3.6 Birds

Supplemental Environmental Impact Statement/

Overseas Environmental Impact Statement

Northwest Training and Testing

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3.6 Birds

This section analyzes potential impacts on birds (e.g., seabirds, shorebirds, upland terrestrial birds) found in the Northwest Training and Testing (NWTT) Study Area. For purposes of this Supplemental Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (Supplemental), the Study Area for birds remains the same as that identified in the 2015 NWTT Final EIS/OEIS, which for birds includes the Offshore Area; Inland Waters; and Western Behm Canal, Alaska. Section 2.1 (Description of the Northwest Training and Testing Study Area) provides detailed descriptions of these areas. Similar to the 2015 NWTT Final EIS/OEIS, this section provides an overview of the species, distribution, and occurrence of birds that are either resident or migratory through the Study Area, as well as new information released since the publication of the 2015 Final EIS/OEIS.

Section 3.6.2 (Environmental Consequences) of this Supplemental analyzes potential impacts of the Proposed Action on birds in the Study Area and summarizes the combined impacts on these birds and determinations under the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act.

3.6.1 Affected Environment

As presented in the 2015 NWTT Final EIS/OEIS, the habitat found within the Study Area supports a wide diversity of resident and migratory seabirds, shorebirds, waterfowl, passerines, and raptors. Descriptions of the climate, productivity, and oceanographic conditions were presented in the 2015 NWTT Final EIS/OEIS and are summarized below for each major component of the Study Area:

- Offshore Area. As described in Section 2.1.1 (Description of the Offshore Area) of the 2015 NWTT Final EIS/OEIS, the Olympic Military Operations Area (MOA) overlays both land and sea (extending to 3 Nautical Miles [NM] off the Washington coast). The MOA lower limit is 6,000 feet (ft.) above mean sea level but not below 1,200 ft. above ground level at the higher terrain elevations of the mountains, and the upper limit is up to but not including 18,000 ft. above mean sea level. Above the Olympic MOA is the Olympic Air Traffic Control Assigned Airspace (ATCAA), which starts at 18,000 ft. The ATCAA has an upper limit of 35,000 ft. The Washington coastline within the Offshore Area contains numerous bays and inlets that provide sheltered waters for wintering waterfowl and seabirds, including ducks, gulls, and shorebirds. Along the coastline, winter bird populations are generally three times higher than the summer populations, which mostly include gulls and alcids (Calambokidis & Steiger, 1990; Falxa & Raphael, 2016). For the purposes of this Supplemental, the Offshore Area also includes the inland terrestrial areas underlying the Olympic MOA. The Offshore Area contains important nesting and foraging areas for resident and migrating birds.
- Inland Waters. The shorelines of the inland estuaries are generally rocky, with small beaches at the mouths of streams and rivers. Extensive mudflats associated with river deltas support large populations of shorebirds and waterfowl in the winter (Nysewander et al., 2005; Ward et al., 2015). The numerous bays and inlets provide sheltered waters for wintering waterfowl, shorebirds, and seabirds. The beaches and mudflats within Puget Sound are an important stopover and wintering habitat for numerous migratory birds.
- Western Behm Canal, Alaska. Similar to the Inland Waters of Washington, Behm Canal, which surrounds Revillagigedo Island, supports large populations of shorebirds and seabirds. Extensive mudflats associated with river deltas support seasonally large populations of shorebirds and waterfowl (Ames et al., 2000). About 200 marine and coastal bird species are common to the

southeast Alaska portion of the Study Area. Loons, grebes, cormorants, sea ducks, bald eagles, gulls, and alcids are year-round residents of the region.

The 2015 NWTT Final EIS/OEIS lists representative bird species known to occur or anticipated to occur within the Study Area. The information regarding these species' presence or absence in the Study Area has not changed since the publication of the 2015 NWTT Final EIS/OEIS. Although the species list presented in the 2015 Final EIS/OEIS remains valid, the list has been updated in this Supplemental to reflect additional species that may occur within the Study Area.

Three ESA-listed bird species may occur within the Study Area (Table 3.6-1): marbled murrelet (*Brachyramphus marmoratus*), short-tailed albatross (*Phoebastria albatrus*), and northern spotted owl (*Strix occidentalis caurina*). The short-tailed albatross is listed as endangered throughout its range. The marbled murrelet is listed as threatened in Washington, Oregon, and California; it is not an ESA-listed species in Alaska. The northern spotted owl is listed as threatened throughout its range. Any updated information on these species in regards to regulatory status and life history information is included in the species-specific discussions below.

Table 3.6-1: Status and Presence of ESA-listed Bird Species and Their Critical Habitat That May Occur in the Northwest Training and Testing Study Area

Species and Regulatory Status		Presence in the Study Area			
Common Name (Scientific Name)	**ESA Status**	**Critical Habitat**	**Offshore Area[1]**	**Inland Waters**	**Western Behm Canal[2]**
Marbled murrelet (*Brachyramphus marmoratus*)	Threatened	Coastal and under the Olympic MOA[3]	✓	✓	✓
Short-tailed albatross (*Phoebastria albatrus*)	Endangered	None designated in Study Area	✓		
Northern spotted owl (*Strix occidentalis caurina*)	Threatened	Under the Olympic MOA[3]	✓		

Notes:
[1]The Olympic MOA overlies both land and sea (extending to 3 NM off the Washington coast), and include areas above 6,000 ft. MSL but not below 1,200 ft. above ground level at the higher terrain elevations of the mountains.
[2]The marbled murrelet is not ESA-listed in Alaska; it is listed as threatened in Washington, Oregon, and California.
[3]Potential overlap in coastal and inland areas beneath the Olympic MOA.

Although the northern spotted owl occurs within the Study Area, the majority of proposed activities would occur within the marine environment well offshore of terrestrial habitat that would support spotted owls. Since the publication of the 2015 NWTT Final EIS/OEIS, there have been no updates to the regulatory status, life history information, or species-specific threats that would alter the analysis from the 2015 NWTT Final EIS/OEIS. In addition, while the current Proposed Action includes aircraft overflights of spotted owl habitat underlying the Olympic MOA, these aircraft overflights are not expected to adversely affect spotted owls. The 2016 Biological Opinions (BO) issued by the United States Fish and Wildlife Service (USFWS) determined that the response of northern spotted owls to aircraft overflights conducting training missions in the airspace over the Olympic Peninsula would not result in flushing or failed attempts by adults to feed nestlings, and determined that the effects would be considered insignificant (U.S. Fish and Wildlife Service, 2016, 2018). The BO conclusions were based on the altitude of aircraft overflights and not number or frequency of overflights. Both BOs concluded that the proposed aircraft operations may affect, but would not adversely affect, northern spotted owls in the Study Area. The altitude of proposed aircraft operations over the Olympic Peninsula would not change under the current Proposed Action and there are no other changes to the Proposed Action that would affect these conclusions. Therefore, the analysis and effects determination for the northern spotted owl from the 2016 and 2018 BOs remain valid.

3.6.1.1 Overview of Birds within the Study Area

Twelve major taxonomic groups (orders) of birds represented in the Study Area may be impacted by NWTT activities. Birds may be found in air, at the water's surface, or within the water column of the Study Area. The birds within the Study Area are divided into six categories, based loosely on their geographic distribution and feeding habits: seabirds, shorebirds, wading birds, waterfowl, landbirds, and raptors. Landbirds, represented by passerines in the order Passeriformes, are an additional category since 2015 and include the common perching birds such as sparrows, jays, chickadees, and thrushes. Raptors are also an additional category since 2015 and include hawks, bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), and owls. These birds of prey inhabit forests and wetlands, with some species (e.g., bald eagle and osprey) associated with aquatic habitats throughout the Study Area in the Offshore Area, Inland Waters, and Western Behm Canal, Alaska (Table 3.6-2 of the 2015 Final NWTT EIS/OEIS has been verified by updated references (American Ornithological Society, 2019; Sibley, 2014).

The distribution of each group within the Study Area is presented in Table 3.6-3 of the 2015 NWTT Final EIS/OEIS. Table 3.6-2 of this Supplemental (a new table) lists additional species that have new science to support their occurrence in additional areas identified since the Navy's 2015 NWTT Final EIS/OEIS.

3.6.1.1.1 Group Size

The Navy conducted a literature search for new information since the publication of the 2015 NWTT Final EIS/OEIS on group size that may change the analysis of potential impacts on birds. No new information is available on group size that would alter the analysis from the 2015 NWTT Final EIS/OEIS. As such, the description regarding group size presented in the 2015 NWTT Final EIS/OEIS remains valid. A summary of group size information for bird groups and specific species is included below.

A variety of group sizes and diversity may be encountered throughout the Study Area, ranging from migration of an individual bird to large concentrations of mixed-species flocks. Depending on season, location, and time of day, the number of birds observed (group size) will vary and will likely fluctuate from year to year. During spring and fall periods, diurnal and nocturnal migrants would likely occur in large groups as they migrate over open water.

Most seabird species nest in groups (colonies) on the ground of coastal areas or oceanic islands, where breeding colonies number from a few individuals to thousands (U.S. Geological Survey, 2016). Outside of the breeding season, most seabirds within the order Procellariformes are solitary, though they may join mixed-species flocks while foraging and can be associated with whales and dolphins (Onley & Scofield, 2007) or areas where prey density is high (U.S. Fish and Wildlife Service, 2005a). During the breeding season, these seabirds usually form large nesting colonies. Similarly, birds within the order Pelecaniformes are typically colonial and foraging occurs either singly or in small groups. However, in the order Charadriiformes, foraging can range from singles or pairs (e.g., family Alcidae) (Lorenz et al., 2016; U.S. Fish and Wildlife Service, 2017) and can extend upward into larger groups (e.g., family Laridae) in which juveniles accompany adults to post-breeding foraging areas.

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Order PROCELLARIIFORMES						
Family DIOMEDEIDAE	Short-tailed albatross	*Phoebastria albatrus*			X	
	Laysan albatross	*Phoebastria immutabilis*			X	
	Black-footed albatross*	*Phoebastria nigripes*		X*	X	X*
Family PROCELLARIIDAE	Northern fulmar	*Fulmarus glacialis*			X	
	Pink-footed shearwater	*Puffinus creatopus*			X	
	Flesh-footed shearwater	*Puffinus carneipes*			X	
	Manx shearwater	*Puffinus puffinus*		X	X	
	Buller's shearwater	*Puffinus bulleri*			X	
	Sooty shearwater	*Puffinus griseus*		X	X	
	Short-tailed shearwater	*Puffinus tenuirostris*			X	
Family HYDROBATIDAE	Fork-tailed storm-petrel	*Oceanodroma furcata*		X	X	X
	Leach's storm-petrel	*Oceanodroma leucorhoa*		X	X	
Order PELECANIFORMES						
Family PELECANIDAE	Brown pelican	*Pelecanus occidentalis*	X	X		
Family PHALACROCORACIDAE	Brandt's cormorant	*Phalacrocorax penicillatus*	X	X		X
	Double-crested cormorant	*Phalacrocorax auritus*	X	X		X
	Pelagic cormorant	*Phalacrocorax pelagicus*	X	X		X
Order CICONIIFORMES						
Family ARDEIDAE	Great blue heron*	*Ardea herodias*	X	X*	X*	X
	American bittern*	*Botaurus lentiginosus*	X	X*		X*
Order PASSERIFORMES						
Family ALAUDIDAE	Streaked horned lark*	*Eremophila alpestris strigata*	X	X		
Family CORVIDAE	Steller's jay*	*Cyanocitta stelleri*	X	X		
Family PARIDAE	Black-capped chickadee*	*Poecile atricapillus*	X	X		
Family TYRANNIDAE	Olive-sided flycatcher*	*Contopus cooperi*	X	X		
Family TURDIDAE	Varied thrush*	*Ixoreus naevius*	X	X		
Family EMBERIZIDAE	Spotted towhee*	*Pipilo maculatus*	X	X		
	Dark-eyed junco*	*Junco hyemalis*	X	X		
Family ICTERIDAE	Western meadowlark*	*Sturnella neglecta*	X	X		

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Order CICONIIFORMES						
Family ARDEIDAE	Great blue heron*	*Ardea herodias*	X	X*	X*	X
	American bittern*	*Botaurus lentiginosus*	X	X*		X*
Order CHARADRIIFORMES						
Family LARIDAE	Bonaparte's gull	*Larus philadelphia*	X	X		X
	Heermann's gull	*Larus heermanni*	X	X		
	Mew gull	*Larus canus*	X	X		X
	Ring-billed gull	*Larus delawarensis*	X	X		X
	California gull	*Larus californicus*	X	X	X	X
	Herring gull	*Larus argentatus*	X	X		X
	Thayer's gull	*Larus thayeri*	X	X	X	X
	Western gull	*Larus occidentalis*	X	X		
	Glaucous-winged gull	*Larus glaucescens*	X	X		X
	Glaucous gull	*Larus hyperboreus*	X	X		X
	Red-legged kittiwake	*Rissa brevirostris*		X	X	
	Sabine's gull	*Xema sabini*		X	X	
	Black-legged kittiwake	*Rissa tridactyla*		X	X	X
	Caspian tern	*Hydroprogne caspia*	X	X		X
	Common tern	*Sterna hirundo*	X	X		
	Arctic tern*	*Sterna paradisaea*	X*	X*	X	
	Aleutian tern*	*Sterna aleutica*				X*
	Red phalarope	*Phalaropus fulicarius*		X	X	
	Red-necked phalarope	*Phalaropus lobatus*	X	X	X	X
Family STERCORARIIDAE	Pomarine jaeger	*Stercorarius pomarinus*			X	
	Parasitic jaeger	*Stercorarius parasiticus*	X	X	X	X
	Long-tailed jaeger	*Stercorarius longicaudus*			X	
	South polar skua	*Stercorarius maccormicki*			X	

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Family ALCIDAE	Common murre	*Uria aalge*	X	X	X	X
	Thick-billed murre*	*Uria lomvia*	X*	X*		X
	Pigeon guillemot	*Cepphus columba*	X	X		X
	Kittlitz's murrelet	*Brachyramphus brevirostris*				X
	Marbled murrelet	*Brachyramphus marmoratus*	X	X	X	X
	Xantus's murrelet*	*Synthliboramphus hypoleucus*		X*	X	
	Ancient murrelet	*Synthliboramphus antiquus*	X	X	X	X
	Cassin's auklet*	*Ptychoramphus aleuticus*	X*	X	X	X*
	Parakeet auklet	*Aethia psittacula*			X	
	Rhinoceros auklet	*Cerorhinca monocerata*	X	X	X	X
	Horned puffin*	*Fratercula corniculata*	X*	X*	X	X*
	Tufted puffin	*Fratercula cirrhata*	X	X	X	X
Family SCOLOPACIDAE	Surfbird	*Aphriza virgata*	X	X		X
	Western sandpiper	*Calidris mauri*	X	X		X
	Spotted sandpiper	*Actitis macularia*	X	X		X
	Least sandpiper	*Calidris minutilla*	X	X		X
	Rock sandpiper	*Calidris ptilocnemis*	X	X		X
	Red knot	*Calidris canutus*	X	X		X
	Short-billed dowitcher	*Limnodromus griseus*	X	X		X
	Ruddy turnstone	*Arenaria interpres*	X	X		X
	Sanderling	*Calidris alba*	X	X		X
	Wandering tattler	*Tringa incana*	X	X		X
	Greater yellowlegs	*Tringa melanoleuca*	X	X		X
	Solitary sandpiper	*Tringa solitaria*	X	X		X
	Lesser yellowlegs	*Tringa flavipes*	X	X		X
	Whimbrel	*Numenius phaeopus*	X	X		X
	Black turnstone	*Arenaria melanocephala*	X	X		X
	Semipalmated sandpiper	*Calidris pusilla*	X	X		X
	Baird's sandpiper	*Calidris bairdii*	X	X		X

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Family SCOLOPACIDAE	Pectoral sandpiper	*Calidris melanotos*	X	X		X
	Dunlin	*Calidris alpina*	X	X		X
	Stilt sandpiper	*Calidris himantopus*	X			
	Ruff	*Philomachus pugnax*	X	X		
	Marbled godwit	*Limosa fedoa*	X	X		X
	Long-billed dowitcher	*Limnodromus scolopaceus*	X	X		X
	Wilson's snipe	*Gallinago delicata*	X	X		X
Family CHARADRIIDAE	Black-bellied plover	*Pluvialis squatarola*	X	X		X
	Semipalmated plover	*Charadrius semipalmatus*	X	X		X
	Killdeer	*Charadrius vociferus*	X	X		X
	Western snowy plover	*Charadrius nivosus*				
	American golden plover	*Pluvialis dominica*	X	X		
	Pacific golden plover	*Pluvialis fulva*	X	X		X
Family HAEMATOPODIDAE	Black oystercatcher	*Haematopus bachmani*	X	X		X
Family RECURVIROSTRIDAE	Black-necked stilt*	*Himantopus mexicanus*	X	X*		
Order GAVIIFORMES						
Family GAVIIDAE	Yellow-billed loon	*Gavia adamsii*	X	X		X
	Common loon	*Gavia immer*	X	X		X
	Pacific loon	*Gavia pacifica*	X	X		X
	Red-throated loon	*Gavia stellata*	X	X		X
Order GRUIFORMES						
Family RALLIDAE	American coot	*Fulica americana*	X	X		X
	Sora	*Porzana carolina*	X	X		
	Virginia rail	*Rallus limicola*	X	X		
Order PODICIPEDIFORMES						
Family PODICIPEDIDAE	Pied-billed grebe	*Podilymbus podiceps*	X	X		X
	Western grebe	*Aechmophorus occidentalis*	X	X		X
	Horned grebe	*Podiceps auritus*	X	X		X
	Red-necked grebe	*Podiceps grisegena*	X	X	X	X
	Eared grebe	*Podiceps nigricollis*	X	X		
	Clark's grebe	*Aechmophorus clarkii*	X	X		

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Order ANSERIFORMES						
Family ANATIDAE	Wood duck*	*Aix sponsa*	X	X*		X*
	Northern pintail	*Anas acuta*	X			X
	Green-winged teal	*Anas crecca*	X			X
	Mallard*	*Anas platyrhynchos*	X	X*	X	X
	Greater scaup	*Aythya marila*	X	X		X
	Canvasback*	*Aythya valisineria*	X	X*		
	Bufflehead*	*Bucephala albeola*	X	X*		X
	Long-tailed duck	*Clangula hyemalis*	X	X		X
	Harlequin duck	*Histrionicus histrionicus*	X	X		X
	White-winged scoter	*Melanitta deglandi*	X	X		X
	Black scoter	*Melanitta americana*	X	X		X
	Surf scoter	*Melanitta perspicillata*	X	X		X
	Common merganser*	*Mergus merganser*	X	X*		X
	Red-breasted merganser	*Mergus serrator*	X	X		X
	Ruddy duck	*Oxyura jamaicensis*	X			
	Gadwall	*Mareca strepera*	X			X
	Eurasian widgeon	*Mareca penelope*	X			X
	American widgeon	*Mareca americana*	X			X
	Blue-winged teal	*Spatula discors*	X	X		X
	Cinnamon teal	*Spatula cyanoptera*	X			
	Northern shoveler	*Spatula clypeata*	X			X
	Redhead	*Aythya americana*	X			
	Ring-necked duck	*Aythya collaris*	X			X
	Lesser scaup	*Aythya affinis*	X			X
	Common goldeneye	*Bucephala clangula*	X	X		X
	Barrow's goldeneye	*Bucephala islandica*	X			X
	Hooded merganser	*Lophodytes cucullatus*	X	X*		X
	Snow goose*	*Anser caerulescens*				
	Greater white-fronted goose	*Anser albifrons*	X	X		

Table 3.6-2: Representative Birds of the Northwest Training and Testing Study Area (continued)

Order/Family	Common Name	Scientific Name	Location within Study Area			
			Inland Waters	Offshore Area (coastal/inland)	Offshore Area (pelagic)	Western Behm Canal
Family ANATIDAE	Trumpeter swan*	*Cygnus buccinator*	X	X*		X
	Tundra swan*	*Cygnus columbianus*	X	X*		
	Canada goose*	*Branta canadensis*	X	X*		X
	Brant*	*Branta bernicla*	X*	X*		X*
Order ACCIPITRIFORMES						
Family ACCIPITRIDAE	Bald eagle*	*Haliaeetus leucocephalus*	X			X
	Sharp-shinned hawk*	*Accipiter striatus*	X			X
	Red-tailed hawk*	*Buteo jamaicensis*	X			X
Family PANDIONIDAE	Osprey*	*Pandion haliaetus*	X			X
Order FALCONIFORMES						
Family FALCONIDAE	American kestrel*	*Falco sparverius*	X			X
	Merlin*	*Falco columbarius*	X			X
	Peregrine falcon*	*Falco peregrinus*	X			X
Order STRIGIFORMES						
Family TYTONIDAE	Barn owl*	*Tyto alba*		X		
Family STRIGIDAE	Great horned owl*	*Bubo virginianus*		X		X
	Northern spotted owl*	*Strix occidentalis caurina*		X		
	Barred owl*	*Strix varia*		X		X
	Northern saw-whet owl*	*Aegolius acadicus*		X		X
	Western screech owl*	*Megascops kennicottii*		X		X
	Northern pygmy owl	*Glaucidium californicum*		X		X

Note: The list of species has been adapted from the 2015 NWTT Final EIS/OEIS with additions (marked with an asterisk [*]) based on suggestions by subject matter experts. The list is not comprehensive of all bird species that occur within the Study Area; rather, it includes representative species of the orders and families of birds that are most likely present in the Study Area.

3.6.1.1.2 Diving Information

Since the publication of the 2015 NWTT Final EIS/OEIS, the Navy conducted a literature search for new information on dive behavior that may change the analysis of potential impacts on birds. No new information is available on dive behavior that would alter the analysis from the 2015 NWTT Final EIS/OEIS. As such, the additional description regarding dive behavior presented in the 2015 NWTT Final EIS/OEIS remains valid. A summary of diving information for bird groups and specific species is included below.

Many of the seabird species found in the Study Area will dive, skim, or grasp prey at the water's surface or within the upper portion (3–6 ft.) of the water column (Cook et al., 2011; Jiménez et al., 2012; Sibley, 2014). Foraging strategies are species specific, such as plunge-diving or pursuit-diving. Plunge-diving, as used 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 (Hansen et al., 2017). Dive durations are correlated with depth and range from a few seconds in shallow divers to several minutes in alcids (Ponganis, 2015). In general, tern species do not usually dive deeper than 3 ft. Pursuit divers, a common foraging strategy of birds such as murrelets and shearwaters, usually float on the water and dive under to pursue fish and other prey. They most commonly eat fish, squid, and crustaceans (Burger et al., 2004). Marbled murrelets forage by pursuit-diving in relatively shallow waters, usually <30 meters (m) in depth, but are assumed to be capable of diving to a depth of 47 m (U.S. Fish and Wildlife Service, 2016).

3.6.1.1.3 Flight Altitudes

While foraging birds will be present near the water surface, migrating birds may fly at various altitudes. Flight altitudes for birds have traditionally been estimated from on the ground (or boat) observations, or from planes; however, flight altitude information increasingly relies on radar studies and telemetry techniques, where the bird's measured altitude is subtracted from the ground elevation (Poessel et al., 2018). Jongbloed (2016) completed a literature review to determine flight height of marine birds to assess potential risks from wind turbine collisions. This review found that most seabird species fly beneath the rotor blade altitudes of offshore wind turbines, which reduces the risk for collision. 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 high enough (5,800 ft.) that they are barely visible through binoculars (Lincoln et al., 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. and 1,000 ft. Radar studies have demonstrated that 95 percent of the migratory movements occur at less than 10,000 ft., with the bulk of the movements occurring under 3,000 ft. (Lincoln et al., 1998). Weather factors may also influence flight heights. Tarroux et al. (2016) examined the flying tactics of Antarctic petrels (*Thalassoica antarctica*) revealing the flexibility of flight strategies. Birds tend to fly higher with favorable wind conditions and fly near ground level during strong winds. Birds were found to adjust their speed and heading during stronger winds to limit drift; however, they were able to tolerate a limited amount of drift. This was also found by Stumpf et al. (2011) for marbled murrelets using radar to quantify flight heights off of the Olympic Peninsula and by Sanzenbacher et al. (2014) off of Northern California. In summary, most marine birds can be expected to fly relatively close to the surface, but may range upwards in altitude depending on a number of factors such as wind speed and direction, precipitation avoidance, time of day or night, foraging behaviors, migration, and distance to coast.

3.6.1.1.4 Distance from Shore

Pelagic ranges, as a function of distance from shore, can range widely for different species and by season. Much of the recent research regarding abundance and distribution as a function of distance from shore for marine birds was conducted to better understand potential impacts on marine birds from offshore energy development. Spiegel et al. (2017) tracked the movements of over 400 individuals of three species (northern gannet [*Morus bassanus*], red-throated loon [*Gavia stellata*], and surf scoter [*Melanitta perspicillata*]) over the course of 5 years off of the mid-Atlantic coast. In general, all three species exhibited a largely near-shore, coastal, or in-shore distribution. Habitat use was concentrated in or around large bays, with the most extensive use at bay mouths. Northern gannets ranged much farther offshore than the other two species and covered a much larger area (including instances of individuals using both the Gulf of Mexico and the mid-Atlantic within a single season). Spiegel et al. (2017) determined that the differences among species distributions were likely due to differences in motility and distribution of their preferred prey.

Pelagic surveys off the coast of Washington were conducted in September–November of 2016, 2017, and 2018 and during January – beginning of April of 2019 (Pearson, 2019). Transects extended out to 38–43 NM from shore. During those surveys 88,110 birds representing 59 species were detected. Common murres (*Uria aalge*), pink-footed shearwaters (*Puffinus creatopus*), northern fulmars (*Fulmarus glacialis*), sooty shearwaters (*Puffinus griseus*), and rhinoceros auklets (*Cerorhinca monocerata*) were the dominate species detected. Storm-petrels, albatross, and Scripps's murrelets (*Synthliboramphus scrippsi*) were found >30 NM from shore; fulmars, skuas, phalaropes, shearwaters, and most alcids were found between 16 and 27 NM from shore; and loons, scoters, cormorants, brown pelican (*Pelecanus occidentalis*), and marbled murrelet were found within 11 NM of shore (Pearson, 2019).

In summary, marine bird distance from shore can depend on a variety of factors, such as physiological abilities of a particular species to tolerate long distance and duration flights, mobility of prey, and seasonal variations in ranges.

3.6.1.1.5 Hearing and Vocalization

The Navy conducted a literature search for new information since the publication of the 2015 NWTT Final EIS/OEIS on bird hearing and vocalizations that may change the analysis of potential impacts on birds. New information regarding hearing sensitivities of waterbirds, including various duck species, is summarized below, along with recent publications that show differences in hearing sensitivities between freshwater divers and ocean pelagic birds. This information is summarized below with an overview of the most current best available science regarding bird hearing and vocalization.

3.6.1.1.5.1 Airborne Hearing in Seabirds

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 air. A review of 32 terrestrial and marine species indicates that birds generally have greatest hearing sensitivity between 1 and 4 kilohertz (kHz) (Beason, 2004; Dooling, 2002). 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, 2002; Dooling & Popper, 2000). Hearing capabilities have been studied for only a few seabirds (Beason, 2004; Beuter et al., 1986; Crowell et al., 2015; Johansen et al., 2016; Larsen et al., 2020; Mooney et al., 2019; Thiessen, 1958; Wever et al., 1969); these studies show that seabird hearing ranges and sensitivity in air are consistent with what is known about bird hearing in general.

Auditory abilities have been measured in 10 diving bird species in-air using electrophysiological techniques (Crowell et al., 2015; Maxwell et al., 2017). All species tested had the best hearing sensitivity from 1 to 3 kHz. The red-throated loon and northern gannet (both non-duck species) had the highest thresholds while the lesser scaup (*Aythya affinis*) and ruddy duck (*Oxyura jamaicensis*) (both duck species) had the lowest thresholds (Crowell et al., 2015). Auditory sensitivity varied amongst the species tested, spanning over 30 decibels (dB) in the frequency range of best hearing. While electrophysiological techniques provide insight into hearing abilities, auditory sensitivity is more accurately obtained using behavioral techniques. Crowell et al. (2016) used behavioral methods to obtain an in-air audiogram of the lesser scaup. Hearing frequency range in air was similar to other birds, with best sensitivity at 2.86 kHz with a threshold of 14 dB referenced to 20 micropascals (re 20 µPa). Maxwell et al. (2017) obtained the behavioral in-air audiogram of a great cormorant (*Phalacrocorax carbo*), and the most sensitive hearing was 18 dB re 20 µPa at 2 kHz.

Crowell et al. (2015) also compared the vocalizations of the same 10 diving bird species to the region of highest sensitivity of in-air hearing. Of the birds studied, vocalizations of only eight species were obtained due to the relatively silent nature of two species. The peak frequency of the vocalizations of seven of the eight species fell within the range of highest sensitivity of in-air hearing. Crowell et al. (2015) suggested that the colonial nesters tested had relatively reduced hearing sensitivity because they relied on individually distinctive vocalizations over short ranges. Additionally, they observed that the species with more sensitive hearing were those associated with freshwater habitats, which are relatively quieter compared to marine habitats with wind and wave noise.

3.6.1.1.5.2 Underwater Hearing in Seabirds

Little is known about the hearing abilities of birds underwater (Dooling & Therrien, 2012). In air, the size of the bird is usually correlated with the sensitivity to sound (Johansen et al., 2016); for example, songbirds tend to be more sensitive to higher frequencies and larger non-songbirds tend to be more sensitive to lower frequencies (Dooling & Popper, 2000). Two studies have tested the ability of a diving bird, a great cormorant, to respond to underwater sounds (Hansen et al., 2017; Johansen et al., 2016). These studies suggests that the cormorant's hearing in air is less sensitive than birds of similar size; however, the hearing capabilities in water are better than what would be expected for a purely in-air adapted ear (Johansen et al., 2016). The frequency range of best hearing underwater was observed to be narrower than the frequency range of best hearing in air, with greatest sensitivity underwater observed around 2 kHz (about 71 dB re 1 µPa based on behavioral responses). Although results were not sufficient to be used to generate an audiogram, Therrien (2014) also examined underwater hearing sensitivity of long-tailed ducks (*Clangula hyemalis*) by measuring behavioral responses. The research showed that auditory thresholds at frequencies within the expected range of best sensitivity (1, 2, and 2.86 kHz) are expected to be between 77 and 127 dB re 1 µPa.

Maxwell et al. (2017) obtained the behavioral in-air audiogram of a great cormorant, and the most sensitive hearing was 18 dB re 20 µPa at 2 kHz. More recently, Larsen et al. (2020) measured auditory evoked potentials and eardrum movement in anesthetized, wild-caught, fledgling great cormorants both in air and underwater. The best average sensitivity was at 1 kHz in both media, where the thresholds were 53 dB re 20 µPa (air) and 84 dB re 1 µPa (water). Statistical analysis showed no difference between sound pressure thresholds in air and underwater, as well as no frequency-medium interaction. The authors suggest that cormorants have anatomical adaptations for underwater hearing; however, the average underwater audiogram obtained in this study does not necessarily support well-developed aquatic hearing. Furthermore, a behavioral audiogram of a single adult great cormorant suggests that absolute thresholds are lower than found by Larsen and colleagues, and shows a best frequency of 2 kHz (Hansen et al., 2017). The differences in audiogram methodology (behavioral vs. auditory evoked potential), life stage (adult vs. fledgling), and arousal state (anesthetized vs. awake), obscure the source of discrepancy between these two studies. The authors suggest additional behavioral (psychophysical) measurements in more individuals.

Mooney et al. (2019) measured auditory brainstem responses (ABRs) from one anesthetized, wild-caught Atlantic puffin (*Fratercula arctica*) and found a hearing range of 0.5–6 kHz, with the best sensitivity in the 1–2 kHz range. That study also measured ABRs from one common murre and found a hearing range of 1–4 kHz, with the best sensitivity at 1 kHz. However, Mooney et al. (2019) were unable to measure ABR responses at 3 kHz for the common murre. Hansen et al. (2020) conducted a series of playback experiments to test whether common murres responded to, and were disrupted by, underwater sound. Underwater broadband sound bursts and mid-frequency naval 53 C sonar signals were presented to two common murres in a quiet pool. The received sound pressure levels varied from 110 to 137 dB re 1 µPa. Both murres showed consistent reactions to sounds of all intensities, as compared to no reactions during control trials. The authors' findings indicate that common murres may be affected by, and therefore potentially also vulnerable to, underwater noise.

Diving birds may not hear as well underwater, compared to other (non-avian) species, based on adaptations to protect their ears from pressure changes (Dooling & Therrien, 2012). Because reproduction and communication with conspecifics occurs in air, adaptations for diving may have evolved to protect in-air hearing ability and may contribute to reduced sensitivity underwater (Hetherington, 2008). There are many anatomical adaptations in diving birds that may reduce sensitivity both in air and underwater. Anatomical ear adaptations are not well investigated, but include cavernous tissue in the meatus and middle ear that may fill with blood during dives to compensate for increased pressure on the tympanum, active muscular control of the meatus to prevent water entering the ear, and interlocking feathers to create a waterproof outer covering (Crowell et al., 2015; Rijke, 1970; Sade et al., 2008). The northern gannet, a plunge diver, has unique adaptations to hitting the water at high speeds, including additional air spaces in the head and neck to cushion the impact and a thicker tympanic membrane than similar-sized birds (Crowell et al., 2015). All of these adaptions could explain the measured higher hearing thresholds of diving birds.

Although important to seabirds in air, it is unknown if seabirds use hearing or vocalizations underwater for foraging, communication, predator avoidance, or navigation (Crowell, 2016; Dooling & Therrien, 2012). Some scientists suggest that birds must rely on vision rather than hearing while underwater (Hetherington, 2008), while others suggest birds must rely on an alternative sense in order to coordinate cooperative foraging and foraging in low light conditions (e.g., night, depth) (Dooling & Therrien, 2012).

Crowell et al. (2015) also compared the vocalizations of the same diving bird species discussed above to the region of highest sensitivity of in-air hearing. Of the birds studied, vocalizations of only eight species were obtained due to the relatively silent nature of two of the species. The peak frequency of the vocalizations of seven of the eight species fell within the range of highest sensitivity of in-air hearing. They suggested that the colonial nesters tested had relatively reduced hearing sensitivity because they relied on individually distinctive vocalizations over short ranges. Additionally, species with more sensitive hearing were those associated with freshwater habitats, which are relatively quieter compared to marine habitats with associated wind and wave noise (Crowell et al., 2015).

3.6.1.1.6 General Threats

The Navy conducted a literature search for new information since the publication of the 2015 NWTT Final EIS/OEIS on general threats that may change the analysis of potential impacts on birds. The 2015 NWTT Final EIS/OEIS analyzed commercial and recreational fishing gear, predation by introduced species, habitat loss, disturbance and degradation of nesting and foraging areas by humans and domesticated animals, noise pollution from construction and other human activities, nocturnal collisions with power lines and artificial lights, collisions with aircraft, and pollution from oil spills and plastic debris. 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 (Congdon et al., 2007; Vandenbosch, 2000). Other general threats include exposure to marine polychlorinated biphenyls (PCBs) in prey; changes in prey abundance, availability and quality; harmfal algal blooms, biotoxins and dead zones; derelict fishing gear that causes entanglement; energy development projects leading to mortality; disturbance, injury, and mortality in the marine environment from exposures to elevated sound levels; and climate change in the Pacific Northwest (U.S. Fish and Wildlife Service, 2009).

Since the publication of the 2015 NWTT Final EIS/OEIS, a more complete understanding of potential climate change-related impacts on water quality, which in turn may impact prey base, has been included in this Supplemental and summarized below. Section 3.1 (Sediments and Water Quality) describes the updated information included in this Supplemental in regards to potential impacts on water quality from climate change. These changes (e.g., air and sea temperatures, precipitation, frequency and intensity of storms, pH level of sea water, and sea level rise) may potentially impact seabirds by reducing overall marine productivity and biodiversity, which could affect the food resources, distribution, and reproductive success of seabirds (Aebischer et al., 1990; Congdon et al., 2007; Duffy, 2011; North American Bird Conservation Initiative & U.S. Committee, 2010). These same climate-related changes (e.g., air and sea temperatures, precipitation, frequency and intensity of storms, and sea level rise) may potentially impact landbirds, including shorebirds and those more inland. Other climate change-related threats to birds in general include wildfires. Wildfire frequency in the western forests has nearly quadrupled when compared to the average of the period between 1970 and 1986 (U.S. Fish and Wildlife Service, 2009). The length of the fire season is longer, and the area burned is larger then it has been in the past. Scientists predict that wildfires will increase and that the area burned by fire in the Pacific Northwest will double by the 2040s and triple by the 2080s (U.S. Fish and Wildlife Service, 2009). This increase in fire frequency, duration, and severity would decrease the available habitat for birds. In the long term, climate change could be the largest threat to birds.

Specifically within the Study Area, the Navy's literature search found new information regarding recent regional impacts on seabirds associated with warming ocean temperatures. The National Marine Fisheries Service (2016a) noted a period of elevated air and sea temperatures have acted effectively as a heat wave in the Bering Sea and northern portion of the Gulf of Alaska, where 2016 temperatures represented a short-term climate event on top of a baseline overall warming trend. These warming trends have caused cyclic summer die-offs of seabirds in the past, with die-offs associated with starvation (U.S. Fish and Wildlife Service, 2015). Since 2015, there are reports of dead northern fulmars, black- and red-legged kittiwakes (*Rissa tridactyla* and *Rissa brevirostris*), shearwaters, murres, and auklets washing ashore in Alaska, all showing signs of starvation, likely due to warming temperature effects on prey base (Liao, 2019).

Plastic debris is abundant and pervasive in the world oceans and, because of its durability, is continuing to increase. The ingestion of plastics by seabirds such as albatrosses and shearwaters occurs with high frequency and is of particular concern. Potential impacts to birds and other wildlife from ingesting plastic and other debris include reduced food consumption due to lower available stomach volume and therefore poorer fat deposition and body condition, physical damage to the digestive tract, and obstruction of the digestive tract which may result in starvation. Additional risks of anthropogenic debris ingestion include the transfer of pollutants and bioaccumulation of plastic-derived chemicals in body tissues, toxicity via uptake of persistent organic pollutants absorbed by plastic particles, and the translocation of microscopic plastics to other organ systems (Roman et al., 2016). The rates of plastic ingestion by seabirds are closely related to the concentrations of plastics in different areas of the ocean due to waste discharges and ocean currents and are increasing (Kain et al., 2016; Wilcox et al., 2015).

The impacts from entanglement of marine species in marine debris are clearly profound, and in many cases, entanglements appear to be increasing despite efforts over four decades to reduce the threat. Many coastal states have undertaken certain efforts to reduce entanglement rates through marine debris clean-up measures and installed fishing line recycle centers at boat landings in part due to entanglement of seabirds and other marine species. One such program is Northwest Straits Initiative's Derelict Fishing Gear Program, which removes nets from Puget Sound waters using commercial divers under protocols that were designed in partnership with Washington State Department of Fish and Wildlife and Department of Natural Resources (Northwest Straits Foundation, 2017).

Fishing-related gear, balloons, and plastic bags were estimated to pose the greatest entanglement risk to marine fauna. In contrast, experts identified a broader suite of items of concern for ingestion, with plastic bags and plastic utensils ranked as the greatest threats. Entanglement and ingestion affected a similar range of taxa, although entanglement was rated as slightly worse because it is more likely to be lethal. Contamination was scored the lowest in terms of impact, affecting a smaller portion of the taxa and being rated as having solely non-lethal impacts (Wilcox et al., 2016).

Seabird bycatch from commercial fisheries may also have population-level impacts to seabirds, particularly smaller populations of the ESA-listed marbled murrelet and short-tailed albatross. Total estimated seabird bycatch in the Alaska federal groundfish and halibut fisheries for all gear types and management plans for 2010-2019 showed an annual average of 3 short-tailed albatross and 36 auklets (the category that includes marbled murrelets) caught as bycatch (Krieger & Eich, 2020). However, for the west coast fisheries within the NWTT action area, there were no reports of short-tailed albatross or murrelet bycatch estimates in 2005, 2010, 2011-2013, and 2014-2015 (National Marine Fisheries Service, 2011, 2013, 2016c, 2019).

3.6.1.2 Marbled Murrelet

The marbled murrelet was listed by the USFWS as a threatened species in Washington, Oregon, and California in 1992 (57 Federal Register [FR] 45328); the marbled murrelet is not ESA-listed in Alaska. Terrestrial critical habitat was designated in 1996 (61 FR 26256) and revised in 2011 (76 FR 61599) in mature and old-growth forest nesting habitat within 48 km of the coast in Washington, Oregon, and California (Figure 3.6-1). No critical habitat is currently designated or proposed in the marine environment. There has been no change in the amount of critical habitat since the publication of the 2015 NWTT Final EIS/OEIS.

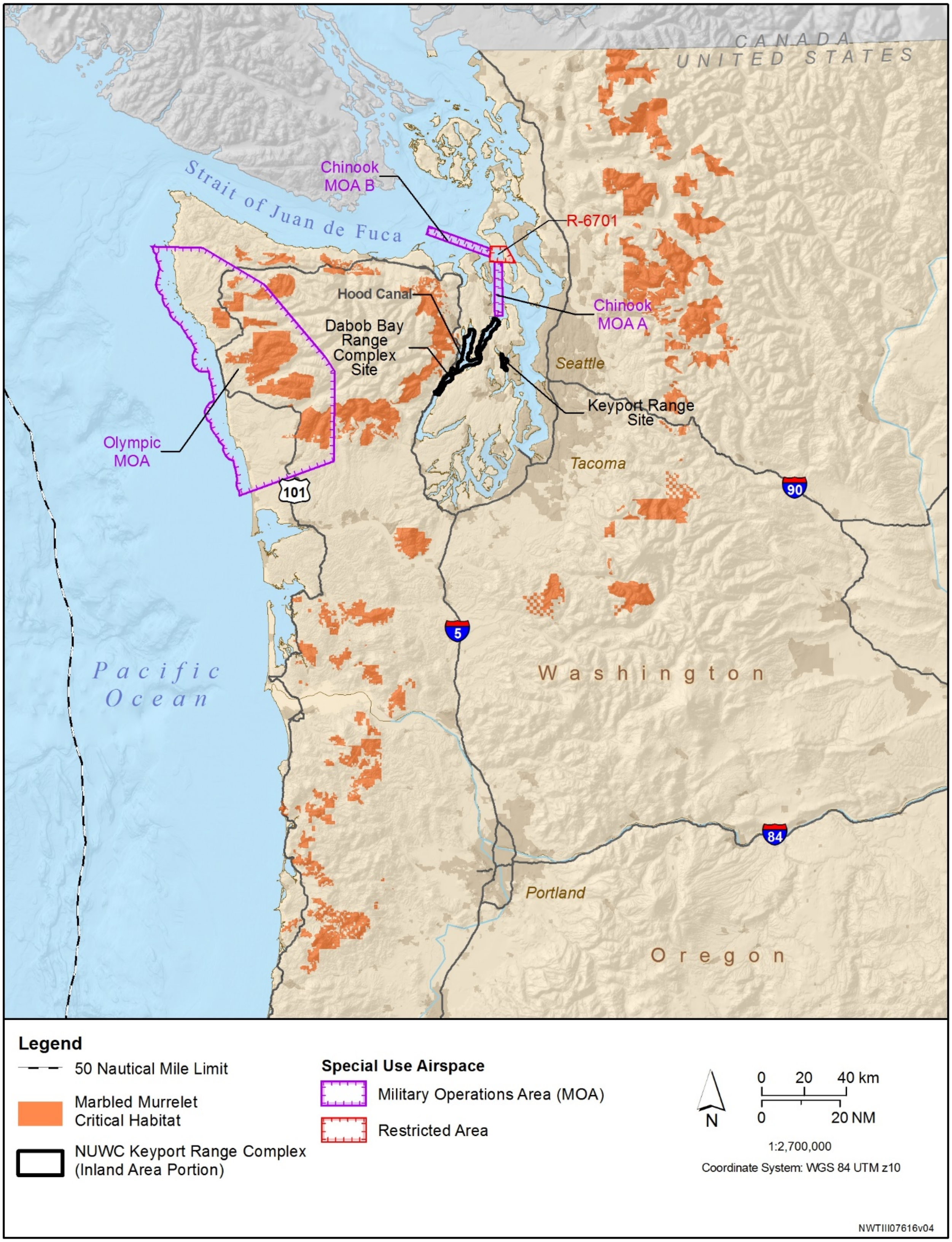

Figure 3.6-1: Critical Habitat for the Marbled Murrelet

As with the 2015 NWTT Final EIS/OEIS, the Study Area analyzed in this Supplemental to address potential impacts on marbled murrelets includes the Offshore Area and Inland Waters in Washington. The Washington Offshore Area primarily includes waters from 3 NM seaward except for an area at Pacific Beach where the Study Area extends to shore (see Figure 2.2-2). As with the 2015 NWTT Final EIS/OEIS, the Study Area analyzed in this Supplemental also includes areas off the coast of Oregon and Northern California from 12 NM from the coastline and extending seaward.

In 1997, the marbled murrelet recovery plan established six marbled murrelet conservation zones (Figure 3.6-2) (U.S. Fish and Wildlife Service, 1997). The conservation zones were established to assist in the design of management actions and the evaluation of impacts at multiple scales and do not have any regulatory requirements.

Murrelets within the Study Area that may be affected by proposed Navy training and testing activities are found in Conservation Zones 1 and 2 (Figure 3.6-2). Conservation Zone 1 includes the Inland Waters portion of the Study Area. This includes all the waters of Puget Sound and most waters of the Strait of Juan de Fuca south of the U.S.-Canada border. Conservation Zone 2 extends the length of the Washington coast.

Conservation Zones 3 and 4 are between the shoreline and the Study Area, but are not within the Offshore area. However, activities occurring in the Study Area offshore of Conservation Zones 3 and 4 could affect marbled murrelets associated with these zones. Additionally, individual marbled murrelets from any of the Conservation Zones (1 through 6) could occur in the Study Area due to the birds' transient nature (U.S. Fish and Wildlife Service, 2016, 2018).

Marbled murrelets are unique among alcids in their use of old-growth forest stands (Falxa & Raphael, 2016). Marbled murrelets do not build a nest but use natural features, such as moss, clumps of mistletoe, or piles of needles as a nest site on tree limbs. Nests are in large conifers in coastal old-growth forests in the Pacific Northwest (Lorenz et al., 2016). Nesting season is asynchronous between April 1 and September 23. During the breeding season, murrelets trend to forage in well-defined areas along the shoreline in relatively shallow marine waters. Important features in nesting habitat are large, mossy limbs in forest canopy (Lorenz et al., 2016).

Since the publication of the 2015 NWTT Final EIS/OEIS, the Navy's literature review, and information included in the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016), new information is available regarding nesting ecology of marbled murrelet. Falxa and Raphael (2016) assessed various terrestrial and marine factors that were important for murrelet spatial distribution and also determined that prey abundance in waters in close proximity to breeding habitat was likely contributing to murrelet declines. They also studied contributing factors to declining spatial distributions in nesting habitats and determined that fire was the major cause of declines in Washington State on federal properties and timber harvesting the major factor on non-federal lands. Further, Falxa and Raphael (2016) found no similar trends in Oregon and California; spatial distributions in these areas appear to be relatively stable compared to declining distributions in Washington State.

The first observed marbled murrelet ground nest within the listed range was found within Olympic National Park in Washington. This nest was on a cliff and appeared to have similar characteristics as a traditional tree limb nest; however, in the year that it was found, it was not successful as the chick was found at the base of the cliff (Wilk et al., 2016).

Sources: U.S. Fish and Wildlife Service, 1997; 76 FR 61599.

Figure 3.6-2: Marbled Murrelet Critical Habitat and Conservation Zones

Since the publication of the 2015 NWTT Final EIS/OEIS, the Navy's literature review, and information included in the 2016 and 2018 USFWS BOs (U.S. Fish and Wildlife Service, 2016, 2018), new information is available regarding at-sea occurrence of marbled murrelets. Specifically, the foraging range for murrelets may extend farther than previously analyzed, out to 5 km offshore and out to 50 km offshore of Alaska (U.S. Fish and Wildlife Service, 2016); however, murrelets tend to be distributed in marine waters adjacent to areas of suitable breeding habitat (Falxa & Raphael, 2016; Raphael et al., 2007). In addition, marbled murrelets captured on the outer Washington coast had larger marine ranges than those in the Puget Sound/Straits of Juan de Fuca (U.S. Fish and Wildlife Service, 2019).

The occurrence of marbled murrelets in marine waters is driven by prey availability. Prey availability varies depending on a variety of factors, but especially upwelling conditions created by seawater temperature changes and seafloor topography. The foraging habits of marbled murrelets change depending on whether they are nesting and provisioning young. During the breeding season, marbled murrelets generally forage in waters within 1 NM of shore out to depths of about 1,300 ft. and are reported to dive at least as deep as 90 ft., based on their capture in gillnets set at this depth (Raphael et al., 2007; U.S. Fish and Wildlife Service, 2005a). In the 2016 USFWS BO, it was determined that marbled murrelets were reasonably certain to occur <3 to 12 NM from shore in summer and <50 NM from shore in winter (U.S. Fish and Wildlife Service, 2016). Marbled murrelet calculations were not considered for >12 NM in summer, nor >50 NM in winter as occurrences at these distances and during these seasons were determined discountable. For the purposes of the NWTT Phase II consultation, USFWS assumed the breeding season density of murrelets in offshore waters >12 NM to be so low that they are unlikely to be observed. Additionally, USFWS assumed the murrelet population during non-breeding season is mixed and randomly distributed. USFWS was "reasonably certain" that marbled murrelets occur in the offshore waters out to a distance of 50 NM during the winter or non-breeding season (U.S. Fish and Wildlife Service, 2016).

The species' wintering range is poorly understood but includes most of the marine areas used for foraging during the breeding season (Raphael et al., 2007). Murrelets exhibit seasonal redistributions during non-breeding seasons. Generally, murrelets are more dispersed and found farther offshore in winter in some areas, although higher concentrations still occur close to shore and in protected waters (U.S. Fish and Wildlife Service, 2016). The farthest offshore records of murrelet distribution are 60 km off the coast of Northern California in October (2011), 46 km off the coast of Oregon in February (2012) (Adams et al., 2014), and at least 300 km off the coast in Alaska (Piatt et al., 2007); however, these pelagic occurrences are considered rare.

The 2018 marbled murrelet population density estimate for Conservation Zones 1 through 5 is 2.56 birds per square kilometer, and a population size of 22,521 birds (McIver et al., 2020). Overall, the 2001–2019 data show an average annual rate of change of -2.2 percent in Conservation Zone 2 (Offshore Area) (Figure 3.6-2). At the Conservation Zone scale, Zone 2 has a negative slope through 2019, but the confidence interval overlaps zero, indicating no conclusive evidence for a population trend (McIver et al., 2020).

Under the Northwest Forest Plan survey effort, surveys are conducted from shore out to 5 km in Conservation Zones 1 and 3, to 8 km in Conservation Zone 2, and to 3 km in Conservation Zones 4 and 5. Details can be found in Pearson et al. (2018).

Survey data is limited for marbled murrelets beyond 8 km of the nearshore coastal areas, and the proportion and density of the population that occurs offshore during the non-breeding season is still unknown. In order to understand the marine distribution further, the Navy (Pacific Fleet) funded spring and winter line-transect pelagic surveys from 2017 to 2019 off the Washington coast.

However, there are observations of marbled murrelets in the offshore Study Area as indicated in Figure 3.6-3 and Figure 3.6-4. Ongoing surveys and analyses, as well as the review of other data sources, provided information for updating marbled murrelet occurrences in the Study Area since the 2016 and 2018 BOs (Menza et al., 2016; U.S. Fish and Wildlife Service, 2016, 2018) as well as depicting marbled murrelet observations during the breeding season (April 1–September 23) and non-breeding season (September 24 – March 31) based on pelagic surveys conducted by the Washington Department of Fish and Wildlife (2016–2019), U.S. Geological Survey's North Pacific Pelagic Seabird Database (1987–2010), NMFS' Groundfish Observation data (2002–2018), and observations from eBird (1971–2019) (eBird, 2019: https://ebird.org/species/marmur/).

Based on the review of above-mentioned observational data, as well as survey data from the Northwest Forest Plan dataset, assumptions were made regarding the various distances marbled murrelets are likely to occur within the NWTT Offshore areas. These distances are depicted as colored bands in Figure 3.6-3 and Figure 3.6-4 during both the breeding and non-breeding seasons. In addition to these Northwest Forest Plan survey data that depict the "likelihood" of marbled murrelet occurrence, the other marbled murrelet observations are important in assessing how far offshore murrelets may occur.

In their BO for ESA consultation on the Proposed Action in the 2015 NWTT Final EIS/OEIS, the USFWS analyzed the proposed activities for both the "reasonably certain" scenario and the "reasonably worst-case scenario" (U.S. Fish and Wildlife Service, 2016). For the "reasonably certain" scenario, the following ranges were used to calculate number of birds within the NWTT Study Area: marbled murrelets were reasonably certain to occur <3 NM in summer, 3 to 12 NM in summer, and <50 NM in winter. Marbled murrelet calculations were not considered for >12 NM in summer, nor >50 NM in winter as occurrences at these distances and during these seasons were determined discountable. For the purposes of the 2016 ESA consultation, USFWS assumed the breeding season density of murrelets in offshore waters further than 22 km (12 NM) to be so low that they are unlikely to be observed. Additionally, USFWS assumed the murrelet population during non-breeding season is mixed and randomly distributed. USFWS was "reasonably certain" that marbled murrelets occur in the offshore waters out to a distance of 50 NM during the winter.

The Inland Waters are within marbled murrelet Conservation Zone 1 (Figure 3.6-2). Population and density estimates for Conservation Zone 1 are based on USFWS surveys conducted during the 2001–2019 breeding seasons. Overall, the 2001–2019 data show an average annual rate of change of -4.8 percent in Conservation Zone 1 (McIver et al., 2020).

3.6.1.3 Short-Tailed Albatross

The largest of the North Pacific albatrosses, the short-tailed albatross was listed as endangered under the ESA throughout its range in July 2000 (65 FR 46643); critical habitat has not been designated for this species (U.S. Fish and Wildlife Service, 2005b). The species is a surface feeder and scavenger, and predominately takes prey by surface-seizing, not diving (U.S. Fish and Wildlife Service, 2008).

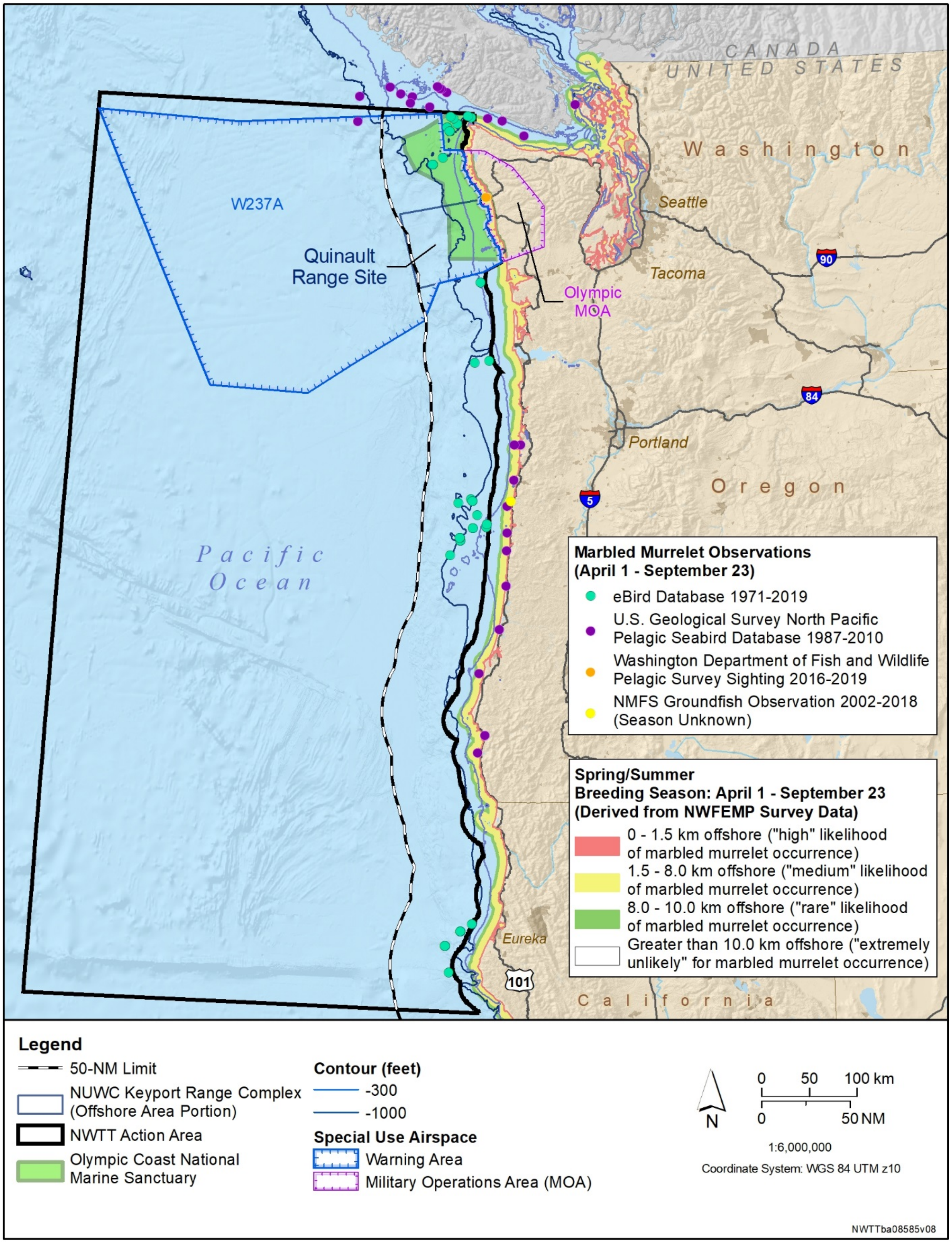

Figure 3.6-3: Occurrences of Marbled Murrelet Within the NWTT Offshore Area During the Breeding Season (April 1–September 23)

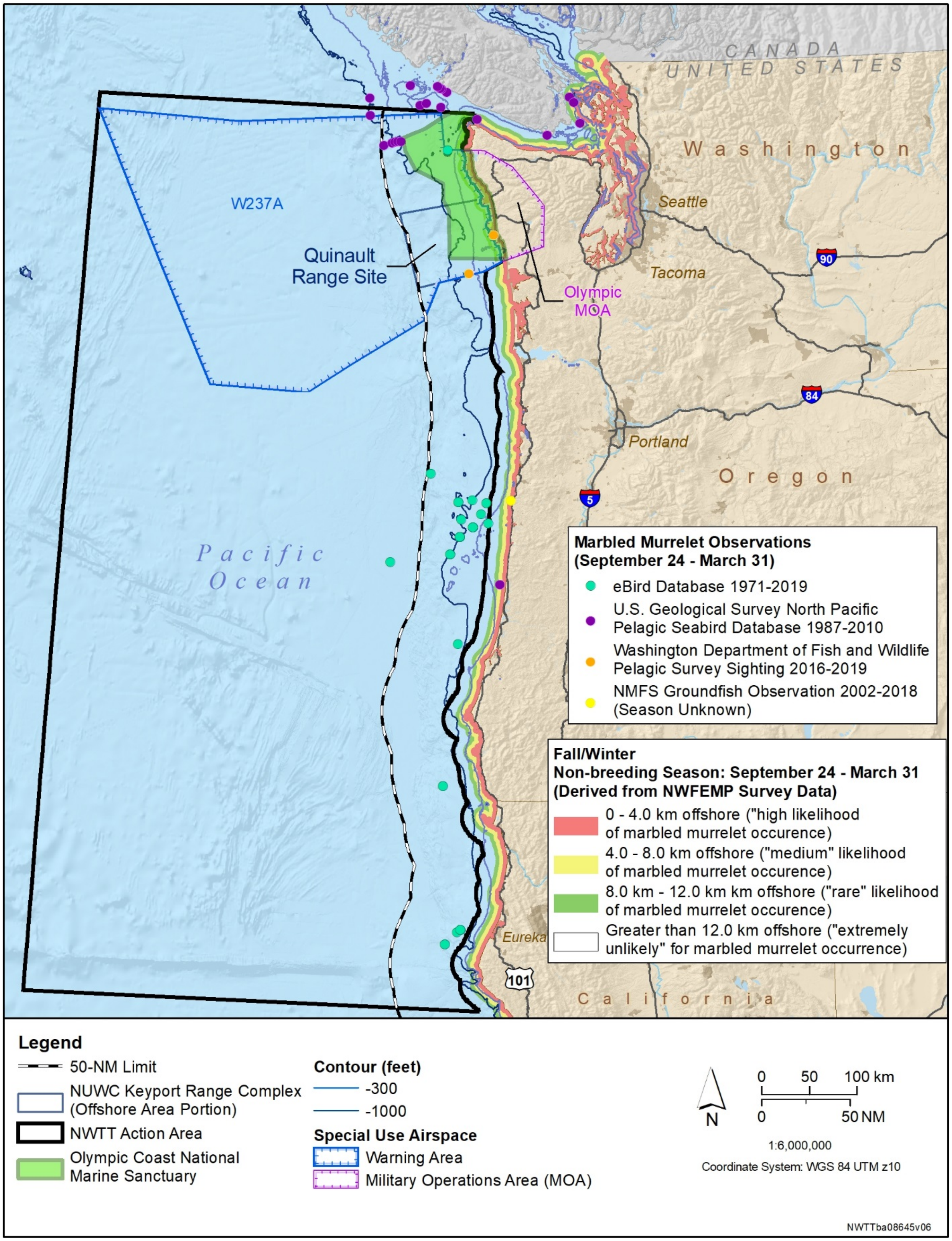

Figure 3.6-4: Occurrences of Marbled Murrelet Within the NWTT Offshore Area During the Non-Breeding Season (September 24–March 31)

Since the publication of the 2015 NWTT Final EIS/OEIS, the 2016 USFWS BO included more recent information regarding nesting ecology and life history information (U.S. Fish and Wildlife Service, 2016); however, these new sources concern recovery efforts and fisheries interactions reductions in the western Pacific outside of the Study Area. New information, however, is available from Orben et al. (2018a), who suggest that juveniles show strong seasonal changes in distributions, traveling more in winter and occupying regions not typically used by adults. While adult short-tailed albatrosses forage over both oceanic and neritic habitats across the North Pacific, concentrating along biologically productive shelf-break areas, juveniles appear to use shelf-based habitats more, especially in the Sea of Okhotsk, Bering Sea, and along the U.S. West Coast. During their initial flight years, juvenile short-tailed albatrosses use a large portion of the North Pacific from tropical to arctic waters, including the transition zone, California Current system, sub-arctic gyres, and the marginal seas: the Bering Sea and Sea of Okhotsk. As juvenile albatrosses age, habitat use switches away from pelagic regions to shelf break and slope habitats, becoming more similar to adult distributions, as anticipated from prior studies summarized in the 2015 NWTT Final EIS/OEIS and 2016 USFWS BO, yet juveniles continue to explore new regions with low levels of spatial fidelity (Orben et al., 2018b; Suryan & Kuletz, 2018).

Juveniles and subadults are most likely to occur in the Offshore Area sporadically, primarily during summer and early fall. Adults may wander into the area outside the breeding season or during years when they do not nest. Although the short-tailed albatross population continues to grow, available data indicate that sightings of this species off the coasts of Washington, Oregon, and Northern California are very rare. For example, eBird, an online, citizen-based checklist program developed by the Cornell Lab of Ornithology and National Audubon Society, has records for sightings of 49 individual short-tailed albatross from 1969 through March 2019 off the coasts of Washington, Oregon, and Northern California (eBird, 2019: https://ebird.org/species/shtalb/). Of the 242 short-tailed albatross sightings recorded during International Pacific Halibut Commission stock assessment surveys from 2002 to 2013, none were in waters off Washington, Oregon, or Northern California (Geernaert, 2013). However, data from U.S. Geological Survey's North Pacific Pelagic Seabird Database (1987–2010) and NMFS' Groundfish Observation data (2002–2018) provide a summary of occurrences within the NWTT Offshore Area, particularly along the 1,000-ft. bathymetric contour and within the 12–50 NM distances offshore (Figure 3.6-5).

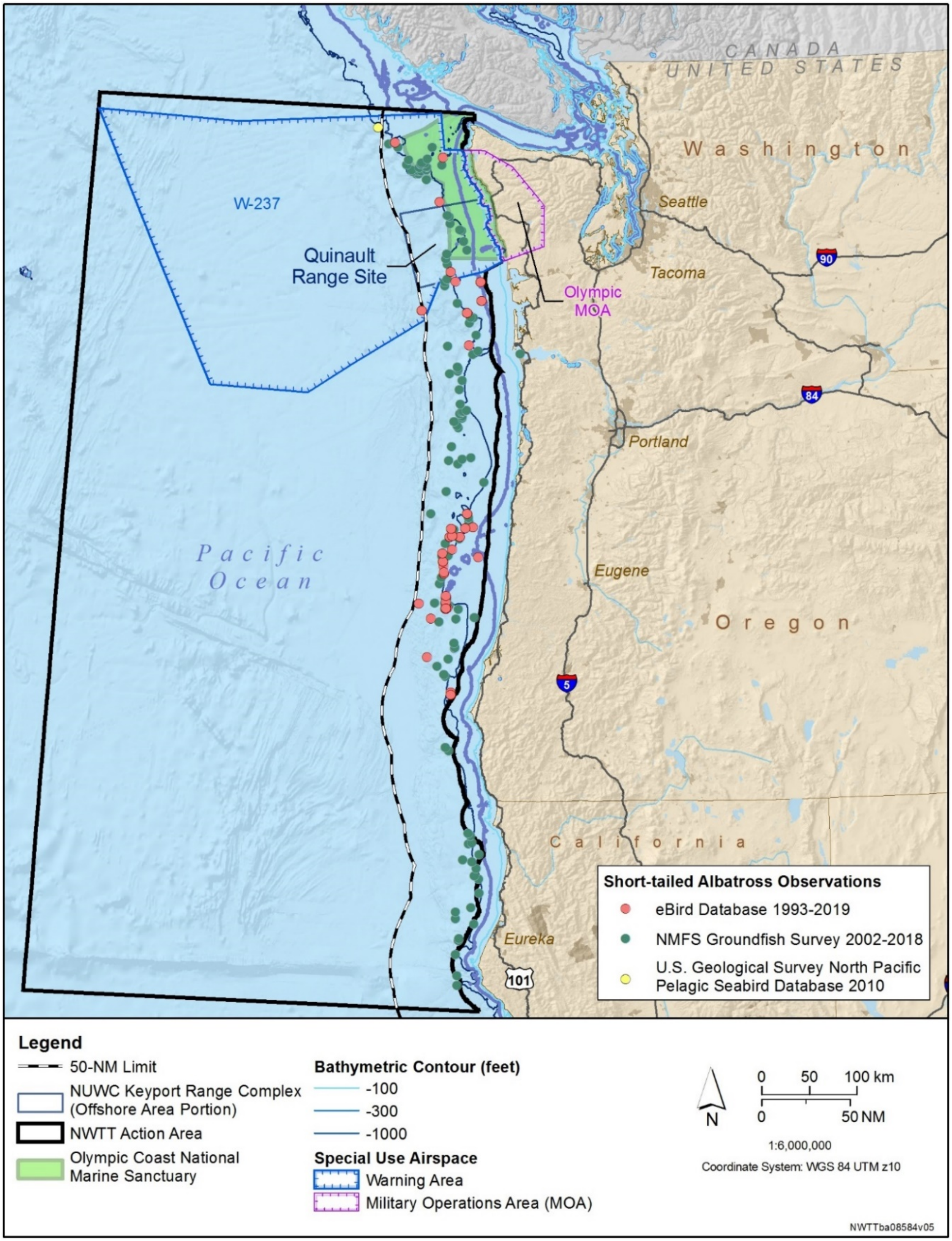

Figure 3.6-5: Occurrences of Short-Tailed Albatross Within the NWTT Offshore Area

3.6.2 Environmental Consequences

In the Proposed Action for this Supplemental, there have been some modifications to the quantity and type of acoustic stressors under the two action alternatives. Because of new activities being proposed, two new stressors would be introduced that are analyzed for their potential effects on marine bird species: high-energy lasers (as an Energy stressor), as detailed in Section 3.0.3.3.2.2 (High-Energy Lasers), and biodegradable polymer (as an Entanglement stressor), as detailed in Section 3.0.3.5.3 (Biodegradable Polymer).

In the 2015 NWTT Final EIS/OEIS, the Navy considered all potential stressors associated with ongoing training and testing activities in the Offshore Area, Inland Waters, and the Western Behm Canal and then analyzed their potential impacts on birds in the Study Area. In this Supplemental, the Navy has reviewed the analysis of impacts from these ongoing activities and additionally analyzed new or changing military readiness activities as projected into the reasonably foreseeable future. The Navy has completed a literature review for information on birds within the Study Area, which included a search for the best available science since the publication of the 2015 NWTT Final EIS/OEIS. Where there has been no substantive or otherwise meaningful change in the action, science, or regulations, the Navy will rely on the previous 2015 NWTT Final EIS/OEIS analysis. Where there has been substantive change in the action, science, or regulations, the information provided in this document will supplement the 2015 NWTT Final EIS/OEIS to support environmental compliance with applicable environmental statutes for birds.

Use of acoustic stressors (sonar and other transducers) and use of explosives have occurred since the 2015 completion of the NWTT Final EIS/OEIS Record of Decision and conclusion of the formal consultation process between the Navy and USFWS in 2016. See Chapter 2 (Description of Proposed Action and Alternatives) for a comparison of all alternatives and a comparison to activities proposed in the 2015 NWTT Final EIS/OEIS. There have been no known additional impacts on bird populations or bird habitats in terrestrial or marine environments that were not accounted for in the 2015 NWTT Final EIS/OEIS (U.S. Department of the Navy, 2015) or the 2016 USFWS BO pursuant to ESA (U.S. Fish and Wildlife Service, 2016). In addition, the Navy will be including a number of measures and adjustments in activities that would reduce potential impacts on the marbled murrelet.

There has been no emergent science that would necessitate changes to conclusions reached by Navy in the 2015 NWTT Final EIS/OEIS regarding those other dismissed stressors as having a negligible and/or discountable impact on bird populations or species. The analysis presented in this section of this Supplemental also considers standard operating procedures that are described in Chapter 2 (Description of Proposed Action and Alternatives), mitigation measures that are described in Chapter 5 (Mitigation), and in Appendix K (Geographic Mitigation Assessment), which defines mitigation areas designed to avoid or reduce potential impacts on birds (e.g., distance from shore restrictions on the use of explosives). The Navy would implement these measures to avoid or reduce potential impacts on birds from stressors associated with the proposed training and testing activities. The Navy coordinated its mitigation development with USFWS through the ESA consultation process.

The potential stressors associated with the training and testing activities in the Study Area include the following, which will be analyzed for potential impacts on birds within the stressor categories below:

- **Acoustic** (sonar and other transducers, vessel noise, aircraft noise, weapons noise)
- **Explosives** (explosive shock wave and sound, explosive fragments)
- **Energy** (in-water electromagnetic devices, and high-energy lasers, radar)

- **Physical disturbance and strike** (vessels and in-water devices, aircraft and aerial targets, and military expended materials)
- **Entanglement** (wires and cables, decelerators/parachutes, biodegradable polymer)
- **Ingestion** (military expended materials other than munitions)
- **Secondary** (impacts on habitat; impacts on prey availability)

This section of this Supplemental evaluates how and to what degree potential impacts on birds from stressors described in Section 3.0.1 (Overall Approach to Analysis) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Tables 2.5-1, 2.5-2, and 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities described in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this supplemental can be easily compared.

3.6.2.1 Acoustic Stressors

Section 3.6.3.1 (Acoustic Stressors) in the 2015 NWTT Final EIS/OEIS provides an overview of seabird hearing, including an explanation of how birds can suffer injury, hearing loss, and physiological stress, as well as various behavioral reactions exhibited by birds when a noise event induces a response. Although it was assumed nesting colonial waterbirds would be more likely to flush or exhibit a mob response when disturbed, observations of nesting black skimmers (*Rhynchops niger*) and nesting least terns (*Sternula antillarum*), gull-billed terns (*Gelochelidon nilotica*), and common terns (*Sterna hirundo*) showed they did not modify nesting behavior in response to military fixed-wing aircraft engaged in low-altitude tactical flights and rotary-wing overflights (Hillman et al., 2015). In addition, long-term consequences associated with noise-induced impacts are discussed in the 2015 NWTT Final EIS/OEIS in Section 3.6.3.1 (Acoustic Stressors).

3.6.2.1.1 Background

The sections below include a survey and synthesis of best-available science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on birds potentially resulting from sound-producing Navy training and testing activities. Impacts on birds depends on the sound source and context of exposure. Possible impacts include auditory or non-auditory trauma; hearing loss resulting in temporary or permanent hearing threshold shift; auditory masking; physiological stress; or changes in behavior, including changing habitat use and activity patterns, increasing stress response, decreasing immune response, reducing reproductive success, increasing predation risk, and degrading communication (Larkin et al., 1996). Numerous studies have documented that birds and other wild animals respond to human-made noise (Bowles et al., 1994; Larkin et al., 1996; National Park Service, 1994). The manner in which birds respond to noise could depend on species' physiology life stage, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence/absence of associated visual stimuli, and previous exposure. Noise may cause physiological or behavioral responses that reduce the animals' fitness or ability to grow, survive, and reproduce successfully.

The types of birds exposed to sound-producing activities depend on where training and testing activities occur. Birds in the study area can be divided into three groups based on breeding and foraging habitat: (1) those species such as albatrosses, petrels, frigatebirds, alcids, jaegers, and some terns that forage over the ocean and nest on coastlines and oceanic islands; (2) species such as pelicans, cormorants, gulls, and some terns that nest along the coast and forage in nearshore areas; and (3) those species such as jaegers, some gull and tern species, grebes, scoters, and ducks and loons that nest and forage along the coast and inland habitats and come to the coastal areas during non-breeding season. In addition, birds that are typically found inland, such as songbirds, may occur in large numbers flying over open ocean areas during annual spring and fall migration periods.

Birds could be exposed to sounds from a variety of sources. While above the water surface, birds may be exposed to airborne sources such as pile driving, weapons noise, vessel noise, and aircraft noise. While foraging and diving, birds may be exposed to underwater sources such as sonar, pile driving, air guns, and vessel noise. While foraging birds will be present near the water surface, migrating birds may fly at various altitudes.

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 underwater). 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 are typically submerged for short durations, and any exposure to underwater sound would be very brief. Birds that plunge-dive include albatrosses, some tern species, boobies, gannets, shearwaters, and tropicbirds. Some birds, such as cormorants, seaducks, alcids, and loons pursue prey under the surface, swimming deeper and staying underwater longer than other plunge-divers. Some of these birds may stay underwater for up to several minutes and reach depths between 50 and 550 ft. (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 than those that forage below the surface. Exposures of birds that forage below the surface may be reduced by destructive interference of reflected sound waves near the water surface (see Appendix D, Acoustic and Explosive Concepts). Sounds generated underwater 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.

3.6.2.1.1.1 Injury

Auditory structures can be susceptible to direct mechanical injury due to high levels of impulsive sound. This could include tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures such as hair cells within the organ of Corti. Auditory trauma differs from auditory fatigue in that the latter involves the overstimulation of the auditory system, rather than direct mechanical damage, which may result in hearing loss (see Section 3.6.2.1.1.2, Hearing Loss). There are no data on damage to the middle ear structures of birds due to acoustic exposures. Because birds are known to regenerate auditory hair cells, studies have been conducted to purposely expose birds to very high sound exposure levels (SELs) in order to induce hair cell damage in the inner ear. Because damage can co-occur with fatiguing exposures at high SELs, effects to hair cells are discussed below in Section 3.6.2.1.1.2 (Hearing Loss).

Because there is no data on non-auditory injury to birds from intense non-explosive sound sources, it may be useful to consider information for other similar-sized vertebrates. The rapid large pressure changes near non-explosive impulsive underwater sound sources, such as some large air guns and pile driving, are thought to be potentially injurious to other small animals (fishes and sea turtles). While long-duration exposures (i.e., minutes to hours) to high sound levels of sonars are thought to be injurious to fishes, this has not been experimentally observed (Popper et al., 2014). Potential for injury is generally attributed to compression and expansion of body gas cavities, either due to rapid onset of pressure changes or resonance (enhanced oscillation of a cavity at its natural frequency). Because water is considered incompressible and animal tissue is generally of similar density as water, animals would be more susceptible to injury from a high-amplitude sound source in water than in air since waves would pass directly through the body rather than being reflected. Proximal exposures to high-amplitude non-impulsive sounds underwater could be limited by a bird's surfacing response.

In air, the risk of barotrauma would be associated with high-amplitude impulses, such as from explosives (discussed in Section 3.6.2.2, Explosives Stressors). Unlike in water, most acoustic energy will reflect off the surface of an animal's body in air. Additionally, air is compressible whereas water is not, allowing energy to dissipate more rapidly. For these reasons, in-air non-explosive sound sources in this analysis are considered to pose little risk of non-auditory injury.

3.6.2.1.1.2 Hearing Loss

Exposure to intense sound may result in hearing loss that persists after cessation of the noise exposure. Hearing loss may be temporary or permanent, depending on factors such as the exposure frequency, received sound pressure level (SPL), temporal pattern, and duration. Hearing loss could impair a bird'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; prey; or predators.

Because in-air measures of hearing loss and recovery in birds due to an acoustic exposure are limited (e.g., quail, budgerigars [*Melopsittacus undulates*], canaries, and zebra finches [*Taeniopygia guttata*] (Ryals et al., 1999); budgerigar (Hashino et al., 1988); parakeet (Saunders & Dooling, 1974); quail (Niemiec et al., 1994)), and no studies exist of bird hearing loss due to underwater sound exposures, auditory threshold shift in birds is considered to be consistent with general knowledge about noise-induced hearing loss described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7). The frequencies affected by hearing loss would vary depending on the exposure frequency. The limited data on hearing loss in birds shows that the frequency of exposure is the hearing frequency most likely to be affected (Saunders & Dooling, 1974).

Hearing loss can be due to biochemical (fatiguing) processes or tissue damage. Tissue damage can include damage to the auditory hair cells and their underlying support cells. Hair cell damage has been observed in birds exposed to long duration sounds that resulted in initial threshold shifts greater than 40 dB (Niemiec et al., 1994; Ryals et al., 1999). Unlike many other animals, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks (Rubel et al., 2013; Ryals et al., 1999). Still, intense exposures are not always fully recoverable, even over periods 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 sound exposures by reducing middle ear pressure, an ability that may protect ears while in flight (Ryals et al., 1999) and from injury due to pressure changes during diving (Dooling & Therrien, 2012).

Hearing loss is typically quantified in terms of threshold shift, which is the amount (in dB) that hearing thresholds at one or more specified frequencies are elevated, compared to their pre-exposure values, at some specific time after the noise exposure. The amount of threshold shift measured usually decreases with increasing recovery time, which is the amount of time that has elapsed since a noise exposure. If the threshold shift eventually returns to zero (i.e., the hearing threshold returns to the pre-exposure value), the threshold shift is called a temporary threshold shift (TTS). If the threshold shift does not completely recover (the threshold remains elevated compared to the pre-exposure value), the remaining threshold shift is called a permanent threshold shift (PTS). Figure 3.0-3 (Chapter 3, Section 3.0.3.7.2 – Hearing Loss) shows two hypothetical threshold shifts: one that completely recovers, a TTS, and one that does not completely recover, leaving some PTS. By definition, TTS is a function of the recovery time; therefore, comparing the severity of noise exposures based on the amount of induced TTS can only be done if the recovery times are also considered. For example, a 20 dB TTS measured 24 hours post-exposure indicates a more hazardous exposure than one producing 20 dB of TTS measured only 2 minutes after exposure. If the TTS is 20 dB after 24 hours, the TTS measured after 2 minutes would be much higher. Conversely, if 20 dB of TTS is measured after 2 minutes, the TTS measured after 24 hours would likely would likely be much smaller. Studies in mammals have revealed that noise exposures resulting in high levels of TTS (greater than 40 dB) may also result in neural injury without any permanent hearing loss (Kujawa & Liberman, 2009; Lin et al., 2011). It is unknown if a similar effect would be observed in birds.

Hearing Loss due to Non-Impulsive Sounds

Behavioral studies of threshold shift in birds within their frequencies of best hearing (between 2 and 4 kHz) due to long duration (30 minutes to 72 hours) continuous, non-impulsive, high-level sound exposures in air have shown that susceptibility to hearing loss varies substantially by species, even in species with similar auditory sensitivities, hearing ranges, and body size (Niemiec et al., 1994; Ryals et al., 1999; Saunders & Dooling, 1974). For example, Ryals et al. (1999) conducted the same exposure experiment on quail and budgerigars, which have very similar audiograms. A 12-hour exposure to a 2.86 kHz tone at 112 dB re 20 µPa SPL (cumulative SEL of 158 dB re 20 µPa2-s) resulted in a 70 dB threshold shift measured after 24 hours of recovery in quail, but a substantially lower 40 dB threshold shift measured after just 12 hours of recovery in budgerigars recovered to within 10 dB of baseline after 3 days and fully recovered by one month (Ryals et al., 1999). Although not directly comparable, this SPL would be perceived as extremely loud but just under the threshold of pain for humans per the American Speech-Language-Hearing Association. Whereas the 158 dB re 20 µPa^2-s SEL tonal exposure to quail discussed above caused 20 dB of PTS (Ryals et al., 1999), a shorter (4-hour) tonal exposure to quail with similar SEL (157 dB re 20 µPa^2-s) caused 65 dB of threshold shift that fully recovered within 2 weeks (Niemiec et al., 1994).

Data on threshold shift in birds due to relatively short-duration sound exposures that could be used to estimate the onset of threshold shift is limited. Saunders and Dooling (1974) provide the only threshold shift growth data measured for birds. Saunders and Dooling (1974) exposed young budgerigars to four levels of continuous 1/3-octave band noise (76, 86, 96, and 106 dB re 20 µPa) centered at 2.0 kHz and measured the threshold shift at various time intervals during the 72-hour exposure. The earliest measurement found 7 dB of threshold shift after approximately 20 minutes of exposure to the 96 dB re 20 µPa SPL noise (127 dB re 20 µPa^2-s SEL). Generally, onset of TTS in other species has been considered 6 dB above measured threshold (Finneran, 2015), which accounts for natural variability in auditory thresholds. The Saunders and Dooling (1974) budgerigar data are the only bird data showing low levels of threshold shift. Because of the observed variability of threshold shift susceptibility among bird species and the relatively long duration of sound exposure in Saunders and Dooling (1974), the observed onset level cannot be assumed to represent the SEL that would cause onset of TTS for other bird species or for shorter duration exposures (i.e., a higher SEL may be required to induce threshold shift for shorter duration exposures).

Since the goal of most bird hearing studies has been to induce hair cell damage to study regeneration and recovery, exposure durations were purposely long. Studies with other non-avian species have shown that long-duration exposures tend to produce more threshold shift than short-duration exposures with the same SEL [e.g., see Finneran (2015)]. The SELs that induced TTS and PTS in these studies likely over-estimate the potential for hearing loss due to any short-duration sound of comparable SEL that a bird could encounter outside of a controlled laboratory setting. In addition, these studies were not designed to determine the exposure levels associated with the onset of any threshold shift or to determine the lowest SEL that may result in PTS.

With insufficient data to determine PTS onset for birds due to a non-impulsive exposure, data from other taxa are considered. Studies of terrestrial mammals suggest that 40 dB of threshold shift is a reasonable estimate of where PTS onset may begin (see (Southall et al., 2007). Similar amounts of threshold shift have been observed in some bird studies with no subsequent PTS. Of the birds studied, the budgerigars showed intermediate susceptibility to threshold shift; they exhibited threshold shifts in the range of 40 dB–50 dB after 12-hour exposures to 112 dB and 118 dB re 20 µPa SPL tones at 2.86 kHz (158–164 dB re 20 μPa^2-s SEL), which recovered to within 10 dB of baseline after 3 days and fully recovered by 1 month (Ryals et al., 1999). These experimental SELs are a conservative estimate of the SEL above which PTS may be considered possible for birds.

All of the above studies were conducted in air. There are no studies of hearing loss to diving birds due to underwater sound exposures.

Hearing Loss due to Impulsive Sounds

The only measure of hearing loss in a bird due to an impulsive noise exposure was conducted by Hashino et al. (1988), in which budgerigars were exposed to the firing of a pistol with a received level of 169 dB re 20 µPa peak SPL (two gunshots per each ear); SELs were not provided. While the gunshot frequency power spectrum had its peak at 2.8 kHz, threshold shift was most extensive below 1 kHz. Threshold shift recovered at frequencies above 1 kHz, while a 24 dB PTS was sustained at frequencies below 1 kHz. Studies of hearing loss in diving birds exposed to impulsive sounds underwater do not exist.

Because there is only one study of hearing loss in birds due to an impulsive exposure, the few studies of hearing loss in birds due to exposures to non-impulsive sound (discussed above) are the only other avian data upon which to assess bird susceptibility to hearing loss from an impulsive sound source. Data from other taxa (U.S. Department of the Navy, 2017) indicate that, for the same SEL, impulsive exposures are more likely to result in hearing loss than non-impulsive exposures. This is due to the high peak pressures and rapid pressure rise times associated with impulsive exposures.

3.6.2.1.1.3 Masking

Masking occurs when one sound, distinguished as the "noise," interferes with the detection or recognition of another sound. The quantitative definition of masking is the amount in decibels an auditory detection or discrimination threshold is raised in the presence of a masker (Erbe et al., 2016). As discussed in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (Section 3.0.3.7), masking can effectively limit the distance over which an animal can communicate and detect biologically relevant sounds. Masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise.

Critical ratios are the lowest ratio of signal-to-noise at which a signal can be detected. When expressed in decibels, critical ratios can easily be calculated by subtracting the noise level (in dB re 1 μPa^2/Hz) from the signal level (in dB re 1 µPa) at detection threshold. A signal must be received above the critical ratio at a given frequency to be detectable by an animal. Critical ratios have been determined for a variety of bird species (e.g., Dooling (1980), Noirot et al. (2011), Dooling and Popper (2000), and Crowell (2016)), and inter-species variability is evident. Some birds exhibit low critical ratios at certain vocal frequencies, perhaps indicating that hearing evolved to detect signals in noisy environments or over long distances (Dooling & Popper, 2000).

The effect of masking is to limit the distance over which a signal can be perceived. An animal may attempt to compensate in several ways, such as by increasing the source level of vocalizations (the Lombard effect), changing the frequency of vocalizations, or changing behavior (e.g., moving to another location, increasing visual display). Birds have been shown to shift song frequencies in the presence of a tone at a similar frequency (Goodwin & Podos, 2013), and in continuously noisy urban habitats, populations have been shown to have altered song duration and shifted to higher frequencies (Slabbekoorn & den Boer-Visser, 2006). Changes in vocalization may incur energetic costs and hinder communication with conspecifics, which, for example, could result in reduced mating opportunities. These effects are of long-term concern in constant noisy urban environments (Patricelli & Blickley, 2006) where masking conditions are prevalent.

3.6.2.1.1.4 Physiological Stress

Animals in the marine environment naturally experience stressors within their environment and as part of their life histories. Contributors to stress include changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators. Anthropogenic sound-producing activities have the potential to provide additional stressors beyond those that naturally occur, as described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7).

Chronic stress due to disturbance may compromise the general health and reproductive success of birds (Kight et al., 2012), but a physiological stress response is not necessarily indicative of negative consequences to individual birds or to populations (Larkin et al., 1996; National Park 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, which can cause changes such as increased blood pressure, available glucose, and blood levels of corticosteroids (Manci et al., 1988). It is possible that individuals would return to normal almost immediately after short-term or transient exposure, and the individual's metabolism and energy budget would not be affected in the long term. 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 Park Service, 1994; Plumpton, 2006). However, the likelihood of habituation is dependent upon a number of factors, including species of bird (Bowles et al., 1991) and frequency of and proximity to exposure. Although Andersen et al. (1990) did not evaluate noise specifically, they found evidence that anthropogenic disturbance is related to changes in home ranges; for example, raptors have been shown to shift their terrestrial home range when concentrated military training activity was introduced to the area. 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).

While physiological responses such as increased heart rate or startle response can be difficult to measure in the field, they often accompany more easily measured reactions like behavioral responses.

A startle is a reflex characterized by rapid increase in heart rate, shutdown of nonessential functions, and mobilization of glucose reserves. Habituation keeps animals from expending energy and attention on harmless stimuli, but the physiological component might not habituate completely (Bowles, 1995).

A strong and consistent behavioral or physiological response is not necessarily indicative of negative consequences to individuals or to populations (Bowles, 1995; Larkin et al., 1996; National Park Service, 1994). For example, many of the reported behavioral and physiological responses to noise are within the range of normal adaptive responses to external stimuli, such as predation, that wild animals face on a regular basis. In many cases, individuals would return to homeostasis or a stable equilibrium almost immediately after exposure. The individual's overall metabolism and energy budgets would not be affected if it had time to recover before being exposed again. If the individual does not recover before being exposed again, physiological responses could be cumulative and lead to reduced fitness. However, it is also possible that an individual would have an avoidance reaction (i.e., move away from the noise source) to repeated exposure or habituate to the noise when repeatedly exposed.

Due to the limited information about acoustically induced stress responses, the Navy conservatively assumes in its effects analysis that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.6.2.1.1.5 Behavioral Reactions

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). The manner in which an animal responds to noise could depend on several factors, including life history characteristics of the species, characteristics of the noise source, sound source intensity, onset rate, distance from the noise source, presence or absence of associated visual stimuli, food and habitat availability, and previous exposure (see Section 3.0.3.7, Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). Researchers have documented a range of bird behavioral responses to noise, including no response, head turn, alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations (Brown et al., 1999; Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006; Pytte et al., 2003; Stalmaster & Kaiser, 1997). Some 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).

Behavioral responses may depend on the characteristics of the noise and whether the noise is similar to biologically relevant sounds such as alarm calls by other birds and predator sounds. For example, European starlings (*Sturnus vulgaris*) took significantly longer to habituate to repeated bird distress calls than white noise or pure tones (Johnson et al., 1985). Starlings may have been more likely to continue to respond to the distress because it is a more biologically meaningful sound. Starlings were also more likely to habituate in winter than summer, possibly meaning that food scarcity or seasonal physiological conditions may affect intensity of behavioral response (Johnson et al., 1985).

Behavioral Reactions to Impulsive Sound Sources

Studies regarding behavioral responses by non-nesting birds to impulsive sound sources are limited. Seismic surveys had no noticeable impacts on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al., 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas.

Responses to aircraft sonic booms are informative of responses to single impulsive sounds. Responses to sonic booms are discussed below in Behavioral Reactions to Aircraft.

Behavioral Reactions to Sonar and Other Active Acoustic Sources

Hansen et al. (2020) exposed two common murres to broadband sound bursts and mid-frequency active sonar playback during an underwater foraging task and found that both birds exhibited behavioral reactions to both stimuli as compared to no reactions in control trials. One subject exhibited stronger behavioral reactions to the noise bursts, and the other to the sonar. The authors found this effect for received levels between 110 and 137 dB re 1 µPa root mean squared and noted that the birds tended to turn or swim away from the sound source. This research suggests that anthropogenic noise within the birds' hearing range may cause behavioral disturbance while foraging underwater.

With respect to the effect of pingers on fishing nets, fewer common murres were entangled in gillnets when the gillnets were outfitted with 1.5 kHz pingers with a source level of 120 dB re 1 µPa; however, there was no significant reduction in rhinoceros auklet bycatch in the same nets (Melvin et al., 2011; Melvin et al., 1999). It was unknown whether the pingers elicited a behavioral response by the birds or decreased prey availability.

Behavioral Reactions to Aircraft

There are multiple possible factors involved in behavioral responses to aircraft overflights, including the noise stimulus as well as the visual stimulus.

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). Although it was assumed nesting colonial waterbirds would be more likely to flush or exhibit a mob response when disturbed, observations of nesting black skimmers and nesting least, gull-billed, and common terns showed they did not modify nesting behavior in response to military fixed-wing aircraft engaged in low-altitude tactical flights and rotary-wing overflights (Hillman et al., 2015). Maximum behavioral responses by crested tern (*Sterna bergii*) to aircraft noise were observed at sound level exposures greater than 85 A-weighted decibels (dBA) re 20 µPa. However, herring gulls (*Larus argentatus*) significantly increased their aggressive interactions within the colony and their flights over the colony during overflights with received SPLs of 101–116 dBA re 20 µPa (Burger, 1981).

Raptors and wading birds have responded minimally to jet (110 dBA re 20 µPa) and propeller plane (92 dBA re 20 µPa) overflights, respectively. Jet flights greater than 1,640 ft. distance from raptors were observed to elicit no response (Ellis, 1981). The impacts of low-altitude 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); however, harlequin ducks (*Histrionicus histrionicus*) were observed to show increased agonistic behavior and reduced courtship behavior up to 1 to 2 hours after low-altitude military jet overflights (Goudie & Jones, 2004).

It is possible that birds could habituate and no longer exhibit behavioral responses to aircraft noise, as has been documented for some impulsive noise sources (Ellis, 1981; Russel et al., 1996) and aircraft noise (Conomy et al., 1998). Ellis (1981), found that raptors would typically exhibit a minor short-term startle response to simulated sonic booms, and there was no long-term effect to productivity.

3.6.2.1.1.6 Long-Term Consequences

Long-term consequences to birds due to acoustic exposures are considered following the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7).

Long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some birds may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. Most research on long-term consequences to birds due to acoustic exposures has focused on breeding colonies or shore habitats, and does not address the brief exposures that may be encountered during migration or foraging at sea. More research is needed to better understand the long-term consequences of human-made noise on birds, although intermittent exposures are assumed to be less likely than prolonged exposures to have lasting consequences.

3.6.2.1.2 Impacts from Sonar and Other Transducers

Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. Use of sonar and other transducers would typically be transient and temporary. General categories of sonar systems are described in Section 3.0.3.1 (Acoustic Stressors).

Information regarding the impacts of sonar on birds is limited, and little is known about the ability of birds to hear underwater. The limited information available (Crowell, 2016; Crowell et al., 2015; Crowell et al., 2016; Johansen et al., 2016; Maxwell et al., 2017) suggest the range of best hearing may shift to lower frequencies in water (Dooling & Therrien, 2012; Therrien, 2014) (see Section 3.6.1.5, Hearing and Vocalization). Because few birds can hear above 10 kHz in air, it is likely that the only sonar sources they may be able to detect are low and mid-frequency sources.

Other than pursuit diving species, the exposure to birds by these sounds is likely to be negligible because they spend only a very short time underwater (plunge-diving or surface-dipping) or forage only at the water surface. Pursuit divers may remain underwater for minutes, increasing the chance of underwater sound exposure. Any exposure would be limited to a bird's dive duration, and a bird may reduce its exposure if its dive is disrupted or the bird re-locates to another foraging area. Possible exposure also depends on whether it forages in areas where these sound sources may be used.

In addition to diving behavior, the likelihood of a bird being exposed to underwater sound depends on factors such as source duty cycle (defined as the percentage of the time during which a sound is generated over a total operational period), whether the source is moving or stationary, and other activities that might be occurring in the area. When used, continuously active sonars transmit more frequently (greater than 80 percent duty cycle) than traditional sonars, but at a substantially lower source level. However, it should be noted that active sonar is rarely used continuously throughout the listed activities, and many sources are mobile. For moving sources such as hull-mounted sonar, the likelihood of an individual bird being repeatedly exposed to an intense sound source over a short period of time is low because the training activities are transient and sonar use and bird diving are intermittent. The potential for birds to be exposed to intense sound associated with stationary sonar sources would likely be limited for some training and testing activities because other activities occurring in conjunction may cause them to leave the immediate area. For example, birds would likely react to helicopter noise during dipping sonar exercises by flushing from the immediate area, and would therefore not be exposed to underwater sonar.

Injury due to acoustic resonance of air space in the lungs from sonar and other transducers is unlikely in birds. Unlike mammals, birds have compact, rigid lungs with strong pulmonary capillaries that do not change much in diameter when exposed to extreme pressure changes (Baerwald et al., 2008), leading to resonant frequencies lower than the frequencies used for Navy sources. Furthermore, potential direct injuries (e.g., barotrauma, hemorrhage, or rupture of organs or tissue) from non-impulsive sound sources such as sonar are unlikely because of slow rise times, lack of a strong shock wave such as that associated with an explosive, and relatively low peak pressures.

A physiological impact, such as hearing loss, would likely only occur if a seabird were close to an intense sound source. An underwater sound exposure would have to be intense and of a sufficient duration to cause hearing loss. Avoiding the sound by returning to the surface would limit extended or multiple sound exposures underwater. Additionally, some diving birds may avoid interactions with large moving vessels upon which the most powerful sonars are operated (Schwemmer et al., 2011). In general, birds are less susceptible to both temporary and PTS than mammals (Saunders & Dooling, 1974). Diving birds have adaptations to protect the middle ear and tympanum from pressure changes during diving that may affect hearing (Dooling & Therrien, 2012). While some adaptions may exist to aid in underwater hearing, other adaptations to protect in-air hearing may limit aspects of underwater hearing (Hetherington, 2008). Because of these reasons, the likelihood of a diving bird experiencing an underwater exposure to sonar or other transducer that could result in an impact on hearing is considered low.

Because diving birds may rely more on vision for foraging and there is no evidence that diving birds rely on underwater acoustic communication for foraging (see Section 3.6.1.5, Hearing and Vocalization), the masking of important acoustic signals underwater by sonar or other transducers is unlikely.

There have been very limited studies documenting diving seabirds' reactions to sonar (e.g., Hansen et al. (2020)). However, given the information and adaptations discussed above, diving seabirds are not expected to detect high-frequency sources underwater and are only expected to detect mid- and low-frequency sources when in close proximity. A diving bird may not respond to an underwater source, or it may respond by altering its dive behavior, perhaps by reducing or ceasing a foraging bout. It is expected that any behavioral interruption would be temporary as the source or the bird changes location.

Some birds commonly follow vessels, including certain species of gulls, storm petrels, and albatrosses, as there is increased potential of foraging success as the prop wake brings prey to the surface (Hamilton, 1958; Hyrenbach, 2001, 2006; Melvin et al., 2001). Birds that approach vessels while foraging are the most likely to be exposed to underwater active acoustic sources, but only if the ship is engaged in anti-submarine warfare or mine warfare with active acoustic sources. However, hull-mounted sonar does not project sound aft of ships (behind the ship, opposite the direction of travel), 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 they would likely not be impacted by high-frequency sources such as those used in mine warfare.

3.6.2.1.2.1 Impacts from Sonar and Other Transducers Under Alternative 1

Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities

Under Alternative 1 training activities, sonar and other transducers would not be regularly used in nearshore areas that could be used by foraging marine birds, except during maintenance and for navigation in areas around ports. General categories and characteristics of sonar systems and the number of hours these sonars would be operated during training activities under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions).

The possibility of a bird species being exposed to sonar and other transducers depends on whether it submerges during foraging and whether it forages in areas where these sound sources may be used. Most sonar use occurs offshore, so the chance for an exposure would be low. It is assumed that birds, including the marbled murrelet and short-tailed albatross, would not be sensitive to frequencies above 10 kHz when underwater in their natural environment. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. In addition, as all designated critical habitat for marbled murrelet, northern spotted owl, steaked horned lark, and western snowy plover occurs in the terrestrial environment, there would be no impacts to designated critical habitat from underwater sound sources. The marbled murrelet and short-tailed albatross are analyzed below for potential impacts associated with the use of sonar and other active acoustic stressors.

Marbled Murrelet. Marbled murrelets regularly foraging in inland areas where sonar and other transducers are used may be exposed to underwater sound. Marbled murrelets may be exposed to underwater sound from training activities; however, for an exposure to occur, a murrelet would have to be submerged at the same time of sonar and other transducer use, and the murrelet would have to be sufficiently close to the sound source. A number of factors reduce the likelihood of exposure, such as the relatively short dive duration and the location where activities occur. Within the Inland Waters, marbled murrelets forage throughout Puget Sound and are known to occur at the Dabob Bay Range Complex (DBRC), Keyport Range site, Naval Station (NS) Everett, Naval Base Kitsap (NBK) Bangor and NBK Bremerton, but only maintenance activities occurring in inland waters have sound sources within the hearing range of birds. The instances of murrelets occurring under water, coinciding at the time and location of maintenance activities, would be infrequent. Most other sonar use occurs farther offshore (e.g., greater than 3 NM from shore), so the chance for an exposure would decrease further from shore. Specifically, anti-submarine warfare activities would typically occur at distances that exceed foraging ranges for murrelets, particularly during the nesting season. Other sonars used for anti-mine warfare, communication, and navigation are outside of the known hearing range for birds. Therefore, exposures would be more likely to occur within winter (when murrelets may forage further offshore); however, instances of murrelets occurring under water, coinciding at the time and location of anti-submarine warfare training, would be infrequent.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on marbled murrelets from sonar and other transducers. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This information includes updated range to effects estimates since the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS. The updated range to effects estimates are based off of a revised modeling methodology using the Navy Acoustic Effects Model and a cumulative SEL threshold to auditory injury of 220 decibels referenced to 1 micropascal squared seconds (dB re 1 μPa^2-s), consistent with the underwater non-impulsive auditory injury threshold applied in the 2016 BO. After reviewing the best available science since 2016, the Navy has re-affirmed this criterion. The ranges to auditory injury for an MF1 hull-mounted sonar would be 5 m for a 30-second exposure and 14 m for a five-minute exposure. Ranges for other less powerful sonars would be substantially less or even zero. Although marbled murrelet foraging bouts last over a period of 27–33 minutes (Nelson, 1997), birds are not submerged during the entire bout, and the average dive time is 16 seconds (Ralph & Miller, 1995). Therefore, the potential for auditory injury is very low.

Short-tailed Albatross. Short-tailed albatrosses are rare vagrant migrants that forage in offshore, open ocean waters (U.S. Fish and Wildlife Service, 2005a). Considering the rarity of this species in general and the infrequent sightings, chances for its potential interactions with training activities within the Study Area 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 a negligible chance that a direct or indirect impact would occur to this species because of training and testing activities that use non-impulse sound sources. In USFWS' 2016 BO, the potential for short-tailed albatross exposures were considered unlikely to result in injury because of the (1) mobility of sonar sources (with the exception of sonobuoys); (2) short-tailed albatross are mobile, are transported by currents, and only dive to shallow depths when foraging; and (3) the range to effects for sonobuoys is considered to be 0 m (U.S. Fish and Wildlife Service, 2016).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on the short-tailed albatross from sonar and other transducers and other acoustic substressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This information includes abundance estimations for off shore areas that overlap with activities using sonar and other transducers, as well as new range to effects estimates based on revised modeling methods (the range to effects for sonobuoys will continue to be considered 0 m). Although the quantitative estimates of impacts on short-tailed albatrosses may be revised during the reinitiated ESA section 7 consultation, the underlying conclusion reached by the Navy and USFWS during the section 7 consultation for activities described in the Navy's 2015 NWTT Final EIS/OEIS are not expected to change—exposures to sonar and other transducers are unlikely to result in injury.

Pursuant to the ESA, acoustic stressors from the use of sonar and other transducers during training activities, as described under Alternative 1, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 Code of Federal Regulations [CFR] Part 21), the impacts from sonar and other transducers during training activities described under Alternative 1 would not result in a significant adverse effect on populations of seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Sonar and Other Transducers Under Alternative 1 for Testing Activities

Sonar and other transducers used in testing activities would occur in the Offshore Area, including the Quinault Range Site. Most of this range is more than 3 NM from shore (see Figure 2.2-2).

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during testing under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Overall use of sonar and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1, 2.5-2, and 2.5-3. Testing activities using sonar and other transducers would occur throughout the Study Area.).

Sonar and other transducers would be used during testing activities in Western Behm Canal, Alaska, under Alternative 1 for communications, range calibration, and position information for units operating submerged on the range (see Table 2.5-2 and Figure 2.2-4). Tactical mid-frequency active sonar would not be used in Western Behm Canal. Low-frequency, mid-frequency, and high-frequency source classes would be used in Western Behm Canal during testing activities conducted under Alternative 1. High-frequency sources are generally outside the audible range of seabird hearing; therefore, the analysis focuses on low-frequency and mid-frequency sources.

The possibility of a bird species being exposed to sonar and other transducers depends on whether the species submerges during foraging and whether it forages in areas where these sound sources may be used. Most sonar use occurs in the Inland Waters, so the chance for an exposure would be low. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. In addition, as all designated critical habitat for marbled murrelet, northern spotted owl, steaked horned lark, and western snowy plover occurs in the terrestrial environment, there would be no impacts to designated critical habitat from underwater sound sources. The marbled murrelet and short-tailed albatross are analyzed below for potential impacts associated with the use of sonar and other active acoustic stressors.

Marbled Murrelet. Marbled murrelets regularly forage in areas where sonar and other transducers would be used for testing activities. Marbled murrelets may be exposed to underwater sound from testing activities; however, for an exposure to occur, a murrelet would have to be submerged at the same time of sonar and other transducer use, and the murrelet would have to be sufficiently close to the sound source. As with training activities, a number of factors reduce the likelihood of exposure, such as the relatively short dive duration and the location where activities occur. A large portion of other sonar use occurs farther offshore, so the chance for an exposure would decrease further from shore. Within the Inland Waters, marbled murrelets forage throughout Puget Sound and are known to occur at the DBRC, Keyport Range site, NS Everett, NBK Bangor, and NBK Bremerton.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on marbled murrelets from sonar and other transducers used during testing activities. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This new information includes range to effects data, increased understanding of underwater hearing abilities of marbled murrelets, and abundance estimations for off shore areas that overlap with activities using sonar and other transducers used during testing activities. The updated range to effects estimates are based off of a revised modeling methodology using the Navy Acoustic Effects Model and a cumulative SEL threshold to auditory injury of 220 dB re 1 μPa^2-s, consistent with the underwater non-impulsive auditory injury threshold applied in the 2016 BO. After reviewing the best available science since 2016, the Navy has re-affirmed this criterion. The ranges to auditory injury for an MF1 hull-mounted sonar would be 5 m for a 30-second exposure and 14 m for a five-minute exposure. Ranges for other less powerful sonars would be substantially less or even zero. Although marbled murrelet foraging bouts last over a period of 27–33 minutes (Nelson, 1997), birds are not submerged during the entire bout, and the average dive time is 16 seconds (Ralph & Miller, 1995). Therefore, the potential for auditory injury is very low.

Short-tailed Albatross. 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 a negligible chance that a direct or indirect impact would occur to this species from sonar or other transducers. In USFWS's 2016 BO, the potential for short-tailed albatross exposures were considered unlikely to result in injury because of the (1) mobility of sonar sources (with the exception of sonobuoys); (2) short-tailed albatross are mobile, are transported by currents, and only dive to shallow depths when foraging; and (3) the range to effects for sonobuoys is considered to be 0 m (U.S. Fish and Wildlife Service, 2016).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on the short-tailed albatross from sonar and other transducers during testing activities. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This new information includes abundance estimations for offshore areas that overlap with testing activities using sonar and other transducers.

Pursuant to the ESA, acoustic stressors from the use of sonar and other transducers during testing activities under Alternative 1 may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from sonar and other transducers during testing activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.1.2.2 Impacts from Sonar and Other Transducers Under Alternative 2

Impacts from Sonar and Other Transducers Under Alternative 2 for Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), training activities under Alternative 2 reflect the maximum number of activities that could occur within a given year. This would result in an overall increase in sonar use compared to Alternative 1.

Marbled Murrelet. Marbled murrelets regularly foraging in inland areas where sonar and other transducers are used may be exposed to underwater sound. Marbled murrelets may be exposed to underwater sound from training activities; however, for an exposure to occur, a murrelet would have to be submerged at the same time of sonar and other transducer use, and the murrelet would have to be sufficiently close to the sound source. A number of factors reduce the likelihood of exposure, such as the relatively short dive duration and the location where activities occur. Within the Inland Waters, marbled murrelets forage throughout Puget Sound and are known to occur at the DBRC, Keyport Range site, NS Everett, NBK Bangor, and NBK Bremerton, but only these maintenance activities occurring in inland waters have sound sources within the hearing range of birds. The instances of murrelets occurring under water, coinciding at the time and location of maintenance activities, would be infrequent. Most other sonar use occurs farther offshore (e.g., greater than 3 NM from shore), so the chance for an exposure would decrease further from shore. Specifically, anti-submarine warfare activities would typically occur at distances that exceed foraging ranges for murrelets, particularly during the nesting season. Other sonars used for anti-mine warfare, communication, and navigation are outside of the known hearing range for birds. Therefore, exposures would be more likely to occur within winter (when murrelets may forage further offshore); however, instances of murrelets occurring under water, coinciding at the time and location of anti-submarine warfare training, would be infrequent. Compared to Alternative 1, exposure to sonar and other transducers substressors would likely increase under Alternative 2.

Short-tailed Albatross. Short-tailed albatrosses are rare vagrant migrants that forage in offshore, open ocean waters (U.S. Fish and Wildlife Service, 2005a). Considering the rarity of this species in general and the infrequent sightings, chances for its potential interactions with training activities within the Study Area would be extremely low, even under Alternative 2 with a relative increase in the overall use of sonar and other transducers. 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 and testing activities that use non-impulse sound sources. In USFWS's 2016 BO, the potential for short-tailed albatross exposures were considered unlikely to result in injury because of the (1) mobility of sonar sources (with the exception of sonobuoys); (2) short-tailed albatross are mobile, are transported by currents, and only dive to shallow depths when foraging; and (3) the range to effects for sonobuoys is considered to be 0 m (U.S. Fish and Wildlife Service, 2016).

Pursuant to the ESA, acoustic stressors from the use of sonar and other transducers during training activities, as described under Alternative 2, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from sonar and other transducers during training activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Sonar and Other Transducers Under Alternative 2 for Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), testing activities under Alternative 2 reflects the maximum number of activities that could occur within a given year. This would result in an overall increase in sonar use compared to Alternative 1.

Under Alternative 2, testing activities using low-frequency sonar and other transducers will take place throughout the NWTT Study Area; however, these sources would occur more frequently in the NWTT Inland Waters.

Marbled Murrelet. Marbled murrelets regularly forage in areas where sonar and other transducers would be used for testing activities. Marbled murrelets may be exposed to underwater sound from testing activities; however, for an exposure to occur, a murrelet would have to be submerged at the same time of sonar and other transducer use, and the murrelet would have to be sufficiently close to the sound source. As with training activities, a number of factors reduce the likelihood of exposure, such as the relatively short dive duration and the location where activities occur. Most other sonar use occurs farther offshore, so the chance for an exposure would decrease further from shore. Within the Inland Waters, marbled murrelets forage throughout Puget Sound and are known to occur at the DBRC, Keyport Range site, NS Everett, NBK Bangor, and NBK Bremerton. With the increase in the use of sonar and other transducers in inland waters under Alternative 2, more marbled murrelets would likely be exposed to this substressors while foraging in inland waters (particularly during the nesting season) compared to Alternative 1.

Short-tailed Albatross. As with training activities, there is a negligible chance of short-tailed albatross exposure to sonar and other transducers. This conclusion is supported by 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. In USFWS's 2016 BO, the potential for short-tailed albatross exposures were considered unlikely to result in injury because of the (1) mobility of sonar sources (with the exception of sonobuoys); (2) short-tailed albatross are mobile, are transported by currents, and only dive to shallow depths when foraging; and (3) the range to effects for sonobuoys is considered to be 0 m (U.S. Fish and Wildlife Service, 2016).

Pursuant to the ESA, acoustic stressors from the use of sonar and other transducers during testing activities, as described under Alternative 2, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from sonar and other transducers during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.2.3 Impacts from Sonar and Other Transducers Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Sonar and other transducers as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from sonar and other transducers on individual birds, but would not measurably improve the status of bird populations.

3.6.2.1.3 Impacts from Vessel Noise

Section 3.6.3.1.4 (Impacts from Vessel Noise) of the 2015 NWTT Final EIS/OEIS discusses the different types of vessels and the noise they generate, along with a summary of potential responses marine birds may exhibit. 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. Since the publication of the 2015 NWTT Final EIS/OEIS and 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016), no new information was identified during the Navy's literature review that would substantially alter the assessment of potential impacts on marine birds from vessel noise. Therefore, the information contained in Section 3.6.3.1.4 (Impacts from Vessel Noise) of the 2015 NWTT Final EIS/OEIS remains valid.

Pursuant to the ESA, vessel noise generated during training and testing activities, as described under Alternatives 1 and 2, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from sonar and other transducers during training and testing activities described under Alternatives 1 and 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other land birds protected under the MBTA.

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the NWTT Study Area. Vessel noise from sources as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities. Discontinuing the training and testing activities would result in less vessel noise within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for vessel noise impacts on individual birds and bird populations.

3.6.2.1.4 Impacts from Aircraft Noise

Section 3.6.3.1.5 (Impacts from Aircraft Noise) of the 2015 NWTT Final EIS/OEIS discusses the different types of aircraft and the noise they generate, along with a summary of potential responses birds may exhibit. Since the publication of the 2015 NWTT Final EIS/OEIS and 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016), no new information was identified during the Navy's literature review that would substantially alter the assessment of potential impacts on birds from aircraft noise. Aircraft restrictions (e.g., flight altitude restrictions, supersonic flights only allowed to occur greater than 30 NM from shore) would remain in place as analyzed in the 2015 NWTT Final EIS/OEIS. Therefore, the information contained in Section 3.6.3.1.5 (Impacts from Aircraft Noise) of the 2015 NWTT Final EIS/OEIS remains valid. A summary of noise sources and potential bird responses is provided below for fixed-wing aircraft and helicopters.

- **Fixed-wing aircraft** (manned and unmanned). Common behavioral responses to aircraft noise include no response or stationary alert behavior (Johnson & Reynolds, 2002), startle response, flying away, and increased vocalizations (Bowles, 1995; Larkin et al., 1996; National Park Service, 1994). In some instances, behavioral responses could interfere with foraging, habitat use, and physiological energy budgets, particularly when an animal continues to respond to repeated exposures. The potential for masking of calls in air is possible if a bird remains in the area; however, due to the transitory nature of aircraft overflights, the duration of masking would be limited. Supersonic flights are only authorized when the aircraft is at least 30 NM from shore and clear of islands and vessels. In such circumstances, some air combat maneuver training would involve high-altitude, supersonic flight which would produce sonic booms, but such airspeeds would be infrequent and are typically conducted at high altitudes and far from shore, limiting the areas where birds could be exposed. When sonic booms do occur, boom duration is generally less than 300 milliseconds. Sonic booms would cause seabirds 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 birds and aircraft are transient in any area, exposure of birds in the open ocean to sonic booms would be infrequent. It is unlikely that individual birds would be repeatedly exposed to sonic booms in the open ocean.

- **Helicopters**. Exposure from helicopter noise may be as brief as fixed-wing aircraft, but lower altitude and hovering or slow-moving helicopters could prolong the exposure, eliciting different responses and resulting in more severe impacts. Helicopter activities at lower altitudes increase the likelihood that birds would respond to noise from overflights with reactions such as flushing (Stalmaster & Kaiser, 1997), although a large portion of birds may exhibit no reaction to nearby helicopters (Grubb et al., 2010). Helicopter flights are generally limited to the inland water areas, unless deployed onboard ships. Helicopter flights, therefore, are more likely to impact the greater numbers of birds 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 bird species. 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. Noise from low-altitude helicopter overflights would only be expected to elicit short-term behavioral or physiological responses in exposed birds.

Birds in areas that may experience repeated exposure often habituate and do not respond behaviorally (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). Throughout the Study Area, repeated exposure of individual birds or groups of birds is unlikely based on the dispersed nature of the overflights and the capability of birds to avoid or rapidly vacate an area of disturbance. Therefore, the general health of individual birds would not be compromised. Occasional startle or alert reactions to aircraft noise are not likely to disrupt major behavior patterns (such as migrating, breeding, feeding, and sheltering) or to result in serious injury to any birds.

3.6.2.1.4.1 Impacts from Aircraft Noise Under Alternative 1

Impacts from Aircraft Noise Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving aircraft is shown in Table 3.0-11 of this Supplemental EIS/OEIS. Airborne noise levels for aircraft used during training activities, along with airborne noise levels at various stages of flight (e.g., takeoff, under afterburner for aircraft) are provided by Bousman and Kufeld (2005) for helicopters (e.g., H-60), U.S. Naval Research Advisory Committee (2009) for F/A-18C/D and F-35A, U.S. Department of the Air Force (2016) for F-35A at takeoff, U.S. Department of the Navy (2012) for EA-18G aircraft (see Table 3.0-4 of this Supplemental). The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on birds would be the same.

Aircraft training activities conducted under Alternative 1 over Inland Waters would be limited to low altitude helicopter overflights, primarily at Crescent Harbor and Restricted Area 6701, and fixed-wing overflights within the Olympic MOA and transit flight paths between Whidbey Island to the MOA, which would occur no lower than 6,000 ft. above mean sea level (including cruising altitude once an aircraft departs from Whidbey Island). Unlike fixed-wing aircraft, helicopters typically operate below 1,000 ft. altitude and often occur as low as 75–100 ft. 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; National Park Service, 1994). The noise level from a hovering SH-60 helicopter at 50 ft. is approximately 90 A-weighted decibels (dBA). Noise from low-altitude helicopter overflights would be expected to elicit short-term behavioral or physiological responses in exposed birds. Birds foraging or loafing on the water’s surface or nesting in adjacent areas could flush in response to the noise, vibration, downwash, or visual cues associated with a helicopter. This could result in energetic costs to individuals from lost foraging time. However, birds are also likely to habituate to disturbance from helicopters (Black et al., 1984; Conomy et al., 1998; Nedelec et al., 2016). Habituation is a simple form of learning, in which an animal, after a period of exposure to a stimulus, stops responding. Navy jets flying over land areas within the Olympic MOA would potentially expose land bird species to various levels of aircraft noise, ranging from low-intensity, ambient-level sounds from distant overflights to high amplitude sounds associated with low altitude flights.

Both ESA-listed bird species within the Study Area (marbled murrelet and short-tailed albatross) are analyzed for potential impacts resulting from aircraft noise. Aircraft noise will impact these bird species differently based on where these species occur and the flight altitude restrictions that overlie their habitats.

Marbled Murrelet. Foraging or loafing murrelets could exhibit short-term behavioral and physiological responses to helicopter overflights but would be expected to resume normal behavior shortly after the helicopter leaves the area. In their 2016 BO, the USFWS concluded that murrelets are likely to habituate to in-air sound fields. Some murrelets may have no previous exposure to these sound fields and may have a stronger behavioral response initially, but they are not likely to abort foraging as a result of encountering a sound field (U.S. Fish and Wildlife Service, 2016). Habituation has likely already occurred in many murrelets because helicopters have been used in Navy training exercises within Puget Sound for decades. Marbled murrelet nesting habitats surrounding Puget Sound and foraging habitats within Puget Sound underlie extensive commercial air traffic routes (see Section 3.12, Socioeconomic Resources and Environmental Justice), which also likely contributes to habituation to aircraft noise by murrelets. Potential marbled murrelet responses to disturbance can range from minor behavioral responses, such as scanning or head-turning, or increased vigilance for short periods, to more severe responses such as flushing. In the 2016 USFWS BO, the criteria used to assess potential risk was aircraft noise exceeding 92 dBA SEL at an active nest site, or aircraft approach within a distance of 110 yards (U.S. Fish and Wildlife Service, 2016). This criteria was based Delaney et al. (1999) that found Mexican spotted owls (*Strix occidentalis lucida*) exposed to helicopter noise did not flush from their roosts until the noise from helicopters exceeded 92 dBA SEL and the helicopters were within a distance of 105 m. It should be noted that no jet aircraft would be within 110 yards of a murrelet, even in flight. In addition, no helicopter training activities occur within the MOA; therefore, there is no chance for an aircraft to occur within the distance (110 yards) where behavioral responses were noted by the Delaney et al. (1999) study.

Most studies of avian responses to aircraft have been limited to raptors and waterfowl. Even within these groups, responses have differed widely, depending on reproductive state, activity, age, exposure frequency, and species. Given the range of responses observed in various bird species, the USFWS expected the combined auditory and visual stimuli of low altitude jet flights to pose a risk of disturbance to marbled murrelets. Navy aircraft (including Navy jet aircraft and helicopters) would fly over the Olympic MOA at altitudes not less than 6,000 ft. above mean sea level. Because marbled murrelet nesting, roosting, and foraging habitat in the Study Area ranges in elevation from 0 to 4,000 ft., the closest approach of an aircraft over marbled murrelet habitat would be 2,000 ft. above ground level.
In summary, the proposed aircraft overflights are likely to affect marbled murrelets through intermittent exposures to aircraft noise throughout the year, including during the nesting season. However, because Navy aircraft would maintain minimum flight altitudes well above the distances at which any significant behavioral responses by affected marbled murrelets are likely to occur, the effects to marbled murrelets by these aircraft overflights should be considered insignificant.

Critical habitat for the marbled murrelet occurs below the MOA; however, none of the primary constituent elements of the critical habitat designation would be impacted by aircraft overflights. Therefore, there would be no effect on designated marbled murrelet critical habitat from proposed training activities.

Short-tailed Albatross. Given the proposed timing, location, and frequency of training in the Offshore Area and the small number of short-tailed albatross that are likely to occur in the Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with aircraft noise. Therefore, any adverse effects of aircraft noise on short-tailed albatross would be discountable.

Pursuant to the ESA, acoustic stressors from aircraft noise during training activities, as described under Alternative 1, may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from aircraft noise during training activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Aircraft Noise Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities involving aircraft is shown in Table 3.0-11 of this Supplemental EIS/OEIS. Compared to ongoing activities, the number of aircraft overflights would increase in the Offshore Area, remain the same in the Western Behm Canal portions of the Study Area, but decrease in Inland Waters. Although the additional number of aircraft flights would increase the frequencies of overflights on land and at sea, impacts on birds are likely minimal because (1) flight restrictions minimizing exposures to birds on land and at sea (discussed above), and (2) the brief duration of exposure.

Marbled Murrelet. Foraging or loafing murrelets could exhibit short-term behavioral and physiological responses to aircraft overflights but would be expected to resume normal behavior shortly after the aircraft leaves the area. In their 2016 BO, the USFWS concluded that murrelets are likely to habituate to in-air sound fields (U.S. Fish and Wildlife Service, 2016). Some murrelets may have no previous exposure to these sound fields and may have a stronger behavioral response initially, but they are not likely to abort foraging as a result of encountering a sound field. Within the Quinault Range, aircraft overflights that test mine countermeasures using UAS may occur from 0 to 3 NM from the shore, with a nominal altitude of 3,000 ft. These flights could occur over foraging habitats of murrelets. In the 2016 USFWS BO, the criteria used to assess potential risk was aircraft noise exceeding 92 dB SEL at an active nest site, or aircraft approach within a distance of 110 yards. Navy aircraft would fly over the Olympic MOA at altitudes not less than 6,000 ft. above mean sea level. Because marbled murrelet nesting, roosting, and foraging habitat in the Study Area ranges in elevation from 0 to 4,000 ft., the closest approach of an aircraft over marbled murrelet habitat would be 2,000 ft. above ground level. In summary, the proposed aircraft overflights are likely to affect marbled murrelets through intermittent exposures to aircraft noise throughout the year, including during the nesting season. However, because Navy aircraft would maintain minimum flight altitudes well above the distances at which any significant behavioral responses by affected marbled murrelets are likely to occur, the effects to marbled murrelets by these aircraft overflights during testing activities should be considered insignificant. Critical habitat for the marbled murrelet occurs below the MOA; however, none of the primary constituent elements of the critical habitat designation would be impacted by aircraft overflights. Therefore, there would be no effect on designated marbled murrelet critical habitat from proposed testing activities.

Short-tailed Albatross. Given the proposed timing, location, and frequency of testing activities in the Offshore Area and the small number of short-tailed albatross that are likely to occur in the Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with aircraft noise. Therefore, the effects of aircraft noise on short-tailed albatross would be discountable.

Pursuant to the ESA, acoustic stressors from aircraft noise during testing activities, as described under Alternative 1, may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from aircraft noise during testing activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.4.2 Impacts from Aircraft Noise Under Alternative 2

Impacts from Aircraft Noise Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities would increase, decrease, or stay the same compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). Increases and decreases shown in Table 2.5-1 for activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As with Alternative 1, exposures under Alternative 2 to most seabirds and landbirds would be infrequent, based on the brief duration and dispersed nature of the aircraft activities. Impacts from aircraft noise training activities would be the same as those discussed under Alternative 1.

Pursuant to the ESA, acoustic stressors from aircraft noise during training activities, as described under Alternative 2, may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from aircraft noise during training activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Aircraft Noise Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities involving aircraft is shown in Table 3.0-11. Compared to Alternative 1, the number of aircraft overflights would increase in the Offshore portions of the Study Area, but stay the same in the Inland Waters and Western Behm Canal portions. Increases and decreases shown in Tables 2.5-2 and 2.5-3 for activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. As with Alternative 1, exposures under Alternative 2 to most seabirds would be infrequent, based on the brief duration and dispersed nature of the aircraft activities. Impacts from aircraft noise testing activities would be the same as those discussed under Alternative 1.

Pursuant to the ESA, acoustic stressors from aircraft noise during testing activities, as described under Alternative 2, may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from aircraft noise during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.4.3 Impacts from Aircraft Noise Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Aircraft noise from sources as listed above would not be introduced into the marine environment or areas over land. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from aircraft noise on individual birds, but would not measurably improve the status of bird populations.

3.6.2.1.5 Impacts from Weapons Noise

Sounds produced by weapons firing (muzzle blast), launch boosters, and projectile travel are potential stressors to birds and are discussed as impulsive noise under Section 3.6.3.1.3 (Impacts from Weapons Firing, Launch, and Water-Surface Impact Noise) in the 2015 NWTT Final EIS/OEIS.

Birds might experience auditory injury from weapon noise exposure during the proposed activities. Very little data exists that can be used to predict the effect of impulsive noise on bird hearing, yet some studies have demonstrated auditory injury from loud sound exposure. The only study to measure hearing loss as a function of impulsive noise sources in birds found PTS, which is auditory injury, after exposing budgerigars to four gunshots that were each 169 dB re 1 µPa peak SPL (Hashino et al., 1988). Based on the hearing loss found by Hashino et al. (1988) over a portion of the hearing range (lower frequencies), exposure to peak pressure of 169 dB re 1 µPa peak SPL could exceed the onset of auditory injury. However, for that study, the SEL, which is another metric for determining auditory injury, was not reported and could not be reliably approximated.

Based on the best available scientific information, the multi-disciplinary science panel convened by USFWS and the Navy to establish pile driving injury criteria, also known as the Hydroacoustic Science

Panel (Science Applications International Corporation, 2011), determined that an impulsive exposure that results in 20 dB of initial threshold shift should be considered injurious (note that this is different from the 40 dB of threshold shift required to produce auditory injury from tonal, non-impulsive sources). The Hydroacoustic Panel relied on results of exposures of budgerigars to broadband sound (Dooling, 1980) in air to estimate the onset of auditory injury for impulsive exposures. Based on those results, the panel set a sound exposure threshold (unweighted) of 135 dB re 20 μPa^2-s cumulative SEL as an approximate threshold for onset of auditory injury in birds due to impulsive sources in air, plus a spectral correction factor of 15 dB to account for low-frequency energy in an impulsive exposure versus the broadband sound in Dooling (1980).

A more relevant metric for injurious exposure to impulsive sounds, especially in close proximity where the fast rise, high pressure of the shock front dominates the impulse, is peak pressure. Consideration of peak pressure is always unweighted. In order to approximate the peak pressure from an impulsive source that would result in auditory injury to birds, the Navy relied on the established relationship between cumulative exposures and impulsive exposures that produced threshold shift in amphibious marine mammals (U.S. Department of the Navy, 2017). After correcting for auditory weighting by subtracting 15 dB from weighted thresholds to estimate unweighted cumulative SEL (National Marine Fisheries Service, 2016b), the offset between SEL and peak SPL that produced threshold shift was 30–38 dB for pinnipeds, depending on the species group (National Marine Fisheries Service, 2016b; Schlundt et al., 2000; Southall et al., 2007). To obtain an approximate onset of auditory injury for impulsive sources in air, the more conservative value of 30 dB was added to the unweighted 135 dB re 20 μPa^2-s cumulative SEL threshold discussed above to obtain an injury threshold of 165 dB re 20 µPa peak SPL. This is less than the peak pressure associated with PTS observed over a portion of the hearing range due to exposure to gunshots (Hashino et al., 1988). This estimated threshold for PTS is consistent with the observations of Hashino et al. described above.

3.6.2.1.5.1 Impact Ranges for Weapon Noise

Impact ranges for auditory injury due to weapon noise exposures were calculated using the methods described below.

Large-Caliber Blast Noise Range to Injury

Blast noise exposure levels are based on extrapolations from actual measurements of blast noise from the MK-45 5 inch large-caliber gun (U.S. Department of the Navy, 1981). The range to onset of auditory injury is approximately 39 m for large-caliber gunnery.

Bow Shock Range to Injury

Bow shock waves produced by supersonic projectiles were analyzed for area of effect using the methods described in "Appendix E: Projectile Bow Shock Analysis" from U.S. Department of the Navy (1981). This method was used to assess the area of effect in the USFWS 2016 BO. The assumptions for the analysis (Mach number, projectile dimensions, and projectile path length) are based on Navy fact files (see https://www.navy.mil/navydata/fact.asp) and weapons manufacturer specifications. These ranges represent the typical maximum range of the system and actual ranges used in training and testing would vary. Mach number at firing likely overestimates the range of effect along the length of the trajectory, as it does not account for deceleration of gun shells. The area of effect over which a bird might be exposed to bow shock waves was calculated assuming that birds are not likely to be present above 20 m, which is consistent with assumptions in the 2016 BO. The auditory injury footprints for each type of supersonic projectile are shown in Table 3.6-3.

Table 3.6-3: Projectile Bow Shock Wave Trajectory and Area of Effect Analysis

Projectile Type[1]	Range to Auditory Injury[2] (m)	Portion of Trajectory Below 20 m Altitude[2](m)	Effective Area of Impact per Event[3] (km^2)
Training			
Gunnery Exercise Surface-to-Air Large Caliber[4] {> 20 NM (NEPM), > 50 NM (HE)]			
MK45 Mod 4 5 in. round (conventional)	12	58	0.0012
Gunnery Exercise Surface-to-Surface Ship Large Caliber {> 20 NM (NEPM), > 50 NM (HE)]			
MK45 Mod 4 5 in. round (conventional)	12	115	0.0025
Gunnery Exercise Surface-to-Air Medium Caliber[4] [> 12 NM]			
MK15 Phalanx CIWS 20-mm APDS	2	58	0.0001
MK38 25mm Machine Gun APDS	3	58	0.0001
Gunnery Exercise Surface-to-Surface Ship Medium Caliber [> 12 NM]			
MK15 Phalanx CIWS 20-mm APDS	2	115	0.0001
MK38 25mm Machine Gun APDS	3	115	0.0002
Missile Exercise Surface-to-Air[4] [> 50 NM]			
RIM-116 Rolling Airframe Missile (RAM)*	9	58	0.0007
RIM-7 Sea Sparrow missile	15	58	0.0020
Testing			
Kinetic Energy Weapon Testing [> 50 NM]			
Kinetic Energy weapon[5]	17	115	0.0053

[1] Only supersonic projectiles shown. The projectiles shown are typical of those that would be used during testing and training, and are considered representative of the types of projectiles that could be used during Phase III.

[2] Assumptions:

- Birds are unlikely to be present above 20 m altitude.
- Low firing angle of 10 degrees.
- Firing point at 10 m above the water surface.
- Target at water surface for Surface-to-Surface Gunnery Exercises and Kinetic Energy Weapon Testing.
- Deceleration of gun shells is not considered (i.e., range to injury is over-estimated for end of trajectory).

[3] The effective area is the two-dimensional area of effect based on the portion of airspace affected above the trajectory footprint.

[4] Target is at altitudes above bird flight altitude.

[5] Kinetic energy weapons are in the early stages of development.

Notes: HE = high-explosive, km^2= square kilometers, m = meters, NEPM = non-explosive practice munitions, NM = nautical miles.

Chapter 5 (Mitigation) of this Supplemental includes procedural mitigation to avoid or reduce potential impacts on birds from weapon noise during large-caliber gunnery activities (see Table 5.3-3 for a description of the mitigation requirements).

3.6.2.1.5.2 Impacts from Weapon Noise Under Alternative 1

Impacts from Weapons Noise Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities would increase, decrease, or stay the same compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). These activities would only occur offshore (not in inshore waters). Most activities involving large-caliber naval gunfire or the launching of targets, missiles, bombs, or other munitions are conducted more than 12 NM from shore. Most sounds would be brief, lasting from less than a second for a blast or inert impact to a few seconds for other launch and object travel sounds. Most incidents of impulsive sounds produced by weapons firing, launch, or inert object impacts would be single events, with the exception of gunfire activities. Variants of the Long Range Acoustic Device are used both on vessels and on piers. These devices communicate voice, tones, or prerecorded tracks within the range of human hearing and may reach birds within 3,000 m of the device. Birds have the potential to be briefly startled or temporarily displaced during training with this device.

Increases and decreases shown in Table 2.5-1 for activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. A bird in the open ocean could be exposed to weapons noise if not already displaced by the visual or noise disturbance of a vessel supporting weapons firing exercises. Birds foraging or migrating through a training area in the open ocean may respond by avoiding areas where weapons firing exercises occur. Exposures to most seabirds would be infrequent, based on the brief duration and dispersed nature of the vessels, and the brief duration of the weapons firing noise. If a bird responds to weapons noise, only short-term behavioral responses such as startle responses, head turning, or avoidance responses would be expected.

Marbled Murrelet. As discussed above, murrelets in nesting seasons tend to be greatest in nearshore waters to reduce flight times between foraging locations and nests; however, in winter, marbled murrelets may range further out to sea. Within the NWTT Study Area, marbled murrelets were reasonably certain to occur within 12 NM of the coastline in the summer and within 50 NM in the winter. Large-caliber weapons and other large platform systems use occurs more than 12 NM from shore. Inland waters and some nearshore coastal areas may use small- and medium-caliber weapons, which produce less noise (per firing event) but would happen more frequently. In general, it is reasonable to assume that although some murrelets may be exposed to large-caliber weapons noise during at-sea activities, most murrelets would likely be exposed to small- and medium-caliber weapons noise. Anticipated reactions, if any, would be behavioral, eliciting short-term responses (cessation of foraging activities, flushing while loafing on water, or diverting flight direction away from the sound source).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on marbled murrelets from weapons firing noise during training activities. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This new information includes range to effects data and abundance estimations for offshore areas that overlap with weapons firing activities.

Short-tailed Albatross. Given the proposed timing, location, and frequency of training in the Offshore Area and the small number of short-tailed albatross that are likely to occur in Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with weapons firing, launch, and non-explosive impact noise. Therefore, the effects of weapons firing, launch, and non-explosive impact noise on short-tailed albatross would be discountable.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on the short-tailed albatross from weapons firing noise during testing activities. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This new information includes abundance estimations for offshore areas that overlap with weapons firing activities.

Pursuant to the ESA, acoustic stressors from weapons noise during training activities, as described under Alternative 1 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from weapons noise during training activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other land birds protected under the MBTA.

Impacts from Weapons Noise Under Alternative 1 for Testing Activities

Under Alternative 1 testing activities, additional testing activities not previously analyzed would occur in the Offshore Area. This section considers the kinetic energy weapons testing that would occur in the Offshore Area greater than 50 NM from the shore. At this distance, it is reasonable to expect decreased marine bird densities, and therefore fewer exposures than activities generating weapons firing noise closer to shore. General characteristics of kinetic energy weapons testing are provided in Section 3.0.3.1.4 (Weapons Noise) and summarized here to consider potential impacts of noise generated from these systems on marine birds.

Supersonic projectiles, which would be similar in size to shells fired from 5 in./54 guns, would travel at approximately 2,600 ft./second, creating a bow shock wave. Pater et al. (2009) measured the characteristics of a bow shock wave from a 5 in. projectile and found that the shock wave ranged from 40 to 147 dB re 20 µPa SPL peak taken at the ground surface at 1,100 m from the firing location and 190 m perpendicular from the trajectory (for safety reasons). Shells fired from a kinetic energy weapon are considered hypersonic, and would travel at about 6,500 ft./second, and peak pressures would be expected to be several dB higher than for shell velocities described by Pater et al. (2009). By definition, bow shock waves, regardless of shell velocity, would travel at the speed of sound in air. Marine birds would be exposed to this type of noise for a very brief period of time (a few seconds), and would likely cause brief and temporary behavioral reactions described previously for other in-air noise disturbances.

As shown in Table 3.0-14, testing activities under Alternative 1 would include 80 hypersonic firing testing events. Because of the distance from shore (greater than 50 NM), lower densities of marine birds, the temporary nature of the impact, the chances of adverse impacts on individual marine birds is remote and no population level impacts are expected to occur.

Marbled Murrelet. As discussed above, murrelets may occur, albeit at lower densities, in areas where kinetic energy weapons are tested. While the summer distribution of murrelets is well documented as occurring primarily in the nearshore waters, the winter distribution of murrelets is poorly documented but does include a few observations of murrelets in offshore areas. Exposure of marbled murrelets to bow shock wave noise from hypersonic shells traveling through the air would not be expected to occur because of the wide dispersal of activities, the low number of murrelets that could be in the area where they would be exposed to noise, and the infrequent number of kinetic energy weapons testing activities. If any marbled murrelets were exposed to bow shock waves, the exposure would be very brief, and with normal activities quickly resuming after behavioral reactions. Anticipated reactions, if any, would be behavioral, eliciting short-term responses (cessation of foraging activities, flushing while loafing on water, or diverting flight direction away from the sound source).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on marbled murrelets from new testing activities involving bow shock wave generation from kinetic energy weapons testing. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This new information includes range to effects data and abundance estimations for offshore areas that overlap with weapons firing activities.

Short-tailed Albatross. Given the proposed timing, location, and frequency of training in the Offshore Area and the small number of short-tailed albatross that are likely to occur in Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with kinetic energy weapons testing. If any short-tailed albatrosses were exposed to bow shock waves, the exposure would be very brief, and with normal activities quickly resuming after behavioral reactions. Anticipated reactions, if any, would be behavioral, eliciting short-term responses (cessation of foraging activities or diverting flight direction away from the sound source).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental for potential impacts on short-tailed albatross from new testing activities involving bow shock wave generation from kinetic energy weapons testing. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This new information includes range to effects data and abundance estimations for offshore areas that overlap with weapons firing activities.

Pursuant to the ESA, acoustic stressors from weapons noise during testing activities, as described under Alternative 1, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from weapons noise during testing activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.5.3 Impacts from Weapons Noise Under Alternative 2

Impacts from Weapons Noise Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities would increase, decrease, or stay the same compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). Increases and decreases shown in Table 2.5-1 for activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. The analysis of stressors discussed under Alternative 1, would be the same for Alternative 2. Therefore, conclusions would be the same.

Pursuant to the ESA, acoustic stressors from weapons noise during training activities, as described under Alternative 2, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from weapons noise during training and testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Weapons Noise Under Alternative 2 for Testing Activities

Under Alternative 2, the number and type of testing activities generating weapons noise are the same as discussed under Alternative 1. Therefore, the analysis of stressors discussed under Alternative 1, would be the same for Alternative 2. Therefore, conclusions would be the same.

Pursuant to the ESA, acoustic stressors from weapons noise during testing activities, as described under Alternative 2, may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from weapons noise during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.1.5.4 Impacts from Weapons Noise Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Weapons noise from sources as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from weapons noise on individual birds, but would not measurably improve the status of bird populations.

3.6.2.2 Explosives Stressors

Section 3.6.3.1.2 (Impacts from Explosives) in the 2015 NWTT Final EIS/OEIS discusses the sources and potential impacts of in-water and in-air explosives noise on marine birds (e.g., injury, hearing loss, physiological stress, masking, and long-term consequences of exposures). This Supplemental includes new explosive testing activities not previously analyzed in the 2015 NWTT Final EIS/OEIS. These new activities using explosives would occur only in the Offshore Area. Explosive training and testing activities in inland waters would either decrease or not change compared to levels analyzed in the 2015 NWTT Final EIS/OEIS (see Table 3.0-7 in this Supplemental for comparisons between the number and types of events proposed in this Supplemental to the 2015 NWTT Final EIS/OEIS).

Explosions in the water, near the water surface, and in the air can introduce loud, impulsive, broadband sounds into the marine environment. But, unlike other acoustic stressors, explosives release energy at a high rate producing a shock wave that can be injurious and even deadly. Therefore, explosive impacts on birds are discussed separately from other acoustic stressors, even though the analysis of explosive impacts will rely on data for bird impacts due to impulsive sound exposure where appropriate.

Explosives are usually described by their net explosive weight, which accounts for the weight and type of explosive material. Additional explanation of the acoustic and explosive terms and sound energy concepts used in this section is found in Appendix D (Acoustic and Explosive Concepts).

This section begins with a summary of relevant data regarding explosive impacts on birds in Section 3.6.2.1.1 (Background). Studies of the effects of sound and energy from explosives on birds are limited, therefore, where necessary, knowledge of impacts on other species from explosives is used to assess impacts on birds.

The sections below include a survey and synthesis of best-available-science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on birds potentially resulting from Navy training and testing activities. A range of impacts could occur to a bird depending on the explosive source and context of the exposure. In addition to acoustic impacts including temporary or permanent hearing loss, auditory masking, physiological stress, or changes in behavior; potential impacts from an explosive exposure can include non-lethal injury and mortality.

3.6.2.2.1 Background

3.6.2.2.1.1 Injury

If a bird is close to an explosive detonation, the exposure to high pressure levels and sound impulse can cause barotrauma. Barotrauma is physical injury due to a difference in pressure between an air space inside the body and the surrounding air or water. Sudden very high pressures can also cause damage at tissue interfaces due to the way pressure waves travel differently through tissues with different material properties. Damage could also occur to the structure of the ear, considered to be the body part most susceptible to pressure damage.

Detonations that occur underwater could injure, kill, or disturb diving birds, particularly pursuit divers that spend more time underwater than other foraging birds (Danil & St Leger, 2011). Studies show that birds are more susceptible to underwater explosions when they are submerged versus partially submerged on the surface. Two species of duck were exposed to explosive blasts while submerged 0.61 m and while sitting on the water surface. Onset of mortality (LD_1) was predicted to occur at an impulse exposure of 248 pascal seconds (Pa-s) (36 pounds per square inch per millisecond [psi-ms]) for birds underwater and 690 Pa-s (100 psi-ms) for birds at the water surface. No injuries would be expected for birds underwater at blast pressures below 41 Pa-s (6 psi-ms) and for birds on the surface at blast pressures below 207 Pa-s (30 psi-ms). Tests of underwater explosive exposures to other taxa (fish, mammals) have shown that susceptibility to injury is related to animal mass, with smaller animals being more susceptible to injury (Yelverton & Richmond, 1981). It is reasonable to assume that this relationship would apply to birds as well. The range to these thresholds would be based on several factors including charge size, depth of the detonation, and how far the bird is beneath the water surface.

Detonations in air or at the water surface could also injure birds while either in flight or at the water surface. Experiments that exposed small, medium, and large birds to blast waves in air were conducted to determine the exposure levels that would be injurious (Damon et al., 1974). Birds were assessed for internal injuries to air sacs, organs, and vasculature, as well as injury to the auditory tympanum, but internal auditory damage was not assessed. Results indicated that peak pressure exposure of 5 psi would be expected to produce no blast injuries, 10 psi would produce slight to extensive injuries, and 20 psi would produce 50 percent mortality. These results also suggested that birds with higher mass may be less susceptible to injury. In addition to the risk of direct blast injury, exposure to an explosion in air may cause physical displacement of a bird that could be injurious if the animal impacts a surface. The same study examined displacement injuries to birds (Damon et al., 1974). Results indicated that impulse exposures below 5 psi-ms would not be expected to result in injuries.

One experiment was conducted with birds in flight, showing how birds can withstand relatively close exposures to in-air explosions (Damon et al., 1974). Flying rock pigeons (*Columba livia*) were exposed to a 64-pound (lb.) net explosive weight explosion. Birds at 44 to 126 ft. from the blast exhibited no signs of injury, while serious injuries were sustained at ranges less than 40 ft. The no injury zone in this experiment was also for exposures less than 5 psi-ms impulse, similar to the results of the displacement injury study. Ranges to the no injury threshold for a range of in-air explosives are shown in Table 3.6-4.

Table 3.6-4: **Range to the No Injury Threshold for Birds Exposed to In-Air Explosives**

Net Explosive Weight	*Range to 5 psi*
5 lb.	21 ft.
10 lb.	26 ft.
100 lb.	57 ft.

Note: Ranges calculated using the methods in (Swisdak, 1978; Swisdak & Montanaro, 1992).

Another risk of explosions in air is exposure to explosive fragmentation, in which pieces of the casing of a cased explosive are ejected at supersonic speeds from the explosion. The risk of direct strike by fragmentation would decrease exponentially with distance from the explosion, as the worst case for strike at any distance is the surface area of the casing fragments, which ultimately would decrease their outward velocity under the influence of drag. It is reasonable to assume that a direct strike in air or at the water surface would be lethal. Once in water, the drag on any fragments would quickly reduce their velocity to non-hazardous levels (Swisdak & Montanaro, 1992).

The initial detonation in a series of detonations may deter birds from subsequent exposures via an avoidance response, however, birds have been observed taking interest in surface objects related to detonation events and subsequently being killed following detonation (R. Stemp in Greene et al. (1985)).

3.6.2.2.1.2 Hearing Loss

Exposure to intense sound may result in hearing loss which persists after cessation of the noise exposure. There are no data on hearing loss in birds specifically due to explosives; therefore, the limited data on hearing loss due to impulsive sounds, described for acoustic stressors in Section 3.6.2.1.1.2 (Hearing Loss), apply to explosive exposures.

3.6.2.2.1.3 Physiological Stress

Animals naturally experience stressors within their environment and as part of their life histories. Changing weather conditions, changes in habitat, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Exposures to explosives have the potential to provide additional stressors beyond those that naturally occur, as described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7).

There are no data on physiological stress in birds specifically due to explosives; therefore, the limited data on physiological stress due to impulsive sounds, described for acoustic stressors in Section 3.6.2.1.1.4 (Physiological Stress), apply to explosive exposures.

3.6.2.2.1.4 Masking

Masking occurs when one sound, distinguished as the "noise," interferes with the detection or recognition of another sound. Exposure to explosives may result in masking. There are no data on masking in birds specifically due to explosives; therefore, the limited data on masking due to impulsive sounds, described for acoustic stressors in Section 3.6.2.1.1.3 (Masking), apply to explosive exposures. Due to the very brief duration of an explosive sound, any masking would be brief during an explosive activity.

3.6.2.2.1.5 Behavioral Reactions

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). The limited data on behavioral reactions due to impulsive sounds, described for acoustic stressors in Section 3.6.2.1.1.5 (Behavioral Reactions), apply to explosive exposures.

Because data on behavioral responses by birds to explosions is limited, information on bird responses to other impulsive sounds may be informative. Seismic surveys had no noticeable impacts on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al., 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas. 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 & Temple, 1986).

3.6.2.2.1.6 Long-Term Consequences

Long-term consequences to birds due to explosive exposures are considered following the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.7).

Long-term consequences to a population are determined by examining changes in the population growth rate. Physical effects that could lead to a reduction in the population growth rate include mortality or injury, which could remove animals from the reproductive pool, and permanent hearing impairment, which could impact foraging and communication. The long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some birds may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. More research is needed to better understand the long-term consequences of anthropogenic stressors, although intermittent exposures to explosive noise are assumed to be less likely to have lasting consequences.

3.6.2.2.2 Impacts from Explosives

3.6.2.2.2.1 Methods for Analyzing Impacts from Explosives

Criteria to assess impacts to birds were developed in support of the 2016 BO. The Navy applied those same thresholds to assess effects in the reinitiation of ESA section 7 consultation with the USFWS for activities described in this Supplemental, except where noted below.

The injury and mortality thresholds for in-air exposures to explosions were established using the data for multiple species of birds exposed to explosions in Damon et al. (1974). The data available from that study enabled establishment of dual metric thresholds for injury and mortality using peak pressure (dB peak) and impulse (Pa-s). There was insufficient data to correct for the mass of the bird using the data in Damon et al. (1974); therefore, the lowest values associated with injury and mortality were applied. These values were used in the analysis conducted in the 2016 BO.

The injury and mortality thresholds for underwater exposures to explosions were established using the data for ducks exposed to explosions in Yelverton et al. (1973). The authors of that study correlated the impulse metric (Pa-s) to injuries observed in birds. The thresholds for injury and mortality developed using the data in Yelverton et al. (1973) were adjusted to account for the relatively smaller mass of the marbled murrelet (200 grams) and the relatively larger mass of the short-tailed albatross (4,000 grams) compared to the ducks in the study. This adjustment was based on the data in Yelverton and Richmond (1981). These values were used in the analysis conducted in the 2016 BO.

The in-air threshold for onset of auditory injury for impulsive noise exposure is 165 dB re 20 μPa peak. Based on the hearing loss found by Hashino et al. (1988), exposure to peak pressure of 169 dB re 1 μPa peak SPL could exceed the onset of auditory injury. However, for that study, the SEL, which is another metric for determining auditory injury, was not reported and could not be reliably approximated. This value differs from the threshold applied in the 2016 BO, as described in Section 3.6.2.1.5 (Impacts from Weapon Noise).

The underwater threshold for auditory injury is extrapolated from the available data on bird hearing loss from in-air exposures. The multi-disciplinary science panel convened by USFWS and the U.S. Navy to establish pile driving injury criteria, also known as the Hydroacoustic Science Panel (Science Applications International Corporation, 2011), set a sound exposure threshold (unweighted) of 135 dB re 20 μPa^2-s cumulative SEL plus a spectral correction factor of 15 dB to account for low-frequency energy in an impulsive exposure as an approximate threshold for onset of auditory injury in birds due to impulsive sources in air. To convert this threshold to an underwater auditory injury threshold, the reference pressure is changed from 20 μPa in air to 1 μPa in water (add 26 dB) and the hearing ability of birds, and correspondingly their sensitivity to auditory impacts, is estimated using the limited data on bird hearing underwater and data from other amphibious species, specifically otariids (see U.S. Department of the Navy (2017)). That data suggests a 36 dB impedance value for birds underwater. The resulting in-water auditory injury threshold is 212 dB re 1 μPa^2-s SEL. This value was used in the analysis conducted in the 2016 BO.

Table 3.6-5 presents the auditory and non-auditory injury thresholds from underwater and in-air explosions for the two ESA-listed diving bird species found in the NWTT Study Area.

Table 3.6-5: Explosive Effects Thresholds for ESA-listed Bird Species

Bird Species	Underwater			In Air		
	Auditory Injury[1] (dB re 1 µPa^2 s)	*Injury[2] (Pa-s)*	*Mortality[2] (Pa-s)*	*Auditory Injury (dB re 20 µPa peak)*	*Injury[3] Dual Metric (dB re 20 µPa peak) (Pa-s)*	*Mortality[3] Dual Metric (dB re 20 µPa peak) (Pa-s)*
Marbled Murrelet	212	36	138	165	185 dB re 20 µPa peak 34.5 Pa-s	191 dB re 20 µPa peak 69 Pa-s
Short-Tailed Albatross		94	361			

[1]Threshold based on methods of the Hydroacoustic Science Panel, consistent with the analysis in the 2016 BO.
[2]Underwater injury and mortality thresholds are adjusted to consider typical mass of each bird species, based on the relationships between injury and mass for fish, consistent with the analysis in the 2016 BO.
[3]Dual metrics from observations of in-air explosive injuries to birds in Damon et al. (1974), consistent with the analysis in the 2016 BO. Data similar to that for underwater explosive injuries is not available to conduct mass-scaling of in-air injury thresholds; however, the data in Damon et al. (1974) is specific to birds and included birds of similar size as considered in this analysis.
Notes: Underwater sound exposure level = dB re 1 µPa^2 s, In-air peak pressure = dB re 20 µPa peak, Impulse = Pa-s (pascal seconds).

3.6.2.2.2.2 Impact Ranges for Explosives

Underwater Explosives

Ranges to effect for explosives were calculated for underwater explosions using the criteria listed in Table 3.6-5 above and the Navy Acoustic Effects Model. Smaller animals are more susceptible to injury from underwater explosions (Yelverton & Richmond, 1981), so the underwater mortality and injury criteria in Table 3.6-5 were scaled to the mass of each species based on the relationships observed for fish. Ranges to auditory injury, non-auditory injury, and mortality for underwater explosives are reported in Table 3.6-6 for the marbled murrelet and Table 3.6-7 for the short-tailed albatross.

Marbled murrelet

For the sources analyzed in Table 3.6-6, a portion of explosive bins occur greater than 50 NM from shore, where there is very little evidence of marbled murrelet presence in the Study Area.

Table 3.6-6: Underwater Explosives Range to Effects (in meters) for the Marbled Murrelet in the Inland Waters and Offshore Area

Range to Effects for Explosives: Marbled Murrelet[1]				
Source Bin[2]	***Source Depth (meters)***	***Range to Auditory Injury (meters)***	***Range to Non-Auditory Injury (meters)***	***Range to Mortality (meters)***
E1	0.1	9 (3–12)	22 (21–23)	6 (6–7)
	18.25	8 (2–11)	25 (24–25)	7 (7–7)
E2	0.1	6 (4–8)	27 (25–30)	8 (8–9)
E3	10 (Inland Waters)	31 (8–75)	103 (75–220)	22 (22–22)
	18.25 (Offshore Area)	23 (8–35)	70 (70–75)	27 (22–35)
E4	10	14 (11–17)	100 (100–100)	30 (30–30)
	30	13 (10–15)	105 (100–140)	30 (30–30)
	70	0 (0–0)	100 (100–100)	19 (19–19)
	90	0 (0–0)	90 (90–95)	0 (0–5)
E5	0.1	25 (10–40)	78 (75–80)	25 (23–25)
E7	10	40 (40–40)	363 (330–400)	110 (110–110)
	30	32 (30–35)	435 (380–550)	123 (110–200)
	70	20 (19–20)	514 (360–775)	110 (110–110)
	90	0 (0–5)	424 (360–775)	100 (100–100)
E8	47.75	40 (40–40)	524 (420–825)	155 (150–230)
E10	0.1	47 (35–55)	245 (200–850)	102 (85–350)
E11	91.4	86 (85–100)	1086 (975–2025)	455 (390–775)
	200	0 (0–10)	1431 (1275–1775)	390 (390–390)

[1]Average distance (in meters) is shown with the minimum and maximum distances due to varying propagation environments in parentheses.
[2]Shaded bins occur greater than 50 NM from the shore, where marbled murrelet presence is unlikely.

Short-Tailed Albatross

For the explosive bin E3 (Inland Waters) listed in Table 3.6-6 above, no geographic overlap with short-tailed albatross is expected because the species does not occur in Inland Waters. There is also limited spatial overlap of short-tailed albatross dive depths and underwater detonations for the bins identified in Table 3.6-7.

Table 3.6-7: Underwater Explosives Range to Effects (in meters) for the Short-Tailed Albatross in the Offshore Area

Range to effects for explosives: Short-tailed Albatross[1]				
Bin[2]	***Source depth***	***Range to Auditory Injury (m)***	***Range to Non-Auditory Injury (m)***	***Range to Mortality (m)***
E1	0.1	2 (0–10)	2 (0–8)	1 (0–3)
	18.25	0 (0–0)	0 (0–0)	2 (2–3)
E2	0.1	6 (4–7)	9 (9–10)	3 (3–3)
E3	18.25	20 (0–45)	25 (25–25)	0 (0–0)
E4	10	14 (10–17)	40 (40–40)	11 (11–11)
	30	0 (0–0)	33 (30–35)	0 (0–0)
	70	0 (0–0)	0 (0–0)	0 (0–0)
	90	0 (0–0)	0 (0–0)	0 (0–0)
E5	0.1	14 (8–20)	17 (17–17)	8 (8–8)
E7	10	40 (40–40)	139 (130–160)	45 (45–45)
	30	30 (30–30)	130 (130–130)	40 (40–40)
	70	0 (0–0)	144 (140–150)	0 (0–0)
	90	0 (0–0)	133 (130–140)	0 (0–0)
E8	45.75	25 (25–30)	200 (190–210)	45 (45–45)
E10	0.1	21 (18 -23)	59 (35–420)	26 (18–140)
E11	91.4	77 (75–100)	491 (470–500)	150 (150–150)
	200	0 (0–0)	547 (525–575)	0 (0–0)

[1]Average distance (in meters) is shown with the minimum and maximum distances due to varying propagation environments in parentheses.
[2]Shaded ranges to effect have no overlap with expected short-tailed albatross dive depth.

<u>**In-Air Explosives**</u>

Ranges to effect for in-air explosions for both species are reported in Table 3.6-8.

The Navy's proposed training activities involving in-air explosives would all occur greater than 50 NM from shore. Explosions that occur at aerial targets would occur at altitudes far above marbled murrelet and short-tailed albatross presence. Table 3.6-8 presents ranges to effect for explosions that would occur at or near the water surface, releasing explosive energy into the air, which are applicable to both the marbled murrelet and the short-tailed albatross. Ranges to effect were calculated using methods based on Swisdak (1975).

Table 3.6-8: Predicted Range to Effects for In-Air Explosions

Bin	Range to effect (meters)				
	Auditory Injury	Injury		Mortality	
	range (m)	impulse[1]	peak pressure	impulse[1]	peak pressure
E1	9.3	0.6	1.7	0.1	1.2
E2	16.0	2.1	2.9	0.8	2.0
E5	43.4	16.4	7.9	7.9	5.4
E10	159.7	193.6	29.0	121.0	19.8

[1]Thresholds for impulse RTE calculations are dependent on NEW of the explosive, so they are scaled appropriately using the lookup table and figure 3a found in U.S. Department of the Navy (1975).

3.6.2.2.3 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

As shown in Table 3.0-7, the number of explosions would increase for E1, E2, and E5 explosives but decrease for E12 explosives. E3 and E10 explosives would remain the same as what was analyzed previously under the 2015 NWTT Final EIS/OEIS. Sound and energy generated by most small underwater explosions are unlikely to disturb birds 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. Explosives detonated at or just above the water surface, such as those used in anti-surface warfare, would create blast waves that would propagate through both the water and air. Detonations in air could also injure birds while either in flight or at the water surface. Detonations in air during anti-air warfare training would typically occur at much higher altitudes (greater than 3,000 ft. above mean sea level) where seabirds and migrating birds are less likely to be present, although some events target incoming threats at lower altitudes. Detonations of bombs with larger net explosive weights, any event employing static targets, or multiple detonations could be more likely to cause seabird mortalities or injuries. If prey species, such as fish, are killed or injured as a result of detonations, some birds may continue to forage close to the area, or may be attracted to the area, and be exposed to subsequent detonations in the same area within a single event, such as gunnery 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 munitions disposal charges. However, a fleeing response to an initial explosion may reduce seabird exposure to any additional explosions that occur within a short timeframe. Detonations either in air or underwater have the potential to cause a permanent or temporary threshold shift, which could affect the ability of a bird to communicate with conspecifics or detect biologically relevant sounds.

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 animal's behavior at the time of the exposure. 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.

Nearshore waters are the primary foraging habitat for many seabird species. Any small detonations close to shore could have a short-term adverse impact on nesting and nearshore foraging species. Larger detonations would typically occur near areas with the potential for relatively high concentrations of seabirds (upwelling areas associated with the Pacific Current; productive live/hard bottom habitats; and large algal mats); therefore, any impacts on seabirds are likely to be greater in these areas.

Offshore training activities involving explosions would typically be conducted in existing training areas, with detonations and explosive munitions typically occurring 50 NM or more from shore. Explosions would occur in Inland Waters within the Crescent Harbor EOD Training Range and Hood Canal EOD Training Range. Unlike offshore training areas where explosives are used, detonations in Crescent Harbor would occur in the same general location that measures approximately 1,200 m wide and 2,400 m long (2.88 km^2). As shown in Table 3.0-7 of this Supplemental, the number of E3 detonations would remain at six per year and the number of charges smaller than 0.1 lb. would remain the same; therefore, birds in Inland Waters would be exposed to the same number of detonations as was analyzed in the 2015 NWTT Final EIS/OEIS.

The Navy will implement mitigation to avoid or minimize potential impacts on seabirds during applicable explosive medium-caliber gunnery activities in the NWTT Offshore Area, and during explosive mine neutralization activities involving Navy divers in NWTT Inland Waters, as discussed in Section 5.3.3 (Explosive Stressors). In addition, the Navy will not use explosives during training activities within 50 NM from shore in the Marine Species Coastal Mitigation Area, which will reduce the likelihood of exposure to birds that migrate or forage in the nearshore portions of the Offshore Area, particularly for marbled murrelets during breeding periods when they are known to forage in waters in close proximity to nest sites.

Marbled Murrelet. As discussed previously, marbled murrelet ranges in breeding periods are closer to breeding habitats, which suggests that no murrelets would be exposed to high explosives (as these activities occur greater than 50 NM from shore). All research, to date, indicates that marbled murrelet occurrence beyond 12 km offshore is extremely unlikely, even during the winter months (Adams et al., 2014; Falxa & Raphael, 2016; Lorenz et al., 2016; Raphael et al., 2007; U.S. Fish and Wildlife Service, 2016). Therefore, exposures to explosive training activities are not likely to occur. In Inland Waters, marbled murrelets have an increased likelihood of exposure. Marbled murrelets exposed to underwater explosions may be subject to lethal or non-lethal injuries. Non-lethal injuries may include scarred or ruptured eardrums, or gastrointestinal tract lesions. Marbled murrelets may survive their exposure to in-air and in-water explosions and associated stressors; however, these individuals would have reduced levels of fitness and reproductive success, and higher risk of predation by reducing their ability to detect and/or evade predators. Lethal injuries may include direct mortality, lung hemorrhaging, ruptured liver, hemorrhaged kidney, ruptured air sacs, and/or coronary air embolisms. For individual marbled murrelets that are exposed to in-air and in-water explosions but not injured or killed, responses would likely include startle responses, flushing, or avoidance behaviors (i.e., diving, or leaving the area). In uninjured individuals, these responses would be short term with no significant disruptions to their normal behavior that would create a likelihood of injury. For in-water explosions, the Navy no longer uses detonation techniques where the detonation is delayed between the time of pre-detonation survey and the detonation in inland waters. This allows the Navy to detonate on command once the pre-detonation surveys have been completed. This may reduce the window of opportunity for birds to enter into the area where injury may occur after the surveys have been completed (U.S. Fish and Wildlife Service, 2016).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for training activities described in this Supplemental for potential impacts on marbled murrelets from explosive stressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This information includes new range to effects estimates not included in the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS. The new range to effects estimates are based off of a revised modeling methodology and in-air explosives criteria, as well as an increased understanding of underwater hearing abilities of marbled murrelets and abundance estimations for areas that overlap with activities using explosives of different types and sizes.

Short-tailed Albatross. Short-tailed albatross pelagic range overlaps with areas that include detonations as part of training activities in the Offshore Area portion of the NWTT Study Area. If a short-tailed albatross were within the range to effects for a particular detonation, mortality and injury may occur, or various behavioral responses. Due to the small range to effects distance and widely dispersed activities within the Offshore Area of the Study Area, and the expected low numbers of short-tailed albatrosses at sea where training activities would occur, short-tailed albatrosses would have a low potential for any exposures from explosives use during training activities. Mitigation measures for explosive medium-caliber gunnery activities will help the Navy avoid or reduce potential impacts on short-tailed albatrosses during those events, as described in Chapter 5 (Mitigation).

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for training activities described in this Supplemental for potential impacts on short-tailed albatrosses from explosive stressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This information includes new range to effects estimates not included in the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS, as well as revised in-air explosive criteria.

Pursuant to the ESA, explosives used during training activities as described under Alternative 1 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from explosives stressors during training activities using explosives described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Explosives Under Alternative 1 for Testing Activities

For a summary of general impacts on marine birds from explosive testing activities, see the discussion above under training activities. As shown in Table 3.0-7, the number of explosions in the Offshore Area would increase for E1, E7, E8, and E11 explosives, but decreases for E4 explosives compared to activities previously analyzed in the 2015 NWTT Final EIS/OEIS. Only one testing activity, explosive Mine Countermeasure and Neutralization Testing, would occur within 50 NM from shore in the Marine

Species Coastal Mitigation Area. This event involves the use of explosives in bins E4 and E7. Based on operational parameters, explosive Mine Countermeasure and Neutralization Testing would occur in waters 3 NM or greater from shore at the Quinault Range Site or 12 NM or greater from shore elsewhere in the NWTT Offshore Area. This activity would not occur south of the Oregon/California border. During the ESA consultation and permitting processes, the Navy developed mitigation to prohibit the use of explosives in bin E7 closer than 6 NM from shore at the Quinault Range Site. The Navy also developed mitigation from October 1 through June 30 within 20 NM from shore to not exceed the use of 20 explosives from bin E4 and 3 explosives from bin E7 annually and no more than 60 explosives from bin E4 and 9 explosives from bin E7 over 7 years. The Navy will not conduct explosive events year-round within the Olympic Coast National Marine Sanctuary Mitigation Area and Juan de Fuca Eddy Marine Species Mitigation Area. There would be no testing activities using explosives in Inland Waters under Alternative 1.

Marbled Murrelet. Marbled murrelets may be exposed to explosives during mine countermeasure and neutralization testing proposed in the Offshore Area. Exposures to explosions during other testing activities, if any, would likely occur when murrelets extend their pelagic ranges in winter (non-breeding) periods. Within the NWTT Study Area, marbled murrelets were reasonably certain to occur within 12 NM of the coastline in the summer and within 50 NM in the winter (Adams et al., 2014; Falxa & Raphael, 2016; Lorenz et al., 2016; Raphael et al., 2007; U.S. Fish and Wildlife Service, 2016). Marbled murrelets exposed to underwater explosions may be subject to lethal or non-lethal injuries. Non-lethal injuries may include scarred or ruptured eardrums, or gastrointestinal tract lesions. Marbled murrelets may survive their exposure to in-air and in-water explosions and associated stressors; however, these individuals have reduced levels of fitness and reproductive success, and higher risk of predation by reducing their ability to detect and/or evade predators. Lethal injuries may include direct mortality, lung hemorrhaging, ruptured liver, hemorrhaged kidney, ruptured air sacs, and/or coronary air embolisms. For individual marbled murrelets that are exposed to in-air and in-water explosions but not injured or killed, responses would likely include a startle response, flushing, or avoidance (i.e., diving, or leaving the area). In uninjured individuals, these responses would be short term with no significant disruptions to their normal behavior that would create a likelihood of injury.

Mitigation measures described above and detailed in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment) would reduce the areas of potential overlap and limit potential exposure of marbled murrelets to explosive activities. For example, limitations on the use of explosives over a 7-year period would result in explosive events being conducted every other year, instead of annually. Requirements to use explosives in bin E7 6 NM or further from shore will significantly reduce potential overlap with marbled murrelet habitat. Additional mitigation area restrictions will result in explosive events not occurring within or north of the Olympic Coast National Marine Sanctuary. Considering the mitigation areas, explosive events would only occur beyond 12 NM from shore off the coast of Oregon (where murrelets are unlikely to occur) or within the portion of the Quinault Range Site located outside of the sanctuary.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for testing activities under Alternative 1 for potential impacts on marbled murrelets from explosive stressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the marbled murrelet. This information includes new range to effects estimates not included in the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS. The new range to effects estimates are based off of a revised modeling methodology and in-air explosives criteria, as well as an increased understanding of underwater hearing abilities of marbled murrelets and abundance estimations for areas that overlap with activities using explosives of different types and sizes.

Short-tailed Albatross. Short-tailed albatross pelagic range overlaps with areas that include detonations as part of testing activities in the Offshore Area portion of the NWTT Study Area. If a short-tailed albatross were within the range to effects for a particular detonation, mortality and injury may occur, or various behavioral responses. Due to the small range to effects distance and widely dispersed activities within the Offshore Area of the Study Area, and the expected low numbers of short-tailed albatrosses at sea where testing activities would occur, short-tailed albatrosses would have a low potential for any exposures from explosives use during testing activities.

The Navy has requested reinitiation of ESA section 7 consultation with the USFWS for testing activities under Alternative 1 for potential impacts on short-tailed albatrosses from explosive stressors. As part of this consultation, the Navy is presenting the most current information to estimate and model potential impacts on the short-tailed albatross. This information includes new range to effects estimates not included in the previous consultation between the Navy and USFWS for activities described in the 2015 NWTT Final EIS/OEIS, as well as revised in-air explosive criteria.

Pursuant to the ESA, explosives used during testing activities as described under Alternative may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from explosives stressors during testing activities using explosives described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.2.3.1 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

For a summary of general impacts on marine birds from explosive training activities, see the discussion above under Alternative 1 training activities. As shown in Table 3.0-7, the number of explosions in the Offshore Area would increase for E1, E2, E5, E10, and E11 explosives (in locations greater than 50 NM from shore). In Inland Waters, the number of E3 explosives and explosives smaller than 0.1 lb. would remain the same.

Marbled Murrelet. As discussed under Alternative 1, marbled murrelet ranges in breeding periods are closer to breeding habitats, which suggests that no murrelets would be exposed to high explosives (as these activities occur greater than 50 NM from shore). Exposures, if any, would likely occur when murrelets extend their pelagic ranges in winter (non-breeding) periods. All research to date indicates that such pelagic environments are rarely or never used by marbled murrelets (Adams et al., 2014; Falxa & Raphael, 2016; Lorenz et al., 2016; Raphael et al., 2007; U.S. Fish and Wildlife Service, 2016). The potential impacts on marbled murrelets from explosive stressors under Alternative 2 training activities are the same as discussed previously under Alternative 1 training activities. For in-water explosions, the Navy no longer uses detonation techniques where the detonation is delayed between the time of pre-detonation survey and the detonation in inland waters. This allows the Navy to detonate on command once the pre-detonation surveys have been completed. This may reduce the window of opportunity for birds to enter into the area where injury may occur after the surveys have been completed (U.S. Fish and Wildlife Service, 2016).

Short-tailed Albatross. Short-tailed albatross pelagic range overlaps with areas that include detonations as part of training activities in the Offshore Area portion of the NWTT Study Area. If a short-tailed albatross were within the range to effects for a particular detonation, mortality and injury may occur, or various behavioral responses. Due to the small range to effects distance and widely dispersed activities within the Offshore Area of the Study Area, and the expected low numbers of short-tailed albatrosses at sea where training activities would occur, short-tailed albatrosses would have a low potential for any exposures from explosives use during training activities.

Pursuant to the ESA, explosives used during training activities as described under Alternative 2 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from explosives stressors during training activities using explosives described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

<u>**Impacts from Explosives Under Alternative 2 for Testing Activities**</u>

For a summary of general impacts on marine birds from explosive testing activities, see the discussion above under Alternative 1 training activities. As shown in Table 3.0-7, the number of explosions in the Offshore Area would increase for E1, E7, E8, and E11 explosives, but decreases for E4 explosives compared to activities previously analyzed in the 2015 NWTT Final EIS/OEIS. There would be no activities using explosives in Inland Waters under Alternative 2.

Marbled Murrelet. Marbled murrelets may be exposed to explosives during mine countermeasure and neutralization testing proposed in the Offshore Area. Exposures to explosions during other testing activities, if any, would likely occur when murrelets extend their pelagic ranges in winter (non-breeding) periods. All research to date indicates that such pelagic environments are rarely or never used by marbled murrelets (Adams et al., 2014; Falxa & Raphael, 2016; Lorenz et al., 2016; Raphael et al., 2007; U.S. Fish and Wildlife Service, 2016). The potential impacts on marbled murrelets from explosive stressors under Alternative 2 testing activities are the same as discussed previously under Alternative 1 testing activities.

Short-tailed Albatross. Short-tailed albatross pelagic range overlaps with areas that include detonations as part of testing activities in the Offshore Area portion of the NWTT Study Area. If a short-tailed albatross were to be within an area considered to be within the range to effects for a particular detonation, mortality and injury may occur, or various behavioral responses. Due to the small range to effects distance and widely dispersed activities within the Offshore Area of the Study Area, and the expected low numbers of short-tailed albatrosses at sea where testing activities would occur, short-tailed albatrosses would have a low potential for any exposures from explosives use during testing activities.

Pursuant to the ESA, explosives used during testing activities as described under Alternative 2 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from explosives stressors during testing activities using explosives described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.2.4 No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Explosives stressors from sources as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from explosives on individual birds, but would not measurably improve the status of bird populations.

3.6.2.3 Energy Stressors

The energy stressors that may impact marine birds include in-water electromagnetic devices and high-energy lasers. Only one new energy stressor (high-energy lasers) used in testing activities differs from the energy stressors that were previously analyzed in the 2015 NWTT Final EIS/OEIS. Use of low-energy lasers was analyzed and dismissed as an energy stressor in the 2015 NWTT Final EIS/OEIS in Section 3.0.5.3.2.2 (Lasers). However, at that time high-energy laser weapons were not part of the Proposed Action for the Study Area.

3.6.2.3.1 Impacts from In-Water Electromagnetic Devices

In-water electromagnetic devices were described in Section 3.0.5.3.2.1 (Electromagnetic) of the 2015 NWTT Final EIS/OEIS; however, they were not analyzed for potential impacts on birds. This Supplemental provides an update to the 2015 NWTT Final EIS/OEIS with an analysis of potential impacts on birds from the use of in-water electromagnetic devices. For a description of in-water electromagnetic devices, see Section 3.0.3.3.1.2 (In-Water Electromagnetic Devices) and Table 3.0-9 in this Supplemental EIS/OEIS.

3.6.2.3.1.1 Impacts from In-Water Electromagnetic Devices Under Alternative 1

<u>Impacts from In-Water Electromagnetic Devices Under Alternative 1 Training Activities</u>

Under Alternative 1 training activities, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same as those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-9).

Exposure of birds would be limited to those foraging at or below the surface (e.g., cormorants, loons, alcids, petrels, grebes) because that is where the devices are used. Birds that forage inshore could be exposed to these in-water electromagnetic stressors because their habitat overlaps with some of the activities that occur in the nearshore portions within the Study Area. However, the in-water electromagnetic fields generated would be distributed over time and location near mine warfare ranges and harbors, and any influence on the surrounding environment would be temporary and localized. More importantly, the in-water electromagnetic devices used are typically towed by a helicopter, surface ship, or unmanned vehicle. It is likely that any birds in the vicinity approaching a vehicle towing an in-water electromagnetic device would be dispersed by the noise and disturbance generated by the vehicles (Section 3.6.2.1.4, Impacts from Aircraft Noise) and therefore move away from the vehicle and device before any exposure could occur.

Impacts on birds from potential exposure to in-water electromagnetic devices would be temporary and inconsequential based on the (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 200 m from the source), (2) very localized potential impact area, (3) temporary duration of the activities (hours), (4) occurrence only underwater, and (5) the likelihood that any birds in the vicinity of the approaching vehicles towing an in-water electromagnetic devices would move away from the vehicle and device before any exposure could occur. No long-term or population-level impacts are expected.

Impacts on prey availability (fishes) would also likely be negligible. For an analysis of in-water electromagnetic devices on prey species for marine birds, see Section 3.6.2.3.1 (Impacts from In-Water Electromagnetic Devices). Some fishes could have a detectable response to electromagnetic exposure, but any impacts would be temporary and would not impact the animal's fitness, which 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 & Fahay, 1998). Therefore, potential impacts on marine bird prey species recruitment are not be expected.

Pursuant to the ESA, use of in-water electromagnetic devices used during training activities as described under Alternative 1 would have no effect on the short-tailed albatross. The use of in-water electromagnetic devices may affect, but are not likely to adversely affect, the marbled murrelet. The Navy is consulting with the USFWS on the marbled murrelet, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from in-water electromagnetic devices during training activities described under Alternatives 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from In-Water Electromagnetic Devices Under Alternative 1 Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 1.

3.6.2.3.1.2 Impacts from In-Water Electromagnetic Devices Under Alternative 2

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same as those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-9). The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on birds would be the same. As described above for Alternative 1, some birds may be exposed to in-water electromagnetic devices during training activities. The impact of these stressors on marine birds under Alternative 2 would be inconsequential because (1) the area exposed to the stressor is extremely small relative to most birds' ranges; (2) birds would only be exposed to electromagnetic energy when submerged; (3) the number of activities involving the stressor is low; (4) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (5) even for susceptible birds (e.g., diving birds), the consequences of exposure are limited to temporary disruptions to navigation and orientation under Alternative 2.

Pursuant to the ESA, use of in-water electromagnetic devices used during training activities as described under Alternative 2 may affect the marbled murrelet and the short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from in-water electromagnetic devices during training activities described under Alternatives 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 2.

3.6.2.3.1.3 Impacts from In-Water Electromagnetic Devices Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. In-water electromagnetic devices as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from in-water electromagnetic devices on individual marine birds and their prey items, but would not measurably improve the status of bird populations or subpopulations.

3.6.2.3.2 Impacts from In-Air Electromagnetic Devices

In-air electromagnetic devices were described as Airborne Electromagnetic Energy in Section 3.0.5.3.2.1 (Electromagnetic) of the 2015 NWTT Final EIS/OEIS; however, they were not analyzed for potential impacts on birds. Sources of electromagnetic energy in the air include communications transmitters, radars, and electronic countermeasures transmitters. Electromagnetic devices on Navy platforms operate across a wide range of frequencies and power. On a single ship the source frequencies may range from 2 megahertz (MHz) to 14,500 MHz, and transmitter maximum average power may range from 0.25 watts to 1,280,00 watts. It is assumed that most Navy platforms associated with the training and testing activities will be transmitting from a variety of in-air electromagnetic devices at all times that they are underway, with very limited exceptions. Most of these transmissions (e.g., for routine surveillance, communications, and navigation) will be at low power. High-power settings are used for a small number of activities including ballistic missile defense training, missile and rocket testing, radar and other system testing, and signature analysis operations. The number of Navy vessels or aircraft in the Study Area at any given time varies and is dependent on local training or testing requirements. Therefore, in-air electromagnetic energy as part of training and testing activities would be widely dispersed throughout the Study Area, but more concentrated in portions of the Study Area near ports, naval installations, and range complexes.

This Supplemental provides an update to the 2015 NWTT Final EIS/OEIS with an analysis of potential impacts on birds from the use of in-water electromagnetic devices. For a description of in-water electromagnetic devices, see Section 3.0.3.3.1.2 (In-Air Electromagnetic Devices) and Table 3.0-9 in this Supplemental EIS/OEIS.

3.6.2.3.2.1 Impacts from In-Air Electromagnetic Devices Under Alternative 1 and Alternative 2

Impacts from In-Air Electromagnetic Devices Under Alternative 1 and 2 for Training and Testing Activities

Studies conducted on in-air electromagnetic sensitivity in birds have typically been associated with land, and little information exists specifically on seabird response to in-air electromagnetic changes at sea. Based on these studies, in-air electromagnetic effects can be categorized as thermal (i.e., capable of causing damage by heating tissue) or non-thermal. Thermal effects are most likely to occur when near high-power systems. Should such effects occur, they would likely cause birds to temporarily avoid the area receiving the electromagnetic radiation until the stressor ceases (Manville, 2016). Currently, questions exist about far-field, non-thermal effects from low-power, in-air electromagnetic devices. Although findings are not always consistent, in a literature review of the topic, Manville (2016) reported that several peer-reviewed studies have shown non-thermal effects can include (1) affecting behavior by preventing birds from using their magnetic compass, which may in turn affect migration; (2) fragmenting the DNA of reproductive cells, decreasing the reproductive capacity of living organisms; (3) increasing the permeability of the blood-brain barrier; (4) other behavioral effects; (5) other molecular, cellular, and metabolic changes; and (6) increasing cancer risk.

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 & Hedenstrom, 2007). However, ample evidence exists that displaced birds can successfully reorient and find their way when one or more cues are removed. 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 et al. (2011) and Wiltschko and Wiltschko (2005) 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.

Given the dispersed nature of Navy testing and training activities at sea and the relatively low-level and dispersed use of these systems at sea, the following conclusions are reached:

- The chance that in-air electromagnetic devices would cause thermal damage to an individual bird is extremely low;
- It is possible, although unlikely, that some birds would be exposed to levels of electromagnetic radiation that would cause discomfort, in which case they would likely avoid the immediate vicinity of testing and training activities;
- The strength of any avoidance response would decrease with increasing distance from the in-air electromagnetic device; and
- No long-term or population-level impacts would occur.

It is unlikely that the marbled murrelet and short-tailed albatross would be exposed to in-air electromagnetic radiation because these species would not be close to vessel or aircraft-based radar systems to receive any measurable amount of electromagnetic field. In their 2016 BO, the USFWS determined that there were several aspects of the electronic warfare training that limit exposures of wildlife to EMR. These factors include antenna configurations of mobile emitters that limit exposure to birds. For example, emitter antennas extend 14 ft. above the mobile emitter vehicles and the directional beams produced by the emitters are aimed to allow unobstructed signal transmission (taking advantage of clear lines of sight) so that there is little or no potential for wildlife on the ground or in the tree canopy to be exposed to the signal (U.S. Fish and Wildlife Service, 2016). Therefore, only birds in flight over the forest canopy have the potential to intersect beams and become exposed to electromagnetic energy from training and testing activities.

Marbled Murrelet. A marbled murrelet would be exposed to electromagnetic energy when their flight paths intersect with a radar beam. The radar emitters are energized intermittently and produce EMR with frequencies between 4 and 8 GHz. The best-available commercial and scientific information indicates that the effects of brief, intermittent exposures to radar frequencies in the range of 4–8 GHz are likely to be insignificant to birds in flight, including the marbled murrelet (Manville, 2016). Physical effects, such as tissue heating or burns, are considered to be discountable, because an exposure lasting a few seconds (as is the case with a bird in flight) would be too brief to manifest these effects.

Pursuant to the ESA, use of in-air electromagnetic devices used during training and testing activities as described under Alternatives 1 and 2 would have no effect on the short-tailed albatross. Activities that use In-air electromagnetic devices may affect the marbled murrelet. The Navy is consulting with the USFWS on the marbled murrelet, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from in-air electromagnetic devices during training and testing activities described under Alternatives 1 and 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.3.2.2 Impacts from In-Air Electromagnetic Devices Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. In-air electromagnetic devices as listed above would not be introduced into the marine environment or areas over land. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from in-air electromagnetic devices on individual birds, but would not measurably improve the status of bird populations or subpopulations.

3.6.2.3.3 Impacts from High-Energy Lasers

Use of low-energy lasers were covered in the 2015 NWTT Final EIS/OEIS in Section 3.0.5.3.2.2 (Lasers), but high-energy laser weapons were not part of the proposed action in the 2015 NWTT Final EIS/OEIS. The use of high-energy lasers represents a new substressor used in an existing activity in this Supplemental EIS/OEIS. As discussed in this Supplemental, Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy laser weapons are designed to disable surface targets, rendering them immobile. High-energy laser weapons testing activities involve evaluating the effectiveness of a high-energy laser deployed from a surface ship or helicopter to create small but critical failures in potential targets from short ranges. The primary concern is the potential for a marine bird to be struck with the laser beam at or near the water's surface, where extended exposure could result in injury or death due to traumatic burns from the beam.

Marine birds could be exposed to a laser only if the beam missed the target or flew between the source and the target. Should the laser strike the sea surface, individual birds at or near the surface could be exposed. Because laser platforms are typically helicopters and ships, marine birds at sea would likely transit away or submerge in response to other stressors, such as ship or aircraft noise, although some marine birds may not exhibit a response to an oncoming vessel or aircraft, increasing the risk of contact with the laser beam. High-energy laser weapons activities would only occur in open ocean locations (not close to land areas).

3.6.2.3.3.1 Impacts from High-Energy Lasers Under Alternative 1

<u>Impacts from High-Energy Lasers Under Alternative 1 Training Activities</u>

No high-energy lasers are proposed for training activities under Alternative 1.

<u>Impacts from High-Energy Lasers Under Alternative 1 Testing Activities</u>

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers) and shown in Table 3.0-10, under Alternative 1 there would be up to 55 testing activities per year involving the use of high-energy lasers. One of those 55 activities is a test of a laser-based optical communication system, which was discussed in Section 3.0.3.3.2.2 and dismissed from further evaluation. The remaining 54 annual testing activities would involve the use of high-energy laser weapons in the Offshore portion of the Study Area. Birds in the open ocean are unlikely to be exposed to high-energy lasers based on (1) the relatively low number of events (54 per year throughout the entire Offshore portion of the Study Area), (2) the very localized potential impact area of the laser beam, (3) the temporary duration of potential impact (seconds), (4) the low probability of a bird at or near the surface at the exact time and place a laser misses its target, (5) the low probability of a bird transiting the area between the source and target and travel through the beam's path, and (6) the low probability of a laser missing its target. A direct strike of a marine bird at the water's surface or within the beam path is extremely unlikely, and potential impacts on the marbled murrelet and short-tailed albatross are discountable (adverse effects are unlikely to occur).

Pursuant to the ESA, use of high-energy lasers during testing activities as described under Alternative 1 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from high-energy lasers during testing activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.3.3.2 Impacts from High-Energy Lasers Under Alternatives 2

<u>Impacts from High-Energy Lasers Under Alternative 2 Training Activities</u>

No high-energy lasers are proposed for training activities under Alternative 2.

Impacts from High-Energy Lasers Under Alternative 2 Testing Activities

As shown in Table 3.0-10, 54 high-energy laser weapons testing activities involving the use of high-energy lasers are proposed to be conducted in the Offshore Area under Alternative 2, the same as under Alternative 1. Therefore, the impacts would be the same as described under Alternative 1.

Pursuant to the ESA, use of high-energy lasers during testing activities as described under Alternative 2 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from high-energy lasers during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.3.3.3 Impacts from High-Energy Lasers Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. High-energy lasers as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would remove the potential for impacts from high-energy lasers on individual marine birds, but would not measurably improve the status of bird populations.

3.6.2.4 Physical Disturbance and Strike Stressors

The physical disturbance and strike stressors that may impact birds include (1) aircraft and aerial targets, (2) vessels and in-water devices, and (3) military expended materials. The annual number of activities including aircraft and aerial targets, vessels and in-water devices, and the annual number of military expended materials are shown in Tables 3.0-11 through 3.0-17. Section 3.6.3.2 (Impacts from Physical Disturbance and Strike Stressors) of the 2015 NWTT Final EIS/OEIS discusses the potential impacts on birds by aircraft and aerial target strikes, vessels and in-water devices (disturbance and strike), and military expended material strike. For the purposes of this Supplemental, only activities that have changed since the publication of the 2015 NWTT Final EIS/OEIS are discussed in this section.

Physical disturbances 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. Birds are unlikely to be struck by aircraft and aerial target strikes, vessels and in-water devices, or military expended material strike. Activities that use these platforms or expend materials typically generate other stressors (e.g., noise) or birds can avoid collision, particularly with vessels and in-water devices, by avoiding the approach of a vessel or in-water device. When strikes do occur, they often result in bird mortality or severe injury, particularly with aircraft strikes.

The Navy will implement procedural mitigation measures to avoid or reduce potential impacts on seabirds from non-explosive small- and medium-caliber gunnery activities, as discussed in Section 5.3.4 (Physical Disturbance and Strike Stressors). The Navy will also implement mitigation to restrict applicable activities within certain distances from shore to avoid or reduce potential impacts of non-explosive practice munitions on seabirds that migrate or forage in the nearshore portions of the NWTT Offshore Area, as described in Appendix K (Geographic Mitigation Assessment). For example, the Navy will not conduct non-explosive large-caliber gunnery activities within 20 NM from shore in the Marine Species Coastal Mitigation Area.

3.6.2.4.1 Impacts from Aircraft and Aerial Target Strikes

Aircraft and aerial targets were described in Section 3.0.5.3.3.5 (Aircraft Strikes) in the 2015 NWTT Final EIS/OEIS. Table 3.0-11 shows the number of ongoing activities (from the 2015 NWTT Final EIS/OEIS) and the number of activities proposed in this Supplemental that include the use of aircraft for both training and testing activities. Bird-aircraft strikes are a grave concern for the Navy because they can harm aircrews. Bird-aircraft strikes can also damage equipment and injure or kill birds (Bies et al., 2006). In the FAA's analysis of aircraft bird strikes from 1990 to 2015, waterfowl, gulls, and raptors are the species groups of birds with the most damaging strikes on aircraft, with most strikes occurring at or after takeoff or landing (Federal Aviation Administration, 2015). Pfeiffer et al. (2018) further analyzed strike risk for specific species and military aircraft using Navy and Air Force strike data. The Navy data covered 27 years (1990–2017) and contained 21,661 wildlife strike records. The Air Force dataset spanned 23 years (1994–2017) and contained 104,129 wildlife strike records. The most hazardous species to military aircraft was the snow goose (*Anser caerulescens*), followed by the common loon (*Gavia immer*), Canada goose (*Branta canadensis*), and black vulture (*Coragyps atratus*) (Pfeiffer et al., 2018). A general overview of flight height characteristics for birds is provided in this Supplemental in Section 3.6.1.3 (Flight Altitudes).

3.6.2.4.1.1 Impacts from Aircraft and Aerial Target Strikes Under Alternative 1

Impacts from Aircraft and Aerial Target Strikes Under Alternative 1 for Training Activities

As shown in Table 3.0-11, the number of activities including aircraft movements under Alternative 1 would increase slightly in the Offshore Area. Within the Offshore Area, birds are least likely to be struck because of the flight altitudes of birds (generally lower for seabirds over open water), and flight altitudes of aircraft. Within inland waters, the number of training activities involving aircraft under Alternative 1 would also increase. As with the 2015 NWTT Final EIS/OEIS, there would be no aircraft activity as part of training activities under Alternative 1 within the Western Behm Canal.

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.

Air combat maneuver (in W-237 and the Olympic MOA), and electronic warfare training (W-237 and the Olympic MOA) activities were analyzed in the 2015 NWTT Final EIS/OEIS and the USFWS 2016 BO.

The USFWS concluded in their 2016 BO that aircraft strikes of marbled murrelets by aircraft over land to be discountable (adverse effects are unlikely to occur) for the following reasons: (1) all aircraft flights occur at altitudes that exceed 6,000 ft. above mean sea level; (2) because murrelets use forests to 4,000 ft. elevation contours, the closest approach to nesting habitat would be 2,000 ft.; (3) murrelets typically fly at 1,000 ft. above ground level; (4) most aircraft flights would occur higher than 10,000 ft. above mean sea level; and (5) the low densities of murrelets and spotted owls that occur throughout the

Olympic MOA (U.S. Fish and Wildlife Service, 2016). Similarly, the USFWS discounted aircraft strikes of marbled murrelets and short-tailed albatrosses for the following reasons: (1) short-tailed albatrosses and marbled murrelets typically fly over the ocean within a few meters of the water surface; (2) both species will be in very low densities and spending the majority of their time on or near the surface of the water; and (3) although aircraft may fly at low altitudes (no less than 3,000 ft.) over the water surface, birds are expected to exhibit behaviors that will separate the birds from the altitudes used by the great majority of the aircraft.

Pursuant to the ESA, activities involving aircraft flights and aerial targets during training activities as described under Alternative 1 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts of aircraft and aerial targets during training activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Aircraft and Aerial Target Strikes Under Alternative 1 for Testing Activities

As shown in Table 3.0-11, the number of testing activities including aircraft movements under Alternative 1 would increase in the Offshore Area. Alternative 1 includes new testing activities not previously analyzed in the 2015 NWTT Final EIS/OEIS. These activities include Mine Countermeasure and Neutralization Testing, Kinetic Energy Weapons testing (when using aerial targets), radar and other systems testing, and simulant testing (when using fixed-wing and rotary-wing aircraft). Within the Offshore Area, birds are least likely to be struck because of the flight altitudes of birds (generally lower for seabirds over open water), and flight altitudes of aircraft. Despite increases in the number of testing activities involving aircraft and aerial targets in the Offshore Area under Alternative 1, birds are at low risk for aircraft or aerial target strike for the same reasons as described above under training activities. Under Alternative 1, the number of aircraft activities in the Western Behm Canal would not change from what was previously analyzed in the 2015 NWTT Final EIS/OEIS. Within inland waters, the number of activities involving aircraft under Alternative 1 testing activities would decrease. These flights generally occur at lower altitudes, which may elevate the risk of strike for birds; however, these aircraft are primarily helicopters and birds are expected to respond to other stimulus and avoid the helicopter, reducing the potential for strike. Therefore, the potential for strike of marbled murrelets within inshore waters is discountable, a conclusion supported in the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016).

Mine Countermeasures and Neutralization Testing may occur in the nearshore and coastal portion of the Quinault Range. Typically, shorebirds when in flight in coastal areas fly within a few meters of the water or land surface and are not susceptible to strike.

Pursuant to the ESA, activities involving aircraft flights and aerial targets during testing activities as described under Alternative 1 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts of aircraft and aerial targets during testing activities described under Alternative 1 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.4.1.2 Impacts from Aircraft and Aerial Targets Under Alternative 2

Impacts from Aircraft and Aerial Targets Under Alternative 2 for Training Activities

As shown in Table 3.0-11, the number of training activities including aircraft movements under Alternative 2 would increase in the Offshore Area compared to what was analyzed previously in the 2015 NWTT Final EIS/OEIS and to what is proposed under Alternative 1. Activities proposed under Alternative 2 in Inland Waters would increase from what was previously analyzed in the 2015 NWTT Final EIS/OEIS and what is proposed under Alternative 1. As with the 2015 NWTT Final EIS/OEIS and Alternative 1, there would be no aircraft activity as part of training activities under Alternative 2 within the Western Behm Canal.

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. 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. As stated previously, birds are least at risk from aircraft or aerial target strike in the Offshore Area, primarily because of the different altitudes birds and aircraft typically occupy over the open ocean, the dispersed number of activities, and the relatively lower abundance of birds in the Offshore Area. Within inland waters, aircraft movements would generally occur at lower altitudes, which may elevate the risk of strike for birds. These aircraft, however, are primarily rotor-wing aircraft. Birds are expected to respond to other stimulus and avoid the helicopter, thus reducing the potential for strike. Therefore, the potential for strike of marbled murrelets within inshore waters is discountable, a conclusion supported in the USFWS 2016 BO (U.S. Fish and Wildlife Service, 2016). The conclusions for aircraft strike under Alternative 2 training activities is the same as for Alternative 1.

Pursuant to the ESA, activities involving aircraft flights and aerial targets during training activities as described under Alternative 2 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts of aircraft and aerial targets during training activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

Impacts from Aircraft and Aerial Targets Under Alternative 2 for Testing Activities

As shown in Table 3.0-11, the number of testing activities including aircraft movements under Alternative 2 would increase in the Offshore Area compared to what was analyzed previously in the 2015 NWTT Final EIS/OEIS and slightly increase compared to what is analyzed under Alternative 1. These increases would occur in the Offshore Area, with decreases in the Inland Waters portion of the Study Area; there would be no change within Western Behm Canal.

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. 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. As stated previously, birds are least at risk from aircraft or aerial target strike in the Offshore Area, primarily because of the different altitudes birds and aircraft typically occupy over the open ocean, the dispersed number of activities, and the relatively lower abundance of birds in the Offshore Area. Within inland waters, aircraft movements would generally occur at lower altitudes, which may elevate the risk of strike for birds. These aircraft, however, are primarily rotor-wing aircraft. Birds are expected to respond to other stimulus and avoid the helicopter, thus reducing the potential for strike. Therefore, the potential for strike of marbled murrelets within inshore waters is discountable, a conclusion supported in the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016). The conclusions for aircraft strike under Alternative 2 testing activities is the same as for Alternative 1.

Pursuant to the ESA, activities involving aircraft flights and aerial targets during testing activities as described under Alternative 2 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts of aircraft and aerial targets during testing activities described under Alternative 2 would not result in a significant adverse effect on populations seabirds, shorebirds, and other birds protected under the MBTA.

3.6.2.4.1.3 Impacts from Aircraft and Aerial Targets Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Aircraft and aerial targets as listed above would not be introduced into the affected marine environment or areas over land. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from aircraft and aerial targets on individual birds, but would not measurably improve the status of bird populations.

3.6.2.4.2 Impacts from Vessels and In-Water Devices

Appendix A (Navy Activities Descriptions) describes the number of vessels used during the various types of Navy's proposed activities. Activities involving Navy vessel movement would be widely dispersed throughout the Study Area. Since the release of the 2015 NWTT Final EIS/OEIS, updated information is available regarding vessel traffic in and around major port facilities within the NWTT Study Area. Data from the ports of Vancouver, Seattle, and Tacoma indicated there were in excess of 10,300 commercial vessel transits in 2017 associated with visits to just those ports (The Northwest Seaport Alliance, 2018; Vancouver Fraser Port Authority, 2017). This information is summarized in Chapter 4 (Cumulative Impacts) of this Supplemental EIS/OEIS.

3.6.2.4.2.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving the movement of vessels or the use of in-water devices would remain generally consistent with those proposed in the 2015 NWTT Final EIS/OEIS (these comparisons are shown in Table 3.0-12 and Table 3.0-13 of this Supplemental). Vessel movement would decrease in the Offshore Area and decrease in Inland Waters, resulting in a small net decrease in activities in the Study Area. No vessel movements would occur as part of training activities within the Western Behm Canal. The activities would occur in the same locations and in a similar manner as were analyzed previously. The increases under Alternative 1 would occur in the Offshore Area and Inland Waters portions of the Study Area, with no use of in-water devices proposed under Alternative 1 occurring in the Western Behm Canal.

In the 2016 BO, the USFWS stated, "The likelihood of either a marbled murrelet or a short-tailed albatross striking a Navy vessel [*sic*] is considered extremely unlikely and is therefore discountable" (U.S. Fish and Wildlife Service, 2016). Activities including vessel movement in the Inland Waters are proposed to decrease. Although activities including vessel movement in the Offshore Area are proposed to increase, the increase in activities does not result in increased risk to marbled murrelets or short-tailed albatross. As stated by the USFWS in the 2016 BO, "marbled murrelets and short-tailed albatross are capable of avoiding vessels" (U.S. Fish and Wildlife Service, 2016).

Similarly, the USFWS stated in the 2016 BO that, "Effects from exposure to in-water devices are considered extremely unlikely and are therefore discountable" (U.S. Fish and Wildlife Service, 2016). There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles.

Marbled Murrelet. Marbled murrelets could encounter vessels or in-water devices during training and testing activities, but strikes are extremely unlikely. Responses of murrelets to vessel operation could include diving, swimming away from a vessel, or abandoning a foraging area. However, the potential for behavioral effects from Navy vessel movements are low because the training and testing events are transitory in time, with few vessels moving over large areas. In addition, if behavioral disruptions result from the vessel operation, they are expected to be temporary. Murrelets are expected to resume their resting, breeding, and foraging bouts with minimal disruption. Therefore, effects are expected to be insignificant.

Short-tailed Albatross. Given the proposed timing, location, and frequency of training in the Offshore Area, and the small number of short-tailed albatross that are likely to occur in the Offshore Area at any given time, it is extremely unlikely that individual albatross would co-occur with Navy vessels or in-water devices. Therefore, the effects of vessel and in-water device strikes on short-tailed albatross would be discountable.

Pursuant to the ESA, training activities that use vessels and in-water devices, as described under Alternative 1, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from vessels and in-water devices during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities involving the movement of vessels or the use of in-water devices would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS (see Table 3.0-12 and Table 3.0-13 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). While vessel movement would increase significantly in the Offshore Area (from 181 to 283 annual activities), it would increase in both Inland Waters (from 916 to 918) and Western Behm Canal (63 to 77), resulting in a net increase in the Study Area. There is also an overall increase in the use of in-water devices (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously. There is an overall increase in the use of in-water devices (Table 3.0-13). This small increase in testing activity numbers would not appreciably change the analysis included in the 2015 NWTT Final EIS/OEIS, with the impact descriptions the same as described previously under Alternative 1 training activities.

Pursuant to the ESA, testing activities that use vessels and in-water devices, as described under Alternative 1, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from vessels and in-water devices during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.4.2.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the movement of vessels or the use of in-water devices would remain generally consistent with those proposed in the 2015 NWTT Final EIS/OEIS (see Table 3.0-12 and Table 3.0-13 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). Vessel movement would decrease slightly in the Study Area (Table 3.0-12), and there is an overall increase in the use of in-water devices (Table 3.0-13). Compared to Alternative 1, Alternative 2 would slightly increase vessel and in-water device use.

As with Alternative 1, the activities described under Alternative 2 in this Supplemental would not be sufficient to modify the vessel and in-water device strike conclusions for seabird species provided in the 2015 NWTT Final EIS/OEIS. Therefore, the conclusions for ESA-listed seabird species and other seabird species protected by the MBTA that were included in the 2015 NWTT Final EIS/OEIS remain valid. During

ESA section 7 consultation between the Navy and USFWS, the Navy determined that the activities described in the 2015 NWTT Final EIS/OEIS may affect, but are not likely to adversely affect the marbled murrelet or short-tailed albatross.

Pursuant to the ESA, training activities that use vessels and in-water devices, as described under Alternative 2, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from vessels and in-water devices during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Impacts from Vessels and In-Water Devices Under Alternative 2 Testing Activities

Under Alternative 2, the number of proposed testing activities involving the movement of vessels or the use of in-water devices would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS (see Table 3.0-12 and Table 3.0-13 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). Compared to the previous 2015 analysis, vessel movement under Alternative 2 would increase in the Offshore Area (from 181 to 285 annual activities), increase in the Inland Waters (from 916 to 1,028), and increase in the Western Behm Canal (from 60 to 77), resulting in an increase in the Study Area. There is also an overall increase in the use of in-water devices (Table 3.0-13). Compared to Alternative 1, Alternative 2 would slightly increase vessel and in-water device use.

As with Alternative 1, the testing activities described under Alternative 2 in this Supplemental would not be sufficient to modify the vessel and in-water device strike conclusions for bird species provided in the 2015 NWTT Final EIS/OEIS. Therefore, the conclusions for ESA-listed seabird species and other seabird species protected by the MBTA that were included in the 2015 NWTT Final EIS/OEIS remain valid.

Pursuant to the ESA, testing activities that use vessels and in-water devices, as described under Alternative 2, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from vessels and in-water devices during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.2.4.2.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Vessels and in-water devices as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from vessels and in-water devices on individual birds, but would not measurably improve the status of bird populations.

3.6.2.4.3 Impacts from Military Expended Materials

For the analysis of impacts from military expended material as physical disturbance stressors, see Section 3.6.3.2.3 (Impacts from Military Expended Materials) in the 2015 NWTT Final EIS/OEIS. Since the 2015 NWTT Final EIS/OEIS, there has been no new or emergent science that would change in any way the rationale for the dismissal of impacts from military expended material as presented in the 2015 analyses. There have been no known instances of physical disturbance or strike to any marine bird as a result of training and testing activities involving the use of military expended materials prior to or since the 2015 NWTT Final EIS/OEIS.

3.6.2.4.3.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities (from a total of 187,016 to 170,754 items). The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. The Navy will implement mitigation within a 200-yard mitigation zone to avoid or reduce potential impacts from non-explosive small- and medium-caliber gunnery activities on seabirds, as detailed in Section 5.3.4 (Physical Disturbance and Strike Stressors). While the number of training activities using military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) remain valid; physical disturbance and strike impacts on birds resulting from military expended materials are not anticipated.

Pursuant to the ESA, training activities that release military expended materials, as described under Alternative 1, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14 through Table 3.0-16 in this Supplemental are combined, the number of items proposed to be expended under Alternative 1 increases compared to ongoing activities (from a total of 8,130 to 10,710 items). The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. While the number of testing activities using military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) remain valid; physical disturbance and strike impacts on marine birds resulting from military expended materials are not expected.

Pursuant to the ESA, testing activities that release military expended materials, as described under Alternative 1, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.4.3.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14 through Table 3.0-16 of this Supplemental are combined, the number of items proposed to be expended under Alternative 2 increases compared to ongoing activities (from a total of 187,016 to 196,629 items). Compared to Alternative 1, there would be an overall increase in the number of items expended under Alternative 2. While the number of testing activities using military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) remain valid; physical disturbance and strike impacts on birds resulting from military expended materials are not expected.

Pursuant to the ESA, training activities that release military expended materials, as described under Alternative 2, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14 through Table 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to ongoing activities and would increase compared to what is proposed under Alternative 1 (by approximately 3,000 total items).

While the number of testing activities using military expended material would change under this Supplemental, the analysis presented in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) remain valid; physical disturbance and strike impacts on birds resulting from military expended materials are not expected.

Pursuant to the ESA, testing activities that release military expended materials, as described under Alternative 2, may affect the ESA-listed marbled murrelet or short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.2.4.3.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Military expended materials as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from military expended materials on individual birds, but would not measurably improve the status of bird populations.

3.6.2.5 Entanglement Stressors

In the 2015 NWTT Final EIS/OEIS, the Navy did not analyze potential impacts on birds from entanglement stressors. The USFWS, however, decided the analysis of entanglement stressors was warranted and included this analysis in the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016). Entanglement stressors were not analyzed in the 2015 NWTT EIS/OEIS because wires and cables and decelerators/parachutes (the types materials analyzed for potential entanglement of other marine animals) were determined to be an extremely low risk for marine birds. Certain activities and their associated stressors take place in specific locations or depth zones within the Study Area outside the range or foraging abilities of most birds. The USFWS analyzed the potential for entanglement of expended materials during training and testing activities and determined that the risk was discountable for marbled murrelets and short-tailed albatross for the following reasons: (1) guidance wires and fiber optic cables would rapidly sink in the water column; (2) decelerators and parachutes have weights and metal clips attached to them that facilitate their descent to the seafloor and minimize the time when entanglement could occur; and (3) items at risk for entanglement of murrelets and albatrosses are expended from moving objects (e.g., torpedoes, unmanned underwater vehicles), which are likely avoided by birds).

Since the publication of the 2015 NWTT Final EIS/OEIS, a new type of expended material is used during the existing countermeasure testing activity that involves the use of biodegradable polymers. The biodegradable polymers that the Navy uses are designed to temporarily interact with the propeller(s) of a target craft, rendering it ineffective. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks. This will breakdown further and dissolve into the water column within weeks to a few months. The final products which are all environmentally benign will be dispersed quickly to undetectable concentrations. Unlike other entanglement stressors, biodegradable polymers only retain their strength for a relatively short period of time, therefore the potential for entanglement by a marine bird would be limited. Furthermore, the longer the biodegradable polymer remains in the water, the weaker it becomes making it more brittle and likely to break. A marine bird would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. If an animal were to encounter the polymer a few hours after it was expended, it is very likely that it would break easily and would no longer be an entanglement stressor. The use of biodegradable polymers is included as a new testing activity in this Supplemental and is analyzed in the following sections.

3.6.2.5.1 Impacts from Biodegradable Polymers Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

There are no training activities under Alternative 1 that use biodegradable polymers.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to be conducted in the Inland Waters under Alternative 1 in the DBRC and the Keyport Range. The impact of biodegradable polymers on marine birds would be inconsequential because biodegradable polymers only retain their strength for a relatively short period of time, and a marine bird would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. It is possible for any marine bird species inhabiting the Inland Waters portion of the Study Area to be at either of those two locations.

The number of proposed testing activities involving biodegradable polymers in the Inland Waters is relatively low. Based on this limited number of annual activities, the concentration of biodegradable polymers within the two Inland Waters locations of the Study Area would likewise be low, and the Navy does not anticipate that any marine birds would become entangled by biodegradable polymers.

Pursuant to the ESA, testing activities that release biodegradable polymers, as described under Alternative 1, would have no effect on the short-tailed albatross and may affect the ESA-listed marbled murrelet. The Navy is consulting with the USFWS on the marbled murrelet, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from biodegradable polymers released during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.5.2 Impacts from Biodegradable Polymers Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

There are no training activities under Alternative 2 that use biodegradable polymers.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Biodegradable polymers were not part of the proposed action analyzed in the 2015 NWTT Final EIS/OEIS. The proposed use of biodegradable polymers under Alternative 2 in this Supplemental is the same as under Alternative 1 (see Table 3.0-21 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). As a result, the expected impacts are the same between the two alternatives and as described in detail above under Alternative 1; Navy does not anticipate that any marine birds would become entangled by biodegradable polymers.

Pursuant to the ESA, testing activities that release biodegradable polymers, as described under Alternative 2, may affect the ESA-listed marbled murrelet. The Navy is consulting with the USFWS on this species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from biodegradable polymers released during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.2.5.3 Impacts from Biodegradable Polymers Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, proposed training and testing activities would not occur. Biodegradable polymers as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for entanglement on individual marine birds, but would not measurably improve the status of bird populations.

3.6.2.6 Ingestion Stressors

As discussed in Section 3.6.3.3 (Ingestion Stressors) of the 2015 NWTT Final EIS/OEIS, a variety of ingestible materials may be released into the marine environment by Navy training and testing activities. Unrecovered materials from the Navy's training and testing activities that that could float at or below the surface include chaff fibers, plastic end caps and pistons from flares, plastic end caps and pistons from chaff cartridges, fragments of missiles (rubber, carbon, or Kevlar fibers), and fragments of targets. Plastic end caps and pistons from flares and chaff cartridges may float for some period of time. The ingestions stressor that may impact marine birds is a broad category of military expended materials other than munitions, that includes fragments from targets, chaff and flare components, and biodegradable polymers) as detailed in Section 3.0.3.6 (Ingestion Stressors) in this Supplemental EIS/OEIS.

The 2015 NWTT Final EIS/OEIS discounted the potential of military expended materials from munitions (non-explosive practice munitions and fragments from high-explosives) as a potential ingestion stressor because 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. The analysis for potential ingestion stressors in the 2015 NWTT Final EIS/OEIS also discounted decelerator/parachutes as an ingestion stressor because these items likely remain on the surface, but sink rapidly because of metal components attached to the decelerator/parachute. In the 2016 USFWS BO, the USFWS agreed with the Navy in discounting military expended materials from munitions and decelerator/parachutes and determined that potential impacts on marbled murrelets would be discountable (unlikely to occur) from ingestion stressors. The USFWS, however, determined that short-tailed albatrosses would likely experience adverse effects from potentially ingestible military expended materials other than munitions (U.S. Fish and Wildlife Service, 2016).

3.6.2.6.1 Impacts from Ingestion Stressors (Military Expended Materials Other than Munitions) Under Alternative 1

<u>**Impacts from Military Expended Materials – Other Than Munitions Under Alternative 1 for Training Activities**</u>

Under Alternative 1, the number of military expended materials other than munitions that would be used during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS (see Table 3.0-15, 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental). When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 1 increases slightly from ongoing activities. While training use of military expended material would change under this Supplemental, the analysis presented in Section 3.6.3.3 (Ingestion Stressors) in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) would not change. The USFWS determined that potential impacts on marbled murrelets from ingestion stressors would be discountable (unlikely to occur), and that the short-tailed albatross would likely experience adverse effects through the introduction of plastic debris in the Study Area.

Pursuant to the ESA, training activities that release military expended materials – other than munitions, as described under Alternative 1, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials – other than munitions released during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

<u>**Impacts from Military Expended Materials, Other Than Munitions, Under Alternative 1 for Testing Activities**</u>

Under Alternative 1 and as presented in Section 3.0 (Introduction, see Table 3.0-15, Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental), testing use of military expended materials – other than munitions will increase in comparison to ongoing activities and as discussed in the 2015 NWTT Final EIS/OEIS. This includes testing activities that use biodegradable polymers, which are proposed to be conducted in the DBRC, Keyport Range, and Hood Canal. The number of proposed testing activities involving biodegradable polymers is relatively low (a maximum of four times annually), as shown in Section 3.0.3.5.3 (Biodegradable Polymer), Table 3.0-21. As stated previously, biodegradable polymers would be used in some testing activities and were not analyzed in the 2015 document. Biodegradable polymers could theoretically be ingested by birds; however, the likelihood is low because testing activities that use biodegradable polymers would only occur in Hood Canal, Keyport Range, and Dabob Bay (only birds foraging in these waters would potentially ingest biodegradable polymers), the material would persist only until the polymer degrades, generally within days to weeks of deployment. Because the final products of the breakdown are all environmentally benign, the Navy does not expect the use biodegradable polymer to have any negative impacts for marine birds.

While testing use of military expended material would change under this Supplemental, the analysis presented in Section 3.6.3.3 (Ingestion Stressors) in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) would not change. The USFWS determined that potential impacts on marbled murrelets from ingestion stressors would be discountable (unlikely to occur), and that the short-tailed albatross would likely experience adverse effects through the introduction of plastic debris in the Study Area. Because biodegradable polymers would only be expended in Inland Waters, only the marbled murrelet would be potentially exposed to biodegradable polymers as an ingestion stressor.

Pursuant to the ESA, testing activities that release military expended materials (other than munitions), as described under Alternative 1, would have no effect on the short-tailed albatross and may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials – other than munitions released during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.2.6.2 Impacts from Military Expended Materials – Other than Munitions Under Alternative 2

Impacts from Military Expended Materials – Other Than Munitions Under Alternative 2 for Training Activities

Under Alternative 2 and as presented in Section 3.0 (Introduction, see Table 3.0-15, Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental), training use of military expended materials – other than munitions increases in comparison to ongoing activities and Alternative 1. The new biodegradable polymers ingestion sub stressor would not be used during training activities under Alternative 2. While training use of military expended material would change under this Supplemental, the analysis presented in Section 3.6.3.3 (Ingestion Stressors) in the 2015 NWTT Final EIS/OEIS and the 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016) would not change. The USFWS determined that potential impacts on marbled murrelets from ingestion stressors would be discountable (unlikely to occur), and that the short-tailed albatross would likely experience adverse effects through the introduction of plastic debris in the Study Area.

Pursuant to the ESA, training activities that release military expended materials – other than munitions, as described under Alternative 2, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials – other than munitions released during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Impacts from Military Expended Materials – Other Than Munitions Under Alternative 2 for Testing Activities

Under Alternative 2 and as presented in Section 3.0 (Introduction, see Table 3.0-15, Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22 for a comparison of what was analyzed in the 2015 NWTT Final EIS/OEIS to what is proposed in this Supplemental), testing use of military expended materials – other than munitions will increase in comparison to ongoing activities and are the same as proposed under Alternative 1 in this Supplemental EIS/OEIS. Given the alternatives are the same and as presented above for Alternative 1 for testing, the conclusions are the same. Impacts from ingestion stressors from the use of military expended materials – other than munitions are not expected.

Pursuant to the ESA, testing activities that release military expended materials – other than munitions, as described under Alternative 2, may affect the ESA-listed marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA. There would be no effect on critical habitat designation for the marbled murrelet.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from military expended materials – other than munitions released during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.2.6.3 Impacts from Military Expended Materials – Other Than Munitions Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Military expended materials –other than munitions as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from military expended materials on individual birds, but would not measurably improve the status of bird populations.

3.6.2.7 Secondary Stressors (Impacts on Habitat or Prey Availability)

Stressors from training and testing activities could pose secondary or indirect impacts on birds via habitat, sediment, and water quality. These include (1) impacts on habitats for birds, and (2) impacts on prey availability.

While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.6.3.4 (Secondary Stressors) remains valid. The changes in training and testing activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of secondary stressors within the Study Area.

As stated in the 2015 NWTT Final EIS/OEIS, indirect impacts of explosives and unexploded ordnance on birds via water could not only cause physical impacts, but prey items (e.g., fishes) might also have behavioral reactions to underwater sound. For example, 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. Secondary impacts from underwater explosions would be temporary, 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 bird populations or habitats, or prey species and habitats, in the Study Area.

Certain metals are harmful to prey items at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Wang & 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. Indirect impacts of metals on birds consuming prey items through the food chain involve concentrations that are 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 birds would be indirectly impacted by toxic metals via the water.

Any effects to birds are not anticipated to be harmful or severe because of (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 impacts on prey availability during training or testing activities as described under Alternative 1 and Alternative 2 may affect the marbled murrelet and short-tailed albatross. The Navy is consulting with the USFWS on these two species, as required by section 7(a)(2) of the ESA for secondary stressors under Alternative 1.

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from secondary stressors would not result in a significant adverse effect on migratory bird populations.

3.6.2.8 Critical Habitat Determinations

The 2015 NWTT Final EIS/OEIS contained critical habitat determinations. Critical habitat has not changed for any of the species considered, and as stated in the analysis above, no activities have increased, decreased, or changed significantly enough to alter the conclusions from the 2015 NWTT Final EIS/OEIS or 2016 USFWS BO (U.S. Fish and Wildlife Service, 2016); therefore, those conclusions remain valid for this Supplemental EIS/OEIS. The Navy has determined that the Alternatives 1 and 2 would have no effect on designated critical habitat for the marbled murrelet, northern spotted owl, streaked horned lark, or the western snowy plover. Critical habitat has not been designated or proposed for the short-tailed albatross.

3.6.2.9 Migratory Bird Treaty Act Determinations

Under the MBTA regulations applicable to military readiness activities (50 CFR Part 21), the impacts from stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations.

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