3.10 Seabirds, Shorebirds and Coastal Birds, and Waterfowl

This section discusses the affected environment and environmental consequences that would result under each alternative for seabirds, shorebirds, coastal birds, and waterfowl in the action area.

3.10.1 Affected Environment

There are roughly 10,000 species of birds in the world (Barrowclough et al., 2016), 1,000 species of birds in the U.S., and 100 ESA-listed species of birds in states and territories adjoining the water bodies of the action area (ECOS, No Date-a). The groups of birds most relevant to the Proposed Action include seabirds, shorebirds, coastal birds, and waterfowl (from now on collectively referred to as "birds"), and ESA-listed species within these groups. Many of the birds found in the project area are also migratory and are protected under the MBTA) (see Section 3.3.4 for discussion of the MBTA). This section presents an overview of these functional groups, a discussion of avian acoustical capabilities, and a description of the distribution of bird species within the action area. It also identifies those bird species that are listed as threatened or endangered under the ESA.

3.10.1.1 Overview of Taxonomic and Functional Groups

Seabirds feed in marine environments where they plunge or dive under the surface to catch prey. They may spend much of their lives at sea foraging over pelagic habitat (open sea), often thousands of kilometers from their nesting grounds. Coastal birds are distinguished by their preference for coastal habitat and vary considerably in foraging and nesting behaviors. Shorebirds, a distinct taxonomic subset of coastal birds, use marine and/or freshwater edge habitat for feeding, breeding, and/or nesting. They largely forage from water's edge through neritic zones (areas where sunlight reaches the sea floor), although specific foraging behaviors vary by species. Waterfowl are found in fresh water and salt water environments and spend much of their lives on the water's surface and dive below to feed. Nearly all species covered in this evaluation are migratory, though their ranges from nesting to foraging sites vary from hundreds to thousands of kilometers. Ecological characteristics of these groups are summarized in **Table 3.10-1**. Birds are found in all regions of the action area, though different bird groups and species predominate in different regions and habitats.

Table 3.10-1. Ecological Characteristics of Functional and Taxonomic Bird Groups

Taxonomic Group	Common Species	Primary Habitat	Feeding Behavior	Common Forage / Prey	Nesting Behavior	Migratory Behavior
Seabirds	Albatross, petrel, booby, gulls, terns, pelicans	Pelagic	Surface feeding, pursuit diving, plunge diving	Baitfish, krill, squid	Large colonies, often on cliffs, small islands, or headlands	Migratory
Shorebirds	Avocet, plover, sandpipers, snipe, oystercatcher, whimbrel, whippet	Coastal	Shallow wading	Small aquatic and terrestrial invertebrates	Solitary, shallow scrapes near bodies of water	Migratory
Waterfowl	Bufflehead, eider,	Coastal / Freshwater	Diving and dabbling	Invertebrates, aquatic	Solitary, ground-	Migratory

Taxonomic Group	Common Species	Primary Habitat	Feeding Behavior	Common Forage / Prey	Nesting Behavior	Migratory Behavior
	harlequin, merganser, scoter		(specialized surface feeding)	insects, small fish, aquatic plants	nesting near bodies of water	

3.10.1.2 Sound Production and Hearing

The mechanics of avian hearing are similar to those of reptiles and mammals, though the audible frequency range for any given species of bird is generally narrower than that of a given mammal. Birds are not as sensitive to the ends of their hearing range as mammals are. Mid-frequency bird hearing generally spans 1 to 5 kHz in air with highest sensitivity at about 2 to 3 kHz. Birds generally cannot perceive sound above 15 kHz (NSF and USGS, 2011).

Hearing ability and sensitivity of birds in underwater conditions is not well known. It is thought that avian hearing is generally adapted to in-air environments, though seabirds may be able to hear underwater. Underwater sound emitters have been documented to deter diving seabirds from gill nets when set to operate at 1.5 kHz (±1 kHz) at 120 dB re 1 µPa (NSF and USGS, 2011).

Based on available data, this Final PEIS assumes that all birds have similar in-air hearing ranges (unless specifically noted otherwise in the literature) and that the birds' ears are primarily used and adapted to above-water conditions, with limited hearing underwater.

3.10.1.3 Threatened and Endangered Species

The USFWS has listed a number of imperiled bird species, sub-species, and populations as either threatened or endangered under the federal ESA. A total of 22 ESA-listed bird species and one bird species (bald eagle - *Haliaeetus leucocephalus*) protected under the Bald and Golden Eagle Protection Act potentially occur in the action area (**Table 3.10-2**). Descriptions of each along with summaries of their habitat, diet, and status are presented following the table.

Table 3.10-2. Federally Protected Seabirds, Shorebirds and Coastal Birds, and Waterfowl Occurring in the Action Area

Common Name	Scientific Name	ESA Status	Lead Agency	Region*	Critical Habitat
Seabirds					
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	USFWS	WCR	Yes
Band-rumped storm-petrel	*Oceanodroma castro*	Endangered	USFWS	PIR	No
Short-tailed albatross	*Phoebastria albatrus*	Endangered	USFWS	AR, PIR, WCR	No
Hawaiian petrel	*Pterodroma sandwichensis*	Endangered	USFWS	PIR	No
Newell's shearwater	*Puffinus auricularis newelli*	Threatened	USFWS	PIR	No
California least tern	*Sternula antillarum browni*	Endangered	USFWS	WCR	No
Roseate tern	*Sterna dougallii*	Threatened	USFWS	GAR	No

Common Name	Scientific Name	ESA Status	Lead Agency	Region*	Critical Habitat
Shorebirds and Coastal Birds					
Red knot	*Calidris canutus rufa*	Threatened	USFWS	GAR, SER	No
Piping Plover	*Charadrius melodus*	Threatened	USFWS	GAR, SER	Yes
Western snowy plover	*Charadrius nivosus*	Threatened	USFWS	WCR	Yes
Hawaiian coot	*Fulica americana alai*	Endangered	USFWS	PIR	No
Whooping crane	*Grus americana*	Endangered	USFWS	GAR, SER	Yes
Bald eagle	*Haliaeetus leucocephalus*	Least Concern	USFWS	All	No
Hawaiian stilt	*Himantopus mexicanus knudseni*	Endangered	USFWS	PIR	No
Wood stork	*Mycteria americana*	Threatened	USFWS	SER	No
Eskimo curlew	*Numenius borealis*	Endangered	USFWS	AR	No
Light-footed clapper rail	*Rallus longirostris levipes*	Endangered	USFWS	WCR	No
California clapper rail	*Rallus longirostris obsoletus*	Endangered	USFWS	WCR	No
Waterfowl					
Laysan duck	*Anas laysanensis*	Endangered	USFWS	PIR	No
Hawaiian duck	*Anas wyvilliana*	Endangered	USFWS	PIR	No
Steller's eider	*Polysticta stelleri*	Threatened	USFWS	AR	Yes
Spectacled eider	*Somateria fischeri*	Threatened	USFWS	AR	Yes

*SER = Southeast Region (includes Gulf of Mexico, the Caribbean, and the Atlantic seaboard from North Carolina to Florida); WCR = West Coast Region (includes Washington, Oregon, and California); PIR = Pacific Islands Region (includes the Hawaiian, Marianas, and American Samoa archipelagos, Wake Island, and the Remote Pacific Islands).

3.10.1.3.1 Seabirds

3.10.1.3.1.1 Marbled Murrelet

The marbled murrelet (**Figure 3.10-1**) is a small seabird that forages for small fish and invertebrates in near-shore marine environments of the Pacific coast from California through Alaska. They prefer to nest in old growth forest interiors with little edge habitat and low fragmentation for breeding (USFWS, 2019). Egg-laying and incubation typically occur from March to August, and nestlings are reared from their emergence through the September fledging period – the period of time in which hatchlings become physically capable of flight (Nelson and Hamer, 1995).

Figure 3.10-1. Marbled Murrelet

Photo credit: USFWS

In 1992, the USFWS listed the marbled murrelet as threatened in California, Oregon, and Washington (ECOS, No Date-a). In 1996, critical habitat was designated in these three states, though the initial 16,000 km^2 designated (3.9 million ac) was revised slightly downward to 15,000 km^2 (3.7 million ac) in 2011. Nesting habitat loss and fragmentation continue to threaten marbled murrelets, along with depredation (the killing of adult birds and offspring by natural predators), harmful algal blooms, oil spills, and reduction of prey species quality and quantity. There were approximately 23,260 marbled murrelets in California, Oregon, and Washington as of 2016 (USFWS, 2019).

3.10.1.3.1.2 Band-rumped Storm-petrel

Band-rumped storm-petrels are small seabirds about the size of a robin. Breeding populations in the eastern Atlantic are regular visitors to marine habitats as close as 50 km (31 mi) from the Gulf and Atlantic coasts of the U.S. Breeding populations in Japan and the Galapagos are also known to range in the Pacific. The Hawai'i DPS is the only current breeding population in the U.S. (Slotterback, 2002). The birds seem to prefer steep cliff crevices and lava flows for mating and nesting and spend the remainder of their time at sea (American Bird Conservancy, No Date). Their primary prey are fish and squid caught at or just below the ocean surface (Slotterback, 2002). This DPS typically lays eggs between May and June and nestlings fledge in October (Hawaii DLNR, 2015a)

Hawaiian band-rumpled storm-petrel populations were reduced primarily by depredation by introduced species. Collisions with manmade structures, particularly associated with light pollution leading to disorientation, were also recognized as threats to the population (75 FR 69222, November 10, 2010). In 2016, the Hawai'i DPS of the band-rumped storm-petrel was listed as endangered in Hawai'i. No critical habitat has been designated for the species (ECOS, No Date-a).

3.10.1.3.1.3 Short-tailed Albatross

The short-tailed albatross (**Figure 3.10-2**) is found in Hawai'i, Alaska, California, Washington, and Oregon. The bird is known to breed only on two remote islands of Japan and they stay close to this area during nesting, breeding, and rearing young; nesting occurs from late-October to mid-June. During the non-breeding seasons, these birds range across the temperate and subarctic Pacific and use areas of upwellings and high productivity and, less frequently, use waters between 3,000 and 6,000 m (10,000 – 20,000 ft) in depth not near upwellings. There is little information on the diet of the short-tailed albatross, though squids, crustaceans, and fishes all seem to be important prey. The birds are also known to follow commercial fishing vessels for feeding purposes (USFWS, 2009a).

Figure 3.10-2. Male Short-tailed Albatross Shelters a Chick

Photo credit: USFWS

In 1970, the short-tailed albatross was listed as an endangered foreign species (an endangered species without primary habitat within the U.S.), though this listing was revised in 2000 to endangered throughout its range. As of 2014, the status of the short-tailed albatross appeared to be improving, though limited breeding distribution continues to be a risk for the species (USFWS, 2014f). No critical habitat has been designated for the species (ECOS, No Date-a).

3.10.1.3.1.4 Hawaiian Petrel

The Hawaiian petrel, also known as the dark-rumped petrel, is a gadfly petrel that nests only in Hawai'i. It nests in burrows in high and difficult terrain with good vegetative cover (USFWS, 1983). Hawaiian petrels typically lay eggs in May/June, and most hatchlings fledge by December (Hawaii DLNR, 2015b). The marine range of the Hawaiian petrel is thought to extend from approximately 10° south to 20° north, expanding to 25° north in spring and up to 50° north in the southern Gulf of Alaska in July and August. This range overlaps with that of the Galapagos petrel and the two species are indistinguishable from each other when observed at sea. The Hawaiian petrel ranges east to areas off the coast of the western continental U.S. and Mexico, and has been observed west as far as the Philippines and Japan, though these sightings are very rare. When encountered at sea and not feeding, the Hawaiian petrel is generally solitary, though they join flocks comprising a mix of species when feeding. The bodies of gadfly petrels are less suited to diving than other petrels, and they are thought to feed on the water surface by seizing prey and by scavenging. Diet studies on Maui indicated that the Hawaiian petrel feeds primarily on squid, but also on fish and crustaceans (Simons and Hodges, 1998).

Following severe population declines attributed to predation and habitat degradation by introduced species, the Hawaiian petrel was listed as endangered in 1967 (USFWS, 1983). These pressures continue to threaten the species and, as of 2017, the population on Kauai was estimated to have decreased by 78 percent since the 1990s (USFWS, 2017b). No critical habitat has been designated for the species (ECOS, No Date-a).

3.10.1.3.1.5 Newell's Shearwater

The Newell's shearwater (previously known as the Newell's Manx shearwater) is a threatened species native to Hawai'i. They breed and nest only on the main Islands of Hawai'i, with 30 to 40 known breeding sites. Additional breeding sites are also expected to exist based on the population size of Newell's shearwater, but the location and number of these additional sites are not currently known. Newell's shearwaters burrow into the ground or nest in rocky crevices at high elevations or on coastal cliffs. In April, they gather at breeding colonies and lay eggs in May and June, with chicks generally fledging in October. During non-breeding nesting periods, the Newell's shearwater is highly pelagic, using tropical and subtropical waters of depths greater than 2,000 m (6,500 ft). They range from the Hawaiian Islands eastward to about 120° west latitude, and from the equator to about 22° north longitude. The birds feed on fish and squid by pursuit-plunging to depths up to 50 m (164 ft) (Ainley et al., 2019).

In 1975, the Newell's shearwater was listed as threatened wherever found. No critical habitat has been designated for the species (ECOS, No Date-a). Depredation by introduced species, collisions with powerlines, light pollution leading to collision deaths among juveniles, and changes to breeding habitats by invasive plants continue to threaten the species. Populations at sea have been estimated to range from 18,000 to 37,000 individuals (USFWS, 2016b).

3.10.1.3.1.6 California Least Tern

The California least tern, previously classified in the genus *Sterna*, is a migratory bird that is native to California and Mexico, ranging from San Francisco in the north through Baja California in the south, though generally concentrated in Los Angeles County, Orange County, and San Diego County. They generally nest from April through August on open beaches in colonies of about 25 pairs. California least terns migrate south along the Pacific coast to wintering locations in Mexico, Costa Rica, and Panama. They forage mainly in near-shore ocean waters and shallow estuaries and lagoons (USFWS, 2006a). The California least tern's diet likely consists of small fish (Thompson et al., 1997).

In 1970, the California least tern was listed as endangered wherever found. No critical habitat has been designated for the species (ECOS, No Date-a). Populations as of 2005 were estimated to be 7,100 breeding pairs. The pressures on nesting habitat that led to the California least tern's decline were still present but somewhat managed by 2006 (USFWS, 2006a).

3.10.1.3.1.7 Roseate Tern

The roseate tern is an exclusively marine, primarily plunge-feeding seabird distributed around the tropics and subtropics of the Indian Ocean, Pacific Ocean, Caribbean Sea, and temperate latitudes of the North Atlantic. The Caribbean roseate tern (**Figure 3.10-3**) population is listed as threatened and the Northeast roseate tern population, sometimes called the North Atlantic roseate tern, is listed as endangered. It should be noted that 'northeast' in this sense refers to the northeast of the continent, not the northeast of the Atlantic Ocean. Discussion of the roseate tern's ecology will focus on these populations.

Figure 3.10-3. Caribbean Roseate Tern

Photo credit: USFWS

The roseate tern forages for small, schooling fish over reefs and sandbars or in pelagic habitats in association with marine predators that bring fish to the surface. The Northeast population prefers sand lance, and the Caribbean population prefers dwarf herring and anchovies. The Northeast population breeds in colonies from New York through Nova Scotia, nesting with common terns on nearshore islands, barrier islands, and rarely on salt marsh islands from May to early-September (ECOS, No Date-a). They prefer nesting habitat with dense cover. The Caribbean population on the other hand, nests in more open areas on rocky to sandy substrates on islands and islets around Cuba, the Florida Keys, the Bahamas, Puerto Rico, the Virgin Islands, and the Lesser Antilles beginning in early-May and extending through July. Roseate terns from these populations are generally confined to South America during the winter. Both populations migrate offshore (Nisbet et al., 2014).

In 1987, the roseate tern was listed as threatened in the western hemisphere and adjacent oceans where not listed as endangered, and endangered in the U.S. on the Atlantic coast from North Carolina northward. No critical habitat has been designated for the species (ECOS, No Date-a). Degradation of habitat is the most urgent threat to the Northeast population, where populations had declined from about 4,000 nesting pairs in 2000 to around 3,000 nesting pairs as of 2010. Depredation, disease, and human disturbances are the most substantial threats to the Caribbean population (ECOS, No Date-a), which were estimated to a maximum of about 7,000 pairs in 2012 (Nisbet et al., 2014).

3.10.1.3.2 Shorebirds and Coastal Birds

3.10.1.3.2.1 Red Knot

The rufa red knot (**Figure 3.10-4**) is a sandpiper shorebird and one of three subspecies of red knots (Baker et al., 2013). Rufa red knots can be found along the Atlantic, Gulf, Caribbean, and Great Lakes coasts of the action area (ECOS, No Date-a). The birds breed in the Arctic beginning in late-May, and the highly precocial (hatchlings requiring lower levels of parental care, e.g., ducklings or goslings) fledge during July (Niles et al., 2008). Red knots overwinter in South America, the Caribbean, and the Gulf coasts of the U.S. and Mexico (USFWS, No Date-a). During migration, knots generally prefer sandy coastal habitats near tidal inlets at the mouths of bays and estuaries. They also use sandy beaches, rocky beaches, mudflats, mangroves, salt marshes, and intertidal rocky areas, particularly those with high availability of bivalves and crustaceans (Baker et al., 2013). Rufa red knots eat a variety of invertebrates such as bivalves, snails, crustaceans, marine worms, and horseshoe crab eggs (USFWS, No Date-a).

Figure 3.10-4. Red Knot with Leg Tag

Photo credit: USFWS

Prior to the early 20th century, red knot populations were heavily and primarily impacted by hunting. After removal of hunting pressures with the passage of the MBTA in 1918, accelerated coastal development and reduction of horseshoe crab populations continued to impact red knot populations. This has resulted in drastic population reductions such as those in the Delaware Bay, where populations fell by 75 percent from the 1980s to 2000s (USFWS, No Date-a). In 2015, the red knot was listed as threatened wherever found. No critical habitat rules have been published (ECOS, No Date-a). USFWS identifies current threats to the rufa red knot as: “sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at stopover areas; disturbance by vehicles, people, dogs, aircraft, and boats; and climate change” (USFWS, No Date-a).

3.10.1.3.2.2 Piping Plover

The piping plover (**Figure 3.10-5**) is a shorebird that breeds and spends the summer months along the Atlantic coast from North Carolina through Newfoundland and much of the Great Lakes. During this part of the year, these plovers generally inhabit and nest on wide, sandy-to-gravelly beaches with little vegetation on barrier islands, ocean fronts, bays, sand bars, spoil islands, tidal creeks, and tidal marshes. In freshwater systems they can be found along the shores of lakes, rivers, ponds, and artificial water bodies, and often nest in or near colonies of terns.

Figure 3.10-5. Piping Plover

Photo credit: USFWS

During migration piping plovers prefer beaches and alkali flats (dried lake beds adjacent to coasts containing high salt concentrations). During non-breeding winter months, piping plovers can be found at beaches, mudflats, and sandflats along the Atlantic Coast from North Carolina to Florida, along the Gulf Coast from Florida through the Yucatan peninsula, as well as on the Caribbean coast of the Yucatan. They frequently use bays, lagoons, and inlets. The birds generally prefer feeding at sand flats, algal flats and mudflats, within 15 m (50 ft) of the shoreline, and mainly within 5 m (16 ft) of the edge of water. They feed on marine worms, various life-stages of insects, terrestrial invertebrates, marine and freshwater benthic invertebrates, crustaceans, and mollusks (Elliott-Smith and Haig, 2004).

In 1985, the piping plover was listed as threatened wherever found, except where listed as endangered in the Great Lakes-Big Rivers region, that is the Great Lakes and their watersheds. Critical habitat was designated in 2001 for the Great Lakes Breeding Population, followed by multiple additional designations and revisions for other populations over subsequent years. Most recently critical habitat for wintering populations in Texas were revised in 2009. Designated areas of critical habitat relevant to the action area include some shorelines along the Great Lakes, Gulf coast, and Atlantic coast from Florida through North Carolina (ECOS, No Date-a). Coast and shore habitat loss and competition from recreational uses represent the greatest threats to the species (USFWS, 2009b).

3.10.1.3.2.3 Western Snowy Plover

Western snowy plovers (**Figure 3.10-6**) can be found residing year-round and migrating along the west coast of the continental U.S. and Mexico. They inhabit and nest on the ground of unvegetated and sparsely vegetated beaches and shores of alkali lakes; the nesting season occurs from March to September (Center for Biological Diversity, No Date). Western snowy plovers feed on terrestrial and aquatic invertebrates in freshwater, marine, and brackish environments. They feed on the sand surface and up to 2 cm (1 in) below surface, normally foraging around the mean high-water line (Page et al., 2009).

Figure 3.10-6. Western Snowy Plover

Photo credit: USFWS

In 1993, the Pacific population of the western snowy plover was listed as threatened in California, Oregon, Washington, and areas of Mexico within 80 km (50 mi) of the Pacific coast. Critical habitat was designated in 1995 and revised as recently as 2012. There are currently multiple, discrete areas of designated critical habitat along the coasts of California, Oregon, and Washington (ECOS, No Date-a). Current threats to the western snowy plover include habitat loss and fragmentation and human-caused disturbance, injury, and kills (USFWS, 2006b).

3.10.1.3.2.4 Hawaiian Coot

Hawaiian coots are wetland birds endemic to the Hawaiian Islands. Although they are generally found in freshwater habitats, coots can also be found on estuaries and calm seas within reefs. Hawaiian coots are believed to maintain similar diets to American coots, that is, plants, algae, aquatic invertebrates, and small aquatic vertebrates in generally freshwater environments, but sometimes in saline environments. The Hawaiian coot is non-migratory and breeds and nests year-round (Pratt and Brisbin, 2002).

In 1970, the Hawaiian coot was listed as endangered wherever found. No critical habitat has been designated for the species (ECOS, No Date-a). The Hawaiian coot continues to face pressure from the same forces that led to its decline: depredation by introduced species and loss and degradation of wetland habitat. Beyond direct impacts from human use, the coastal wetlands used by the coots are vulnerable to sea level rise (USFWS, 2010a).

3.10.1.3.2.5 Whooping Crane

Whooping cranes (**Figure 3.10-7**) can be found in the action area along portions of the Great Lakes, Gulf coast, and a small area of the Florida Atlantic coast (ECOS, No Date-a). There are only four populations of whooping cranes, one of them naturally occurring and the remainder introduced. Whooping cranes generally feed in croplands and roost in wetlands during migration and use estuarine marshes, shallow bays, and tidal flats while overwintering in the Gulf. Some populations winter in wetlands, riverine systems, and flooded agricultural land. Prior to the decline of the species, whooping crane were known to winter along the east coast from New Jersey south. Whooping cranes return to Canadian nesting grounds from April to September to lay/incubate eggs and rear hatchlings (USFWS, No Date-b). When feeding in saltwater environments, whooping cranes primarily consume crabs and clams at depths up to 20 cm (8 in). When feeding in freshwater environments, the cranes generally feed on the margins of wetlands, agricultural fields, pastures, or savannah at the same depth as in saltwater environments (Urbanek and Lewis, 2015).

Figure 3.10-7. Whooping Crane with Chick

Photo credit: USFWS

In 1967, the whooping crane was listed as endangered wherever found, except for reintroduced populations listed as "experimental population, non-essential". Critical habitat was designated for the whooping crane in 1978, including a small area along the Gulf coast northeast of Corpus Christi, Texas (ECOS, No Date-a). Pressures that led to the decline of whooping crane, such as settlement and conversion of habitat in prairie pothole regions, wetlands, and coastal wetland wintering grounds, continue to threaten the species. Threats from sea level rise, temperature changes affecting feed species, and potential salinity changes are also anticipated at the coastal wetland wintering areas. Despite these pressures, populations were reported as growing steadily as of 2012 (USFWS, 2012c).

3.10.1.3.2.6 Bald Eagle

Bald eagles are large, predominantly coastal raptors endemic to North America and range throughout the entire continental U.S. They live near rivers, lakes, marshes, estuaries, and coastlines where they feed primarily on fish, but also waterfowl, rabbits, turtles, snakes, and other small animals. Bald eagles nest in the tops of trees and build nests reaching up to 3 m (10 ft) wide and weighing half a ton (USFWS, 2021b). Nesting season is dependent on the location of the individual but ranges approximately 5 months from initial nest building to fledging. Individual birds can be migratory depending on their location, but often return to breed within 160 km (100 mi) of where they were originally raised.

When the U.S. adopted the bald eagle as a national symbol in 1782, the country was thought to contain at least 100,000 bald eagle nests (USFWS, 2021b). By 1940, bald eagle populations had plummeted due to declines in fish and waterfowl stocks and targeted shooting by landowners fearing livestock losses. In response, Congress passed the Bald Eagle Protection Act – which prohibits the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, of any bald eagle or bald eagle part, alive or dead (16 U.S.C. 668(a); 50 CFR 22) – in order to preserve the culturally significant birds, which was later amended to include golden eagles. Bald eagle populations continued to decline over the next 20 years due to the widespread use of the pesticide dichlorodiphenyltrichloroethane (DDT), which thinned bald eagle eggshells and drastically reduced nesting success. By 1963, only 417 nesting pairs of bald eagles remained in the lower 48 states. Bald eagles were federally listed as endangered in 1967 and only began to recover after the 1972 ban of DDT. By 1995, the species was upgraded to threatened status in the lower 48 states and in 2006 bald eagles were removed from the endangered species list. Today, bald eagles are considered a species of least concern and receive protections only under the Bald and Golden Eagle Protection Act.

3.10.1.3.2.7 Hawaiian Stilt

Hawaiian stilts are wading birds endemic to Hawai'i and are a subspecies of the North American stilt (ECOS, No Date-a). They can be found on six of the eight main islands, occupying lowland coastal wetlands and making seasonal movements among islands. Hawaiian stilts select nest sites on exposed mudflats between March and August (Hawaii DLNR, 2015c). They typically feed on invertebrates and fish in fresh and brackish or saline water up to about 13 cm (5 in) deep, using pecking, snatching, sweeping, and plunging methods (Robinson et al., 1999).

Hunting pressure, wetland habitat loss, and depredation by introduced species reduced Hawaiian stilt populations to a low of about 200 birds in the 1940s (Robinson et al., 1999). In 1970, the Hawaiian stilt was listed as endangered wherever found. No critical habitat has been designated for the species (ECOS, No Date-a). The Hawaiian stilt continues to face pressure from depredation by introduced species and loss and degradation of wetland habitat. Beyond direct impacts from human use, the coastal wetlands used by the stilts are vulnerable to sea level rise (USFWS, 2010b).

3.10.1.3.2.8 Wood Stork

Wood storks (**Figure 3.10-8**) are wading birds inhabiting the southeast of the U.S., including areas of the Gulf and Atlantic coasts (ECOS, No Date-a). Wood storks generally feed in freshwater wetlands of less than 50 cm (20 in) in depth. In coastal Georgia estuaries, the storks sometimes feed in tidal creeks and, less often, tidal pools. In Florida, the storks sometimes feed in estuarine forested swamps. Wood storks roost in trees over water. In their overwintering range, they use freshwater and saltwater wetlands. Wood storks nest in large colonies between October and June, depending on location (FWC, No Date). The birds are generally quiet, apart from some courtship and mating sounds and begging by nestlings, which can become loud enough in colonies to be heard from a distance (Coulter et al., 1999).

Figure 3.10-8. A Lone Wood Stork Wades at Water's Edge

Photo credit: USFWS

Because the storks rely on a specialized feeding strategy requiring wetlands that go through seasonal low-water periods, they are very susceptible to habitat loss. It is estimated that there was a 75 percent reduction in wood stork populations from the 1930s to the 1970s, primarily because of impacts to such habitat. In 1984, the wood stork duck was listed as threatened in Alabama, Florida, Georgia, Mississippi, North Carolina, and South Carolina. No critical habitat has been designated for the species (ECOS, No Date-a).

3.10.1.3.2.9 Eskimo Curlew

The Eskimo curlew (**Figure 3.10-9**) is a shorebird that is extremely rare or extinct, with an estimated population size of less than 50 individuals (USFWS, 2016c). The Eskimo curlew's historical range was from Alaska to Chile, with southward migration intersecting the action area over the northwest Atlantic coast and potentially Great Lakes and northward migration over the Gulf coast. Southward movements would be made from July through October, and northward movements from March through April. The Eskimo curlew's diet is thought to include insects, marine invertebrates, and berries of particular shrubs such as blueberries, crowberry, and bearberry (Gill et al., 1998).

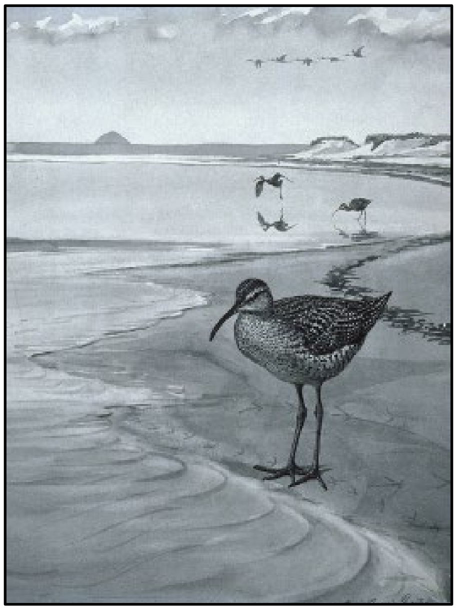


Figure 3.10-9. Painting of an Eskimo Curlew by Louis Agassiz Fuertes (1874-1927)

Photo credit: USFWS

Hunting, destruction of spring migration habitat, and extinction of at least one important insect prey species are thought to have led to the decline of the Eskimo curlew. In 1967, the Eskimo curlew was listed as endangered wherever found. No critical habitat has been designated for the species (ECOS, No Date-a).

3.10.1.3.2.10 Light-footed Clapper Rail

The light-footed clapper rail is a marsh bird endemic to California that now lives from Santa Barbara southward in coastal marshes, lagoons, and their maritime surroundings. The birds forage with the movement of tides in mudflats and shallow water adjacent to vegetated cover. They maintain an omnivorous diet that relies heavily on invertebrates such as insects, snails, crabs, crayfish, isopods, and decapods. Nests are located in dense vegetation such as cordgrass or pickleweed just above tidal inundation. Individuals generally remain in the vicinity of their home marshes (USFWS, 2009c). Nesting usually begins in March, and late nests hatch by August (USFWS, 2009c).

In 1970, the light-footed clapper rail was listed as endangered wherever found. No critical habitat has been designated for the species (ECOS, No Date-a). As of 2007, there were 443 known nesting pairs, though this number declined the following year (USFWS, 2009c).

3.10.1.3.2.11 California Clapper Rail

The California clapper rail is a marsh bird endemic to California that currently inhabits only the tidal salt and brackish marshes around San Francisco Bay. Historically it may have ranged from Morro Bay in the south to Humboldt Bay in the north. California clapper rails are omnivorous, feeding on mussels, spiders, clams, crabs, worms, and even rodents and small birds. They nest from mid-March to August in woven platforms above high tide levels in areas with sufficient invertebrate prey abundance and escape routes from predators (USFWS, 2013).

In 1970, the California clapper rail was listed as endangered wherever found. No critical habitat has been designated for the species (ECOS, No Date-a). As of 2008, California rails were estimated to number at least 1,425 birds. Lack of habitat continues to limit the species' recovery (USFWS, 2013).

3.10.1.3.3 Waterfowl

3.10.1.3.3.1 Laysan Duck

The Laysan duck is endemic to Laysan Island, Hawaii. Laysan Island is approximately 3 km by 1.5 km (2 mi by 1 mi) with a maximum elevation of approximately 12 m (40 f) above sea level. A defining feature of the island is a central saltwater lake that measures approximately 1.6 km by 0.5 km (1 mi by 0.3 mi) and a depth of no more than 10 m (33 ft). Laysan ducks feed on macroinvertebrates in shallow waters along the shores of the lake and in the surrounding sands and undergrowth (Moulton and Marshall, 1996). The birds nest around 350 m (1148 ft) upland of the lake from April through July, but the exact timing of nesting and reproduction is flexible in response to local habitat conditions (USFWS, No Date-c).

In 1967, the Laysan duck was listed as endangered wherever found. No critical habitat has been designated for the species (ECOS, No Date-a).

3.10.1.3.3.2 Hawaiian Duck

The Hawaiian duck is known locally as “koloa” and is a close relative of the mallard. Dependent on freshwater wetland habitat, the ducks were historically distributed on most of the main Hawaiian Islands except the drier islands of Lana’i and Kaho’olawe. Destruction of wetland habitat led to a decline of Hawaiian duck populations. Coastal brackish water, estuaries, and saline habitat are not frequently used by the ducks, apart from populations on Kaua’i observed using freshwater upwellings in coastal brackish marshes (Engilis et al., 2002). The species’ nesting biology is poorly known, but most pairs tend to nest in the upper Alaka’I swamp on Kau’ai. Nesting can occur year-round, but most nesting activity occurs between January and May (Hawaii DLNR, 2015d).

In 1967, the species was listed as endangered wherever found. No critical habitat has been designated (ECOS, No Date-a). The species currently faces threats from hybridization with non-native mallard populations (Engilis et al., 2002).

3.10.1.3.3.3 Steller’s Eider

Steller’s eider (**Figure 3.10-10**) is the smallest of the four species of eider. Its range is in northern latitudes only. The birds nest near freshwater ponds as the spring sea ice begins to break, but return to shallow marine habitats after breeding. While in marine habitats, Steller’s eiders prefer to feed by diving for mollusks and crustaceans, but also eat worms, echinoderms, small fish, gastropods and brachiopods (Fredrickson, 2001).

Figure 3.10-10. Steller's Eider Male and Female

Photo credit: USFWS

The Alaska breeding population of the Steller's Eider was listed as threatened in 1997, and in 2001 critical habitat was designated (ECOS, No Date-a). The five designated units were located at Yukon-Kuskokwim Delta, Kuskokwim Shoals, Seal Islands, Izembek Lagoon, and Nelson Lagoon, which includes Port Moller and Herendeen Bay. Marine environments of greater than 9 m (30 ft) in depth were specifically excluded from the critical habitat regardless of published boundaries (66 FR 8850, February 2, 2001).

3.10.1.3.3.4 Spectacled Eider

Similar to Steller's eider, distribution of the spectacled eider (**Figure 3.10-11**) is limited to Alaska and Russia and the birds inhabit marine environments apart from breeding and nesting activities near tundra ponds. Nesting occurs in the spring season, and breeding females remain with their young on the nesting grounds until early September (ECOS, No Date-a). Spectacled eiders feed mainly on clams and benthic invertebrates in marine habitat and insects and plant materials in freshwater habitat (Peterson et al., 2000).

Figure 3.10-11. Spectacled Eider

Photo credit: USFWS

Populations of spectacled eiders fell by 96 percent from the 1970s to 1992. In 1993, they were listed as threatened wherever found. In 2001, critical habitat for the spectacled eider was designated on the Yukon-Kuskokwim Delta, in Norton Sound, Ledyard Bay, and the Bering Sea between St. Lawrence and St. Matthew Islands (66 FR 9146, February 6, 2001).

3.10.1.4 Regional Distribution

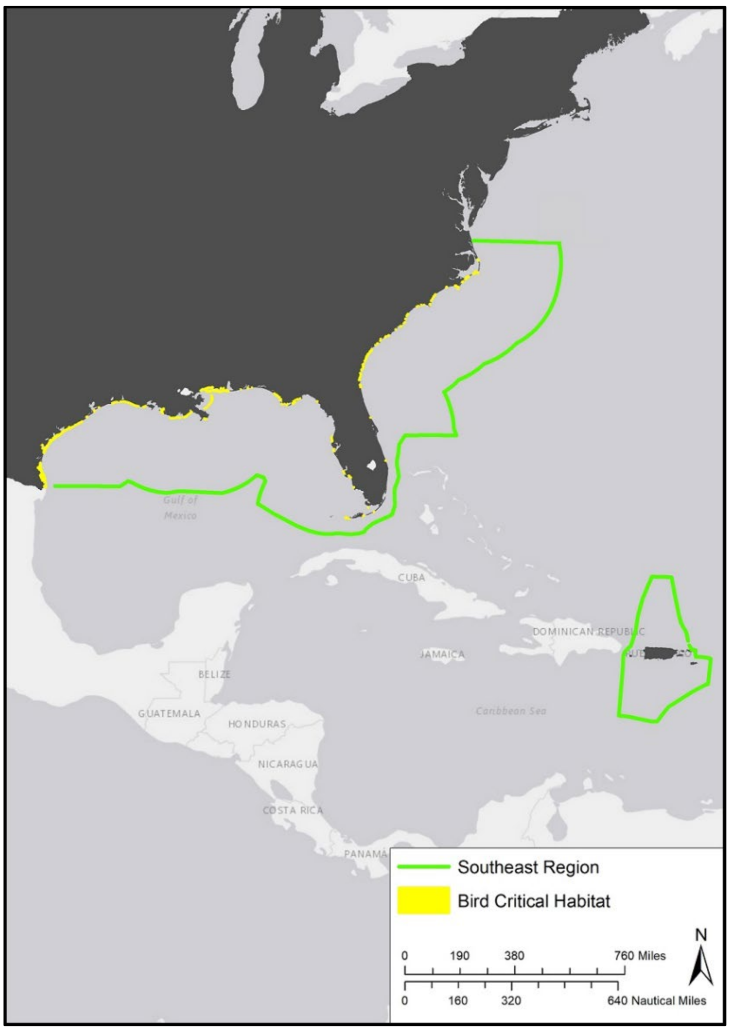
General bird assemblages are discussed in Section 3.10.1.1. This section summarizes region-specific ESA-listed species and critical habitat. It is important to note that not all ESA-listed bird species have designated critical habitat. The majority of critical habitat for birds is located within the Alaska and West Coast Regions.

3.10.1.4.1 Greater Atlantic Region

Four ESA-listed bird species (roseate tern, red knot, piping plover, and whooping crane) occur in the Greater Atlantic Region, as indicated in **Table 3.10-2**. There is no designated critical habitat for these species in this region.

3.10.1.4.2 Southeast Region

Four ESA-listed birds (red knot, whooping crane, wood stork, and piping plover) occur in the Southeast Region, as indicated in **Table 3.10-2**. Whooping cranes and piping plovers also have designated critical habitat in the region as shown in **Figure 3.10-12**.

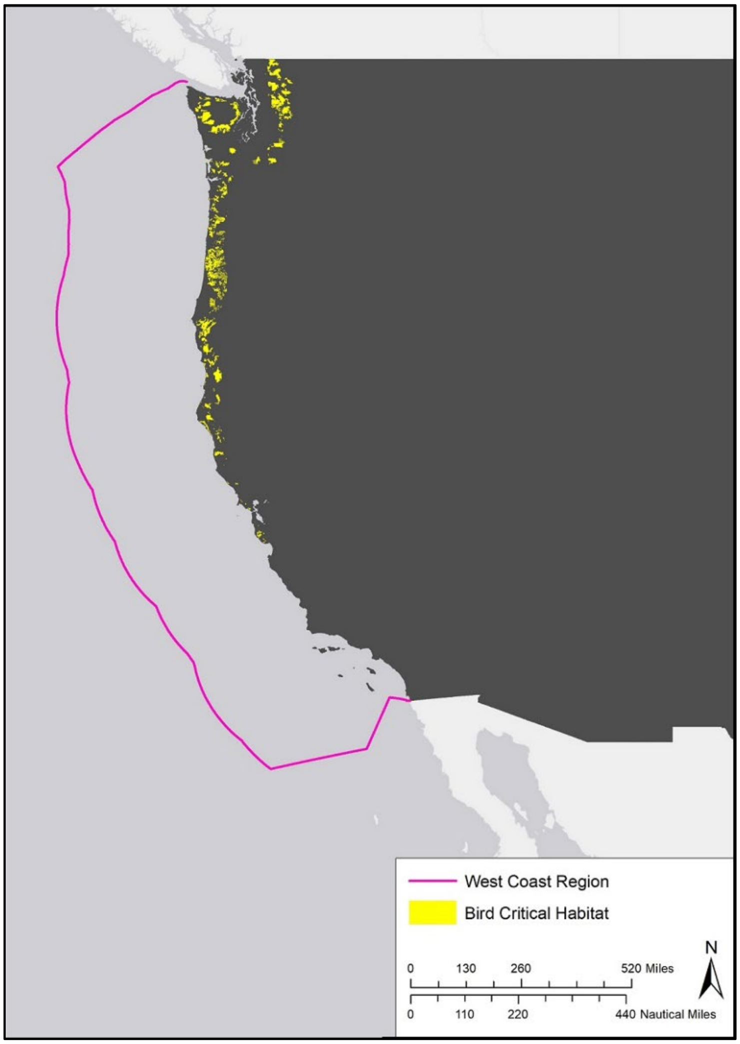


Sources: NMFS, No Date-a; ECOS, No Date-b

Figure 3.10-12. Designated Critical Habitat in the Southeast Region

3.10.1.4.3 West Coast Region

Six ESA-listed bird species (marbled murrelet, short-tailed albatross, California least tern, western snowy plover, light-footed clapper rail, and California clapper rail) occur in the West Coast Region, as indicated in **Table 3.10-2**. Marbled murrelet and western snowy plover have designated critical habitat in the region as shown in **Figure 3.10-13.**

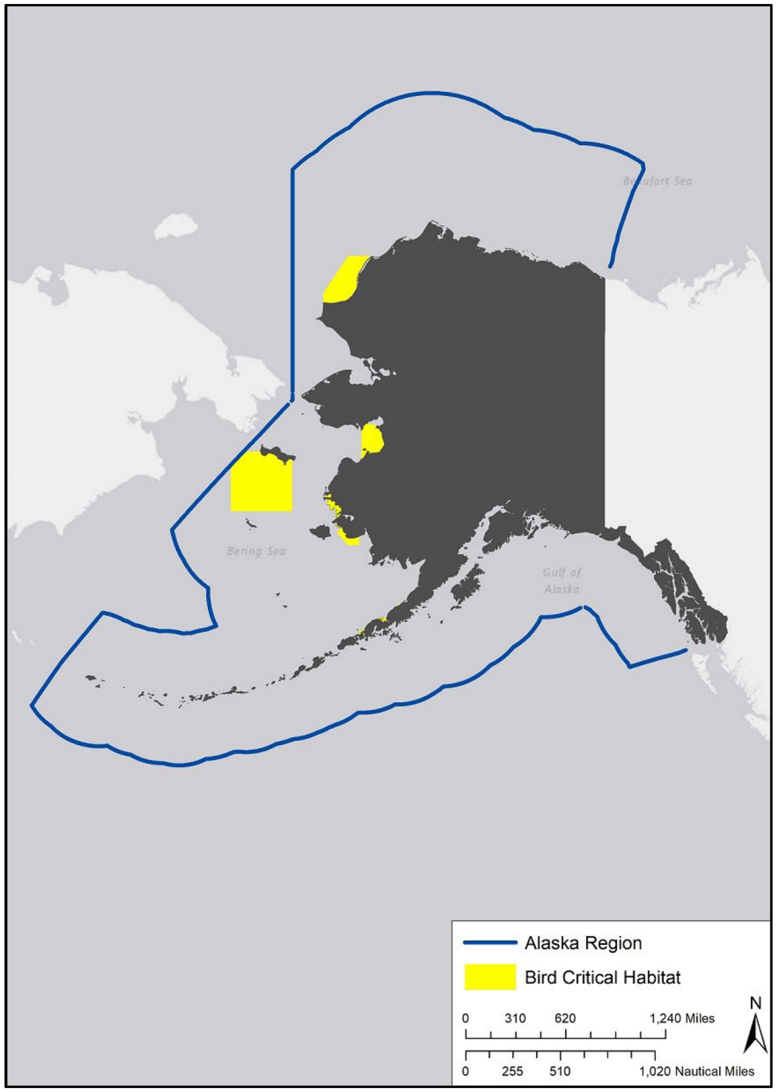


Sources: NMFS, No Date-a; ECOS, No Date-b

Figure 3.10-13. Designated Critical Habitat in the West Coast Region

3.10.1.4.4 Alaska Region

Four ESA-listed birds (short-tailed albatross, Eskimo curlew, Steller's eider, and spectacled eider) occur in the Alaska Region, as indicated in **Table 3.10-2**. Steller's eider and spectacled eider have designated critical habitat in the region, as shown in **Figure 3.10-14**.



Sources: NMFS, No Date-a; ECOS, No Date-b

Figure 3.10-14. Designated Critical Habitat in the Alaska Region

3.10.1.4.5 Pacific Islands Region

Eight ESA-listed birds (band-rumped storm petrel, short-tailed albatross, Hawaiian petrel, Newell's shearwater, Hawaiian coot, Hawaiian Stilt, Laysan duck, and Hawaiian duck) occur in the Pacific Islands Region, as indicated in **Table 3.10-2**. None of these species have designated critical habitat in the region.

3.10.2 Environmental Consequences for Seabirds, Shorebirds and Coastal Birds, and Waterfowl

This section discusses potential impacts to seabirds, shorebirds and coastal birds, and waterfowl and their associated habitat, including designated critical habitat, from NOS activities associated with Alternatives A, B, and C. Activities described in Sections 2.4.1 through 2.4.13 that occur on NOS projects and that could be expected to impact birds and their habitat in the action area include crewed vessel operations, anchoring, ROV and autonomous vehicle operations, use of echo sounders, use of ADCPs, use of acoustic communication systems, use of sound speed data collection equipment, operation of drop/towed cameras and video systems, collection of bottom grab samples, tide gauge installation, maintenance, and removal, GPS reference station installation, and SCUBA operations.

Given the ecological concordance between bird groups, impacts that would affect all groups are hereafter referred to as impacts on birds. Specific impacts based on behavior or habitat of an individual group or species are explicitly stated. Potential impacts could occur in all of the geographic regions described in Section 2.3.1. ESA-listed endangered and threatened species are included in the discussion along with non-listed species because the potential impact mechanisms are the same.

3.10.2.1 Methodology

The factors from NOS activities that could impact birds and their habitat, including ESA-listed species and designated critical habitat, in the action area include: (1) active underwater acoustic sources (e.g., echo sounders, ADCPs, and acoustic communication systems); (2) vessel and equipment sound (e.g., from crewed vessels, ROVs, and autonomous vehicles); (3) aircraft sound (e.g., from installing, maintaining, and removing remote tide gauges and GPS reference stations), (4) water column disruption and underwater activities (e.g., from ROVs and autonomous vehicles; project equipment; anchors; and SCUBA divers); (5) vessel presence and movement (e.g., from crewed vessels, ROVs, and autonomous vehicles); (6) accidental leakage or spillage of oil, fuel, chemicals, or waste into surrounding waters (e.g., from vessel operations); and (7) onshore activities (e.g., installation, maintenance, and removal of tide gauges and GPS reference stations). These potential impact causing factors and their associated impacts on birds and their habitat are discussed below. Note that use of the term “sea floor” in the analysis below also includes lake and river bottoms where NOS activities could occur.

As discussed in Section 3.2.2, significance criteria were developed for each resource analyzed to provide a structured framework for assessing impacts from the alternatives and the significance of the impacts. The significance criteria for birds and bird habitat are shown in **Table 3.10-3**.

Table 3.10-3. Significance Criteria for the Analysis of Impacts to Seabirds, Shorebirds and Coastal Birds, and Waterfowl

Impact Descriptor	Context and Intensity	Significance Conclusion
Negligible	Impacts to birds would be limited to temporary (lasting several hours) behavioral disturbances to individuals located within the project area. No mortality or debilitating injury to any individual bird would occur. There would be no displacement of birds from preferred breeding and feeding areas, nest sites, nursery grounds, or migratory routes. Impacts on bird habitat would be temporary (e.g., temporary displacement of finfish prey) with no lasting damage or alteration.	Insignificant
Minor	Impacts to birds would be temporary or short-term (lasting several days to several weeks) and within the natural range of variability of species' populations, habitats, and the natural processes sustaining them. This could include non-life-threatening injury to individual birds and small disruptions of time-sensitive behaviors such as breeding. Displacement of birds from preferred breeding and feeding areas, nursery grounds, or migratory routes would be short-term and limited to the project	

Impact Descriptor	Context and Intensity	Significance Conclusion
	area. Any resulting increased competition, additional energy expenditure, or loss of young would not affect overall bird population numbers or demographic structure. Impacts on habitat (e.g., short-term displacement of finfish prey, increased turbidity, trampled vegetation) would be easily recoverable with no long-term or permanent damage or alteration.	
Moderate	Impacts to birds would be short-term or long-term (lasting several months or longer) and outside the natural range of variability of species' populations, habitats, and the natural processes sustaining them. This could include debilitating injury or mortality and disruptions of time-sensitive behaviors such as breeding. Behavioral responses and displacement would be expected from individuals within the project area, its immediate surroundings, or beyond. Long-term displacement of individuals from preferred breeding and feeding areas, nursery grounds, or migratory routes would occur. Resulting increased competition and energy expenditure would cause losses of breeding or egg-bearing adults and chicks at large enough scales to negatively impact overall bird population numbers or demographic structure but would not threaten the continued existence of any species. Habitat would be damaged or altered potentially over the long term but would continue to support dependent species.	
Major	Impacts to birds would be short-term or long-term and well outside the natural range of variability of species' populations, habitats, or the natural processes sustaining them. This could include extensive (i.e., affecting a large proportion of the local population), life-threatening, or debilitating injury and mortality and substantial disruption of time-sensitive behaviors such as breeding. Displacement of birds from preferred breeding or feeding areas, nursery grounds, or migratory routes would occur within project areas, their immediate surroundings, and beyond. Behavioral disruptions and displacement would result in the loss of breeding and egg-bearing adults and chicks due to increased competition or energy expenditure at scales large enough to affect overall bird population numbers or demographic structure. Impacts would also be considered major if they threatened the continued existence of any bird species. Full recovery of bird populations would not be expected to occur in a reasonable time. Habitat would be degraded over the long-term or permanently such that it would no longer be able to support dependent populations of birds.	Significant

3.10.2.2 Alternative A: No Action - Conduct Surveys and Mapping for Coastal and Marine Data Collection with Current Technology and Methods, at Current Funding Levels

Impacts of Alternative A are discussed below by impact causing factors for seabirds, shorebirds and coastal birds, waterfowl, and their associated habitat. Under Alternative A, NOS survey effort would continue to cover a total of 2,647,958 nm (4,904,017 km) across all five regions over the five-year period. Although the survey effort under Alternative A would vary by year (see **Table 3.4-4**), approximately 47 percent of the total nautical miles surveyed over the five-year period would continue to be in the Southeast Region. The survey effort in each of the other four regions would continue to be approximately 10 percent of the total survey effort. Slightly greater impacts may continue to occur in the Alaska Region, which contains approximately 18 percent of the total survey effort. Additionally, survey effort in the Great Lakes would average 2,917 nm (5,402 km), as compared to the annual average survey effort of 529,592 nm (980,803 km) for the remainder of the action area. In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location of surveys, sound production and hearing frequency of birds, and population density of birds, that add nuance to this trend.

The analysis of impacts on birds considers all of the impact causing factors introduced above and their impacts on birds and bird habitat. All regions in the action area include several ESA-listed species, and all regions, other than Pacific Islands Region, include designated critical habitat. The Pacific Islands Region contains the greatest number of ESA-listed species and the Alaska and West Coast Regions contain the most designated critical habitat (see **Table 3.10-2**).

3.10.2.2.1 Active Underwater Acoustic Sources

Active acoustic sources used in underwater surveying, including echo sounders, ADCPs, and acoustic communication systems, are a cause of potential impact on birds due to their propagation of underwater sound. The acoustic signals used in NOS active surveying range from 0.5 to 1200 kHz; specific characteristics of each activity are detailed in Section 2.4. Birds have a documented hearing range of around 100 Hz to 10 kHz in air (Dooling and Popper, 2000), but it is unclear whether this range is comparable underwater. The limited data available suggest that the range of bird hearing may shift to lower frequencies in water (Dooling and Therrien, 2012), which may allow birds to hear low and mid-frequency underwater acoustic sources (Navy, 2017b). However, bird hearing is adapted for airborne sound, and there is no evidence that underwater sound is used by birds ecologically.

Surface-diving birds (e.g., cormorants, murres, murrelets, puffins, auklets, guillemots) and plunge-diving birds (e.g., brown pelicans, terns, boobies, gannets) – including ESA-listed marbled murrelets, band-rumped storm petrels, short-tailed albatrosses, Hawaiian petrels, Newell's shearwaters, California least terns, roseate terns, Steller's eiders, and spectacled eiders – may be more susceptible to temporary underwater acoustic disturbance than other bird species due to their foraging behavior. Many diving bird species stay underwater for up to several minutes while foraging and reach depths of 15–168 m (50–550 ft) (Alderfer, 2003; Durant et al., 2003; Jones, 2001; Lin, 2002; Ronconi, 2001). While underwater, sound from echo sounders, ADCPs, and acoustic communication systems could temporarily disrupt foraging activity of diving birds in their immediate vicinity. However, diving birds have adaptations to protect the middle ear and tympanum from pressure changes during diving, and they have other structural protective hearing adaptations for in-air sound that may also serve to protect underwater hearing (Dooling and Therrien, 2012; Hetherington, 2008). Because of these adaptations and the relatively short time period diving birds spend underwater, the likelihood of a diving bird experiencing an underwater exposure from sound emitted by echo sounder, ADCPs, and acoustic communication systems that could result in an impact on hearing is considered low. Diving birds would also be able to surface shortly after exposure to sounds from underwater acoustic sources, limiting their exposure time and potential impacts. Furthermore, only diving birds within several meters of underwater acoustic sources would be temporarily exposed to active acoustic sources. Any increased foraging effort, competition, or energy expenditure resulting from displacement during project operations is not expected to substantially affect individuals or the population of birds as a whole. Non-diving birds would not be affected by underwater active acoustic sources.

Active acoustic sources could affect bird habitat, including designated critical habitat, by displacing finfish prey species from the project area during project operations. As discussed in Section 3.7, active acoustic sources could elicit pathological and behavioral effects on fish and could displace them from the immediate project area during NOS activities. However, given the relatively small project area and short duration of acoustic surveys, finfish prey are not expected to change their long-term behavior or habitat use in response to active underwater acoustic surveying. Consequently, any increased foraging effort, competition, or energy expenditure resulting from displacement of prey species is not expected to harm diving birds or surface feeding birds.

Birds likely cannot hear the majority of active acoustic underwater sound sources; thus, any resulting impacts would be limited to diving birds within meters of the source and would persist only for the duration of the activity. Birds and their prey are expected to return to project areas after the completion of NOS activities and are not expected to experience any long-term changes in habitat availability, habitat use, or energy expenditure. Any resulting impacts from active acoustic underwater sources under Alternative A to birds and bird habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, would continue to be potentially **adverse,** but **negligible** and therefore **insignificant**.

3.10.2.2.2 Vessel and Equipment Sound

Vessel and equipment sound (hereafter vessel sound) make up the majority of the ambient ocean auditory environment and are becoming more prominent with increasing human marine activity. Underwater vessel sound is a combination of tonal sound (sounds with discrete frequencies) and broadband sound (sounds with a combination of many frequencies) (Richardson et al., 1995) and typically ranges in frequency from 0.01 to 10 kHz. Underwater vessel sound is generated predominantly through the propeller operation – including cavitation, singing, and propulsion – of crewed vessels and autonomous vehicles. The intensity of this sound is dependent on the size and speed of the vessel in question, and sound levels attenuate quickly underwater with increasing distance from their source. Birds have a documented hearing range of around 100 Hz to 10 kHz in air (Dooling and Popper, 2000), but it is unclear whether this range is comparable underwater. The limited data available suggest that the range of bird hearing may shift to lower frequencies in water (Dooling and Therrien, 2012), which may allow birds to hear low and mid-frequency vessel and equipment sound. As such, sounds emitted by vessels and equipment used by NOS could potentially contribute to hearing threshold shifts and acoustic masking in exposed birds, but this is unlikely given that diving birds have protective structural hearing adaptations, and there is no evidence of ecological use of underwater sound by birds. Furthermore, only diving birds, including the ESA-listed species described in Section 3.10.2.2.1, within several meters of underwater acoustic sources would be temporarily exposed to active acoustic sources. Given the attenuation of vessel sound towards the surface, it is likely that only diving birds in the immediate vicinity of the vessel would be displaced by vessel sound as long as the vessel remains in the area. This temporary disturbance is not likely to cause any long-term behavioral changes or displacement of affected individuals. Non-diving birds would not be affected by vessel and equipment sound at all.

Vessel sound would affect bird habitat, including designated critical habitat, primarily through the displacement of finfish prey. As with active underwater acoustic sources, vessel sound could elicit pathological and behavioral effects on fish and likely would disturb or displace them from project areas during vessel operation (see Section 3.7 Fish). Fish are expected to return to project areas immediately following vessel activity, and any increased foraging effort, competition, or energy expenditure resulting from the displacement of prey species is not expected to considerably affect diving or surface feeding birds.

Vessel sound would displace birds, including ESA-listed species, and their prey within the immediate vicinity of vessels used by NOS and would not cause any mortality or direct injury. Birds and their prey are expected to return to project areas after the completion of NOS activities and are not expected to experience any long-term changes in habitat availability, habitat use, or energy expenditure. Sound is a common byproduct of oceanic vessel activity, and the impacts created by sound from vessels used by NOS would be indistinguishable from those produced by all other vessels. As such, the impacts to birds and bird habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, from vessel and equipment sound generated during NOS activities under Alternative A would continue to be **adverse**, **negligible**, and therefore **insignificant**.

3.10.2.2.3 Aircraft Sound

NOS projects would use low-flying aircraft, typically helicopters, to access some remote GPS reference stations and tide gauges in Alaska; the resulting aircraft sound could adversely affect birds, including ESA-listed species, in the project area. Fixed-wing aircraft and helicopters generate sound typically below 500 Hz (0.5 kHz) from their engines, airframe, and propellers (Richardson et al., 1995). Birds have a documented hearing range of around 100 Hz to 10 kHz in air (Dooling and Popper, 2000) and would be able to perceive the majority of sound generated by aircraft. Aircraft sound can cause temporary disturbance and displacement of birds up to 1 km (0.6 mi) away from an aircraft (Efroymson et al., 2000). Repeated, more intensive disturbance around sensitive coastal nesting areas, could lead to nest site abandonment and egg or nestling mortality via temperature stress, inadequate feeding of nestlings by parents, or predation. These impacts would also be magnified if coastal nesting ESA-listed bird species, including all species described in Sections 3.10.1.3.1 and 3.10.1.3.2, were exposed to repeated aircraft-induced stress. However, aircraft are not frequently used during NOS activities, and the resulting sound would likely only temporarily displace affected individuals in the Alaska region in a project area. Any disturbance from aircraft sound is unlikely to cause any long-term bird behavioral changes or displacement and would only continue to temporarily disturb existing bird habitat, including designated critical habitat.

Low-flying aircraft are only used very infrequently by NOS and their resulting sound would only displace birds, including ESA-listed species, and their prey within the immediate vicinity of aircraft and would not cause any mortality or direct injury. Birds and their prey are expected to return to project areas after the completion of NOS aircraft activities and are not expected to experience any long-term changes in habitat availability, habitat use, or energy expenditure. Sound is also a common byproduct of aircraft activity and the impacts created by NOS aircraft sound would be indistinguishable from those produced by all other aircraft. As such, the impacts to birds and bird habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, from aircraft sound generated during NOS activities under Alternative A would continue to be **adverse**, **negligible** to **minor**, and therefore **insignificant**.

3.10.2.2.4 Vessel Movement and Presence

Although many NOS projects involve vessel operations and activity, they represent only a very small proportion of the total vessel traffic within the action area (Section 2.4.1). As such, the resulting impacts of vessel operations on birds would only marginally contribute to the overall impact of vessel presence and movement within a given area as compared to that from all other vessels in the EEZ. Nevertheless, vessel presence and movement as a result of NOS projects could cause bird–vessel interactions including visual disturbance, vessel strikes, underwater turbulence from vessel wakes, and reduction or displacement of avian prey.

Much like vessel sound, vessel presence and movement as a result of NOS activities could potentially disrupt normal bird behavior and displace individuals from project areas through visual disturbance. The visual perception of vessels used by NOS would likely induce evasive maneuvers such as changes in flying direction or speed in nearby birds. As a result, some birds would likely be temporarily displaced from project areas while vessels are present. These behavioral changes and displacements would last only for the duration of vessel activity within a given area and would not induce any long-term or permanent changes in bird habitat use, prey availability, or competition. As such, increased evasive behavior and additional energy expenditure as a result of vessel presence and movement are not expected to harm individual birds or affect bird population numbers and demographic structure.

Vessel presence and movement during NOS projects could impact birds by direct collision, resulting in injury or death of the affected individual. Birds' responses to vessel presence and movement vary widely by species, physiological and reproductive status of the individual, distance from the vessel, and the type, intensity, and duration of the disturbance. While it is important to note that no component of the Proposed Action involves any intentional attraction of birds, a number of bird families (e.g., Procellariidae, Pelicanoididae, Laridae, and Alcidae), including all ESA-listed seabirds described in Section 3.10.1.3.1, are attracted to offshore vessels due to light attraction (Wiese et al., 2001) or as a foraging strategy to collect prey brought to the surface by propeller wakes (Hyrenbach, 2002). Accidental collisions occasionally occur, particularly at night, with alcids and petrels being the most frequently affected species (Black, 2005). Additionally, an increase in recent vessel strikes in 2020 and 2021 of Steller's and spectacled eiders, both of which are ESA-listed as threatened, have occurred in the Bering Strait and in the Aleutian Islands in Alaska (USFWS, 2021c). Taking into account the total number of eiders that have been injured or killed by vessel strikes in Alaska in recent years, NOS would expect that any interactions between vessels used by NOS and eiders would be appreciably lower than it has been in the past. Vessels used by NOS typically travel at speeds less than 10 knots during project operations, allowing birds to recognize and avoid vessels. Vessels used by NOS that operate at night, although uncommon, would use the appropriate lighting to comply with navigation rules and best safety practices, limiting the exposure of birds to onboard lighting. All project areas would be continually monitored for protected species by posted crewmembers during vessel operations, further reducing the risk of collision with birds. Given their low likelihood of occurrence, vessel collisions with birds are not expected to affect overall bird populations in terms of its demographic structure or abundance.

Activity from ships and boats being placed in and taken out of the water and traveling at sea or in close proximity to shore could also cause temporary disturbance and changes in behavior of some species of nearby birds (Turnpenny and Nedwell, 1994). The level of disturbance is contingent upon the habituation of the affected birds to human activity; sound and activity-based disturbance would be less pronounced at and near existing marinas, boat docks, heavily trafficked shipping lanes, and popular boating or recreation areas than at isolated island breeding colonies in the Pacific Ocean. Disturbances would be limited to the immediate vicinity of the activity and would not continue to persist after the conclusion of the activity. If repeated, intensive disturbance could eventually lead to nest site abandonment and egg or nestling mortality via temperature stress, inadequate feeding of nestlings by parents, or predation. Frequent, low-level vessel sound could also result in chronic stress responses that harm birds, especially during sensitive life stages such as molting. These impacts would be magnified if coastal nesting ESA-listed bird species, including all species described in Sections 3.10.1.3.1 and 3.10.1.3.2, were exposed to repeated vessel-induced stress. However, vessels used by NOS would operate transiently and only remain within a given area for the duration of activities before moving to new areas. As such, vessels used for NOS projects would not continue to repeatedly disturb birds or contribute to the creation of chronic stress responses.

Vessel presence and movement could affect bird habitat, including designated critical habitat, through the displacement and reduction of prey. As with active underwater acoustic sources, vessel sound could elicit pathological and behavioral effects on prey species (e.g., fish and aquatic macroinvertebrates) and would likely displace them from project areas during vessel operation. Prey are expected to return to project areas immediately following vessel activity, and any increased foraging effort, competition, or energy expenditure resulting from displacement of prey species is not expected to harm individual birds or the bird population. Prey species could also be exposed to waste and debris generated by NOS projects and serve as an additional source of waste ingestion for birds, particularly of bioaccumulated (concentrated in tissue through repeated exposure and ingestion) waste materials. Assuming proper waste disposal regulations are implemented, prey species would only continue to very rarely be exposed to trash and debris from NOS projects, and prey population numbers or habitat would not substantially change. As such, diving and surface-feeding birds would not be affected by increased foraging effort, competition, or energy expenditure resulting from displacement and reduction of prey populations by vessel presence and movement.

Any injury or death to ESA-listed birds would constitute a **moderate** or greater impact, depending on the species, given the protection status afforded to them by the ESA, NMFS, and USFWS. These impacts are particularly relevant to Steller's eiders, spectacled eiders, marbled murrelets, short-tailed albatross, band-rumped storm-petrel, Hawaiian petrel, Newell's shearwater, California least tern, and roseate terns due to the attraction of these species to vessels. Night operations are especially high risk to these species due to their inability to recognize and avoid vessels in low light conditions. However, the duration of NOS projects would be relatively short, on the order of hours, days, or weeks, although a small number of projects may last several months spread across multiple years (See Section 2.3), and there is only a very low likelihood of vessel strike occurrence. Vessels used by NOS operating at night would use the appropriate lighting necessary to comply with safety and navigation rules and best safety practices. Vessels used by NOS would also comprise only a negligible portion of overall vessel traffic, and any impacts produced from their movement would be indistinguishable from those produced by all other vessel traffic. Any displacement of birds and their prey by vessel presence or wakes would be limited to the immediate project vicinity. As such, any resulting impacts to individual birds or to overall bird populations, bird prey, and their respective habitat availability would be well within the natural range of variability. Overall, the effects of vessel presence and movement under Alternative A on birds and their habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, would continue to be **adverse**, **negligible** to **minor**, and therefore **insignificant**.

3.10.2.2.5 Accidental Leakage or Spillage of Oil, Fuel, Chemicals or Waste

Accidental oil, fuel, and chemical discharges as a result of NOS projects could affect birds through various pathways including direct contact, inhalation of the oil, fuel, or volatile components, and ingestion directly or indirectly through the consumption of fouled prey species. Although large spills of volatile materials would not result from NOS activities, small accidental or routine discharges may occur during normal vessel operations. Globally, small discharges from all oceangoing vessels account for at least twice the volume of oil released into marine environments globally than that from large accidental spills due to their higher frequency of occurrence (GESAMP, 2007). Spilled fuel is less dense than water and floats to the surface of the water column where seabirds and shorebirds are susceptible to exposure. The location and size of the spill would determine the magnitude and duration of the impact to bird species in the area. Although the majority of spills typically dissipate in 24 hours, any direct fuel exposure can cause tissue and organ damage in birds in addition to interfering with essential behaviors such as prey detection, predator avoidance, and navigation along migratory routes. Large spills would contaminate areas beyond the immediate project area and increase the likelihood of bird exposure to volatile chemicals and resulting injury or mortality.

All crewed vessels produce some waste through normal operations, and vessels used by NOS could accidentally lose or discard debris, a major form of marine pollution (Laist, 1997). Vessels used by NOS would generate some waste in the form of metal, wood, glass, paper, and plastic, primarily through galley and food service operations on larger vessels. Birds commonly mistake improperly discharged marine waste for forage items and the continued ingestion of waste over time can substantially degrade avian health (Pierce et al., 2004). However, vessels used by NOS would comply with all USCG and EPA waste disposal regulations, and all MARPOL discharge protocols would be followed, which prohibit the illegal discharge of waste, require the development and implementation of onboard waste management plans, require marine debris education for crew members, and require the use of marine sanitation devices to treat and discharge sewage (33 U.S.C. § 1905-1915, 33 U.S.C. § 1952-1953, 33 C.F.R. § 159.7). Adherence to these regulations should prevent discharged waste from vessels used by NOS from harming birds. Furthermore, the vast majority of vessels used by NOS would be small and would not generate substantial amounts of waste, especially because they would not have food service or galley operations.

Accidental discharge of oil, fuel, chemicals, or waste could affect bird habitat, including designated critical habitat, through the disruption of prey sources and nest sites. In the event of a discharge, birds' vertebrate (finfish) and invertebrate (e.g., insects, larvae, polychaete worms, amphipod crustaceans) prey could become exposed and bioaccumulate spilled substances. These prey species would then serve as an additional source of exposure and ingestion of volatile chemicals for foraging birds. Breeding and nesting habitat, including that of ground-nesting ESA-listed piping plovers, roseate terns, red knots, western snowy plovers, California least terns, and Hawaiian stilts in all regions of the EEZ except the Alaska region, along coastlines adjacent to large spills could also be degraded as spilled substances are washed onshore, which could potentially cause birds to abandon important nesting and breeding areas.

Such accidents may be caused by equipment malfunction, human error, or natural phenomena and are not expected during the course of NOS operations. In the unlikely event of an accidental spill, there would be very low likelihood for contaminants to make contact with the water because vessel operations personnel are required to respond immediately using established spill response procedures. For example, on NOAA fleet vessels, in the event of an oil, hazardous substance, or marine pollutant spill, the Commanding Officer takes appropriate action to minimize the effects of the spill. OMAO Procedure 0701-06 VRP/SOPEP provides policy and guidance to all NOAA vessels regarding oil pollution emergency planning and response, in accordance with MARPOL 73/78, Annex I. The plan contains all the information and instruction required for responding to shipboard oil spills, such as general spill mitigation and response, shipboard spill mitigation and response, reporting requirements, completing Corrective Action

Assessments, trainings, drills, and exercises. This plan has been approved by the USCG, and complies with the Oil Pollution Act of 1990 and Federal Water Pollution Act of 1973.

Although the likelihood of spill occurrence is low with proper adherence to existing regulations, coastal ground-nesting ESA-listed species are particularly susceptible to oiling within nesting habitat near high water lines. As such, adverse impacts to any ESA-listed species would be considered **moderate** or greater due to the vulnerable status of these birds. However, given the low likelihood of occurrence and short-term duration of most fuel spills, adverse impacts to birds, including ESA-listed species, designated critical habitat, and species protected by the MBTA, from accidental leakage or spillage of oil, fuel, or chemicals under Alternative A would continue to be **adverse**, **minor** to **moderate** depending on the spill size and location, and **insignificant**.

3.10.2.2.6 Underwater Activities

As with many human activities on or in the water, the vast majority of NOS projects would cause some temporary disturbance to the water column, potentially producing some adverse impacts to diving birds. Anchoring, camera and video systems, SCUBA diving, and CTD instruments could all cause temporary disturbance and displacement of nearby birds. Sound speed data collection equipment is not likely to affect birds as it would be used away from shore on stationary or moving vessels, and any sound or visual disturbance would come predominantly from operation of the crewed vessel rather than from use of equipment per se. Underwater disturbances would likely elicit avoidance behavior from nearby diving birds, but any increased energy expenditure is not expected to substantially affect any individuals or population.

A number of NOS activities involve trailing equipment with lines or wire behind and beneath vessels, which poses a risk of entangling nearby birds. From 2001–2005, entanglement rates ranged from 0.2 percent to 1.2 percent for all seabirds observed by beach monitoring programs in California, Oregon, and Washington (NOAA, 2014b). While the vast majority of entanglements involved fishing gear (e.g., monofilament line and hooks), approximately 8.3 percent of the entanglements were from non-fishery-related items such as plastics and other synthetic materials that birds may gather for making nests (NOAA, 2014b). However, NOS equipment is only submerged for periods of time ranging from minutes to hours (see Section 2.4.7) and is heavier and more conspicuous than discarded monofilament fishing line. All buoys would be attached to the sea floor using the best available mooring systems to reduce entanglement risks. Nearby birds would likely be able to recognize and avoid trailing equipment, thus the likelihood of bird-equipment interactions would be low. Furthermore, trailed equipment would stay within meters of the towing vessel and would only potentially impact birds within its immediate vicinity. Birds within the immediate vicinity of vessels would also likely be displaced by the visual disturbance and sound of the vessel itself (Section 3.10.2.2.4) before they would interact with trailed equipment, further lowering the likelihood of entanglement. Given its low likelihood of occurrence, entanglement of birds under Alternative A is not expected to affect the abundance or demographic structure of any bird populations.

Underwater activities would affect bird habitat, including designated critical habitat, predominantly through the operation of the crewed vessels that are used to carry associated equipment (see Section 3.10.2.2.4) and would not be expected to contribute to any long-term changes in habitat occupancy or behavior of finfish prey. Some underwater activities including anchoring, bottom sampling, use of drop cameras, and mobile ADCPs can also disturb the sea floor, increasing sedimentation and potentially displacing marine macroinvertebrate prey. However, underwater activities would only degrade very small proportions of bird habitat, and any resulting disturbance or degradation would be temporary and limited to the immediate project area.

Underwater activities would likely only displace birds, including ESA-listed species, and bird prey within the immediate vicinity of vessels used by NOS or divers and would not cause any mortality or direct injury. Birds and their prey are expected to return to project areas after the completion of NOS underwater activities and are not expected to experience any long-term changes in habitat availability or use, including that of designated habitat, or energy expenditure outside of the natural range of variation. As such, the impacts to birds and bird habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, from underwater activities under Alternative A would continue to be **adverse**, **negligible** to **minor**, and therefore **insignificant**.

3.10.2.2.7 Onshore Activities

NOS onshore projects, such as the installation, maintenance, and removal of shore-based GPS reference stations and tide gauges, could potentially disturb birds from sensitive nesting, roosting, and breeding areas. Sound and activity from both the access of remote locations and on-shore installation of tide gauges and GPS reference stations could cause temporary disturbance and behavioral changes in nearby birds. Crews may also visit monitoring sites periodically for maintenance, during which sound and activity would disturb nearby birds temporarily. All disturbances would be limited to the immediate vicinity of the project area and would not persist beyond the conclusion of activity in the area. These responses would be well within the normal range of bird behavior; onshore activities are not expected to contribute to any long-term changes in habitat occupancy, avoidance behavior, or energy expenditure in birds.

Onshore activities could degrade and reduce sensitive breeding, roosting, and nesting habitat, including critical habitat. The installation of semi-permanent monitoring equipment such as GPS reference systems and tide gauges could potentially reduce the quantity and quality of shoreline and coastal bird habitat. The majority of birds affected by NOS projects and activities, including all ESA-listed species described in Sections 3.10.1.3.1 and 3.10.1.3.2, breed, nest, and roost along the coast. These behaviors are time-sensitive in nature and disturbances within associated areas would carry a higher potential cost to both individual birds and the overall bird population. During onshore activities, vegetation in and adjacent to the project area could be trampled by foot traffic, damaged, or cleared, but would likely recover post-installation. However, NOS would take all necessary precautions to avoid wounding birds or disturbing nests during onshore activities. Onshore installations would only occupy very small proportions of available habitat, and no long-term changes in bird habitat availability, quality, or use are expected as a result of onshore activities.

Onshore activity would likely only displace birds and prey within the immediate vicinity of the project area and would not cause any mortality or direct injury. Onshore installations would only occupy very small portions of available habitat and birds and their prey are expected to return to project areas after the completion of NOS onshore activities. As such, birds are not expected to experience any long-term changes in habitat availability, habitat use, or energy expenditure outside of the natural range of variation. Given the relatively low level of onshore activity anticipated, along with the short duration of exposure to sound and visual disturbance, the impacts to birds and bird habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, from NOS onshore activities under Alternative A would continue to be **adverse**, **negligible** to **minor**, and therefore **insignificant**.

3.10.2.2.8 Air Emissions from Vessel Operations

Air emissions from NOS activities would adversely impact birds through direct inhalation pathways. It is important to note that vessels used by NOS make up only a small proportion of the total amount of vessel operation (Section 2.4.1) and would only marginally contribute to the overall level of emissions within the action area. However, any emissions of anthropogenic GHGs (CO_2, CH_4, N_2O, and ozone (O_3) by NOS would primarily contribute to ongoing changes in atmospheric and terrestrial conditions. Smokestack and two-stroke outboard motor emissions from vessels used by NOS would release pollutants into the atmosphere of the project area and immediately surrounding areas. Birds are particularly sensitive to air quality due to their high breathing rate and long periods of time spent in open air (Sanderfoot and Holloway, 2017). Prolonged exposure to high amounts of pollutants can result in respiratory stress, physiological changes, and reduced immunocompetency (ability to respond to illness) in birds (Sanderfoot and Holloway, 2017). ESA-listed short-tailed albatrosses, band-rumped storm petrels, and Hawaiian petrels are particularly susceptible to air pollution because they spend large proportions of their time travelling between foraging and nesting habitat. However, NOS activities are not expected to substantially increase air emissions in the oceans and the resulting bird exposure is not expected to substantially affect individual birds or the overall population of any species.

Air emissions could also potentially degrade seabird habitat, including designated critical habitat, by contributing to the acidification of the ocean. Higher atmospheric CO_2 levels increase dissolved CO_2 and bicarbonate ions in seawater, which subsequently leads to a decrease in seawater pH and carbonate ions. In general, a decrease in pH corresponds to a simultaneous increase in acidity, termed "ocean acidification." Changes in seawater carbon chemistry may adversely affect marine biota through a variety of biochemical, physiological, and physical processes and interactions. Although ocean acidification resulting from air emissions is within the range of bird tolerance and is not expected to cause any direct harm to individuals and the population, ocean acidification could potentially reduce the availability of macroinvertebrate prey species that are particularly sensitive to pH levels during their larval life stages. However, as stated previously, NOS activities are not expected to substantially increase air emissions in the oceans and any increased bird competition, foraging effort, or energy expenditure as a result of reduced prey availability from ocean acidification is not expected to substantially affect individuals or the overall population of any bird species.

Air emissions could potentially cause some direct injury to birds, including ESA-listed species. Injury or mortality resulting from air emissions to any ESA-listed species could be considered a large impact due to the vulnerable status of these birds. However, the amount of emissions from vessels used by NOS would be negligible when compared to emissions from all other vessel activity in the oceans. The minimal direct impact on birds species under Alternative A would be confined to the immediate project area for only the duration of activity. Macroinvertebrate prey populations could also potentially be affected by ocean acidification, but any changes in prey population size would be well within the natural range of variability. As such, birds are not expected to experience any long-term changes in habitat availability, habitat use, or energy expenditure from air emissions outside of the range of natural variation. Thus, impacts to birds and bird habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, from NOS air emissions under Alternative A would continue to be **adverse**, **negligible** to **minor** due to air emissions dispersing beyond the immediate project area, and therefore **insignificant**.

3.10.2.2.9 Conclusion

Although the effects of impact causing factors on birds and their associated habitat range from negligible to moderate, moderate impacts are only expected in the extremely unlikely occurrence of a large spill of oil, fuel, or chemicals. Since all other impacts range from negligible to minor, the overall impact of Alternative A on birds, including ESA-listed species, designated critical habitat, and species protected by the MBTA, would continue to be **adverse** and **minor**; therefore, impacts of Alternative A would be **insignificant**.

3.10.2.3 Alternative B: Conduct Surveys and Mapping for Coastal and Marine Data Collection with Equipment Upgrades, Improved Hydroacoustic Devices, and New Tide Stations

Projects under Alternative B would take place in the same geographic areas and timeframes as under Alternative A; however, Alternative B would include more projects, activities, and nautical miles traveled than Alternative A. Under Alternative B, NOS survey effort would cover a total of 2,912,753 nm (5,394,419 km) across all five regions over the five-year period. Overall, survey effort would cover an additional 264,796 nm (490,402 km) under Alternative B (see **Table 3.4-5**), an approximately 10 percent increase over Alternative A (2,647,958 nm [4,904,017 km] total) across all regions over the five-year period. Thus, the greatest number of nautical miles surveyed each year would be in the Southeast Region (with approximately 47 percent of the survey effort); the level of effort in the other four regions would be at similar levels (approximately 10 percent of the survey effort in each region), and perhaps slightly greater in the Alaska Region where the survey effort would be somewhat higher overall (approximately 18 percent). The level of effort in the Great Lakes would remain much lower as compared to an annual total marine survey effort. In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location of surveys, sound production and hearing frequency of birds, and population density of birds, that add nuance to this trend.

Under Alternative B crewed vessel operations would cover 577,000 nm (1,070,000 km), as compared to 518,000 nm (959,000 km) under Alternative A. Vessel operations are among the most disruptive NOS activities to bird populations and could contribute to impacts on bird and bird habitat through visual disturbance, direct collision, vessel sound, vessel wake and underwater turbulence, trailing equipment that could cause entanglement, accidental spills or waste disposal, and air emissions. Although the amount of crewed vessel operations would be greater under Alternative B than under Alternative A, the additional 59,000 nm (109,000 km) would be distributed across the five regions of the EEZ. While these additional operations would result in greater impacts overall, the associated impact-causing factors would not be concentrated enough in any given area to substantially increase the magnitude of impact (e.g., from negligible to minor). This relationship is consistent for all other impact-causing factors from proposed activities, such as onshore disturbance from the installation, maintenance, and removal of tide gauges and installation GPS reference stations; and entanglement risk from anchoring, bottom sample collection, and trailing video equipment.

Impacts of Alternative B on birds and bird habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, would be the same or slightly, but not appreciably, larger than those discussed above under Alternative A for each impact causing factor. Overall, impacts on birds and bird habitat, including ESA-listed species and designated critical habitat, would be **adverse**, **minor** and therefore **insignificant**.

3.10.2.4 Alternative C: Upgrades and Improvements with Greater Funding Support

Projects under Alternative C would take place in the same geographic areas and timeframes as under Alternatives A and B; however, Alternative C would include more projects, activities, and nautical miles traveled than Alternative A. Under Alternative C, NOS survey effort would cover a total of 3,177,549 nm (5,884,821 km) across all five regions over the five-year period. Overall, NOS survey effort would cover an additional 264,796 nm (490,402 km) under Alternative C (see **Table 3.4-6**), an approximate nine percent increase over Alternative B (2,912,753 nm [5,394,419 km] total); and an additional 529,592 nm (980,803 km), an approximate 20 percent increase over Alternative A (2,647,958 nm [4,904,017 km] total) across all regions over the five-year period. Thus, the greatest number of nautical miles surveyed each year would be in the Southeast Region (with approximately percent of the survey effort); the level of effort in the other four regions would be at similar levels (approximately 10 percent of the survey effort in each region), and perhaps slightly greater in the Alaska Region where the survey effort would be somewhat higher overall (approximately 18 percent). The level of effort in the Great Lakes would remain much lower as compared to an annual total marine survey effort. In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location of surveys, sound production and hearing frequency of birds, and population density of birds, that add nuance to this trend.

Under Alternative C, crewed vessel operations would cover 637,000 nm (1,180,000 km), as compared to 577,000 nm (1,070,000 km) under Alternative B and 518,000 nm (959,000 km) under Alternative A. Vessel operations are among the most disruptive NOS activities to bird populations and could contribute to impacts on bird and bird habitat through visual disturbance, direct collision, vessel sound, vessel wake and underwater turbulence, trailing equipment that could cause entanglement, accidental spills or waste disposal, and air emissions. Although the amount of crewed vessel operations would be greater under Alternative C than under Alternatives A and B, the additional 119,000 nm (220,388 km) as compared to Alternative A and the additional 60,000 nm (111,000 km) as compared to Alternative B would be distributed across the five regions of the EEZ. While these additional operations would result in greater impacts overall, the associated impact-causing factors would not be concentrated enough in any given area to substantially increase the magnitude of impact (e.g., from negligible to minor). This relationship is consistent for all other proposed activities contributing potential impacts, such as onshore disturbance from the installation, maintenance, and removal of tide gauges and installation GPS reference stations; and entanglement risk from anchoring, bottom sample collection, and trailing video equipment.

Impacts of Alternative C on birds and bird habitat, including ESA-listed species, designated critical habitat, and species protected by the MBTA, would be the same or somewhat, but not appreciably, larger than those discussed above under Alternative A for each impact causing factor. Overall, impacts on birds and bird habitat, including ESA-listed species and designated critical habitat, would be **adverse**, **minor**, and therefore **insignificant**.

3.10.2.5 Endangered Species Act Effects Determination

Twenty-two species of birds occurring within the action area are listed under the ESA (see **Table 3.10-2**), and federal agencies are required under the ESA to formally determine whether their actions may affect listed birds or their designated critical habitat. Effects determinations divide potential effects into three categories: No Effect; May Affect, but Not Likely to Adversely Affect; and May Affect, and is Likely to Adversely Affect. Actions receiving a “No Effect” designation do not impact listed species or their designated critical habitat (hereafter listed resources) either positively or negatively. This designation is typically used only in situations where no listed resources are present in the action area. Actions receiving a “May Affect, but Not Likely to Adversely Affect” designation have only beneficial, insignificant, or discountable effects to listed resources. Effects are considered insignificant if they are of low relative impact, undetectable, not measurable, or cannot be evaluated. Adverse effects are considered discountable if they are extremely unlikely to occur. Actions designated as “May Affect, and is Likely to Adversely Affect” will negatively impact any exposed listed resources.

Although ESA-listed bird species can likely hear the frequencies emitted by active underwater acoustic sources, bird hearing is adapted for airborne sound. Diving birds could potentially be exposed to active underwater acoustic sources but this exposure would be limited to the short time periods in which these birds are foraging. Furthermore, underwater sound is not thought to be an important ecological factor for bird behavior. Due to the mobile and temporary nature of the projects, the small area of the seas affected during the projects relative to the entire EEZ, and the possibility of birds and their prey to temporarily move away from sound, the response to sound exposure from active underwater acoustic sources would be limited to only a few individuals and, therefore, insignificant (i.e., so small they cannot be meaningfully measured, detected, or evaluated).

The proposed amount of vessel presence and movement associated with activities would be very small in comparison to all other non-project related vessel presence and movement in the EEZ. Given the frequency and duration of vessel operations and the rarity of ESA-listed species, the likelihood of collision is very small. Vessels used by NOS that operate at night, although uncommon, adhere to mitigation measures including the use of appropriate lighting to comply with navigation rules and best safety practices, and all project areas would be continually monitored for protected species by posted crew members during vessel operations, thus limiting the exposure of birds to onboard lighting and further reducing the likelihood of collisions with ESA-listed species. Disturbances from increased vessel presence and movement, including sound, water column disruption, and accidental waste discharge, would be temporary to short-term and would likely only temporarily affect ESA-listed birds. Because disturbance would occur infrequently in any given area and would only temporarily affect ESA-listed birds, the response by ESA-listed birds to vessel presence and movement would be limited to only a few individuals, and therefore, insignificant (i.e., so small they cannot be meaningfully measured, detected, or evaluated) for most ESA-listed bird species. However, because of historical vessel strike occurrences of the Steller's eider and spectacled eider in Alaska, and although impacts of the Proposed Action would be negligible to minor, with moderate impacts only in the very low likelihood of a vessel strike (see Section 3.10.2.2.4), under the ESA this adverse potential impact cannot be considered insignificant (i.e., so small they cannot be meaningfully measured, detected, or evaluated), or discountable (i.e., extremely unlikely to occur).

The likelihood for an accidental spill is expected to be discountable (i.e., extremely unlikely to occur), and exposure of ESA-listed bird species and critical habitats to oil, fuel, and other contaminants is not expected. These accidents may be caused by equipment malfunction, human error, or natural phenomena and are not expected during the course of NOS operations. In the unlikely event of an accidental spill, there would be a very low likelihood for contaminants to make contact with the water because vessel operations personnel are required to respond immediately using established spill response procedures. Therefore, effects from chemical contamination on ESA-listed species are discountable (i.e., extremely unlikely to occur).

Onshore and above-water activities, such as the installation of onshore equipment and use of low-flying aircraft, could potentially disturb and displace nearby ESA-listed species for the duration of activity. No permanent changes in behavioral or habitat use are expected to result from these disturbances. Given the temporary nature of the disturbance and small proportion of total bird habitat affected, the response of ESA-listed birds to onshore activities would be discountable (i.e., extremely unlikely to occur).

Although underwater disturbance by crewed vessels, ROVs, ADCPs, and SCUBA divers could temporarily disturb and displace nearby diving birds, their effects would be temporary and minimal limited to only a few individuals; thus, the response by ESA-listed birds would be discountable (i.e., extremely unlikely to occur).

NOS concludes that the Proposed Action "May Affect, but is Not Likely to Adversely Affect" 20 of the ESA-listed bird species occurring in the action area and "May Affect, Likely to Adversely Affect" two ESA-listed bird species occurring in the action area (**Table 3.10-4**).

Since activities may occur in some areas within or adjacent to designated critical habitats, there is the potential for impacts on critical habitat that support ESA-listed bird species. Critical habitat may be minimally disturbed but would remain functional to maintain viability of the species dependent on it. The Proposed Action "May Affect, but Not Likely to Adversely Affect" the designated critical habitat occurring in the action area (**Table 3.10-4**).

Table 3.10-4. Summary of Effects Determinations for ESA-Listed Seabirds, Shorebirds and Coastal Birds, and Waterfowl and Critical Habitat

Common Name	Scientific Name	Species Determination	Critical Habitat Determination
Seabirds			
Marbled murrelet	*Brachyramphus marmoratus*	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Band-rumped storm-petrel	*Oceanodroma castro*	May Affect, but Not Likely to Adversely Affect	N/A* (no critical habitat designated)
Short-tailed albatross	*Phoebastria albatrus*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Hawaiian petrel	*Pterodroma sandwichensis*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Newell's shearwater	*Puffinus auricularis newelli*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
California least tern	*Sternula antillarum browni*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Roseate tern	*Sterna dougallii*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Shorebirds and Coastal Birds			
Red knot	*Calidris canutus rufa*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Piping Plover	*Charadrius melodus*	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Western snowy plover	*Charadrius nivosus*	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Hawaiian coot	*Fulica americana alai*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Whooping crane	*Grus americana*	May Affect, but Not Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Bald eagle	*Haliaeetus leucocephalus*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)

Common Name	Scientific Name	Species Determination	Critical Habitat Determination
Hawaiian stilt	*Himantopus mexicanus knudseni*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Wood stork	*Mycteria americana*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Eskimo curlew	*Numenius borealis*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Light-footed clapper rail	*Rallus longirostris levipes*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
California clapper rail	*Rallus longirostris obsoletus*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Waterfowl			
Laysan duck	*Anas laysanensis*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Hawaiian duck	*Anas wyvilliana*	May Affect, but Not Likely to Adversely Affect	N/A (no critical habitat designated)
Steller's eider	*Polysticta stelleri*	May Affect, Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect
Spectacled eider	*Somateria fischeri*	May Affect, Likely to Adversely Affect	May Affect, but Not Likely to Adversely Affect

*N/A = Not applicable