfare applications for detecting and neutralizing mines in both the ocean and littoral environment. Office of Naval Research events include: research, development, test and evaluation activities; surface processes acoustic communications experiments; shallow water acoustic communications experiments; sediment acoustics experiments; shallow water acoustic propagation experiments; and long range acoustic propagation experiments.

A.4.1 OFFICE OF NAVY RESEARCH

A.4.1.1 North Pacific Acoustic Lab Philippine Sea 2018–19 Experiment (Deep Water)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">RDT&E Testing</td></tr>
<tr><td>North Pacific Acoustic Lab Philippine Sea 2018–19 Experiment (Deep Water)</td><td colspan="2">The primary purpose of the Kauai Acoustic Communications Experiment is to collect acoustic and environmental data appropriate for studying the coupling of oceanography, acoustics, and underwater communications.</td></tr>
<tr><td>Long Description</td><td colspan="2">The experiment area encompasses international waters. The initial experiment was completed in May of 2011; an acoustic tomography array, a distributed vertical line array (DVLA), and moorings were deployed in the deep-water environment of the northwestern Philippine Sea. The acoustic tomography array and DVLA have remained in situ at the experiment site since that time, collecting oceanographic and acoustic data used to study deep-water propagation and to characterize the temperature and velocity structure in this oceanographically complex and highly dynamic region. In addition, data will be collected during two periods of intensive experimental at-sea operations in May and July of 2018. During the fall of 2018 data will be collected passively by remotely sensing seagliders. Research vessels, acoustic test sources, side scan sonar, ocean gliders, the existing moored acoustic tomographic array and distributed vertical line array, and other oceanographic data collection equipment will be used to collect information on the ocean environment. The final phases of the experiment will be completed during March through May 2019. The resulting analyses will aid in developing a more complete understanding of deep water sound propagation and the temperature-velocity profile of the water column in this part of the world.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Research vessels
Systems: Ocean gliders.
Ordnance/Munitions: None
Targets: None
Duration: 1–2 weeks</td><td>Location:
Mariana Islands Training and Testing Study Area</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Vessel noise, high frequency sonar, acoustic modems, acoustic test sources
Energy: None
Physical Disturbance and Strike: Seafloor devices, vessel strike
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Mooring blocks</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">None</td></tr>
</table>

A.5 United States Coast Guard Training Activities

This section separately presents U.S. Coast Guard Training Activities in order to clearly identify training activities conducted by Department of Homeland Security in the Mariana Islands.

A.5.1 Gunnery Exercise (Surface-to-Surface) Ship – Small-Caliber and Medium-Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Ship) – Small-Caliber and Medium-Caliber **(GUNEX [S-S] Ship – Small-Caliber and Medium-Caliber)**	Ship crews engage surface targets with ship's small- and medium-caliber guns.	
Long Description	This exercise involves vessel crews engaging surface targets at sea with small-caliber and medium-caliber weapons. Vessels use small- and medium-caliber weapons to practice defensive marksmanship, typically against a stationary floating target and high-speed mobile targets. Some targets are expended during the exercise and are not recovered.	
Information Typical to the Event	**Platform:** Surface vessels **Systems:** None **Ordnance/Munitions:** Small-caliber (non-explosive); Medium-caliber (high-explosive or non-explosive). **Targets:** Recoverable and expendable floating target (stationary or towed), remote control high-speed targets **Duration:** 2–3 hours	**Location:** Mariana Islands Training and Testing Study Area > 12 nm from land; Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives (E1), vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, target strike, military expended material strike (projectiles) **Entanglement:** None **Ingestion:** Small-caliber/Medium-caliber projectiles and casings, target fragments, projectile fragments	
Detailed Military Expended Material Information	Small- and medium-caliber projectiles and casings, target fragments, projectile fragments Approximately 200 small- and medium-caliber rounds per event One target used per event. Approximately 50 percent of targets are “Killer Tomatoes” (usually recovered) Approximately 35 percent are high-speed maneuvering targets, which are recovered. Approximately 15 percent of targets are other stationary targets such as a steel drum.	
Assumptions used for Analysis	None	

A.5.2 GUNNERY EXERCISE (SURFACE-TO-SURFACE) BOAT – SMALL-CALIBER AND MEDIUM-CALIBER

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Boat) – Small-Caliber and Medium-Caliber **(GUNEX [S-S] Boat)**	Small boat crews engage surface targets with small- and medium-caliber weapons.	
Long Description	Boat crews engage surface targets with small- and medium-caliber weapons. Boat crews may use high or low speeds to approach and engage targets simulating other boats, floating mines, or near shore land targets with small- and medium-caliber (up to and including 40mm) weapons. A commonly used target is an empty steel drum. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include: small unit river craft, combat rubber raiding craft, rigid-hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.	
Information Typical to the Event	**Platform:** Boats **Systems:** None **Ordnance/Munitions:** Small- and medium-caliber (up to and including 40mm [explosive and non-explosive]) **Targets:** Recoverable or expendable floating target (Figure A-4) (stationary or towed) **Duration:** 1 hour	**Location:** Mariana Islands Training and Testing Study Area > 12 nm [explosive rounds] Study Area > 3 nm from land [non-explosive rounds] Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions (E2), vessel noise, weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectile, target fragments), vessel and in-water device strike **Entanglement:** None **Ingestion:** Projectiles and target fragments, projectiles, casings	
Detailed Military Expended Material Information	Projectiles and target fragments, projectiles, casings One target used per event, typically a stationary target such as a 50-gallon (189-liter) steel drum.	
Assumptions used for Analysis	Assume all Alternatives 1 and 2 events include the use of some explosive rounds. Most events will involve boat crews training with MK 203 40mm grenade launcher.	

A.5.3 MARITIME SECURITY OPERATIONS (MSO)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Maritime Security Operations (MSO)</td><td colspan="2">Helicopter and surface ship crews conduct a suite of Maritime Security Operations (e.g., Vessel, Search, Board, and Seizure; Maritime Interdiction Operations; Force Protection; and Anti-Piracy Operation).</td></tr>
<tr><td>Long Description</td><td colspan="2">Helicopter and surface ship crews conduct a suite of Maritime Security Operations (e.g., visit search, board, and seizure; maritime interdiction operations; force protection; and anti-piracy operation). These activities involve training of boarding parties delivered by helicopters and surface ships to surface vessels for the purpose of simulating vessel search and seizure operations. Various training scenarios are employed and may include small arms with non-explosive blanks and surveillance or reconnaissance unmanned surface and aerial vehicles, and anti-swimmer grenades. The entire exercise may last 2–3 hours.

Vessel Visit, Board, Search, and Seizure: Military and U.S. Coast Guard personnel from vessels and aircraft board suspect vessels, potentially under hostile conditions.

Maritime Interdiction Operations: Vessels and aircraft train in pursuing, intercepting, and ultimately detaining suspect vessels.

Oil Platform Defense: Naval personnel train to defend oil platforms or other similar at sea structures.

Warning Shot/Disabling Fire: Naval and U.S. Coast Guard personnel train in the use of weapons to force fleeing or threatening small boats (typically operating at high speeds) to come to a stop.

Ship Force Protection: Vessel crews train in tracking multiple approaching, circling small craft, assessing threat potential, and communicating amongst crewmates and other vessels to ensure vessels are protected against attack.

Anti-Piracy Training: Naval and U.S. Coast Guard personnel train in deterring and interrupting piracy activity. Training includes large vessels (pirate “mother ships”), and multiple small, maneuverable, and fast craft.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessel (any), rotary-wing aircraft, small boats, high speed vessels, unmanned vehicles (surface and aerial)
Systems: None
Ordnance/Munitions: Small-caliber (non-explosive) and anti-swimmer grenades
Targets: Range support vessel, high performance boats, remote controlled high speed targets towing surface targets
Duration: Up to 3 hours</td><td>Location:
Mariana Islands Training and Testing Study Area; Mariana Islands Range Complex</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Vessel noise, aircraft noise, weapons firing noise, underwater explosion (E3)
Energy: None
Physical Disturbance and Strike: Vessel and in-water device strike, military expended material strike (projectile, target),
Entanglement: None
Ingestion: Small-caliber projectiles, casings, target fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Small-caliber projectiles
Target fragments
Casings, grenade fragments</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Majority of events will occur proximate to NAVBASE Guam including during times of transit in and out of port, as well as during major training events.</td></tr>
</table>

A.5.4 CIVILIAN PORT DEFENSE

Activity Name	Activity Description	
Major Training Events		
Civilian Port Defense	Civilian Port Defense exercises are naval mine warfare activities conducted at various ports and harbors, in support of U.S. Coast Guard and maritime homeland defense/security.	
Long Description	Naval forces provide Mine Warfare capabilities to DHS led event. The three pillars of MIW, Airborne (helicopter), Surface (ships and unmanned vehicles), and Undersea (divers, marine mammals, and unmanned vehicles) mine countermeasures will be brought to bear in order to ensure strategic US ports remain free of mine threats. Various MIW sensors, which utilize active acoustics, will be employed in the detection, classification, and neutralization of mines. Along with traditional MIW techniques, such as helicopter towed mine countermeasures, new technologies (unmanned vehicles) will be utilized. Event locations and scenarios will vary according to U.S. Coast Guard and DHS strategic goals and evolving world events. Purpose of MITT analysis is to ensure adequate Marine Mammal Protection Act (MMPA) authorizations are in place to support the use of acoustic mine detection sensors. Additional analysis and regulatory engagement will be conducted as appropriate as planning for the actual events begin.	
Information Typical to the Event	**Platform:** Surface combatant vessels (e.g., LCS, MCM), U.S. Coast Guard vessels, small boats, rotary wing aircraft **Systems:** Unmanned underwater and surface vehicles, various mine detection sensors (e.g., AN/AQS-20, AN/AQS-24) **Ordnance/Munitions:** High-explosive charges **Targets:** Temporary mine shapes **Duration:** Multiple days	**Location:** Mariana littorals, Mariana Islands Range Complex; Inner and Outer Apra Harbor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF4); underwater explosions (e.g., E2, E4), vessel noise, aircraft noise **Energy:** Magnetic influence mine sweeping **Physical Disturbance and Strike:** Vessel and in-water device strike, seafloor device (bottom placed mine shapes), aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material	None	
Assumptions Used for Analysis	Non-permanent mine shapes will be laid in various places on the bottom. Shapes are varied, from about 1 meter circular to about 2.5 meters long by 1 meter wide. They will be recovered using normal assets, with diver involvement.	

A.5.5 SEARCH AND RESCUE AT SEA

Activity Name	**Activity Description**	
Other		
Search and Rescue at Sea	Vessels and aircraft conduct search and rescue of personnel and vessels at sea.	
Long Description	U.S. Coast Guard vessels, Navy vessels, and rotor-wing and fixed-wing aircraft coordinate on scene actions to search and conduct rescue and recovery of personnel or vessels at sea.	
Information Typical to the Event	**Platform:** Ships, rotor-wing aircraft, fixed-wing aircraft, unmanned aerial vehicles **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 3 days	**Location:** Mariana Islands Test and Training Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, aircraft strike (birds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	None	

A.5.6 PRECISION ANCHORING

Activity Name	Activity Description
Other Training	
Precision Anchoring	Releasing of anchors in designated locations.
Long Description	Vessels navigate to a pre-planned position and deploy the anchor. The vessel uses all means available to determine its position when anchor is dropped, to demonstrate calculating and plotting the anchor's position within 100 yards of center of planned anchorage.
Information Typical to the Event	**Platform:** All surface vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 1 hour **Location:** Mariana Islands anchorages
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, seafloor device strike (anchor) **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	None
Assumptions used for Analysis	None

Appendix B: Notice of Intent

57720 **Federal Register** / Vol. 76, No. 180 / Friday, September 16, 2011 / Notices

ACTION: Proposed Additions to the Procurement List.

SUMMARY: The Committee is proposing to add products and services to the Procurement List that will be furnished by nonprofit agencies employing persons who are blind or have other severe disabilities.

Comments Must Be Received on or Before: 10/17/2011.

ADDRESSES: Committee for Purchase From People Who Are Blind or Severely Disabled, Jefferson Plaza 2, Suite 10800, 1421 Jefferson Davis Highway, Arlington, Virginia 22202–3259.

FOR FURTHER INFORMATION OR TO SUBMIT COMMENTS CONTACT: Barry S. Lineback, Telephone: (703) 603–7740, Fax: (703) 603–0655, or e-mail *CMTEFedReg@AbilityOne.gov.*

SUPPLEMENTARY INFORMATION: This notice is published pursuant to 41 U.S.C. 47(a)(2) and 41 CFR 51–2.3. Its purpose is to provide interested persons an opportunity to submit comments on the proposed actions.

Additions

If the Committee approves the proposed additions, the entities of the Federal Government identified in this notice will be required to procure the products and services listed below from nonprofit agencies employing persons who are blind or have other severe disabilities.

Regulatory Flexibility Act Certification

I certify that the following action will not have a significant impact on a substantial number of small entities. The major factors considered for this certification were:

1. If approved, the action will not result in any additional reporting, recordkeeping or other compliance requirements for small entities other than the small organizations that will furnish the products and services to the Government.
2. If approved, the action will result in authorizing small entities to furnish the products and services to the Government.
3. There are no known regulatory alternatives which would accomplish the objectives of the *Javits-Wagner-O'Day Act* (41 U.S.C. 46–48c) in connection with the products and services proposed for addition to the Procurement List.

Comments on this certification are invited. Commenters should identify the statement(s) underlying the certification on which they are providing additional information.

End of Certification

The following products and services are proposed for addition to the Procurement List for production by the nonprofit agencies listed:

Products

NSN: 7930–00–NIB–0583—Refills, Bathroom Cleaner and Deodorizer, Cartridge Concentrate.

NSN: 7930–00–NIB–0584—Starter Kit, Bathroom Cleaner and Deodorizer, Cartridge Concentrate.

NSN: 7930–00–NIB–0585—Refills, Glass and Hard Surface Cleaner, Cartridge Concentrate.

NSN: 7930–00–NIB–0586—Starter Kit, Glass and Hard Surface Cleaner, Cartridge Concentrate.

NSN: 7930–00–NIB–0591—Refills, Disinfectant Cleaner-Degreaser Cartridge Concentrate.

NSN: 7930–00–NIB–0592—Starter Kit, Disinfectant Cleaner-Degreaser Cartridge Concentrate.

NSN: 7930–00–NIB–0593—Refills, Multi-Purpose Cleaner, Cartridge Concentrate.

NSN: 7930–00–NIB–0594—Starter Kit, Multi-Purpose Cleaner, Cartridge Concentrate.

NPA: Association for Vision Rehabilitation and Employment, Inc., Binghamton, NY.

Contracting Activity: General Services Administration, Fort Worth, TX

Coverage: A-List for the Total Government Requirement as aggregated by the General Services Administration.

Services

Service Type/Location: Grounds & Cemetery Facilities Maintenance, Fort McClellan Veterans Cemetery and Prisoner of War Cemetery, Anniston, AL.

NPA: The Opportunity Center Easter Seal Facility—The Ala ES Soc, Inc., Anniston, AL,

Contracting Activity: DEPT OF THE ARMY, W0LX ANNISTON DEPOT PROP DIV, ANNISTON, AL.

Service Types/Location: Janitorial Service, Grounds Maintenance Service, William Jefferson Clinton Birthplace Home National Historic Site (NHS), 117 S. Hervey St., Hope, AR.

NPA: Rainbow of Challenges, Inc., Hope, AR.

Contracting Activity: DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE, MIDWEST REGION, OMAHA, NE.

Barry S. Lineback,

Director, Business Operations.

[FR Doc. 2011–23804 Filed 9–15–11; 8:45 am]

BILLING CODE 6353–01–P

DEPARTMENT OF DEFENSE

Department of the Air Force

Intent To Grant an Exclusive Patent License

SUMMARY: Pursuant to the provisions of part 404 of Title 37, Code of Federal Regulations, which implements Public Law 96–517, as amended, the Department of the Air Force announces its intention to grant Eclipse Composites Engineering, LLC, a corporation of Utah, having a place of business at 78 West 13775, South #1, Draper, UT, 84020, an exclusive license in any right, title and interest the United States Air Force has in: U.S. Patent Application No. 12/932,341, filed on February 23, 2011, entitled "Resin-Based Molding of Electrically Conductive Structures" by David J. Legare as sole inventor.

FOR FURTHER INFORMATION CONTACT: An exclusive license for the invention described in this patent application will be granted unless a written objection is received within fifteen (15) days from the date of publication of this Notice. Written objections should be sent to: Air Force Research Laboratory, Office of the Staff Judge Advocate, AFRL/RIJ, 26 Electronic Parkway, Rome, New York 13441–4514. Telephone: (315) 330–2087; Facsimile (315) 330–7583.

Bao-Anh Trinh,

DAF, Air Force Federal Register Liaison Officer.

[FR Doc. 2011–23750 Filed 9–15–11; 8:45 am]

BILLING CODE 5001–10–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement/Overseas Environmental Impact Statement for Military Readiness Activities in the Mariana Islands Training and Testing Study Area and To Announce Public Scoping Meetings; Correction

AGENCY: Department of Navy, DoD.

ACTION: Notice; correction.

SUMMARY: The Department of the Navy published a document in the **Federal Register** (76 FR 174) on September 8, 2011, concerning public scoping meetings to support the development of an Environmental Impact Statement/Overseas Environmental Impact Statement for the Mariana Islands Training and Testing Study Area. The document contained an incorrect scoping date.

FOR FURTHER INFORMATION CONTACT: Ms. Nora Macariola—See, Naval Facilities Engineering Command, Pacific. *Attention:* MITT EIS/OEIS, 258 Makalapa Drive, Suite 100, Building 258, Floor 3, Pearl Harbor, Hawaii 96860–3134.

Correction: In the **Federal Register** (76 FR 174) of September 8, 2011, on page

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55654, in the first column, correct the last public scoping date to read:

5. Thursday, September 29, 2011, at the Sinapalo Elementary School Cafeteria, Sinapalo I, Songsong Village, Rota, MP 96951.

Dated: September 9, 2011.

L.M. Senay,

Lieutenant, Judge Advocate General's Corps, U.S. Navy, Alternate Federal Register Liaison Officer.

[FR Doc. 2011–23755 Filed 9–15–11; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF EDUCATION

Notice of Submission for OMB Review

AGENCY: Department of Education.

ACTION: Comment request.

SUMMARY: The Director, Information Collection Clearance Division, Privacy, Information and Records Management Services, Office of Management, invites comments on the submission for OMB review as required by the Paperwork Reduction Act of 1995 (Pub. L. 104–13).

DATES: Interested persons are invited to submit comments on or before October 17, 2011.

ADDRESSES: Written comments should be addressed to the Office of Information and Regulatory Affairs, Attention: Education Desk Officer, Office of Management and Budget, 725 17th Street, NW., Room 10222, New Executive Office Building, Washington, DC 20503, be faxed to (202) 395–5806 or e-mailed to *oira_submission@omb.eop.gov* with a cc: to *ICDocketMgr@ed.gov*. Please note that written comments received in response to this notice will be considered public records.

SUPPLEMENTARY INFORMATION: Section 3506 of the Paperwork Reduction Act of 1995 (44 U.S.C. chapter 35) requires that the Office of Management and Budget (OMB) provide interested Federal agencies and the public an early opportunity to comment on information collection requests. The OMB is particularly interested in comments which: (1) Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility; (2) Evaluate the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used; (3) Enhance the quality, utility, and clarity of the information to be collected; and (4) Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology.

Dated: September 13, 2011.

Darrin King,

Director, Information Collection Clearance Division, Privacy, Information and Records Management Services, Office of Management.

Office of Elementary and Secondary Education

Type of Review: Extension.

Title of Collection: Annual Report of Children in State Agency and Locally Operated Institutions for Neglected and Delinquent Children.

OMB Control Number: 1810–0060.

Agency Form Number(s): Department of Education (ED) Form 4376.

Frequency of Responses: Annually.

Affected Public: State, Local or Tribal Governments.

Total Estimated Number of Annual Responses: 3,552.

Total Estimated Annual Burden Hours: 4,564.

Abstract: An annual survey is conducted to collect data on (1) the number of children enrolled in educational programs of State-operated institutions for neglected or delinquent (N or D) children, community day programs for N or D children, and adult correctional institutions and (2) the October caseload of N or D children in local institutions.

Copies of the information collection submission for OMB review may be accessed from the RegInfo.gov Web site at *http://www.reginfo.gov/public/do/PRAMain* or from the Department's Web site at *http://edicsweb.ed.gov*, by selecting the "Browse Pending Collections" link and by clicking on link number 4662. When you access the information collection, click on "Download Attachments" to view. Written requests for information should be addressed to U.S. Department of Education, 400 Maryland Avenue, SW., LBJ, Washington, DC 20202–4537. Requests may also be electronically mailed to the Internet address *ICDocketMgr@ed.gov* or faxed to 202–401–0920. Please specify the complete title of the information collection and OMB Control Number when making your request.

Individuals who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 1–800–877–8339.

[FR Doc. 2011–23830 Filed 9–15–11; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF EDUCATION

Notice of Submission for OMB Review

AGENCY: Department of Education.

ACTION: Comment request.

SUMMARY: The Director, Information Collection Clearance Division, Privacy, Information and Records Management Services, Office of Management, invites comments on the submission for OMB review as required by the Paperwork Reduction Act of 1995 (Pub. L. 104–13).

DATES: Interested persons are invited to submit comments on or before October 17, 2011.

ADDRESSES: Written comments should be addressed to the Office of Information and Regulatory Affairs, Attention: Education Desk Officer, Office of Management and Budget, 725 17th Street, NW., Room 10222, New Executive Office Building, Washington, DC 20503, be faxed to (202) 395–5806 or e-mailed to *oira_submission@omb.eop.gov* with a cc: to *ICDocketMgr@ed.gov*. Please note that written comments received in response to this notice will be considered public records.

SUPPLEMENTARY INFORMATION: Section 3506 of the Paperwork Reduction Act of 1995 (44 U.S.C. chapter 35) requires that the Office of Management and Budget (OMB) provide interested Federal agencies and the public an early opportunity to comment on information collection requests. The OMB is particularly interested in comments which: (1) Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility; (2) Evaluate the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used; (3) Enhance the quality, utility, and clarity of the information to be collected; and (4) Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology.

Dated: September 13, 2011.

Darrin King,

Director, Information Collection Clearance Division, Privacy, Information and Records Management Services, Office of Management.

National Center for Education Statistics

Type of Review: Revision.

Title of Collection: High School Longitudinal Study of 2009 (HSLS:09)

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(viii) *Date Report Delivered to Congress:* August 30, 2011.

Policy Justification

Norway—Procure and Install Equipment on P–3C Aircraft

The Government of Norway has requested a possible sale for the procurement and installation of 4 AN/USQ–78B Acoustic Processor Technology Refresh (APTR), 4AN/ASQ–227 Aircraft Mission Computers, and 2 Tactical Mobile Acoustic Support Systems on four Royal Norwegian Air Force P–3C aircraft, spare and repair parts, support and test equipment, publications and technical documentation, personnel training and training equipment, U.S. Government and contractor engineering, technical and logistics support services, and other related elements of logistical and program support. The estimated cost is $95 million.

This proposed sale will contribute to the foreign policy and national security of the United States by helping to improve the security of a NATO ally that has been, and continues to be, an important force for economic and political stability.

The proposed sale will update hardware and ensure the sustainment of data provided to the United States as part of various data sharing agreements already in place with the Government of Norway in the area of anti-submarine warfare. Norway will have no difficulty absorbing the additional equipment into its armed forces.

The proposed sale of this equipment and support will not alter the basic military balance in the region.

The prime contractor will be Lockheed Martin Corporation in Owego, New York. Offset agreements associated with this proposed sale are expected, but at this time the specific offset agreements are undetermined and will be defined in negotiations between the purchaser and contractors.

Implementation of this proposed sale will require U.S. Government and contractor representatives to travel to Norway to participate in periodic program technical reviews, training and support visits, and maintenance and support visits semi-annually for a period of four years.

There will be no adverse impact on U.S. defense readiness as a result of this proposed sale.

[FR Doc. 2011–22930 Filed 9–7–11; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Office of the Secretary

Meeting of the Defense Advisory Committee on Women in the Services (DACOWITS)

AGENCY: Department of Defense.

ACTION: Notice.

SUMMARY: Pursuant to Section 10 (a), Public Law 92–463, as amended, notice is hereby given of a forthcoming meeting of the Defense Advisory Committee on Women in the Services (DACOWITS). The purpose of the meeting is for the Committee to receive a follow-up briefing from the Sexual Assault Prevention and Response Office and the Services on the Committee's requests for information concerning sexual assault and sexual harassment. Additionally, the Committee will develop and approve recommendations for the 2011 report. The meeting is open to the public, subject to the availability of space.

Interested persons may submit a written statement for consideration by the Defense Advisory Committee on Women in the Services. Individuals submitting a written statement must submit their statement to the Point of Contact listed below at the address detailed below no later than 5 p.m., Tuesday, September 20, 2011. If a written statement is not received by Tuesday, September 20, 2011, prior to the meeting, which is the subject of this notice, then it may not be provided to or considered by the Defense Advisory Committee on Women in the Services until its next open meeting. The Designated Federal Officer will review all timely submissions with the Defense Advisory Committee on Women in the Services Chairperson and ensure they are provided to the members of the Defense Advisory Committee on Women in the Services. If members of the public are interested in making an oral statement, a written statement should be submitted as above. After reviewing the written comments, the Chairperson and the Designated Federal Officer will determine who of the requesting persons will be able to make an oral presentation of their issue during an open portion of this meeting or at a future meeting. Determination of who will be making an oral presentation is at the sole discretion of the Committee Chair and the Designated Federal Officer and will depend on time available and if the topics are relevant to the Committee's activities. Two minutes will be allotted to persons desiring to make an oral presentation. Oral presentations by members of the public will be permitted only on Thursday, September 22, 2011 from 4:15 p.m. to 5 p.m. in front of the full Committee. Number of oral presentations to be made will depend on the number of requests received from members of the public.

DATES: September 22, 2011, 8 a.m.–5 p.m.; September 23, 2011, 8 a.m.–12 p.m.

ADDRESSES: Sheraton National Hotel, 900 Orme St, Arlington, VA 22204.

FOR FURTHER INFORMATION CONTACT: Mr. Robert Bowling or DACOWITS Staff at 4000 Defense Pentagon, Room 2C548A, Washington, DC 20301–4000. E-mail: Robert.bowling@osd.mil. Telephone (703) 697–2122. Fax (703) 614–6233.

SUPPLEMENTARY INFORMATION:

Meeting Agenda

Thursday, September 22, 2011, 8 a.m.–5 p.m.

—Welcome, introductions, and announcements.
—Receive briefings from the Sexual Assault Prevention and Response Office on sexual assault and harassment information.
—Receive briefings from the Services on sexual assault and harassment information.
—Public Forum.

Friday, September 23, 2011, 8 a.m.–12 p.m.

—Committee develops and approves recommendations for 2011 report.

Dated: September 2, 2011.

Aaron Siegel,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 2011–23002 Filed 9–7–11; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement/Overseas Environmental Impact Statement for Military Readiness Activities in the Mariana Islands Training and Testing Study Area and To Announce Public Scoping Meetings

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act of 1969, as implemented by the Council on Environmental Quality Regulations (40 Code of Federal Regulations parts 1500–1508), and

55654 Federal Register / Vol. 76, No. 174 / Thursday, September 8, 2011 / Notices

Executive Order 12114, the Department of the Navy (DoN) announces its intent to prepare an Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to evaluate the potential environmental effects associated with maintaining military readiness training and research, development, testing, and evaluation (hereafter referred to as "training and testing") activities conducted in the Mariana Islands Training and Testing (MITT) EIS/OEIS Study Area. The MITT Study Area includes the existing Mariana Islands Range Complex (MIRC), additional areas on the high seas, and a general transit corridor between Hawaii to MITT where training and testing activities may occur. The MIRC is the only major Navy range complex in the Study Area.

The DoN is preparing this EIS/OEIS to renew current regulatory permits and authorizations, address current training and testing not covered under existing permits and authorizations, and to obtain those permits and authorizations necessary to support force structure changes and emerging and future training and testing requirements including those associated with new platforms and weapons systems within the MITT Study Area, starting in 2015, thereby ensuring critical Department of Defense (DoD) requirements are met.

The DoN will invite the National Marine Fisheries Service, United States (U.S.) Fish and Wildlife Service (Pacific Islands Fish and Wildlife Office), and U.S. Air Force, to be cooperating agencies in preparation of the EIS/OEIS.

DATES AND ADDRESSES: Five public scoping meetings will be held between 5 and 8 p.m. on:

1. Thursday, September 22, 2011, at the University of Guam, Leon Guerrero School of Business and Public Administration Building, Anthony Leon Guerrero Multi-Purpose Room 129, Mangilao, Guam 96923.
2. Friday, September 23, 2011, at the Southern High School Cafeteria, #1 Jose Perez Leon Guerrero Drive, Santa Rita, Guam 96915.
3. Monday, September 26, 2011, at the Multi-Purpose Center in Susupe, Saipan 96950.
4. Tuesday, September 27, 2011, at the Tinian High School Cafeteria, San Jose Village, Tinian, MP 96952.
5. Wednesday, September 28, 2011, at the Sinapalo Elementary School Cafeteria, Sinapalo I, Songsong Village, Rota, MP 96951

Each of the five scoping meetings will consist of an informal, open house session with information stations staffed by DoN representatives. Meeting details will be announced in local newspapers. Additional information concerning meeting times will be available on the EIS/OEIS Web page located at: *http://www.mitt-eis.com.*

FOR FURTHER INFORMATION CONTACT: Ms. Nora Macariola-See, Naval Facilities Engineering Command, Pacific. Attention: MITT EIS/OEIS, 258 Makalapa Drive, Suite 100, Building 258, Floor 3, Pearl Harbor, Hawaii 96860–3134.

SUPPLEMENTARY INFORMATION: The DoN's proposed action is to conduct military training and testing activities, including the use of active sonar and explosives, within the MITT Study Area. While the majority of training and testing activities take place in established training and testing areas, some activities, such as sonar maintenance and gunnery exercises are conducted concurrent with normal transits.

The MIRC is one component of the MITT Study Area, encompassing 501,873 square nautical miles of open ocean. In addition to the areas covered within the MIRC, the Study Area also includes additional areas on the high seas and transit corridors where training and testing activities may occur.

The proposed action is to conduct military training and testing activities in the MITT study area. The purpose of the proposed action is to achieve and maintain military readiness to meet the requirements of Title 10 of the U.S. Code, thereby ensuring that the DoN and other Services meet their mission to maintain, train, and equip combat-ready military forces capable of winning wars, deterring aggression, and maintaining freedom of the seas.

Three alternatives will be analyzed in the MITT EIS/OEIS. The No Action Alternative would continue baseline training and testing activities, as defined by existing environmental planning documents.

Alternative 1 consists of baseline training and testing activities and overall expansion of the Study Area plus adjustments to types and levels of activities as necessary to support current and planned military training and testing requirements. This Alternative considers activities conducted throughout the Study Area and mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (vessels, aircraft) and weapons systems.

Alternative 2 consists of Alternative 1 plus the establishment of new range capabilities, modifications of existing capabilities, adjustments to type and tempo of training and testing activities, and the establishment of additional locations to conduct training and testing activities within the Study Area.

Resource areas that will be addressed because of the potential effects from the Proposed Action include, but are not limited to, ocean and biological resources (including marine mammals and threatened and endangered species), terrestrial resources, air quality, noise, cultural resources, transportation, regional economy, recreation, and public health and safety.

The scoping process will be used to identify community concerns and local issues that will be addressed in the EIS/OEIS. Federal agencies, state agencies, local agencies, the public, and interested persons are encouraged to provide comments to the DoN to identify specific issues or topics of environmental concern that the commenter believes the DoN should consider. All comments provided orally or in writing at the scoping meetings, will receive the same consideration during EIS/OEIS preparation. Written comments must be postmarked no later than November 7, 2011, and should be mailed to: Naval Facilities Engineering Command, Pacific, 258 Makalapa Drive, Suite 100, Pearl Harbor, HI 96869–3134, Attention: MITT EIS/OEIS Project Manager.

Dated: September 1, 2011.

L.M. Senay,

Lieutenant, Judge Advocate General's Corps, U.S. Navy, Alternate Federal Register Liaison Officer.

[FR Doc. 2011–22985 Filed 9–7–11; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF EDUCATION

Notice of Proposed Information Collection Requests

AGENCY: Department of Education.

ACTION: Comment request.

SUMMARY: The Department of Education (the Department), in accordance with the Paperwork Reduction Act of 1995 (PRA) (44 U.S.C. 3506(c)(2)(A)), provides the general public and Federal agencies with an opportunity to comment on proposed and continuing collections of information. This helps the Department assess the impact of its information collection requirements and minimize the reporting burden on the public and helps the public understand the Department's information collection requirements and provide the requested data in the desired format. The Director, Information Collection Clearance Division, Privacy, Information and

Appendix C: Agency Correspondence

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APPENDIX C AGENCY CORRESPONDENCE

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N01CE1/1137
30 Aug 2011

xxxxxx
xxxxxx
xxxxxx

Dear Name:

Subj: NOTIFICATION OF PREPARATION OF THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS)

This letter is to inform you that the United States (U.S.) Navy, on behalf of the U.S. military services, is preparing an EIS/OEIS to assess the potential environmental impacts from proposed military readiness training and research, development, testing and evaluation activities ("training and testing activities") in the MITT Study Area. Some of these proposed training and testing activities may include the use of active sonar and explosives. The services request your comments on the scope, content and issues to be considered in the development of the EIS/OEIS.

The MITT Study Area is comprised of air, land and sea space and includes the existing Mariana Islands Range Complex (MIRC), additional areas on the high seas and a transit corridor where training and testing activities may occur (see Enclosure 1). The MIRC is the only Navy range complex in the Study Area.

The Proposed Action is to conduct military training and testing activities in the MITT Study Area. The purpose of the Proposed Action is to achieve and maintain military readiness to meet the requirements of Title 10 of the U.S. Code, thereby ensuring that the military services meet their mission to maintain, train and equip combat-ready military forces capable of winning wars, deterring aggression and maintaining freedom of the seas.

Subj: NOTIFICATION OF PREPARATION OF THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS)

The Proposed Action would support military training and testing activities associated with the development, testing and introduction of new vessels, aircraft and weapons systems within the MITT Study Area to ensure critical military requirements are met. This action is needed to support applicable environmental reauthorizations, consultations and other associated environmental requirements for those training and testing activities. The MITT EIS/OEIS is the reevaluation and reauthorization of training and testing activities reviewed in the MIRC EIS/OEIS, which the Navy completed with community input in 2010.

Environmental issues to be addressed in the EIS/OEIS include, but are not limited to, the following resource areas: ocean and biological resources (including marine mammals and threatened and endangered species), terrestrial resources, air quality, airborne soundscape, cultural resources, transportation, regional economy, recreation, and public health and safety. Your input in identifying specific issues and concerns that should be assessed, in these areas and any additional areas, is important to the process.

In compliance with the National Environmental Policy Act of 1969 (NEPA) and the National Historic Preservation Act, the Navy is holding five open house public scoping meetings to support an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to the Proposed Action. Scoping meetings will inform the public of the Proposed Action and NEPA process and give community members an opportunity to submit written and oral comments on the scope, environmental resources and local issues to be addressed in the EIS/OEIS. Input from the public scoping meetings will be used to help identify potentially significant issues to be analyzed in the Draft EIS/OEIS.

The public scoping meetings will be conducted in an open house format and members of the public may arrive at any time during the meetings. There will be no formal presentation; however, service representatives will be available to provide information and answer questions about the Proposed Action.

Subj: NOTIFICATION OF PREPARATION OF THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS)

The public scoping meetings will be held from **5 to 8 p.m.** at the following locations:

On Guam: **Thursday, Sept. 22, 2011**
University of Guam
Leon Guerrero School of Business and Public Administration Building,
Anthony Leon Guerrero Multi-Purpose Room 129
Mangilao, Guam 96923

Friday, Sept. 23, 2011
Southern High School, Cafeteria
#1 Jose Perez Leon Guerrero Drive
Santa Rita, Guam 96915

On Saipan: **Monday, Sept. 26, 2011**
Multi-Purpose Center in Susupe
Saipan, MP 96950

On Tinian: **Tuesday, Sept. 27, 2011**
Tinian High School, Cafeteria
San Jose Village
Tinian, MP 96952

On Rota: **Thursday, Sept. 29, 2011**
Sinapalo Elementary School, Cafeteria
Sinapalo I, Songsong Village
Rota, MP 96951

Regardless of whether you are able to participate in the public scoping meetings, you may send written comments to:

Naval Facilities Engineering Command, Pacific
Attention: MITT EIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

You may also submit comments online at **www.mitt-eis.com**. All comments must be postmarked or received online by **Nov. 7, 2011**, to be considered in the development of the Draft EIS/OEIS.

3

Subj: NOTIFICATION OF PREPARATION OF THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS)

For more information, please visit the project website at **www.mitt-eis.com** or contact Ms. Nora Macariola-See, Navy Technical Representative, (808) 472-1402, email nora.macariola-see@navy.mil.

Sincerely,

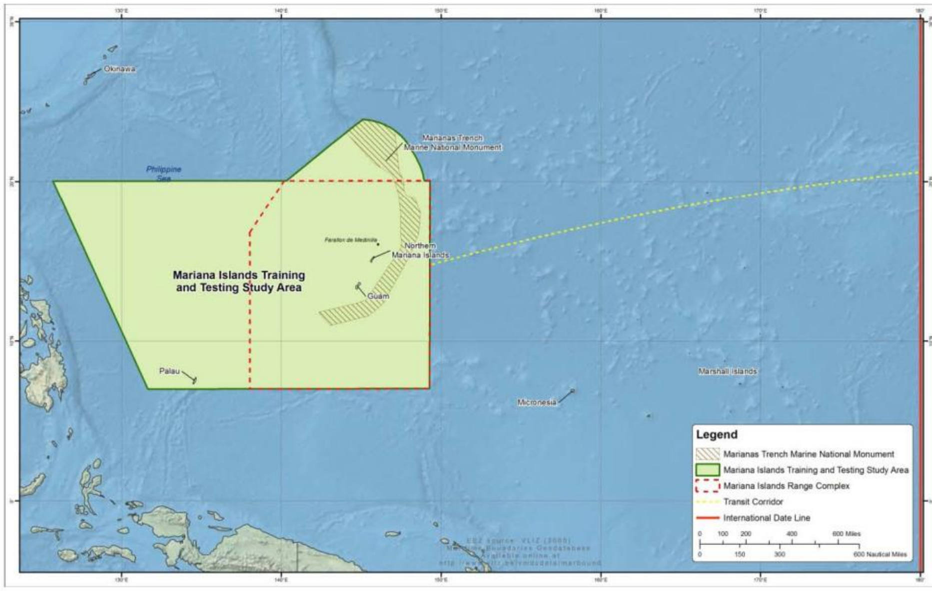
Larry M. Foster

L. M. FOSTER
Director, Environmental Readiness
By direction

Enclosure: 1. MITT Study Area

4

Enclosure: 1. Mariana Islands Training and Testing (MITT) Study Area



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DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

5090
N454/11U158200
15 September 2011

Mr. Timothy K. Bridges
Deputy Assistant Secretary of the Air Force
(Environment, Safety and Occupational Health)
HQ SAF/IEE
1670 Air Force Pentagon
Washington, D.C. 20330-1760

Dear Mr. Bridges:

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) – COOPERATING AGENCY

In accordance with the National Environmental Policy Act (NEPA), the United States (U.S.) Department of the Navy (Navy) is initiating the preparation of an Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation (hereafter referred to as "training and testing") activities that include the use of active sonar and explosives in the Mariana Islands Training and Testing (MITT) EIS/OEIS Study Area. The MITT Study Area includes the existing Mariana Islands Range Complex (MIRC), additional areas on the high seas, and a transit corridor where training and testing activities may occur (see enclosure (1)). The Mariana Islands Range Complex (MIRC) is the only range complex in the MITT Study Area.

The proposed action is to conduct training and testing activities in the MITT study area. The purpose of the proposed action is to achieve and maintain military readiness to meet the requirements of Title 10 of the U.S. Code, thereby ensuring that the Navy and other Services meet their mission to maintain, train, and equip combat-ready military forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The proposed action also serves to support force structure changes and emerging and future training and testing associated with new systems within the MITT EIS/OEIS Study Area, thereby ensuring critical military requirements are met.

The following alternatives are under consideration in this EIS/OEIS:

(1) No Action Alternative: Continue baseline training and testing activities, as defined by existing environmental planning documents, including the *2010 Mariana Islands Range Complex EIS/OEIS* and the *Office of Naval Research Acoustic Impact Analysis for the North Pacific Acoustic Laboratory Philippine Sea 2010 through 2011 Experiment.*

(2) Alternative 1: Consists of baseline training and testing activities and overall expansion of the Study Area plus adjustments to types and levels of activities as necessary to support current and planned military training and testing activities requirements. This Alternative considers activities conducted throughout the Study Area and mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (vessels, aircraft) and weapons systems.

(3) Alternative 2: Consists of Alternative 1 plus the establishment of new range capabilities, modifications of existing capabilities, adjustments to type and tempo of training and testing activities, and the establishment of additional locations to conduct training and testing activities within the Study Area.

The EIS/OEIS will analyze the effects of sound in the water on marine mammals in the areas where training activities occur. In addition, other environmental resource areas that will be addressed as applicable in the EIS/OEIS include air quality; airspace; biological resources, including threatened and endangered species; cultural resources; terrestrial resources, geology and soils; hazardous materials and waste; health and safety; land use; noise; socioeconomics; transportation; and water resources.

In order to adequately evaluate the potential environmental effects of the proposed action, DoD components need to work together in assessing potential impacts to training and testing activities within the MITT study area. To assist in this effort and in accordance with 40 Code of Federal Regulations Part 1501 and the Council on Environmental Quality Cooperating Agency guidance issued on January 30, 2002, the Navy requests that the U.S. Air Force serve as a cooperating agency for the development of the EIS/OEIS.

As defined in 40 CFR Part 1501.6, the Navy is the lead agency for the MITT EIS/OEIS. As the lead agency, the Navy shall:

- Request the participation of each cooperating agency in the NEPA process at the earliest possible time.
- Use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise to the maximum extent possible consistent with its responsibility as lead agency.
- Determine scope of the EIS/OEIS, including the alternatives evaluated.
- Meet with a cooperating agency at the latter's request.
- Circulate the appropriate NEPA documentation to the general public and any other interested parties.
- Schedule and supervise meetings held in support of the NEPA process and compiling any comments received.

- Maintain an administrative record and respond to any Freedom of Information Act requests relating to the EIS/OEIS.

Each cooperating agency shall:

- Participate in the NEPA process at the earliest possible time.
- Participate in meetings hosted by the Navy, including public scoping meetings and hearings, for discussion of issues relating to the EIS/OEIS.
- Assume, on request of the lead agency, responsibility for developing information and preparing environmental analyses, including portions of the environmental impact statement for which the cooperating agency has special expertise.
- Make available staff support at the lead agency's request to enhance the latter's interdisciplinary capability.
- Provide comments on the draft EIS/OEIS document (Version 2.0) within 30 working days.
- Use their own funds.
- Adhere to the overall schedule as set forth by the Navy.
- Provide a formal, written response to this request.

The Navy views this agreement as important to the successful completion of the environmental planning process for the MITT EIS/OEIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. The Draft EIS is scheduled for public review in July 2013 with the Final EIS released in February 2015. The Record of Decision is anticipated to be signed in May 2015. The U.S. Air Force assistance will be invaluable in that endeavor. See enclosure 2 for the notional schedule for the MITT EIS/OEIS.

We appreciate your consideration of our request and look forward to your response. The point of contact for this matter is Ms. Dawn Schroeder at (703) 695-5219, email dawn.schroeder@navy.mil.

for

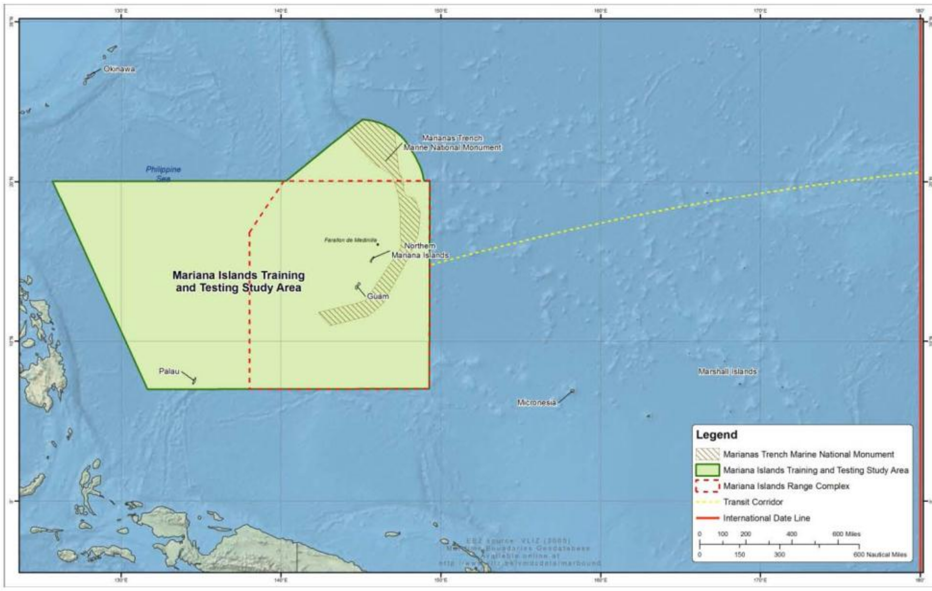
J. P. Quinn
Deputy Director, Energy and Environmental
Readiness Division (OPNAV N45)

Enclosure: 1. MITT Study Area
2. Notional Schedule

Copy to:
PACFLT NO1CE
ASN (EI&E)
DASN (E)
OAGC (EI&E)
CNIC (N45)
PACAF
COMMANDER, JOINT REGION MARIANAS
NAVFAC PACIFIC
NAVFAC MARIANAS

4

Enclosure: 1. Mariana Islands Training and Testing (MITT) Study Area



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Enclosure 2: NOTIONAL SCHEDULE OF EVENTS

MARIANA ISLANDS TRAINING AND TESTING
ENVIRONMENTAL IMPACT STATEMENT/
OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS)

Notice of Intent Published in Federal Register	September 2011
Scoping Meetings	September 2011
Request for Marine Mammal Protection Act Letter of Authorization to National Marine Fisheries Service	April 2013
Draft Environmental Impact Statement Notice of Availability	July 2013
Draft Environmental Impact Statement Public Hearings	August 2013
Final Environmental Impact Statement Notice of Availability	February 2015
Record of Decision	May 2015

6

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

OFFICE OF THE ASSISTANT SECRETARY

2 1 OCT 2011

SAF/IEE
1665 Air Force Pentagon
Washington, DC 20330-1665

Mr. J.P. Quinn
Deputy Director, Energy and Environmental
Readiness Division
Department of the Navy
Office of the Chief Naval Operations
2000 Navy Pentagon
Washington, D.C. 20330-1760

Dear Mr. Quinn:

The Air Force accepts the invitation to act as a Cooperating Agency during preparation of the Mariana Islands Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement, as prescribed in the President's Council on Environmental Quality National Environmental Policy Act (NEPA) Regulations, 40 CFR § 1501.6, *Cooperating Agencies.*

As a Cooperating Agency, the Air Force understands it is expected to participate in various portions of EIS development. As a Cooperating Agency, the Air Force shall:

a. Participate in the NEPA process, including scoping;
b. Assume responsibility, upon request by your organization, for developing information and preparing analyses on issues for which it has special expertise; and
c. Make Air Force staff available for interdisciplinary reviews.

The Air Force requests your office provide appropriate, related information in a timely fashion. In turn, the Air Force will respond in a prompt manner. The Air Force point of contact for this action is Mr. Jack Bush, HQ USAF/A7CIB at (703) 614-0237; jack.bush@pentagon.af.mil.

Sincerely,

TIMOTHY K. BRIDGES
Deputy Assistant Secretary of the Air Force
(Environment, Safety & Occupational Health)

cc:
SAF/IEI/GCN
HQ USAF/A7C
HQ USAF/A30
HQ PACAF/A7
AFLOA/JACE

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NCIL, INFO

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

5090
N454/11158201
15 September 2011

Mr. Eric C. Schwaab
Assistant Administrator
National Marine Fisheries Service
1315 East West Highway
Silver Springs, MD 20910

Dear Mr. Schwaab:

In accordance with the National Environmental Policy Act (NEPA), the Department of the Navy (Navy) is initiating the preparation of an Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation (hereafter referred to as "training and testing") activities that include the use of active sonar and explosives in the Mariana Islands Training and Testing (MITT) EIS/OEIS Study Area. The MITT Study Area includes the existing Mariana Islands Range Complex (MIRC), additional areas on the high seas, and a transit corridor where training and testing activities may occur (see enclosure (1)). The Mariana Islands Range Complex (MIRC) is the only Navy range complex in the MITT Study Area.

An important aspect of the MITT EIS/OEIS will be the analysis of the acoustic effects to marine species protected under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). The MITT EIS/OEIS is also intended to serve as a basis for the renewal of current regulatory permits and authorizations; address current training and testing not covered under the existing permits and authorizations; and obtain those permits and authorizations necessary to support force structure changes and emerging and future training and testing requirements. The MMPA Final Rule and ESA Section 7 Programmatic Biological Opinion for MIRC expire in August 2015 and June 2015, respectively.

To complete the analysis required by the permitting and consultation process, the Navy and the National Marine Fisheries Service (NMFS) will need to work together. Therefore, in accordance with the Council on Environmental Quality's (CEQ) NEPA guidelines (specifically 40 CFR Part 1501) and CEQ's 2002 guidance on cooperating agencies, the Navy requests that NMFS serve as a cooperating agency for the development of the MITT EIS/OEIS.

As the lead agency, the Navy will be responsible for overseeing preparation of the EIS/OEIS that will include, but not limited to, the following:

- Gathering all necessary background information and preparing all necessary permit applications associated with the proposed action.

- Working with NMFS personnel to determine the method of estimating potential effects to protected marine species, including threatened and endangered species.

- Determining the scope of the EIS/OEIS, including the alternatives evaluated.

- Circulating the appropriate NEPA documentation to the general public and any other interested parties.

- Scheduling and supervising meetings held in support of the NEPA process and compiling any comments received.

- Maintaining an administrative record and responding to any Freedom of Information Act requests relating to the EIS/OEIS.

Navy respectfully requests NMFS, in its role as a cooperating agency, provide support as follows:

- Providing timely comments after the Agency Information Meeting (which will be held at the onset of the EIS/OEIS process) and on working drafts of the EIS/OEIS documents. The Navy requests that comments on draft EIS/OEIS documents (Version 2) be provided within 30 working days.

- Responding to Navy requests for information, in particular related to review of the acoustic effects analysis and evaluation of the effectiveness of protection and mitigation measures.

- Coordinating, to the maximum extent practicable, any public comment periods required by the MMPA permitting process with the Navy's NEPA public comment periods.

- Participating, as necessary, in meetings hosted by the Navy for discussion of issues related to the EIS/OEIS, including public hearings and meetings.

- Adhering to the overall schedule as set forth by the Navy.

- Providing a formal, written response to this request.

2

The Navy views this agreement as important to the successful completion of the environmental planning process for the MITT EIS/OEIS. NMFS' assistance will be invaluable in this endeavor. Please see Enclosure 2 for the MITT EIS/OEIS notional schedule.

The point of contact for this action is Ms. Dawn Schroeder, (703) 695-5219, email: dawn.schroeder@navy.mil.

Sincerely,

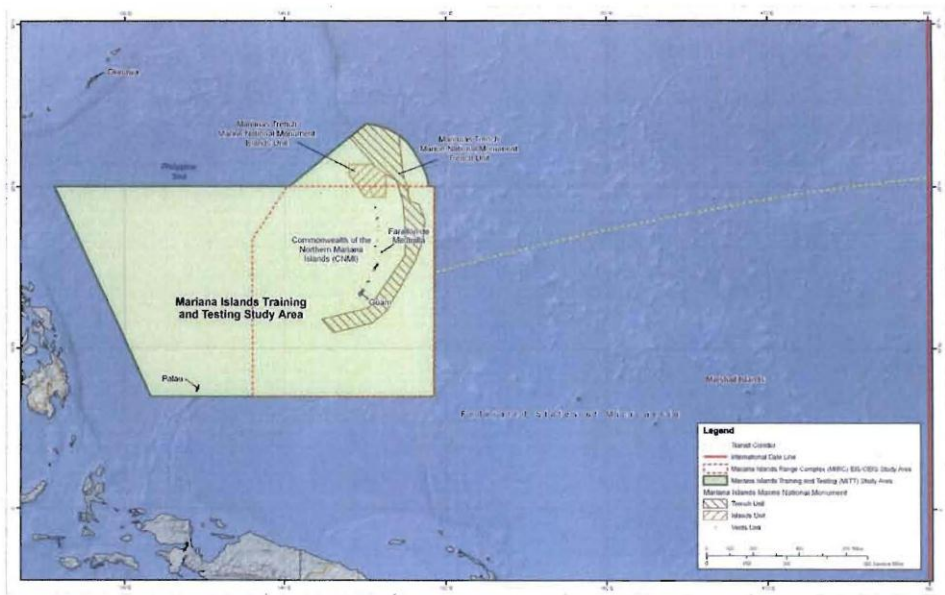
J. P. QUINN
Deputy Director, Energy and Environmental Readiness Division (OPNAV N45)

Enclosure: 1. MITT Study Area
2. Notional Schedule

Copy to:
Commander, U.S. Pacific Fleet
Commander, U.S. Fleet Forces Command
Commander, Naval Installations Command
Commander, Joint Region Marianas
Joint Guam Program Office
Commander, Naval Facilities Engineering Command, Pacific
Mr. Michael D. Tosatto, Regional Administrator, Pacific Islands Regional Office, National Marine Fisheries Service, 1601 Kapiolani Boulevard, Suite 1110, Honolulu, HI 96814

3

Enclosure 1: Mariana Islands Training and Testing (MITT) Study Area



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Enclosure 2: NOTIONAL SCHEDULE OF EVENTS

MARIANA ISLANDS TRAINING AND TESTING
ENVIRONMENTAL IMPACT STATEMENT/
OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS)

Notice of Intent Published in Federal Register	September 2011
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Draft Environmental Impact Statement Notice of Availability	July 2013
Draft Environmental Impact Statement Public Hearings	August 2013
Final Environmental Impact Statement Notice of Availability	February 2015
Record of Decision	May 2015

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910
THE DIRECTOR

JUL 11 2013

Mr. John P. Quinn
Deputy Director, Energy and
Environmental Readiness Division
Department of the Navy
2000 Navy Pentagon
Washington, DC 20350-2000

Dear Mr. Quinn:

Thank you for your letter requesting that NOAA's National Marine Fisheries Service (NMFS) participate as a cooperating agency in the preparation of an Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to evaluate potential environmental effects of military readiness training and research, development, testing, and evaluation (RDT&E) activities conducted within the Mariana Islands Training and Testing (MITT) Study Area. We reaffirm our support of the Navy's decision to prepare an EIS/OEIS and agree to be a cooperating agency, due, in part, to our responsibilities under section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA) and section 7 of the Endangered Species Act.

In response to your letter, NMFS staff will continue to, to the extent possible,

- Provide timely review and comments, within 30 working days, after the Agency Information Meeting and on working drafts of the EIS/OEIS documents;
- Respond to Navy requests for information, in particular those related to the acoustic effects analysis and the evaluation of the effectiveness of protection and mitigation measures, in a timely manner;
- Participate in meetings, as necessary, hosted by the Navy to discuss issues related to the EIS/OEIS, including public hearings on the draft EIS/OEIS; and
- Adhere to the overall schedule as agreed upon by NMFS and the Navy.

If you need any additional information, please contact Ms. Jolie Harrison, NMFS Office of Protected Resources, at (301) 427-8401.

Sincerely,

Samuel D. Rauch, III
Deputy Assistant Administrator
for Regulatory Programs,
performing the functions and duties of the
Assistant Administrator for Fisheries

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

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DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N01CE1/0258
22 Feb 12

Mr. Loyal Mehrhoff
Field Office Supervisor
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

Dear Mr. Mehrhoff:

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

In accordance with the National Environmental Policy Act (NEPA), the Commander, U.S. Pacific Fleet is initiating the preparation of an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation (hereafter referred to as "training and testing") activities that include the use of active sonar and explosives in the Mariana Islands Training and Testing (MITT) EIS/OEIS Study Area. The MITT Study Area includes the existing Mariana Islands Range Complex (MIRC), additional areas on the high seas, and a transit corridor where training and testing activities may occur (see Enclosure 1).

The proposed action is to conduct training and testing activities within the MITT study area. The purpose of the proposed action is to achieve and maintain military readiness to meet the requirements of Title 10 of the U.S. Code, thereby ensuring that the Navy and other Services meet their mission to maintain, train, and equip combat-ready military forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The proposed action also serves to support force structure changes and emerging and future training and testing associated with new systems within the MITT EIS/OEIS Study Area, thereby ensuring critical military requirements are met.

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

The following alternatives are under consideration in this EIS/OEIS:

(1) No Action Alternative: Continue baseline training and testing activities, as defined by existing environmental planning documents, including the *2010 Mariana Islands Range Complex EIS/OEIS* and the *Office of Naval Research Acoustic Impact Analysis for the North Pacific Acoustic Laboratory Philippine Sea 2010 through 2011 Experiment*.

(2) Alternative 1: Consists of baseline training and testing activities and overall expansion of the Study Area plus adjustments to types and levels of activities as necessary to support current and planned military training and testing activities requirements. This Alternative considers activities conducted throughout the Study Area and mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (vessels, aircraft) and weapons systems.

(3) Alternative 2: Consists of Alternative 1 plus the establishment of new range capabilities, modifications of existing capabilities, adjustments to type and tempo of training and testing activities, and the establishment of additional locations to conduct training and testing activities within the Study Area.

The EIS/OEIS will analyze the effects of sound in the water on marine mammals in the areas where training activities occur. In addition, other environmental resource areas that will be addressed as applicable in the EIS/OEIS include air quality; airspace; biological resources, including threatened and endangered species; cultural resources; terrestrial resources, geology and soils; hazardous materials and waste; health and safety; land use; noise; socioeconomics; transportation; and water resources.

In order to adequately evaluate the potential environmental effects of the proposed action, the Navy and the U.S. Fish and Wildlife Service would need to work together on the analysis of

2

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

effects to terrestrial species protected under the Endangered Species Act. To assist in this effort and in accordance with 40 Code of Federal Regulations Part 1501 and the Council on Environmental Quality Cooperating Agency guidance issued on January 30, 2002, the Navy requests that the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office serve as a cooperating agency for the development of the EIS/OEIS.

As the lead agency, the Navy will be responsible for overseeing preparation of the EIS/OEIS that includes, but is not limited to, the following:

- Gathering all necessary background information and preparing the EIS/OEIS and all necessary permit applications associated with acoustic issues within the MITT Study Area.
- Working with U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office personnel to determine the method of estimating potential effects to protected species, including threatened and endangered species.
- Determining the scope of the EIS/OEIS, including the alternatives evaluated.
- Circulating the appropriate NEPA documentation to the general public and any other interested parties.
- Scheduling and supervising meetings held in support of the NEPA process, and compiling any comments received.
- Maintaining an administrative record and responding to any Freedom of Information Act requests relating to the EIS/OEIS.

Navy respectfully requests the U.S. Fish and Wildlife Service, in its role as a cooperating agency, provide support as follows:

3

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

- Providing timely comments after the Agency Information Meeting (which will be held at the onset of the EIS/OEIS process) and on working drafts of the EIS/OEIS documents. The Navy requests that comments on draft EIS/OEIS documents (Version 2) be provided within 30 working days.

- Responding to Navy requests for information. Timely U.S. Fish and Wildlife Service input will be critical to ensure a successful environmental planning process.

- Coordinating, to the maximum extent practicable, any public comment periods that are necessary in the Endangered Species Act process with the Navy's NEPA public comment periods.

- Participating, as necessary, in meetings hosted by the Navy for discussion of issues related to the EIS/OEIS, including public hearings and meetings.

- Adhering to the overall schedule as set forth by the Navy.

- Providing a formal, written response to this request.

The Navy views this agreement as important to the successful completion of the environmental planning process for the MITT EIS/OEIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. The Draft EIS is scheduled for public review in July 2013 with the Final EIS released in February 2015. The Record of Decision is anticipated to be signed in May 2015. The U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office assistance will be invaluable in that endeavor.

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

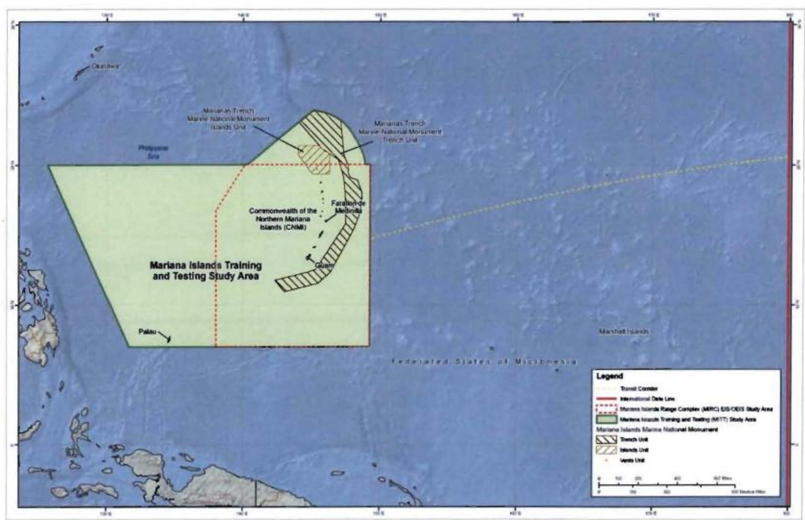
We appreciate your consideration of our request and look forward to your response. The point of contact for this matter is Ms. Nora Macariola-See, NAVFAC Pacific at (808) 472-1402, email: nora.macariola-see@navy.mil).

L. M. FOSTER
Director, Environmental Readiness
By direction

Enclosure: 1. MITT Study Area

Copy to:
CNO (N45)
CNIC (N45)
COMMANDER, JOINT REGION MARIANAS
NAVFAC PACIFIC
NAVFAC MARIANAS

5



Enclosure: 1. Mariana Islands Training and Testing (MITT) Study Area

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2012-TA-0228

Mr. Larry M. Foster
Department of the Navy
250 Makalapa Drive
Pearl Harbor, Hawaii 96860-3131

MAR 27 2012

Subject: Request to be a Cooperating Agency for the Mariana Islands Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement

Dear Mr. Foster:

Thank you for your letter dated February 22, 2012, requesting the U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife Office (PIFWO) be a cooperating agency on the preparation of a Mariana Islands Training and Testing (MITT) Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). We appreciate the offer; however, we cannot serve as a cooperating agency on the EIS/OEIS due to workload constraints.

We do recognize the importance of collaboration between the Department of Navy (DoN) and Service in preparation of the EIS/OEIS and in the section 7 consultation required under the Endangered Species (ESA) of 1973 (16 U.S.C. 1531 *et seq*.), as amended. The Service will still provide comments on preliminary or draft EIS/OEIS documents, and respond to Navy requests for biological information. We will also assist you with ensuring that the best available scientific information is used in the EIS/OEIS and that impacts to ESA-listed species and other natural resources are minimized and offset. We are interested in working collaboratively with the Navy towards these ends without being a formal cooperating agency.

If you have any questions or concerns regarding this consultation, please contact Rachel Rounds, Fish and Wildlife Biologist (phone: 808-792-9400, email: rachel_rounds@fws.gov).

Sincerely,

for Loyal Mehrhoff
Field Supervisor

TAKE PRIDE® IN AMERICA

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DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N01CE1/1133
27 Aug 12

CAPT Casey J. White
Commander
USCG Sector Guam
PSC 455-Box 176
FPO AP-96540-1056

Dear CAPT White:

SUBJECT: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEA ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

In accordance with the National Environmental Policy Act (NEPA), the United States (U.S.) Department of the Navy (Navy) is initiating the preparation of an EIS/OEIS to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation (hereafter referred to as "training and testing") activities that include the use of active sonar and explosives in the MITT EIS/OEIS Study Area. The MITT Study Area includes the existing Mariana Islands Range Complex (MIRC), additional areas on the high seas, and a transit corridor where training and testing activities may occur (see Enclosure 1).

The proposed action is to conduct training and testing activities within the MITT study area. The purpose of the proposed action is to achieve and maintain military readiness to meet the requirements of Title 10 of the U.S. Code, thereby ensuring that the Navy and other Services meet their mission to maintain, train, and equip combat-ready military forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The proposed action also serves to support force structure changes and emerging and future training and testing associated with new systems within the MITT EIS/OEIS Study Area, thereby ensuring critical military requirements are met.

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

The following alternatives are under consideration in this EIS/OEIS:

(1) No Action Alternative: Continue baseline training and testing activities, as defined by existing environmental planning documents, including the *2010 MIRC EIS/OEIS*.

(2) Alternative 1: Consists of baseline training and testing activities and overall expansion of the Study Area plus adjustments to types and levels of activities as necessary to support current and planned military training and testing activities requirements. This Alternative considers activities conducted throughout the Study Area and mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (vessels, aircraft) and weapons systems.

(3) Alternative 2: Consists of Alternative 1 plus the establishment of new range capabilities, modifications of existing capabilities, adjustments to type and tempo of training and testing activities, and the establishment of additional locations to conduct training and testing activities within the Study Area.

The EIS/OEIS will analyze the effects of sound in the water on marine mammals in the areas where training activities occur. In addition, other environmental resource areas that will be addressed as applicable in the EIS/OEIS include air quality; airspace; biological resources, including threatened and endangered species; cultural resources; terrestrial resources, geology and soils; hazardous materials and waste; health and safety; land use; noise; socioeconomics; transportation; and water resources.

In order to adequately evaluate the potential environmental effects of the proposed action, the Navy and the U.S. Coast Guard (Guam Sector) would need to work together in assessing the potential impacts associated with the establishment of safety zones in accordance with 33 Code of Federal Regulations (CFR) Part 165 for military ordnance training conducted at the following locations: (1) Orote Point Known Distance Range;

2

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

(2) Small Boat Small Arms Range; (3) Agat Bay Floating Mine Neutralization Site; (4) Piti Point Floating Mine Neutralization Site; (5) Apra Harbor Underwater Detonation Site; (6) Finegayan Small Arms Range; (7) Pati Point Combined Arms Training and Maintenance Range; and (8) Pati Point Explosive Ordnance Disposal Range. To assist in this effort and in accordance with 40 CFR Part 1501 and the Council on Environmental Quality Cooperating Agency guidance issued on January 30, 2002, the Navy requests that the U.S. Coast Guard (Guam Sector) serve as a cooperating agency for the development of the EIS/OEIS.

The Navy is the lead agency for the MITT EIS/OEIS. As the lead agency, the Navy shall:

- Request the participation of each cooperating agency in the NEPA process at the earliest possible time.
- Use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible consistent with its responsibility as lead agency.
- Meet with a cooperating agency at the latter's request.
- Circulate the appropriate NEPA documentation to the general public and any other interested parties.
- Schedule and supervise meetings held in support of the NEPA process, and compiling any comments received.
- Maintain an administrative record and respond to any Freedom of Information Act requests relating to the EIS/OEIS.

Navy respectfully requests the U.S. Coast Guard, in its role as a cooperating agency, provide support as follows:

- Participate in the NEPA process at the earliest possible time.
- Assume, on request of the lead agency, responsibility for developing information and preparing environmental

3

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

analyses, including portions of the environmental assessment for which the cooperating agency has special expertise.

- Make available staff support at the lead agency's request to enhance the latter's interdisciplinary capability.
- Participate, as necessary, in meetings hosted by the Navy for discussion of issues related to the EIS/OEIS, including public hearings and meetings.
- Coordinate, to the maximum extent practicable, any public comment periods related with the 33 CFR Part 165 process with the Navy's NEPA public comment periods.
- Utilize U.S. Coast Guard resources (including funding) to support role as a cooperating agency.
- Adhere to the overall schedule as set forth by the Navy.
- Provide a formal, written response to this request.

The Navy views this agreement as important to the successful completion of the environmental planning process for the MITT EIS/OEIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. The Draft EIS is scheduled for public review in July 2013 with the Final EIS released in February 2015. The Record of Decision is anticipated to be signed in May 2015. The U.S. Coast Guard's (Guam Sector) assistance will be invaluable in that endeavor. See enclosure 2 for the notional schedule of the MITT EIS/OEIS.

4

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) - COOPERATING AGENCY

We appreciate your consideration of our request and look forward to your response. The point of contact for this matter is Mr. John Van Name, Environmental Program Manager, COMPACFLT N01CE1JVN at (808) 471-1714, email john.vanname@navy.mil.

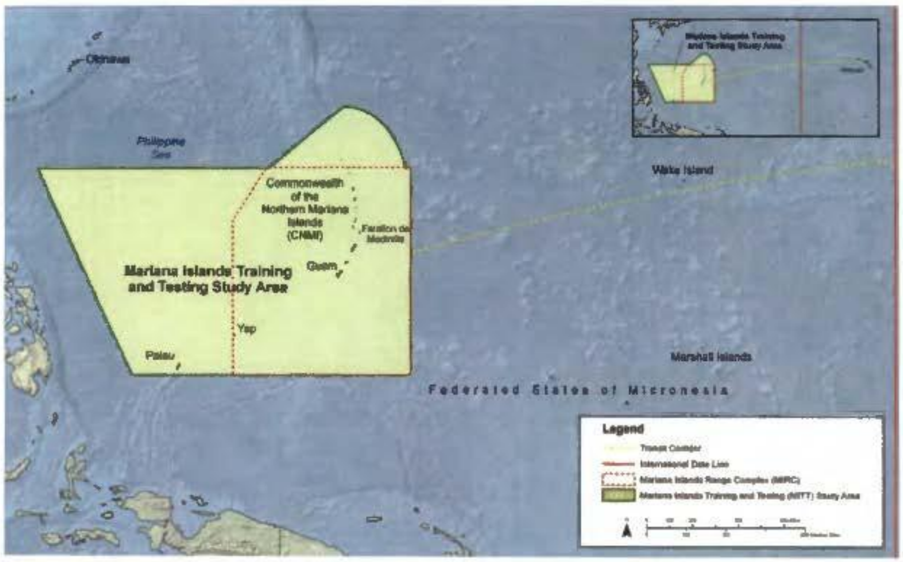
L. M. FOSTER
Director, Environmental Readiness
By direction

Enclosure: 1. MITT Study Area

Copy to:
ASN (EI&E)
DASN (E)
OAGC (EI&E)
CNIC (N45)
COMMANDER, JOINT REGION MARIANAS
NAVFAC PACIFIC
NAVFAC MARIANAS
CNO (N45)

5

Enclosure: 1. Mariana Islands Training and Testing (MITT) Study Area



U.S. Department of Homeland Security
United States Coast Guard

Commander
U. S. Coast Guard
Sector Guam

PSC 455 BOX 176
FPO, AP 96540-1056
Staff Symbol: s
Phone: 671-355-4800
Fax: 671-355-4803
Email: casey.j.white@uscg.mil

5090
10 Oct 2012

MEMORANDUM

From: Casey J White, CAPT
CG SECTOR Guam (s)

Reply to Attn of: BMC Whitaker
671-355-4866

To: Mr. John Van Name
COMPACFLT Pearl Harbor HI (NO1CE1)

Subj: MARIANA ISLANDS TRAINING AND TESTING (MITT) ENVIRONMENTAL IMPACT STATEMENT

Ref: (a) Your memo dated 27 Aug 2012

1. I am in receipt of reference (a) and have reviewed your proposal to extend the study area. Please keep my office informed of your progress in this regard.

2. If I can be of assistance to you, please do not hesitate to contact Sector Guam. My point of contact for this issue is BMC Thomas Whitaker, who can be reached at the number provided above or at Thomas.E.Whitaker@uscg.mil.

#

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U.S. Department of Homeland Security
United States Coast Guard

Commandant
United States Coast Guard

2100 2nd Street, S.W. Stop 7355
Washington, DC 20593-7355
Staff Symbol: DCO
Phone: (202) 372-2000
Fax: (202) 372-2900

MEMORANDUM

16475
SEP 11 2013

From: Peter V. Neffenger, VADM
COMDT (DCO)

Reply to Attn of: Mr. Ed Wandelt
(202) 475-5687

To: Mr. L. M. Foster
Director
Environmental Readiness Division
United States Pacific Fleet

Subj: MARIANA ISLANDS TESTING AND TRAINING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEA ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) – COOPERATING AGENCY

Ref: (a) Your letter 5090 of 27 Aug 12

1. The Coast Guard is pleased to accept the offer, as per reference (a), to participate as a cooperating agency in the subject EIS/OEIS. Doing so will materially further the Coast Guard's interest in the use of Navy range complexes for necessary Coast Guard weapons and military readiness training and will assist in mutual efforts associated with the operation of the Range Complex and establishment of safety zones in accordance with 33 Code of Federal Regulations (CFR) Part 165. As the Coast Guard is a military service and a branch of the Armed Forces, this action is in full compliance with 40 CFR Part 1501 and the Council on Environmental Quality Cooperating Agency guidance issued on 30 January 2002.

2. The Coast Guard agrees with the Navy's statements on page 3 of reference (a) concerning the Navy's actions as the lead agency in the EIS/OEIS. As a cooperating agency, the Coast Guard will, to the extent allowed by available resources and fiscal constraints:

- Participate in the NEPA process;
- Provide data to the Navy on Coast Guard activities and operations that take place in the MITT EIS/OEIS study areas;
- Assume, on request of the Navy, responsibility for developing information and preparing environmental analyses, for which the Coast Guard has special expertise;
- Make available staff support at the lead agency's request to enhance the Navy's interdisciplinary capability, consistent with operational requirements;
- Participate, as necessary, in meetings hosted by the Navy for discussion of issues related to the EIS/OEIS;

SEP 11 2013

16475

Subj: MARIANA ISLANDS TESTING AND TRAINING (MITT) ENVIRONMENTAL IMPACT STATEMENT/OVERSEA ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) – COOPERATING AGENCY

- Coordinate public comment periods for Coast Guard and Navy actions concerning the EIS/OEIS and safety zone processes;
- Utilize available Coast Guard resources, including funding where appropriate, to support our role as a cooperating agency; and
- Adhere to the overall schedule as set forth by the Navy.

3. As a cooperating agency, I request that the U.S. Coast Guard, as an armed force of the United States within the Department of Homeland Security, be expressly mentioned and described in the MITT EIS/OEIS, and our operations and activities that take place in the study area be analyzed for environmental effects in any and all MITT EISs/OEISs.

4. This letter constitutes the formal written response requested by your letter. I request that Navy supply the Coast Guard with two preliminary copies of all draft and final MITT EISs/OEISs for our review and comment prior to publicizing them. We request a minimum 14 day period for Coast Guard review of these documents. This action is important to the successful completion of the environmental planning process for the MITT EIS/OEIS. We look forward to working with the Navy to facilitate mission accomplishment through productive use of the Marianas Range Complex.

5. The Coast Guard point of contact for all correspondence and exchange of information with the Navy concerning the MITT EIS/OEIS is Mr. Terry Rice. Mr. Rice's address and contact information are as follows:

Mr. Terry Rice
Commander (dre)
Fourteenth Coast Guard District
300 Ala Moana Blvd., Suite 9-232
Honolulu, HI 96850-4982

#

Copy: DCMS, PACAREA, CG-4, CG-47, CG-0941, CG-7, CGD FOURTEEN, CG SECTOR GUAM,
N45

2

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N01CE1/0484
17 Apr 2013

Ms. Helen Golde
Acting Director, Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1315 East-West Highway
SSMC3, Room 13821
Silver Springs, MD 20910-3282

Dear Ms. Golde:

SUBJECT: REQUEST FOR MARINE MAMMAL PROTECTION ACT (MMPA) INCIDENTAL TAKE AUTHORIZATION AND REGULATIONS FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ACTIVITIES

In accordance with MMPA, as amended and 50 C.F.R. Part 216, the U.S. Navy requests 5-year incidental take authorization and regulations for the incidental taking of marine mammals associated with MITT activities occurring within the MITT Study Area.

The Proposed Action may incidentally expose marine mammals that reside within the MITT study area to sound and other environmental stressors associated with training and testing activities. The enclosure further describes the MITT activities and study area and provides the specific information required by National Marine Fisheries Service (NMFS) for consideration of an incidental take request.

The U.S. Navy requests that the regulation and the 5-year Letter of Authorization (LOA) be issued to Commander, U.S. Pacific Fleet for training and testing activities. We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities. My point of contact for this matter is Ms. Julie Rivers (808) 471-1714, or e-mail: julie.rivers@navy.mil.

Sincerely,

L. M. FOSTER
Director, Environmental Readiness
By direction

Enclosure: Request for Regulations and LOA for the Incidental Taking of Marine Mammals Resulting from U.S. Navy Training and Testing Activities in the MITT Study Area

Copy to: (w/o enclosure)
Ms. Jolie Harrison, NMFS Office of Protected Resources
Ms. Gina Shultz, NMFS Office of Protected Resources

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DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
N01CE1/0244
March 6, 2014

Ms. Cathryn E. Tortorici
Chief, Endangered Species Act Interagency Cooperation Division
Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
SSMC3, Room 13821
1315 East-West Highway
Silver Spring, MD 20910-3282

Dear Ms. Tortorici:

SUBJECT: REQUEST FOR INITIATION OF ENDANGERED SPECIES ACT (ESA) SECTION 7 FORMAL CONSULTATION FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ACTIVITIES

In accordance with section 7 of the ESA, the U.S. Navy requests initiation of formal consultation on the MITT activities occurring within the MITT Study Area.

The proposed action may affect listed species that reside within the MITT Study Area by exposing them to sound and other environmental stressors associated with training and testing activities. The enclosed CD with the Biological Evaluation of MITT Activities in the Mariana Islands Training and Testing Study Area: Marine Species and Habitats provides information pursuant to 50 C.F.R. §402.12(f). The U.S. Navy is requesting formal consultation on Alternative 1 within the Draft Environmental Impact Statement (DEIS)/Draft Overseas Environmental Impact Statement (DOEIS).

The Navy is requesting formal consultation on ESA-listed species addressed in this consultation package including the humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), blue whale (*Balaenoptera musculus*), sperm whale (*Physeter macrocephalus*), green turtle (*Chelonia mydas)*, hawksbill turtle *(Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*), loggerhead turtle (*Caretta caretta*), and leatherback turtle

SUBJECT: REQUEST FOR INITIATION OF ENDANGERED SPECIES ACT (ESA) SECTION 7 FORMAL CONSULTATION FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ACTIVITIES

(*Dermochelys coriacea*). The Navy is requesting a conference opinion for the 43 proposed coral species found in the Study Area.

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities. My point of contact for this matter is Ms. Julie Rivers (808) 474-6391, or e-mail: julie.rivers@navy.mil.

Sincerely,

L. M. FOSTER
Dir, Environmental Readiness
By direction

Enclosure: CD-ROM of the BE, Draft EIS/OEIS for the Navy's MITT Activities and Excel file with 1dB and 6dB bin modeled exposure data by species

Copy to: (w/o encl)
Mr. Stan Rogers, NMFS Office of Protected Resources
Ms. Michelle Magliocca, NMFS Office of Protected Resources

2

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

APR 16 2014

Mr. L. M. Foster
Director, Environmental Readiness
U.S. Pacific Fleet
250 Makalapa Drive
Pearl Harbor, HI 96860-3131

Dear Mr. Foster:

RE: Request for Endangered Species Act Section 7 consultation for U.S. Navy Mariana Islands Training and Testing

On March 6, 2014, we received a request for formal consultation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*; ESA) for proposed U.S. Navy Mariana Islands Testing and Training (MITT) activities. Following initial review of the submittal, we determined that there is sufficient information in the submittal package to initiate formal section 7 consultation. However, during the consultation process we may need to request additional information or clarification from the U.S. Navy.

We also determined that National Marine Fisheries Service (NMFS) Permits and Conservation Division's proposed promulgation of a rule in accordance with the Marine Mammal Protection Act (MMPA) and subsequent issuance of two Letters of Authorization (LOAs) for take of marine mammals incidental to training and testing activities are interrelated and interdependent with the U.S. Navy's proposed action. As such, section 7 consultation with the U.S. Navy will require information on the proposed rulemaking and draft LOAs from NMFS' Permits and Conservation Division to complete our analysis and prepare a biological opinion.

Considering the complexity of the U.S. Navy and NMFS proposed actions, and ongoing discussions among my staff and the Navy regarding defining the proposed Navy actions for all Phase II consultations, we suggest extending the ESA Section 7 consultation timeline to complete the consultation phase and deliver a draft biological opinion on or before October 14, 2014 concurrent with submittal of the draft Federal Register Notice of the draft MMPA rule. A draft opinion would not be provided on July 28, 2014 per the MITT timeline (revised December 11, 2013); however, we will provide status updates throughout the consultation. We plan to finalize our biological opinion on or before January 30, 2015 prior to promulgation of the MMPA rule, LOAs and signature of the record of decision for the U.S. Navy's Final Environmental Impact Statement. Mutual agreement is required by the ESA (7(b)(1)(B)(ii)) for formal consultations extending beyond the statutory timeline of 90 days to conduct the consultation and 45 days to complete the biological opinion for a total of 135 days. Therefore, we request that you provide a written response indicating your agreement with the proposed consultation timeline above.

If you have questions regarding the consultation, please contact Ms. Cathy Tortorici, Chief, Endangered Species Act Interagency Cooperation Division at (301) 472-8495 or by Email at Cathy.Tortorici@noaa.gov.

Sincerely,
Perry Gayaldo
for Donna S. Weiting
Director,
Office of Protected Resources

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
N01CE1/0426
2 May 2014

Ms. Donna S. Weiting
Director, Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
SSMC3, Room 13821
1315 East-West Highway
Silver Spring, MD 20910-3282

Dear Ms. Weiting:

SUBJECT: REVISED TIMELINE FOR ENDANGERED SPECIES ACT (ESA) SECTION 7 FORMAL CONSULTATION FOR MARIANA ISLANDS TRAINING AND TESTING (MITT) ACTIVITIES

The U.S. Navy (Navy) received the National Marine Fisheries Service (NMFS) April 16, 2014 letter requesting concurrence with shifting the delivery of the draft biological opinion to on or before October 14, 2014. This is concurrent with the submittal of the draft Federal Register Notice of the Marine Mammal Protection Act (MMPA) Final Rule. The letter further states that NMFS plans to finalize the biological opinion on or before January 30, 2015 prior to NMFS promulgation of the MMPA rule, letter of authorization, and signature of the record of decision for the MITT EIS/OEIS.

The Navy agrees with the proposed shift since the October 14, 2014 submittal of the draft biological opinion still tracks with the development and completion of the MITT Final EIS/OEIS, which is scheduled for public release by December 2014. The Navy will provide NMFS comments on the draft biological opinion and draft MMPA rule by November 10, 2014. We request that Mr. Stan Rogers conditionally reserve Nov 14, 2014 for a comment discussion and resolution meeting.

We appreciate your continued support in helping the U.S. Navy to meet its environmental compliance responsibilities. My point of contact for this matter is Ms. Julie Rivers (808) 474-6391, or e-mail: julie.rivers@navy.mil.

Sincerely,

L. M. FOSTER
Director, Environmental Readiness
By direction

Copy to:
Mr. Stan Rogers, NMFS Office of Protected Resources
Mr. Brian Hopper, NMFS Office of Protected Resources
Ms. Kelly Ebert, CNO N45

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DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0850
August 19, 2014

Ms. Cathryn E. Tortorici
Chief, Endangered Species Act Interagency Cooperation Division
Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
SSMC3, Room 13821
1315 East-West Highway
Silver Spring, MD 20910-3282

Dear Ms. Tortorici:

SUBJECT: ADDENDUM TO THE BIOLOGICAL EVALUATION (BE) OF MILITARY TRAINING AND TESTING ACTIVITIES IN THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

The final determination to list the Indo-West Pacific Distinct Population Segment (DPS) of scalloped hammerhead shark as threatened species under the Endangered Species Act (ESA) was issued by the National Marine Fisheries Service (NMFS) in the Federal Register on July 3, 2014. The Indo-West Pacific DPS of scalloped hammerhead shark is present in the MITT Study Area. An effects determination for this DPS was not included in the formal consultation package Navy submitted to NMFS on March 5, 2014 since the scalloped hammerhead shark was not an ESA listed species at that time.

Upon subsequent review of the pertinent biology literature combined with the consideration of proposed Navy training and testing activities in MITT, Navy has reached a "may affect" determination for the Indo-West Pacific DPS of scalloped hammerhead shark.

The enclosed Addendum to the BE of Military Training and Testing Activities in the MITT Study Area: Marine Species and Habitats provides the required information pursuant to 50 C.F.R. §402.12(f).

Subj: ADDENDUM TO THE BIOLOGICAL EVALUATION (BE) OF MILITARY TRAINING AND TESTING ACTIVITIES IN THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities. My point of contact for this matter is Ms. Julie Rivers (808) 471-1714, julie.rivers@navy.mil or alternatively Ms. Meredith Fagan (808)472-1410, meredith.fagan@navy.mil at NAVFACPAC.

Sincerely,

L. M. FOSTER
Dir, Environmental Readiness
By direction

Enclosure: 1. CD-ROM of the Addendum to the BE

Copy to: (w/o encl)
Mr. John Fiorentino, NMFS Office of Protected Resources

2

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N01CE1/0962
August 7, 2013

Loyal Merhoff, PhD
Field Supervisor
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard
Room 3-122
Honolulu, HI 96850

Dear Dr. Merhoff:

SUBJECT: REQUEST FOR CONCURRENCE ON SPECIES LIST AND CRITICAL HABITAT UNITS FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ACTION AREA

We are writing to retract our July 23, 2013 letter in order to clarify our request. In accordance with the Department of the Navy's obligations under Section 7(a)(2) of the Endangered Species Act (ESA), we are requesting concurrence from your office on the extant species and critical habitat units under U.S. Fish and Wildlife Service jurisdiction to be included in the MITT analysis. The proposed action area and the list of species and critical habitat units are included in Attachments 1 and 2.

We look forward to receiving your written concurrence on the species list and critical habitat units and engaging with the Pacific Islands Fish and Wildlife Office on the MITT consultation. For any questions regarding this consultation, please contact Ms. Julie Rivers (COMPACFLT, 808-474-6391, julie.rivers@navy.mil) or Dr. Frans Juola (NAVFAC Pacific, 808-472-1433, frans.juola@navy.mil).

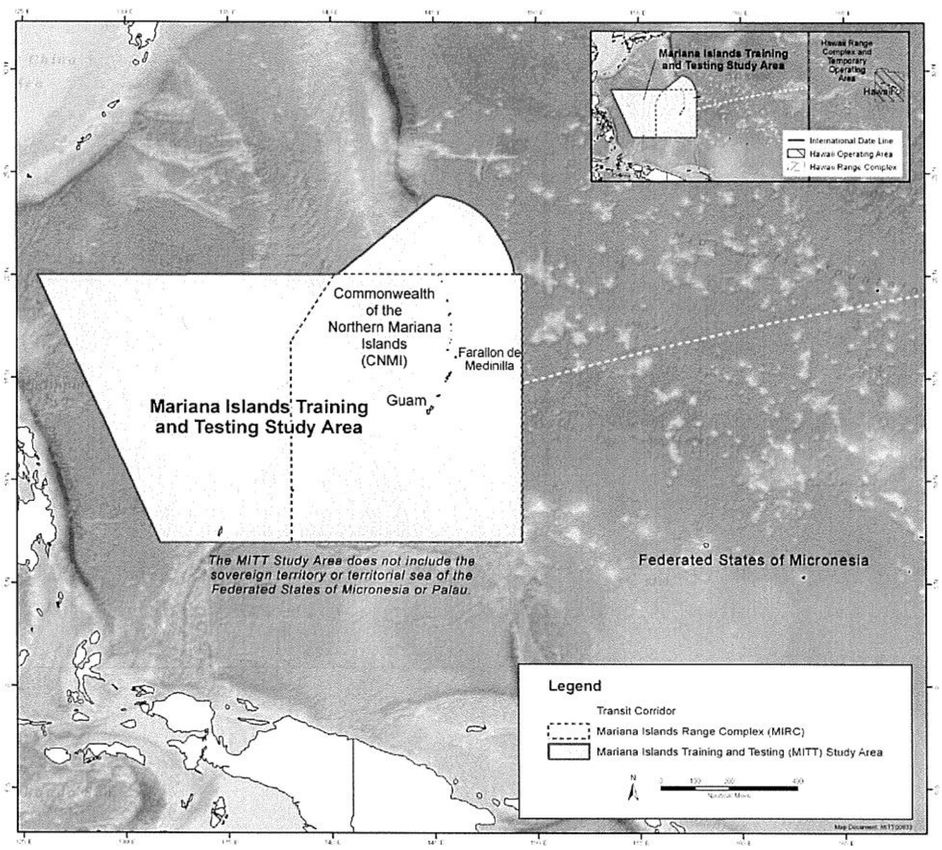
Sincerely,

L. M. FOSTER
By direction

Attachments: 1. MITT Study Area
2. Potentially Affected ESA-listed Species and Designated Critical Habitat Units on Guam and the Commonwealth of the Northern Mariana Islands

Attachment 1

MITT Study Area



Attachment 2:
Extant ESA-listed Species and Designated Critical Habitat Units on Guam and the Commonwealth of the Northern Mariana Islands that maybe affected by MITT activities

Table A-1: ESA-listed Species

Common Name	Scientific Name	ESA Listing Status	Island Occurrence[1]
Plants			
Hayun lagu	*Serianthes nelsonii*	Endangered	Guam, Rota
-	*Osmoxylon mariannense*	Endangered	Rota
-	*Nesogenes rotensis*	Endangered	Rota
Nesting Sea Turtles			
Green sea turtle	*Chelonia mydas*	Threatened	Guam, Rota, Saipan, Tinian
Hawksbill turtle	*Eretmochelys imbricata*	Endangered	
Birds			
Nightingale reed warbler	*Acrocephalus luscinia*	Endangered	Saipan
Mariana crow	*Corvus kubaryi*	Endangered	Rota
Mariana swiftlet	*Aerodramus bartschi*	Endangered	Guam, Saipan
Mariana common moorhen	*Gallinula chloropus guami*	Endangered	Guam, Rota, Tinian, Saipan
Micronesian megapode	*Megapodius laperouse*	Endangered	Guam, Rota, Tinian, Saipan, FDM
Rota bridled white-eye	*Zosterops rotensis*	Endangered	Rota
Short-tailed albatross	*Phoebastria albatrus*	Endangered	-
Hawaiian petrel	*Pterodroma sandwichensis*	Endangered	-
Newell's shearwater	*Puffinus auricularis*	Threatened	-
Mammals			
Mariana fruit bat	*Pteropus mariannus*	Threatened	Guam, Rota, Tinian, Saipan, FDM

Notes:
1. The Action Area for this consultation will include portions of Guam, Rota, Tinian, and Saipan, and all of Farallon de Medinilla (FDM).

Table A-2: Critical Habitat Units

Critical Habitat Unit	Species	Size
Guam National Wildlife Refuge Ritidian Point Unit	Mariana fruit bat, Mariana crow, Guam Micronesian kingfisher	376 acres (152 hectares)
Rota	Mariana crow	6,409 acres (2,594 hectares)
Rota	Rota bridled white-eye	3,958 acres (1,602 hectares)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

TAKE PRIDE IN AMERICA

In Reply Refer To:
2013-SL-0437

SEP 07 2013

Mr. L.M. Foster
Department of the Navy
250 Makalapa Drive
Pearl Harbor, Hawaii 96860

Subject: Species List for the Mariana Islands Training and Testing (MITT)

Dear Mr. Foster:

This letter is in response to your August 7, 2013, request for a list of federally threatened and endangered species, or designated critical habitat within the subject project action area. The Department of Navy proposes to conduct training and testing activities on Guam, Rota, Tinian, Saipan, and Farallon de Medinilla and within air space primarily north, west, and south of the Mariana Islands.

We have reviewed the information you provided and pertinent information in our files. We have attached a list of federally listed species and designated critical habitat that may be affected by your proposed project. If you have any additional questions, please contact Leilani Takano, Fish and Wildlife Biologist (phone: 671-355-5096; email: leilani_takano@fws.gov).

Sincerely,

ACTING FOR Loyal Mehrhoff
Field Supervisor

Attachment

Attachment 1. Species List for the Mariana Islands Training and Testing Area on Guam, Rota, Tinian, Saipan and Farallon de Medinilla (FDM).

Common Name	Scientific Name	ESA Listing Status	Islands
Plants			
-	*Osmoxylon mariannense*	Endangered	Rota
-	*Nesogenes rotensis*	Endangered	Rota
Hayun lagu	*Serianthes nelsonii*	Endangered	Guam, Rota
Mammals			
Mariana fruit bat*	*Pteropus mariannus mariannus*	Threatened	Guam, Rota, Tinian, Saipan, FDM
Birds			
Nightingale reed-warbler	*Acrocephalus luscinia*	Endangered	Saipan
Mariana swiftlet	*Aerodramus bartschi*	Endangered	Guam, Saipan
Mariana crow*	*Corvus kubaryi*	Endangered	Guam[1], Rota
Mariana common moorhen	*Gallinula chloropus guami*	Endangered	Guam, Rota, Tinian, Saipan
Guam rail	*Gallirallus owstoni*	Endangered	Guam[1,2]
Micronesian megapode	*Megapodius laperouse*	Endangered	Tinian, Saipan, FDM
Guam Micronesian kingfisher*	*Todiramphus cinnamominus cinnamominus*	Endangered	Guam[1]
Rota bridled white-eye*	*Zosterops rotensis*	Endangered	Rota
Seabirds[3]			
Short-tailed albatross	*Phoebastria albatrus*	Endangered	-
Newell's shearwater	*Puffins auricularis*	Threatened	-
Reptiles[4]			
Green sea turtle	*Chelonia mydas*	Threatened	Guam, Rota, Tinian, Saipan
Hawksbill turtle	*Eretmochelys imbricate*	Endangered	Guam, Rota, Tinian, Saipan

* Critical habitat for the Mariana fruit bat, Mariana crow, and Guam Micronesian kingfisher has been designated on the Guam National Wildlife Refuge. Critical habitat for the Mariana crow and Rota bridled white-eye has been designated in areas on Rota.

[1] Extirpated in the wild on Guam. Sufficient amount of habitat is needed on Guam for the recovery of the species. [2] A non-essential experimental population was designated for this species on Rota. [3] The project action area is within the non-breeding range of the species. [4] Only includes species utilizing terrestrial resources (e.g., turtle nesting on beaches).

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N01CE1/0339
03 Apr 2014

Loyal Mehrhoff, PhD
Field Supervisor
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard
Room 3-122
Honolulu, HI 96850

Dear Dr. Mehrhoff:

SUBJECT: REQUEST FOR INITIATION OF ENDANGERED SPECIES ACT (ESA) SECTION 7 FORMAL CONSULTATION FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ACTIVITIES

In accordance with section 7(a)(2) of the ESA, the U.S. Navy requests initiation of formal consultation on the land portions of MITT activities. The U.S. Navy is requesting consultation because (1) the previous biological opinion covering military training activities expires in 2015 (Mariana Islands Range Complex [MIRC] 2010 Biological Opinion), and (2) some training activities included in the proposed action have changed relative to the 2010 MIRC Biological Opinion.

The enclosed "Biological Assessment of Military Training Activities in the MITT Study Area: Terrestrial Species and Habitats" provides information pursuant to 50 C.F.R. §402.12(f). The U.S. Navy is requesting formal consultation on Alternative 1 (the preferred alternative) within the Draft Environmental Impact Statement (DEIS)/Draft Overseas Environmental Impact Statement (DOEIS).

The proposed action may affect ESA-listed species that utilize habitat within the action area by exposing them to various stressors. The action area defined in the enclosed biological assessment includes portions of Guam, Rota, Tinian, and Saipan, and the entire island of Farallon de Medinilla. The U.S. Navy determined that:

Subj: REQUEST FOR INITIATION OF ENDANGERED SPECIES ACT (ESA) SECTION 7 FORMAL CONSULTATION FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ACTIVITIES

1. The proposed action on Guam may affect, but is not likely to adversely affect the green sea turtle and hawksbill sea turtle on shore, Mariana fruit bat, Mariana common moorhen, and Mariana swiftlet. The proposed action will not affect designated critical habitat on Guam.

2. The proposed action on Rota may affect, but is not likely to adversely affect the Mariana fruit bat and Mariana crow. The proposed action will not affect designated critical habitat on Rota.

3. The proposed action on Tinian may affect, but is not likely to adversely affect the green sea turtle and hawksbill sea turtle on shore, Mariana fruit bat, Micronesian megapode, and Mariana common moorhen.

4. The proposed action on Saipan may affect, but is not likely to adversely affect the Micronesian megapode, nightingale reed-warbler, and the Mariana swiftlet.

5. The proposed action on Farallon de Medinilla may affect, and is likely to adversely affect the Mariana fruit bat and Micronesian megapode.

The U.S. Navy determined that the proposed action would have no effect on some ESA-listed species and candidate species considered for ESA listing as threatened or endangered. This conclusion was based on (1) the presence of the species relative to the action area, (2) the type of stressors introduced from the proposed action within the action area, (3) the status of recovery actions for extirpated species planned for portions of the action area, and (4) how stressors introduced from the proposed action may impact these future recovery efforts. These analyses are included in the MITT Final EIS/OEIS.

JRM maintains responsibility for most aspects of environmental and archeological compliance for terrestrial training activities on Guam and in the Marianas. Therefore, the U.S. Navy requests that the Biological Opinion be addressed to the Commander, Joint Region Marianas (JRM).

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Subj: REQUEST FOR INITIATION OF ENDANGERED SPECIES ACT (ESA) SECTION 7 FORMAL CONSULTATION FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) ACTIVITIES

Rear Admiral Tilghman D. Payne
Commander, Joint Region Marianas
PSC 455 Box 211
FPO AP, Guam 96540

We look forward to engaging with you and your staff for this consultation. For any questions regarding this consultation, please contact Ms. Julie Rivers (COMPACFLT, 808-474-6391, julie.rivers@navy.mil) or Dr. Frans Juola (NAVFAC Pacific, 808-472-1433, frans.juola@navy.mil).

Sincerely,

L. M. FOSTER
Director, Environmental Readiness
By direction

Enclosures: Biological Assessment of Military Training Activities in the MITT Study Area: Terrestrial Species and Habitats (2 hard copies, 2 CDs)

Copy to: (w/o encl)
National Marine Fisheries Service, Pacific Islands Regional Office (Mr. Michael D. Tosatto)
Commander, Joint Region Marianas (Rear Admiral Tilghman D. Payne)

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
2014-F-0262
2009-F-0345

MAY 0 9 2014

Mr. L.M. Foster
Department of the Navy
250 Makalapa Drive
Pearl Harbor, Hawaii 96860

Subject: Reinitiation of Formal Consultation for the Mariana Islands Range Complex (MIRC), identified as Mariana Islands Training and Testing Activities after 2015, Guam and the Commonwealth of the Northern Mariana Islands

This letter acknowledges the receipt of your April 3, 2014, letter and biological assessment (BA) requesting initiation of formal consultation for the proposed Mariana Islands Training and Testing (MITT) Activities pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). We received your request on April 14, 2014. At issue are the potential impacts on federally-listed threatened and endangered species from the Department of Navy's (DoN) proposed action, which is described in your April 3, 2014, letter as Alternative 1 (the preferred alternative) from the Draft Environmental Impact Statement/Draft Overseas Environmental Impact Statement (September 13, 2013).

In the April 3, 2014 letter, the DoN determined that implementation of the proposed MITT activities may affect, and are likely to adversely affect the threatened Mariana fruit bat (*Pteropus mariannus mariannus*) and endangered Micronesian megapode (*Megapodius laperouse laperouse*) on Farallon de Medinilla. The DoN also determined that implementation of the proposed MITT activities may affect, but are not likely to adversely affect the threatened green sea turtle (*Chelonia mydas*) and the endangered hawksbill sea turtle (*Eretmochelys imbricata*) located on shores on Guam and Tinian; the endangered Mariana common moorhen (*Gallinula chloropus guami*) on Guam and Tinian; the endangered Mariana swiftlet (*Aerodramus bartschi*) on Guam and Saipan; the endangered nightingale reed-warbler (*Acrocephalus luscinia*) on Saipan; the Micronesian megapode on Tinian; and the endangered Mariana crow (*Corvus kubaryi*) and Mariana fruit bat on Rota. The DoN also determined that the proposed action will not affect designated critical habitat for listed species on Guam and Rota.

TAKE PRIDE IN AMERICA

Mr. L.M. Foster Service File No. 2014-F-0262

In a subsequent May 8, 2014, email from Julie Rivers, DoN, to Loyal Mehrhoff, Fish and Wildlife Service (Service), the DoN provided the following additional information and modifications to the April 3, 2014 request: 1) a request for reinitiation of formal consultation for the Mariana Islands Range Complex (MIRC) action, rather than initiation of a new consultation on MITT; 2) a request that the Service's biological opinion follow the format of the project's biological assessment (*e.g.*, by island); 3) clarified that the timeline for the proposed action is the reasonably foreseeable future; and 4) provided a comparison of brown treesnake (*Boiga irrigularis*) control and interdiction measures, with a request to work out details of the measures during the formal consultation period.

We appreciate the additional information and herein provide our response to your requests:

- We acknowledge your request is now to reinitate consultation on MIRC, as the MITT action is a continuation of the MIRC action (biological opinion 2009-F-0345; dated February 22, 2010).

- We agree that in our biological opinion, we will describe the project activities and analyze effects to listed species on an island by island basis as much as possible. However, in order to analyze the likelihood of the action jeopardizing the continued existence of the species, we must also analyze project impacts at the population and species levels; therefore this part of the analysis cannot be formatted by island.

- We agree to work with the DoN on the details of the brown treesnake measures to ensure that the subject project's proposed action includes the following: 1) rapid response support, 2) barrier implementation, and 3) a greater level of specificity related to BTS measures. The attached DoN and Service documents, exchanged on May 8, 2014, provide examples of BTS conservation measures from earlier biological opinions. These documents should provide numerous examples of the specificity related to BTS measures that should be included in the MITT proposed action. We acknowledge your request to work out these details during the consultation period; however, given other concerns with the BA that prevent us from starting the consultation at this time (see below), we believe we can resolve these issues prior to initiating consultation.

We commend the DoN on its clear, well-written BA. However, based on our review of the BA and the additional information regarding the timeframe of the proposed action (described as "reasonably foreseeable future"), the Service has determined that the information you provided to reinitiate formal consultation on the MIRC, now identified as MITT, is insufficient. To complete this reinitiation package, we request the following information and clarifications:

- Please provide an analysis of project effects to the aforementioned listed species as a result of the proposed action occurring within the timeline of a reasonable foreseeable future, which should include a reconsideration of the DoN's determination of "not likely to adversely affect" for some species based on the ongoing nature of the proposed action.

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Mr. L.M. Foster Service File No. 2014-F-0262

- Please clarify if the conservation measures committed to in the MIRC biological opinion (2009-F-0345) will be incorporated into the MITT proposed action. If these conservation measures are no longer part of the MITT action, please describe appropriate equivalent conservation measures that will be implemented as part of the MITT proposed action and how the DoN will offset the impacts due to the loss of the previously agreed-upon conservation measures.

- Considering the timeline of the proposed action, please provide an assessment of the effects of the proposed action to the Mariana fruit bat, the Mariana crow, the endangered Guam rail (*Rallus owstoni*), and the endangered Guam Micronesian kingfisher (*Todiramphus cinnamominus cinnamominus*) on Guam.

  As discussed in previous meetings, and stated in past correspondence from the Service to the DoN, the eventual repatriation and recovery of the Mariana crow, Guam rail and Guam Micronesian kingfisher in the wild is dependent upon the preservation and restoration of adequate amounts of suitable habitat on Guam. An action that results in habitat destruction or degradation that reduces the capability of remaining habitat to support viable populations of these listed species requires consultation in accordance with section 7 of the Act.

- The BA provides limited detail related to implementation of broader biosecurity activities. Please provide additional information on specific biosecurity measures that the DoN will implement to prevent the introduction or spread of invasive species such as the little fire ant (*Wasmannia auropunctata*) and native cycad pests and pathogens from Guam to/within the Commonwealth of the Northern Mariana Islands. Similarly, please provide further description related to biosecurity measures that will be taken to prevent the introduction of invasive species to Hawaii and the mainland United States due to the proposed action. The recent introduction of the coconut rhinoceros beetle (*Oryctes rhinoceros*), to the island of Oahu is of particular concern. The BA should include a discussion of both specific interdiction efforts and rapid response to eradicate accidental introductions.

Saipan -

- On page 39 of the BA, it states field training is generally confined to the Saipan Marpi Maneuver Area. We ask that the DoN identify circumstances when field training would not be confined to the Marpi Manuever Area and the location of these alternative training sites. This information will help inform our analysis of project impacts to the nightingale reed-warbler and this species' habitat.

- On page 40 of the BA, it states that prior to planning exercises, the MIRC Operations will coordinate with appropriate local officials on Saipan to determine the latest species locations, and "the Navy will plan exercises that avoid ESA-listed species to the extent practical". We are concerned about project impacts to the nightingale reed-warbler. Given that DoN has determined that adverse effects to reed-warblers are not likely to

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Mr. L.M. Foster Service File No. 2014-F-0262

occur as result of the proposed action, the ambiguous language of "extent practical" does not provide assurances that adverse effects to reed-warblers are truly insignificant or discountable. In addition, we ask that DoN clarify which local officials would be contacted and how the DoN will determine these local officials have both the expertise and capacity to conduct surveys for listed species before each exercise. Please also clarify how the exercises will be conducted if the local officials are not able to assist with surveys prior to each exercise.

Rota –

- On page 39 of the BA, it states that on Rota, "the Navy will plan exercises that avoid ESA-listed species to the extent practical". We ask that DoN identify areas on Rota that may be used for training if DoN determines it is not practical to avoid listed species. This clarification will help inform our analysis on the Mariana crow and Mariana fruit bat on Rota. As discussed during our meeting with DoN staff on April 23, 2014, we can provide DoN with a map of areas to avoid so that adverse effects to the crow and bat are not likely.

The formal consultation process for the proposed action will not begin until we receive all of the information, or receive a statement explaining why that information cannot be made available. We will notify you when we receive this additional information; our notification letter will also outline the dates within which formal consultation should be complete.

As a reminder, the Act requires that, after initiation of formal consultation, the Federal action agency may not make any irreversible or irretrievable commitment of resources that limits future options. This practice insures agency actions do not preclude the formulation or implementation of reasonable and prudent alternatives that avoid jeopardizing the continued existence of endangered or threatened species or destroying or modifying their critical habitats.

We appreciate the opportunity to assist you with the proposed project. If you have any questions or concerns about this consultation or the consultation process, please feel free to contact me.

Sincerely,

for Loyal Mehrhoff
Field Supervisor

Enclosures

4

BTS Measures - BO Comparison (MIRC, JGPO, DIVERT)

08 MAY 2014

Compiled by:

Sylvan O. Igisomar
Biologist
U.S. Fish and Wildlife Service

Biological Opinion for the Mariana Islands Range Complex, Guam and the Commonwealth of the Northern Mariana Islands Feb 22, 2010 (MIRC)	**Biological Opinion for the Joint Guam Program Office Relocation of the U.S. Marine Corps from Okinawa to Guam and Associated Activities on Guam and Tinian Sept 8, 2010 (JGPO)**	**Formal Consultation for Divert Activities and Exercises at the Saipan International Airport, Commonwealth of the Northern Mariana Islands June 27, 2013 (DIVERT)**
The following are similar segments taken directly from the above three documents relative to Brown Treesnake effort commitments.		
(MIRC pg. 20) 1.1.1 Per Public Law 110-417, [Division A], title III, Section 316, October 14, 2008, 122 Statute 4410 and per DoD Defense Transportation Regulations, Chapter 505 protocols, the USN commits to implementing 100 percent inspection of all outgoing vessels and aircraft with trained quarantine officers and dog detection teams, which could be supplemented by other pest control expertise (with appropriate U.S. Department of Agriculture Wildlife Services brown treesnake detection training and oversight) to meet 100 percent inspection goals for large scale training activities. As a stakeholder, the USFWS would have input on the USN protocols for implementing brown treesnake interdiction and control strategies. The USN will work cooperatively with USFWS and US. Department of Agriculture to seek information in development of protocols for implementation of interdiction and control methods aimed at controlling brown treesnake as related to training activities within the MIRC action area. On an as needed basis, the USFWS, US. Department of Agriculture and USN may request meetings to discuss interdiction and control method protocols as related to military training in the MIRC.	**(JGPO pg. 72)** 11. To fully support the National Defense Reauthorization Act of 2009, the DoN will establish a DoD (i.e., representatives from the Navy, Marine Corps, Army, and Air Force) Brown Tree Snake Working Group to establish and implement a comprehensive program to control and, to the extent practicable, eradicate brown treesnake from military facilities in Guam. Implementation of this activity is ongoing and long-term. The DoN will assist with coordination of funding, planning, and streamlining implementation of DoN brown treesnake projects on Guam. Additional actions include, but are not limited to: a) committing to implement inspections and quarantine procedures at new facilities; b) actively participating in the Brown Tree Snake Working Group and work with partners to develop, prioritize, and implement projects that target landscape-level brown treesnake suppression, interdiction and control for human health and safety and provide areas with low snake densities. The DoN will support implementation and monitoring of efficacy for current techniques that address Integrated Pest Management and landscape level brown treesnake control in Ecological Reserve Areas and other DoN priority areas; c) expanding the existing environmental education program for new personnel arrivals (personnel undergoing Permanent Change of Station). The current program includes online testing and a brown treesnake factsheet; d) funding the development of methods to eradicate or significantly suppress brown treesnake island-wide. As part of the proposed action, the DoN will provide funding for brown treesnake research and suppression throughout the construction phase. <u>Biosecurity Measures Specific to Training Actions</u> 1. 100% inspection of all outgoing cargo on vessels and aircraft from Guam with trained quarantine officers and dog detection teams, which could be supplemented by other pest control expertise with appropriate USDA APHIS brown treesnake detection training and oversight to meet 100% inspection goals for large -scale training activities;	**(DIVERT pg. 11)** Per Public Law 110-417, [Division A], title III, Section 316, October 14, 2008, 122 Statute 4410 and per DoD Defense Transportation Regulations, Chapter 505 protocols, the USAF, with support from Joint Region Marianas (JRM), commits to implementing 100 percent inspection of all outgoing cargo and aircraft that are leaving from Guam associated with the Divert project. Inspections will be performed with trained quarantine officers and dog detection teams, which could be supplemented by other pest control expertise (with appropriate U.S. Department of Agriculture-Wildlife Services (USDA-WS) brown treesnake detection training and oversight) to meet 100 percent inspection goals for training activities, as required by Joint Region Marianas Instruction 5090.4. As a stakeholder, the Service will have input on the USAF protocols for implementing brown treesnake interdiction and control strategies. The USAF will work cooperatively with JRM, the Service, and USDA-WS to seek information in development of protocols for implementation of interdiction and control methods aimed at controlling brown treesnake as related to Divert training activities. On an as needed basis, the Service, USDA-WS, and USAF may request meetings to discuss interdiction and control method protocols as related to Divert military exercises.

(MIRC pg. 20) a. In the event military units, vehicles, and equipment accidentally leave Guam without inspection, as soon as possible, the DoD will notify: (1) their inspection contractor and (2) the point of destination port or airport authorities and work with the destination port to resolve the issue. Urgency of notification is a priority so that rapid response or other actions can be implemented to reduce risk.	**(JGPO pg. 72)** 2. in the event military units, vehicles, and equipment accidentally leave Guam without inspection the DoN will as soon as possible notify their inspection contractor and the point of destination port or airport authorities and work with the destination port to resolve the issue. Urgency of notification is a priority so that rapid response or other actions can be implemented to reduce risk;	**(pg. 11)** a. In the event military units, vehicles, and equipment accidentally leave Guam without inspection, as soon as possible, the USAF will notify: (1) USDA-WS and (2) the point of destination port or airport authorities and work with the destination port to resolve the issue. Urgency of notification is a priority so that rapid response or other actions can be implemented to reduce risk.
(MIRC pg. 20) b. In addition, the USN will route inbound personnel and cargo for tactical approach exercises (that require an uninterrupted flow of events) directly to CNMI training locations to avoid Guam seaports and airfields. If Guam cannot be avoided, USN in cooperation with US. Department of Agriculture and USFWS shall identify and USN will implement appropriate interdiction methods that may include redundant inspections (see 1.1.1.c) or other interdiction methods as agreed to by the USFWS, US. Department of Agriculture and USN. Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100 percent inspected by certified brown treesnake canine programs. If the US Department of Agriculture develops performance standards for this activity, the USN will adopt those standards, provided they are compatible with military mission.	**(JGPO pg. 72)** 3. the DoN will route inbound personnel and cargo for tactical approach exercises that require an uninterrupted flow of events directly to CNMI training locations to avoid Guam seaports and airfields. If Guam cannot be avoided, the DoN in cooperation with USDA shall identify and the DoN will implement appropriate interdiction methods that may include repeated inspections or other interdiction methods as agreed to by USDA and the DoN. Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100% inspected by certified brown treesnake canine programs. If the USDA develops performance standards for this activity, the DoN will adopt those standards, provided they are compatible with military mission;	**(DIVERT pg. 11)** b. In addition, the USAF will route inbound personnel and cargo for tactical approach exercises or humanitarian operations (that require an uninterrupted flow of events) directly to CNMI training locations to avoid Guam seaports and airfields. If Guam cannot be avoided, the USAF, in cooperation with USDA-WS and the Service, shall identify, and USAF will implement appropriate interdiction methods that may include redundant inspections (see 1c) or other interdiction methods as agreed to by the Service, USDA-WS, USAF and JRM. Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100 percent inspected by certified brown treesnake canine programs. If the USDA-WS develops performance standards for this activity, the USAF will adopt those standards, provided they are compatible with military mission.
(MIRC pg. 21) c. The USN is committed to implementing redundant inspections after discussions with appropriate stakeholders. Redundant inspections include inspections on Guam and at the receiving jurisdiction for administrative and logistical movements that do not require a tactical approach to complete the training requirements. It is anticipated that redundant inspections would utilize existing quarantine and inspection protocols at receiving ports. Appropriate stakeholders include, but are not limited to: the USFWS to ensure the inspections are adequate to reduce risks to trust resources, U.S. Department of Agriculture Wildlife Services, receiving jurisdictions and their supporting agencies with expertise in invasive species control, and other inspection authorities as needed to ensure inspection methods are current and revised as new techniques, technology, or data become available.	**(JGPO pg. 73)** 4. the DoN is committed to implementing repeated inspections. Repeated inspections include inspections on Guam and at the receiving jurisdiction for administrative and logistical movements that do not require a tactical approach to complete the training requirements. It is anticipated that repeated inspections will utilize existing quarantine and inspection protocols at receiving ports;	**(DIVERT pg. 11)** c. The USAF is committed to implementing 100% redundant inspections after discussions with appropriate stakeholders. Redundant inspections include inspections on Guam and at the receiving jurisdiction for administrative and logistical movements that do not require a tactical approach to complete the training requirements. It is anticipated that redundant inspections to the extent possible would utilize existing quarantine and inspection protocols at receiving ports, but in the event that there is inadequate inspection coverage the USAF will coordinate with the USDA-WS to provide additional canine inspection teams that will augment quarantine and inspection protocols at the receiving ports. Appropriate stakeholders include, but are not limited to: the Service to ensure the inspections are adequate to reduce risks to trust resources, USDA-WS, receiving jurisdictions and their supporting agencies with expertise in invasive species control, and other inspection authorities as needed to ensure inspection

		methods are current and revised as new techniques, technology, or data become available.
(MIRC pg. 21) 1.1.2 The USN will also establish snake-free quarantine areas for cargo traveling from Guam to CNMI and locations outside of the MIRC. These brown treesnake sterile areas will be subject to: (1) multiple day and night searches with appropriately trained interdiction canine teams that meet performance standards under 1.1.b; (2) snake trapping, and (3) visual inspection for snakes. Temporary barriers may be preferable to permanent exclosures because of the variable sizes needed for various training activities. The USN will produce standard operating procedures for temporary barrier construction and use. Standard operating procedures will ensure that temporary barriers will be constructed and maintained in a manner that assures the efficacy of the barrier tool and that staff maintaining and constructing the temporary barriers will receive training related to this activity prior to construction. Standard operating procedures will be developed in cooperation with the USFWS, U.S. Geological Survey Biological Resources Discipline, and the U.S. Department of Agriculture Wildlife Services to ensure risk to trust resources is adequately minimized. If risks are not adequately minimized, recommendations will be provided for incorporation into the protocols until the USN and USFWS mutually agree the risk has been minimized. The USFWS, USN, and other appropriate parties will meet, if necessary, to resolve concerns such that the protocols ensure risk is adequately minimized.	**(JGPO pg. 73)** 5. the DoN will also establish snake-free quarantine areas for cargo traveling from Guam to the CNMI and other locations. These brown treesnake sterile areas will be subject to: multiple day and night searches with appropriately trained interdiction canine teams; snake trapping, and visual inspection for snakes. Temporary (i.e., movable) barriers may be preferable to permanent exclosures because of the variable sizes needed for various training activities. The DoN will use OPNAVINST 5090.10A for standard operating procedures for temporary barrier construction and use. Standard operating procedures will ensure that temporary barriers are constructed and maintained in a manner that assures the efficacy of the barrier tool and that staff maintaining and constructing the temporary barriers will receive training related to this activity prior to construction. Review of standard operating procedures will be conducted in cooperation with the USGS Biological Resources Discipline, and the USDA APHIS. The DoN and other appropriate parties will meet, if necessary, to resolve concerns such that the protocols ensure risk is adequately minimized;	**(DIVERT pg. 12)** 2. The USAF will also establish snake-free quarantine areas (barriers) for cargo traveling from Guam to CNMI and other brown treesnake-free areas. These barriers will be subject to: (1) multiple day and night searches with appropriately trained interdiction canine teams that meet performance standards under 1b; (2) snake trapping; and (3) visual inspection for snakes. In lieu of permanent barriers, temporary barriers may be preferable to permanent exclosures because of the variable sizes needed to handle different cargo amounts for the various training activities. The USAF will produce standard operating procedures for temporary barrier construction and use within two years of the issuance of this Biological Opinion. Standard operating procedures will ensure that temporary barriers will be constructed and maintained in a manner that assures the efficacy of the barrier and that staff maintaining and constructing the temporary barriers will receive training related to this activity prior to construction. The construction and maintenance of temporary barriers utilized for cargo traveling from Guam to CNMI and other brown treesnake-free areas must be approved by the Service prior to use. During the construction phase of this project, the existing permanent snake-free quarantine area at the Saipan seaport should be utilized for surface cargo following relevant CNMI and DoD regulations. Standard operating procedures will be developed in cooperation with the Service, U.S. Geological Survey, Fort Collins Science Center, Invasive Species Science Branch, and the USDA-WS to ensure risk to trust resources is adequately minimized. If risks are not adequately minimized, additional recommendations will be provided for incorporation into the protocols until the USAF and Service mutually agree the risk has been minimized. The Service, USAF, and other appropriate parties will meet, if necessary, to resolve concerns such that the protocols ensure risk is adequately minimized.
(MIRC pg. 21) 1.1.3 The USN will support rapid response actions to brown treesnake sightings within the CNMI and locations outside of the MIRC (specifically Hawaii) by working with U.S. Geological Survey Biological Resources Discipline to develop procedures and protocols that will		**(DIVERT pg. 12)** 3. The USAF, in conjunction with the Service and JRM, will develop procedures and protocols specific to Divert training events that will support a rapid response action in the event of a brown treesnake sighting resulting from Divert activities. Divert activities

support rapid action for a brown treesnake sighting. For example, USN personnel (civilian and uniform) could be trained to augment response teams on Guam and Hawaii or the USN may retain an agreement with trained, local pest control contractors that meet performance. USN will contact the Brown Treesnake Rapid Response Team Coordinator (Coordinator) on Guam (coordinates and runs the Rapid Response Training course) within 90 days of receiving the BO to request the course. The Coordinator arranges the training based on trainers and attendees.		and exercises will be varied in the number of aircraft and personnel, and each event will have differing logistics support capabilities depending on the nature of the event. The type and amount of logistic support will be agreed to prior to each major event. Logistic support will include consideration of both in-kind assistance through air transport, shared billeting, security detail, food, materials, and ground transportation, and financial compensation for agreed-to response actions that could not be supported by in-kind assistance, including compensation for performance of services to support the deployment and execution of rapid response search teams.
1.2 DoD participation in the Brown Treesnake Control Plan (MIRC pg. 22) 1.2.1 The USN, working in collaboration with the USFWS, and U.S. Department of Agriculture Wildlife Services and Animal and Plant Health Inspection Service will decide how best to implement the Brown Treesnake Control Plan (BTS TWG 2009,37 pp.) relevant to MIRC activities.	**(JGPO pg. 73)** 6. working in collaboration with the USDA APHIS, DoN will decide how best to implement the Brown Treesnake Control Plan (BTS TWG 2009, 37 pp.) relevant to DoD actions;	**(DIVERT pg. 13)** 4 . The USAF, working in collaboration with the Service, and USDA-WS, will decide how best to implement the Brown Treesnake Control Plan (BTS TWG 2009, 37 pp.) relevant to Divert activities. The USAF and Service must mutually agree on the Brown Treesnake Control Plan implementation.
(pg. 22) 1.2.2 The USN provides an environmental education program for new arrivals (see a through d, below). Additionally, the current environmental education program may be updated to provide more recent information to ensure each individual has the most up-to-date training. a. All new service personnel will receive the "Area Training Welcome Aboard Brief." b. Mandatory viewing of a brown treesnake educational video. c. Pocket guides with brown tree snake information and personal inspection guidelines will be carried at all times. d. Assurance that brown treesnake awareness extends from the chain of command to the individual military service member.		**(DIVERT pg. 13)** 5 . The USAF will provide invasive species awareness training for all military and contractor personnel prior to all training activities. This would include a mandatory viewing of a brown treesnake educational video, distribution of pocket guides with brown treesnake information and personal inspection guidelines to be carried at all times, and assurance that brown treesnake awareness extends from the chain of command to the individual military service member.
		(DIVERT pg. 13) 6 . Due to limited availability of inspectors, trained dogs, and quarantine facilities and equipment on Guam and the CNMI, the USAF will coordinate closely with the Service, U.S. Department of Agriculture, CNMI Department of Land and Natural Resources, and Joint Region Marianas staff responsible for managing their brown

		treesnake program, on planning for training activities on Saipan. The USAF, along with cooperating agencies, will identify the inspection and interdiction requirements for the Divert training, including the number of trained quarantine officers and dog detection teams required. The USAF will coordinate and consult with the Service on the inspection and interdiction requirements identified by the USAF, and the Service must concur with these requirements prior to the implementation of the exercise or training activity. The USAF, along with the cooperating agencies, will develop plans to ensure that inspection personnel are available and that all requirements can be met, and will identify the support that the USAF will need to provide for the inspections. Planning for training exercises generally begins months prior to implementation of an exercise, and planning for complex training that would require a substantial number of inspectors, quarantine areas, or other personnel or equipment for control and interdiction generally begins more than a year in advance. If adequate resources, such as trained inspectors and dog teams, are not available during training activities, training will not occur until resources are available.
1.3 Prevention of Invasive Species Introductions and Spread **(pg. 22)** 1.3.1 All personnel involved in MIRC training will adhere to DoD Instruction 5090.7, which calls for individual troops to be responsible for conducting self-inspections to avoid potential introductions of invasive species to Guam and the CNMI. Troops will inspect all gear and clothing (e.g., boots, bags, weapons, pants) for soil accumulations, seeds, invertebrates, and vertebrates). The intent of this measure is to minimize the potential risks and subsequent effects associated with transport of troops and personnel to Guam and to CNMI from areas that contain species that are not native to terrestrial habitats within the MIRC (extra-MIRC travel). In addition, compliance with Instruction 5090.7 will be required for travel to and from training sites within the MIRC (inter-MIRC travel).	**(JGPO pg. 73)** 7. adherence to DoN Instruction 5090.7, which calls for individual troops to be responsible for conducting self-inspections to avoid potential introductions of invasive species to Guam and the CNMI. Troops will inspect all gear and clothing (e.g., boots, bags, weapons, pants) for soil accumulations, seeds, invertebrates, and vertebrates. The intent of this measure is to minimize the potential risks and subsequent effects associated with transport of troops and personnel to Guam and to CNMI from areas that contain species that are not native to Guam and Tinian terrestrial habitats;	**Prevention of Invasive Species Introductions and Spread (DIVERT pg. 13)** I. All personnel involved in Divert training will adhere to DoD Instruction 5090.IOA and the 2005 Brown Treesnake Control and Interdiction Plan, which calls for individual troops to conduct self-inspections to avoid potential transport of brown treesnakes. Troops will inspect all personal gear and clothing (e.g., boots, bags, weapons, pants), hand-carried equipment and supplies and tent canvas. The intent of this measure is to minimize the potential risks and subsequent effects associated with transport of troops and personnel from Guam to the CNMI and other areas that do not have brown treesnakes.
(MIRC pg. 22) 1.3.2 In addition to self inspections, each action will undergo a pathway risk analysis as a tool to improve programmatic efficiency while preventing the spread or introduction of invasive species. Actions at risk of transporting invasive species will have prevention tasks identified and implemented to reduce risk. Methods such as Hazard Analysis and Critical Control Point (HACCP) planning (see	**(JGPO pg. 73)** 8. each action will undergo a pathway risk analysis as a tool to improve programmatic efficiency while preventing the spread or introduction of invasive species. Actions at risk of transporting invasive species will have prevention tasks identified and implemented to reduce risk. Methods such as HACCP planning (see http://www.haccp-nrm.org) may be utilized to conduct pathway analysis;	**(DIVERT pg. 13)** 2. In addition to self-inspections, each training action will undergo a pathway risk analysis is as a tool to improve programmatic efficiency while preventing the spread and introduction of invasive species. Actions at risk of transporting invasive species will have prevention tasks identified and implemented to reduce risk. Methods employed such as HACCP planning development and

http://www.haccp-nrm.org) may be utilized to conduct pathway analysis.		implementation by the USAF may be utilized to conduct pathway analysis. Pathway risk analysis must be completed prior to each training action being implemented.
(MIRC pg. 22) 1.3.3 The USN is a participating agency in the development of the Regional Biosecurity Plan. Once completed, the Regional Biosecurity Plan will be applicable to MIRC training activities when such procedures do not unduly interfere with military training. The USN will continue to work cooperatively with USFWS and U.S. Department of Agriculture in development of protocols for implementation of interdiction and control methods in accordance with recommendations contained in the Regional Biosecurity Plan aimed at controlling brown tree snake and other invasive species as related to training activities within the MIRC action area. The Regional Biosecurity Plan will coordinate and integrate inter-agency invasive species management efforts such as control, interdiction, eradication, and research. This plan is currently in development and draft components of the plan will be completed in March 2010. The final plan is anticipated to be completed in January 2011.		**(DIVERT pg. 14)** 3. The USAF is a participating agency in the development of the Micronesia Biosecurity Plan. The Micronesia Biosecurity Plan is intended to coordinate and integrate inter-agency invasive species management efforts such as control, interdiction, eradication, and research. Once completed, any portions of the Micronesia Biosecurity Plan determined to be applicable to Divert construction and training activities, will be implemented when such procedures do not unduly interfere with military training. The USAF will continue to work cooperatively with the Service and U.S. Department of Agriculture in development of protocols for implementation of interdiction and control methods in accordance with recommendations contained in the Micronesia Biosecurity Plan identified as being tied to USAF actions.
(MIRC pg. 23) 1.4 Cooperative Development of Regional Training Standard Operating Procedures and Exercise Planning. The USN will invite the USFWS to participate in the development of regional standard operating procedures and exercise planning to" better meet invasive species management needs associated with MIRC training. Current procedures can be found in 5090.1 OA "Brown Tree Snake Control and Interdiction Plan" (USN 2005, 28 pp.).	**(JGPO pg. 74)** 9. the DoN will invite the Service to participate in the development of regional standard operating procedures and exercise planning to better meet invasive species management needs associated with proposed training. Current procedures can be found in 5090.10A "Brown Tree Snake Control and Interdiction Plan" (DoN 2005, 28 pp.);	
(MIRC pg. 23) 1.5 Coordination of Training Events The DoD Representative will assure that "Area Training" coordinates meetings for brown tree snake interdiction on all training activities for the training execution phase and an after action review phase. If a snake is found during training, the USN policy is to kill the snake and is reported to USN Environmental Staff.	**(JGPO pg. 74)** 10. the DoN representative will assure that "Area Training" coordinates meetings for brown treesnake interdiction on all training activities for the training execution phase and an after action review phase. If a snake is found during training, the DoN policy is to kill the snake and report it to DoN Environmental staff;	
Additional Brown Treesnake commitments found throughout the three documents.		

(MIRC pg. 34) 4.5.15 The USN will continue (per their INRMP) to trap brown treesnakes in areas surrounding the Mariana swiftlet caves to reduce or prevent brown treesnake predation on the swiftlets and will continue to monitor swiftlet population trends on Guam to evaluate success of avoidance, minimization, and conservation measures described above. **(MIRC pg. 75)** 2.4 Using a standard template, the USN will develop and submit semi-annual reports to the USFWS on the first of October and the first of April of each year beginning 2010 through 2015. The October report will be combined with the report required under 2.2 above. The purpose of the reporting template is to ensure report preparation time is limited, while still concisely discussing the successes and failures of all avoidance, minimization, and conservation measures and terms and conditions listed in this biological opinion for invasive species control and interdiction in relation to the anticipated and observed impacts and incidental take. The report will include details regarding which cargo was inspected or un-inspected, potential level of risk associated with each cargo type, and where the cargo was shipped from training related actions only. The reports should include explanations if specific cargo shipments were missed and document all snake detections or other high risk incidents and the method used for the detection for training related actions only. The report will also include the number of brown treesnake kills during training actions.	**2.1 Project Description (JGPO pg 18)** The DoD has a long history of success in preventing the dispersal of the brown treesnake from Guam in its transport of personnel and cargo. After publication of the DEIS, various agencies within the U.S. Department of Interior (DoI) expressed concern regarding the adequacy of brown treesnake interdiction efforts in response to the relocation of Marine Corps forces to Guam. DoN agrees that it will fund the increase of current federally funded brown treesnake interdiction measures (in Guam, CNMI, and Hawaii) where the increase is related to direct, indirect and induced-growth caused by the Marine Corps relocation to Guam. That funding will continue and become part of the DoN's current brown treesnake interdiction funding under authority of the Brown Tree Snake Control and Eradication Act. The DoI agrees that it is not DoN's responsibility to fund increased interdiction measures that are identified more than one year after the end of the fiscal year in which both Marine Corps relocation construction undertaken to implement the proposed relocation decisions made in the Record of Decision (ROD) for the "Environmental Impact Statement/Overseas Environmental Impact Statement for Guam and CNMI Military Relocation: Relocating Marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force" has ended and the permanent nontransient Marine Corps military units relocated as a result of decisions made in that ROD have concluded their relocation to Guam. For the purposes of this Project Description, interdiction is defined as: "to hinder, prohibit, or prevent the brown treesnake from becoming established in new locations by conducting inspection and suppression processes." **Naval Base Guam Construction Projects (JGPO pg. 32)** In-water ship berthing and embarkation areas, staging areas, an amphibious craft laydown area, a military working dog kennel relocation, a medical and dental clinic, washdown facilities, brown treesnake barriers, and quarantine areas will be developed at Naval Base Guam. In addition, a United States Coast Guard berthing and crew support building will be relocated to an area that is not currently forested. The military working dog kennel will be relocated from its existing site to a new site on Naval Base Guam. The proposed project location is in an existing laydown area for base maintenance with existing access roads and utility tie-ins. Associated with the aircraft carrier berthing at Naval Base Guam are the shore-side facilities (recreation, gathering, laundry, waiting for transportation, and food and beverage sales), staging areas, new	**(DIVERT pg. 8)** 7. All on-site personnel will receive instruction regarding the brown treesnake *(Boiga irregularis)* and what to do immediately in case of a sighting. **(DIVERT pg. 10)** *Invasive Species Interdiction and Control* The USAF will be responsible for oversight of avoidance, minimization, and mitigation implementation by the construction contractors for projects associated with the proposed Divert activities. In addition, the USAF will be responsible for oversight of training, review, and guidance on Hazard Analysis and Critical Control Point (HACCP) plan development, implementation and revision during the construction phase of the project. The HACCP plans will incorporate measures to ensure invasive species, including the brown treesnake, are not transported to the CNMI from Guam via project vehicles, materials and equipment. The USAF will be responsible for assuring that any HACCP plans are implemented by construction contractors to prevent the inadvertent movement of non-native, invasive species from other locations to the project site. The USAF will coordinate development of HACCP plans with the Service, including, but not limited to, annual meetings and reports to ensure the actions to eliminate or reduce risk are sufficient and on-going during construction activities. **Biosecurity (DIVERT pg. 25)** To reduce the risk of introduction and spread of non-native, invasive species via Divert activities, the USAF has proposed to implement a variety of conservation measures throughout the action area. Effective interdiction of brown treesnakes on Guam and the CNMI is critical to preventing the spread of this species. The USAF has committed to snake inspection (100% as a goal), construction of snake barriers and brown treesnakc rapid response to support military training. In addition, the USAF has committed to the establishment of a biosecurity program during construction and implementation of the proposed project. Successful implementation of the biosecurity program will prevent adverse effects to listed species, and other native wildlife, from introduction of non-native species.

	buildings, and parking. The Apra Branch Medical and Dental Clinic will be built on a previously disturbed area that is currently vacant. The Morale, Welfare, and Recreation area will be developed to provide food and beverage booths, seating for 500 people, 40 phone bank seats, 100 stalls for visitor and rental car parking, portable restrooms, laundry facilities, temporary lighting, and trash dumpsters. All facilities will have security lights mounted on buildings or steel poles. Lighting along the wharves will consist of 1,000-watt high pressure sodium floodlights mounted on new or existing poles. Lighting will be shielded and aimed such that the majority of the illumination will be directed towards the wharf deck, extending over water approximately 100 ft (30.5 m). All actions related to development and improvement of waterfront facilities will occur in currently paved or landscaped areas. All utility distribution lines and ductwork will be located underground, generally within existing utility corridors. The DoN will develop permanent and temporary washdown, quarantine, and inspection areas at arrival areas on Guam at Apra Harbor (ship and amphibious vehicle loading and unloading) and Andersen Air Force Base (DoN 2010a, p. 70) as follows. 1. A washdown, quarantine, and inspection facility will be built at Apra Harbor within 600 ft (183 m) of Victor Wharf to reduce the risk of exposure to invasive species after leaving the clean, biosecure area. During construction, invasive species and debris will be removed from the site. Prior to operation, the biosecure area will be inspected and will only begin operations when the area is invasive species-free. These facilities will provide vehicle cargo quarantine, inspection, and storage areas. These areas will be constructed with a brown treesnake barrier and active trapping for brown treesnakes will occur. These facilities will provide a pre-wash down area, vacuum equipment, wash racks (raised platforms with ramps at either end that facilitate cleaning and inspection of undercarriages), an inspection building, and fenced area that will meet the requirements for the use of inspection dogs and a cargo loading and inspection area. Specifically, these facilities will be built in a designated paved area with a wash down area and sufficient space for segregating "clean" from "dirty" equipment, cargo, and vehicles. The areas will be surrounded by brown treesnake barriers following specifications received from the Service: The barriers will be 4.5 ft (1.4m) tall; made from pre-	**(DIVERT pg. 28)** 1 (b) The USAF will submit annual reports to the Service on the tirst of December of each year beginning in 2014. The purpose of the annual report is to discuss successes and failure of all avoidance, minimization, and conservation measures, and terms and conditions listed in this biological opinion in relation to the anticipated and observed impacts and incidental take. The report will include details regarding invasive species control and interdiction including which cargo lights were inspected or non-inspected, potential level of risk associated with each cargo/flight type, and where the cargo/flights originated from for training related actions only. The reports should include explanations if specific inspections were missed and document all snake detections or other high risk incidents and the method used for the detection for training related actions only. The report will also include the number of brown treesnake kills during training actions.

	cast concrete with an outward projecting lip to deter snakes; the barriers will have only two gates providing one-way flow of traffic through the site; each gate made from sliding chain-link with fabric barriers to prevent snake ingress and egress. 2. When in Apra Harbor, the vehicles and equipment unloaded or loaded onto a ship will be inspected and receive a wash down on arrival and departure to prevent introduction of any pest or invasive species that may present a potential threat to agriculture, public health, or the natural resources of Guam or other Pacific Islands. All wash downs will be conducted and supervised by trained personnel in accordance with Armed Forces Technical Guide 31. U.S. Department of Agriculture (USDA) personnel may participate in inspections and brown treesnake inspections will be conducted with involvement of USDA Animal and Plant Health Inspection Service (APHIS) personnel. Vehicles will be inspected (internally and externally) prior to passing into the biosecure area. The water used to wash vehicles will be captured and circulated through filters to prevent pests from spreading. All waste on board ships will continue to be steam sterilized prior to disposal in regulated landfills in accordance with base operating procedures. 7. There are several projects in Apra Harbor. For all facilities, the DoN will attempt to include USDA APHIS at the earliest possible time to plan for brown treesnake inspections. Planning for cargo storage will include considerations of the length of time for storage, risk of brown treesnake or other invasive species, and origin and destination of cargo. These considerations need to be vetted through the Biological Monitor (detailed in subsequent sections of the Project Description) and this staff person will coordinate with other partners. Permanent barriers and moveable brown treesnake barriers will be used as the situation dictates. 8. The DoN will develop permanent and temporary quarantine and inspection areas at a new Air Embarkation and Disembarkation area at Andersen Main Base to load and unload passengers and cargo from aircraft (DoN 2010a, p. 62-63). USDA APHIS will be included in the design of this facility as early as possible to assist with planning. This facility will be surrounded by a brown treesnake barrier built to the specifications described above and will have inspection and quarantine areas to separate "clean" from "dirty" areas such that all aircraft, baggage, equipment, and cargo are 100% inspected upon arrival and 100%	

	inspected upon departure. The aircraft carrier berthing will bring up to 59 aircraft to Guam that may beddown at Andersen Air Force Base. All transient aircraft will follow all existing invasive species inspection protocols, including brown treesnake protocols (DoN 2010a, p. 83). **The following procedures will be in place prior to personnel arrival on Tinian: (JGPO pg. 42)** a) Training activity will be scheduled and notice provided in newspapers or otherwise posted at least one week prior to training event. The focus of the public notice efforts will be on Tinian and Saipan. b) Biosecurity training will be completed through informal coordination with Service, USDA, Guam Division of Aquatic and Wildlife Resources and CNMI Division of Fish and Wildlife, through the regional training authority one week prior to the training event. All materials, equipment (including personell and vehicles), and supplies will be inspected less than 48 hours prior to departure and loaded onto the aircraft. If necessary, inspected equipment may be stored in a "clean" area up to 48 hours, prior to departure. An area is considered "clean" of brown treesnakes if the area is enclosed by a permanent or temporary snake barrier and successful snake suppression is in place. **The following procedures will be in place after arrival on Tinian and prior to any movement or training begins: (JGPO pg. 43)** a) Vehicles and equipment will be subject to brown treesnake inspection protocols on the airfield apron upon arrival. b) All military related cargoes (construction and training equipment, vehicles, materials, and supplies) will be inspected by USDA APHIS and determined to be clean prior to leaving the quarantine and inspection areas for training on Tinian. **(JGPO pg. 46)** The transport of 200 to 400 Marines to Tinian from Guam for the proposed one week per month company-level training exercises will be via aircraft between Andersen Air Force Base and Tinian International Airport. If equipment is moved by barge, a single barge will be able to carry the equipment necessary to support the training evolution. The DoN will utilize the existing single individual and canine conducting all brown treesnake interdiction activities on Tinian. The current brown treesnake interdiction quarantine facility is surrounded by a typhoon proof snake	

	barrier. This facility is adequate for the current import rate of cargo proposed for movement onto Tinian. All military related cargoes (construction and training equipment, vehicles, materials, and supplies) from the proposed project will be inspected by USDA APHIS and determined to be clean prior to leaving the quarantine and inspection areas for work or training on Tinian and for shipment off Tinian. **(JGPO pg. 63)** 8. Consistent with the MIRC BO, the DoD will maintain 328-ft (100-m) no training buffers around the known Mariana swiftlet nesting caves (e.g., Mahlac Cave, Fachi Cave, Maemong Cave) in the Naval Munitions Site and will continue to trap brown treesnake within areas surrounding the swiftlet caves. **General Biosecurity Measures (JGPO pg.69)** Existing levels of federally funded brown treesnake interdiction efforts will be increased, as necessary, to address increases in outbound civilian cargo exports to U.S. states and territories resulting from the proposed action. In order to guide the level of brown treesnake interdiction efforts, an iterative process employing adaptive management techniques will be used. The DoN commits to convening a working group to identify a system of reporting, monitoring and threshold metrics that can be used to guide the appropriate level of brown treesnake interdiction associated with the Marine Corps relocation effort. The prospective working group members will include representatives from DoI-Office of Insular Affairs, USDA APHIS Wildlife Services, Hawaii Department of Agriculture, Government of Guam, CNMI, the Service, and USGS Biological Resources Discipline. The DoN will initiate discussions with prospective working group members within 90 days of the Record of Decision. The working group will serve as a subgroup to the Civil Military Coordination Council (Council). The Council implements Adaptive Program Management for the proposed action as described in the "Environmental Impact Statement/Overseas Environmental Impact Statement for Guam and CNMI Military Relocation: Relocating Marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force." 1. The working group will serve in an advisory capacity to facilitate efficient and effective brown treesnake interdiction efforts. The working group will meet, at a minimum, on a biannual basis. If an issue arises that warrants immediate attention, the working group will convene via	

	electronic mail or telephone. If timing does not allow for engaging the working group, the DoN and Service will coordinate to develop an agreed-upon response. 2. The DoN will provide the Service and the working group with annual reports detailing brown treesnake interdiction measures on Guam and the CNMI and anticipated levels of future DoD construction activity associated with the Marine Corps realignment efforts. The working group will advise the Council on brown treesnake interdiction efforts relative to the construction tempo and sequencing associated with the Marine Corps realignment construction effort. Following completion of the construction phase of the project, the Brown Treesnake Working Group will function as a mechanism to monitor the brown treesnake interdiction program. 3. The DoN will develop a biosecurity program to be employed throughout the construction phase of the military buildup. The program will have terrestrial and aquatic resources response capabilities. The DoN's Biosecurity program will address non-native, invasive species issues on DoD property within Guam and the CNMI. DoN will work with partners to develop newspaper, radio, and television public service messages and website and education materials for the public and DoN describing non-native invasive species, their impacts to native species, what can be done for their prevention and control, and training. The Biosecurity program will work to control and eradicate existing non-native plants and animals. DoD will support opportunities to work collaboratively through Memorandums of Understanding or Memorandums of Agreement with the local government, which will afford improved biosecurity for both DoD and the community as a whole. The Biosecurity progam will include cross training for non-native invasive plant and animal species where inspection and rapid response techniques have been developed. The Biosecurity program will be initiated prior to initiation of construction within recovery habitat on the proposed Main Cantonment area or Andersen Air Force Base. In addition, biosecurity program efforts will: a) establish a process for the DoN to determine rapid response situations identifying when and how, to transfer long-term control efforts to when applicable. This will be part of the Biosecurity Response Team Operations Manual (to be developed as part of this action), which will be modeled	

	after the National Park Service Exotic Plant Management Teams Operations Manual (2002). The Biosecurity Team Operations Manual will be developed within one year of filling the Biosecurity Team. b) Biosecurity Team members will participate in regional and local invasive species work groups (i.e., Regional Invasive Species Council, Guam Invasive Species Committee, Coconut Rhinoceros Beetle Incident Command, Brown Tree Snake Working Group, and other invasive species specific groups) throughout Micronesia. These groups provide opportunities for cross-training, technology transfer, and sharing of current issues with a specific species or region. These venues also provide for the Teams to report on activities to partners. c) assist existing federally-funded brown treesnake rapid response teams to enable coverage of each brown treesnake detection incident in CNMI and Hawaii. The DoN will support USGS Biological Resources Discipline to develop procedures and protocols that will support rapid response team actions for a brown treesnake detection incident. DoN personnel will be trained on rapid response procedures or the DoN may retain agreements with trained, local pest control contractors or cooperating partner agencies that would assist in the response actions. DoN support for rapid response actions would be subject to a Memorandum of Understanding that will be initiated within 180 days of the Record of Decision. Implementation of brown treesnake rapid response is currently provided for pursuant to the MIRC Biological Opinion. If the action is not funded pursuant to the MIRC Biological Opinion in the future, alternate sources of funding would be secured to ensure implementation of this rapid response conservation measure. **(JGPO pg. 71)** 6. The contractor shall provide documentation that supports prevention, worker awareness, and control of non-native invasive and pest species in the project area and efforts to prevent the movement of non-native invasive species to areas outside the project area, whether in a purposeful or inadvertent manner. The contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training, and keep up to date on regulatory required specific training for the type of work to be conducted onsite. This may include, but is not limited to HACCP planning, species- (e.g., brown treesnake and coconut rhinoceros beetle) specific	

	information, regulated pest list, threatened and endangered species information, and proper washdown and inspection techniques for equipment. Vehicle hygiene, that is vehicle washdown and inspection for soil and other material, is required to prevent the inadvertent movement of non-native invasive species from the project site to other locations. The Contractor is required to establish appropriate facilities that comply with all environmental laws and regulations, provide training for proper vehicle hygiene, and promptly take corrective and preventative actions for noncompliance. All large dumpsters without lids shall be inspected by the Biological Monitor for non-native invasive species prior to movement of the dumpster off the project site. 7. The DoN will work with partners to develop, prioritize, and implement eradication and control projects that target non-native invasive lizard species. As an example, eradication or suppression of non-native invasive lizard species to reduce prey for brown treesnake could be implemented in the Ecological Reserve Areas. These types of management actions will be implemented within one year of establishing the Ecological Reserve Area. 8. The DoN will work with partners to develop, prioritize, and implement non-native rodent control (suppression) on Guam for conservation and human health and safety concerns. As an example, suppression of rodents to reduce prey for brown treesnakes or prevent rodent explosions after control of brown treesnakes could be implemented in the Ecological Reserve Areas.	

BTS Measures - BO Comparison (MIRC, JGPO, DIVERT)

08 MAY 2014

Complied by:

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Summary of BO BTS Interdiction and Control Measures

1. 100% Inspections of all outgoing vessels, aircraft, and cargo/equipment leaving Guam for off-island destinations.

a. If BTS inspection missed, USN to notify USDA-WS and Destination

b. Route tactical approach exercises directly to the CNMI to avoid Guam. If Guam cannot be avoided for tactical approaches then, the USN will work with the Service and USDA-WS to implement appropriate interdiction methods.

c. 100% redundant BTS inspections for receiving jurisdiction for administrative and logistical movements.

2. Use of snake-free temporary barriers when deemed necessary. Produce SOPs for temporary barrier maintenance and use.

3. Develop procedures and protocols specific to MITT training events that will support a rapid response action in an event of a BTS sighting resulting from MITT training exercises.

4. Work collaboratively with the Service and USDA-WS to best implement the BTS Control Plan relevant to MITT training activities.

5. Provide invasive species awareness training for all military and contractor personnel prior to all MITT training activities. Mandatory viewing of a BTS educational video, pocket guides with BTS information and personal inspection guidelines, and assurance that BTS awareness extends the chain of command.

6. Coordinate closely with Service, USDA-WS, and CNMI DLNR for planning training activities in the CNMI. Coordinate and consult with the Service on inspection and interdiction requirements identified by the USN, for the Service's concurrence prior to implementation of the exercise or training activity.

1. 100% Inspection for out going from Guam:

A. MIRC BO (FEB 2010)

Page 20, Sec 1.1;

"1.1.1 Per Public Law 110-417, [Division A], title III, Section 316, October 14, 2208, 122 Statute 4410 and per DoD Defense Transportation Regulations, Chapter 505 protocols, the USN commits to implementing 100 percent inspection of all outgoing vessels and aircraft with trained quarantine officers and dog detection teams, which could be supplemented by other pest control expertise (with appropriate U.S. Department of Agriculture Wildlife Services brown treesnake detection training and oversight) to meet 100 percent inspection goals for large scale training activities."

Page 20, Sec 1.1b, line 7;

"Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100 percent inspected by certified brown treesnake canine programs."

B. JGPO BO (SEP 2010)

Page 72, Sec. Biosecurity Measures Specific to Training Actions:

"The following measures pertain to training and training cargo movements

1. 100% inspection of all outgoing cargo on vessels and aircraft from Guam with trained quarantine officers and dog detection teams, which could be supplemented by other pest control expertise with appropriate USDA APHIS brown treesnake detection training and oversight to meet 100% inspection goal for large scale training activities;

3. ......Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100% inspected by certified brown treesnake canine programs."

C. Divert BO (JUN 2013)

Page 11, Sec. 1;

"1. Per Public Law 110-417, [Division A], title III, Section 316, October 14, 2008, 122 Statute 4410 and per DoD Defense Transportation Regulations, Chapter 505 protocols, the USAF, with support from Joint Region Marianas (JRM), commits to implementing 100 percent inspection of all outgoing cargo and aircraft that are leaving from Guam associated with the Divert project. Inspections will be performed with trained quarantine officers and dog detection teams, which could be supplemented by other pest control expertise (with appropriate U.S. Department of Agriculture-Wildlife Services (USDA-WS) brown treesnake detection training and oversight) to meet 100 percent inspection goals for training activities, as required by Joint Region Marianas Instruction 5090.4."

Page 11, Sec. 1.b, line 7;

"Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100 percent inspected by certified brown treesnake canine programs."

Comparison: Included Northwest Field Beddown consultation and ISR Strike BO for additional comparisons. See table and note below for direct comparisons.

Northwest Field Beddown Sec. 7 consultation on AAFB (MAY 2006):

Page 5, paragraph 1, line 4;

"As part of the proposed action, the Air Force has committed to 100-percent inspection of all outbound cargo, supplies, household goods, and aircraft from Guam for brown treesnake interdiction."

ISR Strike BO on AAFB (OCT 2006):

Page 14, paragraph 2;

"Brown Treesnake Interdiction and Control - To prevent brown treesnakes from leaving Guam in any Air Force cargo, vehicles, munitions, household goods, and other items the Air Force will program for and facilitate a 100 percent inspection rate for all of these items departing Guam from Andersen AFB or other sites on Guam where they are staged for departure from Guam."

BTS Inspections	**NWF Beddown**	**ISR Strike BO**	**MIRC BO**	**JGPO BO**	**DIVERT BO**
Cargo/Equipment/Supplies	**X**	**X**	**X**	**X**	**X**
Aircraft	**X**		**X**		**X**
Vessels			**X**		
Vehicles		**X**			
Munitions		**X**			
Other		**X**			

Note: JRM is committed to funding USDA-WS to conduct 100% inspections of all DoD aircraft, cargo, munitions, equipment, POVs, and Household goods that depart Guam for another off-island destinations on a daily basis, per COMNAVMAR INST5090.10A Brown Tree Snake Control and Interdiction Plan (FEB 2005) and 36 WG INST32-7004 Brown Tree Snake Management on AAFB (MAR 2006).

1a. Missed Inspection Notification:

A. **MIRC BO** (FEB 2010)

Page 20, Sec. 1.1.1.a;

"a. In the event military units, vehicles, and equipment accidentally leave Guam without inspection, as soon as possible, the DoD will notify: (1) their inspection contractor and (2) the point of destination port or airport authorities and work with the destination port to resolve the issue. Urgency of notification is a priority so that rapid response or other actions can be implemented to reduce risk."

B. **JGPO BO** (SEP 2010)

Page 72, Sec. Biosecurity Measures Specific to Training Actions:

"2. in the event military units, vehicles, and equipment accidentally leave Guam without inspection the DoN will as soon as possible notify their inspection contractor and the point of destination port or airport authorities and work with the destination port to resolve the issue. Urgency of notification is a priority so that rapid response or other actions can be implemented to reduce risk;"

C. **DIVERT** (JUN 2013)

Page 11, Sec. 1.a;

"a. In the event military units, vehicles, and equipment accidentally leave Guam without inspection, as soon as possible, the USAF will notify: (l) USDA-WS and (2) the point of destination port or airport authorities and work with the destination port to resolve the issue. Urgency of notification is a priority so that rapid response or other actions can be implemented to reduce risk."

Comparison: Identical statement among the three BOs.

1b. Tactical Approach Exercises/Training

A. **MIRC BO** (FEB 2010)

Page 20, Sec. 1.1.1.b

"b. In addition, the USN will route inbound personnel and cargo for tactical approach exercises (that require an uninterrupted flow of events) directly to CNMI training locations to avoid Guam seaports and airfields. If Guam cannot be avoided, USN in cooperation with U.S. Department of Agriculture and USFWS shall identify and USN will implement appropriate interdiction methods that may include redundant inspections (see 1.1.1.c) or other interdiction methods as agreed to by the USFWS, US. Department of Agriculture, and USN. Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100 percent inspected by certified brown treesnake canine programs. If the U.S. Department of Agriculture develops performance standards for this activity, the USN will adopt those standards, provided they are compatible with military mission."

B. **JGPO BO** (SEP 2010)

Page 72, Sec. Biosecurity Measures Specific to Training Actions:

"3. the DoN will route inbound personnel and cargo for tactical approach exercises that require an uninterrupted flow of events directly to CNMI training locations to avoid Guam seaports and airfields. If Guam cannot be avoided, the DoN in cooperation with USDA shall identify and the DoN will implement appropriate interdiction methods that may include repeated inspections or other interdiction methods as agreed to by USDA and the DoN. Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100% inspected by certified brown treesnake canine programs. If the USDA develops performance standards for this activity, the DoN will adopt those standards, provided they are compatible with military mission;"

C. **DIVERT** (JUN 2013)

Page 11, Sec. 1.b;

"b. In addition, the USAF will route inbound personnel and cargo for tactical approach exercises or humanitarian operations (that require an uninterrupted flow of events) directly to CNMI training locations to avoid Guam seaports and airfields. If Guam cannot be avoided, the USAF, in cooperation with USDA-WS and the Service, shall identify, and USAF will implement appropriate interdiction methods that may include redundant inspections (see lc) or other interdiction methods as agreed to by the Service, USDA-WS, USAF and JRM. Additionally, tactical approach exercises will involve only cargo equipment that has not originated from areas containing a brown treesnake population or will be 100 percent inspected by certified brown treesnake canine programs. If the USDA-WS develops performance standards for this activity, the USAF will adopt those standards, provided they are compatible with military mission."

Comparison: Identical statements among the three BOs.

1c. 100% Redundant BTS inspections at Receiving Jurisdiction:

A. **MIRC BO** (FEB 2010)

Page 21, Sec. 1.1.1.c

"c. The USN is committed to implementing redundant inspections after discussions with appropriate stakeholders. Redundant inspections include inspections on Guam and at the receiving jurisdiction for administrative and logistical movements that do not require a tactical approach to complete the training requirements. It is anticipated that redundant inspections would utilize existing quarantine and inspection protocols at receiving ports. Appropriate stakeholders include, but are not limited to: the USFWS to ensure the inspections are adequate to reduce risks to trust resources, U.S. Department of Agriculture Wildlife Services, receiving jurisdictions and their supporting agencies with expertise in invasive species control, and other inspection authorities as needed to ensure inspection methods are current and revised as new techniques, technology, or data become available."

B. **JGPO BO** (SEP 2010)

Page 73, Sec. Biosecurity Measures Specific to Training Actions:

"4. the DoN is committed to implementing repeated inspections. Repeated inspections include inspections on Guam and at the receiving jurisdiction for administrative and logistical movements that do not require a tactical approach to complete the training requirements. It is anticipated that repeated inspections will utilize existing quarantine and inspection protocols at receiving ports;"

C. **DIVERT** (JUN 2013)

Page 11, 1.c

"c. The USAF is committed to implementing 100% redundant inspections after discussions with appropriate stakeholders. Redundant inspections include inspections on Guam and at the receiving jurisdiction for administrative and logistical movements that do not require a tactical approach to complete the training requirements. It is anticipated that redundant inspections to the extent possible would utilize existing quarantine and inspection protocols at receiving ports, but in the event that there is inadequate inspection coverage the USAF will coordinate with the USDA-WS to provide additional canine inspection teams that will augment quarantine and inspection protocols at the receiving ports. Appropriate stakeholders include, but are not limited to: the Service to ensure the inspections are adequate to reduce risks to trust resources, USDA-WS, receiving jurisdictions and their supporting agencies with expertise in invasive species control, and other inspection authorities as needed to ensure inspection methods are current and revised as new techniques, technology, or data become available."

Comparison: Similar statements in all three BOs.

2. Use of Snake-Free Quarantine Areas:

A. **MIRC BO** (FEB 2010)

Page 21, Sec. 1.1.2

"1.1.2 The USN will also establish snake-free quarantine areas for cargo traveling from Guam to CNMI and locations outside of the MIRC. These brown treesnake sterile areas will be subject to: (1) multiple day and night searches with appropriately trained interdiction canine teams that meet performance standards under 1.1.1.b; (2) snake trapping, and (3) visual inspection for snakes. Temporary barriers may be preferable to permanent exclosures because of the variable sizes needed for various training activities. The USN will produce standard operating procedures for temporary barrier construction and use. Standard operating procedures will ensure that temporary barriers will be constructed and maintained in a manner that assures the efficacy of the barrier tool and that staff maintaining and constructing the temporary barriers will receive training related to this activity prior to construction. Standard operating procedures will be developed in cooperation with the USFWS, U.S. Geological Survey Biological Resources Discipline, and the U.S. Department of Agriculture Wildlife Services to ensure risk to trust resources is adequately minimized. If risks are not adequately minimized, recommendations will be provided for incorporation into the protocols until the USN and USFWS mutually agree the risk has been minimized. The USFWS, USN, and other appropriate parties will meet, if necessary, to resolve concerns such that the protocols ensure risk is adequately minimized."

B. **JGPO BO** (SEP 2010)

Page 73, Sec. Biosecurity Measures Specific to Training Actions:

"5. the DoN will also establish snake-free quarantine areas for cargo traveling from Guam to the CNMI and other locations. These brown treesnake sterile areas will be subject to: multiple day and night searches with appropriately trained interdiction canine teams; snake trapping, and visual inspection for snakes. Temporary (i.e., movable) barriers may be preferable to permanent exclosures because of the variable sizes needed for various training activities. The DoN will use OPNAVINST 5090.10A for standard operating procedures for temporary barrier construction and use. Standard operating procedures will ensure that temporary barriers are constructed and maintained in a manner that assures the efficacy of the barrier tool and that staff maintaining and constructing the temporary barriers will receive training related to this activity prior to construction. Review of standard operating procedures will be conducted in cooperation with the USGS Biological Resources Discipline, and the USDA APHIS. The DoN and other appropriate parties will meet, if necessary, to resolve concerns such that the protocols ensure risk is adequately minimized;"

C. **DIVERT** (JUN 2013)

Page 12, Sec 2;

"2. The USAF will also establish snake-free quarantine areas (barriers) for cargo traveling from Guam to CNMI and other brown treesnake-free areas. These barriers will be subject to: (1) multiple day and night searches with appropriately trained interdiction canine teams that meet performance standards under 1b; (2) snake trapping; and (3) visual inspection for snakes. In lieu of permanent barriers, temporary barriers may be preferable to permanent exclosures because of the variable sizes needed to handle different cargo amounts for the various training activities. The USAF will produce standard operating procedures for temporary barrier construction and use within two years of the issuance of this Biological Opinion. Standard operating procedures will ensure that temporary barriers will be constructed and maintained in a manner that assures the efficacy of the barrier and that staff maintaining and constructing the temporary barriers will receive training related to this activity prior to construction. The construction and maintenance of temporary barriers utilized for cargo traveling from Guam to CNMI and other brown treesnake-free areas must be approved by the Service prior to use. During the construction phase of this project, the existing permanent snake-free quarantine area at the Saipan seaport should be utilized for surface cargo following relevant CNMI and DoD regulations. Standard operating procedures will be developed in cooperation with the Service, U.S. Geological Survey, Fort Collins Science Center, Invasive Species Science Branch, and the USDA-WS to ensure risk to trust resources is adequately minimized. If risks are not adequately minimized, additional recommendations will be provided for incorporation into the protocols until the USAF and Service mutually agree the risk has been minimized. The Service, USAF, and other appropriate parties will meet, if necessary, to resolve concerns such that the protocols ensure risk is adequately minimized."

Comparison: Similar statements in all three BOs. Divert BO however puts a timeline on developing temporary barrier SOPs (w/in 2 years) and also adds language on temporary barrier use during the Divert construction phase on Saipan.

3. Rapid Response Action Support/Assistance:

1. **MIRC BO** (FEB 2010)

"1.1.3. The USN will support rapid response actions to brown treesnake sightings within the CNMI and locations outside the MIRC (specifically Hawaii) by working with the U.S. Geological Survey Biological Resources Discipline to develop procedures and protocols that will support rapid action for a brown treesnake sighting. For example, USN personnel (civilian and uniform) could be trained to augment response teams on Guam and Hawaii or the USN may retain an agreement with trained, local pest control contractors that meet performance. USN will contact the Brown Treesnake Rapid Response Team Coordinator (Coordinator) on Guam (coordinates and runs the Rapid Response Training course) within 90 days of receiving the BO to request the course. The Coordinator arranges the training based on trainers and attendees."

2. **JGPO BO** (SEP 2010)

"c) assist existing federally-funded brown treesnake rapid response teams to enable coverage of each brown treesnake detection incident in CNMI and Hawaii. The DoN will support USGS Biological Resources Discipline to develop procedures and protocols that will support rapid response team actions for a brown treesnake detection incident. DoN personnel will be trained on rapid response procedures or the DoN may retain agreements with trained, local pest control contractors or cooperating partner agencies that would assist in the response actions. DoN support for rapid response actions would be subject to a Memorandum of Understanding that will be initiated within 180 days of the Record of Decision. Implementation of brown treesnake rapid response is currently provided for pursuant to the MIRC Biological Opinion. If the action is not funded pursuant to the MIRC Biological Opinion in the future, alternate sources of funding would be secured to ensure implementation of this rapid response conservation measure."

3. **DIVERT** (JUN 2013)

"3. The USAF, in conjunction with the Service and JRM, will develop procedures and protocols specific to Divert training events that will support a rapid response action in the event of a brown treesnake sighting resulting from Divert activities. Divert activities and exercises will be varied in the number of aircraft and personnel, and each event will have differing logistics support capabilities depending on the nature of the event. The type and amount of logistic support will be agreed to prior to each major event. Logistic support will include consideration of both in-kind assistance through air transport, shared billeting, security detail, food, materials, and ground transportation, and financial compensation for agreed-to response actions that could not be supported by in-kind assistance, including compensation for performance of services to support the deployment and execution of rapid response search teams."

Comparison: See table and statements below.

Difference among the BOs	**DIVERT BO**	**MIRC BO**	**JGPO BO**
Assist existing federally-fund BTS rapid response team			X
USAF w/ Service and JRM, will develop procedures and protocols…that will support a rapid response action	X		
Work w/USGS to develop procedures & protocols that will support rapid action for a BTS sighting		X	
Support USGS to develop procedures & protocols that will support rapid response team actions for a BTS detection incident			X
Support rapid response actions by USGS	X		
Rapid Response actions subject to an MOU			X
DoN personnel will be trained on Rapid Response or retain others			X
Example of support, USN could train personnel to augment response teams on Guam and Hawaii or retain others		X	
If MIRC does not fund rapid response, than JGPO will find other funds			X
Logistic support will include consideration of both in-kind assistance through air transport, shared billeting, security detail, food, materials, and ground transportation, and financial compensation for agreed-to response actions that could not be supported by in-kind assistance….	X		

The MIRC BO is vague in what Rapid Response support should be in working with USGS; the JGPO BO is a little more specific in saying, that they will support the USGS Rapid Response Team and draft an MOU, as well as saying DoN personnel will be trained in Rapid Response or to retain others.

The JGPO BO, above states: "If the action is not funded pursuant to the MIRC BO in the future, alternate sources of funding would be secured to ensure implementation of this rapid response conservation measure." This statement implies that MIRC was committed to providing funding some type of support for Rapid Response.

The Divert BO has the USAF committed to compensation for a rapid response action that occurs as a result of Divert activities.

USGS is currently funded by Office of Insular Affairs (OIA) for the USGS BTS Rapid Response Team to deploy to BTS sightings outside of Guam. There are local government personnel on Saipan, Tinian, Rota, and in Hawaii that have USGS BTS rapid response training. OIA also funds travel costs in some instances for local government personnel from the CNMI and Hawaii to attend the 3-week initial Rapid Response Training course and/or 1-week refresher course on Guam.

4. **<u>Work collaboratively with the Service & USDA-WS to implement the BTS Control Plan</u>**:

A. **MIRC BO** (FEB 2010)

Page 22, Sec 1.2;

"**1.2 DoD participation in the Brown Treesnake Control Plan**
1.2.1 The USN, working in collaboration with the USFWS, and U.S. Department of Agriculture Wildlife Services and Animal and Plant Health Inspection Service will decide how best to implement the Brown Treesnake Control Plan (BTS TWG 2009,37 pp.) relevant to MIRC activities."

B. **JGPO BO** (SEP 2010)

Page 73, Sec. <u>Biosecurity Measures Specific to Training Actions</u>:

"6. working in collaboration with the USDA APHIS, DoN will decide how best to implement the Brown Treesnake Control Plan (BTS TWG 2009, 37 pp.) relevant to DoD actions;"

C. **DIVERT** (JUN 2013)

Page 13, Sec. 4;

"4 . The USAF, working in collaboration with the Service, and USDA-WS, will decide how best to implement the Brown Treesnake Control Plan (BTS TWG 2009, 37 pp.) relevant to Divert activities. The USAF and Service must mutually agree on the Brown Treesnake Control Plan implementation."

Comparison: Almost identical statements in each BO.

5. BTS Awareness/Education Training:

A. **MIRC BO** (FEB 2010)

Page 22, Sec 1.2.2;

"1.2.2 The USN provides an environmental education program for new arrivals (see a through d, below). Additionally, the current environmental education program may be updated to provide more recent information to ensure each individual has the most up-to-date training.

a. All new service personnel will receive the "Area Training Welcome Aboard Brief."

b. Mandatory viewing of a brown treesnake educational video.

c. Pocket guides with brown tree snake information and personal inspection guidelines will be carried at all times.

d. Assurance that brown treesnake awareness extends from the chain of command to the individual military service member."

B. **JGPO BO** (SEP 2010)

No BTS awareness training stated in relation to training exercises.

C. **DIVERT** (JUN 2013)

Page 13, Sec. 5;

"5. The USAF will provide invasive species awareness training for all military and contractor personnel prior to all training activities. This would include a mandatory viewing of a brown treesnake educational video, distribution of pocket guides with brown treesnake information and personal inspection guidelines to be carried at all times, and assurance that brown treesnake awareness extends from the chain of command to the individual military service member."

Comparison: MIRC and Divert similar statements. No BTS awareness mentioned in JGPO in regards to training actions.

6. **Coordinate closely with Service, USDA-WS, and CNMI DLNR for planning training**:

A. **MIRC BO** (FEB 2010)

Page 23, Sec. 1.4

"1.4 Cooperative Development of Regional Training Standard Operating Procedures and Exercise Planning
The USN will invite the USFWS to participate in the development of regional standard operating procedures and exercise planning to" better meet invasive species management needs associated with MIRC training. Current procedures can be found in 5090.10A "Brown Tree Snake Control and Interdiction Plan" (USN 2005,28 pp.)."

B. **JGPO BO** (SEP 2010)

Page 74, Sec. Biosecurity Measures Specific to Training Actions:

"9. the DoN will invite the Service to participate in the development of regional standard operating procedures and exercise planning to better meet invasive species management needs associated with proposed training. Current procedures can be found in 5090.10A "Brown Tree Snake Control and Interdiction Plan" (DoN 2005, 28 pp.);"

C. **DIVERT** (JUN 2013)

Page 13, Sec. 6;

"6. Due to limited availability of inspectors, trained dogs, and quarantine facilities and equipment on Guam and the CNMI, the USAF will coordinate closely with the Service, U.S. Department of Agriculture, CNMI Department of Land and Natural Resources, and Joint Region Marianas staff responsible for managing their brown treesnake program, on planning for training activities on Saipan. The USAF, along with cooperating agencies, will identify the inspection and interdiction requirements for the Divert training, including the number of trained quarantine officers and dog detection teams required. The USAF will coordinate and consult with the Service on the inspection and interdiction requirements identified by the USAF, and the Service must concur with these requirements prior to the implementation of the exercise or training activity. The USAF, along with the cooperating agencies, will develop plans to ensure that inspection personnel are available and that all requirements can be met, and will identify the support that the USAF will need to provide for the inspections. Planning for training exercises generally begins months prior to implementation of an exercise, and planning for complex training that would require a substantial number of inspectors, quarantine areas, or other personnel or equipment for control and interdiction generally begins more than a year in advance. If adequate resources, such as trained inspectors and dog teams, are not available during training activities, training will not occur until resources are available."

Comparison: Almost identical statements for MIRC and JGPO, but Divert goes into more detail.

7. **Other similar language**:

A. MIRC BO (FEB 2010)

Page 22, Sec. 1.3.1;

"1.3.1 All personnel involved in MIRC training will adhere to DoD Instruction 5090.7, which calls for individual troops to be responsible for conducting self inspections to avoid potential introductions of invasive species to Guam and the CNMI. Troops will inspect all gear and clothing (e.g., boots, bags, weapons, pants) for soil accumulations, seeds, invertebrates, and vertebrates). The intent of this measure is to minimize the potential risks and subsequent effects associated with transport of troops and personnel to Guam and to CNMI from areas that contain species that are not native to terrestrial habitats within the MIRC (extra-MIRC travel). In addition, compliance with Instruction 5090.7 will be required for travel to and from training sites within the MIRC (inter-MIRC travel)."

B. JGPO BO (SEP 2013)

Page 73, Sec. 7;

"7. adherence to DoN Instruction 5090.7, which calls for individual troops to be responsible for conducting self inspections to avoid potential introductions of invasive species to Guam and the CNMI. Troops will inspect all gear and clothing (e.g., boots, bags, weapons, pants) for soil accumulations, seeds, invertebrates, and vertebrates. The intent of this measure is to minimize the potential risks and subsequent effects associated with transport of troops and personnel to Guam and to CNMI from areas that contain species that are not native to Guam and Tinian terrestrial habitats;"

C. DIVERT BO (JUN 2013)

Page 13, Sec 1;

"Prevention of Invasive Species Introductions and Spread

1. All personnel involved in Divert training will adhere to DoD Instruction 5090.10A and the 2005 Brown Treesnake Control and Interdiction Plan, which calls for individual troops to conduct self-inspections to avoid potential transport of brown treesnakes. Troops will inspect all personal gear and clothing (e.g., boots, bags, weapons, pants), hand-carried equipment and supplies and tent canvas. The intent of this measure is to minimize the potential risks and subsequent effects associated with transport of troops and personnel from Guam to the CNMI and other areas that do not have brown treesnakes."

Comparison: Similar statements, but Divert BO adds BTS reference in regards to personal self-inspection.

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0583
19 June 2014

Dr. Loyal A. Mehrhoff
Field Supervisor
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service
300 Ala Moana Blvd, Suite 3-122
Honolulu, HI 96825

RECEIVED
JUN 19 2014
U.S.FISH & WILDLIFE SVC
PACIFIC ISLANDS FWO
HONOLULU, HI 96850

Dear Dr. Mehrhoff:

SUBJECT: REINITIATION OF CONSULTATION FOR THE MARIANA ISLANDS RANGE COMPLEX (MIRC) ACTIVITIES, GUAM AND THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

This responds to your letter dated May 9, 2014 requesting additional information to augment the Navy's April 3, 2014 request to initiate consultation for activities analyzed in the Mariana Islands Training and Testing (MITT) Environmental Impact Statement within the Mariana Islands Range Complex.

Addendum #1 to the Biological Assessment of Military Training Activities in the Mariana Islands Training and Testing Study Area: Terrestrial Species and Habitats is provided as Enclosure (1) and fully responds to the seven issues outlined in your May 9, 2014 letter, including those discussed via email between our staffs on May 8, 2014 (Enclosure 2). A copy of the Marianas Training Manual (COMNAVMARIANAS Instruction 3500.4A, dated October 8, 2013) referenced in the Biological Assessment and Addendum #1 is provided on a CD-ROM for your use (Enclosure 3).

During a June 9, 2014 teleconference with Ms. Julie Rivers of my staff, your team requested that the Navy assist the USFWS in the efficient preparation of the Biological Opinion by providing a revised Biological Assessment in addition to the Addendum. The Navy agrees to provide a revised BA as soon as possible after receiving confirmation that consultation has been re-initiated. We hope that by providing the revised BA that USFWS might complete the consultation process prior to the statutory deadline.

Subj: REINITIATION OF CONSULTATION FOR THE MARIANA ISLANDS RANGE COMPLEX (MIRC) ACTIVITIES AFTER 2015, GUAM AND THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

We look forward to continuing to work with you through the consultation. For any questions regarding this consultation, please contact Ms. Julie Rivers (COMPACFLT 808-474-6391, julie.rivers@navy.mil) or Dr. Frans Juola (NAVFAC Pacific, 808-472-1433, frans.juola@navy.mil).

Sincerely,

C. M. HANSEN
Captain, CEC, USN
Deputy Fleet Civil Engineer

Enclosures:
1. Addendum #1 to the Biological Assessment of Military Training and Testing Activities in the MITT Study Area: Terrestrial Species and Habitats (two hard copies and two CD-ROM)
2. Email from Ms. Julie Rivers to Loyal Merhoff, USFWS (two hard copies and two CD-ROM
3. Marianas Training Manual (COMNAVMARIANAS Instruction 3500.4A, dated 8 October 2013 (CD-ROM only)

Copy to:
Commander, Joint Region Marianas (Rear Admiral Tilghman D. Payne) (w/encl 1 only on CD-ROM)
Ms. Kelly Ebert, CNO N45
National Marine Fisheries Service, Pacific Islands Regional Office (Mr. Michael D. Tosatto) (w/encl 1 only on CD-ROM)

2

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2014-F-0262
2009-F-0345

AUG 0 7 2014

Mr. L.M. Foster
Department of the Navy
250 Makalapa Drive
Pearl Harbor, Hawaii 96860

Subject: Reinitiation of Formal Consultation for the Mariana Islands Range Complex, identified as Mariana Islands Training and Testing Activities after 2015, Guam and the Commonwealth of the Northern Mariana Islands

This letter acknowledges the U.S. Fish and Wildlife Service's (Service) receipt of your June 19, 2014, letter and addendum to the Biological Assessment (BA) for the subject project. Your letter and addendum was in response to our letter dated May 9, 2014, requesting additional project information needed to reinitiate formal consultation under section 7 of the Endangered Species Act of 1973 as amended (Act) (16 U.S.C. 1531 *et seq.*). The consultation concerns the possible effects of the Mariana Islands Test and Training (MITT), a revision of the Mariana Islands Range Complex (MIRC) activities, on listed species in the Mariana islands.

On July 9, 2014, we met with Navy staff to discuss components of the addendum, including impacts to nightingale reed warbler (*Acrocephalus luscinia*) from the proposed training on Saipan, conservation measures to offset unavoidable impacts from proposed bombing activities, the proposed biosecurity measures, and proposed brown treesnake interdiction and control measures. On July 11, 2014, we received an email from your staff that provided different language on the biosecurity and brown treesnake measures from what we discussed at our July 9, 2014, meeting. We again met on July 17, 2014, to further clarify the proposed biosecurity and brown treesnake measures. Meanwhile, at a meeting on July 14, 2014, between Don Schregardus, Deputy Assistant Secretary of the Navy, and Robyn Thorson, Regional Director for the Service's Pacific Region, the Navy agreed to consider whether it could delay the MITT action for one year, while formal consultations for other, higher priority Navy actions were completed. Accordingly, on July 21, 2014, the Service informed your staff it would suspend discussions on reinitating consultation for MIRC/MITT until the Navy made a determination about the possible delay. Mr. Schregardus provided a response to Ms. Thorson via email

Mr. L.M. Foster Service File No. 2014-F-0262

on August 4, 2014, indicating that the Navy was unable to delay MITT and requested that the Service restart its review of the MITT BA, addendum, and related documentation.

Accordingly, on August 4, 2014, we began reviewing the MITT proposal again. The purpose of this letter is to inform you that all information required of you to reinitiate consultation has been provided or is otherwise accessible to us. We have assigned log number 2014-F-0262 to this consultation. We understand that you will provide an updated Biological Assessment that includes the additional information from the addendum, and as further discussed in our July meetings and email messages. We request that you provide the updated BA within one week upon receipt of this letter.

Section 7 allows the Service up to 90 calendar days to conclude formal consultation with your agency, and an additional 45 calendar days to prepare our biological opinion (unless we mutually agree to an extension). Given the uncertainty regarding whether the Navy would move forward with MITT or delay it one year, we have determined the date consultation was formally reinitiated for this project was August 4, 2014, with the receipt of the email from Mr. Schregardus. Therefore, we expect to provide you with our biological opinion no later than December 17, 2014. However, because there are certain aspects of the proposed action that are still under discussion, in particular the biosecurity and brown treesnake measures, please be aware that if we are unable to come to agreement on appropriate language, the scope and effect of this proposed action will expand greatly. At such time, we may suspend consultation until new information relating to the broader scope is provided to us, including describing any impacts the proposed action may have on other listed species not previously considered.

Although we are reinitating consultation on the MIRC/MITT proposed action at this time, during our July 9 and July 17 meetings, we agreed to continue to work together to develop appropriate language to address a variety of outstanding issues. We will be following up this letter shortly with an additional letter outlining the issues that require resolution. My staff will also be contacting your staff soon to schedule a meeting to continue our discussions.

As a reminder, the Endangered Species Act requires that after initiation of formal consultation, the Federal action agency may not make any irreversible or irretrievable commitment of resources that limits future options. This practice insures agency actions do not preclude the formulation or implementation of reasonable and prudent alternatives that avoid jeopardizing the continued existence of endangered or threatened species or destroying or modifying their critical habitat.

We appreciate the opportunity to assist you with the proposed project. If you have any questions or concerns about this consultation or the consultation process in general, please feel free to contact Kristi Young or Earl Campbell at 808-792-9400.

Sincerely,

Loyal Mehrhoff
Field Supervisor

2

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0822
14 Aug 2014

Dr. Loyal A. Mehrhoff
Field Supervisor
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service
300 Ala Moana Blvd, Suite 3-122
Honolulu, HI 96825

Dear Dr. Mehrhoff:

SUBJECT: REINITIATION OF CONSULTATION FOR THE MARIANA ISLANDS RANGE COMPLEX (MIRC) ACTIVITIES, GUAM AND THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Enclosed is the revised Biological Assessment (BA) of Military Training Activities in the Mariana Islands Training and Testing Study Area: Terrestrial Species and Habitats. This BA incorporates changes made in the BA Addendum #1 delivered on July 17, 2014 as well as other clarifications. Please see the Document Notes on page three of the PDF for an explanation on how the changes were made.

We look forward to continuing to work with you through the consultation. For any questions regarding this consultation, please contact Ms. Julie Rivers (COMPACFLT 808-474-6391, julie.rivers@navy.mil) or Dr. Frans Juola (NAVFAC Pacific, 808-472-1433, frans.juola@navy.mil).

Sincerely,

L. M. FOSTER
By direction

Enclosure: 1. BA of Military Training and Testing Activities in the MITT Study Area: Terrestrial Species and Habitats. Re-initiation of Consultation 2009-F-0345. Revised August 2014. (One hard copy and one CD-ROM)

Copy to:
Commander, Joint Region Marianas (w/encl on CD-ROM)
Regional Administrator, National Marine Fisheries Service, Pacific Islands Regional Office (w/encl on CD-ROM)
Chief, Naval Operations (N454) (w/o encl)

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DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
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PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N01CE1/0522
June 4, 2014

Ms. Lorilee T. Crisostomo
Director
Bureau of Statistics and Plans
P.O. Box 2950
Hagatna, Guam 96932

Dear Ms. Crisostomo:

In accordance with the Federal Coastal Zone Management Act (CZMA) and the National Oceanic and Atmospheric Administration regulations (15 C.F.R. § 930), the U.S. Navy submits the enclosed Federal Consistency Determination (CD) for proposed activities in the Mariana Islands Training and Testing (MITT) Study Area that have reasonably foreseeable coastal effects on Guam.

Based on the enclosed consistency assessment and the activities and analysis contained in the enclosed Draft Environmental Impact Statement/Overseas Impact Statement (DEIS/OEIS), the Navy finds that the proposed military training and testing activities are consistent to the maximum extent practicable with the enforceable policies of the Guam Coastal Management Program (GCMP).

We look forward to your timely review of and concurrence with the Navy's determination. If you have any questions on this matter, please contact Mr. John Van Name at (808) 471-1714 or john.vanname@navy.mil.

Sincerely,

L. M. FOSTER
By direction

Enclosures: 1. CZMA Consistency Determination for Guam
2. CD-ROM of the MITT DEIS/OEIS

Copy to: (w/o encls)
Chief of Naval Operations (N45)
Naval Facilities Engineering Command, Pacific (EV)
Commander, Joint Region Marianas

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Eddie Baza Calvo
Governor of Guam

Ray Tenorio
Lieutenant Governor

BUREAU OF STATISTICS & PLANS
SAGAN PLANU SIHA YAN EMFOTMASION
P.O. Box 2950 Hagåtña, Guam 96932
Tel: (671) 472-4201/3 Fax: (671) 477-1812

Lorilee T. Crisostomo
Director

AUG 2 9 2014

Mr. Larry M. Foster
Director,
U.S. Pacific Fleet Environmental Readiness Division
Department of the Navy
250 Makalapa Drive
Pearl Harbor, Hawaii 96860-3131

Greetings Mr. Foster:

Hafa Adai. The Bureau of Statistics and Plans' Guam Coastal Management Program has reviewed the Department of the Navy's Federal Consistency Determination (CD) for the proposed activities in the Mariana Islands Training and Testing (MITT) Study Area, Ref: 5090 Ser NO1CE1/0522, June 4, 2014.

The Proposed Action is to continue to conduct training and testing activities, which may include the use of active sonar and explosives, primarily in established operating and military warning areas of the MITT Study Area, including the pier-side sonar maintenance and testing in the Inner Apra Harbor, and land-based training activities at existing ranges and other training locations on Guam and the Commonwealth of the Northern Mariana Islands (CNMI). As we understand, "the proposed action is to ensure that the Navy accomplishes its mission to maintain, train, and equip combat-ready military forces capable of winning wars, deterring aggression and maintaining freedom of the seas."

Your letter indicates that the proposed military training and testing activities would not occur within Guam's "coastal zone" and therefore, are not subject to Guam's jurisdiction. It was acknowledged on the submitted consistency determination that certain Department of Defense (DoD) actions that occur on federal land could have reasonably foreseeable effects on coastal uses or resources subject to federal consistency review requirements. The MITT study area includes the existing Mariana Islands Range Complex (MIRC), additional areas on the high seas, and a general transit corridor between Hawaii to MITT where training and testing activities may occur and that the Mariana Island Range Complex (MIRC) is the only major Navy range complex in the study area. It states that the EIS/OEIS was prepared by the Navy to renew current regulatory permits and authorizations, address current training and testing not covered under existing permits and authorizations, and to obtain the permits and authorizations necessary to support force structure changes and emerging and future training and testing requirements including those associated with new platforms and weapons systems within the MITT Study Area starting in 2015, needed to ensure that critical DoD requirements are met. The MTT Study Area is composed of the established ranges at sea ranges and land based training areas in Guam and Commonwealth of the Northern Mariana Islands (CNMI), operating areas, and its special use airspace of the Mariana Islands Range Complex (MIRC), its surrounding seas, including a transit corridor outside the geographic boundaries of the MIRC.

Accordingly, the GCMP Resource Policies that will be affected by the Navy Activities are as follows:

RP1 – Air Quality: All activities and uses shall comply with all local air pollution regulations and all appropriate Federal air quality standards in order to ensure the maintenance of Guam's relatively high air quality. [10 GCA, Chapters 47-52; P.L. 25-152; P.L. 12-200, as amended by P.L. 20-147; P.L. 12-208].

- The foreseeable direct and indirect effect of military training and testing on Guam is in the increase of air pollutants on Guam's air quality that are considered minimal because the training and testing activities described in the MITT DEIS/OEIS will occur mostly offshore of Guam, beyond Guam's territorial boundaries.

- Training and testing activities for sulfur dioxide will be outside the nonattainment areas, such as CNMI, AAFB, Naval Base Guam Munitions Site, Naval Base Telecommunications Site and many other training locations in the Mariana Islands.

- Trace amounts of hazardous air pollutants emitted by combustion sources and use of ordinance during missile and target use are typically smaller in magnitude than emissions of air pollutants from large amounts of fuel, explosives, or those materials consumed during single activity or in one location.

The Navy indicates that because the emissions are intermittent and short-term, its effect is considered minimal with regards to any foreseeable direct or indirect effect on uses and other resources of the Guam coastal zone.

RP2. Water Quality- Safe drinking water shall be assured and aquatic recreation sites shall be protected through the regulation of uses and discharges that pose a pollution threat to Guam's waters, particularly in estuaries, reef and aquifer areas. [P.L. 12-200, as amended by P.L. 20-147; P.L. 24-161; P.L. 25-152; P.L. 26-32 as amended by P.L. 26-113].

- Most activities involving explosives and explosion by products would be conducted beyond the 3 nautical miles off Guam The reasonably foreseeable direct and indirect effects to the uses and resources of the Guam coastal zone from chemicals other than explosives would be minimal because of where these activities would be conducted and the very low concentrations of the chemicals in seawater.

- Based on the Navy's Comprehensive Water Quality Impact analysis of the proposed action, the potential impacts from training and testing activities could be associated with explosives and explosion by products, metals, chemicals other than explosives, and other material. The resulting concentrations in seawater are expected to be very low and not harmful to aquatic organisms.

- Military expended materials with metal components used in nearshore areas specifically designated for mine countermeasure and mine neutralization activities within Apra Harbor and Agat would be subject to State Sediment and Water Quality Standards and guidelines for metals.

RP3. Fragile Areas – Development in the following types of fragile areas including Guam's Marine Protected Areas (MPA) shall be regulated to protect their unique character. - Historical and archeological sites- wildlife habitats;- pristine marine and terrestrial communities; - limestone forests; - mangrove stands and other wetlands and coral reefs shall be regulated to protect their unique character[[P.L. 12-200, as amended by P.L. 20-147; P.L. 24-21; P.L. 27-87; E.O. 97-10].

Page **2** of **4**

- Completion of consultation requirements under Section 7(a)(2) of the ESA with U.S. Fish and Wildlife Service Pacific Islands Fish and Wildlife office for species on Guam.

- The Navy has determined that the proposed action may affect, but is not likely to adversely affect the Mariana fruit bat, Mariana swiftlet, and Mariana common moorhen because the military training and testing activities would not be conducted in the Guam National Wildlife Refuge in Ritidian.

- Implementation of mitigation measures described in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring of the MITT DEIS/OEIS to minimize impacts on terrestrial species and habitats.

- Protective measures will continue to be implemented for all military training and testing activities for all military installations on Guam as iterated in the Programmatic Agreement among the Guam Defense Representative; Commonwealth of the Northern Mariana Islands; Federated States of Micronesia and Republic of Palau; Joint Region Marianas; Commander, Navy Region Marianas; Commander, 36th Wing, Andersen Air Force Base; the Guam Historic Preservation Officer; and the Commonwealth of the Northern Marianas Islands Historic Preservation Officer.

RP4. Living Marine Resources – All living resources within the waters of Guam, particularly fish, shall be protected from over-harvesting and, in the case of corals, sea turtles and marine mammals, from any taking whatsoever. [10 GCA, Chapters 47-52; P.L. 25-152; P.L. 12-200, as amended by P.L. 20-147; P.L. 12-208, P.L. 28-107, P.L. 26-25, P.L. 24-21]

- The Navy will implement mitigation measures resulting from consultations with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service under Section 7 of the ESA for proposed action and will implement mitigation measures for sea turtles and corals in the marine environment resulting from the consultation.

- Most of the training and testing activities that involve stressors would be conducted intermittently and more than 3 nautical miles offshore, outside of the Guam coastal zone. Impacts from stressors to fish would be localized.

- Mitigation measures will be implemented resulting from the Navy's consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act for this training and testing activities. The foreseeable direct and indirect effects to the uses and resources of the Guam coastal zone from impacts to fish from military training and testing activities would be minimal.

- Terms and conditions of the Section 7 consultation between the Navy and the NMFS and U.S. FWLS will be reflected in the Record of Decision (ROD) for the MITT EIS.OEIS.

As noted, the NMFS offered conservation recommendations in accordance with the Essential Fish Habitat provision of the Magnuson-Stevens Fishery Conservation and Management Act (50 C.F.R. §600.905-930) to avoid and minimize impacts to EFH, as iterated in a letter addressed to you from the NMFS, Assistant, Regional Administrator, Habitat Conservation Director dated July 21, 2014. Additionally, the DOD Policy Statement on Executive Order 13089, Coral Reef Protection Implementation Plan states, "DOD has committed to protect U.S. and International coral reef ecosystems and to avoid impacting coral reefs to the maximum extent feasible." *USEPA Dec.12, 2013 letter to NAVFAC.*

RP7. Public Access - The public's right of unrestricted access shall be ensured to all non-federally owned beach areas and all Territorial recreation areas, parks, scenic overlooks, designated conservation areas and other public lands; and agreements shall be encouraged with the owners of private and federal property

Page **3** of **4**

for the provision of reasonable access to, and use of, resources of public nature located on such land. P.L. 12-200, P.L. 20-147, Seashore Protection Act, Territorial Beach Areas Act, Territorial Parks, Subdivision Law, Public Rights Provisions].

- No non-federally owned beach areas, recreational areas, parks, scenic overlooks, designated conservation areas, or other public lands will be affected by the proposed military activities. For security and safety reasons, public access normally allowed (by permit) within military installations may be temporarily curtailed during military training and testing activities and restored upon completion of the training and testing exercises.

Please note that on December 12, 2013, the Bureau provided the attached comments to the Department of Defense (DoD) for the preparation of EIS/OEIS for the MITT activities reviewed in the Mariana Islands Range Complex (MIRC) EIS/OEIS completed by the Navy. We feel that the issues and concerns we provided can be incorporated in the DOD preparation of the Final EIS/OEIS for the MITT.

Based on our review of the Department of the Navy's consistency determination, the Bureau fully understands that the DoD still has to maintain, train and equip the military forces as needed, to balance between protecting the environment and ensuring U.S. soldiers are trained. Therefore, we concur with the Navy consistency determination that the proposed military training and testing activities are consistent to the maximum extent practicable with the enforceable policies of the Guam Coastal Management Program, in accordance with the Coastal Zone Management Act of 1972, (P.L. 92-583) as amended (P.L. 94-370), 15 CFR Part 930 Federal Consistency Rules and Regulations. However, please note that this GCMP concurrence does not fully preclude the need to obtain other required Federal and Government of Guam concurrences, clearances/waivers and permit approvals.

Finally, we will appreciate receiving copies of the Final EIS when released. Please send a hard copy and an electronic copy to Edwin Reyes, Administrator of the Guam Coastal Management Program. Should you have further questions, please contact (671) 475-9672 or email:edwin.reyes@bsp.guam.gov. Si Yu'os Ma'ase and thank you for your attention.

Sincerely,

LORILEE T. CRISOSTOMO
Director

Enclosure: a/s

cc: GEPA
DoAg
DPR/GHPO
DLM
ACOE/R.Winn
Gov. Office/M. Calvo
NOAA-K. Kehoe/A. Loerzel
Navy/M.Cruz
OAG/J.Toft

DEPARTMENT OF THE NAVY
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PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0668
July 2, 2014

Ms. Fran Castro
Director
Division of Coastal Resources Management
CNMI Bureau of Environmental and Coastal Quality
Gualo Rai Center, Suite 201F
P.O. Box 501304
Saipan, MP 96950

Dear Ms. Castro:

In accordance with the Federal Coastal Zone Management Act (CZMA) and the National Oceanic and Atmospheric Administration regulations (15 C.F.R. § 930), the U.S. Navy submits the enclosed Federal Consistency Determination (CD) for proposed activities in the Mariana Islands Training and Testing (MITT) Study Area that have reasonably foreseeable coastal effects on the Commonwealth of the Northern Mariana Islands (CNMI).

Based on the enclosed consistency assessment and the activities and analysis in the enclosed Draft Environmental Impact Statement/Overseas Impact Statement (DEIS/OEIS), the Navy finds that the proposed military training and testing activities are consistent to the maximum extent practicable with the enforceable policies of the CNMI Coastal Resources Management Program (CRMP).

We look forward to your timely review of and concurrence with the Navy's determination. If you have any questions on this matter, please contact Mr. John Van Name at (808) 471-1714 or john.vanname@navy.mil.

Sincerely,

L. M. FOSTER
By direction

Enclosures: 1. CZMA Consistency Determination
2. CD-ROM of the MITT DEIS/OEIS

Copy to (w/o encls):
Naval Facilities Engineering Command, Pacific (EV)
Commander, Joint Region Marianas

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Commonwealth of the Northern Mariana Islands
OFFICE OF THE GOVERNOR
Bureau of Environmental and Coastal Quality
Division of Coastal Resources Management
P.O. Box 10007, Saipan, MP 96950
Tel: (670) 664-8300; Fax: (670) 664-8315
www.crm.gov.mp

Frank M. Rabauliman
Administrator

Frances A. Castro
Director

Mr. John Van Name
Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Re: Consistency Determination for MITT (letter 5090 Ser N01CE1/0523)

Dear Mr. Van Name:

The Commonwealth of the Northern Mariana Island's (CNMI) Division of Coastal Resources Management (DCRM) has received the U.S. Navy's Consistency Determination for the Mariana Islands Training and Testing (MITT) Study Area (letter: 5090 Ser N01CE1/0523). As we noted in our phone conversation on July 23rd 2014, the U.S. Navy's Consistency Determination is currently incomplete, as it does not address the *enforceable policies* of CRM. According to the federal regulations promulgated pursuant to the Coastal Zone Management Act (CZMA):

> The consistency determination shall include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the management program. The statement must be based upon an evaluation of the *relevant enforceable policies* of the management program. (italics added, 15 CFR § 930.39)

The current consistency determination addresses statutes listed in the CNMI's Coastal Resources Management Act. These statutes are largely directed towards the CNMI government and are precatory in nature. The enforceable policies of the CNMI can be found in the Coastal Resource Management Rules and Regulations, Chapter 15-10 of the Northern Mariana Islands Administrative Code (NMIAC), which can be accessed online at: http://www.cnmilaw.org/mediawiki-1.21.2/index.php?title=15-10

We have been discussing the CNMI's enforceable policies with the National Oceanic and Atmospheric Administration (NOAA). In order to be an enforceable policy under the CZMA, the policy must be approved by NOAA. As we discussed, we will be happy to provide you with further guidance regarding the CNMI's enforceable policies as soon as we have made a definitive determination as to which policies are applicable.

At a minimum, we request that the U.S Navy address the following sections of the regulations:

§ 15-10-310 Specific Criteria; Areas of Particular Concern (please note the Management Standards and Unacceptable Use Priorities for the various APCs).

§ 15-10-505 Specific Criteria for Major Sitings

After we receive the updated Consistency Determination, the 60 day review period shall commence. We greatly appreciate your assistance with this process. If you have any questions about this matter, please contact Megan Jungwiwattanaporn at (670) 664-8311 ext 225 or at megan.jungwi@crm.gov.mp.

Sincerely,

Richard Brooks
Acting Director
Division of Coastal Resources Management
Bureau of Environmental and Coastal Quality

Commonwealth of the Northern Mariana Islands
OFFICE OF THE GOVERNOR
Bureau of Environmental and Coastal Quality
Division of Coastal Resources Management
P.O. Box 10007, Saipan, MP 96950
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Frank M. Rabauliman
Administrator

Frances A. Castro
Director

September 4, 2014

Mr. John Van Name
Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Re: 15 Day Extension for MITT Consistency Determination (letter 5090 Ser N01CE1/0523)

Dear Mr. Van Name:

The Commonwealth of the Northern Mariana Island's (CNMI) Division of Coastal Resources Management (DCRM) received the U.S. Navy's Consistency Determination for the Mariana Islands Training and Testing (MITT) Study Area (letter: 5090 Ser N01CE1/0523) on July 8, 2014. DCRM is seeking the mandatory 15 day extension for review under 15 CFR § 930.41. This extension will give DCRM until September 19th, 2014 to review and respond to the MITT Consistency Determination.

DCRM and the Department of the Navy have held several discussions over the past month regarding DCRM's concerns that the July 8th consistency determination did not fully address the enforceable policies of the CNMI's Coastal Management Plan (CMP). The Navy has agreed to update its MITT Consistency Determination. Once DCRM has received the new Consistency Determination, we hope to negotiate with DOD a subsequent deadline to review and respond to the new Consistency Determination.

If you have any questions about this matter, please contact Megan Jungwiwattanaporn at (670) 664-8311 ext 225 or at megan.jungwi@crm.gov.mp.

Sincerely,

for Fran Castro
Director

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DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
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PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0926
Sep 9, 2014

Ms. Fran Castro
Division of Coastal Resources Management
CNMI Bureau of Environmental and Coastal Quality
Gualo Rai Center, Suite 201F
P.O. Box 10007
Saipan, MP 96950

Dear Ms. Castro:

SUBJECT: CONSISTENCY DETERMINATION FOR MILITARY TRAINING AND TESTING WITHIN THE COASTAL ZONE OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

In accordance with the Federal Coastal Zone Management Act (CZMA) and 15 C.F.R. § 930, the U.S. Navy submits the enclosed presumptive Federal Consistency Determination (CD) for proposed activities in the Mariana Islands Training and Testing (MITT) Study Area that have reasonably foreseeable coastal effects on the coastal zone of the Commonwealth of the Northern Mariana Islands (CNMI). The Navy originally submitted a CD to CNMI in July 2014. Thereafter, the Navy and CNMI Coastal Resources Management Program (CRMP) Office engaged in teleconference meetings and e-mail correspondence concerning the applicable enforceable polices of the CNMI CRMP. The enclosed CD is in accordance with those conversations. The Navy requested copies of public notices of NOAA's approval of the CNMI's enforceable policies required by 15 C.F.R. § 923.84(b)(4). This assessment presumes that required public notices have been published.

Based on the enclosed consistency assessment and the activities and analysis in the Draft Environmental Impact Statement/Overseas Impact Statement (DEIS/OEIS), the Navy finds that the proposed military training and testing activities are consistent to the maximum extent practicable with the presumptively enforceable policies of the CNMI CRMP.

We look forward to your timely review of and concurrence with the Navy's determination. If you have any questions on this matter, please contact Mr. John Van Name at (808) 471-1714 or john.vanname@navy.mil.

Sincerely,

L. M. FOSTER
By direction

Enclosure: 1. CZMA Consistency Determination for CNMI

Copy to: (w/o encl)
CNO (N454)
COMNAVAIRSYSCOM PATUXENT RIVER, MD (AIR-1.6)
COMNAVSEASYSCOM WASHINGTON, DC (SEA 04)
ONR (3220A)
NAVFAC PAC (EV)
COMMANDER JOINT REGION MARIANAS

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Frank M. Rabauliman
Administrator

Frances A. Castro
Director

October 7, 2014

Mr. John Van Name
Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Re. Federal Consistency Determination for Mariana Islands Training and Testing (MITT) Study Area (5090 Ser N465/0926)

Dear Mr. Van Name:

The Commonwealth of the Northern Mariana Island's (CNMI) has completed its review of the U.S. Navy's Federal Consistency Determination (CD) for the Mariana Islands Training and Testing (MITT) Study Area. The Navy originally submitted a CD to the CNMI in July 2014. Thereafter, the Navy and the CNMI Division of Coastal Resources Management (DCRM) engaged in teleconference meetings and e-mail correspondence concerning the applicable enforceable policies of the CNMI Coastal Resources Management Program. A revised CD was received by the CNMI on September 11, 2014 (letter 5090 Ser N465/0926).

After careful review of the revised Federal Consistency Determination (CD) and the Draft Environmental Impact Statement (DEIS) upon which it is based, DCRM finds that the proposed MITT activities are not consistent with the enforceable policies of the CNMI Coastal Management Program. Therefore, the CNMI cannot support the proposal as currently proposed by the Department of the Navy, without further mitigation of potential effects on the CNMI's coastal resources.

The Government of the CNMI recognizes the needs of the U.S. military and hopes to accommodate those needs in a manner that is consistent with the federally approved coastal management policies of the CNMI Coastal Management Program. We look forward to the opportunity to discuss our concerns and how the policies of the CNMI Coastal Management Program can be met as soon as possible.

1

I. How the Navy Could Be Consistent and Move Forward With the MITT

As outlined below, DCRM finds that the MITT is not consistent with the enforceable policies of the CNMI Coastal Management Program. In order to be consistent with the enforceable policies of the CNMI, the Navy needs to implement further monitoring and mitigation, including:

- **Fish**: Mitigate permanent effects to essential fish habitat areas from near-bottom explosions. Collect and share baseline data on fish species diversity and abundance within training area, including populations around Saipan, Farallon de Medinilla (FDM), Tinian, and Rota.

- **Birds**: Develop and implement a monitoring plan that assesses the effects of the MITT on endangered bird populations, including collecting population data for the Micronesian megapode, Mariana crow, and Rota bridled white-eyes throughout the MITT study area, including populations on Saipan, FDM, Rota, and Tinian

- **Marine Invertebrates**: Develop and implement a monitoring plan that assesses the presence and population of US Endangered Species Act listed corals in the MITT study area, including coral populations around FDM and Tinian. Share data with DCRM. Restrict testing and training activities, such as amphibious landings and activities that create vessel noise, during coral mass spawning events.

- **Marine Mammals:** Develop and implement a monitoring plan that assesses effects of the MITT to marine mammals, including collecting and analyzing population data over time. Data must be shared with DCRM.

- **Marine Vegetation**: Develop and implement a plan to identify and address any serious damage to seagrass that may occur. The plan should include a pre-assessment of seagrass coverage and health, survey the recovery of marine vegetation, and provide mitigation for damage to seagrass beds. Baseline and recovery data must be shared with DCRM.

- **Sea turtles**: Since the incubation period for green sea turtles is around 62 days, daily beach monitoring at least 60 days prior to beach landing activities should be required to ensure that all sea turtle nests are detected and impacts on nests are avoided. If sea turtle nests are detected, no military activity should occur in the vicinity of the nests for 70 days, until after the nests have hatched.

- **Terrestrial Species**: Develop and implement a monitoring plan that assesses effects of the MITT to the Mariana fruit bat, including collecting and analyzing population data of the Mariana fruit bat over time. Particular care should be given to avoid effects to the Mariana fruit bat population on Rota.

- **Farallon de Medinilla:** Address major erosion, mass wasting, and changes to landforms on certain areas of FDM through a detailed assessment of changes to FDM's landforms over time and the development of a model/projections that may predict future loss of land and mass wasting due to ongoing military activity. Data must be shared with DCRM. If historic analysis and future projections indicate significant changes to the physical character of FDM, DCRM requests development of a detailed mitigation plan, outlining actions that will minimize loss of any additional land.

- **Rota**: Among the islands included in the study area, Rota is the most pristine and provides critical habitat for endangered and threatened species including the Mariana crow, Rota white-eye, and Mariana fruit bat. Rota should be removed as a location for any activities.

- **Water Quality**: Develop and implement a monitoring plan to ensure water quality stays within CNMI standards. Include an assessment of bio-accumulation of toxins in marine life and localized effects within the monitoring plan, including an assessment of fish around Saipan, FDM, Tinian, and Rota.

II. Insufficient Information

The CNMI's Division of Coastal Resources Management finds that the Navy has not provided sufficient information necessary for complete and adequate analysis for multiple components of the proposed action. Further, the CD presumes the Preferred Alternative will go into effect, but does not provide sufficient evidence that an increase in operations will, in fact, have a "negligible" contribution to environmental stressors.

CZMA Section 930.37 of the Federal Consistency regulations provides that the DEIS can be used as a vehicle for a consistency determination, "[h]owever, a Federal agency's federal consistency obligations under the Act are independent of those required under NEPA and are not necessarily fulfilled by the submission of a NEPA document. DCRM appreciates that the updated CD addresses coastal effects not included in the last submission. As stated in the CD, "updates to the Final EIS/OEIS are included in this CZMA consistency determination", including mentions of an improved analysis of sedimentation on Tinian, clarifications on activities on Rota, and measures to protect endangered species (including sea turtles and sea birds) once the Section 7 Endangered Species Act (ESA) consultation between the Navy and the U.S. Fish and Wildlife Service is completed. Although these items are mentioned in the CD, they cannot be considered part of the CD as they have not yet been completed.

As outlined in Section IV of this letter, additional information is needed on the following in order to assess the consistency of the MITT with the CNMI enforceable policies:

- Cumulative impacts - the CD does not look at the cumulative impacts of the MITT with other military activities in the study area, including the divert airfield and the CJMT (§15-10-305and §15-10-505 of the CNMI's enforceable policies)

3

- Localized and long-term effects of water quality contamination on marine biota (§15-10-305)
- How testing and training will affect hazardous lands (§15-10-305)
- How testing and training will affect Anjota Island(§15-10-310)
- How testing and training will affect the Micronesian megapode, particularly on Saipan (§15-10-505)
- How testing and training will affect fish and fish habitat (§15-10-505)

The updated CD outlines the proposed increase in number of activities from the baseline number of activities analyzed in the 2010 Mariana Islands Range Complex (MIRC) EIS/OEIS. However there is little to no information on when these activities will occur, over what period of time the activities will take place, and whether these are separate or simultaneous activities for each location. It is impossible to evaluate the effects of the proposed activities without having these critical details.

DCRM holds that further mitigation measures are needed in addition to those mentioned in the DEIS/OEIS and looks forward to seeing the results of the Section 7 ESA consultation. In order to comply with the enforceable policies of the CNMI, further measures are needed to protect the wildlife and habitats of the CNMI (as outlined in Sections I and IV).

III. The Basis for Finding That the MITT is Consistent to the Maximum Extent Practicable Has Not Been Established

The Coastal Zone Management Act (CZMA) of 1972, 16 USC §§ 1451-1465, § 1456 (c)(1), and the Federal Consistency regulations, 15 CFR §§ 930.30-930.46, mandate that Federal agency activity with a reasonably foreseeable effect on the State's coastal zone must be consistent to the maximum extent practicable with the enforceable policies of the States' federally approved CZMA programs. Under 15 C.F.R. §930.32(a)(1), the standard for "consistent to the maximum extent practicable" means fully consistent with the enforceable policies of the CNMI's management programs unless full consistency is prohibited by existing law applicable to the Federal agency.

The Navy must show how existing law prohibits full consistency with the CNMI's Coastal Management Program. The Navy has not provided any description of any statutory provisions, legislative history, or other legal authority which limits the Navy's discretion to be fully consistent with the enforceable policies of the management program. Accordingly, for the reasons cited below, the proposed MITT is not fully consistent with the enforceable policies of the CNMI coastal management program.

IV. Consistency with Enforceable Policies

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The CNMI has determined the MITT is inconsistent with the enforceable policies of the CNMI Coastal Management Program in the following ways:

Part 300 – § 15-10-305, Standards for DCRM Permit Issuance: General Criteria

a) Cumulative Impact
...determine whether the added impact of the proposed project seeking a DCRM permit will result, when added to the existing use, in a significant degradation of the coastal resource

As noted above, although the DEIS/OEIS looks at the cumulative impacts of the various components of the MITT, it does not look at the cumulative impacts of the MITT in combination with other military activities within the study area. These activities include, but are not limited to, activities described in the Guam and CNMI Military Relocation FEIS/OEIS, Divert Activities and Exercises, Guam and CNMI DEIS, and the upcoming CNMI Joint Military Training DEIS/OEIS. If implemented, these activities will undoubtedly have cumulative effects on the CNMI's coastal resources.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

b) Compatibility
...determine, to the extent practicable, whether the proposed project is compatible with existing adjacent uses and is not contrary to designated land and water uses...

This section is addressed under Part 300, Areas of Particular Concern (APCs). DCRM needs further information on the effects the MITT will have on Rota's APCs.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

c) Alternatives
...determine whether or not a reasonable alternative site exists for the proposed project.

As stated in the CD, "The Navy has assessed reasonable alternatives to training and testing locations" as described in Chapters 1 and 2 of the DEIS/OEIS. The CNMI understands that the MITT Study Area is strategically important for military training and testing. However, it is unclear why the military training and testing operations must be spread out over several islands. The Department of the Navy should consider and explain why testing and training cannot be consolidated to fewer areas in order to minimize environmental impact. In particular, Rota could be removed as a location for proposed terrestrial activities in order to protect its pristine habitat.

Conclusion: Inconsistent – the Navy should consolidate activities to fewer areas in order to minimize environmental impact.

d) Conservation

...determine, to the extent practicable, the extent of the impact of the proposed project...on its watershed and receiving waters, marine, freshwater, wetland, and terrestrial habitat, and preserve, to the extent practicable, the physical and chemical characteristics of the site necessary to support water quality and living resources.

The CD states that "When considered together, the impact of the four stressors (explosive byproducts, metals, chemicals other than explosives, and other military expended materials) would be additive". The Navy maintains that "changes in sediment or water quality would not be detectable", however the CD and the DEIS/OEIS appear to overly rely on dilution and settling of contaminants to keep water quality impacts within water quality standards. The CD includes the following reasons for its no-effect conclusion: "military expended materials and activities are widely dispersed in space and time throughout the MITT study area", "When multiple stressors occur at the same time, it is usually for a brief period", and "potential areas of negative impacts would be limited to small zones".

However, the localized effects of such contaminants could adversely affect many forms of marine biota, potentially harming resources utilized by local stakeholders. The DEIS/OEIS continually mentions that effects to water quality would be short in duration, yet there is no in-depth discussion about possible long-term effects as a result of secondary impacts to the environment, such as sedimentation and bio-accumulation. A study by Woodley and Downs (2014) investigated whether munitions compounds or their breakdown products impact corals. The study found that all nine munitions compounds (six nitrotoluene compounds, RDX, HMX, and Picric acid) tested had some level of toxicity. Further, studies by Denton et al (2010) show bio-accumulation of toxins such as mercury, arsenic, and PCBs in fish caught in Saipan Lagoon.

Further, the CD does not address the effects the MITT will have on FDM. Satellite imagery and oblique photographs show there have been significant changes to the morphology of FDM, apparently through mass wasting along the eastern cliff lines. The land bridge on FDM shows significant signs of mass wasting on the eastern side. The southern end of FDM also shows a recent sea cave collapse. The total loss of land mass on FDM since bombing commenced must be presented.

Although FDM is a federally leased island, testing and training on FDM could lead to spillover effects. DCRM is particularly concerned with the effects of proposed ordinance use on FDM on mass wasting, vegetation loss, erosion, and sedimentation. Both Alternative 1 and Alternative 2 include substantial increases in explosive detonations on

FDM over the current level of activities (the no action alternative). These activities could lead to loss of habitat for migratory birds, while sedimentation could affect habitat for migratory fish.

DCRM requests that baseline data and ongoing monitoring be provided in order to assess the localized and long-term effects of water quality contamination on marine biota.

Conclusion: Inconsistent – the Navy should consider localized and long-term effects of water quality contamination, and provide baseline and monitoring data.

e) Compliance with Local and Federal Law

...require compliance with Federal and CNMI laws, including, but not limited to, air and water quality standards, land use, Federal and CNMI constitutional standards, and applicable permit processes necessary for completion of the proposed project

As outlined throughout this letter, DCRM finds that the MITT is not consistent with the enforceable policies of the CNMI Coastal Management Program. However, further mitigation of potential effects could bring the MITT in line with the CNMI's enforceable policies. The CNMI hopes to discuss possible mitigation efforts going forward and looks forward to the results of the Section 7 ESA consultation between the Navy, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service.

Conclusion: Inconsistent – MITT activities do not comply with local laws as outlined throughout this letter.

f) Right to a Clean and Healthful Environment

Projects shall be undertaken and completed so as to maintain and, where appropriate, enhance and protect the Commonwealth's inherent natural beauty and natural resources, so as to ensure the protection of the people's constitutional right to a clean and healthful environment.

Section f of § 15-10-305 appears to not have been included in the CD. DCRM holds, until shown otherwise, that the MITT will not "maintain and, where appropriate, enhance and protect the Commonwealth's inherent natural beauty and natural resources" (NMIAC, § 15-10-305).

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

g) Effect on Existing Public Services

Activities and uses which would place excessive pressure on existing facilities and services to the detriment of the Commonwealth's interests, plans and policies, shall be discouraged.

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The CD states that: "The Proposed Action has no effect on existing public services within the CNMI coastal zone." DCRM concurs with this statement.

Conclusion: Consistent

h) Adequate Access

...determine whether the proposed project would provide adequate public access to and along the shoreline.

The updated CD states that: "The Proposed Action does not hinder public access to anywhere within the CNMI coastal zone. Public access will only be affected on Navy leased lands within the CNMI."

Historically significant and coastal public-use areas are located in and near the shoreline in the Military Lease Area on Tinian and public access to these areas and beaches for recreation and fishing remain a concern. DCRM is likewise concerned that the cumulative impacts from a combination of activities proposed in this DEIS/OEIS with other military activities in the region could limit public access to these important cultural areas. DCRM recognizes that these areas do not fall within the CNMI's Coastal Management Program. However *The Covenant to Establish a Commonwealth of Northern Mariana Islands* and the *Technical Agreement Regarding Use of Land to Be Leased by the United States in the Northern Mariana Islands* state that closures for military maneuvers will be "kept to a minimum". Further information regarding the closures, including a schedule of such closures is requested.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

i) Setbacks

...determine whether the proposed project provides adequate space between the project and identified hazardous lands including floodplains, erosion-prone areas, storm wave inundation areas...

The CD states that: "There is no construction associated with the Proposed Action; therefore, there is no requirement for setbacks." DCRM concurs with this statement.

Conclusion: Consistent

j) Management measures for control of nonpoint source pollution

...determine if the selected management measures are adequate for the control of nonpoint source pollution resulting from project construction, operations, and maintenance...

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The CD states that: "Standard operating procedures for spill prevention and waste management are included in Chapter 5 of the MITT EIS/OEIS and are also specified in the Mariana Islands Training Manual (COMNAVMARIANSASINST 3500.4A), dated 13 October 2013." It is unclear from Chapter 5 of the EIS/OEIS what the procedures for spill prevention and waste management are. Further, DCRM does not have a copy of the Mariana Islands Training Manual. DCRM requests more information on the control of nonpoint source pollution.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

Part 300 – § 15-10-310, Standards for DCRM Permit Issuance: Specific Criteria/Area of Particular Concern

- **Lagoon and Reef APC (general)**
  The CD states that: "MITT activities within the CNMI coastal zone do not hinder use categories considered high priority"; further, "Nor do MITT activities that would occur within the CNMI coastal zone contribute to unacceptable uses".

  Under the CNMI's enforceable policies, "Unacceptable" uses for the Lagoon and Reef APC include:
  A) discharge of untreated sewage, petroleum products, or other hazardous materials
  C) destruction of coralline reef matter not associated with permitted activities and uses
  D) dumping of trash, litter, garbage or other refuse into the lagoon, or at a place on shore where entry into the lagoon is inevitable

  The MITT plans to discharge hazardous materials (explosive byproducts, chemicals) and dump military expended materials into the Study Area (as outlined under 'DEQ Water Quality Standards'). Corals may be impacted by testing and training activities, particularly around Tinian. Although activities may be restricted to federally leased waters, hazardous materials could travel to CNMI waters and negatively affect wildlife and habitat therein.

  Conclusion: Inconsistent due to discharge of hazardous materials and military expended materials.

- **Lagoon and Reef APC (Anjota Island)**
  The CD states that amphibious raid activities will occur on Anjota Island located off of the island of Rota. The CD claims that these activities and use of Anjota Island's offshore areas will "not hinder activities that are considered high priority categories" or "contribute to the unacceptable activities identified in the regulations". However, no information has been provided to DCRM so that DCRM can assess the effects on its own. In the DEIS/OEIS, listed potential impact concerns for amphibious raids include: vessel noise, weapons firing noise, vessel strike, vehicle strike (pedestrian), and physical disturbance (coral, sea-turtle nests). The only mention of Anjota (Angyuta in the

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DEIS/OEIS) is a brief line under the 'Cultural Resources' section stating that there are no historic properties on Angyuta.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

- **Port and Industrial APC (Rota, Tinian, Saipan)**
  The CD notes that "Some training activities may occur within port and industrial areas of Rota" and that these activities "may include intelligence, surveillance, reconnaissance training, urban warfare training, and amphibious raid training at Anjota Island and Song Song Village". No information has been provided to DCRM so that DCRM can assess the effects on its own in either the CD or the DEIS/OEIS. It is unclear whether or how the MITT will affect port activities or wildlife within the Anjota Preserve.

  Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

Part 500- Standards for Determining Major Siting: Specific Criteria
Under the CNMI's enforceable policies, a "major siting" is defined as "any proposed project which has the potential to directly and significantly impact coastal resources" including "proposed projects with potential for significant adverse effects on submerged lands, ...reefs, wetlands, beaches and lakes...and endangered or threatened species or marine mammal habitats" (§15-10-020(jj)). As outlined below, DCRM believes the MITT could have significant adverse effects on the CNMI's coastal resources.

a) **Project Site Development (§15-10-505)**
The proposed project site development shall be planned and managed so as to ensure compatibility with existing and projected uses of the site and surrounding area.

The CD states that: "The Proposed Action does not include construction of any kind; therefore, there are no site development activities."DCRM concurs that the project complies with this particular enforceable policy.

Conclusion: Consistent

b) **Minimum Site Preparation (§15-10-505)**
Proposed projects shall, to the extent practicable, be located at sites with pre-existing infrastructure, or which require a minimum of site preparation

The CD states that: "Training activities that occur on land require minimal or no site preparation." DCRM concurs that the project complies with this particular enforceable policy.

Conclusion: Consistent

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c) Adverse Impact on Fish and Wildlife (§15-10-505)
The proposed project shall not adversely impact fragile fish and wildlife habitats, or other environmentally sensitive areas

The MITT Study Area is home to several threatened and endangered species that may be adversely affected by the proposed action, including the green sea turtle, hawksbill turtle, a number of endangered bird species, the Mariana fruit bat, and several marine mammals.

- **Effects on Marine Mammals (§15-10-505 (c))**

According to the CD: "Potential impacts of the Proposed Action on marine mammals could be attributed to acoustic, energy, physical disturbance and strike, entanglement, ingestion, and secondary stressors. Under the [Marine Mammal Protection Act] MMPA, training and testing activities that involve the use of sonar, other active acoustic sources, and explosives may result in Level A harassment, Level B harassment, or mortality of certain marine mammals".

DCRM is concerned about the effects the MITT will have on marine mammals and requests further mitigation measures so as to better protect the habitats and wildlife in and around the CNMI. One option, previously suggested by the CNMI Governor, is the creation of habitat protection areas which will exclude portions of the MITT Study Area from training and testing activities so as to better protect wildlife. Of absolute importance is an additional effort to acquire monitoring data on the effects of the MITT to marine mammal populations, and to share this data and any ensuing reports with the CNMI government.

The DEIS/OEIS also reports that: "Starting in 2015, specific allocation of monitoring effort (research objectives, studies, and focus) within the Study Area will be included in a monitoring plan to be developed in cooperation with NMFS." (3.4.5.1) DCRM requests that data and reports developed through this monitoring effort be shared with DCRM.

- **Effects on Sea Turtles (§15-10-505 (c))**

The CD states that "Impacts of the Proposed Action may contribute to sea turtle mortality, injury, or short-term disturbance or behavioral modification. Mortality or injury could be caused by underwater explosions or vessel strikes." Further, "Amphibious vehicles used on Tinian during amphibious warfare activities may potentially strike sea turtles on the beach or crush buried nests." DCRM is encouraged to see that the updated CD addresses effects to sea turtles. The DEIS/OEIS does not discuss effects on nesting sea turtles on the beaches of Tinian, nor was it clear from Chapter 5 of the DEIS/OEIS what mitigation measures are in place for effects from amphibious vehicles.

The updated CD does note that "measures were not included in Chapter 5 of the Draft EIS/OEIS, but will be added to the Final EIS/OEIS once the Section 7 ESA consultation between the Navy and the U.S. Fish and Wildlife Service is completed." DCRM requests increased protection for the sea turtles on Tinian and proposes longer periods of beach monitoring prior to implementation of training activities. The CD states that "pre-exercise surveys for presence of sea turtles no more than six hours prior to an exercise" will occur. This is not enough time to ensure that there are no nests on the beach as nests are visible only for a very short time after initial egg-laying. The incubation period for the green sea turtles is around 62 days, daily beach monitoring at least 60 days prior to the beach landing activities should be required to ensure that all nests are detected.

Effects on Birds (§15-10-505 (c))

The CD states that:

- "the ESA-listed species Mariana common moorhen and the Micronesian megapode, may be impacted by military training on Tinian from acoustic (explosives and weapons firing, launch and impact noise), and physical (ground disturbance, aircraft and aerial target strike, military expended materials, and wildfires) stressors"
- "The Micronesian megapode, the nightingale reed-warbler...occur in the Marpi Maneuver Area in Saipan"
- "The Navy has determined that training activities on Rota would have no effect on the ESA-listed *Serianthesnelsonii*, *Osmoxylonmariannense, Nesogenesrotensis,* or Rota bridled white-eye. "

DCRM is concerned with inconsistencies and the lack of up-to-date data in the DEIS/OEIS that the CD is based on. Section 3.6.1.5 states that: "Not all of the land areas within the MITT Study Area are included for analysis for potential impacts on seabirds and shorebirds.... Rota is excluded from the analysis because training activities on Rota occur in urban and developed settings, such as urban warfare exercises. Saipan is also not included in the analysis for seabirds and shorebirds, although this island supports occasional land training. The area identified for land training activities is the Marpi Maneuver Area, and it does not contain aquatic or marine habitats or terrestrial roosting habitats for seabirds or shorebirds."

The CD notes that the Micronesian megapode, listed as endangered under the US Endangered Species Act, does occur in the Marpi Maneuver Area in Saipan. More information on the effects of testing and training on the Micronesian megapode in Saipan is requested along with mitigation measures undertaken to protect this ESA listed species.

DCRM is also concerned that testing and training will negatively affect marine birds on Rota. Activities by low-flying (<3000 ft. above sea level) aircraft, including unmanned aircraft, over Rota may negatively affect nesting Mariana crows and Rota white-eyes, as a result of aircraft noise, vibration and fuel exhaust. DCRM recommends avoiding such activities on Rota.

Finally, although FDM is a federally leased island, the MITT could cause spillover effects. FDM is an important rookery location for a number of marine birds including black noddies, brown noddies, brown boobies, masked boobies, red-footed boobies, white terns, and great

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frigate birds. These birds are migratory; MITT activities on FDM would likely lead to fewer birds traveling to other islands in the CNMI.

The CD notes several times that conservation measures are included in the Section 7 ESA consultation package submitted to the U.S. Fish and Wildlife Service. DCRM looks forward to seeing further mitigation in the Record of Decision for the MITT FEIS/OEIS once the Section 7 ESA consultation between the Navy and US FWS has concluded. DCRM requests that more monitoring is conducted and that data is shared with DCRM. Monitoring should include collecting population data and assessing population changes over the course of MITT activities, including an assessment of bird populations on Saipan, FDM, Tinian, and Rota.

Effects on Marine Vegetation (§15-10-505 (c))

The CD states: "Other marine resources, such as marine invertebrates, marine vegetation, fish, and marine habitats may be impacted by various stressors described in the MITT DEIS/OEIS. Terrestrial flora and fauna may also be impacted by the Proposed Action, which includes land training activities on Tinian, Saipan, Rota, and FDM."

Section 3.7 of the DEIS/OEIS repeatedly states that impacts to marine vegetation (including seagrasses) from increased turbidity would be minor. However, there are also potential impacts from vessel, anchor, or propeller strikes to seagrass beds. These actions could cause more serious damage through the uprooting of seagrass, with a much longer recovery period. The section even cites a study by Dawes et al. (1997) which reported recovery times of up to 10 years. A plan must be put into place to identify and address any serious damage that may occur, survey the recovery of marine vegetation, and provide mitigation for damage to seagrass beds.

Effects on Marine Invertebrates (§15-10-505 (c))

The CD states that: "Marine invertebrates, including corals, may be impacted by military training and testing activities in and around Tinian from multiple stressors"; however, "the incremental contribution of these stressors…was determined to be negligible". Although the increase in activities proposed under Alternative 1 may be incremental, DCRM notes that the cumulative effects on coral reefs over time may be severe. Further, although much of the proposed training occurs on federally leased lands, damaging corals on leased lands could have spillover effects, as coral reefs provide important habitat for wildlife (e.g. fish, coral larvae) that travel outside of leased lands and into the CNMI coastal zone.

Under Alternative 1 and Alternative 2, the DEIS/OEIS correctly states that "*Non-intermittent noise from testing activities (e.g., vessel noise) could mask reef noise. If this noise source overlapped with the larval settlement period, recruitment of larvae onto a reef habitat may be altered*". Disruptions in coral recruitment processes could result in population declines and shifts in community composition (Hughes and Tanner 2000), which is clearly inconsistent with a conclusion of no adverse effects of active acoustic sources on the coral species proposed for ESA listing. Military testing and training activities that may mask reef noise or otherwise create noise pollution in the vicinity of coral reefs should be limited

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around annual coral mass spawning events. For Sections 3.8.3.1.2.2 and 3.8.3.3.1.2, these activities should not take place during the spawning periods for corals or soft corals.

Amphibious assaults and amphibious raids are proposed for Una Babui and Una Chulu, in the northwest of Tinian and Unai Dankulo in the northeast of Tinian. Although these beaches are on federally leased lands, damaging corals near these beaches could have damaging spillover effects, as coral reefs provide important habitat for wildlife (e.g. fish, coral larvae) that travel outside of leased lands and into the CNMI coastal zone. The near shore areas associated with these beaches are characterized by medium to medium-high habitat complexity and relatively high coral cover and diversity (Brainard et al. 2012). Baseline biological surveys need to be conducted in these areas to determine the presence and abundance of the coral species proposed for listing under the ESA. Amphibious assaults and raids should not occur in areas where these species are present or during annual coral spawning events. Near shore areas used for amphibious assaults and raids need to be monitored for acute and long term effects of increased turbidity, propeller wash, incidental strikes and other physical damage caused by vessels, bottom-crawling unmanned underwater vehicles and towed devices.

Further, the CD does not address affects to the coral reefs around FDM. Although FDM is a federally leased island, damaging the coral reefs surrounding FDM could result in spillover effects. The reefs around FDM provide habitat to fish and wildlife that travel in and out of FDM's coast. DCRM requests monitoring of coral abundance and the effect the MITT has on fish populations traveling in and out of FDM's coastal zone.

Effects on Fish (§15-10-505 (c))

The CD states that "Fish and fish habitats may be impacted by military training and testing in and around Tinian from multiple stressors", however, with mitigation measures "the Proposed Action is consistent to the maximum extent practicable". It is unclear from Chapter 5 of the DEIS/OEIS what these mitigation measures will be. There is no mention in the CD of how military actions will affect fish around the islands of Saipan, FDM, or Rota.

In the DEIS/OEIS, Section 3.9.4 "Summary of Potential Impacts on Fish" states that: "Navy research and monitoring efforts include data collection through conducting long-term studies in areas of Navy activity, occurrence surveys over large geographic areas, biopsy of animals occurring in areas of Navy activity, and tagging studies where animals are exposed to Navy stressors. These efforts are intended to contribute to the overall understanding of what impacts may be occurring overall to animals in these areas". The DEIS/OEIS does not state where these studies occurred, and whether they were in the study area. DCRM requests that these studies be cited and made available for review.

In light of Section 3.9.3.1.1.1 "*Direct Injury Explosives and Other Acoustic Sources*", DCRM requests that fish killed as a result of training activities are collected for sampling. This would provide local agencies with useful baseline data on species diversity and abundance within the affected areas.

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In Section 3.9.3.4.2 "*Impacts from decelerators/parachutes*" the number of parachutes released is a concern. The DEIS/OEIS states that decelerators/parachutes are rare. But the number of expended parachutes would amount to greater than 5,000, which could cause hazards to fish populations including entanglement and damage to habitat.

Section 3.3.3.1.2 states near-bottom explosions in non-living essential fish habitat areas (EFHA) will be permanent but minimal. Permanent impacts should be mitigated.

Effects on Terrestrial Species (§15-10-505 (c))

The updated CD states that on Rota: "the Navy has determined that potential acoustic impacts associated with aircraft overflights may affect, but would not adversely affect, the Mariana crow and Mariana fruit bat".

The Mariana fruit bat (*Pteropusmariannus mariannus*) is listed as threatened or endangered under the CNMI DFW regulations and as threatened under the US Endangered Species Act. The Mariana fruit bat can be found on Saipan, Tinian, FDM and Rota within the MITT study area. The Rota Mariana fruit bat population has become increasingly important for recovery as bats on Guam have nearly disappeared. DCRM is particularly concerned that testing and training on Rota could have a detrimental effect on the Mariana fruit bat population as the Mariana fruit bat is extremely sensitive to disturbance events. More evidence is needed to show that acoustic impacts would not affect the Mariana fruit bat at the population level.

Conclusion – Inconsistent, due to effects on marine mammals, sea turtles, marine birds, vegetation, marine invertebrates, fish, and terrestrial species.

d) Cumulative Environmental Impact (§15-10-505)

The proposed project site shall be selected in order to minimize adverse primary, secondary, or cumulative environmental impacts.

As noted above, although the DEIS/OEIS looks at the cumulative impacts of the various components of the MITT, it does not look at the cumulative impacts of the MITT with other military activities in the study area. These activities include, but are not limited to, activities described in the Guam/CNMI relocation, divert airfield, and the CJMT.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

e) Future Development Options (§15-10-505)

The proposed project site shall not unreasonably restrict the range of future development options in the adjacent areas.

The CD states that "any reasonably foreseeable effects would not hinder future development in adjacent areas". The MITT could negatively affect adjacent wildlife and habitat, which in turn, could negatively affect the tourism industry which relies heavily on the CNMI's natural resources.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

f) Mitigation of Adverse Impact (§15-10-505)

Whenever practicable, adverse impact of the proposed project on the environment shall be mitigated. Mitigation shall include the incorporation of management measures for control of nonpoint source pollution.

The CD repeatedly mentions the Section 7 ESA consultation between the Navy and the U.S. Fish and Wildlife Service. DCRM looks forward to the mitigation efforts resulting from these consultations. Currently, the measures listed in Chapter 5 of the DEIS/OEIS include: lookouts to spot marine mammals and sea turtles, avoiding precision anchoring as well as mine countermeasure and neutralization activities within 350 yards of shallow coral reefs, live hard bottom, artificial reefs, and shipwrecks. These mitigation measures do not do enough to protect the habitats and wildlife within the MITT Study Area in order to comply with § 15-10-305 (d)(f) and § 15-10-505(c).

One option, previously suggested by the CNMI Governor, is the creation of habitat protection areas which will exclude portions of the MITT Study Area from training and testing activities so as to better protect wildlife. Of absolute importance is an additional effort to acquire monitoring data, and to share this data and any ensuing reports with the CNMI Government.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

g) Cultural-historic and Scenic Values (§15-10-505)

Consider siting alternatives that promote the Commonwealth's goals with respect to cultural-historic and scenic values.

The CD states that training and testing activities will not occur in areas of historical and cultural significance in Saipan or Rota. On Tinian, there are resources eligible to be on the National Register of Historic places within the Military Lease Area. DCRM recognizes that these areas are in the Military Lease Area and do not fall within the CNMI's Coastal Management Program. The CNMI does appreciate continued access to these areas and hopes the military will continue to allow access to these important cultural areas.

Conclusion: Consistent

h) Watershed Conservation (§15-10-505)

In regard to site development...avoid development, to the extent practicable, of areas that are particularly susceptible to erosion and sediment loss; preserve areas that provide important water quality benefits and/or are necessary to maintain riparian and aquatic biota and/or protect to the extent practicable the natural integrity of water bodies and natural drainage systems.

The CD states that, "The Proposed Action does not include construction of any kind; therefore, no areas will be disturbed in the coastal zone that would be susceptible to erosion and sediment loss." Although the MITT will not include construction, DCRM is concerned that the MITT will include activities that could increase erosion and sediment loss. DCRM requests further information to ensure that there is no erosion or sediment loss due to MITT activities.

Conclusion: Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.

DEQ Water Quality Standards: Classification and Establishment of Water Use Areas and Specific Water Quality Criteria (Chapter 65-130)

The CD organizes the MITT's water quality effects into the following categories: explosives and explosive byproducts, metals, chemicals, and other materials. The CD and DEIS/OEIS rely largely on dilution and settling of contaminants to keep water quality impacts within water quality standards. DCRM is concerned about localized effects and the possibility of bio-accumulation of toxins in marine life. DCRM requests ongoing monitoring of localized effects and bio-accumulation in wildlife in order to assess these effects.

DCRM is also concerned with the effects of ordinance use on FDM on mass wasting, vegetation loss, erosion, and sedimentation. Although FDM is a federally leased island, testing and training on FDM could lead to spillover effects. Coral reefs could be negatively impacted by sedimentation. Wildlife that travel in and out of FDM and are dependent on reefs for habitat could also be affected.

In Table 4 of the CD, the Navy reports that all water quality standards will be adhered to. DCRM requests baseline and ongoing monitoring to ensure this remains true as military activities expand in the region.

Conclusion: Inconsistent – the Navy should consider localized and long-term effects of water quality contamination, and provide baseline and ongoing monitoring data.

V. Conclusion

In order for the Commonwealth to reconsider its finding, the Department of the Navy will need to modify its MITT proposal to mitigate impacts on CNMI coastal resources, wildlife and habitats. DCRM's list of suggested measures can be found in Section I, page 2 of this letter. Implementing the measures listed would bring the MITT within the enforceable policies of the CNMI. DCRM, however, remains open to discussing specific measures and alternatives proposed by the Navy. The CNMI recognizes the needs of the U.S. military and looks forward to discussing ways the MITT can become consistent with the CNMI's enforceable policies.

If you have any questions about our position, please contact Megan Jungwiwattanaporn, Federal Consistency Specialist, Division of Coastal Resources Management, at 670-664-8311 or megan.jungwi@crm.gov.mp.

Sincerely,

for Fran Castro
Director, DCRM

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DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/1301
Dec 17, 2014

Ms. Fran Castro
Director
Division of Coastal Resources Management
CNMI Bureau of Environmental and Coastal Quality
Gualo Rai Center, Suite 201F
P.O. Box 10007
Saipan, MP 96950

Dear Ms. Castro:

SUBJECT: CONSISTENCY DETERMINATION FOR MILITARY TRAINING AND TESTING ACTIVITIES WITHIN THE COASTAL ZONE OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

In accordance with the Federal Coastal Zone Management Act (CZMA) and 15 C.F.R. § 930, this letter responds to your October 7, 2014 review of the U.S. Navy's consistency determination for military activities within the Commonwealth of the Northern Mariana Islands (CNMI) coastal zone proposed in the Mariana Islands Training and Testing (MITT) Draft Environmental Impact Statement/Overseas Impact Statement.

In your letter, you found that the proposed MITT activities are not consistent with the enforceable policies of the CNMI Coastal Management Program and provided notice of your objection to the Director for the Office of Coastal Management under 15 C.F.R. § 930.43(c). Although the 90-day notice period expired on December 9, 2014, we have appreciated working with your office in that time and would like to continue to resolve our differences under 15 C.F.R. §930.43(d).

In the Navy's consistency determination, the MITT Proposed Action was analyzed in reference to the enforceable policies of the CNMI Coastal Management Program and the Navy concluded the Proposed Action is consistent to the maximum extent practicable with those policies. The additional information provided in Enclosure 1 should effectuate CNMI's concurrence with that

SUBJECT: CONSISTENCY DETERMINATION FOR MILITARY TRAINING AND TESTING ACTIVITIES WITHIN THE COASTAL ZONE OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

determination. Please provide your response to the enclosed information by January 15, 2015.

We appreciate your continued support. If you have any questions on this matter, please contact Mr. John Van Name at (808) 471-1714 or john.vanname@navy.mil.

Sincerely,

L. M. FOSTER
By direction

Enclosure: 1. Supplemental information to Support CZMA Consistency Determination for CNMI

Copy to (w/o encl):
CNO (N454)
COMNAVAIRSYSCOM PATUXENT RIVER, MD (AIR-1.6)
COMNAVSEASYSCOM WASHINGTON, DC (SEA 04)
ONR 3220A
NAVFAC PAC (EV)
COMMANDER, JOINT REGION MARIANAS

ENCLOSURE 1:

Coastal Zone Management Act
Consistency Determination for the
Commonwealth of the Northern Mariana Islands

Supplemental Information to Support the U.S. Navy's Consistency Determination for Military Training and Testing within the Coastal Zone of the Commonwealth of the Northern Mariana Islands

Submitted to:

Commonwealth of the Northern Mariana Islands
Coastal Resources Management Office
Gualo Rai Center, Suite 201F
Saipan, MP 96950

Submitted by:

Commander, United States Pacific Fleet
Department of the Navy
250 Makalapa Drive
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DECEMBER 2014

Coastal Zone Management Act
Consistency Determination for the
Commonwealth of the Northern Mariana Islands

Supplemental Information to Support the U.S. Navy's Consistency Determination for Military Training and Testing within the Coastal Zone of the Commonwealth of the Northern Mariana Islands

Document Notes:

1. Scientific names are listed at first appearance; the common names are used thereafter.
2. Units are provided as English units followed by metric units parenthetically.
3. Suggested Citation:
   U.S. Department of the Navy. (2014). *Supplemental Information to Support the U.S. Navy's Consistency Determination for Military Training and Testing within the Coastal Zone of the Commonwealth of the Northern Mariana Islands.* Prepared for Commander, U.S. Pacific Fleet and Naval Facilities Command Pacific by SRS-Parsons Joint Venture. Contract Number N68711-02-D-8043, Task Order 85. December 2014.

INTRODUCTION

This document provides the Commonwealth of the Northern Mariana Islands (CNMI) Bureau of Environmental and Coastal Quality (BECQ), Division of Coastal Resources Management (DCRM) with supplemental information to support the United States (U.S.) Department of the Navy's (Navy's) Consistency Determination under the Coastal Zone Management Act (CZMA) § 307(c)(1) and 15 C.F.R. Part 930, Subpart C, for the Commonwealth of the Northern Mariana Islands (CNMI) portion of the Proposed Action described in the Mariana Islands Training and Testing (MITT) Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS/OEIS).

Supplemental information contained in this document is provided in response to comments received from the CNMI dated October 7, 2014. The CNMI DCRM raised concerns regarding the following regulations cited from the CNMI administrative code:

- Part 300 – § 15-10-305, Standards for CRM Permit Issuance: General Criteria,
- Part 300 – § 15-10-310, Standards for CRM Permit Issuance: Specific Criteria/Area of Particular Concern,
- Part 500- Standards for Determining Major Siting: Specific Criteria, and,
- DEQ Water Quality Standards: Classification and Establishment of Water Use Areas and Specific Water Quality Criteria.

This document provides the CNMI DCRM conclusions presented in the 7 October 2014 letter with the Navy's responses, presented in the context of the CNMI administrative code language.

Part 300 – § 15-10-305, Standards for CRM Permit Issuance: General Criteria

(a) Cumulative impacts. *"The CRM Administrator and CRM agency officials shall determine the impact of existing uses and activities on coastal resources and determine whether the added impact of the proposed project seeking a CRM permit will result, when added to the existing use, in a significant degradation of the coastal resources. Consideration shall include potential coastal nonpoint source pollution, watershed setting, and receiving waters of the watershed in which a project is situated."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: The added impact of the MITT activities, when added to the existing uses, will not result in a significant degradation of the coastal resources. It should be noted that significant changes in activity levels within the CNMI coastal zone are not being proposed in the MITT EIS/OEIS. DCRM asks the Navy to consider the cumulative impacts of MITT in combination of other military activities within the Study Area, including Guam and CNMI Military Relocation EIS/OEIS and CNMI Joint Military Training EIS/OEIS. While these proposed activities are not appropriate for discussion under this standard as they are not "existing uses and activities", the Navy has considered the Guam and CNMI Military Relocation EIS/OEIS and CNMI Joint Military Training EIS/OEIS in the cumulative effects analysis in the MITT DEIS. Subsequent sections of this response do address existing activities, with particular attention to point and nonpoint source pollution, watershed setting, and receiving waters.

(b) **Compatibility.** *"The CRM Administrator and CRM agency officials shall determine, to the extent practicable, whether the proposed project is compatible with existing adjacent uses and is not contrary to designated land and water uses being followed or approved by the Commonwealth government, its departments or agencies."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: DCRM asks for further information on the effects of MITT activities on Rota's Areas of Particular Concern. Rota is not a primary training and testing area. Most military readiness activities described in the MITT EIS/OEIS would occur on Guam and to a lesser extent within the Tinian military leased area (MLA). The military readiness activities proposed for Rota are shown in Figure 1 and are listed in Table 1 of the Navy's original CD submission. Figure 1 illustrates that proposed military readiness activities on Rota would be restricted to developed areas, outside the critical habitats and conservation areas. All military readiness activities conducted on Rota are coordinated with CNMI and local authorities (e.g., local mayor's office, local law enforcement). Additional communication is provided to the CNMI Military Integration Management Committee (MIMC) via the DoD Joint Region Marianas (JRM).

In addition, the Navy is consulting with U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) on potential impacts of the proposed military readiness activities on threatened and endangered species. Conservation measures resulting from the ESA Section 7 consultations to minimize, avoid, or offset impacts associated with military readiness activities will be implemented. These conservation measures will be formalized in the USFWS Biological Opinion and will be included in the Final MITT EIS/OEIS and Record of Decision (ROD).

(c) **Alternatives.** *"The CRM Administrator and CRM agency officials shall determine whether or not a reasonable alternative site exists for the proposed project."*

CNMI Conclusion: *Inconsistent – the Navy should consolidate activities to fewer areas in order to minimize environmental impact.*

Navy Response to CNMI: Rota and Saipan are not primary training locations and are infrequently used; however, they do provide unique capabilities due to the close proximity of the Marpi Maneuver Area to Saipan based reserve units and Rota's capability to support Special Forces and Humanitarian Relief training. As discussed above, Figure 1 shows that proposed military readiness activities on Rota would be restricted to developed areas, outside the critical habitats and conservation areas. In addition, pre-coordination with local authorities and the CNMI as well as adherence to conditions outlined in the pending USFWS Biological Opinion will ensure that training events can be conducted without any adverse environmental impacts.

(d) **Conservation.** *"The CRM Administrator and CRM agency officials shall determine, to the extent practicable, the extent of the impact of the proposed project, including construction, operation, maintenance and intermittent activities, on its watershed and receiving waters, marine, freshwater, wetland, and terrestrial habitat, and preserve, to the extent practicable, the physical and chemical characteristics of the site necessary to support water quality and living resources."*

CNMI Conclusion: *Inconsistent – the Navy should consider localized and long-term effects of water quality contamination, and provide baseline and monitoring data.*

Navy Response to CNMI: DCRM expresses concern over long term effects to water quality standards and spillover effects from FDM. Spillover effects into the CNMI's coastal zone from military readiness activities are highly unlikely. Military readiness activities that result in expended materials or involve explosives are conducted offshore or at FDM and Guam, outside of the CNMI coastal zone. Surface currents around the Mariana Archipelago are heavily influenced by the Northern Equatorial Current, driven by the northeast and southeast trade winds and predominantly westward, and would generally carry expended materials away from the archipelago. Other information that limits the potential for spillover effects into the CNMI coastal zone are discussed below.

The Navy has conducted annual marine ecological surveys of near shore marine resources at FDM between 1999 and 2012 (no survey was conducted in 2011). A report detailing the findings of these marine ecological surveys and providing baseline monitoring information specific to FDM is available at: *http://mitt-eis.com/DocumentsandReferences/EISDocuments/SupportingTechnicalDocuments.aspx*. This information has also been added to the Final EIS/OEIS in Section 3.1.3.1.5.3 (FDM Specific Impacts).

This area of marine habitat has been utilized for many years for military readiness activities. The conclusions for FDM water quality impacts do not rely on assumptions of dilution and settling; rather, the conclusions are drawn from direct observations of the marine environment surrounding FDM.

Based on these surveys, there is no evidence that long-term adverse impacts to the nearshore environment have taken place as a result of military readiness activities. These findings are based on the number of detectable impacts, the size of those impacts, and the apparent recovery time for the resource to recover. Impacts to the physical environment clearly attributable to military readiness activities were noted in 2007, 2008, 2010, and 2012. Indirect impacts, such as ordnance skipping or eroding off of FDM and rock and ordnance fragments blasted off of the island, were detected in every survey year:

> *"Although some damage can be directly attributed to ordnance impacts, natural factors also contribute to the changes. Examination of photographs from 1944 indicates that changes in the geologic structure of the island by erosion and mass wasting have been going on for decades."*[1]

The ecological surveys completed in 2004 were completed shortly after Typhoon Ting Ting, which passed through the Mariana Islands in June 2004 and afforded an opportunity to observe damage to the island and nearshore environment of FDM from typhoons. Observations of fresh coral branch breakages, fresh boulder/rock slides, and submerged exposure of bright yellow-

[1] U.S. Department of the Navy. (2013). Calendar year 2012 assessment of near shore marine resources at Farallon de Medinilla, Commonwealth of the Northern Mariana Islands. Prepared by Stephen H. Smith, Donald E. Marx, Jr., & Lee H. Shannon. Project Number: 16940-57-001001

orange patches of underlying rock were attributed to concussive force of waves generated by Typhoon Ting Ting. Ecological surveys completed in 2005 noted that disturbed sites in 2004 showed no color differences with surrounding undamaged areas and new small (less than 3 cm) scattered colonies of coral and crustose coralline algae. By 2006 and observed again through 2012, no visual evidence of abnormalities, damaged, or diseased coral could be detected.

Further, no new submerged cliff blocks were observed between 2005 and 2012. Small to medium size fresh rock fragments (generally less than 1 ft. [30 cm]) have been observed yearly and are attributed to detonation impacts. In 2007, the first clear indication of a detonation of a bomb on the seafloor was observed. The impact area was measured to be approximately 100 square feet (9 square meters). During the subsequent survey in 2008, the impact area supported new growth of stony corals and crustose algae; by 2009, no trace of the disturbance could be detected by the surveyors. It should be noted that the vast majority of unexploded ordnance observed in the water lacked fins and tail assemblies, which indicates that the ordnance either skipped or ricocheted off of the island or were eroded or washed off of FDM at a later date.

Based on these direct observations of impacts off the coast of FDM, the majority of disturbances to the seafloor sediments, substrates, and mass wasting of FDM can be attributed to typhoons and storm surges. Further, damage attributed to military readiness activities was temporary as evidenced by recovery within 2 to 3 years at the same rate of damage associated with natural phenomenon. The ecological surveys have also monitored water quality indicators that have been associated with diminished water quality in other locations. For instance, high densities of macrobioeroders (e.g., boring sponges), bleaching of corals, surface lesions, or dead patches on stony corals or stony coral mucus production have been associated with sedimentation, pollutants, or other stressors that diminish water quality.[2,3,4] A moderate bleaching event was noted in 2007 and a barnacle infestation was noted in 2012 (U.S. Department of the Navy 2013a). The bleaching event was regional and extended from southern Japan through the Mariana Islands and south through waters surrounding Palau. Subsequent surveys observed soft and fire corals had recovered completely and 75 percent of the stony corals had recovered by 2008.

Throughout all ecological surveys, the coral fauna at FDM were observed to be healthy and robust. The nearshore physical environment and basic habitat types at FDM have remained unchanged over the 13 years of survey activity. These conclusions are based on (1) a limited amount of physical damage, (2) very low levels of partial mortality and disease (less than 1 percent of all species observed), (3) absence of excessive mucus production, (4) good coral recruitment, (5) complete recovery by 2012 of the 2007 bleaching event, and (6) a limited number of macrobioeroders and an absence of invasive crown of thorns starfish (*Acanthaster*

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[2] Riegl B. M. (1995). Effects of sand deposition on Scleractinian and Alcyonacean corals. *Marine Biology, 121,* 517-526.

[3] Wild, C. (2005). Influence of Coral Mucus on Nutrient Fluxes in Carbonate Sands. *Mar Ecol Prog Ser, 287,* 87-98.

[4] Cooper, T. F. (2008). Temporal Dynamics in Coral Bioindicators for Water Quality on Coastal Reefs of the Great Barrier Reef. *Marine Freshwater Resource, 59*, 703-716.

planci). **These factors suggest that sedimentation that may result from military use of FDM is not sufficient as to adversely impact water quality or fish habitat.**

Further, Navy protective measures in place on FDM protect against the loss of migratory bird habitat. Measures that require avoidance of targeting cliffs and restricting naval ship gunnery from firing towards the eastern cliff face are specifically designed to minimize impact to migratory bird habitat.

(e) Compliance with Local and Federal Laws. *"The CRM Administrator and CRM agency officials shall require compliance with federal and CNMI laws, including, but not limited to, air and water quality standards, land use, federal and CNMI constitutional standards, and applicable permit processes necessary for completion of the proposed project."*

CNMI Conclusion: *Inconsistent – MITT activities do not comply with local laws as outlined throughout this letter.*

Navy Response to CNMI: The Navy is in compliance with all applicable federal and CNMI law and will continue to be in compliance of federal and CNMI law with the implementation of MITT activities. The Navy is confident that the information provided in this document will assure CNMI that the Navy is consistent to the maximum extent practicable with the enforceable policies of the CNMI Coastal Management Program.

(f) Ensuring Access to Clean and Healthful Environment. *"Projects shall be undertaken and completed so as to maintain and, where appropriate, enhance and protect the Commonwealth's inherent natural beauty and natural resources, so as to ensure the protection of the people's constitutional right to a clean and healthful environment."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: The Navy's determination regarding subsection (f) was inadvertently left out of the Navy's CD submission. As discussed above, the military readiness activities included in the MITT EIS/OEIS will not spillover into the coastal zone and will not restrict citizens' access to a clean and healthy environment on the CNMI. Further, these activities would not harm the aesthetic value of the environment as most activities would be short on duration, occur far offshore, occur on leased lands within the CNMI, or in locations coordinated with local authorities and the CNMI via the MIMC. **(g) Effect on Existing Public Services.** *"Activities and uses which would place excessive pressure on existing facilities and services to the detriment of the Commonwealth's interests, plans and policies, shall be discouraged."*

CNMI Conclusion: *Consistent.*

(h) Adequate Access. *"The CRM Administrator and CRM agency officials shall determine whether the proposed project would provide adequate public access to and along the shoreline."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: The military will avoid restricting public access to popular beaches and historic areas on Tinian as much as practicable without impacting military readiness activities. For example, during the recently completed training exercises within the Tinian MLA, Able Runway was avoided and training activities were concentrated on the Baker Runway. This was done to continue public access to the historical areas within the lease area. The military coordinates with the local mayor (e.g., Tinian mayor) if closure cannot be avoided. Military readiness activities that occur within the CNMI but outside of military lease areas are conducted in cooperation with local authorities and the MIMC. All other military readiness activities are conducted on federal lands not within the CNMI coastal zone or in coastal waters that would not be closed from public access.

(i) Setbacks. *"The CRM Administrator and CRM agency officials shall determine whether the proposed project provides adequate space between the project and identified hazardous lands including floodplains, erosion-prone areas, storm wave inundation areas, air installation crash and sound zones and major fault lines unless it can be demonstrated that such development does not pose unreasonable risks to the health safety, and welfare of the people of the Commonwealth, and complies with applicable laws."*

CNMI Conclusion: *Consistent.*

(j) Management Measures for Control of Nonpoint Source Pollution. *"The CRM Administrator and CRM agency officials shall determine if the selected management measures are adequate for the control of nonpoint source pollution resulting from project construction, operations and maintenance, including intermittent activities such as repairs, routine maintenance, resurfacing, road or bridge repair, cleaning, and grading, landscape maintenance, chemical mixing, and other nonpoint sources."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: The Navy provides guidance to commanders and exercise planners to ensure that hazardous materials and solid wastes are handled in an environmentally responsible and sustainable manner. Environmental staff personnel from JRM, Naval Base Guam, and Andersen AFB support proper materials handling during the planning and execution phases of planned exercises. All Navy shore installations, ships, and air detachments comply with hazardous materials and hazardous waste management requirements of OPNAVINST 5090.1 series of instructions[5].

Major exercises within the Marianas are required to reduce the use of hazardous materials, and storage of hazardous materials must occur in proper storage areas lined with impervious barriers within a central storage areas away from catch basins, storm drains, and waterways with clear label protocols. Spill prevention and control measures are also required, which include spill prevention and control plans, collection points, assurance of final disposition by host commands, segregation and labeling at collection points, accountability of hazardous

[5] The most recent iteration of OPNAVIST 5090.1 series instruction is M-5090.1D, dated 10 January 2014. The instruction may be accessed at: http://doni.daps.dla.mil/SECNAV%20Manuals1/5090.1.pdf

materials through the use of applicable Material Safety Data Sheets (MSDS) or Hazardous Material Information Sheets (HMIS) for each material, handling and packaging protocols for personnel and training requirements. Exercise planners are also required to include provisions for wastewater (black water)/human waste, such as portable toilets or field facilities accessible at all training sites. Solid waste generated during exercises is deposited in waterproofed containers (such as tri-wall containers) with collection points determined prior to the initiation of the exercise. Lithium batteries are considered dangerous at all times and are handled as hazardous waste with proper disposal protocols (burying is prohibited and batteries are transported to the Conforming Storage Facility on Naval Base Guam). Before leaving a training site, units are required to ensure that all occupied areas have been inspected for cleanliness including proper closing and marking of field latrines and drainage systems, and training areas have been cleared of all stores, equipment and refuse.

As demonstrated by the above summary of the various requirements for units to reduce the potential for point and non-point source pollution, the Navy is consistent to the maximum extent practicable with this regulation.

Part 300 – § 15-10-310, Standards for CRM Permit Issuance: Specific Criteria/Area of Particular Concern

Lagoon and Reef APC (general).

CNMI Conclusion: *Inconsistent due to discharge of hazardous materials and military expended materials.*

Navy Response to CNMI: As stated above (see discussions in item (d) Conservation), spillover effects into the CNMI's coastal zone from military readiness activities are unlikely. Military readiness activities that result in expended materials are conducted offshore, are widely dispersed throughout the Study Area, and are outside of the APCs and CNMI coastal zone. Furthermore, the unlikelihood of spillover effects is supported by the dynamics of the Northern Equatorial Current. Also, at-sea and ashore environmental protections limit or avoid the potential for hazardous materials to enjoin with sediments and be deposited as non-point source and point source pollution. Discussions on direct observations of reef conditions surrounding FDM are also included above. In summary, these factors reduce to the maximum extent practicable any potential impacts on the Lagoon and Reef APC within the CNMI coastal zone.

Lagoon and Reef APC (Anjota Island).

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: The activities that would occur within the Lagoon and Reef APC (Anjota Island) would be infrequent and would not be intrusive or impair this APC. If the Navy schedules amphibious raid exercises within this APC, it is done so in cooperation with the Mayor's Office on Rota, local law enforcement, and the CNMI MIMC.

An amphibious raid on Rota would be a short event lasting 4 to 8 hours, occurring day or night (typically during the darkest part of the night), and would be characterized by its speed, stealth, and the minimum number of forces required to carry out the mission. A well planned and executed raid on Rota would typically go unnoticed and undetected. A typical amphibious raid carried out on Rota may involve a limited number of small craft in the near shore area that would come ashore under cover of darkness. Amphibious Raid for Rota would not involve the use of LCAC, LCU, or amphibious assault vehicles (AAV) to conduct beach landings.

Raid forces for Rota would typically involve few personnel (e.g., enough to fill a rubber raiding craft) and will not involve live fire munitions. Although exercises are designed with the minimum number of personnel to meet training requirements, larger raid exercises are possible. For example, a company-size amphibious group would include approximately 150 personnel, but this level of training would be extremely infrequent and would require careful coordination with the municipality during the exercise planning stage. Since it is standard operating procedure to avoid underwater obstructions such as coral, and highly illuminated areas, raid forces would avoid any landing area where coral cannot be avoided or where landings are highly illuminated. Anjota Island offers one potential site on Rota that may support amphibious raid events as described above.

Port and Industrial APC (Rota).

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: The Navy's CD and Figure 1 (included in this document) include a list of activities that could occur on Rota. Activities that could occur within the Port and Industrial APC (Rota) include amphibious raids (described above), as well as other activities that involve very few personnel in pedestrian reconnaissance activities. These are non-intrusive activities that are limited to potential training areas shown in Figure 1. If the Navy schedules amphibious raid exercises within this APC, it is done so in cooperation with the Mayor's Office on Rota, local law enforcement, and the CNMI MIMC.

Part 500- Standards for Determining Major Siting: Specific Criteria

(a) Project Site Development. *The proposed project site development shall be planned and managed so as to ensure compatibility with existing and projected uses of the site and surrounding area.*

CNMI Conclusion: *Consistent.*

(b) Minimum Site Preparation. *Proposed projects shall, to the extent practicable, be located at sites with pre-existing infrastructure, or which require a minimum of site preparation.*

CNMI Conclusion: *Consistent.*

(c) Adverse Impact on Fish and Wildlife. *"The proposed project shall not adversely impact fragile fish and wildlife habitats, or other environmental sensitive areas."*

CNMI Conclusion: *Inconsistent due to effects on marine mammals, sea turtles, marine birds, vegetation, marine invertebrates, fish, and terrestrial species.*

Navy Response to CNMI: As demonstrated below, MITT activities will not adversely impact fragile fish and wildlife habitats, or other environmentally sensitive areas.

Marine Mammals: The Navy is requesting a letter of authorization (LOA) from the NMFS under MMPA for potential impacts on marine mammals. The Navy is also consulting with NMFS and FWS under Section 7 of the ESA for potential impacts on threatened and endangered marine species from military readiness activities. The Navy implements mitigation measures during military readiness activities to reduce or avoid potential impacts on marine resources (e.g., marine mammals, sea turtles). Table 1 provides a summary of the mitigation measures implemented by the Navy to reduce or avoid potential impacts on marine resources.

The Navy has been implementing a marine species monitoring plan for military readiness activities since 2010 which is comprised of marine mammal and sea turtle monitoring throughout the MITT Study Area. The Navy annually reports these monitoring efforts to National Marine Fisheries Service. Marine species monitoring efforts are designed to track compliance with take authorizations, evaluate the effectiveness of mitigation measures, and improve the understanding of the effects of military readiness activities on marine resources. Marine species monitoring reports explaining annual efforts conducted in the MITT Study Area are posted on *www.navymarinespeciesmonitoring.us/reading-room/pacific/*.

Sea Turtles: The Navy is consulting with NMFS (for marine species) and USFWS (for terrestrial species) under Section 7 of the ESA for potential impacts on threatened and endangered species from military readiness activities. Conservation measures specific to beach monitoring or other training restrictions resulting from these consultations to minimize, avoid, or offset impacts associated with military readiness activities will be included in the Final EIS/OEIS and ROD. Navy will ensure all measures outlined in the NMFS and USFWS Biological Opinions are implemented.

Birds: Activities on Saipan that may occur within the Saipan Marpi Maneuver Area would not occur within limestone forest areas (habitat for the Micronesian megapode). During the ESA Section 7 consultation between the Navy and the USFWS, the Navy requested, and received, locations of megapodes observed within the Marpi area. These detections were located just below Suicide Cliffs in intact limestone forest to the south and west of the Marpi Maneuver Area. This same habitat extends across the road into the southwestern portion of the maneuver area; however, this area is not used for training. On Rota, aircraft operations are prohibited within a 1,000 ft. horizontal and vertical buffer on the surface and coastline of Rota, with the exception of normal approaches and takeoffs that may occur at the Rota International Airport and combat search and rescue training activities based out of the airport.

The Navy has designed conservation measures in cooperation with USFWS for ESA-listed species, as well as for non-ESA listed seabird species to minimize the effects on FDM. These measures are listed below:[6]

- The Navy will continue to implement targeting and access restrictions, such as: (1) no targeting of the northern Special Use Area (north of the No Fire Line shown in Figures 2 and 3) and no targeting of the narrow land bridge, (2) only targeting Impact Areas 1, 2, and 3 during air-to-ground bombing exercises and air-to-ground missile and gunnery exercises and Impact Area 1 (closest to the northern Special Use Area) is for inert ordnance only, and (3) personnel are not authorized on FDM without approval from JRM Operations.
- There are six Naval Surface Firing Support (NSFS) targets on the western cliffs and flats of the island, no other cliff locations are targeted.
- Naval surface vessels only fire on FDM from the west to the east, avoiding impacts to roosting birds along the eastern cliff face.
- The Navy prohibits use of live cluster weapons/scatterable munitions, fuel air explosives, incendiary munitions, depleted uranium rounds, or bombs greater than 2,000 pounds. It should be noted that some spotting charges use small amounts of phosphorous and smoke markers will be used during some direct action activities for targeting.
- The Navy maintains brown treesnake interdiction and control protocols specific for FDM.

Marine Vegetation: CNMI requests a plan to identify and address any serious damage that may occur, survey the recovery of marine vegetation, and provide mitigation for damage to seagrass beds. However, the Navy's activities do not occur within seagrass beds. Seagrass beds are located in waters off of Tinian, but do not coincide with amphibious assault/raid approaches. Marine vegetation, including seagrass, surrounding Tinian, Saipan, and FDM from the National Oceanic and Atmospheric Administration (NOAA) satellite surveys are shown in Figures 3-38, 3-39, and 3-40 of the MITT EFH Assessment, respectively. The MITT EFH Assessment is available at: *http://mitt-eis.com/DocumentsandReferences/EISDocuments/ SupportingTechnicalDocuments.aspx*.

Marine Invertebrates: As stated above (see discussions in item (d) Conservation), coral damage associated with military readiness activities on FDM has been noted, along with damage attributed to natural causes. But, the impacts are temporary and localized, with complete recovery witnessed within 2 to 3 years, with no significant long-term impacts to the nearshore marine environment. This is substantiated by the continued robust health of the coral communities surrounding FDM, with a lack of indicators attributed to diminished water quality.

Amphibious training activities that would occur on Tinian within the Tinian MLA use defined approaches that avoid corals. Avoidance of these areas protects personnel and amphibious

[6] Some of the conservation measures may be subject to change, depending on the final Biological Opinion, expected to be released in 2015. The measures listed are existing conservation measures under the MIRC 2010 Biological Opinion.

vehicles, as well as avoids impacts on corals in nearshore environments surrounding Tinian. If impacts on corals cannot be avoided, additional mitigation measure and consultation with NMFS would be considered as appropriate before the activity would be conducted.

During offshore activities, where impacts to coral reefs are possible, the Navy maintains a 350 yard (320 meter) mitigation zone for coral reefs to avoid impacts to these habitats (see Table 1).

Scheduling of military readiness activities and locations inevitably overlaps a wide array of marine species habitats, including foraging habitats, reproductive areas, migration corridors, and seasonal coral spawning. Training schedules are based on deployment schedules and evolving events. Training schedules cannot be tailored to avoid seasonal coral spawning. Limiting activities to avoid certain seasons would adversely impact the effectiveness of the training or testing activity, and would therefore result in an unacceptable increased risk to achieving the purpose and need of the proposed action in the MITT EIS/OEIS. However, impact to coral larvae associated with an increase in ambient sound levels would be short-term and localized to the activity location. The noise levels would be restored to normal levels immediately following the completion of the training or testing activity. There is no anticipated effect of non-impulsive acoustic sources, including sonar, on benthic substrates and biogenic habitats.

These conclusions were included in the Navy's EFH consultation with NMFS, with no anticipated effects to coralline EFH or Habitats of Particular Concern (HAPC). FDM, the areas used for amphibious training activities on Tinian, and offshore areas used for activities that may impact coral reef areas, are outside of the CNMI coastal zone. Based on the protective measures and observations during long-term monitoring of FDM's nearshore environment, the likelihood of spillover effects into the CNMI coastal zone is considerably low; therefore, military activities proposed in the MITT EIS/OEIS are consistent to the maximum extent practicable with this regulation.

Fish: The Navy completed consultation with NMFS for potential impacts of military readiness activities on Essential Fish Habitat (EFH) under the MSA. The Navy has addressed NMFS concerns and EFH recommendations. Enclosed are copies of the NMFS EFH recommendations and the Navy's response to the recommendations. A copy of the MITT EFH Assessment is available on the MITT website at: *http://mitt-eis.com/DocumentsandReferences/EISDocuments/SupportingTechnicalDocuments.aspx*.

Mitigation measures that the Navy implements to avoid or reduce impacts to marine mammals and sea turtles may indirectly benefit EFH and HAPCs. Mitigation measures that have designated stand offs from benthic habitats will have a direct positive impact on EFH and HAPCs. Table 1 provides a crosswalk for mitigation measures that are relevant for fish and fish habitat impact minimization.

Research and monitoring efforts mentioned in Section 3.9.4 of the EIS/OEIS refer to the marine species monitoring plan the Navy has been implementing since 2010 throughout the MITT Study Area. As earlier mentioned, marine species monitoring efforts are designed to track compliance with take authorizations, evaluate the effectiveness of mitigation measures, and improve the understanding of the effects of military readiness activities on protected marine resources.

Marine species monitoring reports explaining annual efforts conducted in the MITT Study Area are posted on http://www.navymarinespeciesmonitoring.us/reading-room/pacific /.

Terrestrial Species: As shown in Figure 1, proposed military readiness activities on Rota would be restricted to developed areas, outside the critical habitats and conservation areas. In addition, all military readiness activities conducted on Rota will be coordinated with local and CNMI authorities (e.g., local mayor's office, local law enforcement). Additional communication will be provided to the CNMI MIMC via the JRM.

The Navy is consulting with USFWS under Section 7 of the ESA for potential impacts on threatened and endangered species from military readiness activities. Conservation measures resulting from these consultations to minimize, avoid, or offset impacts will be implemented. These measures exclude training activities from fruit bat habitat areas and maintaining a 1,000 ft. vertical and horizontal flight restriction on the island, with the exception of normal approaches and takeoffs at Rota International Airport(not part of training activities) and for combat search and rescue trainings that may occur at the airport.

(d) Cumulative Environmental Impact. *"The proposed project site shall be selected in order to minimize adverse primary, secondary, or cumulative environmental impacts."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: Please see the discussion presented under Part 300 – § 15-10-305(a) for cumulative impacts in the context of CNMI's coastal zone regulation. Cumulative impacts are evaluated in a NEPA context in the MITT EIS/OEIS.

As presented under Part 300 – § 15-10-305(a), the contribution to cumulative impacts is minimial. The planning, coordination, and siting efforts ensure that the military readiness activities described in the MITT EIS/OEIS is consistent to the maximum extent practicable with this regulation.

(e) Future Development Options. *"The proposed project site shall not unreasonably restrict the range of future development options in the adjacent area."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: CNMI expressed concern that MITT activities could negatively affect the tourism industry which relies on CNMI's natural resources. As discussed above, the proposed activities on Saipan (where most tourism infrastructure is expected to occur) and on Rota are conducted in coordination with local authorities and the MIMC. On Tinian, training activities would only occur within the military lease area. It is unlikely that these activities would impact wildlife on adjacent lands, and thereby constrain development. Coupled with the conservation measures designed to reduce or avoid impacts to wildlife, the potential impacts to adjacent lands and consequential constraining effects on tourism development are minimal; therefore, MITT-proposed military readiness activities that may occur within the CNMI are consistent to the maximum extent practicable with this regulation.

(f) Mitigation of Adverse Impacts. *"Whenever practicable, adverse impact of the proposed project on the environment shall be mitigated. Mitigation shall include the incorporation of management measures for control of nonpoint source pollution."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: The Navy has various training restrictions within the leased areas to reduce or avoid potential impacts to wildlife resources. For example, no training occurs within Hagoi or within intact limestone forest regions within the Tinian MLA. On FDM, various targeting and ordnance restrictions are in place to reduce impacts on the Mariana fruit bats, Micronesian megapodes, and non-ESA listed seabird species. As part of the natural resources management effort within the leased lands, the Navy has engaged in periodic long-term monitoring of natural resources. The Navy also maintains protections for training activities that occur outside of the leased areas. For example, on Rota, training is limited to previously developed areas and conducted in coordination with local authorities and the MIMC. On Saipan, training also avoids limestone forests within the Marpi Maneuver Area.

As mentioned above, the Navy is consulting with the following federal agencies:

- NMFS for potential impacts on: (1) marine mammals under the MMPA; (2) threatened and endangered marine species under Section 7 of the ESA; and (3) EFH under the MSA
- USFWS for potential impacts on threatened and endangered terrestrial species under Section 7 of the ESA

Conservation measures resulting from these consultations to minimize, avoid, or offset impacts associated with military readiness activities will be implemented. While CNMI states that "Current mitigation measures do not do enough to protect the habitats and wildlife within the MITT Study Area", the Navy is confident that the mitigations and measures that result from our NMFS and FWS consultations will in fact provide adequate protections to habitats and wildlife.

(g) Cultural-Historic/Scenic Value. *"Consider siting alternatives that promote the Commonwealth's goals with respect to cultural-historic and scenic values."*

CNMI Conclusion: *Consistent.*

(h) Watershed Conservation. *"In regard to site development (including roads, highways, and bridges), avoid development, to the extent practicable, of areas that are particularly susceptible to erosion and sediment loss; preserve areas that provide important water quality benefits and/or are necessary to maintain riparian and aquatic biota and/or protect to the extent practicable the natural integrity of waterbodies and natural drainage systems."*

CNMI Conclusion: *Insufficient information has been provided for DCRM to agree that the MITT activities are consistent with this regulation.*

Navy Response to CNMI: CNMI expressed concern that MITT will include activities that could increase erosion and sediment loss. Only activities on FDM have the potential for sediment loss due to military readiness activities. But, targeting restrictions are in place to reduce this potential. These measures include the establishment of impact areas and particular targets, and restricting targeting to only those areas as well as restricting the types of munitions used within these impact areas (see discussions in item (c) Adverse Impact on Fish and Wildlife: Birds). Further, long term monitoring studies of the surrounding reef zone are summarized in this document (see discussions in item (d) Conservation).

Direct observations of damage off the coast of FDM indicated that the majority of disturbances to the seafloor sediments, substrates, and mass wasting of FDM can be attributed to typhoons and storm surges and damage attributed to military readiness activities. However, the damage attributed to military readiness activities was temporary and evidence shows that any damage recovered within the same time frame as natural disturbances (2 to 3 years). Other indicators of diminished water quality attributed to sedimentation were absent from waters off of FDM. These indicators include a lack of high densities of macrobioeroders (e.g., boring sponges), bleaching of corals, surface lesions, or dead patches on stony corals' or stony coral mucus production. These factors, coupled with the minimization measures in place on FDM (targeting and ordnance restrictions) and the unlikely potential of spillover into the CNMI coastal zone, ensure that MITT activities are consistent to the maximum extent practicable with this regulation.

DEQ Water Quality Standards: Classification and Establishment of Water Use Areas and Specific Water Quality Criteria

CNMI Conclusion: *Inconsistent – the Navy should consider localized and long-term effects of water quality contamination, and provide baseline and ongoing monitoring data.*

Navy Response to CNMI:

The Navy, when assessing the potential for localized and long-term effects of water quality contamination from military activities considers a number of factors in the assessments of water ranges around the world. These considerations include munitions distribution, corrosion and constituent release rates, fate and transport of munitions constituents in the marine environment, and marine organism exotoxicity.

Munitions are distributed over a wide area during training and testing activities, with only the potential for concentrated munitions in waters surrounding FDM. Discussions on direct observations of reef conditions surrounding FDM are also included above. Once munitions are deposited in benthic environments, they tend to progress through rotation cycles, depending on the energy of the environment and shape of the munitions, followed by burying. In coral coasts, few munitions bury upon impact (approximately 10 percent), but scouring and colonization act to cover the munitions.[7] For observations of colonization of munitions surfaces in waters surrounding FDM, see discussion above. Underwater corrosion has been the subject of considerable research over the years. Beaubien et al. (1972) provide an annotated bibliography

[7] Inman, D.L. and Douglas, S.A. (2002). Scour and Burial of Bottom Mines: a Primer for Fleet Use. Integrative Oceanography Division, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA 92093-0209. Scripps Institution of Oceanography (SIO) Reference Series No. 02-8.

summarizing research completed prior to 1972.[8] Additional testing has been performed, both in the laboratory and under real world conditions. One of the most extensive test programs has focused on understanding corrosion of the USS Arizona, which was sunk by the Japanese in Pearl Harbor and is now maintained as a memorial.[9,10] The objective of this program was to understand the current state of the ship's structure and to predict how it could degrade in the future as a result of continued corrosion. These studies and others suggest that, in seawater, corrosion decreases to a steady rate after approximately 2 to 3 years. Further, the rate of corrosion generally decreases with depth and increases as the water flow increases. The Navy Research Laboratory (1972) presented information on the deterioration of materials, including munitions, based on published and unpublished studies, and on authoritative opinions. In general, the resistance of munitions to seawater depends on the following characteristics: type of packaging and packing; structural strength of the assembly; materials of construction; rate of corrosion; tightness of seals; and susceptibility of the propellant, explosives, and associated devices to water damage.

Munitions detonation is a fairly complete process based on the low levels of explosives contamination identified in range fate studies and range assessment characterizations.[11] In general, an average high-order detonation rate of 97 percent may be assumed for munitions used during military readiness activities in the Marianas, with a dud rate of 3 percent, and a low-order detonation rate (partial detonation) of 0.06 percent.[12] As a result, release rates of explosive materials due to in-water detonations would not be expected to be great. These low levels would lead to minimal environmental impacts.

Studies of munitions impacts on nearshore and deep waters off of Oahu Island, Hawaii, are available and support Navy conclusions for MITT. In the shallow water environment, Cox, De Carlo, and Overfield (2007)[13] collected samples along Ordinance Reef, off of Wai'anae on Oahu.

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[8] Beaubien, L. A., Wolock, I., and Buchanan, C. L. (1972) Behavior of Materials in a Subsurface Ocean Environment, NRL Report 7447, Naval Research Laboratory, Washington, D. C., 1972.

[9] Russell, M. A. (2006). A Minimum-Impact Method for Measuring Corrosion Rate of Steel-Hulled Shipwrecks in Seawater. *The International Journal of Nautical Archaeology:35*, pp. 310-318.

[10] National Park Service. (2008). Long Term Management Strategies for USS Arizona, A Submerged Cultural Resource in Pearl Harbor, Submerged Resources Center Technical Report 27, Santa Fe, New Mexico, 2008.

[11] Naval Research Laboratory. (1972). Behavior of Materials in a Subsurface Ocean Environment. NRL Report 7447. Washington, D.C. July 14, 1972.

[12] Dauphin and Doyle. (2000). Report *of Findings For: Study of Ammunition Dud and Low Order Detonation Rates*. Prepared by U.S. Army Defense Ammunition Center, Technical Center for Explosives Safety, McAlester, Oklahoma. Prepared for the U.S. Army Environmental Center, ATTN: SFIM-AEC-ETD, Aberdeen Proving Ground, Maryland. July.

[13] Cox, E., De Carlo, E., Overfield, M. (2007). Ordnance Reef, Wai'anae, HI.: Remote Sensing Survey and Sampling at Discarded Military Munitions Site. Marine Sanctuaries Conservation Series NMSP-07-01. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Sanctuary Program, Silver Spring, MD. 112 pp.

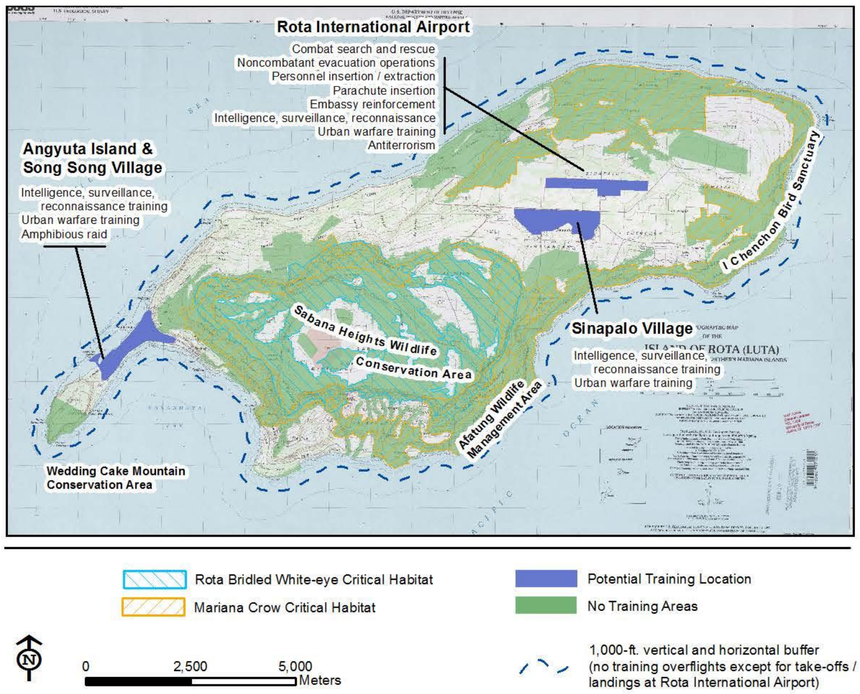
This study was overseen by the NOAA National Marine Sanctuaries Program to collect screening level data to support the DoD's evaluation of potential explosive and human health hazards posed by military munitions. The objectives of the Ordnance Reef Project were to independently collect data to define the extent of a discarded military munitions sea disposal site and determine through biological, sediment and water column sampling whether munitions constituents, such as explosives, metals, may potentially impact human health and the environment. The discarded munitions off of Wai'anae ranged from small arms munitions to large caliber projectiles and naval gun ammunition. The results showed "very low" trace metal enrichment of marine sediments. There were no detections of the explosive materials cyclonite (RDX), trinitrotoluene (TNT), or tetryl in the sampling effort, although dinitroluene (DNT) was detected in 4 of the 47 sample sites. Of these 4 samples, 3 were associated with munitions (due to proximity to munitions). One sample was located near shore and not associated with munitions. It should be noted that DNT compounds are used in flexible polyurethane foams (bedding and furniture), as well as in dyes and air bags of automobiles. No explosives or related compounds were detected in any of the 49 fish samples. Overall, the results indicated that there was no significant impact from munitions disposal on the water quality of shallow waters off the Wai'anae Coast, and little evidence of contamination of sediments as a result of munitions disposal. With few exceptions, the overall ranges of concentrations of trace elements found in this study's samples were found to be consistent with those observed in uncontaminated settings. This study is applicable to FDM because the sediments off the Wai'anae coast are primarily carbonate sediments, similar to sediments surrounding FDM.

The University of Hawaii investigated 3 deepwater munitions dump sites 5 miles south of Pearl Harbor to see if any of the dumped munitions posed a threat to human health or the environment. Two of the sites are in waters 6,000 feet or more deep, while the third site was in water as deep as 1,500 feet. The data do not indicate any adverse effects on ecological health or human health from the consumption of fish and shrimp collected near the dump sites.

As stated above, spillover effects into the CNMI's coastal zone from military readiness activities are unlikely. Military readiness activities that result in expended materials are conducted offshore, outside of the CNMI coastal zone. In part, the low potential for spillover effects is due to the dispersed nature of most activities that involve expended materials and the dynamics of the Northern Equatorial Current. In summary, these factors ensure that activities described in the MITT EIS/OEIS are consistent to the maximum extent practicable with DEQ water quality standards.

Conclusion

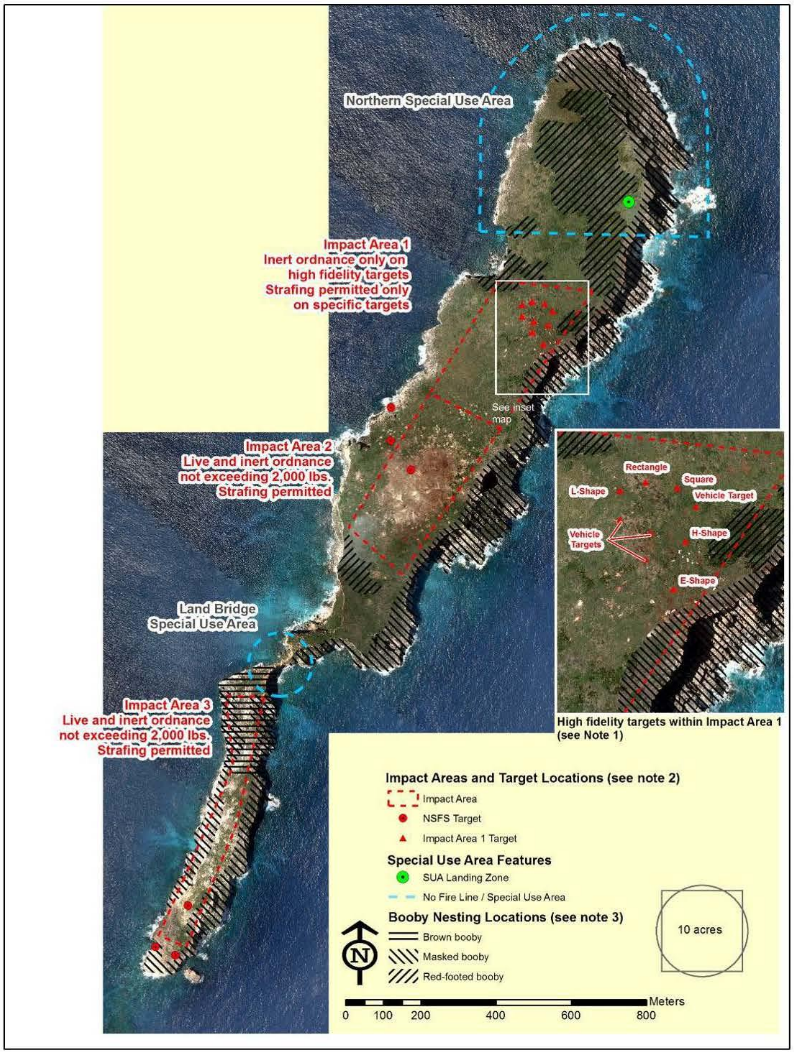
As stated in the Navy's CD, the Navy has analyzed the MITT Proposed Action in reference to the enforceable policies of the CNMI Coastal Management Program and concludes the Proposed Action is consistent to the maximum extent practicable with those policies. The additional information provided in this document should effectuate CNMI's concurrence with that determination.



Note: Potential training locations (shaded in red) show where training activities may occur. Intelligence, surveillance, reconnaissance training and urban warfare training locations are not exact and are arranged in coordination with the Rota Mayor's office. These training activities occur in developed areas. No training activity would occur within designated critical habitat for the Mariana crow or Rota bridled white-eye, local conservation areas, or other any other area considered to be habitat for ESA-listed species. Green shaded areas represent all areas that could be occupied by ESA-listed species at any time throughout the year. These areas are not proposed for training. Mariana fruit bat colonies are not depicted in the map as they fall within designated critical habitat or conservation areas.

Figure 1: Rota Training Areas and Restricted Areas

Figure 2: FDM Impact Areas and No Targeting Areas (Oblique View)



Source: Aerial photography provided by U.S. Department of the Navy (2014).
Note 1: Target vehicles, rectangular target, square target, and L-shaped target receive only lightweight inert ordnance not exceeding100 lbs. Strafing prohibited. The H-shaped target may be targeted with inert ordnance not exceeding 500 lbs. Strafing prohibited. The E-shaped target may be targeted with inert ordnance not exceeding 2,000 lbs. Strafing authorized.
Note 2: Areas outside of designated Impact Areas are considered "No Fire Areas" in accordance with COMNAVMARIANASINST 3500.4A.
Note 3: Booby nesting locations are updated based on (1) observations of booby nesting during periodic aerial surveys, (2) species specific habitat preferences, and (3) information provided by Lusk et al. 2000.

Figure 3: FDM Impact Areas and No Targeting Areas (Plan View)

Table 1: Summary of Recommended Mitigation Measures

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Indirect or Direct Beneficial Effects on EFH
Acoustic (Non-Impulsive Stressors)			
Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar during Anti-Submarine Warfare and Mine Warfare	2 Lookouts (general) 1 Lookout (minimally manned, moored, or anchored)	Low-Frequency: 200 yd. (183 m) shutdown for marine mammals and sea turtles Hull-Mounted Mid-Frequency: 1,000 yd. (914 m) and 500 yd. (457 m) power downs and 200 yd. (183 m) shutdown for marine mammals and sea turtles.	Indirect
Acoustic (Explosive/Impulsive Stressors)			
Improved Extended Echo Ranging Sonobuoys	1 Lookout	600 yd. (549 m) for marine mammals and sea turtles.	Indirect
Explosive Sonobuoys using 0.6–2.5 lb. NEW	1 Lookout	350 yd. (320 m) for marine mammals and sea turtles.	Indirect
Anti-Swimmer Grenades	1 Lookout	200 yd. (183 m) for marine mammals and sea turtles.	Indirect
Mine Countermeasures and Mine Neutralization using Positive Control Firing Devices	General: 1 or 2 Lookouts (NEW dependent) Diver-placed: 2 Lookouts Lookouts will survey the mitigation zone for seabirds prior to and after the detonation event.	NEW dependent for marine mammals and sea turtles and flocks of seabirds.	Indirect
Mine Neutralization Activities Using Diver-Placed Time-Delay Firing Devices	4 Lookouts Lookouts will survey the mitigation zone for seabirds prior to and after the detonation event.	Up to 10 min. time-delay using up to 29 lb. NEW: 1,000 yd. (915 m) for marine mammals and sea turtles.	Indirect
Gunnery Exercises – Small- and Medium-Caliber using a Surface Target	1 Lookout	200 yd. (183 m) for marine mammals and sea turtles.	Indirect
Gunnery Exercises – Large-Caliber using a Surface Target	1 Lookout	600 yd. (549 m) for marine mammals and sea turtles. 70 yd. (64 m) within 30 degrees on either side of the gun target line on the firing side for marine mammals and sea turtles.	Indirect

Table 1: Summary of Recommended Mitigation Measures (continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Indirect or Direct Beneficial Effects on EFH
Missile Exercises (Including Rockets) up to 250 lb. NEW using a Surface Target	1 Lookout	900 yd. (823 m) for marine mammals and sea turtles. 350 yd. (320 m) for surveyed shallow coral reefs.	Direct
Missile Exercises (Including Rockets) from 251 to 500 lb. NEW using a Surface Target	1 Lookout	2,000 yd. (1.8 km) for marine mammals and sea turtles. 350 yd. (320 m) for surveyed shallow coral reefs.	Direct
Bombing Exercises, Explosive and Non-Explosive	1 Lookout	Explosive: 2,500 yd. (2.3 km) for marine mammals and sea turtles. Non-Explosive: 1,000 yd. (914 m) for marine mammals and sea turtles. Both: 350 yd. (320 m) for surveyed shallow coral reefs.	Direct
Torpedo (Explosive) Testing	1 Lookout	2,100 yd. (1.9 km) for marine mammals and sea turtles and jellyfish aggregations.	Indirect
Sinking Exercises	2 Lookouts	2.5 nm for marine mammals and sea turtles and jellyfish aggregations.	Indirect
At-Sea Explosive Testing	1 Lookout	1,600 yd. (1.4 km) for marine mammals and sea turtles.	Indirect
Physical Strike and Disturbance			
Vessel Movements	1 Lookout	500 yd. (457 m) for whales. 200 yd. (183 m) for all other marine mammals (except bow riding dolphins).	Indirect
Towed In-Water Device Use	1 Lookout	250 yd. (229 m) for marine mammals	Indirect
Precision Anchoring	No Lookouts in addition to standard personnel standing watch	Avoidance of precision anchoring within the anchor swing diameter of shallow coral reefs, live hardbottom, artificial reefs, and shipwrecks.	Direct

Table 1: Summary of Recommended Mitigation Measures (continued)

Activity Category or Mitigation Area	Recommended Lookout Procedural Measure	Recommended Mitigation Zone and Protection Focus	Indirect or Direct Beneficial Effects on EFH
Shallow Coral Reefs, Hardbottom Habitat, Artificial Reefs, and Shipwrecks	No Lookouts in addition to standard personnel standing watch	The Navy will not conduct precision anchoring within the anchor swing diameter, or explosive mine countermeasure and neutralization activities (except in existing anchorages and near-shore training areas around Guam and within Apra Harbor) within 350 yd. (320 m) of surveyed shallow coral reefs, live hardbottom, artificial reefs, and shipwrecks. No explosive or non-explosive small-, medium-, and large-caliber gunnery exercises using a surface target, explosive or non-explosive missile exercises using a surface target, explosive and non-explosive bombing exercises, or at-sea explosive testing within 350 yd. (320 m) of surveyed shallow coral reefs	Direct

Notes: EFH = Essential Fish Habitat, NEW = Net Explosive Weight, lb. = pounds, yd. = yards, m = meters, km = kilometers

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January 20, 2015

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Re. Federal Consistency Determination for Mariana Islands Training and Testing (MITT) Study Area (5090 Ser N465/1301)

Dear Mr. Van Name:

The Commonwealth of the Northern Mariana Islands (CNMI) has completed its review of your December 17, 2014 letter providing additional information on the proposed activities in the Marianas Islands Training and Testing (MITT) study area. The CNMI previously found the activities of the MITT to be inconsistent with the enforceable policies of the CNMI Coastal Management Program. In light of the new information received, the CNMI is issuing a conditional concurrence for the MITT military activities.

The Department of the Navy submitted its final Federal Consistency Determination (CD) on September 11, 2014, and the CNMI replied on October 7, 2014 - finding that the MITT, as then described, was inconsistent with the enforceable policies of the CNMI. After receiving the Navy's December 17, 2014 letter, the CNMI and the Navy continued discussions to resolve our differences and agreed upon a January 20, 2015 due date for the CNMI's decision. The CNMI has appreciated working with the Navy over this time and the efforts the Navy has taken to explain the MITT.

The Navy is currently consulting with U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) under Section 7 of the ESA. The Navy references these consultations several times in its CD and in its December 17 reply. The Section 7 consultations are a process separate from the Federal Consistency process and the promise of future conservation measures under a separate federal law do not necessarily fulfill federal consistency requirements. However, the CNMI recognizes that for the threatened and endangered species on

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and around Saipan, Rota, Tinian, and FDM, the federal consultation process is likely to provide sufficient protection for the purposes the CNMI's Coastal Management Program.

During its discussions with the Navy, the CNMI also raised concerns regarding military activities on Saipan, Tinian, and Rota. The Navy addressed the following concerns:

- **Military activities on Saipan:**
  The CNMI was concerned that military activities on Saipan could negatively affect local lifestyles, tourism, and wildlife habitats. Marpi is public land, not leased to the military, and the CNMI was concerned that military activities could hinder access and damage habitat. However, given the small size of the planned trainings and the Navy's willingness to coordinate with local authorities, DCRM believes MITT trainings on Saipan could be conducted with minimal impact.

  The Navy clarified that military activities on Saipan would occur in the "Cowtown" area of Marpi, and would involve one to two dozen individuals training at a time. "Urban warfare training" would consist of maneuvering in the existing environment with no construction or clearing taking place. There would be no use of helicopters in the Marpi area. All activities would be coordinated with local authorities and notice would be given to the public ahead of time. Limestone forests would be avoided to limit effects to sensitive bird species in the Marpi area.

  Condition: Training on Saipan will be limited to the area around Cowtown and trainings will not significantly exceed two dozen individuals at a time. Helicopters will not be used in Marpi and no construction will occur. As outlined in the CD, trainings on Saipan will be coordinated with local authorities. Given these conditions the Navy will be consistent with § 15-10-505 (c)(e)(f) of the Northern Mariana Islands Administrative Code (NMIAC).

- **Military activities on Rota:**
  The CNMI was concerned about the impact military trainings would have on Rota. The Navy reiterated that amphibious raids on Rota would not involve amphibious assault vehicles. Rather, landings would involve swimming or rubber craft (similar to zodiacs). The Navy reiterated that trainings would be infrequent and would be coordinated with local authorities. The Navy further explained that Section 7 talks with USFWS could include no-go areas to protect the Marianas fruit bat.

  Condition: Given successful Section 7 negotiations with USFWS and continued consultations with local authorities prior to trainings, DCRM considers the Navy consistent with §15-10-310 of the NMIAC.

- **Coral Spawning:**

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A mass coral spawning event occurs near Tinian after the July full moon for 7-10 days each year. This is an important time for coral reproduction and coral health in the CNMI. The Navy stated in its December 17, 2014 letter that "Training schedules are based on deployment schedules and evolving events. Training schedules cannot be tailored to avoid seasonal coral spawning." This is not sufficient reason to negatively impact coral health in the CNMI. However, in follow-up discussions the Navy further explained that any training occurring during the mass coral spawning would have a negligible effect. The Navy has indicated that the primary activity occurring during the coral spawning will be landings of combat swimmer and inflatable boats.

Condition: Navy trainings must not significantly affect the mass coral spawning event off of Tinian. In accordance with § 65-130-530(b)(3) of the NMIAC, activities creating sediment plumes that could adversely affect coral reproduction are to be stopped for the duration of the coral spawning. If Navy activities do not create a significant sediment plume, then there will be no need for a stoppage period. However, if the Navy determines activities will generate a significant sediment plume, the Navy should inform the CNMI so a work stoppage can be implemented. Care should also be taken to avoid significant acoustic affects to the coral during the spawning period.

- **Sea Turtles on Tinian**:
  The Navy had previously proposed using amphibious vehicles for amphibious warfare activities on several of Tinian's sea turtle nesting beaches. The CNMI was concerned that amphibious landings would crush sea turtle nests and affect local sea turtle populations. The Navy has since informed the CNMI that the beaches on Tinian are ill suited for mechanized landings under the MITT, and that there will be no tracked vehicles landing on Tinian's beaches under the MITT.

  Condition: There will be no mechanized tracked vehicles on Tinian's beaches under the MITT. Given this condition the Navy will be consistent with §15-10-505(c).

- **Historical Sites on Tinian:**
  The CNMI is concerned that increased military activity on Tinian could lead to a decrease in public access to popular beaches and historical sites, including the atomic bomb pits and Able Runway. The Navy assured the CNMI that under the MITT there would not be a significant increase in closures as compared to the past few years. The Navy further stated that closures of beaches and historical sites would be avoided as much as practicable and that closures would be conducted in cooperation with local authorities. The CNMI remains concerned that increased military activities on Tinian, including the upcoming CJMT, could affect public access to historical sites. However, this concern is addressed by the Navy's assurances that closures will not increase from the historical level of closures.

Condition: There will be no significant increase in closures of popular beaches and historical sites, including the atomic bomb pits and Able Runway, under the MITT. As stated in the CD, closures will be conducted in cooperation with local authorities. Given these conditions the Navy will be consistent with §15-10-305(h).

The CNMI appreciates the additional information provided by the Navy in its December 17, 2014 letter and in follow-up conversations thereafter. Given that the Section 7 ESA consultations are successful, and that the above conditions are met, the CNMI considers the MITT to be consistent with the CNMI's enforceable policies.

The Government of the CNMI recognizes the needs of the U.S. military and the importance of military training. Pursuant to 15 C.F.R. § 930.4 a conditional concurrence automatically becomes an objection if the conditions are not agreed to. The CNMI hopes the statements in this letter accurately reflect the discussions held with the U.S. Navy. We appreciate the time the Navy has taken to discuss the MITT and resolve our differences under 15 C.F.R. § 930.43(d).

If you have any questions about our position, please contact Megan Jungwiwattanaporn, Division of Coastal Resources Management, at 670-664-8311 or megan.jungwi@crm.gov.mp.

Sincerely,

Fran Castro
Director, DCRM

Cc:

Jeffrey Payne	Acting Director Office for Coastal Management, NOAA
Eloy Inos	Governor, CNMI
J.P. San Nicolas	Mayor, Tinian
Mertie Kani	Acting Director, Historic Preservation Office
Richard Seman	Acting Secretary, Department of Lands and Natural Resources
Patricia Rasa	Acting Secretary, Department of Public Lands
Frank Rabauliman	Administrator, Bureau of Environmental and Coastal Quality

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
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PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0244
Mar 12, 2015

Ms. Fran Castro
Director
Division of Coastal Resources Management
CNMI Bureau of Environmental and Coastal Quality
Gualo Rai Center, Suite 201F
P.O. Box 10007
Saipan, MP 96950

Dear Ms. Castro:

SUBJECT: CONSISTENCY DETERMINATION FOR MILITARY TRAINING AND TESTING ACTIVITIES WITHIN THE COASTAL ZONE OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

In accordance with the Federal Coastal Zone Management Act (CZMA) and 15 C.F.R. § 930, this letter responds to your January 20, 2015 Conditional Concurrence of the U.S. Navy's consistency determination (CD) for military readiness activities within the CNMI coastal zone proposed in the Mariana Islands Training and Testing (MITT) Draft Environmental Impact Statement/Overseas Impact Statement (DEIS/OEIS).

The Navy concluded that the MITT Proposed Action is fully consistent with the enforceable policies of the CNMI Coastal Management Program. We have appreciated working with your office throughout this process. In light of Mr. John Van Name's conversation on March 4, 2015, and subsequent email with Ms. Megan Jungwiwattanaporn on March 6, 2015, we understand that your office concurs that the proposed MITT activities as clarified below are consistent with the enforceable policies.

Condition that Section 7 Consultations be Complete:

We will complete consultation with US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) before MITT activities commence.

SUBJECT: CONSISTENCY DETERMINATION FOR MILITARY TRAINING AND TESTING ACTIVITIES WITHIN THE COASTAL ZONE OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Conditions for Military Activities on Saipan:

"Training on Saipan will be limited to the area around "Cowtown" and trainings will not significantly exceed two dozen individuals at a time. Helicopters will not be used in Marpi and no construction will occur. As outlined in the CD, trainings on Saipan will be coordinated with local authorities. Given these conditions the Navy will be consistent with § 15-10-505(c)(e)(f) of the Northern Mariana Islands Administrative Code (NMIAC)."

There is no intention to conduct construction activities or use helicopters during training activities within Marpi. If these activities are contemplated in the future, appropriate ESA consultation would be required. While training will be limited to the area around "Cowtown", the Saipan Army National Guard could have a requirement to train greater than "two dozen" individuals at a time. However, regardless of the exact number of individuals involved, all training activities will be conducted in accordance with the protective measures set forth in issued USFWS Biological Opinion, will be coordinated with local authorities, and will remain consistent with § 15-10-505.

Conditions for Military Activities on Rota:

"Given successful Section 7 negotiations with USFWS and continued consultations with local authorities prior to trainings, DCRM considers the Navy consistent with § 15-10-310 of the NMIAC"

Agree. As discussed above, Section 7 ESA consultation with USFWS will be completed, and we will continue to coordinate all training activities with local authorities.

Conditions for Coral Spawning on Tinian:

"Navy trainings must not significantly affect the mass coral spawning event off of Tinian. In accordance with § 65-130-530(b)(3) of the NMIAC, activities creating sediment plumes that could adversely affect coral reproduction are to be stopped for the duration of the coral spawning. If Navy activities do not

SUBJECT: CONSISTENCY DETERMINATION FOR MILITARY TRAINING AND TESTING ACTIVITIES WITHIN THE COASTAL ZONE OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

create a significant sediment plume, then there will be no need for a stoppage period. However, if the Navy determines activities will generate a significant sediment plume, the Navy should inform the CNMI so a work stoppage can be implemented. Care should also be taken to avoid significant acoustic affects to the coral during the spawning period."

As discussed, Navy analysis determined that training events on and around Tinian and the physical and acoustic stressors related to those activities, including the generation of turbidity, will only have a negligible impact on coral spawning. As ESA Section 7 consultation with NMFS is not yet complete, Navy will revisit its conclusion if the pending Biological Opinion determines otherwise. However, the Navy has received no indication that NMFS analysis will contradict the Navy's findings.

In addition, § 65-130-530(b)(3) of the NMIAC applies to mixing zones and associated conditions relevant to "dredging activities, the discharge of dredged or fill material, or other in-water, construction-related activities". As the military is not proposing any dredging or construction-related activities under the MITT, § 65-130-530(b)(3) of the NMIAC is not applicable. The proposed MITT activities are consistent with the applicable enforceable policies of CNMI.

Conditions for Sea Turtles on Tinian:

"There will be no mechanized tracked vehicles on Tinian's beaches under the MITT. Given this condition the Navy will be consistent with§ 15-10-505(c)."

Concur. The utilization of mechanized tracked vehicles during amphibious beach landings under the MITT has been deferred. Appropriate consultations will be initiated to support any future plans to conduct this activity, if such a need arises.

Conditions for Historical Sites on Tinian:

"There will be no significant increase in closures of popular beaches and historical sites, including the atomic bomb pits and Able Runway, under the MITT. As stated in the CD,

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SUBJECT: CONSISTENCY DETERMINATION FOR MILITARY TRAINING AND TESTING ACTIVITIES WITHIN THE COASTAL ZONE OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

closures will be conducted in cooperation with local authorities. Given these conditions the Navy will be consistent with § 15-1 0-305(h)."

Concur. The military will continue to coordinate with local authorities to minimize public access restrictions to Tinian beaches and historic sites.

Per our discussions with your office on March 4, 2015, we are confident that DCRM agrees that, with clarification regarding the numbers of Reservists within Marpi and the non-applicability of § 65-130-530, the MITT is consistent to the maximum extent practicable with the CNMI's enforceable policies.

We appreciate your continued support. If you have any questions on this matter, please contact Mr. John Van Name at (808) 471-1714 or john.vanname@navy.mil.

Sincerely,

L. M. FOSTER
By direction

Copy to (w/o encl):
CNO (N454)
COMNAVAIRSYSCOM PATUXENT RIVER, MD (AIR-1.6)
COMNAVSEASYSCOM WASHINGTON, DC (SEA 04)
ONR 3220A
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COMMANDER, JOINT REGION MARIANAS

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DEPARTMENT OF THE NAVY
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NMFS/PIRO
MAY 21 2014
Received

IN REPLY REFER TO:
5090
Ser N01CE1/0476
15 May 2014

Mr. Michael Tosatto
Administrator, Pacific Islands Region
National Marine Fisheries Service
NOAA Inouye Regional Center (IRC)
1845 Wasp Blvd., Building 176
Honolulu, HI 96818

Dear Mr. Tosatto:

SUBJECT: ESSENTIAL FISH HABITAT (EFH) ASSESSMENT FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT)

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the U.S. Navy (Navy) has prepared the EFH Assessment for the training and testing activities conducted within the MITT Study Area. The Navy's assessment concludes that EFH within the MITT Study Area may be adversely affected by training and testing activities and requests initiation of the MSA's EFH consultation process.

Additional information on MITT may be found at the project website (www.mitt-eis.com), including the EFH assessment and the Draft Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) prepared by the Navy to analyze potential environmental impacts that could result from activities under the Proposed Action. The Navy's preferred alternative in the Draft EIS/OEIS and analyzed in the EFH Assessment is Alternative 1.

We appreciate your continued support in helping the U.S. Navy to meet its environmental responsibilities. My point of contact for this matter is Ms. Julie Rivers (808) 474-6391, or e-mail: julie.rivers@navy.mil.

Sincerely,

L. M. FOSTER
Director, Environmental Readiness
By direction

Enclosure: EFH Assessment for MITT (hard copy and CD-ROM)

Copy to: (w/o encl)
Mr. Stan Rogers, NMFS Office of Protected Resources
Mr. Brian Hopper, NMFS Office of Protected Resources
Dr. Kelly Ebert, CNO N45

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1845 Wasp Blvd., Bldg 176
Honolulu, Hawaii 96818
(808) 725-5000 • Fax: (808) 973-2941

L.M. Foster
U.S. Pacific Fleet
250 Makalapa Drive,
JBPHH, Hawaii 96860-3134

July 21, 2014

Dear Mr. Foster:

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) Pacific Islands Regional Office, Habitat Conservation Division (PIRO HCD) has reviewed the Essential Fish Habitat (EFH) Assessment for training and testing activities in the Mariana Islands Training and Testing Study Area. We appreciate the opportunity to provide the following comments in accordance with the EFH provision §305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 USC §1855).

The proposed action includes two categories of military readiness activities, training and testing, within the Mariana Islands Range Complex (MIRC). These training and testing activities are fully described in Alternative 1 (Preferred Alternative) in the Mariana Islands Training and Testing (MITT) EIS/OEIS. The Navy, U.S. Air Force, U.S. Marine Corps, and U.S. Coast Guard routinely train in the Action Area in preparation for national defense missions. Typical training and testing activities and exercises covered in the EIS include the detonation of underwater explosives; weapons firing; the use of active sonar, acoustics and electromagnetic devices; deployment of seafloor devices and other in-water devices (remotely operated vehicles); vessel movement; and ship to shore transport of personnel, equipment and supplies. In addition, sonar maintenance and gunnery exercises may also be conducted during ship transits that occur outside of the MIRC. The MITT EIS/OEIS also describes a number of major training exercises such as Joint Expeditionary Exercises, Joint Multi-Strike Group Exercises, and Marine Air Ground Task Force Exercise (Amphibious)-Battalion expected to take place within the MIRC.

The Action Area for the Essential Fish Habitat Assessment (EFHA) is the MITT Study Area excluding the land-based training areas. The Action Area is composed of established at-sea ranges that encompass waters surrounding Guam and the Commonwealth of the Northern Mariana Islands (CNMI), operating areas (OPAREAs), and special use airspace in the region of the Mariana Islands that includes the existing Mariana Islands Range Complex (MIRC) (497,469 square nautical miles [nm^2]), additional areas on the high seas (487,132 nm^2), and a transit corridor between the MIRC and the Hawaii Range Complex (HRC). The at-sea components of the MIRC include nearshore and offshore training and testing areas, ocean surface and subsurface areas, and special use airspace. These areas extend from the waters south of Guam to north of Pagan (CNMI), and from the Pacific Ocean east of the Mariana Islands to the Philippine Sea to the west.

The Action Area also includes pierside locations in the Apra Harbor Naval Complex, including channels and routes to and from the Navy port in the Apra Harbor Naval Complex, and associated wharves and facilities within the Navy port and shipyard. Nearshore training and testing areas including the small arms ranges on Guam, the Agat and Piti Mine Neutralization Sites, the Apra Harbor UNDET Site, and the Pati Point Explosive Ordnance Disposal Range, are also included.

Magnuson-Stevens Act

Pursuant to the Magnuson-Stevens Act, the Secretary of Commerce, through NMFS, is responsible for the conservation and management of fishery resources found off the coasts of the United States. See 16 U.S.C. 1801 et seq. Section 1855(b)(2) of the Magnuson Act requires federal agencies to consult with NMFS, with respect to "any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat identified under this Act." The statute defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity." 16 U.S.C. 1802(10). Adverse effects on EFH are defined further as "any impact that reduces the quality and/or quantity of EFH," and may include "site-specific or habitat-wide impacts, including individual, cumulative or synergistic consequences of actions." 50 C.F.R. § 600.810(a). The consultation process allows NMFS to make a determination of the project's effects on EFH and provide Conservation Recommendations to the lead agency on actions that would adversely affect such habitat. See 16 U.S.C. 1855(b)(4)(A).

Essential Fish Habitat

In the Mariana Archipelago, the marine water column from the shoreline to the EEZ to depths of 1,000m and the seafloor to depths of 700m are classified as EFH. This EFH supports various life stages for the management unit species (MUS) identified under the Western Pacific Regional Fishery Management Council's Pelagic and Mariana Archipelago Fishery Ecosystem Plans (FEPs). The MUS and life stages that may be found in these waters include: eggs, larvae, juveniles and adults of Coral Reef Ecosystem Management Unit Species (CRE-MUS), Bottomfish MUS(BMUS), Pelagic MUS(PMUS), and the Crustacean MUS (CMUS).

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Areas designated as Habitat Area of Particular Concern are found within the study area and include all slopes and escarpments between 40m-280m depth, the water column down to 1,000m that lies above seamounts and banks with summits shallower than 2,000m within the EEZ, the Orote and Haputo Ecological Reserve Areas, Guam National Wildlife Refuge at Ritidian, Jade Shoals, Cocos Lagoon, and Saipan Lagoon.

NMFS PIRO is concerned that the land-based portions of the MITT study area have been excluded from analysis within the EFH Assessment. Without an understanding of the land based activities, we are unable to fully evaluate the effect of these activities on EFH, and hence are unable to provide conservation recommendations for these land based activities as required. We are also concerned that the Navy's definition of impact as defined in the MITT EFH Assessment does not accurately describe the effects a "stressor" may have on EFH. For example, "stressor" duration of a few hours, days, or weeks can result in adverse effects to EFH that are more than temporary or minimal in nature. In addition, the analysis fails to consider the recovery time necessary between impacts. For example, if an activity such as landing an AAV requires 2-7 months for recovery, but is repeated more than six times a year at the same location, it may have a significant, if not permanent, effect on EFH over the long-term (MITT Section 3.8). Further, the repeated assumption in the EIS that impacts from training activities are similar to those of a natural storm and therefore not significant, is insufficient as a rationale for not mitigating the impacts from these activities. This analysis fails to recognize the impacts of storms on reef systems, particularly areas protected from natural storm impacts, and also does not account for the significant increase in frequency of these events under the MITT Preferred Alternative.

In discussions regarding the CNMI Joint Military Training EIS, it has been clearly stated that the designated landing craft beaches on Tinian require significant modification or "homogenization" to facilitate safe landing activities. This process if carried out will have substantial impacts to EFH. Landing craft including RHIB in most of the sites described in this EFHA will have significant impacts to coral due to the high density of corals along the extremely shallow reef crests at these sites. We strongly recommend that this analysis be updated for the FEIS to clarify the sites that will be used or reflect the actual number of landings that will take place given the abovementioned constraints. In addition, please provide an analysis of potential impacts of Unmanned Undersea Vehicles. The information provided in the EIS and EFHA is insufficient to determine the impacts of these activities.

Navy has also determined throughout the document that adverse effect to EFH will be minimal due to calculation that the impact area from an individual stressor only represents a small proportion of the entire range complex. For example, the assessment indicates that expended materials from training activities will affect 158,208m^2 and expended materials from testing activities will affect an additional 12,588m^2 for a total area impacted of 170,796m^2(Page 4-44). It is impossible to calculate the exact impact on EFH based on the information provided, but if only

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10% of the expended materials fall within EFH for CREMUS or BMUS, it would have substantial adverse effect on the limited EFH available for these MUS.

NMFS PIRO finds that the proposed activities **Would Affect EFH**. As such, we offer the following Conservation Recommendations in accordance with the EFH provision of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (50 C.F.R. § 600.905 – 930) to avoid and minimize these impacts to EFH:

1. Evaluate the impacts to EFH from the land-based portions of the MITT study area such as any activities occurring on Farallon de Medinilla, as well as Andersen Air Force Base, Naval Base Guam, Saipan, Tinian, and Rota, and work together with NMFS to implement measures to mitigate any identified adverse effects to EFH.

2. Avoid, to the greatest extent practicable, conducting any training and testing activities in the MITT study areas that have been designated as Habitat Area of Concern (HAPC) for CREMUS. Also, avoid conducting activities that have impact to seafloor in areas designated as HAPC for BMUS. Avoidance of these areas will eliminate risk of impact to these important habitats. (Please refer to the Western Pacific Regional Fishery Management Council's Mariana Archipelago FEP for these EFH designations).

3. Develop and implement a protocol for immediate clean-up of unexploded ordinance also for floating debris such as parachutes in areas designated as EFH for juvenile and adult life stages for CREMUS (all seafloor around the Mariana Islands shallower than 100 m depth). Unexploded ordinance may cause direct impacts to EFH if triggered after use, and parachutes become marine debris that may move with currents, tides and waves and trap fish and abrade corals in their path.

4. Conduct further analysis to assess the impacts of amphibious landings and over the beach insertions/extractions by small boats and unmanned vehicles. Due to the fragile nature of the coral reef habitats in the proposed training and testing sites and the proposed frequency of these events, the impacts are likely to be additive and cumulative in nature. Recent discussions regarding the CNMI Joint Military Training EIS suggest that the landing beaches on Tinian are physically unable to accommodate AAV landings and would need substantial modification for use as landing craft beaches. Please clarify DoD's expected use of these beaches and provide analysis of potential impacts.

5. Conduct landing craft and small boat insertions only during high tide and avoid sensitive reef habitat and operate the vessels in ways that minimize turbidity and sedimentation and avoid abrasion impact to corals and dense seagrass beds. We recommend that DoD further constrain the areas of landing operations to minimize impacts. Many of the areas listed on page 4-32, specifically San Luis Beach, Gab Gab Beach, Haputo Beach, Unai Chulu, Unai

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Dankulo, and Unai Babui, have relatively high coral cover along the very shallow reef margin. The use of these areas for landing craft and small boats is highly likely to result in significant damage to corals. The EFHA and Draft EIS/OEIS do not fully assess the potential impacts of these activities and do not adequately describe the mitigation actions that DoD will take to address this.

6. To the extent possible, avoid activities that cause sedimentation and explosions, including landing craft exercises, during the 21 day primary coral spawning period each year. This is typically a 21 day period beginning around the full moon in July.

7. Limit precision anchoring activities to avoid all hard substrate in Apra Harbor and at the Saipan Anchorage, not just "surveyed" reef areas. Either set precision anchoring zone in soft habitat greater than 350m from hard areas per the hard-soft maps (i.e. Figure 3-28) or conduct surveys to delineate an area free of coral habitat to ensure that this activity avoids damage to EFH.

8. Plan training activities that include expended materials (e.g. GUNEX, TORPEX, etc) to avoid all areas where the seafloor is less than 700m deep, including offshore banks, shoals, and seamounts within the MIRC. Discharging expended materials in depths greater than 700m will avoid impacts to seafloor EFH. Materials may affect EFH in the water column, however, these will be limited to temporary impacts as the materials fall to the bottom. Efforts should be made to mitigate for expended materials discharged in depths less than 700 m. Include EFH maps for offshore banks, shoals, and seamounts that fall within the training zones in your analysis of impacts and provide these maps to naval forces through the PMAP system to facilitate impact avoidance during training activities.

9. Re-analyze the explosive impacts scenario to include the smaller, more sensitive fish sizes. According to the EFHA, the worst case scenario uses the 30lb fish for the analysis, yet this size class has the smallest range and therefore does not reflect a worst case scenario.

10. DoD should not increase the amount of explosive used at the Apra Harbor UNDET site. The Apra Harbor UNDET site is more confined and relatively close to high coral cover areas (see Figure 4-4). Doubling the current explosive charge increases the likelihood of impacts to coral reef habitat and CREMUS using the area. Ideally, use of the Apra Harbor UNDET site should be discontinued in favor of the openwater sites outside of the harbor.

Please be advised that regulations (Section 305(b)(4)(B) of the MSA) to implement the EFH provisions of the MSA require that Federal action agencies provide a written response to this letter within 30 days of its receipt and at least 10 days prior to final approval of the action. A preliminary response is acceptable if final action cannot be completed within 30 days. The final response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the activity. If the response is inconsistent with our EFH Conservation Recommendations, an explanation of the reason for not implementing the recommendations must be provided.

Conclusion

In conclusion, NMFS greatly appreciates the Navy's efforts to effectively coordinate with us on the proposed Mariana Islands Training and Testing EIS/OEIS, and the efforts to and minimize adverse effect to EFH including coral reef resources for this large scale project. We determine that adverse affect to EFH will occur without minimization measures such as the EFH Conservation Recommendations listed above. The information provided in the EIS and EFH Assessment suggests that there may be significant impacts to marine resources, particularly EFH, associated with this action as currently described.

We greatly appreciate the opportunity to review and comment on this project. Should you have any questions, comments, or require additional technical assistance, please contact Valerie Brown in our Guam Field Office valerie.brown@noaa.gov or 671-646-1904.

Sincerely,

Gerry Davis
Assistant Regional Administrator
Habitat Conservation Division

cc by e-mail:
Ryan Winn, US ACOE, Honolulu District
Amelia DeLeon, GCMP, BSP
Celestino Aguon, DAWR, DoAg

6

DEPARTMENT OF THE NAVY
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IN REPLY REFER TO:
5090
N465/0851
August 19, 2014

Mr. Gerry Davis
Assistant Regional Administrator
Habitat Conservation Division
National Marine Fisheries Service
Pacific Islands Regional Office
1845 Wasp Blvd., Building 176
Honolulu, HI 96818

Dear Mr. Davis:

SUBJECT: ESSENTIAL FISH HABITAT (EFH) ASSESSMENT FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and regulations governing conservation of EFH, this letter responds to the National Marine Fisheries Service's (NMFS) July 21, 2014, conservation recommendations for proposed military training and testing activities in the Marina Islands Training and Testing (MITT) Study Area.

We acknowledge your concerns outside of the conservation recommendations regarding activities on the land-based portions of the MITT Study Area, amphibious landings, expended materials in areas designated as EFH, and the associated analysis within the EFH Assessment. The MITT Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) include land-based activities on Guam and the Commonwealth of the Northern Mariana Islands (CNMI) (including Farallon de Medinilla [FDM]) (refer to Enclosure 1). The only land-based activities that could impact EFH are those conducted on FDM. Proposed activities on FDM may impact surrounding marine habitats; however, these impacts are expected to be minimal and, therefore, will not require mitigation.

In regards to the stressor analysis and impacts, the term stressor is broadly used in the EIS and EFHA to refer to an agent, condition, or other stimulus that causes stress to an organism or alters physical, socioeconomic, or cultural resources. Further information on the approach to analysis is provided in Section 3.0.5 of the MITT EIS/OEIS. The EFH Assessment is based on best available data regarding location of habitat within the Study Area and, when available, the condition of habitat. The analysis considers data from annual marine ecological surveys of near shore marine resources at FDM between 1999 and 2012 (no survey was performed in 2011). This area of marine habitat has been utilized for many years for military

SUBJECT: ESSENTIAL FISH HABITAT (EFH) ASSESSMENT FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

activities, activities which are much more impactful than the remaining activities proposed throughout the MITT Study Area. Although minor ecological impacts which could be attributed to military training were detected in 2012 and previous surveys, no significant or substantial impacts to the physical or biological environment have been detected between 1999 and 2012. This conclusion was reached by all the investigators (1999 - 2012) and was based upon four criteria: 1) very few areas of disturbance have been detected, 2) most of the disturbed areas have been located in natural rubble environments, 3) the size of the disturbed areas were generally less than two square meters, and 4) substantial or complete recovery has occurred within one year. Therefore, the analysis reflects that similar (or reduced) impacts and recovery times would be expected in other portions of the MITT Study Area from the proposed actions.

Amphibious landings using LCAC, LCU, AAV or other large amphibious craft over beaches are addressed in the MITT EIS/OEIS and EFH Analysis programmatically. Amphibious landings identified in the MITT EIS/OEIS are potential locations where these activities could occur. The few amphibious landings proposed would only be conducted after additional assessments are made to 1) ensure the activity could be conducted in such a way as to avoid impacts, or 2) if impacts cannot be avoided, additional mitigation measures and consultation would be considered as appropriate.

Unmanned Underwater Vehicles (UUVs) consist of two categories: remotely operated vehicles and autonomous underwater vehicles. Within these two categories are many sub-types and designs meeting differing requirements. In general, free-swimming UUV, both remotely operated or autonomous, are by design equipped with depth/mapping sensors and operated in such a way as to avoid all contact with obstructions or bottom, and avoid areas of high surge such as the surf zone. Some UUVs, such as crawlers, are by design able to operate in areas of high current/surge found in shallow waters, nearshore, and the surf zone. Crawlers which can operate in this environment are typically autonomous, battery-powered amphibious vehicles typically used for functions such as reconnaissance missions in the nearshore and the surf zone. These devices are used to classify and map underwater mines in shallow water areas. They are capable of traveling 2 ft. (0.61 m) per second along the seafloor and can avoid obstacles. Crawlers move over the surface of the seafloor and would not harm or alter any hard substrates encountered; therefore the hard bottom habitat would not be impaired. In soft substrates, they may leave a trackline of depressed sediments approximately 24 in. (62 cm) wide (the width of the device) in their wake. However, since they operate in shallow water, any disturbed sediments would be redistributed by wave and tidal action shortly following the disturbance. Any disturbance to the soft sediments would not impair their ability to function as a habitat.

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SUBJECT: ESSENTIAL FISH HABITAT (EFH) ASSESSMENT FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

Finally, in regards to military expended materials, most activities that expend materials are not scheduled consistently in the same location and mostly occur within deeper offshore areas. Because expended materials occur over a vast area in deeper waters, there are minimal impacts to EFH. The Navy has conducted monitoring in the coastal areas around FDM since 1999. Based on the findings from these studies, impacts to the marine habitats from military expended materials have shown to be insignificant. Therefore, impacts to EFH throughout the Study Area from military expended materials would be minimal and would not require further mitigation.

The following provides Navy's responses to the ten EFH conservation recommendations offered in your letter:

Recommendation 1:

Evaluate the impacts to EFH from the land-based portions of the MITT Study Area such as any activities occurring on Farallon de Medinilla, as well as Andersen Air Force Base, Naval Base Guam, Saipan, Tinian, and Rota, and work together with NMFS to implement measures to mitigate any identified adverse effects to EFH.

Navy response:

MITT activities that could potentially cause erosion and sedimentation of nearshore habitats discussed in the Draft EIS/OEIS are limited to those occurring on FDM. There are no land-based activities that involve construction or other ground disturbing activities. In response to your comments on the Draft EIS, information regarding potential sediment runoff from military use of FDM has been added to Section 3.1 (Sediments and Water Quality) of the Final EIS/OEIS, and information regarding how erosion on FDM may impact specific resources has been added to relevant resource sections in the Final EIS/OEIS (e.g., marine communities, marine invertebrates, fish, sea turtles, and marine mammals). The analysis concludes that impacts from erosion caused by land-based activities on sediment and water quality would be indirect, short term, and local. Any increase in turbidity that may impact surrounding biological communities would be minimal and not expected to result in long-term adverse impacts to EFH. A copy of the MITT Preliminary FEIS Version 2 was provided to NMFS Headquarters and Hawaii offices for review on 24 June 2014.

Recommendation 2:

Avoid, to the greatest extent practicable, conducting any training and testing activities in the MITT Study Area that have been designated as Habitat Area of Particular Concern (HAPC) for Coral Reef Ecosystem Management Unit Species (CREMUS). Also, avoid conducting activities that have impact to seafloor in areas designated as HAPC for

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SUBJECT: ESSENTIAL FISH HABITAT (EFH) ASSESSMENT FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

Bottomfish Management Unit Species (BMUS). Avoidance of these areas will eliminate risk of impact to these important habitats. (Please refer to the Western Pacific Regional Fishery Management Council's Mariana Archipelago FEP for EFH designations.)

Navy response:

The Navy cannot practicably avoid all designated EFH areas for all activities, but proposes to implement certain measures to avoid and minimize impacts to EFH. For example:

- The Navy conducts underwater detonations in designated locations where they have historically occurred and have been previously analyzed in the MIRC EIS/OEIS (e.g., Agat Bay Mine Neutralization Site, Outer Apra Harbor Underwater Detonation Site, and Piti Floating Mine Neutralization Site);

- The Navy conducts precision anchoring primarily in locations where this activity has historically occurred, (e.g., established and regulated anchorages in Apra Harbor see attached figure); and

- Prior to conducting any amphibious landing using LCAC, LCU, AAV or other large amphibious craft over beaches that may contain bottom obstructions or coral, site-specific assessments will be conducted to determine conditions and if additional consultations or NEPA are required.

Recommendation 3:

Develop and implement a protocol for immediate clean-up of unexploded ordnance also for floating debris such as parachutes in areas designated as EFH for juvenile and adult life stages of CREMUS (all seafloor around the Mariana Islands shallower than 100 m depth). Unexploded ordnance may cause direct impacts to EFH if triggered after use, and parachutes become marine debris that may move with currents, tides and waves and trap and abrade corals in their path.

Navy response:

Navy considers emergency actions associated with unexploded ordnance outside the scope of the proposed action and states that there are already operating procedures in place depending on the type of emergency. Navy reiterates that the majority of training items would be expended in the open ocean, where substrates would be primarily clays and silts. Navy will, however, remove associated debris (plastic for wrapping C4 charges, some targets, torpedoes and non-

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expendable materials) to the extent practicable as is related to training and testing activities.

Recommendation 4:

Conduct further analysis to assess the impacts of amphibious landings and over the beach insertions/extractions by small boats and unmanned vehicles. Due to the fragile nature of the coral reef habitats in the proposed training and testing sites and the proposed frequency of these events, the impacts are likely to be additive and cumulative in nature. Recent discussions regarding the CNMI Joint Military Training EIS suggest that the landing beaches in Tinian are physically unable to accommodate AAV landings and would need substantial modifications for use as landing craft beaches. Please clarify DOD's expected use of the beaches and provide analysis of potential impacts.

Navy response:

Hydrographic and beach surveys would not be necessary for beach landings that involve small boats, such as rigid hull inflatable boats (RHIBs). Small craft follow standard operating procedures and use a combination of shallow draft, small footprint, inherent maneuverability, or depth sensors to avoid damage to themselves, obstructions (e.g. hard substrates), and the seafloor.

Unmanned vehicles are not proposed for use during amphibious landings and over the beach insertions/extractions.

As previously discussed, amphibious landings using LCAC, LCU, AAV or other large amphibious craft over beaches are addressed in the MITT EIS/OEIS and EFH Analysis programmatically. The few Amphibious landings proposed would only be conducted after additional assessments are made to 1) ensure the activity could be done in such a way as to avoid impacts, or 2) if impacts cannot be avoided, would not be conducted in these areas without further studies and a site-specific analysis to determine potential impacts as well as additional mitigation measures and consultation as appropriate.

Recommendation 5:

Conduct landing craft and small boat insertions only during high tide and avoid sensitive reef habitat and operate the vessels in ways that minimize turbidity and sedimentation and avoid abrasion impacts to corals and dense seagrass beds. We recommend that DoD further constrain the areas of landing operations to minimize impacts. Many of the areas listed on page 4-32, specifically San Luis Beach, Gab Gab Beach, Haputo Beach, Unai Chulu, Unai Dankulo, and Unai Babui, have relatively high coral cover along the very shallow reef margin. The EFHA and Draft EIS/OIS do not fully assess the potential impacts of

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SUBJECT: ESSENTIAL FISH HABITAT (EFH) ASSESSMENT FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

these activities and do not adequately describe the mitigation actions that DoD will take to address this.

Navy response:

Navy protocol is that amphibious landing activities would only be scheduled within designated boat lanes and beach landing areas. Standard operating procedure is to conduct beach landings and departures at high tide, and for constrained beaches (e.g., Unai Babui). Commander, Naval Forces Marianas [COMNAVMAR] Instruction 3500.4A requires that AAVs land at high tide one vehicle at a time over a designated approach lane.

Based on surveys prior to conducting landing activities, if the beach landing area and boat lane is clear, the activity could be conducted, and crews would follow procedures to avoid obstructions to navigation, including coral reefs; however, if there is any potential for impacts on corals or hard bottom substrate, the Navy would coordinate with applicable resource agencies before conducting the activity. Evaluation of cumulative and additive impacts from the proposed activities based on the surveys would be conducted at that time.

As previously mentioned, small craft follow standard operating procedures and use a combination of shallow draft, small footprint, inherent maneuverability, or depth sensors to avoid damage to themselves, obstructions, and the bottom. Hydrographic and beach surveys would not be necessary for beach landings with small boats, such as rigid hull inflatable boats (RHIBs).

Recommendation 6:

To the extent possible, avoid activities that cause sedimentation and explosions, including landing craft exercises, during 21 day primary coral spawning period each year. This is typically a 21 day period beginning around the full moon in July.

Navy response:

While training activities may overlap coral spawning periods during some years and some mobile larvae may be affected, due to the dispersed nature, frequency and duration of most activities proposed in the MITT Study Area the impacts from these activities are considered temporary and minimal. Scheduling of training activities and locations inevitably overlaps a wide array of marine species habitats, including foraging habitats, reproductive areas, migration corridors, and seasonal coral spawning. Training schedules are based on deployment schedules and evolving events. Training schedules cannot be tailored to avoid seasonal coral spawning. Limiting activities to avoid certain seasons would adversely impact the

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effectiveness of the training or testing activity, and would therefore result in an unacceptable increased risk to achieving the purpose and need for the proposed action in the MITT EIS/OEIS. Refer to Chapter 5, Section 5.3.4.1.11 (Avoiding Marine Species Habitats) of the MITT EIS for details.

Recommendation 7:

Limit precision anchoring activities to avoid all hard substrate in Apra Harbor and at the Saipan Anchorage, not just "surveyed" reef areas. Either set precision anchoring zone in soft habitat greater than 350m from hard areas per the hard-soft maps (i.e., Figure 3-28) or conduct surveys to delineate an area free of coral habitat to ensure that this activity avoids damage to EFH.

Navy response:

The Navy conducts precision anchoring primarily in locations where this activity has historically occurred per pre-existing federal recognition and regulation (e.g., the federally established, charted, and regulated anchorages in Apra Harbor, see Enclosure 2). These locations in Apra Harbor inevitably overlap both hard and soft bottom habitats, however since these areas are previously disturbed the impacts are anticipated to be minimal. Limiting activities to avoid these habitats would adversely impact the effectiveness of the training or testing activity.

Recommendation 8:

Plan training activities that include expended materials (e.g. GUNEX, TORPEX, etc.) to avoid all areas where the seafloor is less than 700m deep, including offshore banks, shoals, and seamounts within the Mariana Islands Range Complex (MIRC). Discharging expended materials in depths greater than 700m will avoid impacts to seafloor EFH. Materials may affect EFH in the water column, however, these will be limited to temporary impacts as the materials fall to the bottom. Efforts should be made to mitigate for expended materials discharged in depths less than 700m. Include EFH maps for offshore banks, shoals, and seamounts that fall within the training zones in your analysis of impacts and provide these maps to naval forces through the PMAP system to facilitate impact avoidance during training activities.

Navy response:

The Navy cannot practicably avoid discharging expended materials in all designated EFH areas at depths less than 700 m. However, in heavily used coastal areas around FDM, monitoring since 1999 has determined that impacts to the marine habitats from military expended materials have been insignificant. This was based on few areas of

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SUBJECT: ESSENTIAL FISH HABITAT (EFH) ASSESSMENT FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

disturbance detected in the monitoring; most of the observed disturbance areas have been located in natural rubble environments, the size of disturbed areas was less than 2 square meters, and substantial or complete recovery was observed within 1 year (Smith et al. 2013). Therefore, impacts to EFH areas within the Study Area located in water depths less than 700 m are expected to be minimal and temporary, and would not require mitigation.

Recommendation 9:

Re-analyze the explosive impacts scenarios to include the smaller more sensitive fish sizes. According to the EFHA, the worst case scenario uses the 30lb fish for the analysis, yet this size calls has the smallest range and therefore does not reflect a worst case scenario.

Navy response:

The explosive impacts scenarios for the 10 percent mortality range for fish in the EFHA include 1-ounce (oz.), 1-pound (lb.), and 30 lb. fish as shown in Table 4-5 of the EFHA. However, the text of the EFHA in the DEIS incorrectly states that the worst-case scenario is based off of the 30 lb. fish, when it was based off of the 1 oz. fish. This text will be amended in the Final EIS. Additionally, a determination on the impacts requires more information than what is currently available and, therefore, the analysis in the EFHA does not draw on any further conclusions for mortality of fish from explosives beyond what is presented in Table 4-5.

Recommendation 10:

DoD should not increase the amount of explosive used at Apra Harbor UNDET site. The Apra Harbor UNDET site is more confined and relatively close to high coral cover areas (see Figure 4-4). Doubling the current explosive charge increases the likelihood of impacts to coral reef habitats and CREMUS using the area. Ideally, use of the Apra Harbor UNDET site should be discontinued in favor of the openwater sites outside of the Harbor.

Navy response:

The Apra Harbor Underwater Detonation Site has a long history of usage and the surrounding benthic habitat is previously disturbed. The Navy does not propose to increase the frequency of activity for bottom-laid underwater explosion from what was analyzed in previous NEPA documents for the MIRC. The Navy is proposing to increase the net explosive weight (NEW) limit at this site to permit accomplishing a 20 lb. NEW training requirement. However, based on your concern regarding high coral cover areas in Apra Harbor, the Navy has re-evaluated the need for an increase in NEW utilized at the Outer Apra Harbor UNDET site

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SUBJECT: ESSENTIAL FISH HABITAT (EFH) ASSESSMENT FOR THE MARIANA ISLANDS TRAINING AND TESTING (MITT) STUDY AREA

and has determined that the 10 lb NEW limit will support current training needs and no increase is needed at this time. If the proposed increase becomes necessary at a later date, the Navy will conduct the appropriate analysis to assess potential effects on nearby coral. If and when such analysis is complete, the Navy will initiate site-specific EFH consultation with NMFS.

We appreciate your continued support in helping the U.S. Navy meet its environmental responsibilities. My point of contact for this matter is Ms. Julie Rivers. She can be reached at (808) 474-6391 or julie.rivers@navy.mil.

Sincerely,

L. M. FOSTER
Dir, Environmental Readiness
By direction

Enclosures: 1. Table 1-1. Land-Based Training Activities in the MITT Action Area
2. Figure 1-1. Nearshore Habitat Map

Copy to: (w/o encl)
Mr. Stan Rogers, NMFS Office of Protected Resources
Mr. John Fiorentino, NMFS Office of Protected Resources
Dr. Kelly Ebert, CNO N45

Enclosure 1

Table 1-1: Land-Based Training Activities in the MITT Action Area

Activity Name[1]	Action Area Component Where Trainings May Occur[2]					Activity Description
	Guam	Rota[3]	Tinian	Saipan	FDM	
Strike Warfare						
Bombing Exercise Air-to-Ground	-	-	-	-	X	Fixed-wing aircraft drop of explosive and non-explosive bombs on a land target.
Gunnery Exercise Air-to-Ground	-	-	-	-	X	Helicopters and fixed wing aircraft fire guns at land based targets.
Missile Exercise	-	-	-	-	X	Missiles or rockets from aircraft launched at a land target.
Combat Search and Rescue	X	X	X	X	-	CSAR units use helicopters, night vision and identification systems, and insertion and extraction techniques under hostile conditions to locate, rescue, and extract personnel.
Amphibious Warfare						
Fire Support Exercise-Land Based Target	-	-	-	-	X	Surface ship crews use large-caliber guns to fire on land-based targets in support of forces ashore.
Amphibious Assault	X	-	X	-	-	Forces move ashore from ships at sea for the immediate execution of inland objectives.
Amphibious Raid	X	X	X	-	-	Small unit forces move swiftly from ships at sea in amphibious assault craft for a specific short-term mission. Raids are quick operations with as few personnel as possible.
Urban Warfare Training	X	-	X	X	-	Forces sized from squad (13 personnel) to battalions (approximately 950 personnel) conduct training activities in mock urban environments.
Noncombatant Evacuation Operations / Humanitarian Assistance Operations / Disaster Relief Operations	X	-	X	-	-	Military units evacuate noncombatants from hostile or unsafe areas or provide humanitarian assistance in times of disaster.
Naval Special Warfare						

Enclosure 1

Activity Name[1]	Action Area Component Where Trainings May Occur[2]					Activity Description
	Guam	Rota[3]	Tinian	Saipan	FDM	
Personnel Insertion/Extraction	**X**	**X**	**X**	-	-	**Military personnel train for covert insertion and extraction into target areas using helicopters, fixed-wing aircraft (insertion only), small boats, and submersibles.**
Parachute Insertion	**X**	**X**	**X**	-	-	**Military personnel train for covert insertion into target areas using parachutes.**
Embassy Reinforcement	X	X	X	-	-	Special warfare units train to provide reinforcement of an embassy under hostile conditions.
Direct Action (Combat Close Quarters and Breaching)	**X**	-	**X**	-	-	**Military personnel train for use of force, breaching doors and obstacles, and close quarters combat.**
Direct Action (Tactical Air Control Party/Joint Tactical Air Control)	-	-	-	-	**X**	**Military personnel train to control combat support aircraft and designate targets for airspace de-confliction and terminal control for close air support. Teams also train to use small arms and mortars.**
Intelligence, Surveillance, Reconnaissance	X	X	X	X	-	Special warfare units train to collect and report battlefield intelligence.
Urban Warfare Training	X	X	X	X	-	Special warfare units train in mock urban environments.
Other Training Activities						
Maneuver (Convoy, Land Navigation)	X	-	X	-	-	Units conduct field maneuver training or convoy training.
Water Purification	**X**	-	**X**	-	-	**Units conduct water purification training using water purification equipment in field conditions.**
Field Training Exercise	X	X	X	X	-	Units train in securing an area, establishing a camp or post, and guarding and patrolling.
Force Protection	X	X	X	-	-	Units train in providing defensive force protection against a terror threat.
Anti-terrorism	X	X	X	-	-	Units train in conducting direct action against a terror threat.

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Enclosure 1

Activity Name[1]	Action Area Component Where Trainings May Occur[2]					Activity Description
	Guam	Rota[3]	Tinian	Saipan	FDM	
Seize Airfield	X	-	X	-	-	Train Naval Special Warfare, Navy Expeditionary Combat Command, or Marine Corps personnel to seize control of an airfield or port for use by friendly forces. These activities only occur at DoD-controlled airfields (on owned or leased lands on Guam and Tinian).
Airfield Expeditionary	X	-	X	-	-	Units conduct training establishing, securing, maintaining, or operating an expeditionary airfield. These activities only occur at DoD-controlled airfields (on owned or leased lands on Guam and Tinian).
Land Demolitions (Improvised Explosive Device Discovery/Disposal)	X	-	X	-	-	Explosive ordnance units conduct training detecting, isolating, or securing Improvised explosive devices or unexploded ordnance.
Land Demolitions (Unexploded Ordnance) Discovery/Disposal	**X**	-	-	-	-	**Explosive ordnance units conduct disposal of unexploded ordnance. Training is incidental to the emergency disposal of unexploded ordnance. Disposal occurs at Andersen AFB EOD Range. Emergency detonations may occur at Andersen AFB EOD Range and Naval Base Guam Munitions Site.**

Notes:

1. Activities in **bold text** are activities that are proposed to increase in the number of occurrences per year relative to the number of exercises previously analyzed in the 2010 MIRC Biological Opinion. Activities that are not in bold text will not increase in occurrences per year.
2. The major training activities discussed in the MITT EIS/OEIS that include land training components include Joint Expeditionary Exercise, Joint Multi-Strike Group Exercise, Fleet Strike Group Exercise, Marine Air Ground Task Force Exercise (Amphibious)—Battalion, Special Purpose Marine Air Ground Task Force Exercise , and Urban Warfare Exercise. The types and numbers of activities are included in the named activity descriptions for training activities. In other words, the major exercises do not add additional events, any additional training activities are included in the activity descriptions.
3. All activities on Rota are expected to occur at the Rota International Airport, Angyuta Island, Commonwealth Port Facility, and other developed areas.

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Enclosure 2

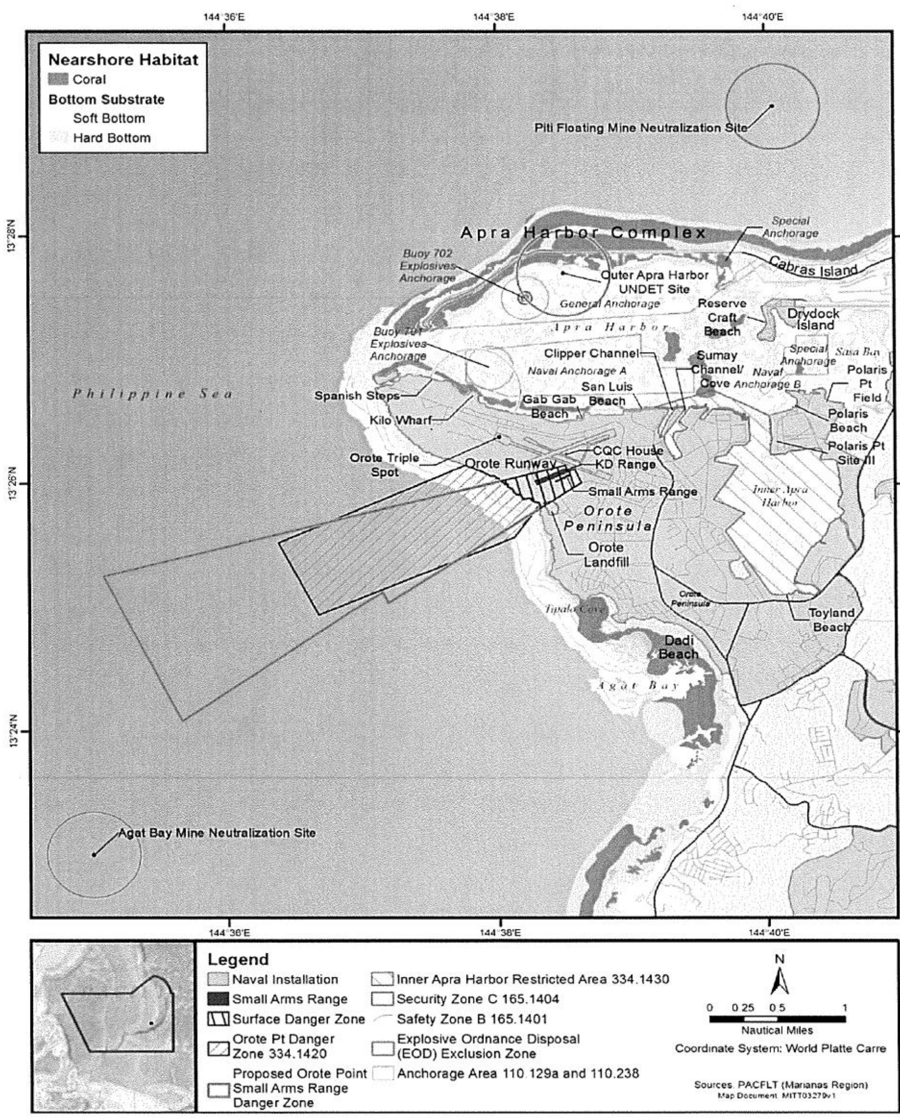

Figure 1-1. Nearshore Habitat Map

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Appendix D: Air Quality Emissions Calculations and Record of Non-Applicability

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D AIR QUALITY EMISSIONS CALCULATIONS

This appendix discusses emission factors, calculations, and assumptions used in the air quality analyses presented in the Air Quality section of Chapter 3 (see Section 3.2).

D.1 SURFACE OPERATIONS EMISSIONS

Surface operations are activities associated with vessel movements. Training and testing activities use a variety of marine vessels, including cruisers, destroyers, frigates, carriers, submarines, amphibious vessels, and small boats. These vessels use a variety of propulsion methods, including marine outboard engines, diesel engines, and gas turbines.

Marine Outboard Engines:

The United States Environmental Protection Agency (USEPA) has published emissions factors for air pollutants produced by several types of two-stroke and four-stroke outboard engines. The most conservative emission factors for two-stroke engines of various horsepower are presented in Table D.1-1.

Table D.1-1: Emission Factors for Two Stroke Engines

USEPA Outboard Engine Emissions Factors (grams/hp-hr.)			
NO_x	CO	VOC	SO_x
0.018	0.63	0.25	0.00108

Notes: CO = carbon monoxide, hp = horsepower, hr. = hour, NO_x = nitrogen oxides, SO_x = sulfur oxides, USEPA = United States Environmental Protection Agency, VOC = volatile organic compounds

Source: USEPA 1999, Exhaust Emissions Factors for Non-Road Engine Modeling-Spark Ignition. Report No. NR-010b; Office of Mobile Sources, Assessment and Modeling Division, EPA-R-99-009.

Emissions for surface craft using outboard engines were calculated using USEPA AP-42 factors, and multiplied by the engine horsepower and hours of operation.

$$Emissions = HP \times HR/YR \times EF \times ENG$$

Where:

Emissions = surface craft emissions
HP = horsepower (reflective of a particular load factor/engine power setting)
HR/YR = hours per year
EF = emission factor for specific engine type
ENG = number of engines

To obtain the total criteria pollutant emissions for the Proposed Action, emissions were calculated for each training or testing activity, type of surface vessel, and criteria pollutant. These individual estimates of emissions, in units of tons per year, were then summed by criteria pollutant to obtain the aggregate emissions for surface vessel emissions activities.

Diesel Engines:

Limited data were available for large marine diesel engines. Therefore, USEPA AP-42 emissions factors for industrial reciprocating engines were used to calculate diesel engine emissions. Other sources of vessel emissions factors were previous United States Department of the Navy (Navy) Environmental Impact Statement (EIS)/Overseas EIS (OEIS) documents (citing JJMA 2001). Diesel was assumed to be the primary fuel to ensure a conservative estimate. Calculation methods similar to those described for Marine Outboard Engines were used to obtain emissions estimates for diesel engines.

$$Emissions = HP \times HR/YR \times EF \times ENG$$

Where:

Emissions = surface craft emissions
HP = horsepower (reflective of a particular load factor/engine power setting)
HR/YR = hours per year
EF = emission factor for specific engine type
ENG = number of engines

Diesel engine emission factors were multiplied by the engine horsepower and annual hours of operation to calculate the pollutant emissions per year.

D.2 AIR OPERATIONS EMISSIONS

Training and testing consists of the activities of various aircraft, including the F/A-18, P-3, SH-60B and other military aircraft. Aircraft operations of concern are those that occur from ground level up to 3,000 feet (ft.) (914 meters [m]) above ground level (AGL). The 3,000 ft. (914 m) AGL ceiling was assumed to be the atmospheric mixing height above which any pollutant generated would not contribute to increased pollutant concentrations at ground level (known as the mixing zone). All pollutant emissions from aircraft generated above 3,000 ft. (914 m) AGL are excluded from analysis for compliance with National Ambient Air Quality Standards. The pollutant emission rate is a function of the aircraft engine's fuel flow rate and efficiency. Emissions for one complete training activity for a particular aircraft are calculated by knowing the specific engine pollutant emission factors for each mode of operation.

For this EIS/OEIS, emission factors for most military engines were obtained from Navy's Aircraft Environmental Support Office (AESO) memoranda and previous Navy EIS/OEIS documentation (primarily citing the Federal Aviation Administration's Emissions and Dispersion Modeling [EDMS] model). For those aircraft for which engine data were unavailable, an applicable surrogate was used. Table D.2-1 is an example of emission factors for the aircraft engines. The table lists the various engine power modes, time in each mode, fuel flow, and corresponding pollutant emission factors.

Table D.2-1: Emission Factors for Military Aircraft

Aircraft Type	Engine Model	Number of Engines	Time in Mode*, hours	Fuel Flow, lb./hr./engine	Emission Factors, lb./1,000 gallons (gal.) of fuel				
					CO	NOx	VOC	SOx	PM
EA-6B	J52-P-408A (2)	2	3.2	3,195	7.99	5.71	1.09	0.40	12.20
FA-18E/F	F414-GE-400 (2)	2	38.4	5,169	0.72	14.75	0.12	0.40	6.56
P-3	T56-A-14 (4)	4	2.4	1,200	1.82	8.43	0.41	0.40	3.97
SH-60B	T700-GE-401C (2)	2	120	600	6.25	6.40	0.55	0.40	4.20

*Time in Mode = time operating below 3,000 ft. during a Joint Expeditionary Exercise

D.3 Ordnance and Munitions Emissions

Available emissions factors (AP-42, *Compilation of Air Pollutant Emission Factors*) were used. These factors were then multiplied by the net weight of the explosive and the number of items that were used per year. This calculation provides estimates of annual emissions.

Emissions = EXP/YR×EF×Net Wt

Where:

Emissions = ordnance emissions
EXP/YR = explosives, propellants, and pyrotechnics used per year
EF = emissions factor
Net Wt = net weight of explosive

D.4 Emissions from Vehicles and Other Equipment

Available emissions factors (AP-42, *Compilation of Air Pollutant Emission Factors* and other sources) were used. These factors were then multiplied by the fuel usage for the vehicle or the equipment.

Emissions = EF x fuel usage

Where:

Emissions = vehicle/equipment emissions
Fuel usage = lb./year
EF = emissions factor

D.5 Emissions Estimates Spreadsheets

Tables D.5-1 to D.5-22 presented after the Record of Non-Applicability contain the emission factors and the emissions calculations for aircraft, vessels, ordnance, vehicles and other equipment for training and testing. The emissions are provided in total as well as by geographical jurisdiction (onshore and within state waters, federal waters, and beyond federal waters) for surface vessels and aircraft. Table D.5-23 presents the emissions from activities that will occur in Guam's sulfur oxide non-attainment areas, which are also included for purposes of the conformity analysis.

D.6 RECORD OF NON-APPLICABILITY

The following are the Record of Non-Applicability memorandum (Figure D.6-1), the Navy Record of Non-Applicability (Figure D.6-2) and the Conformity Analysis (Figure D.6-3). The conformity analysis is included in Section 3.2, Air Quality.

MEMORANDUM FOR THE RECORD

From: Commander, U.S. Pacific Fleet

Subj: Applicability Analyses for Mariana Islands Training and Testing (MITT) Environmental Impact Statement/Overseas Environmental Impact Statement – Military Readiness Activities in Waters of the Territory of Guam

Ref: (a) 40 CFR, Part 93, Subpart B: Determining Conformity of General Federal Actions to State or Federal Implementation Plans

Encl: (1) Record of Non-Applicability for Mariana Islands Training and Testing Activities in Waters of the Territory of Guam;

(2) Conformity Analyses for Preferred Alternative in Waters of the Territory of Guam

1. Enclosure (1) is a Record of Non-Applicability for those activities associated with Pacific Fleet training and testing activities that are expected to occur annually in waters of the Territory of Guam. SO_x emissions of the Preferred Alternative are included in Enclosure (2). Comparison of the calculated values in Enclosure 2 with those in 40 C.F.R. 93.153(b) show that this project is below the *de minimis* levels.

2. If there are any questions or if additional information is needed, please call John VanName at (808) 471-1714.

Figure D.6-1: Record of Non-Applicability Memorandum

NAVY RECORD OF NON-APPLICABILITY FOR CLEAN AIR ACT CONFORMITY

The Proposed Action falls under the Record of Non-Applicability (RONA) category, and is documented with this RONA.

Action Proponents: United States Pacific Fleet
Naval Sea Systems Command
Naval Air Systems Command
Space and Naval Warfare Systems Command
Office of Naval Research

Proposed Action Name: Mariana Islands Training and Testing (MITT)

Proposed Action Location: Mariana Islands Range Complex, Guam

Proposed Action and Emissions Summary:

See attached Conformity Analysis

Affected Air Basin: Guam Air Basin

Date RONA prepared: April 17, 2015

RONA prepared by: Naval Facilities Engineering Command, Pacific

Attainment Area Status and Emissions Evaluation Conclusion:

To the best of my knowledge and belief, the information contained within this General Conformity Applicability Analysis is correct and accurate. By signing this statement, I am in agreement with the finding that the total of all reasonably foreseeable direct and indirect emissions that will result from this action is below the *de minimis* threshold set forth in 40 C.F.R. 93.153(b). Accordingly, it is the Navy's determination that this action conforms to the applicable State Implementation Plan (SIP).

RONA Approval:

Signature: Larry M. Foster Date: 21 APR 2015

Name/Rank: Mr. Larry Foster

Position: Director, Fleet Environmental

Activity: Commander, U.S. Pacific Fleet

Enclosure 1

Figure D.6-2: Record of Non-Applicability Form

Subject: Conformity Analysis for Navy Training and Testing

The Proposed Action falls under the Record of Non-Availability (RONA) category pursuant to 40 Code of Federal Regulations (CFR) Parts 52 and 93, and the basis for exemption from conformity requirements is documented with this RONA.

The MITT EIS/OEIS has been prepared to assess current and future training and testing activities. The Study Area includes the waters of the Territory of Guam. The training and testing activities generally will involve a variety of boats and other watercraft. Aircraft overflights and vessel operations during portions of anti-submarine warfare and anti-surface warfare training and testing events would occur within the waters of the Territory of Guam.

Table 1 lists the emission sources, their engines, and their fuels that will operate in the non-attainment areas of Guam. This and other engine information were used to calculate the potential emissions of sulfur oxides.

Table 1: List of Emission Sources, Engines, and Fuels

Boat or Source	Fuel	Number of Engines and Engine Size
Cruiser	Distillate Oil	Four – 33,600 hp
Amphibious assault ship	Distillate Oil	Two boilers, two turbines – 70,000 hp total
Amphibious transport dock	Distillate Oil	Two boilers, two turbines – 24,000 hp total
Guided missile frigate	Distillate Oil	Two – 41,000 hp total
Landing craft – utility	Distillate Oil	Two – 680 hp
Landing craft – air cushioned	Distillate Oil	Four – 16,000 hp total
Rigid hull inflatable boat	Gasoline	Two – 300 hp
Combat rubber raiding craft	Gasoline	One – 55 hp
CH-46	Jet Fuel	Two – 1870 hp
CH-53	Jet Fuel	Two – 3925 hp
MH-53	Jet Fuel	Three – 4380 hp
MV-22	Jet Fuel	Two – 6150 hp
UH-1	Jet Fuel	One – 1,100 hp
AH-1	Jet Fuel	Two – 1690 hp
AV-8	Jet Fuel	One – 23,500 pound force
AV-8B	Jet Fuel	One – 23,500 pound force
H-60	Jet Fuel	Two – 1890 hp
SH-60B	Jet Fuel	Two – 1890 hp
C-130	Jet Fuel	Four – 4590 hp
MQ-4C	Jet Fuel	One – 8,917 pound force
Light armored vehicle	Distillate Oil	One – 19.5 hp
Assault Amphibious Vehicle	Distillate Oil	One – 400 hp
High Mobility Multi-Purpose Wheeled Vehicle	Distillate Oil	One – 190 hp
Truck	Distillate Oil	One – 170 hp
Dozer	Distillate Oil	One – 420 hp
Forklift	Distillate Oil	One – 120 hp
Generator	Distillate Oil	One – 120 hp
Reverse Osmosis Water Purification Unit	Distillate Oil	One – 120 hp

Note: hp = horsepower

Enclosure 2

Figure D.6-3: Conformity Analysis

In addition to the engine information for each vessel, the annual hours of operation for each vessel was needed to estimate the emissions of SO_x. Using the engine and fuel information and proposed hours of operation, the appropriate emission factors were identified from various U.S. Environmental Protection Agency documents for marine engines. These documents included:

1. Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder, EPA420-D-007-001, March 2007.
2. USEPA Memorandum, "Emission Factors for Recreational Marine Diesel Engines," EPA Doc No. EPA420-F-02-044, dated 09 September 2002.
3. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition EPA 420-P-04-009. April 2004.
4. "Conversion Factors for Hydrocarbon Emission Components" EPA420-R-05-015. December 2005, NR-002c.

For each source, the appropriate emission factor is multiplied by the period of use and the engine size to estimate emissions. Similar methods were applied to calculate aircraft emissions. The emissions of sulfur oxides from all sources were added. Appendix D of the EIS/OEIS contains the information from which these emissions estimates were calculated. The emissions estimates for sulfur oxides for each alternative are provided in Table 2 below.

Table 2: Emissions Estimates for the Preferred Alternative for Training and Testing Activities in the Non-Attainment Areas of Guam

Estimated Annual Air Pollutant Emissions in the Study Area (within 3 nm), Alternative 1			
Emissions by Air Pollutant (TPY)			
		SOx	
No Action Alternative		**172**	
Alternative 1			
Aircraft		9	
Vessels		254	
Ordnance		0	
Other		0	
Alternative 1 Total		**263**	
Change		**91**	
De Minimis Threshold		100	
Exceeds Threshold?		No	

Enclosure 2 (continued)

Figure D.6-3: Conformity Analysis (continued)

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Table D.5 -1 Surface Ship Emission Factors

Surface Ship	Emissions Factors (lb/hr) Propulsion Engines + Generators				
	CO	NOx	HC	SOx	PM10
CG-3	114.75	65.22	7.67	33.55	3.44
DDG-3	106.67	53.84	7.84	21.22	2.80
FFG-3	120.04	78.11	11.64	16.08	4.30
TRB-3	6.47	56.22	1.55	7.40	1.18
AOE-2	6.67	39.37	5	119.43	23.77
USCG	5.74	57.91	0.88	11.55	0.21
LHA-1	7.38	43.53	5.53	130.97	26.29
LHD-2	6.80	40.12	5.10	120.70	24.23
LPD-2	2.94	17.32	2.20	52.11	10.46
LCAC	25.41	55.32	0.72	43.30	3.89
LCU	36.21	44.95	0.52	3.11	1.57
AAV-2	0.76	6.22	0.82	1.25	0.26
AAAV					
PC-2	17.21	38.14	2.94	8.23	0.92
MK V-2	3.86	29.49	0.99	4.73	0.40
RIB-4	0.34	9.14	0.06	1.44	0.15
CRRC-5		0.15	12.90		
AE-2	20.17	20.93	0.99	5.97	1.57
BW-3		0.26	26.30		
SSN	0	0	0	0	0
SSGN	0	0	0	0	0
T-AGO(LFA)	6.67	39.37	5	119.43	23.77
CG-PARTNER	107.79	47.1	9.9	21	2.6
DDG-PARTNER	103.99	49.9	9	17.9	2.5
SS-PARTNER	2.94	17.32	2.2	52.11	10.46

Table D.5-2 Aircraft Emission Factors

Aircraft	Emission Indices, lb/1,000 lb fuel					Emissions Factors (lb/hr)				
	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM
AH-1W	11.21	5.44	0.57	0.4	4.2	9.10252	4.41728	0.46284	0.3248	3.4104
AV-8B	8.8	6.71	0.28	0.4	7.1	52.8	40.26	1.68	2.4	42.6
C-130 F/R/T	2.07	8.16	0.47	0.4	3.97	9.315	36.72	2.115	1.8	17.865
CH-46	17.04	4.12	2.64	0.4	1.78	20.448	4.944	3.168	0.48	2.136
CH-53	2.13	8.08	0.15	0.4	2.21	9.50832	36.06912	0.6696	1.7856	9.86544
E-2 / E-2C	2.16	8.06	0.49	0.4	3.97	4.752	17.732	1.078	0.88	8.734
EA-18G	0.72	14.75	0.12	0.4	6.56	7.44336	152.4855	1.24056	4.1352	67.81728
EA-6B	7.99	5.71	1.09	0.4	12.12	51.0561	36.4869	6.9651	2.556	77.4468
EP-3	3.7	7.8	0.5	0.4	3	15.5844	32.8536	2.106	1.6848	12.636
F-15	3.62	46.72	0.65	0.4	8.15	22.42952	289.4771	4.0274	2.4784	50.4974
FA-18A/C	2.44	6.74	0.44	0.4	6.36	16.19184	44.72664	2.91984	2.6544	42.20496
FA-18E/F	0.72	14.75	0.12	0.4	6.56	7.44336	152.4855	1.24056	4.1352	67.81728
HH-60	6.25	6.4	0.55	0.4	4.2	7.5	7.68	0.66	0.48	5.04
Learjet	22.38	5.9	4.26	0.4	1.27	23.81232	6.2776	4.53264	0.4256	1.35128
MH-60R/S	6.25	6.4	0.55	0.4	4.2	7.5	7.68	0.66	0.48	5.04
P-3C	1.82	8.43	0.41	0.4	3.97	8.736	40.464	1.968	1.92	19.056
P-8 MMA	1.24	9.26	0.28	0.4	0.56	4.045624	30.21168	0.913528	1.30504	1.827056
S-3	14.1	4.07	1.86	0.4	3.62	32.289	9.3203	4.2594	0.916	8.2898
S-3B	14.1	4.07	1.86	0.4	3.62	32.289	9.3203	4.2594	0.916	8.2898
SH-60	6.25	6.4	0.55	0.4	4.2	7.5	7.68	0.66	0.48	5.04
SH-60B	6.25	6.4	0.55	0.4	4.2	7.5	7.68	0.66	0.48	5.04
SH-60B/F	6.25	6.4	0.55	0.4	4.2	7.5	7.68	0.66	0.48	5.04
SH-60F	6.25	6.4	0.55	0.4	4.2	7.5	7.68	0.66	0.48	5.04
UH-1N	3.34	4.72	0.17	0.4	4.2	1.8036	2.5488	0.0918	0.216	2.268
A-10	4	8.83	0.4	0.4	2.67	12.104	26.71958	1.2104	1.2104	8.07942
B-1B	0.84	13.12	0.11	0.4	0.14	5.5776	87.1168	0.7304	2.656	0.9296
E-2	0.65	10.45	0.16	0.4	3.97	2.8847	46.3771	0.71008	1.7752	17.61886
E-3	2.07	8.45	0.31	0.4	0.26	67.65588	276.1798	10.13204	13.0736	8.49784
KC-135	1.34	13.5	0.03	0.4	0.13	30.66992	308.988	0.68664	9.1552	2.97544
MQ-4C						2.1	38.84	0.66	3.54	0.61
MV-22	19.74	3.94	3.43	0.4	1.78	22.1088	4.4128	3.8416	0.448	1.9936

Table D.5-3 Ordnance Emission Factors

Ordnance Type	Ordnance	Emission Factor (lb per lb)							Emission Factor (lb/item)						
		CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead
BOMB	CBU MK20 ROCKEYE									0.00					
	GBU32I JDAM		0.1482							57.06					
	LGTR									0.00					
	MK76		0.085							0.26					
	BDU 48		0.085							0.26					
	MK82 HE		0.3184							61					
	GBU12 - Paveway II		0.3184							61					
	MK82 INERT		0.085							0.26					
	BDU 45		0.085							0.26					
	MK83 HE		0.1482							62					
	GBU 16		0.1482							66					
	MK84		0.1482							140					
	MK83 INERT		0.085							0.26					
OTHER ORD	**Type**														
	EER/IEER AN/SQQ-110	1.2	0.0044	0.011				0.00004		0.02					
	BLASTING CAP MK11								1.80E-03	3.10E-04	4.50E-05	4.60E-04	2.90E-04		1.30E-04
	Detonator														
	FIRING DEVICE														
	FUSE														
	GRENADE SIMULATOR								4.10E-03	0.0004	5.60E-03	0.12		4.70E-04	1.40E-06
	Grenades	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.00					
	Haversacks	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.42					
	K143 Antipersonnel Mine	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.03					
	M1A2 BANGALORE TORP	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.21					
	M7 BANDOLEER MK57 (Claymore mine)		0.15108												

Table D.5-3 Ordnance Emission Factors

Ordnance Type	Ordnance	Emission Factor (lb per lb)							Emission Factor (lb/item)						
		CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead
	M112 DEMO CHARGE								7.90E-01	2.60E-02	7.90E-03	2.60E-02	1.90E-02		1.70E-04
	M700 BLASTING FUSE		0.149						0.0008	0.0003	0.0002	0.00009	0.00009	0.000002	0
	Flare, Aircraft Parachute														
		0.039	0.021	0.054	0.1	0.092	0.00018			5.91E-05	0.000152	0.000282	0.000259	5.07E-07	
	Chaff	0.039	0.021	0.054	0.1	0.092	0.00018			5.91E-05	0.000152	0.000282	0.000259	5.07E-07	
	MK36 M0 DEMO CHARGE														
	MK75 CHARGE														
	MK84 [86] EOD Shaped Charge														
	MK120 NONELEC DET (ft)														
	MK123 NONELEC DET (ft)														
	MK138 DEMO CHG ASSEMBLY	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04							
	MK140 FLEXIBLE CHARGE														
	PBXN-109 TEST Det Cord														
	SIGNAL MK 18(G950) SMOKE														
	C4 1.25 LB	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.02625	0.007875	0.02625	0.01875	0.00015	
	C4 5 LB	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.105	0.0315	0.105	0.075	0.0006	
	C4 15 LB	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.315	0.0945	0.315	0.225	0.0018	
	C4 40 LB	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.84	0.252	0.84	0.6	0.0048	0.0056
	C4 100 LB	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		2.1	0.63	2.1	1.5	0.012	0.014

Table D.5-3 Ordnance Emission Factors

Ordnance Type	Ordnance	Emission Factor (lb per lb)							Emission Factor (lb/item)						
		CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead
	C4 300 LB	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.021	0.0063	0.021	0.015	0.00012	0.00014
	C4 500 LB	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.021	0.0063	0.021	0.015	0.00012	0.00014
	TNT Blocks 0.5 lbd		0.398												
	DEMO SHEET														
	DETONATING CORD														
	DEMO CHARGE														
	SIMULATED ARTILLERY	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04		0.002888	0.000866	0.002888	0.002063	1.65E-05	
PROJECTILE (LARGE)	155MM HE	6.51	2.35E+01	1.43E+00	0.496	0.2418		2.26E-03							
	155MM ILL								6.00	8.63	0.087	3.44	0.13	0.0027	0.029
	5"/54 Inert	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5"/54	5"/54 BLP	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06							
	5"/54 HCVT+32 (EOD)	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		0.16	0	0.0096	0.00744	0	0.000048
	5"/54 HECVT	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		0.1280	0.1600	0.0096	0.0074		
	5"/54 HEPD	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		0.16	0	0.0096	0.00744	0	0.000048
	5"/54 HEVT	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		1.60E-01	0.00E+00	9.60E-03	7.44E-03	0.00E+00	4.80E-05
	5"/54 ILL	1.50E-02	1.40E-02	3.60E-04	9.20E-04	7.60E-04		1.30E-06		1.12E-01	2.88E-03	7.36E-03	6.08E-03	0.00E+00	1.04E-05
	5"54/54 VTNF	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		1.60E-01	0.00E+00	9.60E-03	7.44E-03	0.00E+00	4.80E-05
5"/62	5"/62	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		1.60E-01	0.00E+00	9.60E-03	7.44E-03	0.00E+00	4.80E-05
	5"/62 HE-MFF	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		1.60E-01	0.00E+00	9.60E-03	7.44E-03	0.00E+00	4.80E-05
	5"/62 HECVT	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		1.60E-01	0.00E+00	9.60E-03	7.44E-03	0.00E+00	4.80E-05
	5"/62 HEET	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		1.60E-01	0.00E+00	9.60E-03	7.44E-03	0.00E+00	4.80E-05
	5"/62 KEET	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06		1.60E-01	0.00E+00	9.60E-03	7.44E-03	0.00E+00	4.80E-05
60mm	60MM								0.4	0.06	0.005	0.062	0.03		0.0004
	60MM WP								0.13	0.154	0.0124	0.221	0.494	0.00014	0.001
76mm	76MM BLP	1.44E-02	1.80E-02		1.08E-03	8.37E-04		5.40E-06							
	81MM HE								1.48	0.14	0.016	0.173	0.096		0.0007
	81MM ILL								1.48	0.14	0.016	0.173	0.096		0.0007
CAS	GAU-17 30mm														
PROJECTILE (SMALL)	20MM	0.19	0.38	0.0049	0.0075	0.0053		0.00026	0.016	0.033	0.00043	0.00066	0.00046		0.000023

Table D.5-3 Ordnance Emission Factors

Ordnance Type	Ordnance	Emission Factor (lb per lb)							Emission Factor (lb/item)						
		CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead
	25MM								0.11	0.019	0.00067	0.0027	0.0017		0.000055
	30MM EFV Main Gun	0.14	0.028	0.0063	0.13	0.08		0.00037		7.28E-03	1.64E-03	3.38E-02	2.08E-02	0.00E+00	9.62E-05
	40MM	5.70E-01	6.00E-02	1.30E-02	1.10E-01	5.60E-02		6.20E-04	4.90E-02	4.00E-03	1.30E-03	9.50E-03	5.10E-03	0.00E+00	8.00E-05
	40MM HE	5.70E-01	6.00E-02	1.30E-02	1.10E-01	5.60E-02		6.20E-04	4.90E-02	4.00E-03	1.30E-03	9.50E-03	5.10E-03	0.00E+00	8.00E-05
	40MM ILL	7.20E-02	2.40E-02	6.50E-03	1.40E-01	1.20E-01	0.00019	7.90E-04	0.015	0.005	0.0014	0.029	0.025	0.00004	1.60E-04
	40MM PRACTICE	2.60E-01	2.50E-01	9.50E-03	1.40E-02	1.10E-02		1.10E-03	2.70E-03	2.60E-03	9.70E-05	1.40E-04	1.20E-04	0.00E+00	1.10E-05
	.45 CAL	2.80E-01	3.40E-01	1.00E-02	4.70E-02	4.00E-02		1.60E-02	2.20E-04	2.60E-04	8.10E-06	3.70E-05	3.10E-05		1.20E-05
	5.56	2.40E-01	4.40E-01	1.30E-02	9.20E-03	7.60E-03		3.20E-03	8.70E-04	1.60E-03	8.50E-05	3.90E-05	2.80E-05		5.10E-06
	5.56 BLANK	2.60E-01	3.20E-01	2.30E-02	7.80E-03	6.80E-03	0.00011	1.10E-03	2.30E-04	2.80E-04	2.00E-05	6.90E-06	6.00E-06	9.80E-09	9.70E-07
	.50CAL	1.50E-01	3.30E-01	3.60E-02	9.60E-03	5.60E-03		4.00E-04	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05
	.50CAL	1.50E-01	3.30E-01	3.60E-02	9.60E-03	5.60E-03		4.00E-04	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05
	.50CAL BLANK	3.10E-01	2.70E-01	4.10E-03	1.40E-02	1.30E-02		1.70E-03	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05
	7.62	3.50E-01	2.50E-01	1.60E-02	6.10E-03	5.60E-03	0.00013	9.70E-04	1.20E-03	2.30E-03	9.70E-05	5.10E-05	3.80E-05		4.90E-06
	7.62	3.50E-01	2.50E-01	1.60E-02	6.10E-03	5.60E-03	0.00013	9.70E-04	1.20E-03	2.30E-03	9.70E-05	5.10E-05	3.80E-05		4.90E-06
	9MM								2.00E-04	3.10E-04	1.50E-05	2.40E-05	2.00E-05	8.20E-08	6.80E-06
	.300 WIN MAG								1.90E-03	3.00E-03	1.50E-05	9.40E-05	7.30E-05		1.80E-05
	.223 Rifle Rounds								7.50E-05	8.00E-05	5.00E-06	3.40E-06	2.60E-06		1.90E-06
	.22 Magnum								7.50E-05	8.00E-05	5.00E-06	3.40E-06	2.60E-06		1.90E-06
	.22 Long Rifle								7.50E-05	8.00E-05	5.00E-06	3.40E-06	2.60E-06		1.90E-06
	12 Guage Shotgun	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05							
MINE SHAPE	M18A1	1.6	2.00E-02	1.80E-02	4.90E-02	2.60E-02		5.70E-05							
	MK76														
MISSILE	AGM-114B														
	AGM-65 Maverick														
	AGM-84	0.4		0.06	0.1025	0.1025			140	30.62356	35.574	61.795	61.795		
	AIM-120														
	AIM-7														
	AIM-9														
	BGM-71E TOW-A														
	GBU-9														

Table D.5-3 Ordnance Emission Factors

Ordnance Type	Ordnance	Emission Factor (lb per lb)							Emission Factor (lb/item)						
		CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	CO_2	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead
	AGM-88 HARM														
	NSM														
	JSOW														
	Japanese Missile Tests														
	Tactical Tomahawk														
	Seasparrow Missile														
	SLAM ER														
	SM2 or equivalent														
ROCKET	2.75" RKT	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03							
	2.75" RKT HE	3.00E-01	1.70E-01	2.40E-03	1.00E-01	5.30E-02		2.60E-04	5.5	0.93	0.0056	0.4	0.29		0.07
	2.75" RKT I	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03							
PYROTECHNICS	MK58 Marine Location Marker	1	1.30E-02	1.20E-02	3.20E-02	1.70E-02	6.10E-05	3.80E-05							
	Smoke Grenade AN-M8								3.30E-02	4.60E-02	1.00E-03	6.80E-01	1.10E-01	1.20E-04	4.70E-04

Table D.5-4 Emission Factors for Other Items

ITEM	EMISSION FACTORS, lb/hr							
	CO	NO_X	VOC	SO_X	PM_{10}	CO_2	N_2O (lb/gal)	CH_4
AAV	0.61	1.67	0.20	0.00	0.77	151.0000	0.0006	0.0179
LAV	0.61	1.67	0.20	0.00	0.77	151.0000	0.0006	0.0179
HMMWV	0.61	1.67	0.20	0.00	0.77	151.0000	0.0006	0.0179
Trucks	0.61	1.67	0.20	0.00	0.77	151.0000	0.0006	0.0179
Dozer	1.1058	2.3867	0.2854	0.0025	0.0993	239.0000	0.0006	0.0257
Forklift	0.2215	0.3551	0.0497	0.0006	0.0178	54.4000	0.0006	0.0045
ROWPU	0.4857	0.7130	0.1008	0.0009	0.0537	77.9000	0.0006	0.0091
Generator	0.2974	0.5083	0.0702	0.0007	0.0296	61.0000	0.0006	0.0063
Crane	0.4553	1.1066	0.1276	0.0014	0.0466	129.0000	0.0006	0.0115

AAV – Assault Amphibious Vehicle
LAV – Light Armored Vehicle
HMMWV – High Mobility Multipurpose Wheeled Vehicle
ROWPU – Reverse Osmosis Water Purification Unit

Table D.5-5 Emissions from Surface Ships During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
ANTI-AIR WARFARE																																			
Air Combat Maneuver	720																																		
Air Defense Exercise	80																																		
Air Intercept Control	0																																		
Gunnery Exercise, A-A (Medium Caliber)	12																																		
Missile Exercise, A-A	12																																		
Gunnery Exercise, S-A (Large Caliber)	0	0	FFG	Guided Missile Frigate	2.00	2.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
Gunnery Exercise, S-A (Medium Caliber)	0	0	FFG	Guided Missile Frigate	2.00	2.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
Missile Exercise, S-A	2	4	FFG	Guided Missile Frigate	2.00	2.0	100%	8.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
STRIKE WARFARE																																			
Bombing Exercise, A-G	1300																																		
Missile Exercise, A-G	60																																		
Gunnery Exercise, A-G	22																																		
Combat Search and Rescue	60																																		
AMPHIBIOUS WARFARE																																			
Fire Support Exercise - Land-Based target	8	8	CG	Cruiser	1	8.0	100%	64.00	64.0	0.0	0.0	7,344	4,174	491	2,147	220	198	0	0	0	0	0	0	0	0	0	0	0	0	184	11,776	247,932	8	7	250,572
Amphibious Rehearsal, No Landing - Marine Air Ground Task Force	0																																		
Amphibious Assault - Marine Air Ground Task Force	4	4	CG	Cruiser	1	8.0	100%	32.0	32.0	0.0	0.0	3,672	2,087	245	1,074	110	99	0	0	0	0	0	0	0	0	0	0	0	0	184	5,888	123,966	4	4	125,286
		4	LHA	Amphib. Assault Ship - Tarawa	1	8.0	100%	32.0	32.0	0.0	0.0	236	1,393	177	4,191	841	757	0	0	0	0	0	0	0	0	0	0	0	0	373	11,936	251,301	8	7	253,977
		8	LPD	Amphibious Transport Dock - Wasp	2	8.0	100%	64.0	64.0	0.0	0.0	188	1,109	141	3,335	669	602	0	0	0	0	0	0	0	0	0	0	0	0	373	23,872	502,601	16	14	507,954
		8	FFG	Guided Missile Frigate	2	8.0	100%	64.0	64.0	0.0	0.0	7,683	4,999	745	1,029	275	248	0	0	0	0	0	0	0	0	0	0	0	0	79	5,056	106,449	3	3	107,583
Amphibious Raid - Special Purpose Marine Air Ground Task Force	2	2	LHA	Amphib. Assault Ship - Tarawa	1	6.0	100%	12.0	12.0	0.0	0.0	89	522	66	1,572	315	284	0	0	0	0	0	0	0	0	0	0	0	0	373	4,476	94,238	3	3	95,241
		4	LPD	Amphibious Transport Dock - Wasp	2	2.5	100%	10.0	10.0	0.0	0.0	29	173	22	521	105	94	0	0	0	0	0	0	0	0	0	0	0	0	373	3,730	78,531	3	2	79,368
Urban Warfare Training	17																																		
Non-Combatant Evacuation Operation	2	2	LHA	Amphib. Assault Ship - Tarawa	1	80.0	100%	160.0	160.0	0.0	0.0	1,181	6,965	885	20,955	4,206	3,786	0	0	0	0	0	0	0	0	0	0	0	0	373	59,680	1,256,503	41	36	1,269,884

Table D.5-5 Emissions from Surface Ships During Training, No Action Alternative

		OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
Type of Training	Training Ops (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
		4	LPD	Amphibious Transport Dock - Wasp	2	80.0	100%	320.0	320.0	0.0	0.0	940	5,543	705	16,676	3,347	3,012	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
		2	LCU	Landing Craft Utility	1	80.0	100%	160.0	160.0	0.0	0.0	5,794	7,192	83	498	251	226	0	0	0	0	0	0	0	0	0	0	0	0	66	10,560	222,330	7	6	224,698
Humanitarian Assistance/ Disaster Relief Operations	2	2	LHA	Amphib. Assault Ship - Tarawa	1	8.0	100%	16.0	16.0	0.0	0.0	118	696	88	2,096	421	379	0	0	0	0	0	0	0	0	0	0	0	0	373	5,968	125,650	4	4	126,988
		4	LPD	Amphibious Transport Dock - Wasp	2	8.0	100%	32.0	32.0	0.0	0.0	94	554	70	1,668	335	301	0	0	0	0	0	0	0	0	0	0	0	0	373	11,936	251,301	8	7	253,977
		2	LCAC	Landing Craft Air Cushioned	1	8.0	100%	16.0	16.0	0.0	0.0	407	885	12	693	62	56	0	0	0	0	0	0	0	0	0	0	0	0	611	9,776	205,824	7	6	208,016
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	0																																		
ANTI-SURFACE WARFARE																																			
Gunnery Exercise, A-S (Small Caliber) - Ship	220																																		
Gunnery Exercise, A-S (Medium Caliber) - Ship	155																																		
Missile Exercise (A-S) - Rocket	0																																		
Missile Exercise (A-S)	2																																		
Laser Targeting	60																																		
Bombing Exercise (A-S)	28																																		
Torpedo Exercise (Submarine to Surface)	0																																		
Missile Exercise (S-S)	0	0	FFG	Guided Missile Frigate	2.00	2.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
Gunnery Exercise (S-S)-Ship, Large Caliber	12																																		
		3	CG	Cruiser	0.22	2.5	100%	6.6	0.0	1.8	4.8	0	0	0	0	0	0	212	121	14	62	6	6	545	310	36	159	16	15	184	1,214	25,568	1	1	25,840
		5	DDG	Guided Missile Destroyer	0.45	2.5	100%	13.5	0.0	3.8	9.7	0	0	0	0	0	0	403	204	30	80	11	10	1,037	523	76	206	27	24	187	2,525	53,151	2	2	53,717
		2	FFG	Guided Missile Frigate	0.15	2.5	100%	4.5	0.0	1.3	3.2	0	0	0	0	0	0	151	98	15	20	5	5	389	253	38	52	14	13	79	356	7,485	0	0	7,564
		1	Unknown	Other	0.05	2.5	100%	1.5	0.0	0.4	1.1	0	0	0	0	0	0	3	17	2	51	10	9	7	43	6	130	26	24	66	99	2,084	0	0	2,107
		1	USCG	US Coast Guard	0.12	2.5	100%	3.6	0.0	1.0	2.6	0	0	0	0	0	0	6	58	1	12	0	0	15	150	2	30	1	0	66	238	5,002	0	0	5,056
Gunnery Exercise (S-S)-Ship, Medium caliber	5																																		
		1	CG	Cruiser	0.22	2.5	100%	2.8	0.0	0.8	2.0	0	0	0	0	0	0	88	50	6	26	3	2	227	129	15	66	7	6	184	506	10,653	0	0	10,767
		2	DDG	Guided Missile Destroyer	0.45	2.5	100%	5.6	0.0	1.6	4.1	0	0	0	0	0	0	168	85	12	33	4	4	432	218	32	86	11	10	187	1,052	22,146	1	1	22,382

Table D.5-5 Emissions from Surface Ships During Training, No Action Alternative

Type of Training	Training Ops (#)	Operational Information - Vessels: Ship / Vessel / Boat: Number	Ship Type	Type	Participation	Range Time (hr): Per Ship	Time at Each Power Level (%)	Total	Distribution (hr): 0-3 nm from shore	3-12 nm from shore	>12 nm from shore	Emissions By Jurisdiction (lb/year): State (0-3 nm offshore): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Waters of U S (3-12 nm): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	International Waters (>12 nm): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Greenhouse Gas Emissions (lb/year): Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
		1	FFG	Guided Missile Frigate	0.15	2.5	100%	1.9	0.0	0.5	1.4	0	0	0	0	0	0	63	41	6	8	2	2	162	105	16	22	6	5	79	148	3,119	0	0	3,152
		1	USCG	US Coast Guard	0.12	2.5	100%	1.5	0.0	0.4	1.1	0	0	0	0	0	0	2	24	0	5	0	0	6	63	1	12	0	0	66	99	2,084	0	0	2,107
Sinking Exercise (SINKEX)	2	10	FFG	Guided Missile Frigate	5.00	16.0	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	19,206	12,498	1,862	2,573	688	619	79	12,640	266,123	9	8	268,957
Gunnery Exercise (S-S) Boat – Medium-caliber	0	0	FFG	Guided Missile Frigate	5.00	3.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
Gunnery Exercise (S-S) Small-caliber	32	64	CRRC	Combat Rubber Raiding Craft	2	3.0	100%	192.0	0.0	0.0	192.0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	2,477	0	0	0	3	576	12,127	0	0	12,256
Maritime Security Operations (MSO)	6	6	FFG	Guided Missile Frigate	1	8.0	100%	48.0	0.0	0.0	48.0	0	0	0	0	0	0	0	0	0	0	0	0	5,762	3,749	559	772	206	186	79	3,792	79,837	3	2	80,687
		6	RHIB	Rigid Hulled Inflatable Boat	1	8.0	100%	48.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	16.3	438.7	2.9	69.1	7.2	6	14	672	14,148	0	0	14,299
		6	CRRC	Combat Rubber Raiding Craft	1	8.0	100%	48.0	0.0	0.0	48.0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	619	0	0	0	3	144	3,032	0	0	3,064
ANTI-SUBMARINE WARFARE																																			
Tracking Exercise-Helo	18																																		
Torpedo Exercise-Helo	4																																		
Tracking Exercise-Maritime Patrol Advanced Extended Echo Ranging Sonobuoys	8																																		
Tracking Exercise - Maritime Patrol Aircraft	8																																		
Torpedo Exercise-Maritime Patrol Aircraft	4																																		
Tracking Exercise –Surface	30	30	FFG	Guided Missile Frigate	1	2.0	100%	60.0	0.0	30.0	30.0	0	0	0	0	0	0	3,601	2,343	349	482	129	116	3,601	2,343	349	482	129	116	79	4,740	99,796	3	3	100,859
Torpedo Exercise-Surface	3	3	FFG	Guided Missile Frigate	1	2.0	100%	6.0	0.0	3.0	3.0	0	0	0	0	0	0	360	234	35	48	13	12	360	234	35	48	13	12	79	474	9,980	0	0	10,086
Tracking Exercise–Submarine	10																																		
Torpedo Exercise – Submarine	10																																		
MAJOR TRAINING EVENTS																																			
Joint Expeditionary Exercise	1	1	CVN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		1	CG		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	9,180	5,218	614	2,684	275	248	0	0	0	0	0	0	184	14,720	309,915	10	9	313,215

Table D.5-5 Emissions from Surface Ships During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat			Range Time (hr)				Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
		2	FFG		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	19,206	12,498	1,862	2,573	688	619	0	0	0	0	0	0	79	12,640	266,123	9	8	268,957
		5	DDG		5	80.0	100%	400.0	0.0	400.0	0.0	0	0	0	0	0	0	42,668	21,536	3,136	8,488	1,120	1,008	0	0	0	0	0	0	187	74,800	1,574,839	51	45	1,591,611
		1	LHD/LHA		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	590	3,482	442	10,478	2,103	1,893	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		2	LSD		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	1,088	6,419	816	19,312	3,877	3,489	0	0	0	0	0	0	373	59,680	1,256,503	41	36	1,269,884
		1	LPD		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		1	TAOE		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	534	3,150	400	9,554	1,902	1,711	0	0	0	0	0	0	1,865	149,200	3,141,257	102	89	3,174,711
		1	SSN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		1	SSGN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		2	T-AGO(LFA)		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	1,067	6,299	800	19,109	3,803	3,423	0	0	0	0	0	0	1,865	298,400	6,282,514	204	178	6,349,422
		1	CG-PARTNER		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	8,623	3,768	792	1,680	208	187	0	0	0	0	0	0	184	14,720	309,915	10	9	313,215
		2	DDG-PARTNER		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	16,638	7,984	1,440	2,864	400	360	0	0	0	0	0	0	187	29,920	629,936	20	18	636,644
		1	SS-PARTNER		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		5	LCAC		5	80.0	100%	400.0	0.0	400.0	0.0	0	0	0	0	0	0	10,164	22,128	288	17,320	1,556	1,400	0	0	0	0	0	0	611	244,400	5,145,598	167	145	5,200,398
		2	LCU		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	5,794	7,192	83	498	251	226	0	0	0	0	0	0	66	10,560	222,330	7	6	224,698
		19	CRRC		19	80.0	100%	1520.0	0.0	1520.0	0.0	0	0	0	0	0	0	0	226	19,610	0	0	0	0	0	0	0	0	0	3	4,560	96,006	3	3	97,029
		2	RHIB		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	54	1,462	10	230	24	22	0	0	0	0	0	0	14	2,240	47,161	2	1	47,663
		14	AAV		14	80.0	100%	1120.0	0.0	1120.0	0.0	0	0	0	0	0	0	851	6,966	918	1,400	291	262	0	0	0	0	0	0	3	3,360	70,741	2	2	71,495
Joint Multi-Strike Group Exercise	1	3	CVN		3	80.0	100%	240.0	0.0	0.0	240.0																								
		3	CG		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	27,540	15,653	1,841	8,052	826	743	184	44,160	929,745	30	26	939,646
		3	FFG		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	28,810	18,746	2,794	3,859	1,032	929	79	18,960	399,184	13	11	403,435
		12	DDG		12	80.0	100%	960.0	0.0	0.0	960.0	0	0	0	0	0	0	0	0	0	0	0	0	102,403	51,686	7,526	20,371	2,688	2,419	187	179,520	3,779,614	123	107	3,819,867
		3	TAOE		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	1,601	9,449	1,200	28,663	5,705	5,134	1,865	447,600	9,423,770	306	266	9,524,134
		5	SSN		5	80.0	100%	400.0	0.0	0.0	400.0																								
		2	T-AGO(LFA)		2	80.0	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	1,067	6,299	800	19,109	3,803	3,423	1,865	298,400	6,282,514	204	178	6,349,422
		1	SS-PARTNER		1	80.0	100%	80.0	0.0	0.0	80.0	0	0	0	0	0	0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	373	29,840	628,251	20	18	634,942
Fleet Strike Group Exercise	0	0	CVN	Nuclear Carrier (No emissions)	1	56.0	100%	0.0	0.0	0.0	0.0																								
		0	CG		1	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	0	0	0	0	0
		0	FFG		1	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
		0	DDG		3	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0
		0	LHD/LHA		1	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	373	0	0	0	0	0
		0	TAOE		1	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,865	0	0	0	0	0
		0	SSN	Nuclear Carrier (No emissions)	1	56.0	100%	0.0	0.0	0.0	0.0																								
Integrated Anti-Submarine Warfare Exercise	0	0	CVN	Nuclear Carrier (No emissions)	1	40.0	100%	0.0	0.0	0.0	0.0																								
		0	CG		1	40.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	0	0	0	0	0
		0	FFG		1	40.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
		0	DDG		3	40.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0
		0	SSN	Nuclear Carrier (No emissions)	1	40.0	100%	0.0	0.0	0.0	0.0																								
Ship Squadron Anti-Submarine Warfare Exercise	0																																		
Maritime Homeland Defense / Security Mine Countermeasures	0	0	FFG	Guided Missile Frigate	4	8.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
Marine Air Ground Task Force Exercise (Amphibious)	4	4	LHD/LHA		1	80.0	100%	320.0	320.0	0.0	0.0	2,362	13,930	1,770	41,910	8,413	7,572	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769

Table D.5-5 Emissions from Surface Ships During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
		4	LSD		1	80.0	100%	320.0	320.0	0.0	0.0	2,176	12,838	1,632	38,624	7,754	6,978	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
		4	LPD		1	80.0	100%	320.0	320.0	0.0	0.0	940	5,543	705	16,676	3,347	3,012	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
Special Purpose Marine Air Ground Task Force Exercise	2	2	LHA	Amphib. Assault Ship - Tarawa	1	80.0	100%	160.0	52.8	52.8	54.4	390	2,298	292	6,915	1,388	1,249	390	2,298	292	6,915	1,388	1,249	401	2,368	301	7,125	1,430	1,287	373	59,680	1,256,503	41	36	1,269,884
		4	LPD	Amphibious Transport Dock - Wasp	2	80.0	100%	320.0	105.6	105.6	108.8	310	1,829	233	5,503	1,105	994	310	1,829	233	5,503	1,105	994	319	1,885	240	5,670	1,138	1,024	373	119,360	2,513,005	82	71	2,539,769
Urban Warfare Exercise	5	5	LHA	Amphib. Assault Ship - Tarawa	1	112.0	100%	560.0	560.0	0.0	0.0	4,133	24,377	3,097	73,343	14,722	13,250	0	0	0	0	0	0	0	0	0	0	0	0	373	208,880	4,397,760	143	124	4,444,596
		10	LPD	Amphibious Transport Dock - Wasp	2	112.0	100%	1120.0	1120.0	0.0	0.0	3,288	19,401	2,466	58,367	11,715	10,543	0	0	0	0	0	0	0	0	0	0	0	0	373	417,760	8,795,519	285	249	8,889,191
ELECTRONIC WARFARE																																			
Electronic Warfare Operations (EW Ops)	72	72	FFG	Guided Missile Frigate	1	4	100%	288.0	0.0	0.0	288.0	0	0	0	0	0	0	0	0	0	0	0	0	34,572	22,496	3,352	4,631	1,238	1,115	79	22,752	479,021	16	14	484,122
Counter Targeting Flare Exercise (FLAREX) - Aircraft	546																																		
Counter Targeting Chaff Exercise (CHAFFEX) - Ship	16	16	FFG	Guided Missile Frigate	1	4	100%	64.0	0.0	0.0	64.0	0	0	0	0	0	0	0	0	0	0	0	0	7,683	4,999	745	1,029	275	248	79	5,056	106,449	3	3	107,583
Counter Targeting Chaff Exercise (CHAFFEX) - Aircraft	546																																		
MINE WARFARE																																			
Submarine Mine Exercise	0	0																																	
Mine Countermeasure Exercise – Sonar (AQS-20, LCS)	0	0	CG	Cruiser	0.2	1.5	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	0	0	0	0	0
			DDG	Guided Missile Destroyer	0.14	1.5	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0
			FFG	Guided Missile Frigate	0.12	1.5	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
Mine Countermeasure Exercise – Surface (SMCMEX) Sonar (SQQ-32, MCM)	0	0	MCM	MCM Class	1	8	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	373	0	0	0	0	0
Mine Neutralization – Remotely Operated Vehicle Sonar (AQS-235[AQS-20], SLQ-48)	0	0	RHIB	Rigid Hulled Inflatable Boat	1	12	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0
Mine Laying - Aircraft	3																																		
Mine Neutralization – Explosive Ordnance Disposal	20	60	RHIB	Rigid Hulled Inflatable Boat	3	12.0	100%	720.0	720.0	0.0	0.0	244.8	6580.8	43.2	1036.8	108.0	97	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	10,080	212,224	7	6	214,485
Limpet Mine Neutralization System/Shock Wave Generator	0	0	RHIB	Rigid Hulled Inflatable Boat	1	4.0	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	0	0	0	0	0
Mine Countermeasure – Towed Mine Detection	0	0	MCM	MCM Class	1	15.0	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	373	0	0	0	0	0
NAVAL SPECIAL WARFARE																																			

Table D.5-5 Emissions from Surface Ships During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)						Fuel Flow (GPH)	Annual Fuel Consumption (gal)				
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$			CO_2	N_2O	CH_4	CO_{2-e}
Personnel I&E	150	750	RHIB	Rigid Hulled Inflatable Boat	5	8.0	100%	6000.0	6000.0	0.0	0.0	2040.0	54840.0	360.0	8640.0	900.0	810	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	84,000	1,768,536	57	50	1,787,371
		900	CRRC	Combat Rubber Raiding Craft	6	8.0	100%	7200.0	7200.0	0.0	0.0	0	1,070	92,890	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	21,600	454,766	15	13	459,610
Parachute Insertion	12																																		
Embassy Reinforcement	50	50	LCAC	Landing Craft Air Cushioned	1	24.0	100%	1200.0	1200.0	0.0	0.0	30,492	66,384	864	51,960	4,668	4,201	0	0	0	0	0	0	0	0	0	0	0	0	611	733,200	15,436,793	501	436	15,601,195
Direct Action (Combat Close Quarters)	40																																		
Direct Action (Breaching)	40																																		
Direct Action (TAC-P)	3																																		
Underwater Demolition Qualifications	30	30	CRRC	Combat Rubber Raiding Craft	1	8.0	100%	240.0	0.0	240.0	0.0	0	0	0	0	0	0	0	36	3,096	0	0	0	0	0	0	0	0	0	3	720	15,159	0	0	15,320
Intelligence, Surveillance, Reconnaissance	16																																		
Urban Warfare Training	8	8	LHA	Amphib. Assault Ship - Tarawa	1	40.0	100%	320.0	320.0	0.0	0.0	2,362	13,930	1,770	41,910	8,413	7,572	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
		16	LPD	Amphibious Transport Dock - Wasp	2	40.0	100%	640.0	640.0	0.0	0.0	1,879	11,086	1,409	33,353	6,694	6,025	0	0	0	0	0	0	0	0	0	0	0	0	373	238,720	5,026,011	163	142	5,079,538
Underwater Survey	6	18	RHIB	Rigid Hulled Inflatable Boat	3	8.0	100%	144.0	144.0	0.0	0.0	49.0	1316.2	8.6	207.4	21.6	19	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	2,016	42,445	1	1	42,897
		18	CRRC	Combat Rubber Raiding Craft	3	8.0	100%	144.0	144.0	0.0	0.0	0	21	1,858	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	432	9,095	0	0	9,192
OTHER																																			
Surface Ship Sonar Maintenance	0	0	FFG	Guided Missile Frigate	1	4.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
Submarine Sonar Maintenance	0																																		
Small Boat Attack	0	0	CRRC	Combat Rubber Raiding Craft	1	4.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Search and Rescue at Sea	0																									50									
Submarine Navigation	0																																		
Precision Anchoring	0	0	FFG	Guided Missile Frigate	1	4.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
Maneuver (Convoy, Land Navigation)	16																																		
Water Purification	0																																		
Field Training Exercise	100																																		
Force Protection	75																																		
Anti-Terrorism	80																																		
Seize Airfield	12																																		
Airfield Expeditionary	12																																		
Unmanned Aerial Vehicle Operation	0																																		

Table D.5-5 Emissions from Surface Ships During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																				Greenhouse Gas Emissions (lb/year)			
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120																																		
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	200																																		
TOTAL TRAINING EMISSIONS (LBS/YEAR)									20,148	5,563	3,634	78,437	271,737	113,127	434,900	80,406	72,365	122,686	118,538	35,655	117,774	20,849	18,764	236,398	156,060	25,101	107,387	20,124	18,112		4,742,184	99,841,942	3,239	2,822	100,905,258
TOTAL TRAINING EMISSIONS (TONS/YEAR)												39	136	57	217	40	36	61	59	18	59	10	9	118	78	13	54	10	9		4,742,184	49,921	2	1	50,453

Table D.5-6 Emissions from Surface Ships During Testing, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
ANTI-SURFACE WARFARE																																			
Air to Surface Missile Test	0																																		
ANTI-SUBMARINE WARFARE																																			
Anti-submarine Warfare Tracking Test - MPA	0																																		
Anti-submarine Warfare Torpedo Test	0																																		
Broad Area Maritime Surveillance (BAMS) Testing	1																																		
LIFECYCLE ACTIVITIES TESTING																																			
Ship Signature Testing	0	0	FFG	Guided Missile Frigate	1	4.0	100%	0.00	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	79	0	0	0	0	0
ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING																																			
Torpedo Explosive Testing	0	0	DDG		3	4	100%	0.00	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	187.0	0.0	0	0.00	0.00	0
Countermeasure Testing	0	0	DDG		2.00	2.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0
At-Sea Sonar Testing	0	0	SSN	Nuclear Carrier (No emissions)	4.00	2.0	100%	0.0	0.0	0.0	0.0																								
		0	CG		1	2.0	100%	0.00	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	184	0	0	0	0	0
		0	DDG		4.00	2.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING																																			
Pierside Integrated Swimmer Defense	0	0	FFG	Guided Missile Frigate	1	8.0	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.0	0	0	0	0	0
NEW SHIP CONSTRUCTION																																			
ASW Mission Package Testing	0	0	LCS	Littoral Combat Ship	1	60.0	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.0	0	0	0	0	0
MCM Mission Package Testing	0	0	LCS	Littoral Combat Ship	1	60.0	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.0	0	0	0	0	0
ASUW Mission Package Testing	0	0	LCS	Littoral Combat Ship	1	40.0	100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.0	0	0	0	0	0
OFFICE OF NAVAL RESEARCH																																			
North Pacific Acoustic Lab Philippine Sea 2018-19 Experiment (Deep Water)	1																																		
TOTAL TESTING EMISSIONS (lbs per year)									0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
TOTAL TESTING EMISSIONS (tons per year)												0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0

Table D.5-7 Emissions from Surface Ships During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
ANTI-AIR WARFARE																																			
Air Combat Maneuver	4800																																		
Air Defense Exercise	100																																		
Air Intercept Control	4800																																		
Gunnery Exercise, A-A (Medium Caliber)	36																																		
Missile Exercise, A-A	18																																		
Gunnery Exercise, S-A (Large Caliber)	5	10	FFG	Guided Missile Frigate	2.00	2.0	100%	20.0	0.0	0.0	20.0	0	0	0	0	0	0	0	0	0	0	0	0	2,401	1,562	233	322	86	77	79	1,580	33,265	1	1	33,620
Gunnery Exercise, S-A (Medium Caliber)	12	24	FFG	Guided Missile Frigate	2.00	2.0	100%	48.0	0.0	0.0	48.0	0	0	0	0	0	0	0	0	0	0	0	0	5,762	3,749	559	772	206	186	79	3,792	79,837	3	2	80,687
Missile Exercise, S-A	15	30	FFG	Guided Missile Frigate	2.00	2.0	100%	60.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
STRIKE WARFARE																																			
Bombing Exercise, A-G	2300																																		
Missile Exercise, A-G	85																																		
Gunnery Exercise, A-G	96																																		
Combat Search and Rescue	80																																		
AMPHIBIOUS WARFARE																																			
Fire Support Exercise - Land-Based target	10	10	CG	Cruiser	1	8.0	100%	80.00	80.0	0.0	0.0	9,180	5,218	614	2,684	275	248	0	0	0	0	0	0	0	0	0	0	0	0	184	14,720	309,915	10	9	313,215
Amphibious Rehearsal, No Landing - Marine Air Ground Task Force	12	48	LHD/LHA		4	24.0	100%	1152.0	1152.0	0.0	0.0	8501.8	50146.6	6370.6	150877.4	30286.1	27257.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	373.0	429696	9046819.584	293.482	255.669	9143168.17
		48	LSD		4	24.0	100%	1152.0	1152.0	0.0	0.0	7833.6	46218.2	5875.2	139046.4	27913.0	25121.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	373.0	429696	9046819.584	293.482	255.669	9143168.17
		48	LPD		4	24.0	100%	1152.0	1152.0	0.0	0.0	3382.2	19955.2	2536.7	60034.6	12049.2	10844.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	373.0	429696	9046819.584	293.482	255.669	9143168.17
Amphibious Assault - Marine Air Ground Task Force	6	6	CG	Cruiser	1	8.0	100%	48.0	48.0	0.0	0.0	5,508	3,131	368	1,610	165	149	0	0	0	0	0	0	0	0	0	0	0	0	184	8,832	185,949	6	5	187,929
		6	LHA	Amphib. Assault Ship - Tarawa	1	8.0	100%	48.0	48.0	0.0	0.0	354	2,089	265	6,287	1,262	1,136	0	0	0	0	0	0	0	0	0	0	0	0	373	17,904	376,951	12	11	380,965
		12	LPD	Amphibious Transport Dock - Wasp	2	8.0	100%	96.0	96.0	0.0	0.0	282	1,663	211	5,003	1,004	904	0	0	0	0	0	0	0	0	0	0	0	0	373	35,808	753,902	24	21	761,931
		12	FFG	Guided Missile Frigate	2	8.0	100%	96.0	96.0	0.0	0.0	11,524	7,499	1,117	1,544	413	372	0	0	0	0	0	0	0	0	0	0	0	0	79	7,584	159,674	5	5	161,374
Amphibious Raid - Special Purpose Marine Air Ground Task Force	6	6	LHA	Amphib. Assault Ship - Tarawa	1	6.0	100%	36.0	36.0	0.0	0.0	266	1,567	199	4,715	946	852	0	0	0	0	0	0	0	0	0	0	0	0	373	13,428	282,713	9	8	285,724
		12	LPD	Amphibious Transport Dock - Wasp	2	2.5	100%	30.0	30.0	0.0	0.0	88	520	66	1,563	314	282	0	0	0	0	0	0	0	0	0	0	0	0	373	11,190	235,594	8	7	238,103
Urban Warfare Training	36																																		
Non-Combatant Evacuation Operation	5	5	LHA	Amphib. Assault Ship - Tarawa	1	80.0	100%	400.0	400.0	0.0	0.0	2,952	17,412	2,212	52,388	10,516	9,464	0	0	0	0	0	0	0	0	0	0	0	0	373	149,200	3,141,257	102	89	3,174,711
		10	LPD	Amphibious Transport Dock - Wasp	2	80.0	100%	800.0	800.0	0.0	0.0	2,349	13,858	1,762	41,691	8,368	7,531	0	0	0	0	0	0	0	0	0	0	0	0	373	298,400	6,282,514	204	178	6,349,422
		5	LCU	Landing Craft Utility	1	80.0	100%	400.0	400.0	0.0	0.0	14,484	17,980	208	1,244	628	565	0	0	0	0	0	0	0	0	0	0	0	0	66	26,400	555,826	18	16	561,745

Table D.5-7 Emissions from Surface Ships During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
Humanitarian Assistance/ Disaster Relief Operations	5	5	LHA	Amphib. Assault Ship - Tarawa	1	8.0	100%	40.0	40.0	0.0	0.0	295	1,741	221	5,239	1,052	946	0	0	0	0	0	0	0	0	0	0	0	0	373	14,920	314,126	10	9	317,471
		10	LPD	Amphibious Transport Dock - Wasp	2	8.0	100%	80.0	80.0	0.0	0.0	235	1,386	176	4,169	837	753	0	0	0	0	0	0	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		5	LCAC	Landing Craft Air Cushioned	1	8.0	100%	40.0	40.0	0.0	0.0	1,016	2,213	29	1,732	156	140	0	0	0	0	0	0	0	0	0	0	0	0	611	24,440	514,560	17	15	520,040
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	100																																		
ANTI-SURFACE WARFARE																																			
Gunnery Exercise, A-S (Small Caliber) - Ship	242																																		
Gunnery Exercise, A-S (Medium Caliber) - Ship	295																																		
Missile Exercise (A-S) - Rocket	3																																		
Missile Exercise (A-S)	20																																		
Laser Targeting	600																																		
Bombing Exercise (A-S)	37																																		
Torpedo Exercise (Submarine to Surface)	5																																		
Missile Exercise (S-S)	12	24	FFG	Guided Missile Frigate	2.00	2.0	100%	48.0	0.0	0.0	48.0	0	0	0	0	0	0	0	0	0	0	0	0	5,762	3,749	559	772	206	186	79	3,792	79,837	3	2	80,687
Gunnery Exercise (S-S)- Ship, Large Caliber	140																																		
		31	CG	Cruiser	0.22	2.5	100%	77.0	0.0	21.6	55.4	0	0	0	0	0	0	2,474	1,406	165	723	74	67	6,362	3,616	425	1,860	191	172	184	14,168	298,293	10	8	301,470
		63	DDG	Guided Missile Destroyer	0.45	2.5	100%	157.5	0.0	44.1	113.4	0	0	0	0	0	0	4,704	2,374	346	936	123	111	12,096	6,105	889	2,406	318	286	187	29,453	620,093	20	18	626,697
		21	FFG	Guided Missile Frigate	0.15	2.5	100%	52.5	0.0	14.7	37.8	0	0	0	0	0	0	1,765	1,148	171	236	63	57	4,538	2,953	440	608	163	146	79	4,148	87,321	3	2	88,251
		7	Unknown	Other	0.05	2.5	100%	17.5	0.0	4.9	12.6	0	0	0	0	0	0	33	197	25	591	119	107	86	506	64	1,521	305	275	66	1,155	24,317	1	1	24,576
		17	USCG	US Coast Guard	0.12	2.5	100%	42.0	0.0	11.8	30.2	0	0	0	0	0	0	68	681	10	136	2	2	174	1,751	27	349	6	6	66	2,772	58,362	2	2	58,983
Gunnery Exercise (S-S)- Ship, Medium caliber	100																																		
		22	CG	Cruiser	0.22	2.5	100%	55.0	0.0	15.4	39.6	0	0	0	0	0	0	1,767	1,004	118	517	53	48	4,544	2,583	304	1,329	136	123	184	10,120	213,066	7	6	215,336
		45	DDG	Guided Missile Destroyer	0.45	2.5	100%	112.5	0.0	31.5	81.0	0	0	0	0	0	0	3,360	1,696	247	668	88	79	8,640	4,361	635	1,719	227	204	187	21,038	442,924	14	13	447,641
		15	FFG	Guided Missile Frigate	0.15	2.5	100%	37.5	0.0	10.5	27.0	0	0	0	0	0	0	1,260	820	122	169	45	41	3,241	2,109	314	434	116	104	79	2,963	62,372	2	2	63,037
		1	LPD	Amphibious Transport Dock - Wasp	0.01	2.5	100%	1.5	0.0	0.4	1.1	0	0	0	0	0	0	1	7	1	22	4	4	3	19	2	56	11	10	373	560	11,780	0	0	11,905
		5	Unknown	Other	0.05	2.5	100%	12.5	0.0	3.5	9.0	0	0	0	0	0	0	24	140	18	422	85	76	61	361	46	1,086	218	196	66	825	17,370	1	0	17,555

Table D.5-7 Emissions from Surface Ships During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
		12	USCG	US Coast Guard	0.12	2.5	100%	30.0	0.0	8.4	21.6	0	0	0	0	0	0	48	486	7	97	2	2	124	1,251	19	249	5	4	66	1,980	41,687	1	1	42,131
Sinking Exercise (SINKEX)	2	10	FFG	Guided Missile Frigate	5.00	16.0	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	19,206	12,498	1,862	2,573	688	619	79	12,640	266,123	9	8	268,957
Gunnery Exercise (S-S) Boat – Medium-caliber	10	50	FFG	Guided Missile Frigate	5.00	3.0	100%	150.0	0.0	0.0	150.0	0	0	0	0	0	0	0	0	0	0	0	0	18,006	11,717	1,746	2,412	645	581	79	11,850	249,490	8	7	252,147
Gunnery Exercise (S-S) Small-caliber	40	80	CRRC	Combat Rubber Raiding Craft	2	3.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	3,096	0	0	0	3	720	15,159	0	0	15,320
Maritime Security Operations (MSO)	40	40	FFG	Guided Missile Frigate	1	8.0	100%	320.0	0.0	0.0	320.0	0	0	0	0	0	0	0	0	0	0	0	0	38,413	24,995	3,725	5,146	1,376	1,238	79	25,280	532,245	17	15	537,914
		40	RHIB	Rigid Hulled Inflatable Boat	1	8.0	100%	320.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	108.8	2924.8	19.2	460.8	48.0	43	14	4,480	94,322	3	3	95,326
		40	CRRC	Combat Rubber Raiding Craft	1	8.0	100%	320.0	0.0	0.0	320.0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	4,128	0	0	0	3	960	20,212	1	1	20,427
ANTI-SUBMARINE WARFARE																																			
Tracking Exercise-Helo	62																																		
Torpedo Exercise-Helo	4																																		
Tracking Exercise-Maritime Patrol Advanced Extended Echo Ranging Sonobuoys	11																																		
Tracking Exercise -Maritime Patrol Aircraft	34																																		
Torpedo Exercise-Maritime Patrol Aircraft	4																																		
Tracking Exercise –Surface	132	132	FFG	Guided Missile Frigate	1	2.0	100%	264.0	0.0	132.0	132.0	0	0	0	0	0	0	15,845	10,311	1,536	2,123	568	511	15,845	10,311	1,536	2,123	568	511	79	20,856	439,102	14	12	443,779
Torpedo Exercise-Surface	3	3	FFG	Guided Missile Frigate	1	2.0	100%	6.0	0.0	3.0	3.0	0	0	0	0	0	0	360	234	35	48	13	12	360	234	35	48	13	12	79	474	9,980	0	0	10,086
Tracking Exercise– Submarine	12																																		
Torpedo Exercise – Submarine	10																																		
MAJOR TRAINING EVENTS																																			

Table D.5-7 Emissions from Surface Ships During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Joint Expeditionary Exercise	1	1	CVN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		1	CG		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	9,180	5,218	614	2,684	275	248	0	0	0	0	0	0	184	14,720	309,915	10	9	313,215
		2	FFG		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	19,206	12,498	1,862	2,573	688	619	0	0	0	0	0	0	79	12,640	266,123	9	8	268,957
		5	DDG		5	80.0	100%	400.0	0.0	400.0	0.0	0	0	0	0	0	0	42,668	21,536	3,136	8,488	1,120	1,008	0	0	0	0	0	0	187	74,800	1,574,839	51	45	1,591,611
		1	LHD/LHA		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	590	3,482	442	10,478	2,103	1,893	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		2	LSD		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	1,088	6,419	816	19,312	3,877	3,489	0	0	0	0	0	0	373	59,680	1,256,503	41	36	1,269,884
		1	LPD		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		1	TAOE		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	534	3,150	400	9,554	1,902	1,711	0	0	0	0	0	0	1,865	149,200	3,141,257	102	89	3,174,711
		1	SSN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		1	SSGN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		2	T-AGO(LFA)		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	1,067	6,299	800	19,109	3,803	3,423	0	0	0	0	0	0	1,865	298,400	6,282,514	204	178	6,349,422
		1	CG-PARTNER		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	8,623	3,768	792	1,680	208	187	0	0	0	0	0	0	184	14,720	309,915	10	9	313,215
		2	DDG-PARTNER		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	16,638	7,984	1,440	2,864	400	360	0	0	0	0	0	0	187	29,920	629,936	20	18	636,644
		1	SS-PARTNER		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		5	LCAC		5	80.0	100%	400.0	0.0	400.0	0.0	0	0	0	0	0	0	10,164	22,128	288	17,320	1,556	1,400	0	0	0	0	0	0	611	244,400	5,145,598	167	145	5,200,398
		2	LCU		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	5,794	7,192	83	498	251	226	0	0	0	0	0	0	66	10,560	222,330	7	6	224,698
		19	CRRC		19	80.0	100%	1520.0	0.0	1520.0	0.0	0	0	0	0	0	0	0	226	19,610	0	0	0	0	0	0	0	0	0	3	4,560	96,006	3	3	97,029
		2	RHIB		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	54	1,462	10	230	24	22	0	0	0	0	0	0	14	2,240	47,161	2	1	47,663
		14	AAV		14	80.0	100%	1120.0	0.0	1120.0	0.0	0	0	0	0	0	0	851	6,966	918	1,400	291	262	0	0	0	0	0	0	3	3,360	70,741	2	2	71,495
Joint Multi-Strike Group Exercise	1	3	CVN		3	80.0	100%	240.0	0.0	0.0	240.0																								
		3	CG		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	27,540	15,653	1,841	8,052	826	743	184	44,160	929,745	30	26	939,646
		3	FFG		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	28,810	18,746	2,794	3,859	1,032	929	79	18,960	399,184	13	11	403,435
		12	DDG		12	80.0	100%	960.0	0.0	0.0	960.0	0	0	0	0	0	0	0	0	0	0	0	0	102,403	51,686	7,526	20,371	2,688	2,419	187	179,520	3,779,614	123	107	3,819,867
		3	TAOE		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	1,601	9,449	1,200	28,663	5,705	5,134	1,865	447,600	9,423,770	306	266	9,524,134
		5	SSN		5	80.0	100%	400.0	0.0	0.0	400.0																								
		2	T-AGO(LFA)		2	80.0	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	1,067	6,299	800	19,109	3,803	3,423	1,865	298,400	6,282,514	204	178	6,349,422
		1	SS-PARTNER		1	80.0	100%	80.0	0.0	0.0	80.0	0	0	0	0	0	0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	373	29,840	628,251	20	18	634,942
Fleet Strike Group Exercise	0	0	CVN	Nuclear Carrier (No emissions)	1	56.0	100%	0.0	0.0	0.0	0.0																								
		0	CG		1	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	0	0	0	0	0
		0	FFG		1	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
		0	DDG		3	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0
		0	LHD/LHA		1	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	373	0	0	0	0	0
		0	TAOE		1	56.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,865	0	0	0	0	0
		0	SSN	Nuclear Carrier (No emissions)	1	56.0	100%	0.0	0.0	0.0	0.0																								
Integrated Anti-Submarine Warfare Exercise	0	0	CVN	Nuclear Carrier (No emissions)	1	40.0	100%	0.0	0.0	0.0	0.0																								
		0	CG		1	40.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	184	0	0	0	0	0
		0	FFG		1	40.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
		0	DDG		3	40.0	100%	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	187	0	0	0	0	0
		0	SSN	Nuclear Carrier (No emissions)	1	40.0	100%	0.0	0.0	0.0	0.0																								
Ship Squadron Anti-Submarine Warfare Exercise	1	1	CG		1	40.0	100%	40.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4590.0	2608.8	306.8	1342.0	137.6	123.8	0.0	0.0	0.0	0.0	0.0	0.0	184.0	7360	154957.44	5.02688	4.3792	156607.736

Table D.5-7 Emissions from Surface Ships During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
		1	FFG		1	40.0	100%	40.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4801.6	3124.4	465.6	643.2	172.0	154.8	0.0	0.0	0.0	0.0	0.0	0.0	79.0	3160	66530.64	2.15828	1.8802	67239.191
		3	DDG		3	40.0	100%	120.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12800.4	6460.8	940.8	2546.4	336.0	302.4	0.0	0.0	0.0	0.0	0.0	0.0	187.0	22440	472451.76	15.3265	13.3518	477483.369
Maritime Homeland Defense / Security Mine Countermeasures	1	4	FFG	Guided Missile Frigate	4	8.0	100%	32.0	32.0	0.0	0.0	3,841	2,500	372	515	138	124	0	0	0	0	0	0	0	0	0	0	0	0	79	2,528	53,225	2	2	53,791
Marine Air Ground Task Force Exercise (Amphibious)	4	4	LHD/LHA		1	80.0	100%	320.0	320.0	0.0	0.0	2,362	13,930	1,770	41,910	8,413	7,572	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
		4	LSD		1	80.0	100%	320.0	320.0	0.0	0.0	2,176	12,838	1,632	38,624	7,754	6,978	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
		4	LPD		1	80.0	100%	320.0	320.0	0.0	0.0	940	5,543	705	16,676	3,347	3,012	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
Special Purpose Marine Air Ground Task Force Exercise	2	2	LHA	Amphib. Assault Ship - Tarawa	1	80.0	100%	160.0	52.8	52.8	54.4	390	2,298	292	6,915	1,388	1,249	390	2,298	292	6,915	1,388	1,249	401	2,368	301	7,125	1,430	1,287	373	59,680	1,256,503	41	36	1,269,884
		4	LPD	Amphibious Transport Dock - Wasp	2	80.0	100%	320.0	105.6	105.6	108.8	310	1,829	233	5,503	1,105	994	310	1,829	233	5,503	1,105	994	319	1,885	240	5,670	1,138	1,024	373	119,360	2,513,005	82	71	2,539,769
Urban Warfare Exercise	5	5	LHA	Amphib. Assault Ship - Tarawa	1	112.0	100%	560.0	560.0	0.0	0.0	4,133	24,377	3,097	73,343	14,722	13,250	0	0	0	0	0	0	0	0	0	0	0	0	373	208,880	4,397,760	143	124	4,444,596
		10	LPD	Amphibious Transport Dock - Wasp	2	112.0	100%	1120.0	1120.0	0.0	0.0	3,288	19,401	2,466	58,367	11,715	10,543	0	0	0	0	0	0	0	0	0	0	0	0	373	417,760	8,795,519	285	249	8,889,191
ELECTRONIC WARFARE																																			
Electronic Warfare Operations (EW Ops)	480	480	FFG	Guided Missile Frigate	1	4	100%	1920.0	0.0	0.0	1920.0	0	0	0	0	0	0	0	0	0	0	0	0	230,477	149,971	22,349	30,874	8,256	7,430	79	151,680	3,193,471	104	90	3,227,481
Counter Targeting Flare Exercise (FLAREX) - Aircraft	3200																																		
Counter Targeting Chaff Exercise (CHAFFEX) - Ship	40	40	FFG	Guided Missile Frigate	1	4	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	19,206	12,498	1,862	2,573	688	619	79	12,640	266,123	9	8	268,957
Counter Targeting Chaff Exercise (CHAFFEX) - Aircraft	3200																																		
MINE WARFARE																																			
Submarine Mine Exercise	16																																		
Mine Countermeasure Exercise – Sonar (AQS-20, LCS)	4	1	CG	Cruiser	0.2	1.5	100%	1.2	0.0	0.7	0.5	0.0	0.0	0.0	0.0	0.0	0	85.4	48.5	5.7	25.0	2.6	2	52.3	29.7	3.5	15.3	1.6	1	184	221	4,649	0	0	4,698
		1	DDG	Guided Missile Destroyer	0.14	1.5	100%	0.8	0.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0	55.6	28.0	4.1	11.1	1.5	1	34.0	17.2	2.5	6.8	0.9	1	187	157	3,307	0	0	3,342
		1	FFG	Guided Missile Frigate	0.13	1.5	100%	0.8	0.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0	58.1	37.8	5.6	7.8	2.1	2	35.6	23.2	3.5	4.8	1.3	1	79	62	1,297	0	0	1,311

Table D.5-7 Emissions from Surface Ships During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS: Ship / Vessel / Boat: Number	Ship Type	Type	Participation	Range Time (hr): Per Ship	Time at Each Power Level (%)	Total	Distribution (hr): 0-3 nm from shore	3-12 nm from shore	>12 nm from shore	Emissions By Jurisdiction (lb/year): State (0-3 nm offshore): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Waters of U S (3-12 nm): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	International Waters (>12 nm): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Greenhouse Gas Emissions (lb/year): Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
Mine Countermeasure Exercise – Surface (SMCMEX) Sonar (SQQ-32, MCM)	4	4	MCM	MCM Class	1	8.0	100%	32.0	32.0	0.0	0.0	94.0	554.3	70.5	1667.6	334.7	301	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	373	11,936	251,301	8	7	253,977
Mine Neutralization – Remotely Operated Vehicle Sonar (AQS-235[AQS-20], SLQ-48)	4	4	RHIB	Rigid Hulled Inflatable Boat	1	12.0	100%	48.0	48.0	0.0	0.0	16.3	438.7	2.9	69.1	7.2	6	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	672	14,148	0	0	14,299
Mine Laying - Aircraft	4																																		
Mine Neutralization – Explosive Ordnance Disposal	20	60	RHIB	Rigid Hulled Inflatable Boat	3	12.0	100%	720.0	720.0	0.0	0.0	244.8	6580.8	43.2	1036.8	108.0	97	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	10,080	212,224	7	6	214,485
Limpet Mine Neutralization System/Shock Wave Generator	40	40	RHIB	Rigid Hulled Inflatable Boat	1	4.0	100%	160.0	160.0	0.0	0.0	54.4	1462.4	9.6	230.4	24.0	22	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	2,240	47,161	2	1	47,663
Mine Countermeasure – Towed Mine Detection	4	4	MCM	MCM Class	1	15.0	100%	60.0	60.0	0.0	0.0	176.2	1039.3	132.1	3126.8	627.6	565	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	373	22,380	471,189	15	13	476,207
NAVAL SPECIAL WARFARE																																			
Personnel I&E	240	1200	RHIB	Rigid Hulled Inflatable Boat	5	8.0	100%	9600.0	9600.0	0.0	0.0	3264.0	87744.0	576.0	13824.0	1440.0	1,296	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	134,400	2,829,658	92	80	2,859,793
		1440	CRRC	Combat Rubber Raiding Craft	6	8.0	100%	11520.0	11520.0	0.0	0.0	0	1,711	148,625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	34,560	727,626	24	21	735,375
Parachute Insertion	20																																		
Embassy Reinforcement	50	50	LCAC	Landing Craft Air Cushioned	1	24.0	100%	1200.0	1200.0	0.0	0.0	30,492	66,384	864	51,960	4,668	4,201	0	0	0	0	0	0	0	0	0	0	0	0	611	733,200	15,436,793	501	436	15,601,195
Direct Action (Combat Close Quarters)	72																																		
Direct Action (Breaching)	72																																		
Direct Action (TAC-P)	18																																		
Underwater Demolition Qualifications	30	30	CRRC	Combat Rubber Raiding Craft	1	8.0	100%	240.0	0.0	240.0	0.0	0	0	0	0	0	0	0	36	3,096	0	0	0	0	0	0	0	0	0	3	720	15,159	0	0	15,320
Intelligence, Surveillance, Reconnaissance	16																																		
Urban Warfare Training	18	18	LHA	Amphib. Assault Ship - Tarawa	1	40.0	100%	720.0	720.0	0.0	0.0	5,314	31,342	3,982	94,298	18,929	17,036	0	0	0	0	0	0	0	0	0	0	0	0	373	268,560	5,654,262	183	160	5,714,480
		36	LPD	Amphibious Transport Dock - Wasp	2	40.0	100%	1440.0	1440.0	0.0	0.0	4,228	24,944	3,171	75,043	15,062	13,555	0	0	0	0	0	0	0	0	0	0	0	0	373	537,120	11,308,524	367	320	11,428,960

Table D.5-7 Emissions from Surface Ships During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Underwater Survey	16	48	RHIB	Rigid Hulled Inflatable Boat	3	8.0	100%	384.0	384.0	0.0	0.0	130.6	3509.8	23.0	553.0	57.6	52	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	5,376	113,186	4	3	114,392
		48	CRRC	Combat Rubber Raiding Craft	3	8.0	100%	384.0	384.0	0.0	0.0	0	57	4,954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1,152	24,254	1	1	24,513
OTHER																																			
Surface Ship Sonar Maintenance	42	42	FFG	Guided Missile Frigate	1	4.0	100%	168.0	168.0	0.0	0.0	20,167	13,122	1,956	2,701	722	650	0	0	0	0	0	0	0	0	0	0	0	0	79	13,272	279,429	9	8	282,405
Submarine Sonar Maintenance	48																																		
Small Boat Attack	18	18	CRRC	Combat Rubber Raiding Craft	1	4.0	100%	72.0	0.0	72.0	0.0	0	0	0	0	0	0	0	11	929	0	0	0	0	0	0	0	0	0	3	216	4,548	0	0	4,596
Search and Rescue at Sea	40	80	USCG	US Coast Guard	2	40.0	100%	3200.0	0.0	3200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18368.0	185312.0	2816.0	36960.0	672.0	604.8	0	0	0	0	0	0	66	211200	4446605	144.25	125.66	4,493,961
Submarine Navigation	40																																		
Precision Anchoring	18	18	FFG	Guided Missile Frigate	1	4.0	100%	72.0	72.0	0.0	0.0	8,643	5,624	838	1,158	310	279	0	0	0	0	0	0	0	0	0	0	0	0	79	5,688	119,755	4	3	121,031
Maneuver (Convoy, Land Navigation)	16																																		
Water Purification	16																																		
Field Training Exercise	100																																		
Force Protection	75																																		
Anti-Terrorism	80																																		
Seize Airfield	12																																		
Airfield Expeditionary	12																																		
Unmanned Aerial Vehicle Operation	1000																																		
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120																																		
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	236																																		
TOTAL TRAINING EMISSIONS (LBS/YEAR)									34,988	9,294	6,994	158,513	519,825	198,044	967,349	187,053	168,348	190,097	333,400	43,461	165,170	23,228	20,905	557,915	367,448	59,762	156,736	31,938	28,744		7,501,337	157,933,149	5,123	4,463	159,615,136
TOTAL TRAINING EMISSIONS (TONS/YEAR)												79	260	99	484	94	84	95	167	22	83	12	10	279	184	30	78	16	14		7,501,337	78,967	3	2	79,808

Table D.5-8 Emissions from Surface Ships During Testing, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
ANTI-SURFACE WARFARE																																			
Air to Surface Missile Test	8																																		
ANTI-SUBMARINE WARFARE																																			
Anti-submarine Warfare Tracking Test - MPA	188																																		
Anti-submarine Warfare Torpedo Test	40																																		
Broad Area Maritime Surveillance (BAMS) Testing	10																																		
LIFECYCLE ACTIVITIES TESTING																																			
Ship Signature Testing	17	17	FFG	Guided Missile	1	4.0	100%	68.0	22.4	22.4	23.1	2,694	1,753	261	361	96	87	2,694	1,753	261	361	96	87	2,775	1,806	269	372	99	89	79	5,372	113,102	4	3	114,307
ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING																																			
Torpedo Explosive Testing	2	6	DDG		3	4.0	100%	24.0	0.0	0.0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	2,560	1,292	188	509	67	60	187	4,488	94,490	3	3	95,497
Countermeasure Testing	2	4	DDG		2	2.0	100%	8.0	4.0	4.0	0.0	427	215	31	85	11	10	427	215	31	85	11	10	0	0	0	0	0	0	187	1,496	31,497	1	1	31,832
At-Sea Sonar Testing	20	80	SSN	Nuclear Carrier	4	2.0	100%	160.0	0.0	0.0	160.0																								
		20	CG		1	2.0	100%	40.0	0.0	0.0	40.0	0	0	0	0	0	0	0	0	0	0	0	0	4,590	2,609	307	1,342	138	124	184	7,360	154,957	5	4	156,608
		80	DDG		4	2.0	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	17,067	8,614	1,254	3,395	448	403	187	29,920	629,936	20	18	636,644
SHIPBOARD PROTECTION SYSTEMS AND SWMMER DEFENSE TESTING																																			
Pierside Integrated Swimmer Defense	1	1	FFG	Guided Missile	1	8.0	100%	8.0	8.0	0.0	0.0	960	625	93	129	34	31	0	0	0	0	0	0	0	0	0	0	0	0	79	632	13,306	0	0	13,448
NEW SHIP CONSTRUCTION																																			
ASW Mission Package Testing	33	33	LCS	Littoral Comba	1	60	1	1980	0	1980	0	0	0	0	0	0	0	237679.2	154657.8	23047.2	31838.4	8514	7662.6	0	0	0	0	0	0	79	156420	3293266.68	106.835	93.0699	3328339.955
MCM Mission Package Testing	32	32	LCS	Littoral Comba	1	60	1	1920	0	1920	0	0	0	0	0	0	0	230476.8	149971.2	22348.8	30873.6	8256	7430.4	0	0	0	0	0	0	79	151680	3193470.72	103.597	90.2496	3227481.168
ASUW Mission Package Testing	4	4	LCS	Littoral Comba	1	40	1	160	0	80	80	0	0	0	0	0	0	9603.2	6248.8	931.2	1286.4	344	309.6	9603.2	6248.8	931.2	1286.4	344	309.6	79	12640	266122.56	8.63312	7.5208	268956.764
OFFICE OF NAVAL RESEARCH																																			
North Pacific Acoustic Lab Philippine Sea 2018-19 Experiment (Deep Water)	1																																		
TOTAL TESTING EMISSIONS (LBS/YEAR)									34	4,006	487	4,081	2,593	386	574	142	128	480,880	312,846	46,620	64,444	17,222	15,500	36,596	20,570	2,950	6,905	1,096	987		370,008	7,790,148	253	220	7,873,113
TOTAL TESTING EMISSIONS (TONS/YEAR)												2	1	0	0	0	0	240	156	23	32	9	8	18	10	1	3	1	0		370,008	3,895	0	0	3,937

Table D.5-9. Emissions from Surface Ships During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
ANTI-AIR WARFARE																																			
Air Combat Maneuver	5300																																		
Air Defense Exercise	100																																		
Air Intercept Control	5300																																		
Gunnery Exercise, A-A (Medium Caliber)	45																																		
Missile Exercise, A-A	24																																		
Gunnery Exercise, S-A (Large Caliber)	5	10	FFG	Guided Missile Frigate	2.00	2.0	100%	20.0	0.0	0.0	20.0	0	0	0	0	0	0	0	0	0	0	0	0	2,401	1,562	233	322	86	77	79	1,580	33,265	1	1	33,620
Gunnery Exercise, S-A (Medium Caliber)	12	24	FFG	Guided Missile Frigate	2.00	2.0	100%	48.0	0.0	0.0	48.0	0	0	0	0	0	0	0	0	0	0	0	0	5,762	3,749	559	772	206	186	79	3,792	79,837	3	2	80,687
Missile Exercise, S-A	15	30	FFG	Guided Missile Frigate	2.00	2.0	100%	60.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	0	0	0	0	0
STRIKE WARFARE																																			
Bombing Exercise, A-G	2520																																		
Missile Exercise, A-G	85																																		
Gunnery Exercise, A-G	96																																		
Combat Search and Rescue	80																																		
AMPHIBIOUS WARFARE																																			
Fire Support Exercise - Land-Based target	10	10	CG	Cruiser	1	8.0	100%	80.00	80.0	0.0	0.0	9,180	5,218	614	2,684	275	248	0	0	0	0	0	0	0	0	0	0	0	0	184	14,720	309,915	10	9	313,215
Amphibious Rehearsal, No Landing - Marine Air Ground Task Force	12	48	LHD/LHA		4	24.0	100%	1152.0	1152.0	0.0	0.0	8501.8	50146.6	6370.6	150877.4	30286.1	27257.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	373.0	429696	9046819.584	293.482	255.669	9143168.17
		48	LSD		4	24.0	100%	1152.0	1152.0	0.0	0.0	7833.6	46218.2	5875.2	139046.4	27913.0	25121.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	373.0	429696	9046819.584	293.482	255.669	9143168.17
		48	LPD		4	24.0	100%	1152.0	1152.0	0.0	0.0	3382.2	19955.2	2536.7	60034.6	12049.2	10844.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	373.0	429696	9046819.584	293.482	255.669	9143168.17
Amphibious Assault - Marine Air Ground Task Force	6	6	CG	Cruiser	1	8.0	100%	48.0	48.0	0.0	0.0	5,508	3,131	368	1,610	165	149	0	0	0	0	0	0	0	0	0	0	0	0	184	8,832	185,949	6	5	187,929
		6	LHA	Amphib. Assault Ship - Tarawa	1	8.0	100%	48.0	48.0	0.0	0.0	354	2,089	265	6,287	1,262	1,136	0	0	0	0	0	0	0	0	0	0	0	0	373	17,904	376,951	12	11	380,965
		12	LPD	Amphibious Transport Dock - Wasp	2	8.0	100%	96.0	96.0	0.0	0.0	282	1,663	211	5,003	1,004	904	0	0	0	0	0	0	0	0	0	0	0	0	373	35,808	753,902	24	21	761,931
		12	FFG	Guided Missile Frigate	2	8.0	100%	96.0	96.0	0.0	0.0	11,524	7,499	1,117	1,544	413	372	0	0	0	0	0	0	0	0	0	0	0	0	79	7,584	159,674	5	5	161,374
Amphibious Raid - Special Purpose Marine Air Ground Task Force	6	6	LHA	Amphib. Assault Ship - Tarawa	1	6.0	100%	36.0	36.0	0.0	0.0	266	1,567	199	4,715	946	852	0	0	0	0	0	0	0	0	0	0	0	0	373	13,428	282,713	9	8	285,724
		12	LPD	Amphibious Transport Dock - Wasp	2	2.5	100%	30.0	30.0	0.0	0.0	88	520	66	1,563	314	282	0	0	0	0	0	0	0	0	0	0	0	0	373	11,190	235,594	8	7	238,103
Urban Warfare Training	36																																		
Non-Combatant Evacuation Operation	5	5	LHA	Amphib. Assault Ship - Tarawa	1	80.0	100%	400.0	400.0	0.0	0.0	2,952	17,412	2,212	52,388	10,516	9,464	0	0	0	0	0	0	0	0	0	0	0	0	373	149,200	3,141,257	102	89	3,174,711
		10	LPD	Amphibious Transport Dock - Wasp	2	80.0	100%	800.0	800.0	0.0	0.0	2,349	13,858	1,762	41,691	8,368	7,531	0	0	0	0	0	0	0	0	0	0	0	0	373	298,400	6,282,514	204	178	6,349,422
		5	LCU	Landing Craft Utility	1	80.0	100%	400.0	400.0	0.0	0.0	14,484	17,980	208	1,244	628	565	0	0	0	0	0	0	0	0	0	0	0	0	66	26,400	555,826	18	16	561,745

Table D.5-9. Emissions from Surface Ships During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Humanitarian Assistance/ Disaster Relief Operations	5	5	LHA	Amphib. Assault Ship - Tarawa	1	8.0	100%	40.0	40.0	0.0	0.0	295	1,741	221	5,239	1,052	946	0	0	0	0	0	0	0	0	0	0	0	0	373	14,920	314,126	10	9	317,471
		10	LPD	Amphibious Transport Dock - Wasp	2	8.0	100%	80.0	80.0	0.0	0.0	235	1,386	176	4,169	837	753	0	0	0	0	0	0	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		5	LCAC	Landing Craft Air Cushioned	1	8.0	100%	40.0	40.0	0.0	0.0	1,016	2,213	29	1,732	156	140	0	0	0	0	0	0	0	0	0	0	0	0	611	24,440	514,560	17	15	520,040
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	100																																		
ANTI-SURFACE WARFARE																																			
Gunnery Exercise, A-S (Small Caliber) - Ship	242																																		
Gunnery Exercise, A-S (Medium Caliber) - Ship	295																																		
Missile Exercise (A-S) - Rocket	10																																		
Missile Exercise (A-S)	20																																		
Laser Targeting	600																																		
Bombing Exercise (A-S)	37																																		
Torpedo Exercise (Submarine to Surface)	5																																		
Missile Exercise (S-S)	12	24	FFG	Guided Missile Frigate	2.00	2.0	100%	48.0	0.0	0.0	48.0	0	0	0	0	0	0	0	0	0	0	0	0	5,762	3,749	559	772	206	186	79	3,792	79,837	3	2	80,687
Gunnery Exercise (S-S)- Ship, Large Caliber	140																																		
		31	CG	Cruiser	0.22	2.5	100%	77.0	0.0	21.6	55.4	0	0	0	0	0	0	2,474	1,406	165	723	74	67	6,362	3,616	425	1,860	191	172	184	14,168	298,293	10	8	301,470
		63	DDG	Guided Missile Destroyer	0.45	2.5	100%	157.5	0.0	44.1	113.4	0	0	0	0	0	0	4,704	2,374	346	936	123	111	12,096	6,105	889	2,406	318	286	187	29,453	620,093	20	18	626,697
		21	FFG	Guided Missile Frigate	0.15	2.5	100%	52.5	0.0	14.7	37.8	0	0	0	0	0	0	1,765	1,148	171	236	63	57	4,538	2,953	440	608	163	146	79	4,148	87,321	3	2	88,251
		7	Unknown	Other	0.05	2.5	100%	17.5	0.0	4.9	12.6	0	0	0	0	0	0	33	197	25	591	119	107	86	506	64	1,521	305	275	66	1,155	24,317	1	1	24,576
		17	USCG	US Coast Guard	0.12	2.5	100%	42.0	0.0	11.8	30.2	0	0	0	0	0	0	68	681	10	136	2	2	174	1,751	27	349	6	6	66	2,772	58,362	2	2	58,983
Gunnery Exercise (S-S)- Ship, Medium caliber	100																																		
		22	CG	Cruiser	0.22	2.5	100%	55.0	0.0	15.4	39.6	0	0	0	0	0	0	1,767	1,004	118	517	53	48	4,544	2,583	304	1,329	136	123	184	10,120	213,066	7	6	215,336
		45	DDG	Guided Missile Destroyer	0.45	2.5	100%	112.5	0.0	31.5	81.0	0	0	0	0	0	0	3,360	1,696	247	668	88	79	8,640	4,361	635	1,719	227	204	187	21,038	442,924	14	13	447,641
		15	FFG	Guided Missile Frigate	0.15	2.5	100%	37.5	0.0	10.5	27.0	0	0	0	0	0	0	1,260	820	122	169	45	41	3,241	2,109	314	434	116	104	79	2,963	62,372	2	2	63,037
		1	LPD	Amphibious Transport Dock - Wasp	0.01	2.5	100%	1.5	0.0	0.4	1.1	0	0	0	0	0	0	1	7	1	22	4	4	3	19	2	56	11	10	373	560	11,780	0	0	11,905
		5	Unknown	Other	0.05	2.5	100%	12.5	0.0	3.5	9.0	0	0	0	0	0	0	24	140	18	422	85	76	61	361	46	1,086	218	196	66	825	17,370	1	0	17,555

Table D.5-9. Emissions from Surface Ships During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
		12	USCG	US Coast Guard	0.12	2.5	100%	30.0	0.0	8.4	21.6	0	0	0	0	0	0	48	486	7	97	2	2	124	1,251	19	249	5	4	66	1,980	41,687	1	1	42,131
Sinking Exercise (SINKEX)	2	10	FFG	Guided Missile Frigate	5.00	16.0	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	19,206	12,498	1,862	2,573	688	619	79	12,640	266,123	9	8	268,957
Gunnery Exercise (S-S) Boat – Medium-caliber	10	50	FFG	Guided Missile Frigate	5.00	3.0	100%	150.0	0.0	0.0	150.0	0	0	0	0	0	0	0	0	0	0	0	0	18,006	11,717	1,746	2,412	645	581	79	11,850	249,490	8	7	252,147
Gunnery Exercise (S-S) Small-caliber	40	80	CRRC	Combat Rubber Raiding Craft	2	3.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	3,096	0	0	0	3	720	15,159	0	0	15,320
Maritime Security Operations (MSO)	40	40	FFG	Guided Missile Frigate	1	8.0	100%	320.0	0.0	0.0	320.0	0	0	0	0	0	0	0	0	0	0	0	0	38,413	24,995	3,725	5,146	1,376	1,238	79	25,280	532,245	17	15	537,914
		40	RHIB	Rigid Hulled Inflatable Boat	1	8.0	100%	320.0	0.0	0.0	320.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	108.8	2924.8	19.2	460.8	48.0	43	14	4,480	94,322	3	3	95,326
		40	CRRC	Combat Rubber Raiding Craft	1	8.0	100%	320.0	0.0	0.0	320.0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	4,128	0	0	0	3	960	20,212	1	1	20,427
ANTI-SUBMARINE WARFARE																																			
Tracking Exercise-Helo	62																																		
Torpedo Exercise-Helo	4																																		
Tracking Exercise-Maritime Patrol Advanced Extended Echo Ranging Sonobuoys	11																																		
Tracking Exercise -Maritime Patrol Aircraft	34																																		
Torpedo Exercise-Maritime Patrol Aircraft	4																																		
Tracking Exercise –Surface	132	132	FFG	Guided Missile Frigate	1	2.0	100%	264.0	0.0	132.0	132.0	0	0	0	0	0	0	15,845	10,311	1,536	2,123	568	511	15,845	10,311	1,536	2,123	568	511	79	20,856	439,102	14	12	443,779
Torpedo Exercise-Surface	3	3	FFG	Guided Missile Frigate	1	2.0	100%	6.0	0.0	3.0	3.0	0	0	0	0	0	0	360	234	35	48	13	12	360	234	35	48	13	12	79	474	9,980	0	0	10,086
Tracking Exercise– Submarine	12																																		
Torpedo Exercise – Submarine	10																																		
MAJOR TRAINING EVENTS																																			
Joint Expeditionary Exercise	1	1	CVN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		1	CG		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	9,180	5,218	614	2,684	275	248	0	0	0	0	0	0	184	14,720	309,915	10	9	313,215
		2	FFG		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	19,206	12,498	1,862	2,573	688	619	0	0	0	0	0	0	79	12,640	266,123	9	8	268,957
		5	DDG		5	80.0	100%	400.0	0.0	400.0	0.0	0	0	0	0	0	0	42,668	21,536	3,136	8,488	1,120	1,008	0	0	0	0	0	0	187	74,800	1,574,839	51	45	1,591,611
		1	LHD/LHA		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	590	3,482	442	10,478	2,103	1,893	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		2	LSD		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	1,088	6,419	816	19,312	3,877	3,489	0	0	0	0	0	0	373	59,680	1,256,503	41	36	1,269,884

Table D.5-9. Emissions from Surface Ships During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
		1	LPD		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		1	TAOE		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	534	3,150	400	9,554	1,902	1,711	0	0	0	0	0	0	1,865	149,200	3,141,257	102	89	3,174,711
		1	SSN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		1	SSGN	Nuclear Carrier (No emissions)	1	80.0	100%	80.0	0.0	80.0	0.0																								
		2	T-AGO(LFA)		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	1,067	6,299	800	19,109	3,803	3,423	0	0	0	0	0	0	1,865	298,400	6,282,514	204	178	6,349,422
		1	CG-PARTNER		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	8,623	3,768	792	1,680	208	187	0	0	0	0	0	0	184	14,720	309,915	10	9	313,215
		2	DDG-PARTNER		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	16,638	7,984	1,440	2,864	400	360	0	0	0	0	0	0	187	29,920	629,936	20	18	636,644
		1	SS-PARTNER		1	80.0	100%	80.0	0.0	80.0	0.0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	0	0	0	0	0	0	373	29,840	628,251	20	18	634,942
		5	LCAC		5	80.0	100%	400.0	0.0	400.0	0.0	0	0	0	0	0	0	10,164	22,128	288	17,320	1,556	1,400	0	0	0	0	0	0	611	244,400	5,145,598	167	145	5,200,398
		2	LCU		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	5,794	7,192	83	498	251	226	0	0	0	0	0	0	66	10,560	222,330	7	6	224,698
		19	CRRC		19	80.0	100%	1520.0	0.0	1520.0	0.0	0	0	0	0	0	0	0	226	19,610	0	0	0	0	0	0	0	0	0	3	4,560	96,006	3	3	97,029
		2	RHIB		2	80.0	100%	160.0	0.0	160.0	0.0	0	0	0	0	0	0	54	1,462	10	230	24	22	0	0	0	0	0	0	14	2,240	47,161	2	1	47,663
		14	AAV		14	80.0	100%	1120.0	0.0	1120.0	0.0	0	0	0	0	0	0	851	6,966	918	1,400	291	262	0	0	0	0	0	0	3	3,360	70,741	2	2	71,495
Joint Multi-Strike Group Exercise	1	3	CVN		3	80.0	100%	240.0	0.0	0.0	240.0																								
		3	CG		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	27,540	15,653	1,841	8,052	826	743	184	44,160	929,745	30	26	939,646
		3	FFG		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	28,810	18,746	2,794	3,859	1,032	929	79	18,960	399,184	13	11	403,435
		12	DDG		12	80.0	100%	960.0	0.0	0.0	960.0	0	0	0	0	0	0	0	0	0	0	0	0	102,403	51,686	7,526	20,371	2,688	2,419	187	179,520	3,779,614	123	107	3,819,867
		3	TAOE		3	80.0	100%	240.0	0.0	0.0	240.0	0	0	0	0	0	0	0	0	0	0	0	0	1,601	9,449	1,200	28,663	5,705	5,134	1,865	447,600	9,423,770	306	266	9,524,134
		5	SSN		5	80.0	100%	400.0	0.0	0.0	400.0																								
		2	T-AGO(LFA)		2	80.0	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	1,067	6,299	800	19,109	3,803	3,423	1,865	298,400	6,282,514	204	178	6,349,422
		1	SS-PARTNER		1	80.0	100%	80.0	0.0	0.0	80.0	0	0	0	0	0	0	0	0	0	0	0	0	235	1,386	176	4,169	837	753	373	29,840	628,251	20	18	634,942
Fleet Strike Group Exercise	1	1	CVN	Nuclear Carrier (No emissions)	1	56.0	100%	56.0	0.0	0.0	56.0																								
		1	CG		1	56.0	100%	56.0	0.0	0.0	56.0	0	0	0	0	0	0	0	0	0	0	0	0	6,426	3,652	430	1,879	193	173	184	10,304	216,940	7	6	219,251
		1	FFG		1	56.0	100%	56.0	0.0	0.0	56.0	0	0	0	0	0	0	0	0	0	0	0	0	6,722	4,374	652	900	241	217	79	4,424	93,143	3	3	94,135
		3	DDG		3	56.0	100%	168.0	0.0	0.0	168.0	0	0	0	0	0	0	0	0	0	0	0	0	17,921	9,045	1,317	3,565	470	423	187	31,416	661,432	21	19	668,477
		1	LHD/LHA		1	56.0	100%	56.0	0.0	0.0	56.0	0	0	0	0	0	0	0	0	0	0	0	0	413	2,438	310	7,334	1,472	1,325	373	20,888	439,776	14	12	444,460
		1	TAOE		1	56.0	100%	56.0	0.0	0.0	56.0	0	0	0	0	0	0	0	0	0	0	0	0	374	2,205	280	6,688	1,331	1,198	1,865	104,440	2,198,880	71	62	2,222,298
		1	SSN	Nuclear Carrier (No emissions)	1	56.0	100%	56.0	0.0	0.0	56.0																								
Integrated Anti-Submarine Warfare Exercise	1	1	CVN	Nuclear Carrier (No emissions)	1	40.0	100%	40.0	0.0	40.0	0.0																								
		1	CG		1	40.0	100%	40.0	0.0	40.0	0.0	0	0	0	0	0	0	4,590	2,609	307	1,342	138	124	0	0	0	0	0	0	184	7,360	154,957	5	4	156,608
		1	FFG		1	40.0	100%	40.0	0.0	40.0	0.0	0	0	0	0	0	0	4,802	3,124	466	643	172	155	0	0	0	0	0	0	79	3,160	66,531	2	2	67,239
		3	DDG		3	40.0	100%	120.0	0.0	120.0	0.0	0	0	0	0	0	0	12,800	6,461	941	2,546	336	302	0	0	0	0	0	0	187	22,440	472,452	15	13	477,483
		1	SSN	Nuclear Carrier (No emissions)	1	40.0	100%	40.0	0.0	40.0	0.0																								
Ship Squadron Anti-Submarine Warfare Exercise	1	1	CG		1	40.0	100%	40.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4590.0	2608.8	306.8	1342.0	137.6	123.8	0.0	0.0	0.0	0.0	0.0	0.0	184.0	7360	154957.44	5.02688	4.3792	156607.736
		1	FFG		1	40.0	100%	40.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4801.6	3124.4	465.6	643.2	172.0	154.8	0.0	0.0	0.0	0.0	0.0	0.0	79.0	3160	66530.64	2.15828	1.8802	67239.191
		3	DDG		3	40.0	100%	120.0	0.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12800.4	6460.8	940.8	2546.4	336.0	302.4	0.0	0.0	0.0	0.0	0.0	0.0	187.0	22440	472451.76	15.3265	13.3518	477483.369
Maritime Homeland Defense / Security Mine Countermeasures	1	4	FFG	Guided Missile Frigate	4	8.0	100%	32.0	32.0	0.0	0.0	3,841	2,500	372	515	138	124	0	0	0	0	0	0	0	0	0	0	0	0	79	2,528	53,225	2	2	53,791
Marine Air Ground Task Force Exercise (Amphibious)	4	4	LHD/LHA		1	80.0	100%	320.0	320.0	0.0	0.0	2,362	13,930	1,770	41,910	8,413	7,572	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
		4	LSD		1	80.0	100%	320.0	320.0	0.0	0.0	2,176	12,838	1,632	38,624	7,754	6,978	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769

Table D.5-9. Emissions from Surface Ships During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS: Ship / Vessel / Boat: Number	Ship Type	Type	Participation	Range Time (hr): Per Ship	Time at Each Power Level (%)	Total	Distribution (hr): 0-3 nm from shore	3-12 nm from shore	>12 nm from shore	Emissions By Jurisdiction (lb/year): State (0-3 nm offshore): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Waters of U S (3-12 nm): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	International Waters (>12 nm): CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Greenhouse Gas Emissions (lb/year): Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
		4	LPD		1	80.0	100%	320.0	320.0	0.0	0.0	940	5,543	705	16,676	3,347	3,012	0	0	0	0	0	0	0	0	0	0	0	0	373	119,360	2,513,005	82	71	2,539,769
Special Purpose Marine Air Ground Task Force Exercise	2	2	LHA	Amphib. Assault Ship - Tarawa	1	80.0	100%	160.0	52.8	52.8	54.4	390	2,298	292	6,915	1,388	1,249	390	2,298	292	6,915	1,388	1,249	401	2,368	301	7,125	1,430	1,287	373	59,680	1,256,503	41	36	1,269,884
		4	LPD	Amphibious Transport Dock - Wasp	2	80.0	100%	320.0	105.6	105.6	108.8	310	1,829	233	5,503	1,105	994	310	1,829	233	5,503	1,105	994	319	1,885	240	5,670	1,138	1,024	373	119,360	2,513,005	82	71	2,539,769
Urban Warfare Exercise	5	5	LHA	Amphib. Assault Ship - Tarawa	1	112.0	100%	560.0	560.0	0.0	0.0	4,133	24,377	3,097	73,343	14,722	13,250	0	0	0	0	0	0	0	0	0	0	0	0	373	208,880	4,397,760	143	124	4,444,596
		10	LPD	Amphibious Transport Dock - Wasp	2	112.0	100%	1120.0	1120.0	0.0	0.0	3,288	19,401	2,466	58,367	11,715	10,543	0	0	0	0	0	0	0	0	0	0	0	0	373	417,760	8,795,519	285	249	8,889,191
ELECTRONIC WARFARE																																			
Electronic Warfare Operations (EW Ops)	530	530	FFG	Guided Missile Frigate	1	4	100%	2120.0	0.0	0.0	2120.0	0	0	0	0	0	0	0	0	0	0	0	0	254,485	165,593	24,677	34,090	9,116	8,204	79	167,480	3,526,124	114	100	3,563,677
Counter Targeting Flare Exercise (FLAREX) - Aircraft	3534																																		
Counter Targeting Chaff Exercise (CHAFFEX) - Ship	40	40	FFG	Guided Missile Frigate	1	4	100%	160.0	0.0	0.0	160.0	0	0	0	0	0	0	0	0	0	0	0	0	19,206	12,498	1,862	2,573	688	619	79	12,640	266,123	9	8	268,957
Counter Targeting Chaff Exercise (CHAFFEX) - Aircraft	3534																																		
MINE WARFARE																																			
Submarine Mine Exercise	16	0																																	
Mine Countermeasure Exercise – Sonar (AQS-20, LCS)	4	1	CG	Cruiser	0.2	1.5	100%	1.2	0.0	0.7	0.5	0.0	0.0	0.0	0.0	0.0	0	85.4	48.5	5.7	25.0	2.6	2	52.3	29.7	3.5	15.3	1.6	1	184	221	4,649	0	0	4,698
		1	DDG	Guided Missile Destroyer	0.14	1.5	100%	0.8	0.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0	55.6	28.0	4.1	11.1	1.5	1	34.0	17.2	2.5	6.8	0.9	1	187	157	3,307	0	0	3,342
		1	FFG	Guided Missile Frigate	0.13	1.5	100%	0.8	0.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0	58.1	37.8	5.6	7.8	2.1	2	35.6	23.2	3.5	4.8	1.3	1	79	62	1,297	0	0	1,311
Mine Countermeasure Exercise – Surface (SMCMEX) Sonar (SQQ-32, MCM)	4	4	MCM	MCM Class	1	8.0	100%	32.0	32.0	0.0	0.0	94.0	554.3	70.5	1667.6	334.7	301	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	373	11,936	251,301	8	7	253,977
Mine Neutralization – Remotely Operated Vehicle Sonar (AQS-235[AQS-20], SLQ-48)	4	4	RHIB	Rigid Hulled Inflatable Boat	1	12.0	100%	48.0	48.0	0.0	0.0	16.3	438.7	2.9	69.1	7.2	6	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	672	14,148	0	0	14,299
Mine Laying - Aircraft	4																																		
Mine Neutralization – Explosive Ordnance Disposal	20	60	RHIB	Rigid Hulled Inflatable Boat	3	12.0	100%	720.0	720.0	0.0	0.0	244.8	6580.8	43.2	1036.8	108.0	97	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	10,080	212,224	7	6	214,485

Table D.5-9. Emissions from Surface Ships During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Limpet Mine Neutralization System/Shock Wave Generator	40	40	RHIB	Rigid Hulled Inflatable Boat	1	4.0	100%	160.0	160.0	0.0	0.0	54.4	1462.4	9.6	230.4	24.0	22	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	2,240	47,161	2	1	47,663
Mine Countermeasure – Towed Mine Detection	4	4	MCM	MCM Class	1	15.0	100%	60.0	60.0	0.0	0.0	176.2	1039.3	132.1	3126.8	627.6	565	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	373	22,380	471,189	15	13	476,207
NAVAL SPECIAL WARFARE																																			
Personnel I&E	240	1200	RHIB	Rigid Hulled Inflatable Boat	5	8.0	100%	9600.0	9600.0	0.0	0.0	3264.0	87744.0	576.0	13824.0	1440.0	1,296	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	134,400	2,829,658	92	80	2,859,793
		1440	CRRC	Combat Rubber Raiding Craft	6	8.0	100%	11520.0	11520.0	0.0	0.0	0	1,711	148,625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	34,560	727,626	24	21	735,375
Parachute Insertion	20																																		
Embassy Reinforcement	50	50	LCAC	Landing Craft Air Cushioned	1	24.0	100%	1200.0	1200.0	0.0	0.0	30,492	66,384	864	51,960	4,668	4,201	0	0	0	0	0	0	0	0	0	0	0	0	611	733,200	15,436,793	501	436	15,601,195
Direct Action (Combat Close Quarters)	72																																		
Direct Action (Breaching)	72																																		
Direct Action (TAC-P)	18																																		
Underwater Demolition Qualifications	30	30	CRRC	Combat Rubber Raiding Craft	1	8.0	100%	240.0	0.0	240.0	0.0	0	0	0	0	0	0	0	36	3,096	0	0	0	0	0	0	0	0	0	3	720	15,159	0	0	15,320
Intelligence, Surveillance, Reconnaissance	16																																		
Urban Warfare Training	18	18	LHA	Amphib. Assault Ship - Tarawa	1	40.0	100%	720.0	720.0	0.0	0.0	5,314	31,342	3,982	94,298	18,929	17,036	0	0	0	0	0	0	0	0	0	0	0	0	373	268,560	5,654,262	183	160	5,714,480
		36	LPD	Amphibious Transport Dock - Wasp	2	40.0	100%	1440.0	1440.0	0.0	0.0	4,228	24,944	3,171	75,043	15,062	13,555	0	0	0	0	0	0	0	0	0	0	0	0	373	537,120	11,308,524	367	320	11,428,960
Underwater Survey	16	48	RHIB	Rigid Hulled Inflatable Boat	3	8.0	100%	384.0	384.0	0.0	0.0	130.6	3509.8	23.0	553.0	57.6	52	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	14	5,376	113,186	4	3	114,392
		48	CRRC	Combat Rubber Raiding Craft	3	8.0	100%	384.0	384.0	0.0	0.0	0	57	4,954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1,152	24,254	1	1	24,513
OTHER																																			
Surface Ship Sonar Maintenance	42	42	FFG	Guided Missile Frigate	1	4.0	100%	168.0	168.0	0.0	0.0	20,167	13,122	1,956	2,701	722	650	0	0	0	0	0	0	0	0	0	0	0	0	79	13,272	279,429	9	8	282,405
Submarine Sonar Maintenance	48																																		
Small Boat Attack	18	18	CRRC	Combat Rubber Raiding Craft	1	4.0	100%	72.0	0.0	72.0	0.0	0	0	0	0	0	0	0	11	929	0	0	0	0	0	0	0	0	0	3	216	4,548	0	0	4,596
Search and Rescue at Sea	40	80	USCG	US Coast Guard	2	40.0	100%	3200.0	0.0	3200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18368.0	185312.0	2816.0	36960.0	672.0	604.8	0	0	0	0	0	0	66	211200	4446605	144.25	125.66	4,493,961
Submarine Navigation	40																																		

Table D.5-9. Emissions from Surface Ships During Training, Alternative 2

		OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
Type of Training	Training Ops (#)	Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Precision Anchoring	18	18	FFG	Guided Missile Frigate	1	4.0	100%	72.0	72.0	0.0	0.0	8,643	5,624	838	1,158	310	279	0	0	0	0	0	0	0	0	0	0	0	0	79	5,688	119,755	4	3	121,031
Maneuver (Convoy, Land Navigation)	16																																		
Water Purification	16																																		
Field Training Exercise	100																																		
Force Protection	75																																		
Anti-Terrorism	80																																		
Seize Airfield	12																																		
Airfield Expeditionary	12																																		
Unmanned Aerial Vehicle Operation	1000																																		
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120																																		
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	236																																		
TOTAL TRAINING EMISSIONS (LBS/YEAR)									34,988	9,574	7,698	158,513	519,825	198,044	967,349	187,053	168,348	212,289	345,594	45,174	169,702	23,874	21,486	613,778	404,784	65,078	180,319	36,505	32,855		7,721,569	162,569,914	5,274	4,594	164,301,283
TOTAL TRAINING EMISSIONS (TONS/YEAR)												79	260	99	484	94	84	106	173	23	85	12	11	307	202	33	90	18	16		7,721,569	81,285	3	2	82,151

Table D.5-10. Emissions from Surface Ships During Testing, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - VESSELS										Emissions By Jurisdiction (lb/year)																		Greenhouse Gas Emissions (lb/year)					
		Ship / Vessel / Boat				Range Time (hr)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)											
		Number	Ship Type	Type	Participation	Per Ship	Time at Each Power Level (%)	Total	0-3 nm from shore	3-12 nm from shore	>12 nm from shore	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
ANTI-SURFACE WARFARE																																			
Air to Surface Missile Test	10																																		
ANTI-SUBMARINE WARFARE																																			
Anti-submarine Warfare Tracking Test - MPA	207																																		
Anti-submarine Warfare Torpedo Test	44																																		
Broad Area Maritime Surveillance (BAMS) Testing	11																																		
LIFECYCLE ACTIVITIES TESTING																																			
Ship Signature Testing	19	19	FFG	Guided Missile	1	4.0	100%	76.0	25.1	25.1	25.8	3,011	1,959	292	403	108	97	3,011	1,959	292	403	108	97	3,102	2,018	301	416	111	100	79	6,004	126,408	4	4	127,754
ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING																																			
Torpedo Explosive Testing	2	6	DDG		3	4.0	100%	24.0	0.0	0.0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	2,560	1,292	188	509	67	60	187	4,488	94,490	3	3	95,497
Countermeasure Testing	3	6	DDG		2	2.0	100%	12.0	6.0	6.0	0.0	640	323	47	127	17	15	640	323	47	127	17	15	0	0	0	0	0	0	187	2,244	47,245	2	1	47,748
At-Sea Sonar Testing	24	96	SSN	Nuclear Carrie	4	2.0	100%	192.0	0.0	0.0	192.0																								
		24	CG		1	2.0	100%	48.0	0.0	0.0	48.0	0	0	0	0	0	0	0	0	0	0	0	0	5,508	3,131	368	1,610	165	149	184	8,832	185,949	6	5	187,929
		96	DDG		4	2.0	100%	192.0	0.0	0.0	192.0	0	0	0	0	0	0	0	0	0	0	0	0	20,481	10,337	1,505	4,074	538	484	187	35,904	755,923	25	21	763,973
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING																																			
Pierside Integrated Swimmer Defense	1	1	FFG	Guided Missile	1	8.0	100%	8.0	8.0	0.0	0.0	960	625	93	129	34	31	0	0	0	0	0	0	0	0	0	0	0	0	79	632	13,306	0	0	13,448
NEW SHIP CONSTRUCTION																																			
ASW Mission Package Testing	37	37	LCS	Littoral Comba	1	60	1	2220	0	2220	0	0	0	0	0	0	0	266488.8	173404.2	25840.8	35697.6	9546	8591.4	0	0	0	0	0	0	79	175380	3692450.52	119.785	104.351	3731775.101
MCM Mission Package Testing	36	36	LCS	Littoral Comba	1	60	1	2160	0	2160	0	0	0	0	0	0	0	259286.4	168717.6	25142.4	34732.8	9288	8359.2	0	0	0	0	0	0	79	170640	3592654.56	116.547	101.531	3630916.314
ASUW Mission Package Testing	4	4	LCS	Littoral Comba	1	40	1	160	0	80	80	0	0	0	0	0	0	9603.2	6248.8	931.2	1286.4	344	309.6	9603.2	6248.8	931.2	1286.4	344	309.6	79	12640	266122.56	8.63312	7.5208	268956.764
OFFICE OF NAVAL RESEARCH																																			
North Pacific Acoustic Lab Philippine Sea 2018-19 Experiment (Deep Water)	1																																		
TOTAL TESTING EMISSIONS (lbs per year)									**39**	**4,491**	**562**	**4,611**	**2,907**	**432**	**659**	**159**	**143**	**539,029**	**350,653**	**52,253**	**72,247**	**19,303**	**17,372**	**41,254**	**23,027**	**3,294**	**7,896**	**1,225**	**1,103**		**416,764**	**8,774,549**	**285**	**248**	**8,867,998**
TOTAL TESTING EMISSIONS (tons per year)												**2**	**1**	**0**	**0**	**0**	**0**	**270**	**175**	**26**	**36**	**10**	**9**	**21**	**12**	**2**	**4**	**1**	**1**		**416,764**	**4,387**	**0**	**0**	**4,434**

Table D.5-11 Emissions from Aircraft During Training, No Action Alternative

Type of Training	OPERATIONAL INFORMATION - AIRCRAFT														EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
Amphibious Raid - Special Purpose Marine Air Ground Task Force	2	4	8.0	H-53	12.0	96.0	100%	96.0	100%	0%	0%	96.00	0.00	0.00	913	3463	64	171	947	852	0	0	0	0	0	0	0	0	0	0	0	0	1326848	43	37	1,340,979
		10	20.0	MV-22	12.0	240.0	100%	240.0	100%	0%	0%	240.00	0.00	0.00	5306	1059	922	108	478	431	0	0	0	0	0	0	0	0	0	0	0	0	1664504	54	47	1,682,231
		2	4.0	UH-1	12.0	48.0	100%	48.0	100%	0%	0%	48.00	0.00	0.00	87	122	4	10	109	98	0	0	0	0	0	0	0	0	0	0	0	0	80253	3	2	81,108
		4	8.0	AH-1	12.0	96.0	100%	96.0	100%	0%	0%	96.00	0.00	0.00	874	424	44	31	327	295	0	0	0	0	0	0	0	0	0	0	0	0	241353	8	7	243,924
		4	8.0	AV-8	12.0	96.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1783398	58	50	1,802,391
Urban Warfare Training	17	1	17	AH-1	28.0	476.0	100%	476.0	100%	0%	0%	476.00	0.00	0.00	4333	2103	220	155	1623	1461	0	0	0	0	0	0	0	0	0	0	0	0	1196709	39	34	1,209,454
		1	17	UH-1	28.0	476.0	100%	476.0	100%	0%	0%	476.00	0.00	0.00	859	1213	44	103	1080	972	0	0	0	0	0	0	0	0	0	0	0	0	795841	26	22	804,317
		1	17	MV-22	28.0	476.0	100%	476.0	100%	0%	0%	476.00	0.00	0.00	10524	2100	1829	213	949	854	0	0	0	0	0	0	0	0	0	0	0	0	3301267	107	93	3,336,426
		1	17	H-53	28.0	476.0	100%	476.0	100%	0%	0%	476.00	0.00	0.00	4526	17169	319	850	4696	4226	0	0	0	0	0	0	0	0	0	0	0	0	6578954	213	186	6,649,020
		1	17	MH-53	8.0	136.0	100%	136.0	100%	0%	0%	136.00	0.00	0.00	1293	4905	91	243	1342	1208	0	0	0	0	0	0	0	0	0	0	0	0	1879701	61	53	1,899,720
		1	17	H-60	8.0	136.0	100%	136.0	100%	0%	0%	136.00	0.00	0.00	1020	1044	90	65	685	617	0	0	0	0	0	0	0	0	0	0	0	0	505296	16	14	510,677
Non-Combatant Evacuation Operation	2	10	20	MV-22	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	8844	1765	1537	179	797	718	0	0	0	0	0	0	0	0	0	0	0	0	2774174	90	78	2,803,719
		4	8	H-53	20.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1521	5771	107	286	1578	1421	0	0	0	0	0	0	0	0	0	0	0	0	2211413	72	62	2,234,965
		2	4	UH-1	20.0	80.0	100%	80.0	100%	0%	0%	80.00	0.00	0.00	144	204	7	17	181	163	0	0	0	0	0	0	0	0	0	0	0	0	133755	4	4	135,179
		4	8	AH-1	20.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1456	707	74	52	546	491	0	0	0	0	0	0	0	0	0	0	0	0	402255	13	11	406,539
		4	8	AV-8	20.0	160.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2972329	96	84	3,003,985
Humanitarian Assistance/ Disaster Relief Operations	2	10	20	MV-22	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	8844	1765	1537	179	797	718	0	0	0	0	0	0	0	0	0	0	0	0	2774174	90	78	2,803,719
		4	8	H-53	20.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1521	5771	107	286	1578	1421	0	0	0	0	0	0	0	0	0	0	0	0	2211413	72	62	2,234,965
		2	4	UH-1	20.0	80.0	100%	80.0	100%	0%	0%	80.00	0.00	0.00	144	204	7	17	181	163	0	0	0	0	0	0	0	0	0	0	0	0	133755	4	4	135,179
		4	8	AH-1	20.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1456	707	74	52	546	491	0	0	0	0	0	0	0	0	0	0	0	0	402255	13	11	406,539
		4	8	AV-8	20.0	160.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2972329	96	84	3,003,985
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	0	1	0.0	MQ-4C	4.0	0.0	100%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANTI-SURFACE WARFARE																																				
Gunnery Exercise, A-S (Small Caliber) - Ship	220	0.25	55	FA-18E/F	2.0	110.0	10%	11.0	0%	0%	100%	0.00	0.00	11.00	0	0	0	0	0	0	0	0	0	0	0	0	82	1677	14	45	746	671	3520910	114	100	3,558,408
		0.75	165	SH-60B	2.0	330.0	100%	330.0	0%	0%	100%	0.00	0.00	330.00	0	0	0	0	0	0	0	0	0	0	0	0	2475	2534	218	158	1663	1497	1226086	40	35	1,239,144
Gunnery Exercise, A-S (Medium Caliber) - Ship	155	0.25	38.75	FA-18E/F	2.0	77.5	10%	7.8	0%	0%	100%	0.00	0.00	7.75	0	0	0	0	0	0	0	0	0	0	0	0	58	1182	10	32	526	473	2480641	80	70	2,507,060
		0.75	116.25	SH-60B	2.0	232.5	100%	232.5	0%	0%	100%	0.00	0.00	232.50	0	0	0	0	0	0	0	0	0	0	0	0	1744	1786	153	112	1172	1055	863833	28	24	873,033
Missile Exercise (A-S) - Rocket	0	0.33	0	FA-18E/F	2.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.66	0	SH-60B	2.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Missile Exercise (A-S)	2	0.5	1	FA-18E/F	2.0	2.0	10%	0.2	0%	0%	100%	0.00	0.00	0.20	0	0	0	0	0	0	0	0	0	0	0	0	1	30	0	1	14	12	64017	2	2	64,698
		0.5	1	SH-60B	2.0	2.0	100%	2.0	0%	0%	100%	0.00	0.00	2.00	0	0	0	0	0	0	0	0	0	0	0	0	15	15	1	1	10	9	7431	0	0	7,510
Laser Targeting	60	0.5	30	FA-18E/F	1.0	30.0	10%	3.0	0%	0%	100%	0.00	0.00	3.00	0	0	0	0	0	0	0	0	0	0	0	0	22	457	4	12	203	183	960248	31	27	970,475
		0.5	30	SH-60B	1.0	30.0	100%	30.0	0%	0%	100%	0.00	0.00	30.00	0	0	0	0	0	0	0	0	0	0	0	0	225	230	20	14	151	136	111462	4	3	112,649

Table D.5-11 Emissions from Aircraft During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT: Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			EMISSIONS/YEAR (lb) BY JURISDICTION: State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)						Greenhouse Gas Emissions (lb/year)			
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
Bombing Exercise (A-S)	28	0.5	14	FA-18E/F	1.0	14.0	10%	1.4	0%	0%	100%	0.00	0.00	1.40	0	0	0	0	0	0	0	0	0	0	0	0	10	213	2	6	95	85	448116	15	13	452,888
		0.5	14	P-3	1.0	14.0	10%	1.4	0%	0%	100%	0.00	0.00	1.40	0	0	0	0	0	0	0	0	0	0	0	0	12	57	3	3	27	24	208063	7	6	210,279
Torpedo Exercise (Submarine to Surface)	0																																			
Missile Exercise (S-S)	0																																			
Gunnery Exercise (S-S)-Ship, Large Caliber	12	0	0																																	
Gunnery Exercise (S-S)-Ship, Medium caliber	5	0	0																																	
Sinking Exercise (SINKEX)	2	2	4	FA-18E/F	8.0	32.0	10%	3.2	0%	0%	100%	0.00	0.00	3.20	0	0	0	0	0	0	0	0	0	0	0	0	24	488	4	13	217	195	1024265	33	29	1,035,173
		1	2	P-3	8.0	16.0	10%	1.6	0%	0%	100%	0.00	0.00	1.60	0	0	0	0	0	0	0	0	0	0	0	0	14	65	3	3	30	27	237786	8	7	240,319
		1	2	SH-60B	8.0	16.0	100%	16.0	0%	0%	100%	0.00	0.00	16.00	0	0	0	0	0	0	0	0	0	0	0	0	120	123	11	8	81	73	59447	2	2	60,080
Gunnery Exercise (S-S) Boat – Medium-caliber	0																																			
Gunnery Exercise (S-S) Small-caliber	32																																			
Maritime Security Operations (MSO)	6	1	6	SH-60B	4.0	24.0	100%	24.0	100%	0%	0%	24.00	0.00	0.00	180	184	16	12	121	109	0	0	0	0	0	0	0	0	0	0	0	0	89170	3	3	90,120
ANTI-SUBMARINE WARFARE																																				
Tracking Exercise-Helo	18	3	54	SH-60B	4.0	216.0	100%	216.0	0%	100%	0%	0.00	216.00	0.00	0	0	0	0	0	0	1620	1659	143	104	1089	980	0	0	0	0	0	0	802529	26	23	811,076
Torpedo Exercise-Helo	4	3	12	SH-60B	4.0	48.0	100%	48.0	0%	100%	0%	0.00	48.00	0.00	0	0	0	0	0	0	360	369	32	23	242	218	0	0	0	0	0	0	178340	6	5	180,239
Tracking Exercise-Maritime Patrol Advanced Extended Echo Ranging Sonobuoys	8	1	8	P-3	6.0	48.0	75%	36.0	0%	100%	0%	0.00	36.00	0.00	0	0	0	0	0	0	314	1457	71	69	686	617	0	0	0	0	0	0	713359	23	20	720,956
Tracking Exercise - Maritime Patrol Aircraft	8	1	8	P-3	6.0	48.0	75%	36.0	0%	100%	0%	0.00	36.00	0.00	0	0	0	0	0	0	314	1457	71	69	686	617	0	0	0	0	0	0	713359	23	20	720,956
Torpedo Exercise-Maritime Patrol Aircraft	4	1	4	P-3	6.0	24.0	75%	18.0	0%	100%	0%	0.00	18.00	0.00	0	0	0	0	0	0	157	728	35	35	343	309	0	0	0	0	0	0	356680	12	10	360,478
Tracking Exercise –Surface	30																																			
Torpedo Exercise-Surface	3																																			
Tracking Exercise–Submarine	10																																			
Torpedo Exercise – Submarine	10																																			
MAJOR TRAINING EVENTS																																				
Joint Expeditionary Exercise	1	48	48	FA-18E/F	8.0	384.0	10%	38.4	0%	100%	0%	0.00	38.40	0.00	0	0	0	0	0	0	286	5855	48	159	2604	2344	0	0	0	0	0	0	12291177	399	347	12,422,078
		4	4	EA-6B	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	163	117	22	8	248	223	0	0	0	0	0	0	633106	21	18	639,849
		4	4	E-2	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	15	57	3	3	28	25	0	0	0	0	0	0	217971	7	6	220,292
		3	3	P-3	8.0	24.0	10%	2.4	0%	100%	0%	0.00	2.40	0.00	0	0	0	0	0	0	21	97	5	5	46	41	0	0	0	0	0	0	356680	12	10	360,478

Table D.5-11 Emissions from Aircraft During Training, No Action Alternative

Type of Training	OPERATIONAL INFORMATION - AIRCRAFT				Aircraft: Time		Altitude		Distribution (%)			Distribution (hr)			EMISSIONS/YEAR (lb) BY JURISDICTION: State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)						Greenhouse Gas Emissions (lb/year)			
	Training Ops (#)	Aircraft: Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
		6	6	AV-8B	8.0	48.0	10%	4.8	0%	100%	0%	0.00	4.80	0.00	0	0	0	0	0	0	253	193	8	12	204	184	0	0	0	0	0	0	891699	29	25	901,195
		2	2	C-130	8.0	16.0	10%	1.6	0%	100%	0%	0.00	1.60	0.00	0	0	0	0	0	0	15	59	3	3	29	26	0	0	0	0	0	0	222925	7	6	225,299
		4	4	A-10	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	39	86	4	4	26	23	0	0	0	0	0	0	599618	19	17	606,004
		1	1	E-3	8.0	8.0	10%	0.8	0%	100%	0%	0.00	0.80	0.00	0	0	0	0	0	0	54	221	8	10	7	6	0	0	0	0	0	0	3238254	105	92	3,272,741
		1	1	KC-135	8.0	8.0	10%	0.8	0%	100%	0%	0.00	0.80	0.00	0	0	0	0	0	0	25	247	1	7	2	2	0	0	0	0	0	0	2267689	74	64	2,291,840
		15	15	SH-60B	8.0	120.0	100%	120.0	0%	100%	0%	0.00	120.00	0.00	0	0	0	0	0	0	900	922	79	58	605	544	0	0	0	0	0	0	445849	14	13	450,598
		4	4	CH-53	8.0	32.0	100%	32.0	0%	100%	0%	0.00	32.00	0.00	0	0	0	0	0	0	304	1154	21	57	316	284	0	0	0	0	0	0	442283	14	12	446,993
		12	12	CH-46	8.0	96.0	100%	96.0	0%	100%	0%	0.00	96.00	0.00	0	0	0	0	0	0	1963	475	304	46	205	185	0	0	0	0	0	0	356680	12	10	360,478
		4	4	AH-1	8.0	32.0	100%	32.0	0%	100%	0%	0.00	32.00	0.00	0	0	0	0	0	0	291	141	15	10	109	98	0	0	0	0	0	0	80451	3	2	81,308
		2	2	UH-1	8.0	16.0	100%	16.0	0%	100%	0%	0.00	16.00	0.00	0	0	0	0	0	0	29	41	1	3	36	33	0	0	0	0	0	0	26751	1	1	27,036
		10	10	MV-22	8.0	80.0	100%	80.0	0%	100%	0%	0.00	80.00	0.00	0	0	0	0	0	0	1769	353	307	36	159	144	0	0	0	0	0	0	554835	18	16	560,744
Joint Multi-Strike Group Exercise	1	144	144	FA-18E/F	8.0	1152.0	10%	115.2	0%	0%	100%	0.00	0.00	115.20	0	0	0	0	0	0	0	0	0	0	0	0	857	17566	143	476	7813	7031	36873530	1196	1042	37,266,233
		12	12	EA-6B	8.0	96.0	10%	9.6	0%	0%	100%	0.00	0.00	9.60	0	0	0	0	0	0	0	0	0	0	0	0	490	350	67	25	743	669	1899318	62	54	1,919,546
		12	12	E-2	8.0	96.0	10%	9.6	0%	0%	100%	0.00	0.00	9.60	0	0	0	0	0	0	0	0	0	0	0	0	46	170	10	8	84	75	653912	21	18	660,877
		5	5	P-3	8.0	40.0	10%	4.0	0%	0%	100%	0.00	0.00	4.00	0	0	0	0	0	0	0	0	0	0	0	0	35	162	8	8	76	69	594466	19	17	600,797
		1	1	E-3	8.0	8.0	10%	0.8	0%	0%	100%	0.00	0.00	0.80	0	0	0	0	0	0	0	0	0	0	0	0	54	221	8	10	7	6	3238254	105	92	3,272,741
		2	2	KC-135	8.0	16.0	10%	1.6	0%	0%	100%	0.00	0.00	1.60	0	0	0	0	0	0	0	0	0	0	0	0	49	494	1	15	5	4	4535378	147	128	4,583,680
		6	6	B-1B	8.0	48.0	10%	4.8	0%	0%	100%	0.00	0.00	4.80	0	0	0	0	0	0	0	0	0	0	0	0	27	418	4	13	4	4	3947253	128	112	3,989,292
		24	24	F-15	8.0	192.0	10%	19.2	0%	0%	100%	0.00	0.00	19.20	0	0	0	0	0	0	0	0	0	0	0	0	431	5558	77	48	970	873	3683311	119	104	3,722,538
		45	45	SH-60B	8.0	360.0	100%	360.0	0%	0%	100%	0.00	0.00	360.00	0	0	0	0	0	0	0	0	0	0	0	0	2700	2765	238	173	1814	1633	1337548	43	38	1,351,793
Fleet Strike Group Exercise	0	48	0	FA-18E/F	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	EA-6B	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	E-2	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3	0	P-3	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		6	0	AV-8B	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	0	E-3	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	0	KC-135	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		24	0	F-15	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		15	0	SH-60B	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	CH-53	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		12	0	CH-46	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	AH-1	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		2	0	UH-1	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		10	0	MV-22	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Integrated Anti-Submarine Warfare Exercise	0	48	0	FA-18E/F	8.0	0.0	10%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	EA-6B	8.0	0.0	10%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	E-2	8.0	0.0	10%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3	0	P-3	8.0	0.0	10%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		15	0	SH-60B	8.0	0.0	100%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table D.5-11 Emissions from Aircraft During Training, No Action Alternative

OPERATIONAL INFORMATION - AIRCRAFT

Type of Training	Training Ops (#)	Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)		
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore
Ship Squadron Anti-Submarine Warfare Exercise	0													
Maritime Homeland Defense / Security Mine Countermeasures	0													
Marine Air Ground Task Force Exercise (Amphibious)	4	1	4	C-130	8.0	32.0	10%	3.2	50%	50%	0%	1.60	1.60	0.00
		2	8	SH-60B	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00
		4	16	CH-53	8.0	128.0	100%	128.0	50%	50%	0%	64.00	64.00	0.00
		12	48	CH-46	8.0	384.0	100%	384.0	50%	50%	0%	192.00	192.00	0.00
		4	16	AH-1	8.0	128.0	100%	128.0	50%	50%	0%	64.00	64.00	0.00
		2	8	UH-1	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00
		10	40	MV-22	8.0	320.0	100%	320.0	50%	50%	0%	160.00	160.00	0.00
Special Purpose Marine Air Ground Task Force Exercise	2	1	2	C-130	8.0	16.0	10%	1.6	50%	50%	0%	0.80	0.80	0.00
		4	8	CH-53	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00
		12	24	CH-46	8.0	192.0	100%	192.0	50%	50%	0%	96.00	96.00	0.00
		4	8	AH-1	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00
		2	4	UH-1	8.0	32.0	100%	32.0	50%	50%	0%	16.00	16.00	0.00
		10	20	MV-22	8.0	160.0	100%	160.0	50%	50%	0%	80.00	80.00	0.00
Urban Warfare Exercise	5	1	5	C-130	8.0	40.0	10%	4.0	100%	0%	0%	4.00	0.00	0.00
		4	20	CH-53	8.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00
		12	60	CH-46	8.0	480.0	100%	480.0	100%	0%	0%	480.00	0.00	0.00
		4	20	AH-1	8.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00
		2	10	UH-1	8.0	80.0	100%	80.0	100%	0%	0%	80.00	0.00	0.00
		10	50	MV-22	8.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00
ELECTRONIC WARFARE														
Electronic Warfare Operations (EW Ops)	72	1	72	FA-18E/F	2.0	144.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00
Counter Targeting Flare E	546	0.9	491.4	F-15	3.0	1474.2	0%	0.0	0%	0%	100%	0.00	0.00	0.00
		0.06	32.76	FA-18E/F	3.0	98.3	0%	0.0	0%	0%	100%	0.00	0.00	0.00
		0.04	21.84	SH-60B	3.0	65.5	100%	65.5	0%	0%	100%	0.00	0.00	65.52
Counter Targeting Chaff E	16													
Counter Targeting Chaff Exercise (CHAFFEX) - Aircraft	546	0.9	491.4	F-15	3.0	1474.2	0%	0.0	0%	0%	100%	0.00	0.00	0.00
		0.06	32.76	FA-18E/F	3.0	98.3	0%	0.0	0%	0%	100%	0.00	0.00	0.00
		0.04	21.84	SH-60B	3.0	65.5	100%	65.5	0%	0%	100%	0.00	0.00	65.52
MINE WARFARE														
Submarine Mine Exercise	0													

EMISSIONS/YEAR (lb) BY JURISDICTION and **Greenhouse Gas Emissions (lb/year)**

Type of Training	Type	State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)						Greenhouse Gas Emissions (lb/year)			
		CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
Ship Squadron Anti-Submarine Warfare Exercise																							
Maritime Homeland Defense / Security Mine Countermeasures																							
Marine Air Ground Task Force Exercise (Amphibious)	C-130	15	59	3	3	29	26	15	59	3	3	29	26	0	0	0	0	0	0	445849	14	13	450,598
	SH-60B	240	246	21	15	161	145	240	246	21	15	161	145	0	0	0	0	0	0	237786	8	7	240,319
	CH-53	609	2308	43	114	631	568	609	2308	43	114	631	568	0	0	0	0	0	0	1769130	57	50	1,787,972
	CH-46	3926	949	608	92	410	369	3926	949	608	92	410	369	0	0	0	0	0	0	1426718	46	40	1,441,913
	AH-1	583	283	30	21	218	196	583	283	30	21	218	196	0	0	0	0	0	0	321804	10	9	325,231
	UH-1	58	82	3	7	73	65	58	82	3	7	73	65	0	0	0	0	0	0	107004	3	3	108,143
	MV-22	3537	706	615	72	319	287	3537	706	615	72	319	287	0	0	0	0	0	0	2219339	72	63	2,242,975
Special Purpose Marine Air Ground Task Force Exercise	C-130	7	29	2	1	14	13	7	29	2	1	14	13	0	0	0	0	0	0	222925	7	6	225,299
	CH-53	304	1154	21	57	316	284	304	1154	21	57	316	284	0	0	0	0	0	0	884565	29	25	893,986
	CH-46	1963	475	304	46	205	185	1963	475	304	46	205	185	0	0	0	0	0	0	713359	23	20	720,956
	AH-1	291	141	15	10	109	98	291	141	15	10	109	98	0	0	0	0	0	0	160902	5	5	162,616
	UH-1	29	41	1	3	36	33	29	41	1	3	36	33	0	0	0	0	0	0	53502	2	2	54,072
	MV-22	1769	353	307	36	159	144	1769	353	307	36	159	144	0	0	0	0	0	0	1109670	36	31	1,121,488
Urban Warfare Exercise	C-130	37	147	8	7	71	64	0	0	0	0	0	0	0	0	0	0	0	0	557312	18	16	563,247
	CH-53	1521	5771	107	286	1578	1421	0	0	0	0	0	0	0	0	0	0	0	0	2211413	72	62	2,234,965
	CH-46	9815	2373	1521	230	1025	923	0	0	0	0	0	0	0	0	0	0	0	0	1783398	58	50	1,802,391
	AH-1	1456	707	74	52	546	491	0	0	0	0	0	0	0	0	0	0	0	0	402255	13	11	406,539
	UH-1	144	204	7	17	181	163	0	0	0	0	0	0	0	0	0	0	0	0	133755	4	4	135,179
	MV-22	8844	1765	1537	179	797	718	0	0	0	0	0	0	0	0	0	0	0	0	2774174	90	78	2,803,719
ELECTRONIC WARFARE																							
Electronic Warfare Operations (EW Ops)	FA-18E/F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4609191	150	130	4,658,279
Counter Targeting Flare E	F-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28280919	917	799	28,582,111
	FA-18E/F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3145773	102	89	3,179,275
	SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	491	503	43	31	330	297	243434	8	7	246,026
Counter Targeting Chaff E																							
Counter Targeting Chaff Exercise (CHAFFEX) - Aircraft	F-15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28280919	917	799	28,582,111
	FA-18E/F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3145773	102	89	3,179,275
	SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	491	503	43	31	330	297	243434	8	7	246,026
MINE WARFARE																							
Submarine Mine Exercise																							

Table D.5-11 Emissions from Aircraft During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT													EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
Mine Countermeasure Exercise – Sonar (AQS-20, LCS)	0																																			
Mine Countermeasure Exercise – Surface (SMCMEX) Sonar (SQQ-32, MCM)	0																																			
Mine Neutralization – Remotely Operated Vehicle Sonar (AQS-235[AQS-20], SLQ-48)	0																																			
Mine Laying - Aircraft	3	0.5	2	FA-18E/F	0.5	0.8	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24006	1	1	24,262
		0.5	2	P-3	1.0	1.5	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22292	1	1	22,530
Mine Neutralization – Explosive Ordnance Disposal	20																																			
Limpet Mine Neutralization System/Shock Wave Generator	0																																			
Mine Countermeasure – Towed Mine Detection	0																																			
NAVAL SPECIAL WARFARE																																				
Personnel I&E	150	4	600	H-60	8.0	4800.0	100%	4800.0	100%	0%	0%	4800.00	0.00	0.00	36000	36864	3168	2304	24192	21773	0	0	0	0	0	0	0	0	0	0	0	0	17833976	579	504	18,023,908
		2	300	MV-22	8.0	2400.0	100%	2400.0	100%	0%	0%	2400.00	0.00	0.00	53061	10591	9220	1075	4785	4306	0	0	0	0	0	0	0	0	0	0	0	0	16645045	540	470	16,822,314
Parachute Insertion	12	1	12	C-130	4.0	48.0	100%	48.0	100%	0%	0%	48.00	0.00	0.00	447	1763	102	86	858	772	0	0	0	0	0	0	0	0	0	0	0	0	668774	22	19	675,897
		1	12	CH-46	4.0	48.0	100%	48.0	100%	0%	0%	48.00	0.00	0.00	982	237	152	23	103	92	0	0	0	0	0	0	0	0	0	0	0	0	178340	6	5	180,239
		1	12	H-60	4.0	48.0	100%	48.0	100%	0%	0%	48.00	0.00	0.00	360	369	32	23	242	218	0	0	0	0	0	0	0	0	0	0	0	0	178340	6	5	180,239
Embassy Reinforcement	50	1	50	SH-60B	4.0	200.0	100%	200.0	100%	0%	0%	200.00	0.00	0.00	1500	1536	132	96	1008	907	0	0	0	0	0	0	0	0	0	0	0	0	743082	24	21	750,996
		1	50	AV-8B	4.0	200.0	100%	200.0	100%	0%	0%	200.00	0.00	0.00	10560	8052	336	480	8520	7668	0	0	0	0	0	0	0	0	0	0	0	0	3715412	121	105	3,754,981
Direct Action (Combat Close Quarters)	40																																			
Direct Action (Breaching)	40																																			
Direct Action (TAC-P)	3																																			
Underwater Demolition Qualifications	30																																			
Intelligence, Surveillance, Reconnaissance	16	1	16.0	MQ-4C	4.0	64.0	100%	64.0	0%	50%	50%	0.00	32.00	32.00	0	0	0	0	0	0	67	1243	21	113	20	18	67	1243	21	113	20	18	501729	16	14	507,073
Urban Warfare Training	8																																			
Underwater Survey	6	1	6	SH-60B	2.0	12.0	100%	12.0	100%	0%	0%	12.00	0.00	0.00	90	92	8	6	60	54	0	0	0	0	0	0	0	0	0	0	0	0	44585	1	1	45,060
OTHER																																				
Surface Ship Sonar Maintenance	0																																			
Submarine Sonar Maintenance	0																																			

Table D.5-11 Emissions from Aircraft During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT													EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	$CO_{2\text{-e}}$
Small Boat Attack	0																																			
Search and Rescue at Se	0																																			
Submarine Navigation	0																																			
Precision Anchoring	0																																			
Maneuver (Convoy, Land Navigation)	16																																			
Water Purification	0																																			
Field Training Exercise	100																																			
Force Protection	75																																			
Anti-Terrorism	80	1	80	SH-60B	2.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1200	1229	106	77	806	726	0	0	0	0	0	0	0	0	0	0	0	0	594466	19	17	600,797
Seize Airfield	12																																			
Airfield Expeditionary	12																																			
Unmanned Aerial Vehicle Operation	0																																			
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120																																			
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	200																																			
TOTAL TRAINING EMISSIONS (LBS/YEAR)															**214,984**	**144,751**	**28,708**	**9,431**	**71,808**	**64,628**	**22,544**	**24,096**	**3,203**	**1,332**	**10,575**	**9,518**	**12,781**	**72,715**	**1,430**	**2,302**	**32,342**	**29,108**	**360,075,875**	**11,681**	**10,176**	**363,910,681**
TOTAL TRAINING EMISSIONS (TONS/YEAR)															**107**	**72**	**14**	**5**	**36**	**32**	**11**	**12**	**2**	**1**	**5**	**5**	**6**	**36**	**1**	**1**	**16**	**15**	**180,038**	**6**	**5**	**181,955**

Table D.5-12 Emissions from Aircraft During Testing, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT													EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
ANTI-SURFACE WARFARE																																				
Air to Surface Missile Test	0	1	0	P-3	4	0	75%	0	0%	0%	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANTI-SUBMARINE WARFARE																																				
Anti-submarine Warfare Tracking Test - MPA	0	1	0	P-3	6.0	0.0	75%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anti-submarine Warfare Torpedo Test	0	0.33	0	SH-60	8.0	0.0	75%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.33	0	MH-60	8.0	0.0	75%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.33	0	P-3	8.0	0.0	75%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Broad Area Maritime Surveillance (BAMS) Testing	1	1	1	MQ-4C	1.0	1.0	100%	1.0	100%	0%	0%	1.00	0.00	0.00	2	39	1	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	7840	0	0	7,923
LIFECYCLE ACTIVITIES TESTING																																				
Ship Signature Testing	0																																			
ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING																																				
Torpedo Explosive Testing	0																																			
Countermeasure Testing	0																																			
At-Sea Sonar Testing	0																																			
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING																																				
Pierside Integrated Swimmer Defense	0																																			
NEW SHIP CONSTRUCTION																																				
ASW Mission Package Testing	0																																			
MCM Mission Package Testing	0																																			
OFFICE OF NAVAL RESEARCH																																				
North Pacific Acoustic Lab Philippine Sea 2018-19 Experiment (Deep Water)	1																																			
TOTAL TESTING EMISSIONS (lbs per year)															2.1	38.84	0.66	3.54	0.61	0.549	0	0	0	0	0	0	0	0	0	0	0	0	7839.518824	0.2543171	0.22155	7923.009662
TOTAL TESTING EMISSIONS (tons per year)															0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.919759412	0.0001272	0.0001108	3.961504831

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Table D.5-13 Emissions from Aircraft During Training, Alternative 1

Type of Training	Training Ops (#)	Aircraft: Distribution	Aircraft: A/C Sorties (#)	Aircraft: Type	Time: Ave Time on Range (hr)	Time: Total Time on Range (hr)	Altitude: Time < 3,000 ft (%)	Altitude: Time < 3,000 ft (hr)	Distribution (%): 0-3 nm from shore	Distribution (%): 3-12 nm from Shore	Distribution (%): >12 nm from Shore	Distribution (hr): Total Time 0-3 nm from shore	Distribution (hr): Total Time 3-12 nm from shore	Distribution (hr): Total Time >12 nm from shore	State (0-3 nm offshore): CO	State: NOx	State: HC	State: SOx	State: PM	State: PM2.5	Waters of U S (3-12 nm): CO	Waters of U S: NOx	Waters of U S: HC	Waters of U S: SOx	Waters of U S: PM	Waters of U S: PM2.5	International Waters (>12 nm): CO	International Waters: NOx	International Waters: HC	International Waters: SOx	International Waters: PM	International Waters: PM2.5	Greenhouse Gas Emissions (lb/year): CO_2	N_2O	CH_4	CO_{2-e}
		10	120	MV-22	24.0	2880.0	100%	2880.0	100%	0%	0%	2880.00	0.00	0.00	63673	12709	11064	1290	5742	5167	0	0	0	0	0	0	0	0	0	0	0	0	19974054	648	564	20,186,777
Amphibious Assault - Marine Air Ground Task Force	6	4	24.0	CH-53	18.0	432.0	100%	432.0	100%	0%	0%	432.00	0.00	0.00	4108	15582	289	771	4262	3836	0	0	0	0	0	0	0	0	0	0	0	0	5970815	194	169	6,034,404
		10	60.0	MV-22	18.0	1080.0	100%	1080.0	100%	0%	0%	1080.00	0.00	0.00	23878	4766	4149	484	2153	1938	0	0	0	0	0	0	0	0	0	0	0	0	7490270	243	212	7,570,041
		2	12.0	UH-1	18.0	216.0	100%	216.0	100%	0%	0%	216.00	0.00	0.00	390	551	20	47	490	441	0	0	0	0	0	0	0	0	0	0	0	0	361138	12	10	364,984
		4	24.0	AH-1	18.0	432.0	100%	432.0	100%	0%	0%	432.00	0.00	0.00	3932	1908	200	140	1473	1326	0	0	0	0	0	0	0	0	0	0	0	0	1086089	35	31	1,097,656
		4	24.0	AV-8	18.0	432.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8025289	260	227	8,110,759
Amphibious Raid - Special Purpose Marine Air Ground Task Force	6	4	24.0	H-53	12.0	288.0	100%	288.0	100%	0%	0%	288.00	0.00	0.00	2738	10388	193	514	2841	2557	0	0	0	0	0	0	0	0	0	0	0	0	3980544	129	112	4,022,936
		10	60.0	MV-22	12.0	720.0	100%	720.0	100%	0%	0%	720.00	0.00	0.00	15918	3177	2766	323	1435	1292	0	0	0	0	0	0	0	0	0	0	0	0	4993513	162	141	5,046,694
		2	12.0	UH-1	12.0	144.0	100%	144.0	100%	0%	0%	144.00	0.00	0.00	260	367	13	31	327	294	0	0	0	0	0	0	0	0	0	0	0	0	240759	8	7	243,323
		4	24.0	AH-1	12.0	288.0	100%	288.0	100%	0%	0%	288.00	0.00	0.00	2622	1272	133	94	982	884	0	0	0	0	0	0	0	0	0	0	0	0	724059	23	20	731,771
		4	24.0	AV-8	12.0	288.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5350193	174	151	5,407,172
Urban Warfare Training	36	1	36	AH-1	28.0	1008.0	100%	1008.0	100%	0%	0%	1008.00	0.00	0.00	9175	4453	467	327	3438	3094	0	0	0	0	0	0	0	0	0	0	0	0	2534208	82	72	2,561,197
		1	36	UH-1	28.0	1008.0	100%	1008.0	100%	0%	0%	1008.00	0.00	0.00	1818	2569	93	218	2286	2058	0	0	0	0	0	0	0	0	0	0	0	0	1685311	55	48	1,703,259
		1	36	MV-22	28.0	1008.0	100%	1008.0	100%	0%	0%	1008.00	0.00	0.00	22286	4448	3872	452	2010	1809	0	0	0	0	0	0	0	0	0	0	0	0	6990919	227	198	7,065,372
		1	36	H-53	28.0	1008.0	100%	1008.0	100%	0%	0%	1008.00	0.00	0.00	9584	36358	675	1800	9944	8950	0	0	0	0	0	0	0	0	0	0	0	0	13931902	452	394	14,080,277
		1	36	MH-53	8.0	288.0	100%	288.0	100%	0%	0%	288.00	0.00	0.00	2738	10388	193	514	2841	2557	0	0	0	0	0	0	0	0	0	0	0	0	3980544	129	112	4,022,936
		1	36	H-60	8.0	288.0	100%	288.0	100%	0%	0%	288.00	0.00	0.00	2160	2212	190	138	1452	1306	0	0	0	0	0	0	0	0	0	0	0	0	1070039	35	30	1,081,434
Non-Combatant Evacuation Operation	5	10	50	MV-22	20.0	1000.0	100%	1000.0	100%	0%	0%	1000.00	0.00	0.00	22109	4413	3842	448	1994	1794	0	0	0	0	0	0	0	0	0	0	0	0	6935435	225	196	7,009,298
		4	20	H-53	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	3803	14428	268	714	3946	3552	0	0	0	0	0	0	0	0	0	0	0	0	5528533	179	156	5,587,412
		2	10	UH-1	20.0	200.0	100%	200.0	100%	0%	0%	200.00	0.00	0.00	361	510	18	43	454	408	0	0	0	0	0	0	0	0	0	0	0	0	334387	11	9	337,948
		4	20	AH-1	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	3641	1767	185	130	1364	1228	0	0	0	0	0	0	0	0	0	0	0	0	1005638	33	28	1,016,348
		4	20	AV-8	20.0	400.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7430824	241	210	7,509,962
Humanitarian Assistance/ Disaster Relief Operations	5	10	50	MV-22	20.0	1000.0	100%	1000.0	100%	0%	0%	1000.00	0.00	0.00	22109	4413	3842	448	1994	1794	0	0	0	0	0	0	0	0	0	0	0	0	6935435	225	196	7,009,298
		4	20	H-53	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	3803	14428	268	714	3946	3552	0	0	0	0	0	0	0	0	0	0	0	0	5528533	179	156	5,587,412
		2	10	UH-1	20.0	200.0	100%	200.0	100%	0%	0%	200.00	0.00	0.00	361	510	18	43	454	408	0	0	0	0	0	0	0	0	0	0	0	0	334387	11	9	337,948
		4	20	AH-1	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	3641	1767	185	130	1364	1228	0	0	0	0	0	0	0	0	0	0	0	0	1005638	33	28	1,016,348
		4	20	AV-8	20.0	400.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7430824	241	210	7,509,962
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	100	1	100.0	MQ-4C	4.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	840	15536	264	1416	244	220	0	0	0	0	0	0	0	0	0	0	0	0	3135808	102	89	3,169,204
ANTI-SURFACE WARFARE																																				
Gunnery Exercise, A-S (Small Caliber) - Ship	242	0.25	60.5	FA-18E/F	2.0	121.0	10%	12.1	0%	0%	100%	0.00	0.00	12.10	0	0	0	0	0	0	0	0	0	0	0	0	90	1845	15	50	821	739	3873001	126	109	3,914,248
		0.75	181.5	SH-60B	2.0	363.0	100%	363.0	0%	0%	100%	0.00	0.00	363.00	0	0	0	0	0	0	0	0	0	0	0	0	2723	2788	240	174	1830	1647	1348694	44	38	1,363,058

Table D.5-13 Emissions from Aircraft During Training, Alternative 1

Type of Training	OPERATIONAL INFORMATION - AIRCRAFT														EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
Gunnery Exercise, A-S (Medium Caliber) - Ship	295	0.25	73.75	FA-18E/F	2.0	147.5	10%	14.8	0%	0%	100%	0.00	0.00	14.75	0	0	0	0	0	0	0	0	0	0	0	0	110	2249	18	61	1000	900	4721220	153	133	4,771,501
		0.75	221.25	SH-60B	2.0	442.5	100%	442.5	0%	0%	100%	0.00	0.00	442.50	0	0	0	0	0	0	0	0	0	0	0	0	3319	3398	292	212	2230	2007	1644070	53	46	1,661,579
Missile Exercise (A-S) - Rocket	3	0.33	0.99	FA-18E/F	2.0	2.0	10%	0.2	0%	0%	100%	0.00	0.00	0.20	0	0	0	0	0	0	0	0	0	0	0	0	1	30	0	1	13	12	63376	2	2	64,051
		0.66	1.98	SH-60B	2.0	4.0	100%	4.0	0%	0%	100%	0.00	0.00	3.96	0	0	0	0	0	0	0	0	0	0	0	0	30	30	3	2	20	18	14713	0	0	14,870
Missile Exercise (A-S)	20	0.5	10	FA-18E/F	2.0	20.0	10%	2.0	0%	0%	100%	0.00	0.00	2.00	0	0	0	0	0	0	0	0	0	0	0	0	15	305	2	8	136	122	640165	21	18	646,983
		0.5	10	SH-60B	2.0	20.0	100%	20.0	0%	0%	100%	0.00	0.00	20.00	0	0	0	0	0	0	0	0	0	0	0	0	150	154	13	10	101	91	74308	2	2	75,100
Laser Targeting	600	0.5	300	FA-18E/F	1.0	300.0	10%	30.0	0%	0%	100%	0.00	0.00	30.00	0	0	0	0	0	0	0	0	0	0	0	0	223	4575	37	124	2035	1831	9602482	312	271	9,704,748
		0.5	300	SH-60B	1.0	300.0	100%	300.0	0%	0%	100%	0.00	0.00	300.00	0	0	0	0	0	0	0	0	0	0	0	0	2250	2304	198	144	1512	1361	1114624	36	32	1,126,494
Bombing Exercise (A-S)	37	0.5	19	FA-18E/F	1.0	18.5	10%	1.9	0%	0%	100%	0.00	0.00	1.85	0	0	0	0	0	0	0	0	0	0	0	0	14	282	2	8	125	113	592153	19	17	598,459
		0.5	19	P-3	1.0	18.5	10%	1.9	0%	0%	100%	0.00	0.00	1.85	0	0	0	0	0	0	0	0	0	0	0	0	16	75	4	4	35	32	274940	9	8	277,869
Torpedo Exercise (Submarine to Surface)	5																																			
Missile Exercise (S-S)	12																																			
Gunnery Exercise (S-S)- Ship, Large Caliber	140																																			
Gunnery Exercise (S-S)- Ship, Medium caliber	100																																			
Sinking Exercise (SINKEX)	2	2	4	FA-18E/F	8.0	32.0	10%	3.2	0%	0%	100%	0.00	0.00	3.20	0	0	0	0	0	0	0	0	0	0	0	0	24	488	4	13	217	195	1024265	33	29	1,035,173
		1	2	P-3	8.0	16.0	10%	1.6	0%	0%	100%	0.00	0.00	1.60	0	0	0	0	0	0	0	0	0	0	0	0	14	65	3	3	30	27	237786	8	7	240,319
		1	2	SH-60B	8.0	16.0	100%	16.0	0%	0%	100%	0.00	0.00	16.00	0	0	0	0	0	0	0	0	0	0	0	0	120	123	11	8	81	73	59447	2	2	60,080
Gunnery Exercise (S-S) Boat – Medium-caliber	10																																			
Gunnery Exercise (S-S) Small-caliber	40																																			
Maritime Security Operations (MSO)	40	1	40	SH-60B	4.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1200	1229	106	77	806	726	0	0	0	0	0	0	0	0	0	0	0	0	594466	19	17	600,797
ANTI-SUBMARINE WARFARE																																				
Tracking Exercise-Helo	62	3	186	SH-60B	4.0	744.0	100%	744.0	0%	100%	0%	0.00	744.00	0.00	0	0	0	0	0	0	5580	5714	491	357	3750	3375	0	0	0	0	0	0	2764266	90	78	2,793,706
Torpedo Exercise-Helo	4	3	12	SH-60B	4.0	48.0	100%	48.0	0%	100%	0%	0.00	48.00	0.00	0	0	0	0	0	0	360	369	32	23	242	218	0	0	0	0	0	0	178340	6	5	180,239
Tracking Exercise-Maritime Patrol Advanced Extended Echo Ranging Sonobuoys	11	1	11	P-3	6.0	66.0	75%	49.5	0%	100%	0%	0.00	49.50	0.00	0	0	0	0	0	0	432	2003	97	95	943	849	0	0	0	0	0	0	980869	32	28	991,315
Tracking Exercise - Maritime Patrol Aircraft	34	1	34	P-3	6.0	204.0	75%	153.0	0%	100%	0%	0.00	153.00	0.00	0	0	0	0	0	0	1337	6191	301	294	2916	2624	0	0	0	0	0	0	3031776	98	86	3,064,064
Torpedo Exercise-Maritime Patrol Aircraft	4	1	4	P-3	6.0	24.0	75%	18.0	0%	100%	0%	0.00	18.00	0.00	0	0	0	0	0	0	157	728	35	35	343	309	0	0	0	0	0	0	356680	12	10	360,478

Table D.5-13 Emissions from Aircraft During Training, Alternative 1

Type of Training	OPERATIONAL INFORMATION - AIRCRAFT														EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
Tracking Exercise –Surface	132																																			
Torpedo Exercise-Surface	3																																			
Tracking Exercise–Submarine	12																																			
Torpedo Exercise – Submarine	10																																			
MAJOR TRAINING EVENTS																																				
Joint Expeditionary Exercise	1	48	48	FA-18E/F	8.0	384.0	10%	38.4	0%	100%	0%	0.00	38.40	0.00	0	0	0	0	0	0	286	5855	48	159	2604	2344	0	0	0	0	0	0	12291177	399	347	12,422,078
		4	4	EA-6B	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	163	117	22	8	248	223	0	0	0	0	0	0	633106	21	18	639,849
		4	4	E-2	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	15	57	3	3	28	25	0	0	0	0	0	0	217971	7	6	220,292
		3	3	P-3	8.0	24.0	10%	2.4	0%	100%	0%	0.00	2.40	0.00	0	0	0	0	0	0	21	97	5	5	46	41	0	0	0	0	0	0	356680	12	10	360,478
		6	6	AV-8B	8.0	48.0	10%	4.8	0%	100%	0%	0.00	4.80	0.00	0	0	0	0	0	0	253	193	8	12	204	184	0	0	0	0	0	0	891699	29	25	901,195
		2	2	C-130	8.0	16.0	10%	1.6	0%	100%	0%	0.00	1.60	0.00	0	0	0	0	0	0	15	59	3	3	29	26	0	0	0	0	0	0	222925	7	6	225,299
		4	4	A-10	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	39	86	4	4	26	23	0	0	0	0	0	0	599618	19	17	606,004
		1	1	E-3	8.0	8.0	10%	0.8	0%	100%	0%	0.00	0.80	0.00	0	0	0	0	0	0	54	221	8	10	7	6	0	0	0	0	0	0	3238254	105	92	3,272,741
		1	1	KC-135	8.0	8.0	10%	0.8	0%	100%	0%	0.00	0.80	0.00	0	0	0	0	0	0	25	247	1	7	2	2	0	0	0	0	0	0	2267689	74	64	2,291,840
		15	15	SH-60B	8.0	120.0	100%	120.0	0%	100%	0%	0.00	120.00	0.00	0	0	0	0	0	0	900	922	79	58	605	544	0	0	0	0	0	0	445849	14	13	450,598
		4	4	CH-53	8.0	32.0	100%	32.0	0%	100%	0%	0.00	32.00	0.00	0	0	0	0	0	0	304	1154	21	57	316	284	0	0	0	0	0	0	442283	14	12	446,993
		12	12	CH-46	8.0	96.0	100%	96.0	0%	100%	0%	0.00	96.00	0.00	0	0	0	0	0	0	1963	475	304	46	205	185	0	0	0	0	0	0	356680	12	10	360,478
		4	4	AH-1	8.0	32.0	100%	32.0	0%	100%	0%	0.00	32.00	0.00	0	0	0	0	0	0	291	141	15	10	109	98	0	0	0	0	0	0	80451	3	2	81,308
		2	2	UH-1	8.0	16.0	100%	16.0	0%	100%	0%	0.00	16.00	0.00	0	0	0	0	0	0	29	41	1	3	36	33	0	0	0	0	0	0	26751	1	1	27,036
		10	10	MV-22	8.0	80.0	100%	80.0	0%	100%	0%	0.00	80.00	0.00	0	0	0	0	0	0	1769	353	307	36	159	144	0	0	0	0	0	0	554835	18	16	560,744
Joint Multi-Strike Group Exercise	1	144	144	FA-18E/F	8.0	1152.0	10%	115.2	0%	0%	100%	0.00	0.00	115.20	0	0	0	0	0	0	0	0	0	0	0	0	857	17566	143	476	7813	7031	36873530	1196	1042	37,266,233
		12	12	EA-6B	8.0	96.0	10%	9.6	0%	0%	100%	0.00	0.00	9.60	0	0	0	0	0	0	0	0	0	0	0	0	490	350	67	25	743	669	1899318	62	54	1,919,546
		12	12	E-2	8.0	96.0	10%	9.6	0%	0%	100%	0.00	0.00	9.60	0	0	0	0	0	0	0	0	0	0	0	0	46	170	10	8	84	75	653912	21	18	660,877
		5	5	P-3	8.0	40.0	10%	4.0	0%	0%	100%	0.00	0.00	4.00	0	0	0	0	0	0	0	0	0	0	0	0	35	162	8	8	76	69	594466	19	17	600,797
		1	1	E-3	8.0	8.0	10%	0.8	0%	0%	100%	0.00	0.00	0.80	0	0	0	0	0	0	0	0	0	0	0	0	54	221	8	10	7	6	3238254	105	92	3,272,741
		2	2	KC-135	8.0	16.0	10%	1.6	0%	0%	100%	0.00	0.00	1.60	0	0	0	0	0	0	0	0	0	0	0	0	49	494	1	15	5	4	4535378	147	128	4,583,680
		6	6	B-1B	8.0	48.0	10%	4.8	0%	0%	100%	0.00	0.00	4.80	0	0	0	0	0	0	0	0	0	0	0	0	27	418	4	13	4	4	3947253	128	112	3,989,292
		24	24	F-15	8.0	192.0	10%	19.2	0%	0%	100%	0.00	0.00	19.20	0	0	0	0	0	0	0	0	0	0	0	0	431	5558	77	48	970	873	3683311	119	104	3,722,538
		45	45	SH-60B	8.0	360.0	100%	360.0	0%	0%	100%	0.00	0.00	360.00	0	0	0	0	0	0	0	0	0	0	0	0	2700	2765	238	173	1814	1633	1337548	43	38	1,351,793
Fleet Strike Group Exercise	0	48	0	FA-18E/F	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	EA-6B	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	E-2	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3	0	P-3	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		6	0	AV-8B	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	0	E-3	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	0	KC-135	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		24	0	F-15	8.0	0.0	10%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table D.5-13 Emissions from Aircraft During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT: Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			EMISSIONS/YEAR (lb) BY JURISDICTION: State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)						Greenhouse Gas Emissions (lb/year)			
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
		15	0	SH-60B	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	CH-53	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		12	0	CH-46	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	AH-1	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		2	0	UH-1	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		10	0	MV-22	8.0	0.0	100%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Integrated Anti-Submarine Warfare Exercise	0	48	0	FA-18E/F	8.0	0.0	10%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	EA-6B	8.0	0.0	10%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	E-2	8.0	0.0	10%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3	0	P-3	8.0	0.0	10%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		15	0	SH-60B	8.0	0.0	100%	0.0	0%	100%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ship Squadron Anti-Submarine Warfare Exercise	1	3	3	P-3	40.0	120.0	10%	12.0	0%	100%	0%	0.00	12.00	0.00	0	0	0	0	0	0	105	486	24	23	229	206	0	0	0	0	0	0	1783398	58	50	1,802,391
		4	4	MH-60	40.0	160.0	75%	120.0	0%	100%	0%	0.00	120.00	0.00	0	0	0	0	0	0	900	922	79	58	605	544	0	0	0	0	0	0	594466	19	17	600,797
		4	4	SH-60H	40.0	160.0	100%	160.0	0%	100%	0%	0.00	160.00	0.00	0	0	0	0	0	0	1200	1229	106	77	806	726	0	0	0	0	0	0	594466	19	17	600,797
Maritime Homeland Defense / Security Mine Countermeasures	1																																			
Marine Air Ground Task Force Exercise (Amphibious)	4	1	4	C-130	8.0	32.0	10%	3.2	50%	50%	0%	1.60	1.60	0.00	15	59	3	3	29	26	15	59	3	3	29	26	0	0	0	0	0	0	445849	14	13	450,598
		2	8	SH-60B	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00	240	246	21	15	161	145	240	246	21	15	161	145	0	0	0	0	0	0	237786	8	7	240,319
		4	16	CH-53	8.0	128.0	100%	128.0	50%	50%	0%	64.00	64.00	0.00	609	2308	43	114	631	568	609	2308	43	114	631	568	0	0	0	0	0	0	1769130	57	50	1,787,972
		12	48	CH-46	8.0	384.0	100%	384.0	50%	50%	0%	192.00	192.00	0.00	3926	949	608	92	410	369	3926	949	608	92	410	369	0	0	0	0	0	0	1426718	46	40	1,441,913
		4	16	AH-1	8.0	128.0	100%	128.0	50%	50%	0%	64.00	64.00	0.00	583	283	30	21	218	196	583	283	30	21	218	196	0	0	0	0	0	0	321804	10	9	325,231
		2	8	UH-1	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00	58	82	3	7	73	65	58	82	3	7	73	65	0	0	0	0	0	0	107004	3	3	108,143
		10	40	MV-22	8.0	320.0	100%	320.0	50%	50%	0%	160.00	160.00	0.00	3537	706	615	72	319	287	3537	706	615	72	319	287	0	0	0	0	0	0	2219339	72	63	2,242,975
Special Purpose Marine Air Ground Task Force Exercise	2	1	2	C-130	8.0	16.0	10%	1.6	50%	50%	0%	0.80	0.80	0.00	7	29	2	1	14	13	7	29	2	1	14	13	0	0	0	0	0	0	222925	7	6	225,299
		4	8	CH-53	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00	304	1154	21	57	316	284	304	1154	21	57	316	284	0	0	0	0	0	0	884565	29	25	893,986
		12	24	CH-46	8.0	192.0	100%	192.0	50%	50%	0%	96.00	96.00	0.00	1963	475	304	46	205	185	1963	475	304	46	205	185	0	0	0	0	0	0	713359	23	20	720,956
		4	8	AH-1	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00	291	141	15	10	109	98	291	141	15	10	109	98	0	0	0	0	0	0	160902	5	5	162,616
		2	4	UH-1	8.0	32.0	100%	32.0	50%	50%	0%	16.00	16.00	0.00	29	41	1	3	36	33	29	41	1	3	36	33	0	0	0	0	0	0	53502	2	2	54,072
		10	20	MV-22	8.0	160.0	100%	160.0	50%	50%	0%	80.00	80.00	0.00	1769	353	307	36	159	144	1769	353	307	36	159	144	0	0	0	0	0	0	1109670	36	31	1,121,488
Urban Warfare Exercise	5	1	5	C-130	8.0	40.0	10%	4.0	100%	0%	0%	4.00	0.00	0.00	37	147	8	7	71	64	0	0	0	0	0	0	0	0	0	0	0	0	557312	18	16	563,247
		4	20	CH-53	8.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1521	5771	107	286	1578	1421	0	0	0	0	0	0	0	0	0	0	0	0	2211413	72	62	2,234,965
		12	60	CH-46	8.0	480.0	100%	480.0	100%	0%	0%	480.00	0.00	0.00	9815	2373	1521	230	1025	923	0	0	0	0	0	0	0	0	0	0	0	0	1783398	58	50	1,802,391
		4	20	AH-1	8.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1456	707	74	52	546	491	0	0	0	0	0	0	0	0	0	0	0	0	402255	13	11	406,539
		2	10	UH-1	8.0	80.0	100%	80.0	100%	0%	0%	80.00	0.00	0.00	144	204	7	17	181	163	0	0	0	0	0	0	0	0	0	0	0	0	133755	4	4	135,179
		10	50	MV-22	8.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	8844	1765	1537	179	797	718	0	0	0	0	0	0	0	0	0	0	0	0	2774174	90	78	2,803,719
ELECTRONIC WARFARE																																				

Table D.5-13 Emissions from Aircraft During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT													EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
Direct Action (Combat Close Quarters)	72																																			
Direct Action (Breaching)	72																																			
Direct Action (TAC-P)	18																																			
Underwater Demolition Qualifications	30																																			
Intelligence, Surveillance, Reconnaissance	16	1	16.0	MQ-4C	4.0	64.0	100%	64.0	0%	50%	50%	0.00	32.00	32.00	0	0	0	0	0	0	67	1243	21	113	20	18	67	1243	21	113	20	18	501729	16	14	507,073
Urban Warfare Training	18																																			
Underwater Survey	16	1	16	SH-60B	2.0	32.0	100%	32.0	100%	0%	0%	32.00	0.00	0.00	240	246	21	15	161	145	0	0	0	0	0	0	0	0	0	0	0	0	118893	4	3	120,159
OTHER																																				
Surface Ship Sonar Maintenance	42																																			
Submarine Sonar Maintenance	48																																			
Small Boat Attack	18																																			
Search and Rescue at Sea	40	2	80	MH-60	40.0	3200.0	75%	2400.0	100%	0%	0%	2400.00	0.00	0.00	18000.00	18432.00	1584.00	1152.00	12096.00	10886.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11889318	385.69	336.00	12,015,939
Submarine Navigation	40																																			
Precision Anchoring	18																																			
Maneuver (Convoy, Land Navigation)	16																																			
Water Purification	16																																			
Field Training Exercise	100																																			
Force Protection	75																																			
Anti-Terrorism	80	1	80	SH-60B	2.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1200	1229	106	77	806	726	0	0	0	0	0	0	0	0	0	0	0	0	594466	19	17	600,797
Seize Airfield	12																																			
Airfield Expeditionary	12																																			
Unmanned Aerial Vehicle Operation	1000	1	1000	MQ-4C	4.0	4000.0	100%	4000.0	100%	0%	0%	4000.00	0.00	0.00	8400.00	155360.00	2640.00	14160.00	2440.00	2196.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31358075	1017.27	886.20	31,692,039
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120																																			

Table D.5-13 Emissions from Aircraft During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT: Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)		
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	236													
TOTAL TRAINING EMISSIONS (LBS/YEAR)														
TOTAL TRAINING EMISSIONS (TONS/YEAR)														

Type of Training	EMISSIONS/YEAR (lb) BY JURISDICTION: State (0-3 nm offshore)						Waters of U S (3-12 nm)					
	CO	NOx	HC	SOx	PM	$PM_{2.5}$	CO	NOx	HC	SOx	PM	$PM_{2.5}$
Land Demolitions (Unexploded Ordnance) Discovery / Disposal												
TOTAL TRAINING EMISSIONS (LBS/YEAR)	545,479	522,741	76,376	38,682	165,678	149,110	29,934	36,181	4,025	2,000	17,431	15,688
TOTAL TRAINING EMISSIONS (TONS/YEAR)	273	261	38	19	83	75	15	18	2	1	9	8

Type of Training	International Waters (>12 nm)						Greenhouse Gas Emissions (lb/year)			
	CO	NOx	HC	SOx	PM	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_{2-e}
Land Demolitions (Unexploded Ordnance) Discovery / Disposal										
TOTAL TRAINING EMISSIONS (LBS/YEAR)	59,291	839,957	8,432	23,454	375,635	338,071	1,451,235,021	47,079	41,013	1,466,690,668
TOTAL TRAINING EMISSIONS (TONS/YEAR)	30	420	4	12	188	169	725,618	24	21	733,345

Table D.5-14 Emissions from Aircraft During Testing, Alternative 1

Type of Training		OPERATIONAL INFORMATION - AIRCRAFT													EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	$PM_{2.5}$	CO	NOx	HC	SOx	PM	$PM_{2.5}$	CO	NOx	HC	SOx	PM	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_{2e}
ANTI-SURFACE WARFARE																																				
Air to Surface Missile Test	8	1	8	P-3	4	32	75%	24	0%	0%	100%	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	209.664	971.136	47.232	46.08	457.344	411.6096	475572.7059	15.427765	13.44	480637.5529
ANTI-SUBMARINE WARFARE																																				
Anti-submarine Warfare Tracking Test - MPA	188	1	188	P-3	6.0	1128.0	75%	846.0	0%	100%	0%	0.00	846.00	0.00	0	0	0	0	0	0	7391	34233	1665	1624	16121	14509	0	0	0	0	0	0	16763938	544	474	16,942,474
Anti-submarine Warfare Torpedo Test	40	0.33	13	SH-60	8.0	105.6	75%	79.2	0%	100%	0%	0.00	79.20	0.00	0	0	0	0	0	0	594	608	52	38	399	359	0	0	0	0	0	0	392347	13	11	396,526
		0.33	13	MH-60	8.0	105.6	75%	79.2	0%	100%	0%	0.00	79.20	0.00	0	0	0	0	0	0	594	608	52	38	399	359	0	0	0	0	0	0	392347	13	11	396,526
		0.33	13	P-3	8.0	105.6	75%	79.2	0%	100%	0%	0.00	79.20	0.00	0	0	0	0	0	0	692	3205	156	152	1509	1358	0	0	0	0	0	0	1569390	51	44	1,586,104
Broad Area Maritime Surveillance (BAMS) Testing	10	1	10	MQ-4C	1.0	10.0	100%	10.0	100%	0%	0%	10.00	0.00	0.00	21	388	7	35	6	5	0	0	0	0	0	0	0	0	0	0	0	0	78395	3	2	79,230
LIFECYCLE ACTIVITIES TESTING																																				
Ship Signature Testing	17																																			
ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING																																				
Torpedo Explosive Testing	2																																			
Countermeasure Testing	2																																			
At-Sea Sonar Testing	20																																			
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING																																				
Pierside Integrated Swimmer Defense	1																																			
NEW SHIP CONSTRUCTION																																				
ASW Mission Package Testing	33																																			
MCM Mission Package Testing	32																																			
OFFICE OF NAVAL RESEARCH																																				
North Pacific Acoustic Lab Philippine Sea 2018-19 Experiment (Deep Water)	1																																			
TOTAL TESTING EMISSIONS (lbs per year)															**21**	**388.4**	**6.6**	**35.4**	**6.1**	**5.49**	**9270.5472**	**38653.805**	**1925.34**	**1852.42**	**18428.947**	**16586.05**	**209.664**	**971.136**	**47.232**	**46.08**	**457.344**	**411.6096**	**19671990.67**	**638.16708**	**555.9435**	**19881497.28**
TOTAL TESTING EMISSIONS (tons per year)															**0**	**0**	**0**	**0**	**0**	**0**	**5**	**19**	**1**	**1**	**9**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**9835.995335**	**0.3190835**	**0.2779718**	**9940.748639**

Table D.5-15. Emissions from Aircraft During Training, Alternative 2

		OPERATIONAL INFORMATION - AIRCRAFT													EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
Type of Training	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
ANTI-AIR WARFARE																																				
Air Combat Maneuver	5300	1	5300	FA-18E/F	1.0	5300.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	169643843	5503	4794	171,450,550
		1	5300	AV-8B	1.0	5300.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98458412	3194	2783	99,506,993
Air Defense Exercise	100	2	200	FA-18E/F	1.0	200.0	50%	100.0	0%	0%	100%	0.00	0.00	100.00	0	0	0	0	0	0	0	0	0	0	0	0	744	15249	124	414	6782	6104	6401654	208	181	6,469,832
Air Intercept Control	5300	2	10600	FA-18E/F	1.0	10600.0	50%	5300.0	0%	0%	100%	0.00	0.00	5300.00	0	0	0	0	0	0	0	0	0	0	0	0	39450	808173	6575	21917	359432	323488	339287687	11007	9588	342,901,099
Gunnery Exercise, A-A (Medium Caliber)	45	1	45	AV-8B	1.0	45.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	835968	27	24	844,871
		1	45	FA-18E/F	1.0	45.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1440372	47	41	1,455,712
Missile Exercise, A-A	24	1	24	AV-8B	1.0	24.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	445849	14	13	450,598
		1	24	FA-18E/F	1.0	24.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	768199	25	22	776,380
Gunnery Exercise, S-A (Large Caliber)	5	1	5	AV-8B	1.0	5.0	0%	0.0	0%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92885	3	3	93,875
		1	5	FA-18E/F	1.0	5.0	0%	0.0	0%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	160041	5	5	161,746
Gunnery Exercise, S-A (Medium Caliber)	12	1	12	AV-8B	1.0	12.0	0%	0.0	0%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	222925	7	6	225,299
		1	12	FA-18E/F	1.0	12.0	0%	0.0	0%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	384099	12	11	388,190
Missile Exercise, S-A	15																																			
STRIKE WARFARE																																				
Bombing Exercise, A-G	2520	1	2520	FA-18E/F	1.0	2520.0	10%	252.0	0%	0%	100%	0.00	0.00	252.00	0	0	0	0	0	0	0	0	0	0	0	0	1876	38426	313	1042	17090	15381	80660846	2617	2280	81,519,884
Missile Exercise, A-G	85	0.5	43	FA-18E/F	2.0	85.0	10%	8.5	0%	0%	100%	0.00	0.00	8.50	0	0	0	0	0	0	0	0	0	0	0	0	63	1296	11	35	576	519	2720703	88	77	2,749,679
		0.5	43	SH-60B	2.0	85.0	100%	85.0	0%	0%	100%	0.00	0.00	85.00	0	0	0	0	0	0	0	0	0	0	0	0	638	653	56	41	428	386	315810	10	9	319,173
Gunnery Exercise, A-G	96	0.5	48	FA-18E/F	2.0	96.0	10%	9.6	0%	0%	100%	0.00	0.00	9.60	0	0	0	0	0	0	0	0	0	0	0	0	71	1464	12	40	651	586	3072794	100	87	3,105,519
		0.5	48	SH-60B	2.0	96.0	100%	96.0	0%	0%	100%	0.00	0.00	96.00	0	0	0	0	0	0	0	0	0	0	0	0	720	737	63	46	484	435	356680	12	10	360,478
Combat Search and Rescue	80	0.5	40	SH-60B	2.0	80.0	100%	80.0	50%	50%	0%	40.00	40.00	0.00	300	307	26	19	202	181	300	307	26	19	202	181	0	0	0	0	0	0	297233	10	8	300,398
		0.5	40	C-130	2.0	80.0	10%	8.0	50%	50%	0%	4.00	4.00	0.00	37	147	8	7	71	64	37	147	8	7	71	64	0	0	0	0	0	0	1114624	36	32	1,126,494
AMPHIBIOUS WARFARE																																				
Fire Support Exercise - Land-Based target	10																																			
Amphibious Rehearsal, No Landing - Marine Air Ground Task Force	12	2	24	SH-60B	24.0	576.0	100%	576.0	100%	0%	0%	576.00	0.00	0.00	4320	4424	380	276	2903	2613	0	0	0	0	0	0	0	0	0	0	0	0	2140077	69	60	2,162,869
		4	48	CH-53	24.0	1152.0	100%	1152.0	100%	0%	0%	1152.00	0.00	0.00	10954	41552	771	2057	11365	10228	0	0	0	0	0	0	0	0	0	0	0	0	15922174	517	450	16,091,745
		12	144	CH-46	24.0	3456.0	100%	3456.0	100%	0%	0%	3456.00	0.00	0.00	70668	17086	10949	1659	7382	6644	0	0	0	0	0	0	0	0	0	0	0	0	12840463	417	363	12,977,214
		4	48	AH-1	24.0	1152.0	100%	1152.0	100%	0%	0%	1152.00	0.00	0.00	10486	5089	533	374	3929	3536	0	0	0	0	0	0	0	0	0	0	0	0	2896238	94	82	2,927,083
		2	24	UH-1	24.0	576.0	100%	576.0	100%	0%	0%	576.00	0.00	0.00	1039	1468	53	124	1306	1176	0	0	0	0	0	0	0	0	0	0	0	0	963035	31	27	973,291

Table D.5-15. Emissions from Aircraft During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT: Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			EMISSIONS/YEAR (lb) BY JURISDICTION: State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)						Greenhouse Gas Emissions (lb/year)			
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2e}
		10	120	MV-22	24.0	2880.0	100%	2880.0	100%	0%	0%	2880.00	0.00	0.00	63673	12709	11064	1290	5742	5167	0	0	0	0	0	0	0	0	0	0	0	0	19974054	648	564	20,186,777
Amphibious Assault - Marine Air Ground Task Force	6	4	24.0	CH-53	18.0	432.0	100%	432.0	100%	0%	0%	432.00	0.00	0.00	4108	15582	289	771	4262	3836	0	0	0	0	0	0	0	0	0	0	0	0	5970815	194	169	6,034,404
		10	60.0	MV-22	18.0	1080.0	100%	1080.0	100%	0%	0%	1080.00	0.00	0.00	23878	4766	4149	484	2153	1938	0	0	0	0	0	0	0	0	0	0	0	0	7490270	243	212	7,570,041
		2	12.0	UH-1	18.0	216.0	100%	216.0	100%	0%	0%	216.00	0.00	0.00	390	551	20	47	490	441	0	0	0	0	0	0	0	0	0	0	0	0	361138	12	10	364,984
		4	24.0	AH-1	18.0	432.0	100%	432.0	100%	0%	0%	432.00	0.00	0.00	3932	1908	200	140	1473	1326	0	0	0	0	0	0	0	0	0	0	0	0	1086089	35	31	1,097,656
		4	24.0	AV-8	18.0	432.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8025289	260	227	8,110,759
Amphibious Raid - Special Purpose Marine Air Ground Task Force	6	4	24.0	H-53	12.0	288.0	100%	288.0	100%	0%	0%	288.00	0.00	0.00	2738	10388	193	514	2841	2557	0	0	0	0	0	0	0	0	0	0	0	0	3980544	129	112	4,022,936
		10	60.0	MV-22	12.0	720.0	100%	720.0	100%	0%	0%	720.00	0.00	0.00	15918	3177	2766	323	1435	1292	0	0	0	0	0	0	0	0	0	0	0	0	4993513	162	141	5,046,694
		2	12.0	UH-1	12.0	144.0	100%	144.0	100%	0%	0%	144.00	0.00	0.00	260	367	13	31	327	294	0	0	0	0	0	0	0	0	0	0	0	0	240759	8	7	243,323
		4	24.0	AH-1	12.0	288.0	100%	288.0	100%	0%	0%	288.00	0.00	0.00	2622	1272	133	94	982	884	0	0	0	0	0	0	0	0	0	0	0	0	724059	23	20	731,771
		4	24.0	AV-8	12.0	288.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5350193	174	151	5,407,172
Urban Warfare Training	36	1	36	AH-1	28.0	1008.0	100%	1008.0	100%	0%	0%	1008.00	0.00	0.00	9175	4453	467	327	3438	3094	0	0	0	0	0	0	0	0	0	0	0	0	2534208	82	72	2,561,197
		1	36	UH-1	28.0	1008.0	100%	1008.0	100%	0%	0%	1008.00	0.00	0.00	1818	2569	93	218	2286	2058	0	0	0	0	0	0	0	0	0	0	0	0	1685311	55	48	1,703,259
		1	36	MV-22	28.0	1008.0	100%	1008.0	100%	0%	0%	1008.00	0.00	0.00	22286	4448	3872	452	2010	1809	0	0	0	0	0	0	0	0	0	0	0	0	6990919	227	198	7,065,372
		1	36	H-53	28.0	1008.0	100%	1008.0	100%	0%	0%	1008.00	0.00	0.00	9584	36358	675	1800	9944	8950	0	0	0	0	0	0	0	0	0	0	0	0	13931902	452	394	14,080,277
		1	36	MH-53	8.0	288.0	100%	288.0	100%	0%	0%	288.00	0.00	0.00	2738	10388	193	514	2841	2557	0	0	0	0	0	0	0	0	0	0	0	0	3980544	129	112	4,022,936
		1	36	H-60	8.0	288.0	100%	288.0	100%	0%	0%	288.00	0.00	0.00	2160	2212	190	138	1452	1306	0	0	0	0	0	0	0	0	0	0	0	0	1070039	35	30	1,081,434
Non-Combatant Evacuation Operation	5	10	50	MV-22	20.0	1000.0	100%	1000.0	100%	0%	0%	1000.00	0.00	0.00	22109	4413	3842	448	1994	1794	0	0	0	0	0	0	0	0	0	0	0	0	6935435	225	196	7,009,298
		4	20	H-53	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	3803	14428	268	714	3946	3552	0	0	0	0	0	0	0	0	0	0	0	0	5528533	179	156	5,587,412
		2	10	UH-1	20.0	200.0	100%	200.0	100%	0%	0%	200.00	0.00	0.00	361	510	18	43	454	408	0	0	0	0	0	0	0	0	0	0	0	0	334387	11	9	337,948
		4	20	AH-1	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	3641	1767	185	130	1364	1228	0	0	0	0	0	0	0	0	0	0	0	0	1005638	33	28	1,016,348
		4	20	AV-8	20.0	400.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7430824	241	210	7,509,962
Humanitarian Assistance/ Disaster Relief Operations	5	10	50	MV-22	20.0	1000.0	100%	1000.0	100%	0%	0%	1000.00	0.00	0.00	22109	4413	3842	448	1994	1794	0	0	0	0	0	0	0	0	0	0	0	0	6935435	225	196	7,009,298
		4	20	H-53	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	3803	14428	268	714	3946	3552	0	0	0	0	0	0	0	0	0	0	0	0	5528533	179	156	5,587,412
		2	10	UH-1	20.0	200.0	100%	200.0	100%	0%	0%	200.00	0.00	0.00	361	510	18	43	454	408	0	0	0	0	0	0	0	0	0	0	0	0	334387	11	9	337,948
		4	20	AH-1	20.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	3641	1767	185	130	1364	1228	0	0	0	0	0	0	0	0	0	0	0	0	1005638	33	28	1,016,348
		4	20	AV-8	20.0	400.0	0%	0.0	100%	0%	0%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7430824	241	210	7,509,962
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	100	1	100.0	MQ-4C	4.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	840	15536	264	1416	244	220	0	0	0	0	0	0	0	0	0	0	0	0	3135808	102	89	3,169,204
ANTI-SURFACE WARFARE																																				
Gunnery Exercise, A-S (Small Caliber) - Ship	242	0.25	60.5	FA-18E/F	2.0	121.0	10%	12.1	0%	0%	100%	0.00	0.00	12.10	0	0	0	0	0	0	0	0	0	0	0	0	90	1845	15	50	821	739	3873001	126	109	3,914,248
		0.75	181.5	SH-60B	2.0	363.0	100%	363.0	0%	0%	100%	0.00	0.00	363.00	0	0	0	0	0	0	0	0	0	0	0	0	2723	2788	240	174	1830	1647	1348694	44	38	1,363,058
Gunnery Exercise, A-S (Medium Caliber) - Ship	295	0.25	73.75	FA-18E/F	2.0	147.5	10%	14.8	0%	0%	100%	0.00	0.00	14.75	0	0	0	0	0	0	0	0	0	0	0	0	110	2249	18	61	1000	900	4721220	153	133	4,771,501

Table D.5-15. Emissions from Aircraft During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT														EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
		0.75	221.25	SH-60B	2.0	442.5	100%	442.5	0%	0%	100%	0.00	0.00	442.50	0	0	0	0	0	0	0	0	0	0	0	0	3319	3398	292	212	2230	2007	1644070	53	46	1,661,579
Missile Exercise (A-S) - Rocket	10	0.33	3.3	FA-18E/F	2.0	6.6	10%	0.7	0%	0%	100%	0.00	0.00	0.66	0	0	0	0	0	0	0	0	0	0	0	0	5	101	1	3	45	40	211255	7	6	213,504
		0.66	6.6	SH-60B	2.0	13.2	100%	13.2	0%	0%	100%	0.00	0.00	13.20	0	0	0	0	0	0	0	0	0	0	0	0	99	101	9	6	67	60	49043	2	1	49,566
Missile Exercise (A-S)	20	0.5	10	FA-18E/F	2.0	20.0	10%	2.0	0%	0%	100%	0.00	0.00	2.00	0	0	0	0	0	0	0	0	0	0	0	0	15	305	2	8	136	122	640165	21	18	646,983
		0.5	10	SH-60B	2.0	20.0	100%	20.0	0%	0%	100%	0.00	0.00	20.00	0	0	0	0	0	0	0	0	0	0	0	0	150	154	13	10	101	91	74308	2	2	75,100
Laser Targeting	600	0.5	300	FA-18E/F	1.0	300.0	10%	30.0	0%	0%	100%	0.00	0.00	30.00	0	0	0	0	0	0	0	0	0	0	0	0	223	4575	37	124	2035	1831	9602482	312	271	9,704,748
		0.5	300	SH-60B	1.0	300.0	100%	300.0	0%	0%	100%	0.00	0.00	300.00	0	0	0	0	0	0	0	0	0	0	0	0	2250	2304	198	144	1512	1361	1114624	36	32	1,126,494
Bombing Exercise (A-S)	37	0.5	19	FA-18E/F	1.0	18.5	10%	1.9	0%	0%	100%	0.00	0.00	1.85	0	0	0	0	0	0	0	0	0	0	0	0	14	282	2	8	125	113	592153	19	17	598,459
		0.5	19	P-3	1.0	18.5	10%	1.9	0%	0%	100%	0.00	0.00	1.85	0	0	0	0	0	0	0	0	0	0	0	0	16	75	4	4	35	32	274940	9	8	277,869
Torpedo Exercise (Submarine to Surface)	5																																			
Missile Exercise (S-S)	12																																			
Gunnery Exercise (S-S)- Ship, Large Caliber	140																																			
Gunnery Exercise (S-S)- Ship, Medium caliber	100																																			
Sinking Exercise (SINKEX)	2	2	4	FA-18E/F	8.0	32.0	10%	3.2	0%	0%	100%	0.00	0.00	3.20	0	0	0	0	0	0	0	0	0	0	0	0	24	488	4	13	217	195	1024265	33	29	1,035,173
		1	2	P-3	8.0	16.0	10%	1.6	0%	0%	100%	0.00	0.00	1.60	0	0	0	0	0	0	0	0	0	0	0	0	14	65	3	3	30	27	237786	8	7	240,319
		1	2	SH-60B	8.0	16.0	100%	16.0	0%	0%	100%	0.00	0.00	16.00	0	0	0	0	0	0	0	0	0	0	0	0	120	123	11	8	81	73	59447	2	2	60,080
Gunnery Exercise (S-S) Boat – Medium-caliber	10																																			
Gunnery Exercise (S-S) Small-caliber	40																																			
Maritime Security Operations (MSO)	40	1	40	SH-60B	4.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1200	1229	106	77	806	726	0	0	0	0	0	0	0	0	0	0	0	0	594466	19	17	600,797
ANTI-SUBMARINE WARFARE																																				
Tracking Exercise-Helo	62	3	186	SH-60B	4.0	744.0	100%	744.0	0%	100%	0%	0.00	744.00	0.00	0	0	0	0	0	0	5580	5714	491	357	3750	3375	0	0	0	0	0	0	2764266	90	78	2,793,706
Torpedo Exercise-Helo	4	3	12	SH-60B	4.0	48.0	100%	48.0	0%	100%	0%	0.00	48.00	0.00	0	0	0	0	0	0	360	369	32	23	242	218	0	0	0	0	0	0	178340	6	5	180,239
Tracking Exercise-Maritime Patrol Advanced Extended Echo Ranging Sonobuoys	11	1	11	P-3	6.0	66.0	75%	49.5	0%	100%	0%	0.00	49.50	0.00	0	0	0	0	0	0	432	2003	97	95	943	849	0	0	0	0	0	0	980869	32	28	991,315
Tracking Exercise - Maritime Patrol Aircraft	34	1	34	P-3	6.0	204.0	75%	153.0	0%	100%	0%	0.00	153.00	0.00	0	0	0	0	0	0	1337	6191	301	294	2916	2624	0	0	0	0	0	0	3031776	98	86	3,064,064
Torpedo Exercise-Maritime Patrol Aircraft	4	1	4	P-3	6.0	24.0	75%	18.0	0%	100%	0%	0.00	18.00	0.00	0	0	0	0	0	0	157	728	35	35	343	309	0	0	0	0	0	0	356680	12	10	360,478

Table D.5-15. Emissions from Aircraft During Training, Alternative 2

Type of Training	OPERATIONAL INFORMATION - AIRCRAFT														EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
Tracking Exercise –Surface	132																																			
Torpedo Exercise-Surface	3																																			
Tracking Exercise–Submarine	12																																			
Torpedo Exercise – Submarine	10																																			
MAJOR TRAINING EVENTS																																				
Joint Expeditionary Exercise	1	48	48	FA-18E/F	8.0	384.0	10%	38.4	0%	100%	0%	0.00	38.40	0.00	0	0	0	0	0	0	286	5855	48	159	2604	2344	0	0	0	0	0	0	12291177	399	347	12,422,078
		4	4	EA-6B	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	163	117	22	8	248	223	0	0	0	0	0	0	633106	21	18	639,849
		4	4	E-2	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	15	57	3	3	28	25	0	0	0	0	0	0	217971	7	6	220,292
		3	3	P-3	8.0	24.0	10%	2.4	0%	100%	0%	0.00	2.40	0.00	0	0	0	0	0	0	21	97	5	5	46	41	0	0	0	0	0	0	356680	12	10	360,478
		6	6	AV-8B	8.0	48.0	10%	4.8	0%	100%	0%	0.00	4.80	0.00	0	0	0	0	0	0	253	193	8	12	204	184	0	0	0	0	0	0	891699	29	25	901,195
		2	2	C-130	8.0	16.0	10%	1.6	0%	100%	0%	0.00	1.60	0.00	0	0	0	0	0	0	15	59	3	3	29	26	0	0	0	0	0	0	222925	7	6	225,299
		4	4	A-10	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	39	86	4	4	26	23	0	0	0	0	0	0	599618	19	17	606,004
		1	1	E-3	8.0	8.0	10%	0.8	0%	100%	0%	0.00	0.80	0.00	0	0	0	0	0	0	54	221	8	10	7	6	0	0	0	0	0	0	3238254	105	92	3,272,741
		1	1	KC-135	8.0	8.0	10%	0.8	0%	100%	0%	0.00	0.80	0.00	0	0	0	0	0	0	25	247	1	7	2	2	0	0	0	0	0	0	2267689	74	64	2,291,840
		15	15	SH-60B	8.0	120.0	100%	120.0	0%	100%	0%	0.00	120.00	0.00	0	0	0	0	0	0	900	922	79	58	605	544	0	0	0	0	0	0	445849	14	13	450,598
		4	4	CH-53	8.0	32.0	100%	32.0	0%	100%	0%	0.00	32.00	0.00	0	0	0	0	0	0	304	1154	21	57	316	284	0	0	0	0	0	0	442283	14	12	446,993
		12	12	CH-46	8.0	96.0	100%	96.0	0%	100%	0%	0.00	96.00	0.00	0	0	0	0	0	0	1963	475	304	46	205	185	0	0	0	0	0	0	356680	12	10	360,478
		4	4	AH-1	8.0	32.0	100%	32.0	0%	100%	0%	0.00	32.00	0.00	0	0	0	0	0	0	291	141	15	10	109	98	0	0	0	0	0	0	80451	3	2	81,308
		2	2	UH-1	8.0	16.0	100%	16.0	0%	100%	0%	0.00	16.00	0.00	0	0	0	0	0	0	29	41	1	3	36	33	0	0	0	0	0	0	26751	1	1	27,036
		10	10	MV-22	8.0	80.0	100%	80.0	0%	100%	0%	0.00	80.00	0.00	0	0	0	0	0	0	1769	353	307	36	159	144	0	0	0	0	0	0	554835	18	16	560,744
Joint Multi-Strike Group Exercise	1	144	144	FA-18E/F	8.0	1152.0	10%	115.2	0%	0%	100%	0.00	0.00	115.20	0	0	0	0	0	0	0	0	0	0	0	0	857	17566	143	476	7813	7031	36873530	1196	1042	37,266,233
		12	12	EA-6B	8.0	96.0	10%	9.6	0%	0%	100%	0.00	0.00	9.60	0	0	0	0	0	0	0	0	0	0	0	0	490	350	67	25	743	669	1899318	62	54	1,919,546
		12	12	E-2	8.0	96.0	10%	9.6	0%	0%	100%	0.00	0.00	9.60	0	0	0	0	0	0	0	0	0	0	0	0	46	170	10	8	84	75	653912	21	18	660,877
		5	5	P-3	8.0	40.0	10%	4.0	0%	0%	100%	0.00	0.00	4.00	0	0	0	0	0	0	0	0	0	0	0	0	35	162	8	8	76	69	594466	19	17	600,797
		1	1	E-3	8.0	8.0	10%	0.8	0%	0%	100%	0.00	0.00	0.80	0	0	0	0	0	0	0	0	0	0	0	0	54	221	8	10	7	6	3238254	105	92	3,272,741
		2	2	KC-135	8.0	16.0	10%	1.6	0%	0%	100%	0.00	0.00	1.60	0	0	0	0	0	0	0	0	0	0	0	0	49	494	1	15	5	4	4535378	147	128	4,583,680
		6	6	B-1B	8.0	48.0	10%	4.8	0%	0%	100%	0.00	0.00	4.80	0	0	0	0	0	0	0	0	0	0	0	0	27	418	4	13	4	4	3947253	128	112	3,989,292
		24	24	F-15	8.0	192.0	10%	19.2	0%	0%	100%	0.00	0.00	19.20	0	0	0	0	0	0	0	0	0	0	0	0	431	5558	77	48	970	873	3683311	119	104	3,722,538
		45	45	SH-60B	8.0	360.0	100%	360.0	0%	0%	100%	0.00	0.00	360.00	0	0	0	0	0	0	0	0	0	0	0	0	2700	2765	238	173	1814	1633	1337548	43	38	1,351,793
Fleet Strike Group Exercise	1	48	48	FA-18E/F	8.0	384.0	10%	38.4	0%	0%	100%	0.00	0.00	38.40	0	0	0	0	0	0	0	0	0	0	0	0	286	5855	48	159	2604	2344	12291177	399	347	12,422,078
		4	4	EA-6B	8.0	32.0	10%	3.2	0%	0%	100%	0.00	0.00	3.20	0	0	0	0	0	0	0	0	0	0	0	0	163	117	22	8	248	223	633106	21	18	639,849
		4	4	E-2	8.0	32.0	10%	3.2	0%	0%	100%	0.00	0.00	3.20	0	0	0	0	0	0	0	0	0	0	0	0	15	57	3	3	28	25	217971	7	6	220,292
		3	3	P-3	8.0	24.0	10%	2.4	0%	0%	100%	0.00	0.00	2.40	0	0	0	0	0	0	0	0	0	0	0	0	21	97	5	5	46	41	356680	12	10	360,478
		6	6	AV-8B	8.0	48.0	10%	4.8	0%	0%	100%	0.00	0.00	4.80	0	0	0	0	0	0	0	0	0	0	0	0	253	193	8	12	204	184	891699	29	25	901,195
		1	1	E-3	8.0	8.0	10%	0.8	0%	0%	100%	0.00	0.00	0.80	0	0	0	0	0	0	0	0	0	0	0	0	54	221	8	10	7	6	3238254	105	92	3,272,741
		1	1	KC-135	8.0	8.0	10%	0.8	0%	0%	100%	0.00	0.00	0.80	0	0	0	0	0	0	0	0	0	0	0	0	25	247	1	7	2	2	2267689	74	64	2,291,840
		24	24	F-15	8.0	192.0	10%	19.2	0%	0%	100%	0.00	0.00	19.20	0	0	0	0	0	0	0	0	0	0	0	0	431	5558	77	48	970	873	3683311	119	104	3,722,538

Table D.5-15. Emissions from Aircraft During Training, Alternative 2

		OPERATIONAL INFORMATION - AIRCRAFT													EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
Type of Training	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
		15	15	SH-60B	8.0	120.0	100%	120.0	0%	0%	100%	0.00	0.00	120.00	0	0	0	0	0	0	0	0	0	0	0	0	900	922	79	58	605	544	445849	14	13	450,598
		4	4	CH-53	8.0	32.0	100%	32.0	0%	0%	100%	0.00	0.00	32.00	0	0	0	0	0	0	0	0	0	0	0	0	304	1154	21	57	316	284	442283	14	12	446,993
		12	12	CH-46	8.0	96.0	100%	96.0	0%	0%	100%	0.00	0.00	96.00	0	0	0	0	0	0	0	0	0	0	0	0	1963	475	304	46	205	185	356680	12	10	360,478
		4	4	AH-1	8.0	32.0	100%	32.0	0%	0%	100%	0.00	0.00	32.00	0	0	0	0	0	0	0	0	0	0	0	0	291	141	15	10	109	98	80451	3	2	81,308
		2	2	UH-1	8.0	16.0	100%	16.0	0%	0%	100%	0.00	0.00	16.00	0	0	0	0	0	0	0	0	0	0	0	0	29	41	1	3	36	33	26751	1	1	27,036
		10	10	MV-22	8.0	80.0	100%	80.0	0%	0%	100%	0.00	0.00	80.00	0	0	0	0	0	0	0	0	0	0	0	0	1769	353	307	36	159	144	554835	18	16	560,744
Integrated Anti-Submarine Warfare Exercise	1	48	48	FA-18E/F	8.0	384.0	10%	38.4	0%	100%	0%	0.00	38.40	0.00	0	0	0	0	0	0	286	5855	48	159	2604	2344	0	0	0	0	0	0	12291177	399	347	12,422,078
		4	4	EA-6B	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	163	117	22	8	248	223	0	0	0	0	0	0	633106	21	18	639,849
		4	4	E-2	8.0	32.0	10%	3.2	0%	100%	0%	0.00	3.20	0.00	0	0	0	0	0	0	15	57	3	3	28	25	0	0	0	0	0	0	217971	7	6	220,292
		3	3	P-3	8.0	24.0	10%	2.4	0%	100%	0%	0.00	2.40	0.00	0	0	0	0	0	0	21	97	5	5	46	41	0	0	0	0	0	0	356680	12	10	360,478
		15	15	SH-60B	8.0	120.0	100%	120.0	0%	100%	0%	0.00	120.00	0.00	0	0	0	0	0	0	900	922	79	58	605	544	0	0	0	0	0	0	445849	14	13	450,598
Ship Squadron Anti-Submarine Warfare Exercise	1	3	3	P-3	40.0	120.0	10%	12.0	0%	100%	0%	0.00	12.00	0.00	0	0	0	0	0	0	105	486	24	23	229	206	0	0	0	0	0	0	1783398	58	50	1,802,391
		4	4	MH-60	40.0	160.0	75%	120.0	0%	100%	0%	0.00	120.00	0.00	0	0	0	0	0	0	900	922	79	58	605	544	0	0	0	0	0	0	594466	19	17	600,797
		4	4	SH-60H	40.0	160.0	100%	160.0	0%	100%	0%	0.00	160.00	0.00	0	0	0	0	0	0	1200	1229	106	77	806	726	0	0	0	0	0	0	594466	19	17	600,797
Maritime Homeland Defense / Security Mine Countermeasures	1																																			
Marine Air Ground Task Force Exercise (Amphibious)	4	1	4	C-130	8.0	32.0	10%	3.2	50%	50%	0%	1.60	1.60	0.00	15	59	3	3	29	26	15	59	3	3	29	26	0	0	0	0	0	0	445849	14	13	450,598
		2	8	SH-60B	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00	240	246	21	15	161	145	240	246	21	15	161	145	0	0	0	0	0	0	237786	8	7	240,319
		4	16	CH-53	8.0	128.0	100%	128.0	50%	50%	0%	64.00	64.00	0.00	609	2308	43	114	631	568	609	2308	43	114	631	568	0	0	0	0	0	0	1769130	57	50	1,787,972
		12	48	CH-46	8.0	384.0	100%	384.0	50%	50%	0%	192.00	192.00	0.00	3926	949	608	92	410	369	3926	949	608	92	410	369	0	0	0	0	0	0	1426718	46	40	1,441,913
		4	16	AH-1	8.0	128.0	100%	128.0	50%	50%	0%	64.00	64.00	0.00	583	283	30	21	218	196	583	283	30	21	218	196	0	0	0	0	0	0	321804	10	9	325,231
		2	8	UH-1	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00	58	82	3	7	73	65	58	82	3	7	73	65	0	0	0	0	0	0	107004	3	3	108,143
		10	40	MV-22	8.0	320.0	100%	320.0	50%	50%	0%	160.00	160.00	0.00	3537	706	615	72	319	287	3537	706	615	72	319	287	0	0	0	0	0	0	2219339	72	63	2,242,975
Special Purpose Marine Air Ground Task Force Exercise	2	1	2	C-130	8.0	16.0	10%	1.6	50%	50%	0%	0.80	0.80	0.00	7	29	2	1	14	13	7	29	2	1	14	13	0	0	0	0	0	0	222925	7	6	225,299
		4	8	CH-53	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00	304	1154	21	57	316	284	304	1154	21	57	316	284	0	0	0	0	0	0	884565	29	25	893,986
		12	24	CH-46	8.0	192.0	100%	192.0	50%	50%	0%	96.00	96.00	0.00	1963	475	304	46	205	185	1963	475	304	46	205	185	0	0	0	0	0	0	713359	23	20	720,956
		4	8	AH-1	8.0	64.0	100%	64.0	50%	50%	0%	32.00	32.00	0.00	291	141	15	10	109	98	291	141	15	10	109	98	0	0	0	0	0	0	160902	5	5	162,616
		2	4	UH-1	8.0	32.0	100%	32.0	50%	50%	0%	16.00	16.00	0.00	29	41	1	3	36	33	29	41	1	3	36	33	0	0	0	0	0	0	53502	2	2	54,072
		10	20	MV-22	8.0	160.0	100%	160.0	50%	50%	0%	80.00	80.00	0.00	1769	353	307	36	159	144	1769	353	307	36	159	144	0	0	0	0	0	0	1109670	36	31	1,121,488
Urban Warfare Exercise	5	1	5	C-130	8.0	40.0	10%	4.0	100%	0%	0%	4.00	0.00	0.00	37	147	8	7	71	64	0	0	0	0	0	0	0	0	0	0	0	0	557312	18	16	563,247
		4	20	CH-53	8.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1521	5771	107	286	1578	1421	0	0	0	0	0	0	0	0	0	0	0	0	2211413	72	62	2,234,965
		12	60	CH-46	8.0	480.0	100%	480.0	100%	0%	0%	480.00	0.00	0.00	9815	2373	1521	230	1025	923	0	0	0	0	0	0	0	0	0	0	0	0	1783398	58	50	1,802,391
		4	20	AH-1	8.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1456	707	74	52	546	491	0	0	0	0	0	0	0	0	0	0	0	0	402255	13	11	406,539
		2	10	UH-1	8.0	80.0	100%	80.0	100%	0%	0%	80.00	0.00	0.00	144	204	7	17	181	163	0	0	0	0	0	0	0	0	0	0	0	0	133755	4	4	135,179
		10	50	MV-22	8.0	400.0	100%	400.0	100%	0%	0%	400.00	0.00	0.00	8844	1765	1537	179	797	718	0	0	0	0	0	0	0	0	0	0	0	0	2774174	90	78	2,803,719

Table D.5-15. Emissions from Aircraft During Training, Alternative 2

Type of Training		OPERATIONAL INFORMATION - AIRCRAFT													EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
ELECTRONIC WARFARE																																				
Electronic Warfare Operations (EW Ops)	530	1	530	FA-18E/F	2.0	1060.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33928769	1101	959	34,290,110
Counter Targeting Flare Exercise (FLAREX) - Aircraft	3534	0.9	3180.6	F-15	3.0	9541.8	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	183049027	5938	5173	184,998,498
		0.06	212.04	FA-18E/F	3.0	636.1	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20361102	661	575	20,577,948
		0.04	141.36	SH-60B	3.0	424.1	100%	424.1	0%	0%	100%	0.00	0.00	424.08	0	0	0	0	0	0	0	0	0	0	0	0	3181	3257	280	204	2137	1924	1575632	51	45	1,592,412
Counter Targeting Chaff Exercise (CHAFFEX) - Ship	40																																			
Counter Targeting Chaff Exercise (CHAFFEX) - Aircraft	3534	0.9	3180.6	F-15	3.0	9541.8	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	183049027	5938	5173	184,998,498
		0.06	212.04	FA-18E/F	3.0	636.1	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20361102	661	575	20,577,948
		0.04	141.36	SH-60B	3.0	424.1	100%	424.1	0%	0%	100%	0.00	0.00	424.08	0	0	0	0	0	0	0	0	0	0	0	0	3181	3257	280	204	2137	1924	1575632	51	45	1,592,412
MINE WARFARE																																				
Submarine Mine Exercise	16																																			
Mine Countermeasure Exercise – Sonar (AQS-20, LCS)	4																																			
Mine Countermeasure Exercise – Surface (SMCMEX) Sonar (SQQ-32, MCM)	4																																			
Mine Neutralization – Remotely Operated Vehicle Sonar (AQS-235[AQS-20], SLQ-48)	4																																			
Mine Laying - Aircraft	4	0.5	2	FA-18E/F	0.5	1.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32008	1	1	32,349
		0.5	2	P-3	1.0	2.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29723	1	1	30,040
																																			0.00	0
Mine Neutralization – Explosive Ordnance Disposal	20																																			
Limpet Mine Neutralization System/Shock Wave Generator	40																																			
Mine Countermeasure – Towed Mine Detection	4																																			
NAVAL SPECIAL WARFARE																																				
Personnel I&E	240	4	960	H-60	8.0	7680.0	100%	7680.0	100%	0%	0%	7680.00	0.00	0.00	57600	58982	5069	3686	38707	34836	0	0	0	0	0	0	0	0	0	0	0	0	28534362	926	806	28,838,253
		2	480	MV-22	8.0	3840.0	100%	3840.0	100%	0%	0%	3840.00	0.00	0.00	84898	16945	14752	1720	7655	6890	0	0	0	0	0	0	0	0	0	0	0	0	26632072	864	753	26,915,703
Parachute Insertion	20	1	20	C-130	4.0	80.0	100%	80.0	100%	0%	0%	80.00	0.00	0.00	745	2938	169	144	1429	1286	0	0	0	0	0	0	0	0	0	0	0	0	1114624	36	32	1,126,494
		1	20	CH-46	4.0	80.0	100%	80.0	100%	0%	0%	80.00	0.00	0.00	1636	396	253	38	171	154	0	0	0	0	0	0	0	0	0	0	0	0	297233	10	8	300,398
		1	20	H-60	4.0	80.0	100%	80.0	100%	0%	0%	80.00	0.00	0.00	600	614	53	38	403	363	0	0	0	0	0	0	0	0	0	0	0	0	297233	10	8	300,398
Embassy Reinforcement	50	1	50	SH-60B	4.0	200.0	100%	200.0	100%	0%	0%	200.00	0.00	0.00	1500	1536	132	96	1008	907	0	0	0	0	0	0	0	0	0	0	0	0	743082	24	21	750,996
		1	50	AV-8B	4.0	200.0	100%	200.0	100%	0%	0%	200.00	0.00	0.00	10560	8052	336	480	8520	7668	0	0	0	0	0	0	0	0	0	0	0	0	3715412	121	105	3,754,981

Table D.5-15. Emissions from Aircraft During Training, Alternative 2

Type of Training		OPERATIONAL INFORMATION - AIRCRAFT														EMISSIONS/YEAR (lb) BY JURISDICTION																		Greenhouse Gas Emissions (lb/year)			
		Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)			State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)									
	Training Ops (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO	NOx	HC	SOx	PM	PM2.5	CO_2	N_2O	CH_4	CO_{2-e}
Direct Action (Combat Close Quarters)	72																																			
Direct Action (Breaching)	72																																			
Direct Action (TAC-P)	18																																			
Underwater Demolition Qualifications	30																																			
Intelligence, Surveillance, Reconnaissance	16	1	16.0	MQ-4C	4.0	64.0	100%	64.0	0%	50%	50%	0.00	32.00	32.00	0	0	0	0	0	0	67	1243	21	113	20	18	67	1243	21	113	20	18	501729	16	14	507,073
Urban Warfare Training	18																																			
Underwater Survey	16	1	16	SH-60B	2.0	32.0	100%	32.0	100%	0%	0%	32.00	0.00	0.00	240	246	21	15	161	145	0	0	0	0	0	0	0	0	0	0	0	0	118893	4	3	120,159
OTHER																																				
Surface Ship Sonar Maintenance	42																																			
Submarine Sonar Maintenance	48																																			
Small Boat Attack	18																																			
Search and Rescue at Sea	40	2	80	MH-60	40.0	3200.0	75%	2400.0	100%	0%	0%	2400.00	0.00	0.00	18000	18432	1584	1152	12096	10886	0	0	0	0	0	0	0	0	0	0	0	0	11889318	386	336	12,015,939
Submarine Navigation	40																																			
Precision Anchoring	18																																			
Maneuver (Convoy, Land Navigation)	16																																			
Water Purification	16																																			
Field Training Exercise	100																																			
Force Protection	75																																			
Anti-Terrorism	80	1	80	SH-60B	2.0	160.0	100%	160.0	100%	0%	0%	160.00	0.00	0.00	1200	1229	106	77	806	726	0	0	0	0	0	0	0	0	0	0	0	0	594466	19	17	600,797
Seize Airfield	12																																			
Airfield Expeditionary	12																																			
Unmanned Aerial Vehicle Operation	1000	1	1000	MQ-4C	4.0	4000.0	100%	4000.0	100%	0%	0%	4000.00	0.00	0.00	8400.00	155360.00	2640.00	14160.00	2440.00	2196.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31358075	1017.27	886.20	31,692,039
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120																																			

Table D.5-15. Emissions from Aircraft During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION - AIRCRAFT: Aircraft			Time		Altitude		Distribution (%)			Distribution (hr)		
		Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	236													
TOTAL TRAINING EMISSIONS (LBS/YEAR)														
TOTAL TRAINING EMISSIONS (TONS/YEAR)														

Type of Training	EMISSIONS/YEAR (lb) BY JURISDICTION: State (0-3 nm offshore)						Waters of U S (3-12 nm)						International Waters (>12 nm)						Greenhouse Gas Emissions (lb/year)			
	CO	NOx	HC	SOx	PM	$PM_{2.5}$	CO	NOx	HC	SOx	PM	$PM_{2.5}$	CO	NOx	HC	SOx	PM	$PM_{2.5}$	CO_2	N_2O	CH_4	CO_{2-e}
Land Demolitions (Unexploded Ordnance) Discovery / Disposal																						
TOTAL TRAINING EMISSIONS (LBS/YEAR)	545,479	522,741	76,376	38,682	165,678	149,110	31,319	43,229	4,182	2,232	20,962	18,866	70,354	935,743	10,040	26,119	417,056	375,351	1,597,897,713	51,836	45,158	1,614,915,316
TOTAL TRAINING EMISSIONS (TONS/YEAR)	273	261	38	19	83	75	16	22	2	1	10	9	35	468	5	13	209	188	798,949	26	23	807,458

Table D.5-16. Emissions from Aircraft During Testing, Alternative 2

OPERATIONAL INFORMATION - AIRCRAFT

Type of Training	Training Ops (#)	Aircraft: Distribution	Aircraft: A/C Sorties (#)	Aircraft: Type	Time: Ave Time on Range (hr)	Time: Total Time on Range (hr)	Altitude: Time < 3,000 ft (%)	Altitude: Time < 3,000 ft (hr)	Distribution (%): 0-3 nm from shore	Distribution (%): 3-12 nm from Shore	Distribution (%): >12 nm from Shore	Distribution (hr): Total Time 0-3 nm from shore	Distribution (hr): Total Time 3-12 nm from shore	Distribution (hr): Total Time >12 nm from shore
ANTI-SURFACE WARFARE														
Air to Surface Missile Test	10	1	10	P-3	4	40	75%	30	0%	0%	100%	0	0	30
ANTI-SUBMARINE WARFARE TESTING														
Anti-submarine Warfare Tracking Test - MPA	207	1	207	P-3	6.0	1242.0	75%	931.5	0%	100%	0%	0.00	931.50	0.00
Anti-submarine Warfare Torpedo Test	44	0.33	15	SH-60	8.0	116.2	75%	87.1	0%	100%	0%	0.00	87.12	0.00
		0.33	15	MH-60	8.0	116.2	75%	87.1	0%	100%	0%	0.00	87.12	0.00
		0.33	15	P-3	8.0	116.2	75%	87.1	0%	100%	0%	0.00	87.12	0.00
Broad Area Maritime Surveillance (BAMS) Testing	11	1	11	MQ-4C	1.0	11.0	100%	11.0	100%	0%	0%	11.00	0.00	0.00
LIFECYCLE ACTIVITIES TESTING														
Ship Signature Testing	19													
ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING														
Torpedo Explosive Testing	2													
Countermeasure Testing	3													
At-Sea Sonar Testing	24													
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING														
Pierside Integrated Swimmer Defense	1													
NEW SHIP CONSTRUCTION														
ASW Mission Package Testing	37													
MCM Mission Package Testing	36													
OFFICE OF NAVAL RESEARCH														
North Pacific Acoustic Lab Philippine Sea 2018-19 Experiment (Deep Water)	1													
TOTAL TESTING EMISSIONS (lbs per year)														
TOTAL TESTING EMISSIONS (tons per year)														

EMISSIONS/YEAR (lb) BY JURISDICTION

Type of Training	State (0-3 nm offshore): CO	NOx	HC	SOx	PM	$PM_{2.5}$	Waters of U S (3-12 nm): CO	NOx	HC	SOx	PM	$PM_{2.5}$	International Waters (>12 nm): CO	NOx	HC	SOx	PM	$PM_{2.5}$
ANTI-SURFACE WARFARE																		
Air to Surface Missile Test	0	0	0	0	0	0	0	0	0	0	0	0	262.08	1213.92	59.04	57.6	571.68	514.512
ANTI-SUBMARINE WARFARE TESTING																		
Anti-submarine Warfare Tracking Test - MPA	0	0	0	0	0	0	8138	37692	1833	1788	17751	15976	0	0	0	0	0	0
Anti-submarine Warfare Torpedo Test	0	0	0	0	0	0	653	669	57	42	439	395	0	0	0	0	0	0
	0	0	0	0	0	0	653	669	57	42	439	395	0	0	0	0	0	0
	0	0	0	0	0	0	761	3525	171	167	1660	1494	0	0	0	0	0	0
Broad Area Maritime Surveillance (BAMS) Testing	23	427	7	39	7	6	0	0	0	0	0	0	0	0	0	0	0	0
LIFECYCLE ACTIVITIES TESTING																		
Ship Signature Testing																		
ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING																		
Torpedo Explosive Testing																		
Countermeasure Testing																		
At-Sea Sonar Testing																		
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING																		
Pierside Integrated Swimmer Defense																		
NEW SHIP CONSTRUCTION																		
ASW Mission Package Testing																		
MCM Mission Package Testing																		
OFFICE OF NAVAL RESEARCH																		
North Pacific Acoustic Lab Philippine Sea 2018-19 Experiment (Deep Water)																		
TOTAL TESTING EMISSIONS (lbs per year)	23.1	427.24	7.26	38.94	6.71	6.039	10205.464	42555.603	2119.64	2039.39	20288.992	18260.09	262.08	1213.92	59.04	57.6	571.68	514.512
TOTAL TESTING EMISSIONS (tons per year)	0	0	0	0	0	0	5	21	1	1	10	9	0	1	0	0	0	0

Greenhouse Gas Emissions (lb/year)

Type of Training	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
ANTI-SURFACE WARFARE				
Air to Surface Missile Test	594465.8824	19.284706	16.8	600796.9412
ANTI-SUBMARINE WARFARE TESTING				
Anti-submarine Warfare Tracking Test - MPA	18458166	599	522	18,654,745
Anti-submarine Warfare Torpedo Test	431582	14	12	436,179
	431582	14	12	436,179
	1726329	56	49	1,744,714
Broad Area Maritime Surveillance (BAMS) Testing	86235	3	2	87,153
LIFECYCLE ACTIVITIES TESTING				
Ship Signature Testing				
ANTI-SURFACE WARFARE / ANTI-SUBMARINE WARFARE TESTING				
Torpedo Explosive Testing				
Countermeasure Testing				
At-Sea Sonar Testing				
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING				
Pierside Integrated Swimmer Defense				
NEW SHIP CONSTRUCTION				
ASW Mission Package Testing				
MCM Mission Package Testing				
OFFICE OF NAVAL RESEARCH				
North Pacific Acoustic Lab Philippine Sea 2018-19 Experiment (Deep Water)				
TOTAL TESTING EMISSIONS (lbs per year)	21728359.62	704.87649	614.05785	21959766.55
TOTAL TESTING EMISSIONS (tons per year)	10864.17981	0.3524382	0.3070289	10979.88327

Table D.5-17 Emissions from Ordnance During Training and Testing, No Action Alternative

Ordnance Category	Training	Testing	Emissions from Ordnance During Training, lb/year						Emissions from Ordnance During Testing, lb/year					
	units/year	units/year	CO	NOx	VOC	SOx	PM_{10}	$PM_{2.5}$	CO	NOx	VOC	SOx	PM_{10}	$PM_{2.5}$
BOMBS														
Bombs (H-E)	2,978	0	182,053.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bombs (N-E)	2,872	0	732.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PROJECTILES														
Small Caliber	63,000	0	144.9	6.1	0.0	0.0	3.2	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Medium Caliber (H-E)	100	0	0.4	0.1	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Medium Caliber (N-E)	48,000	0	124.8	4.7	0.0	0.0	6.7	5.8	0.0	0.0	0.0	0.0	0.0	0.0
Large Caliber (H-E)	1,040	0	133.1	166.4	0.0	0.0	10.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0
Large Caliber (N-E)	200	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missiles (H-E)	103	0	3,154.2	3,664.1	0.0	0.0	6,364.9	6,364.9	0.0	0.0	0.0	0.0	0.0	0.0
Missiles (N-E)	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rockets (H-E)	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rockets (N-E)	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COUNTERMEASURES														
Chaff	5,830	0	0.3	0.9	0.0	0.0	1.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0
Flares	5,720	0	0.3	0.9	0.0	0.0	1.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL EMISSIONS (LBS/YEAR)			186,344	3,843	0	0	6,389	6,384	0	0	0	0	0	0
TOTAL EMISSIONS (TONS/YEAR)			93.2	1.9	0.0	0.0	3.2	3.2	0.0	0.0	0.0	0.0	0.0	0.0

Table D.5-18 Emissions from Ordnance During Training and Testing, Alternative 1

Ordnance Category	Training	Testing	Emissions from Ordnance During Training, lb/year						Emissions from Ordnance During Testing, lb/year					
	units/year	units/year	CO	NOx	VOC	SOx	PM_{10}	$PM_{2.5}$	CO	NOx	VOC	SOx	PM_{10}	$PM_{2.5}$
BOMBS														
Bombs (H-E)	7,440	0	454,828.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bombs (N-E)	4,838	0	1,233.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PROJECTILES														
Small Caliber	173,530	0	399.1	16.8	0.0	0.0	8.9	6.6	0.0	0.0	0.0	0.0	0.0	0.0
Medium Caliber (H-E)	19,186	2050	76.7	24.9	0.0	0.0	182.3	97.8	8.2	2.7	0.0	0.0	19.5	10.5
Medium Caliber (N-E)	177,650	2050	461.9	17.2	0.0	0.0	24.9	21.3	5.3	0.2	0.0	0.0	0.3	0.2
Large Caliber (H-E)	8,803	24	1,126.8	1,408.5	0.0	0.0	84.5	65.5	3.1	3.8	0.0	0.0	0.2	0.2
Large Caliber (N-E)	5,220	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missiles (H-E)	189	20	5,787.9	6,723.5	0.0	0.0	11,679.3	11,679.3	612.5	711.5	0.0	0.0	1,235.9	1,235.9
Missiles (N-E)	0	4	0.0	0.0	0.0	0.0	0.0	0.0	122.5	142.3	0.0	0.0	247.2	247.2
Rockets (H-E)	2,114	0	1,966.0	11.8	0.0	0.0	845.6	613.1	0.0	0.0	0.0	0.0	0.0	0.0
Rockets (N-E)	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COUNTERMEASURES														
Chaff	25,840	0	1.5	3.9	0.0	0.0	7.3	6.7	0.0	0.0	0.0	0.0	0.0	0.0
Flares	25,600	0	1.5	3.9	0.0	0.0	7.2	6.6	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL EMISSIONS (lbs per year)			465,883	8,211	0	0	12,840	12,497	752	860	0	0	1,503	1,494
TOTAL EMISSIONS (tons per year)			232.9	4.1	0.0	0.0	6.4	6.2	0.4	0.4	0.0	0.0	0.8	0.7

Table D.5-19 Emissions from Ordnance During Training and Testing, Alternative 2

Ordnance Category	Training	Testing	Emissions from Ordnance During Training, lb/year						Emissions from Ordnance During Testing, lb/year					
	units/year	units/year	CO	NOx	VOC	SOx	PM_{10}	$PM_{2.5}$	CO	NOx	VOC	SOx	PM_{10}	$PM_{2.5}$
BOMBS														
Bombs (H-E)	8,019	0	490,223.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bombs (N-E)	5,090	0	1,298.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PROJECTILES														
Small Caliber	154,630	0	355.6	15.0	0.0	0.0	7.9	5.9	0.0	0.0	0.0	0.0	0.0	0.0
Medium Caliber (H-E)	26,336	2250	105.3	34.2	0.0	0.0	250.2	134.3	9.0	2.9	0.0	0.0	21.4	11.5
Medium Caliber (N-E)	179,900	2250	467.7	17.5	0.0	0.0	25.2	21.6	5.9	0.2	0.0	0.0	0.3	0.3
Large Caliber (H-E)	1,653	28	211.6	264.5	0.0	0.0	15.9	12.3	3.6	4.5	0.0	0.0	0.3	0.2
Large Caliber (N-E)	5,220	28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Missiles (H-E)	201	25	6,155.3	7,150.4	0.0	0.0	12,420.8	12,420.8	765.6	889.4	0.0	0.0	1,544.9	1,544.9
Missiles (N-E)	0	5	0.0	0.0	0.0	0.0	0.0	0.0	153.1	177.9	0.0	0.0	309.0	309.0
Rockets (H-E)	2,380	0	2,213.4	13.3	0.0	0.0	952.0	690.2	0.0	0.0	0.0	0.0	0.0	0.0
Rockets (N-E)	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COUNTERMEASURES														
Chaff	28,512	0	1.7	4.3	0.0	0.0	8.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0
Flares	28,272	0	1.7	4.3	0.0	0.0	8.0	7.3	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL EMISSIONS (lbs per year)			501,034	7,504	0	0	13,688	13,300	937	1,075	0	0	1,876	1,866
TOTAL EMISSIONS (tons per year)			250.5	3.8	0.0	0.0	6.8	6.6	0.5	0.5	0.0	0.0	0.9	0.9

Table D.5-20 Emissions from Other Items During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
AMPHIBIOUS WARFARE																		
Fire Support Exercise - Land-Based target	8																	
Amphibious Assault - Marine Air Ground Task Force	4	56	LAV	14	2.0	112.0	69	187	23	0	86	77	7	756	16,912	0	2	17,088
Amphibious Raid - Special Purpose Marine Air Ground Task Force	2	28	LAV	14	2.0	56.0	34	93	11	0	43	39	7	378	8,456	0	1	8,544
Urban Warfare Training	17	17	USMC-LAV	1	56.0	952.0	585	1,588	194	3	730	657	7	6,426	143,752	4	17	145,245
		136	USMC-HMMWV	8	56.0	7616.0	4,682	12,703	1,549	21	5,841	5,257	7	51,409	1,150,016	29	136	1,161,963
		68	USMC-TRUCK	4	56.0	3808.0	2,341	6,351	775	10	2,921	2,629	7	25,704	575,008	15	68	580,981
		68	USAF-HMMWV	4	16.0	1088.0	669	1,815	221	3	834	751	7	7,344	164,288	4	19	165,995
		34	USAF-TRUCK	2	16.0	544.0	334	907	111	1	417	376	7	3,672	82,144	2	10	82,997
		68	NAVY-HMMWV	4	16.0	1088.0	669	1,815	221	3	834	751	7	7,344	164,288	4	19	165,995
		34	NAVY-TRUCK	2	16.0	544.0	334	907	111	1	417	376	7	3,672	82,144	2	10	82,997
		68	ARMY-HMMWV	4	16.0	1088.0	669	1,815	221	3	834	751	7	7,344	164,288	4	19	165,995
		34	ARMY-TRUCK	2	16.0	544.0	334	907	111	1	417	376	7	3,672	82,144	2	10	82,997
Non-Combatant Evacuation Operation	2	32	HMMWV	16	40.0	1280.0	787	2,135	260	3	982	884	7	8,640	193,280	5	23	195,288
		16	TRUCK	8	40.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
		2	LAV	1	40.0	80.0	49	133	16	0	61	55	7	540	12,080	0	1	12,205
Humanitarian Assistance/ Disaster Relief Operations	2	32	HMMWV	16	40.0	1280.0	787	2,135	260	3	982	884	7	8,640	193,280	5	23	195,288
		16	TRUCK	8	40.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
		2	LAV	1	40.0	80.0	49	133	16	0	61	55	7	540	12,080	0	1	12,205
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	0																	

Table D.5-20 Emissions from Other Items During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
MAJOR TRAINING EVENTS																		
Joint Expeditionary Exercise	1	14.0	AAV	14	20.0	280.0	172	467	57	1	215	193	7	1,890	42,280	1	5	42,719
		13.0	LAV	13	20.0	260.0	160	434	53	1	199	179	7	1,755	39,260	1	5	39,668
		78.0	HMMWV	78	40.0	3120.0	1,918	5,204	635	8	2,393	2,154	7	21,060	471,120	12	56	476,014
		36.0	TRUCKS	36	40.0	1440.0	885	2,402	293	4	1,104	994	7	9,720	217,440	6	26	219,699
		2.0	DOZER	2	20.0	40.0	44	95	11	0	4	4	11	427	9,560	0	1	9,657
		6.0	FORKLIFT	6	20.0	120.0	27	43	6	0	2	2	2	292	6,528	0	1	6,591
		2.0	ROWPU	2	240.0	480.0	233	342	48	0	26	23	3	1,672	37,392	1	4	37,779
Joint Multi-Strike Group Exercise	1																	
Fleet Strike Group Exercise	0																	
Integrated Anti-Submarine Warfare Exercise	0																	
Maritime Homeland Defense / Security Mine Countermeasures	0																	
Marine Air Ground Task Force Exercise (Amphibious)	4	56.0	AAV	14	20.0	1120.0	689	1,868	228	3	859	773	7	7,560	169,120	4	20	170,877
		20.0	LAV	5	20.0	400.0	246	667	81	1	307	276	7	2,700	60,400	2	7	61,027
		312.0	HMMWV	78	40.0	12480.0	7,673	20,815	2,538	34	9,572	8,615	7	84,241	1,884,480	48	223	1,904,057
		144.0	TRUCKS	36	40.0	5760.0	3,541	9,607	1,172	16	4,418	3,976	7	38,881	869,760	22	103	878,795
		8.0	DOZER	2	20.0	160.0	177	382	46	0	16	14	11	1,709	38,240	1	4	38,628
		24.0	FORKLIFT	6	20.0	480.0	106	170	24	0	9	8	2	1,167	26,112	1	2	26,364
		8.0	ROWPU	2	240.0	1920.0	932	1,369	193	2	103	93	3	6,686	149,568	4	17	151,116
Special Purpose Marine Air Ground Task Force Exercise	2	6.0	AAV	3	20.0	120.0	74	200	24	0	92	83	7	810	18,120	0	2	18,308
		10.0	LAV	5	20.0	200.0	123	334	41	1	153	138	7	1,350	30,200	1	4	30,514
		32.0	HMMWV	16	40.0	1280.0	787	2,135	260	3	982	884	7	8,640	193,280	5	23	195,288
		16.0	TRUCKS	8	40.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
		2.0	DOZER	1	20.0	40.0	44	95	11	0	4	4	11	427	9,560	0	1	9,657
		4.0	FORKLIFT	2	20.0	80.0	18	28	4	0	1	1	2	195	4,352	0	0	4,394
		2.0	ROWPU	1	240.0	480.0	233	342	48	0	26	23	3	1,672	37,392	1	4	37,779

Table D.5-20 Emissions from Other Items During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Urban Warfare Exercise	5	15.0	AAV	3	28.0	420.0	258	701	85	1	322	290	7	2,835	63,420	2	8	64,079
		25.0	LAV	5	28.0	700.0	430	1,168	142	2	537	483	7	4,725	105,700	3	13	106,798
		80.0	HMMWV	16	56.0	4480.0	2,754	7,472	911	12	3,436	3,093	7	30,241	676,480	17	80	683,508
		40.0	TRUCKS	8	56.0	2240.0	1,377	3,736	456	6	1,718	1,546	7	15,120	338,240	9	40	341,754
		5.0	DOZER	1	28.0	140.0	155	334	40	0	14	13	11	1,496	33,460	1	4	33,800
		10.0	FORKLIFT	2	28.0	280.0	62	99	14	0	5	4	2	681	15,232	0	1	15,379
		5.0	ROWPU	1	336.0	1680.0	816	1,198	169	2	90	81	3	5,850	130,872	3	15	132,227
NAVAL SPECIAL WARFARE																		
Personnel I&E	150																	
Parachute Insertion	12																	
Embassy Reinforcement	50	200	HMMWV	4	12.0	2400.0	1,476	4,003	488	6	1,841	1,657	7	16,200	362,400	9	43	366,165
		100	TRUCK	2	12.0	1200.0	738	2,001	244	3	920	828	7	8,100	181,200	5	21	183,082
Direct Action (Combat Close Quarters)	40																	
Direct Action (Breaching)	40																	
Direct Action (TAC-P)	3																	
Underwater Demolition Qualifications	30																	
Intelligence, Surveillance, Reconnaissance	16																	
Urban Warfare Training	8	32	HMMWV	4	20.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
		16	TRUCK	2	20.0	320.0	197	534	65	1	245	221	7	2,160	48,320	1	6	48,822
Underwater Survey	6																	
OTHER																		
Surface Ship Sonar Maintenance	0																	

Table D.5-20 Emissions from Other Items During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
Submarine Sonar Maintenance	0																	
Small Boat Attack	0																	
Submarine Navigation	0																	
Precision Anchoring	0																	
Maneuver (Convoy, Land Navigation)	16	16	LAV	1	4.0	64.0	39	107	13	0	49	44	7	432	9,664	0	1	9,764
		64	HMMWV	4	4.0	256.0	157	427	52	1	196	177	7	1,728	38,656	1	5	39,058
		32	TRUCK	2	4.0	128.0	79	213	26	0	98	88	7	864	19,328	0	2	19,529
Water Purification	0	0	ROWPU	1	8.0	0.0	0	0	0	0	0	0	#DIV/0!	0	0	0	0	0
Field Training Exercise	100	1600	HMMWV	16	12.0	19200.0	11,804	32,024	3,905	52	14,726	13,254	7	129,602	2,899,200	74	344	2,929,318
		1200	TRUCK	12	12.0	14400.0	8,853	24,018	2,929	39	11,045	9,940	7	97,202	2,174,400	55	258	2,196,988
		800	Generator	8	48.0	38400.0	11,421	19,517	2,697	27	1,135	1,022	3	104,712	2,342,400	60	242	2,365,983
Force Protection	75	300	HMMWV	4	8.0	2400.0	1,476	4,003	488	6	1,841	1,657	7	16,200	362,400	9	43	366,165
		150	TRUCK	2	8.0	1200.0	738	2,001	244	3	920	828	7	8,100	181,200	5	21	183,082
		150	Generator	2	8.0	1200.0	357	610	84	1	35	32	3	3,272	73,200	2	8	73,937
Anti-Terrorism	80	320	HMMWV	4	4.0	1280.0	787	2,135	260	3	982	884	7	8,640	193,280	5	23	195,288
		160	TRUCK	2	4.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
Seize Airfield	12	36	HMMWV	3	4.0	144.0	89	240	29	0	110	99	7	972	21,744	1	3	21,970
		36	TRUCK	3	4.0	144.0	89	240	29	0	110	99	7	972	21,744	1	3	21,970
Airfield Expeditionary	12	12	Dozer	1	2.0	24.0	27	57	7	0	2	2	11	256	5,736	0	1	5,794
		72	Truck	6	4.0	288.0	177	480	59	1	221	199	7	1,944	43,488	1	5	43,940
		12	Crane	1	2.0	24.0	11	27	3	0	1	1	6	138	3,096	0	0	3,126
		12	Forklift	1	2.0	24.0	5	9	1	0	0	0	2	58	1,306	0	0	1,318
		12	Earth Mover	1	2.0	24.0	27	57	7	0	2	2	11	256	5,736	0	1	5,794
Unmanned Aerial Vehicle Operation	0																	
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120	240	HMMWV	2	2.0	480.0	295	801	98	1	368	331	7	3,240	72,480	2	9	73,233
		120	TRUCK	1	2.0	240.0	148	400	49	1	184	166	7	1,620	36,240	1	4	36,616

Table D.5-20 Emissions from Other Items During Training, No Action Alternative

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	200	400	HMMWV	2	2.0	800.0	492	1,334	163	2	614	552	7	5,400	120,800	3	14	122,055
		200	TRUCK	1	2.0	400.0	246	667	81	1	307	276	7	2,700	60,400	2	7	61,027
TOTAL TRAINING EMISSIONS (lbs per year)							**78,022**	**196,576**	**24,366**	**312**	**80,481**	**72,433**			**18,483,346**	**471**	**2,150**	**18,674,505**
TOTAL TRAINING EMISSIONS (tons per year)							**39**	**98**	**12**	**0**	**40**	**36**			**9,242**	**0**	**1**	**9,337**

Table D.5-21 Emissions from Other Items During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
AMPHIBIOUS WARFARE																		
Fire Support Exercise - Land-Based target	10																	
Amphibious Assault - Marine Air Ground Task Force	6	84	LAV	14	2.0	168.0	103	280	34	0	129	116	7	1,134	25,368	1	3	25,632
Amphibious Raid - Special Purpose Marine Air Ground Task Force	6	84	LAV	14	2.0	168.0	103	280	34	0	129	116	7	1,134	25,368	1	3	25,632
Urban Warfare Training	36	36	USMC-LAV	1	56.0	2016.0	1,239	3,362	410	5	1,546	1,392	7	13,608	304,416	8	36	307,578
		288	USMC-HMMWV	8	56.0	16128.0	9,915	26,900	3,280	44	12,370	11,133	7	108,866	2,435,328	62	289	2,460,627
		144	USMC-TRUCK	4	56.0	8064.0	4,958	13,450	1,640	22	6,185	5,567	7	54,433	1,217,664	31	144	1,230,314
		144	USAF-HMMWV	4	16.0	2304.0	1,416	3,843	469	6	1,767	1,590	7	15,552	347,904	9	41	351,518
		72	USAF-TRUCK	2	16.0	1152.0	708	1,921	234	3	884	795	7	7,776	173,952	4	21	175,759
		144	NAVY-HMMWV	4	16.0	2304.0	1,416	3,843	469	6	1,767	1,590	7	15,552	347,904	9	41	351,518
		72	NAVY-TRUCK	2	16.0	1152.0	708	1,921	234	3	884	795	7	7,776	173,952	4	21	175,759
		144	ARMY-HMMWV	4	16.0	2304.0	1,416	3,843	469	6	1,767	1,590	7	15,552	347,904	9	41	351,518
		72	ARMY-TRUCK	2	16.0	1152.0	708	1,921	234	3	884	795	7	7,776	173,952	4	21	175,759
Non-Combatant Evacuation Operation	6	96	HMMWV	16	40.0	3840.0	2,361	6,405	781	10	2,945	2,651	7	25,920	579,840	15	69	585,864
		48	TRUCK	8	40.0	1920.0	1,180	3,202	391	5	1,473	1,325	7	12,960	289,920	7	34	292,932
		6	LAV	1	40.0	240.0	148	400	49	1	184	166	7	1,620	36,240	1	4	36,616
Humanitarian Assistance/ Disaster Relief Operations	6	96	HMMWV	16	40.0	3840.0	2,361	6,405	781	10	2,945	2,651	7	25,920	579,840	15	69	585,864
		48	TRUCK	8	40.0	1920.0	1,180	3,202	391	5	1,473	1,325	7	12,960	289,920	7	34	292,932
		6	LAV	1	40.0	240.0	148	400	49	1	184	166	7	1,620	36,240	1	4	36,616
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	100																	

Table D.5-21 Emissions from Other Items During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
MAJOR TRAINING EVENTS																		
Joint Expeditionary Exercise	1	14.0	AAV	14	20.0	280.0	172	467	57	1	215	193	7	1,890	42,280	1	5	42,719
		13.0	LAV	13	20.0	260.0	160	434	53	1	199	179	7	1,755	39,260	1	5	39,668
		78.0	HMMWV	78	40.0	3120.0	1,918	5,204	635	8	2,393	2,154	7	21,060	471,120	12	56	476,014
		36.0	TRUCKS	36	40.0	1440.0	885	2,402	293	4	1,104	994	7	9,720	217,440	6	26	219,699
		2.0	DOZER	2	20.0	40.0	44	95	11	0	4	4	11	427	9,560	0	1	9,657
		6.0	FORKLIFT	6	20.0	120.0	27	43	6	0	2	2	2	292	6,528	0	1	6,591
		2.0	ROWPU	2	240.0	480.0	233	342	48	0	26	23	3	1,672	37,392	1	4	37,779
Joint Multi-Strike Group Exercise	1																	
Fleet Strike Group Exercise	0																	
Integrated Anti-Submarine Warfare Exercise	0																	
Maritime Homeland Defense / Security Mine Countermeasures	1																	
Marine Air Ground Task Force Exercise (Amphibious)	4	56.0	AAV	14	20.0	1120.0	689	1,868	228	3	859	773	7	7,560	169,120	4	20	170,877
		20.0	LAV	5	20.0	400.0	246	667	81	1	307	276	7	2,700	60,400	2	7	61,027
		312.0	HMMWV	78	40.0	12480.0	7,673	20,815	2,538	34	9,572	8,615	7	84,241	1,884,480	48	223	1,904,057
		144.0	TRUCKS	36	40.0	5760.0	3,541	9,607	1,172	16	4,418	3,976	7	38,881	869,760	22	103	878,795
		8.0	DOZER	2	20.0	160.0	177	382	46	0	16	14	11	1,709	38,240	1	4	38,628
		24.0	FORKLIFT	6	20.0	480.0	106	170	24	0	9	8	2	1,167	26,112	1	2	26,364
		8.0	ROWPU	2	240.0	1920.0	932	1,369	193	2	103	93	3	6,686	149,568	4	17	151,116
Special Purpose Marine Air Ground Task Force Exercise	2	6.0	AAV	3	20.0	120.0	74	200	24	0	92	83	7	810	18,120	0	2	18,308
		10.0	LAV	5	20.0	200.0	123	334	41	1	153	138	7	1,350	30,200	1	4	30,514
		32.0	HMMWV	16	40.0	1280.0	787	2,135	260	3	982	884	7	8,640	193,280	5	23	195,288
		16.0	TRUCKS	8	40.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
		2.0	DOZER	1	20.0	40.0	44	95	11	0	4	4	11	427	9,560	0	1	9,657
		4.0	FORKLIFT	2	20.0	80.0	18	28	4	0	1	1	2	195	4,352	0	0	4,394
		2.0	ROWPU	1	240.0	480.0	233	342	48	0	26	23	3	1,672	37,392	1	4	37,779

Table D.5-21 Emissions from Other Items During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Urban Warfare Exercise	5	15.0	AAV	3	28.0	420.0	258	701	85	1	322	290	7	2,835	63,420	2	8	64,079
		25.0	LAV	5	28.0	700.0	430	1,168	142	2	537	483	7	4,725	105,700	3	13	106,798
		80.0	HMMWV	16	56.0	4480.0	2,754	7,472	911	12	3,436	3,093	7	30,241	676,480	17	80	683,508
		40.0	TRUCKS	8	56.0	2240.0	1,377	3,736	456	6	1,718	1,546	7	15,120	338,240	9	40	341,754
		5.0	DOZER	1	28.0	140.0	155	334	40	0	14	13	11	1,496	33,460	1	4	33,800
		10.0	FORKLIFT	2	28.0	280.0	62	99	14	0	5	4	2	681	15,232	0	1	15,379
		5.0	ROWPU	1	336.0	1680.0	816	1,198	169	2	90	81	3	5,850	130,872	3	15	132,227
NAVAL SPECIAL WARFARE																		
Personnel I&E	240																	
Parachute Insertion	20																	
Embassy Reinforcement	50	200	HMMWV	4	12.0	2400.0	1,476	4,003	488	6	1,841	1,657	7	16,200	362,400	9	43	366,165
		100	TRUCK	2	12.0	1200.0	738	2,001	244	3	920	828	7	8,100	181,200	5	21	183,082
Direct Action (Combat Close Quarters)	72																	
Direct Action (Breaching)	72																	
Direct Action (TAC-P)	18																	
Underwater Demolition Qualifications	30																	
Intelligence, Surveillance, Reconnaissance	16																	
Urban Warfare Training	18	72	HMMWV	4	20.0	1440.0	885	2,402	293	4	1,104	994	7	9,720	217,440	6	26	219,699
		36	TRUCK	2	20.0	720.0	443	1,201	146	2	552	497	7	4,860	108,720	3	13	109,849
Underwater Survey	16																	
OTHER																		
Surface Ship Sonar Maintenance	42																	
Submarine Sonar Maintenance	48																	

Table D.5-21 Emissions from Other Items During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Small Boat Attack	18																	
Submarine Navigation	40																	
Precision Anchoring	18																	
Maneuver (Convoy, Land Navigation)	16	16	LAV	1	4.0	64.0	39	107	13	0	49	44	7	432	9,664	0	1	9,764
		64	HMMWV	4	4.0	256.0	157	427	52	1	196	177	7	1,728	38,656	1	5	39,058
		32	TRUCK	2	4.0	128.0	79	213	26	0	98	88	7	864	19,328	0	2	19,529
Water Purification	16	16	ROWPU	1	8.0	128.0	62	91	13	0	7	6	3	446	9,971	0	1	10,074
Field Training Exercise	100	1600	HMMWV	16	12.0	19200.0	11,804	32,024	3,905	52	14,726	13,254	7	129,602	2,899,200	74	344	2,929,318
		1200	TRUCK	12	12.0	14400.0	8,853	24,018	2,929	39	11,045	9,940	7	97,202	2,174,400	55	258	2,196,988
		800	Generator	8	48.0	38400.0	11,421	19,517	2,697	27	1,135	1,022	3	104,712	2,342,400	60	242	2,365,983
Force Protection	75	300	HMMWV	4	8.0	2400.0	1,476	4,003	488	6	1,841	1,657	7	16,200	362,400	9	43	366,165
		150	TRUCK	2	8.0	1200.0	738	2,001	244	3	920	828	7	8,100	181,200	5	21	183,082
		150	Generator	2	8.0	1200.0	357	610	84	1	35	32	3	3,272	73,200	2	8	73,937
Anti-Terrorism	80	320	HMMWV	4	4.0	1280.0	787	2,135	260	3	982	884	7	8,640	193,280	5	23	195,288
		160	TRUCK	2	4.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
Seize Airfield	12	36	HMMWV	3	4.0	144.0	89	240	29	0	110	99	7	972	21,744	1	3	21,970
		36	TRUCK	3	4.0	144.0	89	240	29	0	110	99	7	972	21,744	1	3	21,970
Airfield Expeditionary	12	12	Dozer	1	2.0	24.0	27	57	7	0	2	2	11	256	5,736	0	1	5,794
		72	Truck	6	4.0	288.0	177	480	59	1	221	199	7	1,944	43,488	1	5	43,940
		12	Crane	1	2.0	24.0	11	27	3	0	1	1	6	138	3,096	0	0	3,126
		12	Forklift	1	2.0	24.0	5	9	1	0	0	0	2	58	1,306	0	0	1,318
		12	Earth Mover	1	2.0	24.0	27	57	7	0	2	2	11	256	5,736	0	1	5,794
Unmanned Aerial Vehicle Operation	1000																	
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120	240	HMMWV	2	2.0	480.0	295	801	98	1	368	331	7	3,240	72,480	2	9	73,233
		120	TRUCK	1	2.0	240.0	148	400	49	1	184	166	7	1,620	36,240	1	4	36,616
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	236	472	HMMWV	2	2.0	944.0	580	1,574	192	3	724	652	7	6,372	142,544	4	17	144,025
		236	TRUCK	1	2.0	472.0	290	787	96	1	362	326	7	3,186	71,272	2	8	72,012

Table D.5-21 Emissions from Other Items During Training, Alternative 1

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
TOTAL TRAINING (lbs per year)							95,844	244,850	30,255	390	102,645	92,380		1,021,699	22,855,405	582	2,669	23,091,982
TOTAL TRAINING (tons per year)							48	122	15	0	51	46		1,021,699	11,428	0	1	11,546

Table D.5-22 Emissions from Other Items During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
AMPHIBIOUS WARFARE																		
Fire Support Exercise - Land-Based target	10																	
Amphibious Assault - Marine Air Ground Task Force	6	84	LAV	14	2.0	168.0	103	280	34	0	129	116	7	1,134	25,368	1	3	25,632
Amphibious Raid - Special Purpose Marine Air Ground Task Force	6	84	LAV	14	2.0	168.0	103	280	34	0	129	116	7	1,134	25,368	1	3	25,632
Urban Warfare Training	36	36	USMC-LAV	1	56.0	2016.0	1,239	3,362	410	5	1,546	1,392	7	13,608	304,416	8	36	307,578
		288	USMC-HMMWV	8	56.0	16128.0	9,915	26,900	3,280	44	12,370	11,133	7	108,866	2,435,328	62	289	2,460,627
		144	USMC-TRUCK	4	56.0	8064.0	4,958	13,450	1,640	22	6,185	5,567	7	54,433	1,217,664	31	144	1,230,314
		144	USAF-HMMWV	4	16.0	2304.0	1,416	3,843	469	6	1,767	1,590	7	15,552	347,904	9	41	351,518
		72	USAF-TRUCK	2	16.0	1152.0	708	1,921	234	3	884	795	7	7,776	173,952	4	21	175,759
		144	NAVY-HMMWV	4	16.0	2304.0	1,416	3,843	469	6	1,767	1,590	7	15,552	347,904	9	41	351,518
		72	NAVY-TRUCK	2	16.0	1152.0	708	1,921	234	3	884	795	7	7,776	173,952	4	21	175,759
		144	ARMY-HMMWV	4	16.0	2304.0	1,416	3,843	469	6	1,767	1,590	7	15,552	347,904	9	41	351,518
		72	ARMY-TRUCK	2	16.0	1152.0	708	1,921	234	3	884	795	7	7,776	173,952	4	21	175,759
Non-Combatant Evacuation Operation	6	96	HMMWV	16	40.0	3840.0	2,361	6,405	781	10	2,945	2,651	7	25,920	579,840	15	69	585,864
		48	TRUCK	8	40.0	1920.0	1,180	3,202	391	5	1,473	1,325	7	12,960	289,920	7	34	292,932
		6	LAV	1	40.0	240.0	148	400	49	1	184	166	7	1,620	36,240	1	4	36,616
Humanitarian Assistance/ Disaster Relief Operations	6	96	HMMWV	16	40.0	3840.0	2,361	6,405	781	10	2,945	2,651	7	25,920	579,840	15	69	585,864
		48	TRUCK	8	40.0	1920.0	1,180	3,202	391	5	1,473	1,325	7	12,960	289,920	7	34	292,932
		6	LAV	1	40.0	240.0	148	400	49	1	184	166	7	1,620	36,240	1	4	36,616
Unmanned Aerial Vehicle - Intelligence, Surveillance, and Reconaissance	100																	

Table D.5-22 Emissions from Other Items During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
MAJOR TRAINING EVENTS																		
Joint Expeditionary Exercise	1	14.0	AAV	14	20.0	280.0	172	467	57	1	215	193	7	1,890	42,280	1	5	42,719
		13.0	LAV	13	20.0	260.0	160	434	53	1	199	179	7	1,755	39,260	1	5	39,668
		78.0	HMMWV	78	40.0	3120.0	1,918	5,204	635	8	2,393	2,154	7	21,060	471,120	12	56	476,014
		36.0	TRUCKS	36	40.0	1440.0	885	2,402	293	4	1,104	994	7	9,720	217,440	6	26	219,699
		2.0	DOZER	2	20.0	40.0	44	95	11	0	4	4	11	427	9,560	0	1	9,657
		6.0	FORKLIFT	6	20.0	120.0	27	43	6	0	2	2	2	292	6,528	0	1	6,591
		2.0	ROWPU	2	240.0	480.0	233	342	48	0	26	23	3	1,672	37,392	1	4	37,779
Joint Multi-Strike Group Exercise	1																	
Fleet Strike Group Exercise	1																	
Integrated Anti-Submarine Warfare Exercise	1																	
Maritime Homeland Defense / Security Mine Countermeasures	1																	
Marine Air Ground Task Force Exercise (Amphibious)	4	56.0	AAV	14	20.0	1120.0	689	1,868	228	3	859	773	7	7,560	169,120	4	20	170,877
		20.0	LAV	5	20.0	400.0	246	667	81	1	307	276	7	2,700	60,400	2	7	61,027
		312.0	HMMWV	78	40.0	12480.0	7,673	20,815	2,538	34	9,572	8,615	7	84,241	1,884,480	48	223	1,904,057
		144.0	TRUCKS	36	40.0	5760.0	3,541	9,607	1,172	16	4,418	3,976	7	38,881	869,760	22	103	878,795
		8.0	DOZER	2	20.0	160.0	177	382	46	0	16	14	11	1,709	38,240	1	4	38,628
		24.0	FORKLIFT	6	20.0	480.0	106	170	24	0	9	8	2	1,167	26,112	1	2	26,364
		8.0	ROWPU	2	240.0	1920.0	932	1,369	193	2	103	93	3	6,686	149,568	4	17	151,116
Special Purpose Marine Air Ground Task Force Exercise	2	6.0	AAV	3	20.0	120.0	74	200	24	0	92	83	7	810	18,120	0	2	18,308
		10.0	LAV	5	20.0	200.0	123	334	41	1	153	138	7	1,350	30,200	1	4	30,514

Table D.5-22 Emissions from Other Items During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	$PM_{2.5}$	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	$CO_{2\text{-}e}$
		32.0	HMMWV	16	40.0	1280.0	787	2,135	260	3	982	884	7	8,640	193,280	5	23	195,288
		16.0	TRUCKS	8	40.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
		2.0	DOZER	1	20.0	40.0	44	95	11	0	4	4	11	427	9,560	0	1	9,657
		4.0	FORKLIFT	2	20.0	80.0	18	28	4	0	1	1	2	195	4,352	0	0	4,394
		2.0	ROWPU	1	240.0	480.0	233	342	48	0	26	23	3	1,672	37,392	1	4	37,779
Urban Warfare Exercise	5	15.0	AAV	3	28.0	420.0	258	701	85	1	322	290	7	2,835	63,420	2	8	64,079
		25.0	LAV	5	28.0	700.0	430	1,168	142	2	537	483	7	4,725	105,700	3	13	106,798
		80.0	HMMWV	16	56.0	4480.0	2,754	7,472	911	12	3,436	3,093	7	30,241	676,480	17	80	683,508
		40.0	TRUCKS	8	56.0	2240.0	1,377	3,736	456	6	1,718	1,546	7	15,120	338,240	9	40	341,754
		5.0	DOZER	1	28.0	140.0	155	334	40	0	14	13	11	1,496	33,460	1	4	33,800
		10.0	FORKLIFT	2	28.0	280.0	62	99	14	0	5	4	2	681	15,232	0	1	15,379
		5.0	ROWPU	1	336.0	1680.0	816	1,198	169	2	90	81	3	5,850	130,872	3	15	132,227
NAVAL SPECIAL WARFARE																		
Personnel I&E	240																	
Parachute Insertion	20																	
Embassy Reinforcement	50	200	HMMWV	4	12.0	2400.0	1,476	4,003	488	6	1,841	1,657	7	16,200	362,400	9	43	366,165
		100	TRUCK	2	12.0	1200.0	738	2,001	244	3	920	828	7	8,100	181,200	5	21	183,082
Direct Action (Combat Close Quarters)	72																	
Direct Action (Breaching)	72																	
Direct Action (TAC-P)	18																	
Underwater Demolition Qualifications	30																	
Intelligence, Surveillance, Reconnaissance	16																	
Urban Warfare Training	18	72	HMMWV	4	20.0	1440.0	885	2,402	293	4	1,104	994	7	9,720	217,440	6	26	219,699
		36	TRUCK	2	20.0	720.0	443	1,201	146	2	552	497	7	4,860	108,720	3	13	109,849
Underwater Survey	16																	

Table D.5-22 Emissions from Other Items During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
OTHER																		
Surface Ship Sonar Maintenance	42																	
Submarine Sonar Maintenance	48																	
Small Boat Attack	18																	
Submarine Navigation	40																	
Precision Anchoring	18																	
Maneuver (Convoy, Land Navigation)	16	16	LAV	1	4.0	64.0	39	107	13	0	49	44	7	432	9,664	0	1	9,764
		64	HMMWV	4	4.0	256.0	157	427	52	1	196	177	7	1,728	38,656	1	5	39,058
		32	TRUCK	2	4.0	128.0	79	213	26	0	98	88	7	864	19,328	0	2	19,529
Water Purification	16	16	ROWPU	1	8.0	128.0	62	91	13	0	7	6	3	446	9,971	0	1	10,074
Field Training Exercise	100	1600	HMMWV	16	12.0	19200.0	11,804	32,024	3,905	52	14,726	13,254	7	129,602	2,899,200	74	344	2,929,318
		1200	TRUCK	12	12.0	14400.0	8,853	24,018	2,929	39	11,045	9,940	7	97,202	2,174,400	55	258	2,196,988
		800	Generator	8	48.0	38400.0	11,421	19,517	2,697	27	1,135	1,022	3	104,712	2,342,400	60	242	2,365,983
Force Protection	75	300	HMMWV	4	8.0	2400.0	1,476	4,003	488	6	1,841	1,657	7	16,200	362,400	9	43	366,165
		150	TRUCK	2	8.0	1200.0	738	2,001	244	3	920	828	7	8,100	181,200	5	21	183,082
		150	Generator	2	8.0	1200.0	357	610	84	1	35	32	3	3,272	73,200	2	8	73,937
Anti-Terrorism	80	320	HMMWV	4	4.0	1280.0	787	2,135	260	3	982	884	7	8,640	193,280	5	23	195,288
		160	TRUCK	2	4.0	640.0	393	1,067	130	2	491	442	7	4,320	96,640	2	11	97,644
Seize Airfield	12	36	HMMWV	3	4.0	144.0	89	240	29	0	110	99	7	972	21,744	1	3	21,970
		36	TRUCK	3	4.0	144.0	89	240	29	0	110	99	7	972	21,744	1	3	21,970
Airfield Expeditionary	12	12	Dozer	1	2.0	24.0	27	57	7	0	2	2	11	256	5,736	0	1	5,794
		72	Truck	6	4.0	288.0	177	480	59	1	221	199	7	1,944	43,488	1	5	43,940
		12	Crane	1	2.0	24.0	11	27	3	0	1	1	6	138	3,096	0	0	3,126
		12	Forklift	1	2.0	24.0	5	9	1	0	0	0	2	58	1,306	0	0	1,318
		12	Earth Mover	1	2.0	24.0	27	57	7	0	2	2	11	256	5,736	0	1	5,794

Table D.5-22 Emissions from Other Items During Training, Alternative 2

Type of Training	Training Ops (#)	OPERATIONAL INFORMATION					Emissions, lb/year						Greenhouse Gas Emissions					
		Vehicles/Equipment			Range Time (hr)		State (0-3 nm offshore)											
		Number	Type	Participation	Per Vehicle/ Equipment	Total	CO	NO_x	HC	SO_x	PM_{10}	PM2.5	Fuel Flow (GPH)	Annual Fuel Consumption (gal)	CO_2	N_2O	CH_4	CO_{2-e}
Unmanned Aerial Vehicle Operation	1000																	
Land Demolitions (Improvised Explosive Device) Discovery / Disposal	120	240	HMMWV	2	2.0	480.0	295	801	98	1	368	331	7	3,240	72,480	2	9	73,233
		120	TRUCK	1	2.0	240.0	148	400	49	1	184	166	7	1,620	36,240	1	4	36,616
Land Demolitions (Unexploded Ordnance) Discovery / Disposal	236	472	HMMWV	2	2.0	944.0	580	1,574	192	3	724	652	7	6,372	142,544	4	17	144,025
		236	TRUCK	1	2.0	472.0	290	787	96	1	362	326	7	3,186	71,272	2	8	72,012
TOTAL TRAINING (lbs per year)							95,844	244,850	30,255	390	102,645	92,380		1,021,699	22,855,405	582	2,669	23,091,982
TOTAL TRAINING (tons per year)							48	122	15	0	51	46		1,021,699	11,428	0	1	11,546

Table D.5-23 Emissions in the Nonattainment Area of Guam, All Alternatives

Training Activities in Nonattainment Area	No Action Alternative, lbs per year						Alternative 1, lbs per year						Alternative 2, lbs per year					
	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5
AMW - Amp Assault																		
Vessels	11779	9588	1308	9629	1896	1706	17668	14381	1962	14444	2844	2560	17668	14381	1962	14444	2844	2560
Aircraft	21538	15204	3105	961	5585	5027	32307	22806	4658	1442	8378	7540	32307	22806	4658	1442	8378	7540
Ordnance																		
Others	69	187	23	0	86	77	103	280	34	0	129	116	103	280	34	0	129	116
AMW - Amp Raid																		
Vessels	118	696	88	2093	420	378	354	2087	265	6278	1260	1134	354	2087	265	6278	1260	1134
Aircraft	7179	5068	1035	320	1862	1676	21538	15204	3105	961	5585	5027	21538	15204	3105	961	5585	5027
Ordnance																		
Others	34	93	11	0	43	39	103	280	34	0	129	116	103	280	34	0	129	116
AMW - Urban WT																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	22554	28535	2592	1629	10375	9337	47762	60427	5489	3449	21971	19773	47762	60427	5489	3449	21971	19773
Ordnance																		
Others	10619	28808	3513	47	13248	11923	22487	61005	7440	99	28054	25248	22487	61005	7440	99	28054	25248
AMW - NEO																		
Vessels	7914	19700	1673	38129	7805	7024	19785	49250	4182	95323	19512	17560	19785	49250	4182	95323	19512	17560
Aircraft	11966	8447	1725	534	3103	2793	29914	21117	4313	1335	7758	6982	29914	21117	4313	1335	7758	6982
Ordnance																		
Others	1230	3336	407	5	1534	1381	3074	8340	1017	14	3835	3452	3074	8340	1017	14	3835	3452
AMW - HADR																		
Vessels	619	2136	170	4456	818	736	1546	5340	426	11140	2044	1840	1546	5340	426	11140	2044	1840
Aircraft	11966	8447	1725	534	3103	2793	29914	21117	4313	1335	7758	6982	29914	21117	4313	1335	7758	6982
Ordnance																		
Others	1230	3336	407	5	1534	1381	3074	8340	1017	14	3835	3452	3074	8340	1017	14	3835	3452
AMW - UAV/ISR																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	0	0	0	0	0	0	840	15536	264	1416	244	220	840	15536	264	1416	244	220
Ordnance																		
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASUW - MSO																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	180	184	16	12	121	109	1200	1229	106	77	806	726	1200	1229	106	77	806	726
Ordnance																		
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAJOR - Maritime Homeland																		
Vessels	0	0	0	0	0	0	3841	2500	372	515	138	124	3841	2500	372	515	138	124
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAJOR - SPMAGTF																		
Vessels	700	4128	525	12418	2493	2243	700	4128	525	12418	2493	2243	700	4128	525	12418	2493	2243
Aircraft	4364	2193	651	154	840	756	4364	2193	651	154	840	756	4364	2193	651	154	840	756
Ordnance																		
Others	1672	4202	519	7	1749	1574	1672	4202	519	7	1749	1574	1672	4202	519	7	1749	1574

Table D.5-23 Emissions in the Nonattainment Area of Guam, All Alternatives

Training Activities in Nonattainment Area	No Action Alternative, lbs per year						Alternative 1, lbs per year						Alternative 2, lbs per year					
	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5
MAJOR - Urban WT																		
Vessels	7421	43778	5563	131710	26437	23793	7421	43778	5563	131710	26437	23793	7421	43778	5563	131710	26437	23793
Aircraft	21818	10967	3254	772	4200	3780	21818	10967	3254	772	4200	3780	21818	10967	3254	772	4200	3780
Ordnance																		
Others	5853	14708	1818	23	6122	5510	5853	14708	1818	23	6122	5510	5853	14708	1818	23	6122	5510
MW - Limpet Mine																		
Vessels	0	0	0	0	0	0	54	1462	10	230	24	22	54	1462	10	230	24	22
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NSW - Insertion/Extraction																		
Vessels	2040	55910	93250	8640	900	810	3264	89455	149201	13824	1440	1296	3264	89455	149201	13824	1440	1296
Aircraft	89061	47455	12388	3379	28977	26079	142498	75928	19821	5407	46363	41726	142498	75928	19821	5407	46363	41726
Ordnance																		
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NSW - Parachute Insertion																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	1789	2369	285	132	1202	1082	2981	3948	475	221	2003	1803	2981	3948	475	221	2003	1803
Ordnance																		
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NSW - Embassy Reinforcement																		
Vessels	30492	66384	864	51960	4668	4201	30492	66384	864	51960	4668	4201	30492	66384	864	51960	4668	4201
Aircraft	12060	9588	468	576	9528	8575	12060	9588	468	576	9528	8575	12060	9588	468	576	9528	8575
Ordnance																		
Others	2213	6004	732	10	2761	2485	2213	6004	732	10	2761	2485	2213	6004	732	10	2761	2485
NSW - ISR																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NSW - Urban WT																		
Vessels	4241	25016	3179	75263	15107	13596	9541	56286	7152	169342	33990	30591	9541	56286	7152	169342	33990	30591
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		
Others	590	1601	195	3	736	663	1328	3603	439	6	1657	1491	1328	3603	439	6	1657	1491
NSW - Underwater Survey																		
Vessels	49	1338	1866	207	22	19	131	3567	4977	553	58	52	131	3567	4977	553	58	52
Aircraft	90	92	8	6	60	54	240	246	21	15	161	145	240	246	21	15	161	145
Ordnance																		
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other - Small Boat Attack																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		

Table D.5-23 Emissions in the Nonattainment Area of Guam, All Alternatives

Training Activities in Nonattainment Area	No Action Alternative, lbs per year						Alternative 1, lbs per year						Alternative 2, lbs per year					
	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5	CO	NO_x	VOC	SO_x	PM_{10}	PM2.5
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other - ROWPU																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		
Others	0	0	0	0	0	0	62	91	13	0	7	6	62	91	13	0	7	6
Other - Field Training Exercise																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		
Others	32078	75559	9531	118	26906	24216	32078	75559	9531	118	26906	24216	32078	75559	9531	118	26906	24216
Other - Force Protection																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		
Others	2570	6614	817	11	2797	2517	2570	6614	817	11	2797	2517	2570	6614	817	11	2797	2517
Other - AT																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	1200	1229	106	77	806	726	1200	1229	106	77	806	726	1200	1229	106	77	806	726
Ordnance																		
Others	1180	3202	391	5	1473	1325	1180	3202	391	5	1473	1325	1180	3202	391	5	1473	1325
Other - IED																		
Vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aircraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ordnance																		
Others	443	1201	146	2	552	497	443	1201	146	2	552	497	443	1201	146	2	552	497
Testing - BAMS																		
Vessels																		
Aircraft	2	39	1	4	1	1	21	388	7	35	6	5	23	427	7	39	7	6
Ordnance																		
Others																		
TOTAL NONATTAINMENT EMISSIONS (LBS/YEAR)	330919	517340	154357	343831	189869	170882	519695	793969	246498	525318	291320	262188	519697	794008	246499	525321	291320	262188
TOTAL NONATTAINMENT EMISSIONS (TONS/YEAR)	165	259	77	172	95	85	260	397	123	263	146	131	260	397	123	263	146	131