

3.6 SEA TURTLES

There are seven species of sea turtles worldwide: loggerhead, green, hawksbill, Kemp's ridley, olive ridley, flatback, and leatherback. All but the flatback (which is endemic to northern Australia) are present throughout U.S. coastal and marine waters, including all navigationally significant U.S. waters, extending seaward to the limits of the EEZ. A list of sea turtle species in the action area, including current status and region of occurrence, is provided in **Table 3.6-1**.

All sea turtles in U.S. waters are protected under the ESA by NMFS while in water and by the USFWS while onshore. Under the ESA, a species is considered endangered if it is "in danger of extinction throughout all or a significant portion of its range." A species is considered threatened if it "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Sea turtles and their nests are also protected to varying degrees by some states and localities.

3.6.1 Affected Environment

The following sections provide discussions of sea turtle species including acoustic capability, regional distribution, and descriptions of ESA-listed species.

The order Testudines includes all turtles and tortoises. The Cheloniidae family includes hard-shelled turtles and comprises six of the seven sea turtle species. The Dermochelyidae family lacks a bony shell and includes only one sea turtle species, the leatherback.

Sea turtles are air breathing reptiles that are primarily aquatic, generally coming ashore only to lay eggs. Hatchlings immediately enter the sea and migrate to the pelagic zone where they may shelter and feed in drift communities for 1 to 15 years. All but two species then return to coastal zones at the early-to-mid juvenile stage. The turtles then remain in the coastal zone unless their migration routes to breeding and nesting areas include movements through pelagic habitat. The exceptions to this are leatherbacks and olive ridleys, which remain in the pelagic zone for the majority of their lives. Adult sea turtles range in size from the Kemp's ridley, measuring about 0.6 m (2 ft) and weighing 45 kilograms (kgs) (100 lbs), to the leatherback, reaching up to 1.7 m (5.5 ft) and 1,000 kgs (2,200 lbs) (NMFS, No Date-f). All species are thought to be long-lived, with life spans expected to range from at least 30 years to over 80 years. Sea turtle bodies are fusiform, that is, tapering at the front and rear. This improves their movements in aquatic environments but prevents retraction of their heads and limbs. Sea turtle limbs are adapted to aquatic movements and feeding. Their diets differ by species and life-stage, including herbivory, carnivory, and omnivory. Likewise, feeding strategies also vary by species and life stage. Sea turtles breathe by coming to the surface.

All sea turtles are protected by the ESA throughout their ranges. Additionally, four species have critical habitat designated for their entire range or one of their constituent distinct population segments (DPSs). **Table 3.6-1** lists the six species of sea turtles and nine DPSs occurring in the action area. Three entire species are listed as endangered along with four DPSs. One species is listed as threatened along with the five remaining DPSs.

Table 3.6-1. Sea Turtles Occurring in the Action Area

DPS (if applicable)	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
Loggerhead – <i>Caretta caretta</i>					
Northwest Atlantic	Threatened	NMFS, USFWS	GAR, SER	Yes	Nesting: occurs from April to September, peaking in June and July. Within the action area, nesting for the Northwest Atlantic DPS typically occurs on high energy, narrow, steep, coarse-grained beaches from Texas to Virginia. Most nesting within the action area occurs within Florida, Georgia, South Carolina, and North Carolina. Outside the action area, the North Pacific DPS nests in Japan and the South Pacific DPS nests mainly in Queensland, Australia. Post hatchling: local downwellings with floating algae and/or seaweed. Pelagic developmental phase (7-15 years): offshore oceanic zone. Late juvenile and adult: nearshore coastal and/or continental shelf.
North Pacific	Endangered	NMFS, USFWS	WCR, AR	No	
South Pacific	Endangered	NMFS	PIR	No	
Green - <i>Chelonia mydas</i>					
North Atlantic	Threatened	NMFS, USFWS	GAR, SER	Yes	Nesting: Occurs from June to September. Nesting typically occurs on beaches with a sloping platform and minimal disturbance. Most nesting within the action area occurs in Florida and Hawaii, with some nesting occurring in the U.S. Virgin Islands, Puerto Rico, Georgia, South Carolina, and North Carolina. Pelagic developmental phase (5 to 7 years): offshore oceanic zone, pelagic drift communities. Late juvenile and adult: Nearshore, bays, lagoons, reefs, especially areas with seagrass beds.
South Atlantic	Threatened	NMFS, USFWS	SER	No	
Central North Pacific	Threatened	NMFS, USFWS	PIR	No	
Central West Pacific	Endangered	NMFS, USFWS	PIR	No	
Central South Pacific	Endangered	NMFS, USFWS	PIR	No	
East Pacific	Threatened	NMFS, USFWS	WCR	No	

DPS (if applicable)	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
Hawksbill - <i>Eretmochelys imbricate</i>					
--	Endangered	NMFS, USFWS	GAR, SER, WCR, PIR	Yes	<p>Nesting: Occurs April to November. Nesting occurs on beaches and “pocket” beaches with little or no sand. Most nesting within the action area occurs within the U.S. Virgin Islands, Puerto Rico, and Hawaii. Nest sites have also been documented in American Samoa and Guam.</p> <p>Pelagic developmental phase: offshore oceanic zone, floating algal mats, flotsam and jetsam drift lines.</p> <p>Late juvenile and adult: shallow coastal zones, coral reefs, high-energy shoals, and mangroves.</p>
Kemp’s Ridley - <i>Lepidochelys kempii</i>					
--	Endangered	NMFS, USFWS	GAR, SER	No	<p>Nesting: Occurs from April to July. Nesting within the action area occurs primarily on Texas beaches of the Gulf of Mexico, although nest sites have been documented on Atlantic beaches of North Carolina, South Carolina, and Florida.</p> <p>Pelagic developmental phase (1 to 2 years): offshore oceanic zone primarily of the Gulf of Mexico but also the Atlantic by way of the Gulf Stream, floating Sargassum mats.</p> <p>Juvenile and adult: nearshore, areas of the Gulf of Mexico or northwestern Atlantic.</p>
Olive Ridley - <i>Lepidochelys olivacea</i>					
--	Threatened	NMFS, USFWS	SER, WCR, PIR	No	<p>Nesting: Occurs from June to December up to 3 times in a single nesting season. Nesting occurs outside the action area in the Pacific beaches of Mexico and Costa Rica; and</p>

DPS (if applicable)	ESA Status	Lead Agency	Region*	Critical Habitat	General Habitat
					in Indian Ocean beaches of India, Bangladesh, Myanmar, Malaysia, and Pakistan. Breeding: coastal areas Juvenile/adult: mainly pelagic, but can inhabit coastal areas, bays, and estuaries.
Leatherback - <i>Dermochelys coriacea</i>					
--	Endangered	NMFS, USFWS	All	Yes	Nesting: Occurs from March to July on beaches. Nesting within the action area occurs on the Atlantic coast of Florida, the U.S. Virgin Islands, and Puerto Rico. Juvenile/adult: pelagic

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

*GAR = Greater Atlantic Region (includes the U.S. portions of the Great Lakes, New England, and the mid-Atlantic); SER = Southeast Region (includes the southern portion of the U.S. Eastern Seaboard, the U.S. Caribbean Islands [Puerto Rico and the U.S. Virgin Islands], and the Gulf of Mexico); AR = Alaska Region (includes Alaskan waters and the Arctic); WCR = West Coast Region (includes coastal California, Oregon and Washington); PIR = Pacific Islands Region (includes Hawaii and territories of the U.S.)

3.6.1.1 Sound Production and Hearing

NOAA's Ocean Noise Strategy Roadmap (NOAA, 2016) recognizes that the biological importance of hearing in sea turtles has not been studied in great detail, but that it "seems likely that they use sound for navigation, to locate prey, to avoid predators, and for general environmental awareness". It is thought to be unlikely that turtles use sound for communication, though recent research is exploring this hypothesis. Sea turtle hearing has been inferred from studies of the animals' physiology and morphology and from electrophysiological studies.

Sea turtle hearing is better suited to aquatic than open-air conditions and varies by species, size, and age, with smaller and younger turtles having the broadest sensitivity ranges and larger, older turtles having the narrowest. Sea turtle hearing in aquatic conditions generally ranges from 50 Hz to 1600 Hz, with the highest sensitivities falling in the 200 Hz to 400 Hz range (BOEM, 2014a; NOAA, 2016; Piniak, 2012; and Southwood et al., 2008). Avoidance is generally observed at 166 to 174 dB re 1 μ Pa and behavioral harassment is considered to occur at sound intensities equal to or greater than 175 dB re 1 μ Pa, though studies have been limited and the Bureau of Ocean Energy Management (BOEM) recognized that this results in incomplete or unavailable information with regard to sea turtle physiology and behavioral response to intense sounds (BOEM, 2014a).

3.6.1.2 Regional Distribution

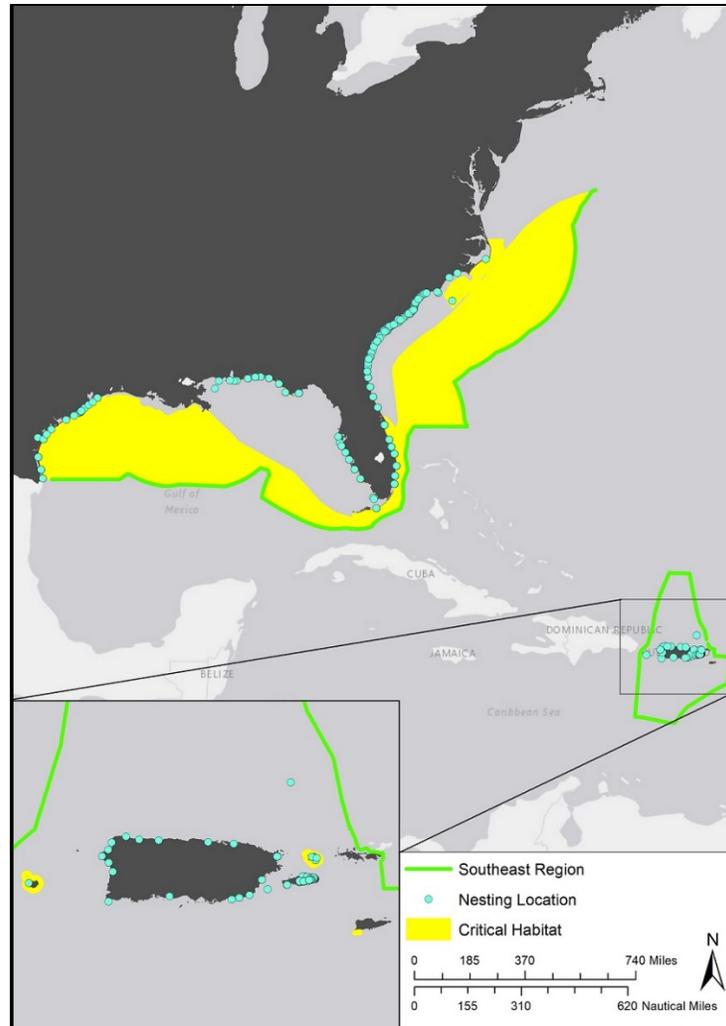
Sea turtles are found throughout the action area. Like marine mammals, sea turtles are known to make wide-ranging movements and may not be present in a specific region year-round; however, some species are considered distinct populations and do not migrate as broadly. Range varies by species and DPS, with some migrating up to 16,000 km (10,000 mi) per year and diving to nearly 1,200 m (4,000 ft) deep (NMFS, No Date-f). The distribution of sea turtles may be influenced by ecological conditions, physical features, and seasonal movements. Movements are most often associated with development stage and seasonal feeding, breeding, and nesting activities.

3.6.1.2.1 Greater Atlantic Region

Five of the six sea turtle species in the action area occur in the Greater Atlantic Region, as indicated in **Table 3.6-1**. Only the olive ridley are absent. The loggerhead Northwest Atlantic DPS and green North Atlantic DPS are listed as threatened. The hawksbill (rare in this region), Kemp's ridley, and leatherback are listed as endangered. There is no designated critical habitat or known nest sites in the Greater Atlantic Region.

3.6.1.2.2 Southeast Region

All six of the sea turtle species in the action area occur in the Southeast Region, as indicated in **Table 3.6-1**. The loggerhead Northwest Atlantic DPS, green North Atlantic DPS, and olive ridley are listed as threatened. The hawksbill, Kemp's ridley, and leatherback are listed as endangered. Critical habitat is designated in the region for leatherback, green, hawksbill, and loggerhead (**Figure 3.6-1**). Leatherback, hawksbill, green, loggerhead, and Kemp's ridley sea turtles are known to nest in the Southeast region (**Figure 3.6-1**).

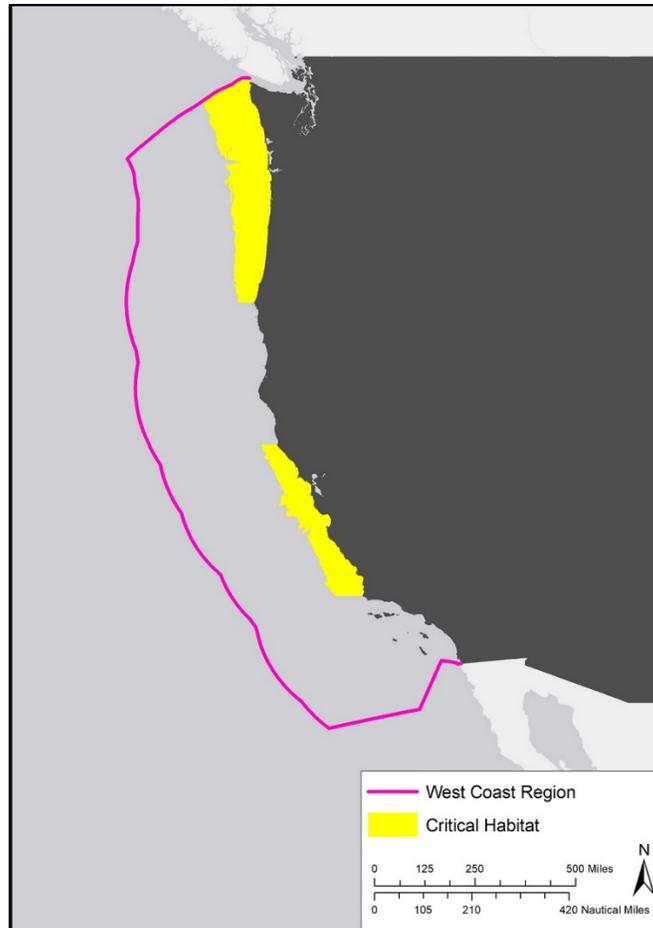


Sources: ECOS, No Date-a; NMFS, No Date-f; SWOT, 2020

Figure 3.6-1. Southeast Region Sea Turtle Designated Critical Habitat and Nesting Sites

3.6.1.2.3 West Coast Region

Five of the six sea turtle species in the action area occur in the West Coast Region, as indicated in **Table 3.6-1**. Only the Kemp's ridley are absent. The loggerhead North Pacific DPS, hawksbill, and leatherback are listed as endangered. The green East Pacific DPS and olive ridley are listed as threatened. Critical habitat is designated in the region for leatherback sea turtles (**Figure 3.6-2**), but there are no known nest locations for any species of sea turtle.



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

Figure 3.6-2. West Coast Region Sea Turtle Designated Critical Habitat

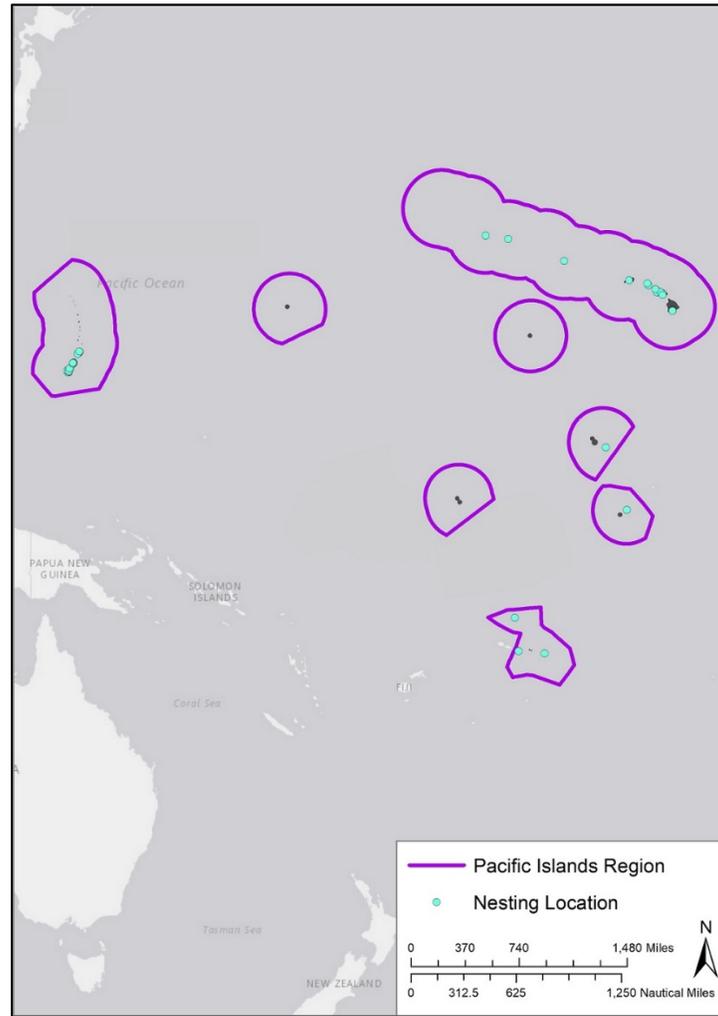
3.6.1.2.4 Alaska Region

Four of the six species of sea turtles in the action area have ranges or have been sighted in the Alaska Region. Leatherback sea turtles have the broadest range in the region, though green sea turtles also have a limited range in southeastern areas. Alaska Department of Fish and Game also lists sightings, but no range, of olive ridley and loggerheads (ADF&G, No Date-e). Leatherbacks are listed as endangered throughout their range. The loggerhead North Pacific DPS includes the Alaska region and is listed as endangered. Though DPS descriptions for green turtles do not extend into the Alaska region, the nearest DPSs are the East Pacific, listed as endangered, and Central North Pacific, listed as threatened. Olive ridleys are listed as threatened throughout their range. No critical habitat is designated for sea turtles in the region, and there are no known sea turtle nest sites.

3.6.1.2.5 Pacific Islands Region

Five of the six sea turtle species in the action area occur in the Greater Atlantic Region, as indicated in **Table 3.6-1**. Only the Kemp's ridley are absent. The loggerhead South Pacific DPS, green Central West Pacific DPS, green Central South Pacific DPS, hawksbill, and leatherback are listed as endangered. The green Central North Pacific DPS and olive ridley are listed as threatened. No critical habitat for sea turtles

has been designated in the Pacific Islands Region, although green, hawksbill, leatherback, and loggerhead sea turtles are known to nest there (**Figure 3.6-3**).



Sources: ECOS, No Date-a; NMFS, No Date-f, SWOT, 2020

Figure 3.6-3. Pacific Islands Region Sea Turtle Nesting Sites

3.6.1.3 Threatened and Endangered Species

All six species of sea turtles and their constituent DPSs are federally listed in the action area. Four species or their constituent DPSs also have designated critical habitat. These species are shown in **Table 3.6-1** and described in detail below.

3.6.1.3.1 Loggerhead (Northwest Atlantic, North Pacific, and South Pacific Distinct Population Segment)

Loggerhead sea turtles (**Figure 3.6-4**) can generally be found in temperate and tropical waters around the world. Upon hatching, loggerheads swim to sea for up to several days before settling at localized downwellings where floating materials, such as rafts of Sargassum, may accumulate. In this habitat, they expend little energy while floating and feeding opportunistically on small animals (Conant et al., 2009). Currents eventually move the young turtles into the pelagic zone where they remain for 7 to 15 years

before migrating to coastal areas. As juveniles and adults, loggerheads are primarily carnivorous and have large heads with strong jaws with which to feed on benthic invertebrates, whelks, mollusks, horseshoe crabs and sea urchins. Loggerheads may take 20 to 30 years to mature and at full growth reach approximately 1 m (3 ft) in length and weigh up to 113 kgs (250 lbs). Upon reaching maturity, loggerheads nest every 2 to 3 years on the beaches where they hatched. The lifespan of the turtles is thought to be 70 to 80 years or more (NMFS, No Date-f).



Figure 3.6-4. Young Loggerhead

Photo credit: Nathalie Jacque, Solv

Historically, human encroachment on nesting beaches, harvest of eggs, harvest of subadults and adults, depredation, insufficiency of protective regulations, and incidental fishing takes led to the decline of loggerhead populations. In 1979, loggerheads were listed as threatened under the ESA wherever the species occurs (Conant et al., 2009). In 2011, USFWS determined that loggerheads comprise nine DPSs, of which four are listed under the ESA as threatened and five as endangered (ECOS, No Date-a). Loggerheads continue to face threats from bycatch in fishing gear, ocean pollution and debris, and intentional killing (NMFS, No Date-f).

Three DPSs occur in the action area: North Pacific, South Pacific, and Northwest Atlantic. The North Pacific DPS includes individuals that hatch on beaches in Japan and spend their entire lives in the north Pacific without crossing the equator. After hatching, the turtles initially move in a passive manner with the North Pacific gyre, and then use the Kuroshi and North Pacific currents on their developmental migration, which serves to isolate them from the South Pacific DPS. As adults, the turtles return to nest on the beaches where they were hatched, thus maintaining the pattern of separation. North Pacific DPS turtles forage off the west coast of North America as far south as Baja California Sur, Mexico (Conant et al., 2009) and have been observed as far north as Alaska (NMFS, No Date-f). The North Pacific DPS is listed as endangered and has no designated critical habitat (ECOS, No Date-a). Populations are estimated to be small, declining, and at risk of extinction (Conant et al., 2009).

The South Pacific DPS includes individuals hatched mainly in Queensland, Australia, but also in New Caledonia, Vanuatu, and Tokelau. These genetically distinct sea turtles are the only loggerheads inhabiting the Pacific south of the equator. New hatchlings travel passively generally with the South Pacific gyre and spend developmental phases in the central and southeastern Pacific before returning to the west to mate and nest (Conant et al., 2009). The South Pacific DPS is listed as endangered and has no designated critical habitat (ECOS, No Date-a). Populations are at risk of extinction (Conant et al., 2009).

The Northwest Atlantic DPS includes loggerheads hatched primarily in the southeast U.S. and the Yucatan Peninsula of Mexico and Central America, and secondarily from other nesting sites throughout the Caribbean and western Atlantic as far south as northern South America. Hatchlings and juveniles use the North Atlantic gyre for early life stage movements before generally returning to neritic habitats nearby the areas where they hatched. Northwest Atlantic DPS juvenile loggerheads have some overlap in distribution with Northeast Atlantic and Mediterranean DPSs. Later-stage juveniles and adults inhabit neritic zones from Florida to Massachusetts, the Bahamas, Cuba, and the Gulf of Mexico (Conant et al., 2009). The DPS is listed as threatened and 38 discrete areas of critical habitat have been designated in the Gulf of Mexico and the Atlantic (ECOS, No Date-a). Populations are at risk of extinction (Conant et al., 2009).

3.6.1.3.2 Green (North Atlantic, South Atlantic, Central North Pacific, Central South Pacific, Central West Pacific, and East Pacific Distinct Population Segment)



Figure 3.6-5. Green Sea Turtle

Photo Credit: Ali Bayless, NOAA/NMFS/PIFSC

Green sea turtles (**Figure 3.6-5**) can be found across broad ranges of the Atlantic and Pacific. Young green sea turtles inhabit the pelagic zone for 5 to 7 years before migrating to coastal areas, bays, and lagoons for later stages of life. They primarily feed on algae and seagrass, though sponges and invertebrates occasionally make up part of their diet. Green sea turtles may take 25 to 35 years to mature and at full growth reach approximately 1 m (3-4 ft) in length and weigh up to 160 kgs (350 lbs). Upon reaching maturity, they nest every 2 to 5 years. The lifespan of the turtles is thought to be 60 years or more (NMFS, No Date-f).

In 1978, green sea turtles were listed as threatened wherever found except for the breeding colonies in Florida and the Pacific coast of Mexico, which were listed as endangered. In 1998, marine critical habitat was designated around Culebra Island in Puerto Rico (NMFS and USFWS, 2007). In 2016, 11 green sea turtle DPSs were designated as endangered or threatened (FR, 2016b). Six of these DPSs occur in the action area: the threatened North Atlantic, South Atlantic, East Pacific, and Central North Pacific DPSs and the endangered Central West Pacific and Central South Pacific DPSs (ECOS, No Date-a). Green sea turtles currently face threats from bycatch in fishing gear, ocean pollution and debris, disease, harvest of eggs, and intentional killing (NMFS, No Date-f).

The North Atlantic DPS includes turtles that nest and hatch on beaches along the Atlantic, Caribbean, and Gulf coasts of Central and North America and islands of the northwest Caribbean, and the Atlantic coast

of Mauritania. The population is widespread. There are approximately 167,500 nesting females in the DPS at 74 known nesting sites, with 79 percent nesting at a single site in Costa Rica. Of the nesting sites with enough data to establish population trends, three sites were stable and four were increasing as of 2015 (Seminoff, 2015).

The South Atlantic DPS includes turtles that nest and hatch along the Atlantic and Caribbean coasts of South America, southeast Caribbean islands, and west coast of Africa. The population is widespread. There are approximately 63,300 nesting females in the DPS at 51 known nesting sites, with 51 percent nesting at a single site in Bissau. Of the nesting sites with enough data to establish population trends, two sites were stable and one could not be determined as of 2015 (Seminoff, 2015).

The East Pacific DPS includes turtles that nest and hatch on beaches along the Pacific coasts of North, Central, and South America and islands of the eastern Pacific. The population exhibits a limited spatial range. There are approximately 20,000 nesting females in the DPS at 39 known nesting sites, with 58 percent nesting at a single site in Mexico. The only nesting site with enough data to establish a population trend was increasing as of 2015 (Seminoff, 2015).

The Central North Pacific DPS includes turtles that nest and hatch on the islands of the Hawaiian Archipelago. The population exhibits a limited spatial range. There are approximately 3,800 nesting females in the DPS at 13 known nesting sites, with 96 percent nesting at a single site in Hawaii. The only nesting site with enough data to establish a population trend was increasing as of 2015 (Seminoff, 2015).

The Central West Pacific DPS includes turtles that nest and hatch in an area very roughly bounded as follows: 41° north to 13° south latitude and 129° east to 175° west longitude. The highest levels of nesting in the area include sites in Micronesia, two islands of Japan, Marshall Islands, and Palau. The population is moderately dispersed. There are approximately 6,500 nesting females in the DPS at 51 known nesting sites, with 22 percent nesting at a single site in Micronesia. The only nesting site with enough data to establish a population trend was increasing as of 2015 (Seminoff, 2015).

The Central South Pacific DPS includes turtles that nest and hatch in an area very roughly bounded as follows: nine degrees north to 40° south latitude and 171° east to 96° west longitude. This includes a portion of New Zealand, Fiji, Tuvalu, Kiribati, French Polynesia, American Samoa, Cook Islands, Tokelau, Tonga, and Easter Island, Chile. The population is widespread. There are approximately 167,500 nesting females in the DPS at 59 known nesting sites, with 36 percent nesting at a single site in French Polynesia. No nesting sites had enough data to establish population trends as of 2015 (Seminoff, 2015).

3.6.1.3.3 Hawksbill

Hawksbill sea turtles (**Figure 3.6-6**) can generally be found in tropical waters of the Atlantic and Pacific, as well as the Gulf of Mexico, Caribbean Sea, and along the east coast of the U.S. as far north as Massachusetts. Young hawksbills spend a few years among drift materials in the pelagic zone before moving to coastal areas. As adults, the turtles can be found in coral reef, hard bottom, sea grass, algal bed, mangrove, and estuary habitats. Hawksbills are omnivorous, feeding on sponges, algae, corals, invertebrates, and inorganic material. The shapes of hawksbill mouths and beaks give the turtles their name and help them obtain food from small holes and difficult to reach areas of coral reefs. They take 20 to 35 years to mature and at full growth reach approximately 1 m (30 to 35 in) in length and weigh up to 70 kgs (150 lbs). Upon reaching maturity, hawksbills nest every 2 to 7 years in the vicinity of beaches where they hatched. Hawksbills can migrate from 80 to over 1,600 km (50-1,000 mi) between feeding and

nesting grounds. The lifespan of the turtles is unknown but expected to be relatively long (NMFS, No Date-f; NMFS and USFWS, 2013a).



Figure 3.6-6. Hawksbill

Photo credit: Don McLeish, NOAA/NMFS/PIFSC

Historically, a combination of factors led to the decline of hawksbill populations, the most detrimental of which was the taking of turtles for their shells. The shells exhibit a unique marbled appearance and were the source of “tortoise shell” used in jewelry, handicrafts and other decorative applications. The tortoise shell trade led to the near extinction of the species. In 1970, hawksbills were listed as threatened wherever the species occurs (ECOS, No Date-a) and trade in their shells has been internationally banned (NMFS, No Date-f). In 1982, terrestrial critical habitat for hawksbill was designated in Puerto Rico in the vicinity of Isla Mona, Culebra Island, Cayo Norte, and Isla Culebrita. In 1998, marine critical habitat was designated around Isla Mona and Isla Munito, Puerto Rico (NMFS and USFWS, 2013a).

Hawksbills currently face threats primarily from habitat loss, but also from bycatch in fishing gear, vessel strikes, pollution and debris, intentional killing, and hybridization. Global populations modelled at 88 sites showed that all 63 of the sites with conclusive data had population declines over the last 100 years, while 25 sites were inconclusive. More recently, 41 sites were assessed and showed about two thirds of the sites were still in decline, while about a quarter were increasing and the remaining were stable (NMFS and USFWS, 2013a). Internationally, the species is currently identified as critically endangered with declining populations (IUCN, No Date).

3.6.1.3.4 Kemp’s Ridley

Kemp’s ridley sea turtles (**Figure 3.6-7**) can generally be found in the Gulf of Mexico and the northwest Atlantic as far north as the Grand Banks and Nova Scotia. Nesting occurs on beaches along the Gulf coasts of Mexico and the U.S. and at isolated locations along the Atlantic coast from Florida through North Carolina (NMFS and USFWS, 2015). Young Kemp’s ridleys move into the pelagic zone of the Gulf of Mexico and sometimes the Atlantic and spend 1 to 2 years amongst Sargassum floats. Upon reaching about 20 cm (8 in) in size the turtles migrate to coastal zones for the remainder of their development and adult lives. Kemp’s ridleys are omnivorous as young and early juveniles feeding among Sargassum mats, but generally prefer crabs as late-juveniles and adults when inhabiting coastal waters; they may also perform scavenging roles. They take about 13 years to mature and at full growth reach approximately 0.7 m (2.25 ft) in length and weigh up to 45 kgs (100 lbs). Upon reaching maturity, Kemp’s ridleys nest every 1 to 3

years en masse in arribadas (large waves of arriving females). The lifespan of the turtles is unknown but expected to be at least 30 years (NMFS, No Date-f).



Figure 3.6-7. Kemp's Ridley Sea Turtle

Photo credit: Kate Sampson, NOAA Fisheries

Kemp's ridley sea turtles were once abundant in the Gulf of Mexico, with a single arribada observed in 1947 containing up to 40,000 turtles. By the late 1960s, the largest recorded arribadas contained 1,500 to 5,000 turtles. Nesting sites that hosted tens of thousands of turtles in the 1940s were estimated to be used by only 250 females in 1985. The historical decline of Kemp's ridley populations has been attributed to egg collection, killing of nesting females, and bycatch (NMFS and USFWS, 2015). In December 1970, Kemp's ridleys were listed as endangered wherever the species occurs (ECOS, No Date-a). No critical habitat has been designated for the species.

Although the Kemp's ridley made a limited recovery from its low in the mid-1980s, overall nests again declined from 2009. The turtles currently face threats from chemical pollution, fisheries interactions, and habitat degradation and loss (NMFS and USFWS, 2015; NMFS, No Date-f).

3.6.1.3.5 Olive Ridley

Olive ridleys (**Figure 3.6-8**) are the most numerous of the sea turtles with global estimates of 800,000 females nesting annually (NMFS, No Date-f). Olive ridleys can generally be found in tropical waters of the Pacific and Atlantic, though they have been observed as far north as Alaska. In the Atlantic they are generally observed only south of Florida. Olive ridleys do not nest in the U.S. (NMFS and USFWS, 2014). They are one of two sea turtle species that inhabit pelagic zones throughout their lives, apart from migrating to breeding and nesting grounds and occasional instances of populations inhabiting coastal waters. Olive ridleys are omnivorous foragers and have been observed over 3,800 km (2,400 mi) from shore. They take 7 to 17 years to mature and at full growth reach approximately 0.5m (22 to 31 in) in length and weigh up to 45 kgs (100 lbs). Upon reaching maturity, olive ridleys nest yearly en masse in arribadas. The lifespan of the turtles is unknown but expected to be relatively long (NMFS, No Date-f).

In 1978, olive ridleys were listed as threatened wherever the species occurs except for the endangered breeding colony populations on the Pacific coast of Mexico (ECOS, No Date-a). No critical habitat has been identified for olive ridleys.

Endangered olive ridley populations in Mexico seem to have stabilized. Threatened populations in the eastern Pacific are in decline at some nesting beaches, while they are stable or increasing at others, with too little data to assign an overall trend. Threatened populations in the western Atlantic are very small,

with some nesting populations declining and others increasing (NMFS and USFWS, 2014). Olive ridley populations continue to face threats from bycatch in fishing gear, vessel strikes, pollution and debris, harvest of eggs, and killing of adults (NMFS, No Date-f).



Figure 3.6-8. Olive Ridley Sea Turtle

Source: World Wildlife Fund

3.6.1.3.6 Leatherback

Leatherback sea turtles (**Figure 3.6-9**) can generally be found in very broad ranges of the Atlantic and Pacific, with known ranges along nearly the entire coastline of the continental U.S., Hawaii, Puerto Rico, the U.S. Virgin Islands, and observations as far north as Alaska (NMFS and USFWS, 2013b). They are one of two sea turtle species that spends the majority of its life in pelagic habitat apart from nesting. Leatherbacks' mouths are adapted to their carnivorous diet of soft-bodied jellyfish and salps (planktonic tunicates). It is believed that the turtles take 9 to 29 years to mature. At full growth leatherbacks reach approximately 1.5 m (4.5 to 5.5 ft) in length and weigh up to 1,000 kgs (2,200 lbs). Upon reaching maturity, they nest every 2 to 3 years, often on different beaches. The turtles can migrate up to 16,000 km (10,000 mi) each year, including up to 6,000 km (3,700 mi) each way to and from foraging and nesting grounds. Leatherbacks can dive to almost 1,200 m (4,000 ft) below the ocean surface. The lifespan of the turtles is unknown but expected to be relatively long (NMFS, No Date-f).



Figure 3.6-9. Leatherback Sea Turtle

Photo credit: Dru Devlin, NOAA

In 1970, leatherbacks were listed as endangered wherever the species occurs. In 1978, terrestrial critical habitat was designated in the U.S. Virgin Islands on the southwestern side of St. Croix at Sandy Point National Wildlife Refuge, and the following year marine critical habitat was designated along the same

coast. In 2012, additional marine critical habitat was designated off the coasts of California, Oregon, and Washington (NMFS and USFWS, 2013b).

Leatherbacks currently face threats from habitat alteration and loss, bycatch in fishing gear, vessel strikes, pollution and debris, harvest of eggs, intentional killing (NMFS, No Date-f), and depredation (NMFS and USFWS, 2013b). Eastern Pacific populations of leatherbacks have collapsed, while Atlantic populations seem to be stable or increasing. This could be due to more consistent availability and quality of forage in the Atlantic resulting in higher reproduction rates (NMFS and USFWS, 2013b).

3.6.2 Environmental Consequences for Sea Turtles

This section discusses the potential impacts on sea turtles, all of which are ESA-listed, and sea turtle habitat of 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 have impacts on sea turtles and their habitats in the action area include crewed vessel operations, anchoring, ROV and autonomous vehicles, 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/removal, GPS reference station installation, and SCUBA operations.

3.6.2.1 Methodology

The factors from NOS activities that could impact sea turtles and sea turtle habitat include: (1) active underwater acoustic sources (e.g., echo sounders, ADCPs, and acoustic communication systems); (2) vessel and equipment sound (e.g., from surface vessels, ROVs, and autonomous vehicles); (3) vessel presence and movement (e.g., surface vessels, ROVs, and autonomous vehicles); (4) vessel wakes (e.g., from surface vessels; ROVs; and autonomous vehicles); (5) accidental leakage or spillage of oil, fuel, and chemicals into surrounding waters (e.g., from vessel operations); (6) underwater activities (e.g., use of underwater survey equipment; anchors; and divers); 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 sea turtles and sea turtle 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 to provide a structured framework for assessing impacts from the alternatives and the significance of the impacts. The significance criteria for impacts to sea turtles were developed to encompass the context and intensity of NOS activities as they relate to direct and indirect impacts to sea turtles and designated critical sea turtle habitat. The significance criteria for sea turtles are shown in **Table 3.6-2**.

Table 3.6-2. Significance Criteria for the Analysis of Impacts to Sea Turtles

Impact Descriptor	Context and Intensity	Significance Conclusion
Negligible	Impacts to sea turtles 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 sea turtle would occur. There would be no displacements of sea turtles from preferred breeding and feeding areas, nesting beaches, or migratory routes. Impacts (e.g.,	Insignificant

Impact Descriptor	Context and Intensity	Significance Conclusion
	increased water turbidity, displacement of marine macroinvertebrate prey) on sea turtle habitat would be temporary with no lasting damage or alteration.	
Minor	Impacts to sea turtles 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 sea turtles and small short-term disruptions of time-sensitive behaviors such as breeding, nesting, or the emergence and dispersal of hatchlings. Displacement of sea turtles from preferred breeding and feeding areas, nesting beaches, or migratory routes would be short-term and limited to the project area and immediately surrounding areas. Any resulting increased competition, additional energy expenditure, or loss of hatchlings would not affect overall sea turtle population numbers or demographic structure. Impacts on habitat (e.g., short-term displacement of marine macroinvertebrate prey, increased turbidity) would be easily recoverable with no long-term or permanent damage or alteration.	
Moderate	Impacts to sea turtles 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 some short-term disruption of time-sensitive behaviors such as breeding, nesting, or the emergence and dispersal of hatchlings. Behavioral responses and displacement would be expected from individual sea turtles within the project area, its immediate surroundings, or beyond. Long-term displacement of individuals from preferred breeding and feeding areas, nesting beaches, or migratory routes would occur. Resulting increased competition and energy expenditure would cause losses of breeding or egg-bearing adults and hatchlings, but not at large enough scales to negatively impact overall sea turtle population numbers or demographic structure. Impacts would not threaten the continued existence of any species. Habitat would be damaged or altered potentially over the long term (e.g., degradation of seagrass beds) but would continue to support dependent species.	
Major	Impacts to sea turtles 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, nesting, or the emergence and dispersal of hatchlings.	Significant

Impact Descriptor	Context and Intensity	Significance Conclusion
	<p>Long-term displacement of sea turtles from preferred breeding or feeding areas, nesting beaches, 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 hatchlings due to increased competition or energy expenditure at scales large enough to affect overall sea turtle population numbers or demographic structure. Full recovery of sea turtle 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 sea turtles.</p>	

3.6.2.2 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 sea turtles and their associated habitat. Under Alternative A, excluding survey effort in the Great Lakes which would not impact sea turtles, NOS survey effort would continue to cover a total of 3,300,043 nm (6,111,680 km) across all five regions over the six-year period. Although the survey effort under Alternative A would vary by year (see **Table 3.5-6**), over 50 percent of the total linear nautical miles surveyed over the six-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. A slightly higher level of effort would occur in the Alaska Region, which contains approximately 16 percent of the total survey effort, but this area is only rarely visited by sea turtles. 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 and depth of surveys, hearing frequency of the animals, and population density of sea turtles, that add nuance to this trend.

The analysis of impacts on sea turtles considers all of the impact causing factors introduced above and their impacts on sea turtles and sea turtle habitat. Potential impacts could occur in all of the geographic regions. All regions include several sea turtle species and designated critical habitat. The Pacific Islands Region contains the greatest number of sea turtle species, and the Greater Atlantic and Southeast Regions contain the most designated critical habitat areas (see **Table 3.6-1**).

3.6.2.2.1 Active Underwater Acoustic Sources

Active underwater acoustic sources are used to survey a variety of ocean features and could cause impacts to sea turtles from the propagation of underwater sound. The intermittent acoustic pulses used in NOS active surveying range from 1 to 1,200 kHz and decrease in intensity with distance from the project vessel; acoustic characteristics of the active acoustic underwater equipment used by NOS are detailed in Section 2.4. As such, acoustic pulses are typically considered a potential temporary disturbance limited to the immediate vicinity of the project vessel. Sea turtles are low frequency specialists with a generalized hearing range of 30 to 2,000 Hz (0.03 to 2 kHz) and are most sensitive to sound between 200 and 400 Hz (0.2 and 0.4 kHz) (BOEM, 2014a; NMFS, 2018b; NOAA, 2016; Piniak et al., 2012; and Southwood et al., 2008). Hearing below 80 Hz is less sensitive but still possible (Lenhardt, 1994). Sea turtles may be able to

hear low frequency sources that go down to 0.5 kHz. These low frequency sources are used in deeper water, so animals exposed would likely be farther away from the source. However, underwater sound produced by active underwater acoustic sources would mostly be at frequencies reaching up to orders of magnitude above the documented sea turtle hearing range and would therefore be imperceptible to sea turtles and unlikely to cause direct injury, hearing threshold shifts, auditory masking, or behavioral changes.

Similarly, active underwater acoustic sources are not perceptible to sea turtle macroinvertebrate prey (see Section 3.8.2.2.1.1) and would not affect any other characteristics of sea turtle habitat, including designated critical habitat. Sea turtles 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 to sea turtles and sea turtle habitat, including designated critical habitat, would continue to be potentially **adverse**, but **negligible** and therefore **insignificant**.

3.6.2.2.2 Vessel and Equipment Sound

Vessel and equipment sound (hereafter vessel sound) represent the majority of the ambient ocean auditory environment and are becoming more prominent with increased human marine activity. Vessel sound is a combination of tonal sounds (sounds with discrete frequencies such as music notes) and broadband sounds (sounds with a combination of many frequencies such as a choir harmonizing) (Richardson et al., 1995), which respectively contribute to hearing threshold shifts and acoustic masking. Vessel sound ranges in frequency from 10 Hz to 10 kHz and is generated predominantly through propeller operation, including cavitation, singing, and propulsion. The intensity of the sound received by sea turtles is dependent on the size and speed of the vessel in question and the distance of the sea turtle from the vessel. Vessel sound has the potential to disrupt normal sea turtle behavior because of their high hearing sensitivity between 200 and 400 Hz.

Underwater sound has the potential to impact sea turtles through hearing threshold shifts or auditory masking. Hearing threshold shifts refer to changes in the hearing range of an organism due to exposure to high intensity sounds. Threshold shifts can be short-term or long-term depending on the intensity of the sound exposure and can result in permanently reduced hearing capabilities of the affected organism. Although hearing threshold shifts in sea turtles are not well studied, the U.S. Navy estimates that exposure to sound intensities of 189 dB and 204dB could respectively cause temporary and permanent threshold shifts in sea turtles (Navy, 2017a). These estimates were derived using the best available data on sea turtle hearing thresholds and mathematical relationships of threshold shifts in similar species. However, the vessels used by NOS typically produce source levels of 130 to 160 dB while transiting, and only larger vessels outside the scope of this Draft PEIS, such as tankers or icebreakers, emit sound with the potential to cause threshold shifts in sea turtles (Erbe, 2013; Erbe et al., 2019). Note that this discussion of impacts on sea turtles from sound intensity (measured in dB) should not be confused with impacts from sound frequency (measured in Hz and kHz); see discussion of underwater sound in Section 3.0. Auditory masking refers to those sounds which do not cause direct changes to hearing thresholds, but have the potential to obscure ecologically relevant sounds to sea turtles. Masking sounds can interfere with the acquisition of prey or mates, the avoidance of predators, and the identification of appropriate nesting sites. There is a small possibility that project vessel sound could contribute to auditory masking, but it is unclear whether masking would realistically have any effect on sea turtles since the role of hearing in sea turtle ecology is unknown; there are no quantitative data demonstrating masking effects for sea turtles (BOEM, 2014a).

Underwater sound intensities of 175 to 176 dB, which are roughly equivalent to the airborne sound intensity of a motorcycle engine, evoke erratic behavioral changes in green and leatherback turtles, including evasive maneuvers such as diving or changes in swimming direction or speed (McCauley et al., 2000b). Source levels as low as 166 dB can induce avoidance behaviors in sea turtles and may temporarily displace them from project areas. Although sound produced by project vessels would typically be outside of this range, source levels may vary by 20 to 40 dB within a ship class due to variability in design, maintenance, and operational parameters (Simard et al., 2016) and could potentially elicit behavioral responses in sea turtles. However, vessel sound attenuates quickly towards the surface of the water column and would not likely be perceptible to sea turtles outside several meters of the immediate vicinity of the vessel or persist after the conclusion of vessel activity. As such, any behavioral changes and displacements would last only for the duration of vessel activity within a given area and would not cause any long-term or permanent changes in sea turtle habitat use, prey availability, or competition.

Vessel sound could potentially have an adverse effect on sea turtle habitat, including designated critical habitat, through the disturbance and displacement of prey populations. Sea turtles, depending on the species, eat seagrasses, algae, fish eggs, and marine macroinvertebrates such as sponges, sea squirts, squid, shrimp, crabs, jellyfish, cuttlefish, or sea cucumbers. Marine invertebrates, including squid, jellyfish, and cuttlefish, are sensitive to low frequency sound ranging from 50 to 400 Hz, although the exact range of invertebrate sound perception is unknown (Mooney et al., 2010; Solé et al., 2016). These important sea turtle prey species could temporarily be disturbed or displaced from project areas by vessel sound (see Section 3.8 Aquatic Macroinvertebrates). However, displacement would likely only last for the duration of vessel operation in the immediate area, and vessel sound is not expected to cause any long-term changes in marine invertebrate behavior or habitat use. Any increased foraging effort, competition, or energy expenditure resulting from displacement of prey species is not expected to substantially affect sea turtles.

Vessel sound would likely only displace sea turtles and prey within the immediate vicinity of project vessels and would not cause any mortality or direct injury to sea turtles. Sea turtles 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 sea turtles and sea turtle habitat, including designated critical habitat, from vessel and equipment sound generated during NOS activities would continue to be **adverse, negligible**, and therefore **insignificant**.

3.6.2.2.3 Vessel Presence and Movement

Although many NOS projects involve vessel operations and activity, they comprise only a very small proportion of the total amount of vessel operations within the action area (Section 2.4.1). As such, the resulting impacts of vessel operations on sea turtles only contribute marginally to the overall impact of all vessel presence and movement within a given area. Nevertheless, vessel presence and movement as a result of NOS projects could cause sea turtle–vessel interactions including visual disturbance, vessel strikes, underwater turbulence from vessel wakes, and reduction or displacement of sea turtle prey.

Much like vessel sound, the visual presence of project vessels could disrupt normal sea turtle behavior and displace individuals from project areas. Very little research exists on sea turtle responses to vessel disturbance, but one study suggests that sea turtles may habituate to vessel sound and may be more likely to respond to the presence of vessels (Hazel et al., 2007). The visual presence of project vessels in a given area could potentially cause behavioral changes in nearby sea turtles, including evasive maneuvers such

as diving or changes in swimming direction or speed. Sea turtles would also likely be temporarily displaced from project areas while vessels are present. However, only sea turtles within approximately 10 m (33 ft) of vessels appear to alter their behavior, regardless of the primary vessel stressor (i.e., sight or sound) motivating the response (Hazel et al., 2007). These behavioral changes and displacements would last only for the duration of vessel activity within a given area and would not cause any long-term or permanent changes in sea turtle habitat use, prey availability, or competition. Vessels operating at night would also only use the minimum lighting necessary to comply with navigation rules and best safety practice in order to avoid visual disturbances to nesting sea turtles and emerging hatchling. As such, increased evasive behavior and additional energy expenditure as a result of vessel presence is not expected to harm individuals or the population.

NOS project vessels within the action area could potentially collide with sea turtles, resulting in debilitating injury or death of individuals. Propeller and collision injuries to sea turtles arising from interactions with boats and ships are relatively common; 20.5 percent of observed leatherback sea turtles in the Atlantic Ocean and Gulf of Mexico had sustained propeller injuries in 2004 (USDOC et al., 2008). The sea turtle collision probability of any vessel is contingent upon its size and speed. Larger, relatively slow-moving vessels are less likely to strike sea turtles than smaller vessels travelling at higher speeds because turtles more easily recognize and avoid larger, slow moving vessels. Given the low speed and small size of most project vessels (see Section 2.4.1) and that all project vessels would constantly monitor for protected species, collisions are expected to be generally avoided during NOS projects and during transit to a project site. However, behavioral observations of sea turtle vessel avoidance reveal that some sea turtles may be susceptible to vessel strikes at speeds as low as two knots (Hazel et al., 2007). Regardless, the overall probability of collision between project vessels and sea turtles remains low given that adult and sub-adult sea turtles only spend small proportions of their time at the water surface where they are most susceptible to vessel strikes. Poor visibility conditions at night would impede the ability of project vessels and sea turtles to recognize and avoid each other, potentially resulting in a higher risk of vessels striking sea turtles engaged in nocturnal feeding, mate searching, and movement towards nesting beaches. However, as sea turtles are predominantly diurnal and do not surface often during the night, and because NOS operations are uncommon at night; the overall probability of nighttime collisions is expected to be very low. Extreme weather events would also reduce visibility between vessels and sea turtles but would not be expected to appreciably raise the overall probability of collision since project vessels would not, whenever possible, operate in poor weather conditions. As such, the probability of project vessels striking sea turtles would be very low.

Wakes associated with project vessel movements could also disturb the water column and adversely impact sea turtles within the project area. Moving project vessels would displace large amounts of water, and the resulting underwater turbulence could disturb and displace nearby sea turtles. However, this displacement would be temporary, and would occur only while project vessels are within 10 m (33 ft) of sea turtles (Hazel et al., 2007). Any evasive behavior and energy expenditure as a result of water disturbance from vessel wakes is not expected to substantially affect individuals or populations; sea turtles are expected to return to preferred feeding, breeding, and migratory routes upon departure of the project vessel. Impacts to sea turtles as a result of displacement would likely increase if the frequency of disturbance increases (i.e., spatially or temporally replicated passes in a given project area), but NOS projects would be coordinated carefully to ensure project areas are not repeatedly sampled unnecessarily (see Section 2.4.1).

The presence and movement of project vessels could affect sea turtle habitat, including designated critical habitat, through the disturbance and displacement of macroinvertebrate prey. As with active underwater

acoustic sources and vessel sound discussed above, vessel presence and movement would likely displace motile (capable of self-powered motion) macroinvertebrate prey species from project areas through underwater visual disturbance or turbulence from wakes. Prey 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 macroinvertebrate prey is not expected to harm sea turtle individuals or overall sea turtle populations.

Any injury or death to sea turtles would constitute a **moderate** or greater impact, depending on the species, given the protection status afforded to sea turtles by the ESA. However, there is a very low likelihood of vessel strikes, displacement of sea turtles and their prey by vessel presence or wakes would be limited to the immediate project vicinity, and the duration of NOS projects would be on the order of hours, days, or weeks, although a small number of projects may last several months spread across years (see Section 2.4.1). As such, any resulting impacts to individual sea turtles or to overall sea turtle populations, sea turtle prey, and their respective habitat availability would be well within the natural range of variability. Furthermore, vessels used by NOS only represent a negligible portion of overall vessel traffic within the U.S. EEZ, and the impacts created by project vessel movements would be indistinguishable from those produced by all other vessels. Overall, the effects of vessel presence and movement on sea turtles and their habitat, including designated critical habitat, would continue to be **adverse, negligible to minor, and therefore insignificant.**

3.6.2.2.4 Accidental Leakage or Spillage of Oil, Fuel, Chemicals, and Waste

Accidental oil, fuel, or chemical spills as a result of NOS projects could affect sea turtles through various pathways including direct contact, inhalation of the oil or fuel and its volatile components, and ingestion. Several aspects of sea turtle biology and behavior place them particularly at risk for exposure to spilled fuels, including lack of avoidance behavior, indiscriminate feeding in areas where ocean currents converge and inhalation of large volumes of air before dives (Milton et al., 2003). Turtles surfacing within or near an oil or fuel release may inhale petroleum vapors, causing respiratory stress. Ingested oil or fuel, particularly the lighter fractions, can be acutely toxic to sea turtles. The direct exposure of sensitive tissues (e.g., eyes or other mucous membranes) and soft tissues to diesel fuel or volatile hydrocarbons could produce irritation and inflammation. Oil and fuel also can adhere to turtle skin or shells, prolonging and exacerbating the direct effects of tissue exposure. Larger spills would contaminate areas beyond the immediate project area and increase the likelihood of sea turtle exposure to volatile chemicals and resulting injury or mortality. However, the vast majority of spills or releases are confined to the immediate project area and would disperse quickly within the ocean typically within a day or less (USDOD and NOAA, 2006). A small spill would not be likely to result in the death or life-threatening injury of individual turtles or hatchlings, or the long-term displacement of adult turtles from preferred feeding, breeding, or nesting habitats or migratory routes.

All crewed vessels produce some waste through normal operations; during activities, vessels operated by NOS could accidentally lose or discard debris, a major form of marine pollution (Laist, 1997). Project vessels would generate some waste in the form of metal, wood, glass, paper, and plastic, primarily through galley and food service operations on larger vessels. Marine debris can potentially impact sea turtles through entanglement and ingestion. Entanglement with marine debris is a far more likely cause of mortality to sea turtles than its ingestion; loggerhead turtles have been found entangled in debris ranging from fishing lines to onion sacks (USDOD et al., 2008). However, all project vessel operations would comply with USCG and EPA regulations that prohibit the discharge of waste unless it is processed such that it is able to pass through a 25-mm mesh screen (33 C.F.R § 151.51–77), require the development and implementation of onboard waste management plans, mandate marine debris education for crew

members, and require the use of a certified marine sanitation device to treat and discharge sewage (33 U.S.C. § 1905–15, 33 U.S.C. § 1952–53, 33 C.F.R. § 159.7). Adherence to these regulations should prevent discharged project vessel waste from harming sea turtles. Furthermore, the vast majority of project vessels would be small and would not generate substantial amounts of waste, especially because they would not have food service or galley operations where much of the waste is generated.

Accidental discharge of oil, fuel, chemicals, or waste could potentially affect sea turtle habitat, including designated critical habitat, through the contamination of prey and sensitive foraging areas. Important sea turtle food sources, such as macroinvertebrates and seagrasses, could become contaminated and bioaccumulate (concentrate ingested substances in tissue) spilled contaminants. These food resources would be additional routes for exposure to and ingestion of volatile chemicals by sea turtles. Breeding and nesting habitat along coastlines adjacent to spills could also potentially be degraded as spilled substances are washed ashore. However, it is unlikely that a small spill in the ocean would reach turtle nests, which are usually located above the high tide line. Large spills that extend beyond the immediate project area have a much greater likelihood of degrading sensitive sea turtle foraging and nesting habitat and could result in long-term changes in sea turtle habitat availability. Assuming proper adherence to waste disposal regulations, prey species would very rarely be exposed to trash and debris from NOS projects. As such, the exposure of sea turtles to oil, fuel, chemicals, or waste from contaminated prey would be negligible and is not expected to threaten individual sea turtles or sea turtle populations.

Any injury or death to sea turtles would constitute a **moderate** or larger impact, depending on the species, given the protection status afforded to sea turtles by the ESA, NMFS, and USFWS. However, there is only a very low likelihood of small spill occurrence and no possibility of large spills given the size of vessels used by NOS. Displacement of sea turtles and their prey by small amounts of discharged oil, fuel, chemicals, or waste would likely be limited to the immediate vicinity of vessels and dispersal period of the discharged substance. Any resulting impacts to individual sea turtles or sea turtle populations, sea turtle prey, and their respective habitat availability would be well within the natural range of variability. Small spills are a normal byproduct of oceanic vessel activity, and the impacts created by potentially small NOS spills would be indistinguishable from those produced by all other vessels. As such, adverse impacts to sea turtles and sea turtle habitat, including designated critical habitat, from accidental leakage or spillage of oil, fuel, chemicals and waste would continue to be **adverse, negligible to moderate** depending on the spill size and location, and therefore **insignificant**.

3.6.2.2.5 Underwater Activities

The vast majority of NOS underwater activities would result in temporary disturbance to the water column, potentially impacting sea turtles. The lowering and raising of echo sounders, anchors and chains, CTD equipment, sound speed data collection equipment, camera and video systems, and grab samplers could temporarily displace sea turtles and disrupt their behavior. Any evasive behavior and energy expenditure as a result of water disturbance is not expected to affect individuals or populations in the long term; if displaced, sea turtles are expected to return to preferred feeding, breeding, and migratory routes and resume normal activities after completion of NOS projects in the area. The impact on sea turtles should be minimal and cease when the anchoring system or equipment comes to rest or is taken out of the water. However, sea turtles are particularly sensitive to disturbances during seasonal breeding periods and within coastal areas adjacent to nesting habitat. Repeated, prolonged underwater activities in these areas could disrupt important, time-sensitive behaviors, which would likely have more severe or more intense adverse effects on turtles.

Similarly, a number of NOS activities involve trailing the equipment listed above with lines or wire behind and beneath project vessels, which poses a risk of entangling nearby sea turtles. Although sea turtle entanglement with marine debris is recognized as a major source of mortality, entanglement with equipment is not well studied and is typically limited to fishery-related bycatch (Duncan et al., 2017). Anecdotal accounts indicate that sea turtle mortalities have resulted from entanglement with trailed seismic equipment off the West Coast of Africa (Nelms et al., 2016), which suggests that sea turtles could also become entangled in the various trailed equipment used by NOS during projects. Entangled sea turtles may drown or starve or be struck by vessels due to restricted mobility in addition to potentially suffering physical trauma and/or systemic infections (NMFS, 2018). However, the trailed equipment used during NOS would only be submerged for periods of time ranging from minutes to hours (see Section 2.4), limiting the potential exposure to sea turtles and possible entanglement. Trailed equipment is also typically more conspicuous than common entanglement hazards such as discarded monofilament fishing line, and nearby sea turtles would likely be able to recognize and avoid trailing equipment. Furthermore, the majority of trailed equipment would stay within meters of the towing vessel and would only potentially impact sea turtles within close range; however, they would likely be displaced by the visual disturbance and sound of the vessel itself (Section 3.6.2.2.2) before they could interact with any trailed equipment. As such, entanglement with trailed NOS equipment is not expected to be a substantial threat to sea turtles.

SCUBA diving activities are included in 248 NOS projects under Alternative A (**Table 2.4-1**) and have the potential to adversely affect sea turtles through behavioral responses to diver presence. Although SCUBA diving is largely considered a non-invasive activity, exposure to human presence can alter sea turtle behavioral patterns. Recent studies demonstrate that sea turtles are susceptible to disturbance by divers (Schofield et al., 2006; Dunbar et al., 2008) and spend less time foraging when divers are present (Hayes et al., 2017). These behavioral changes would only last for the duration of diver activity in the immediate area and any increased energy expenditure, competition, or nutritional deficiencies are not expected to affect individual sea turtles or the overall sea turtle population. Prolonged or repeated disturbances in designated critical seagrass habitat, migratory routes, or sensitive coastal areas adjacent to nesting beaches could disrupt important, time-sensitive behaviors, which would likely have more severe, adverse effects on turtles.

Underwater activities including anchoring, bottom sampling, drop cameras, and mobile ADCPs can disturb the sea floor, increasing sedimentation and potentially adversely affecting sea turtle habitat, including designated critical habitat. Seagrass and macroalgae, important sources of forage for some species of sea turtle, can be directly uprooted by disturbance to the sea floor and are highly sensitive to changes in water quality. Seagrass fields in the Southeast and Greater Atlantic Regions are designated as critical habitat for turtles; direct destruction of seagrass in these areas would adversely impact sea turtle populations. Furthermore, reductions in water quality can also result in displacement of marine macroinvertebrate sea turtle prey. However, seafloor disturbance would be limited to relatively small portions of a given project area and any resulting changes to water quality would be quickly dissipated by the prevailing ocean currents in the area.

Underwater activities would likely only displace sea turtles and prey within the immediate vicinity of project vessels or divers and would not cause any mortality or direct injury to sea turtles. Sea turtles 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, habitat use, or energy expenditure. As such, the impacts to sea turtles and sea turtle habitat, including designated critical

habitat, from underwater activities would continue to be **adverse, negligible to minor**, and therefore **insignificant**.

3.6.2.2.6 Onshore Activities

NOS onshore projects would comprise installation, operation, and maintenance of shore-based GPS reference stations and installation and maintenance of tide gauges. The majority of sea turtle species move seasonally between foraging and nesting areas (Mansfield et al., 2009; Hawkes et al., 2011). Impacts from onshore projects could potentially occur if the site is located near a nesting beach, in which case it is likely that large numbers of sea turtles would be present both on the beach and within nearshore waters during the nesting season. Female sea turtles are particularly sensitive to human and other artificial disturbances (e.g., anthropogenic light sources) while selecting nest sites, and disturbance resulting from onshore projects could disrupt nesting behavior and decrease nest success. However, since female sea turtles come ashore and dig their nests at night, there is little likelihood of any NOS activities conducted onshore during daytime hours directly disturbing them. Sea turtles are long-lived organisms that have a very low likelihood of surviving to sexual maturity (Davenport, 1997), and decreased nest success would have long-term, adverse effects on the populations of all sea turtle species.

Low-flying aircraft, specifically helicopters, are infrequently used to access GPS reference stations and tide gauges in remote areas of the Alaska Region and could also disturb sea turtles through sound and visual disturbance. Behavioral responses to low-flying aircraft are similar to those caused by vessel sound, presence, and movement and include evasive diving or rapid changes in swimming speed and direction. The level of sea turtle disturbance caused by passing aircraft is contingent upon the aircraft's altitude, the aspect (direction and angle) of the aircraft relative to the receiver, receiver depth and water depth, and seafloor type. However, any exposure of individual sea turtles to aircraft-related sound would be expected to cause only temporary disturbance or displacement from the project area. Furthermore, sea turtles only rarely occur within the Alaskan region, which substantially lowers the likelihood of their exposure to aircraft.

Onshore activity would likely only displace sea turtles and prey within the immediate vicinity of the project area and would not cause any mortality or direct injury to sea turtles. Sea turtles and their prey are expected to return to project areas after the completion of NOS onshore activities and are not expected to experience any long-term changes in habitat availability, habitat use, or energy expenditure. Given the relatively low level of onshore project activity anticipated, along with the short duration of exposure to sound and visual disturbance, the impacts to sea turtles and sea turtle habitat, including critical habitat, from NOS onshore activities would continue to be **adverse, negligible**, and therefore **insignificant**.

3.6.2.2.7 Air Emissions

Smokestack and two-stroke outboard motor emissions from vessels used by NOS would release pollutants, including CO₂, into the atmosphere of the project area and immediately surrounding areas. Higher atmospheric CO₂ levels increase dissolved CO₂ 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. Ocean acidification resulting from higher atmospheric CO₂ levels due to anthropogenic emissions is within the range of sea turtle tolerance and is not expected to cause any direct harm to individuals and the population. Nonetheless, air emissions could potentially degrade sea

turtle habitat indirectly, including designated critical habitat, by reducing the availability of macroinvertebrate prey species which are particularly sensitive to acidity during their larval life stages.

It is important to note that project vessels 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 GHG (CO₂, CH₄, and N₂O) by project vessels would contribute negligibly to ongoing changes in oceanic conditions (as well as atmospheric and terrestrial conditions) (Limpinsel et al., 2017). Thus, NOS projects would not substantially increase air emissions in the oceans and any increased sea turtle competition, foraging effort, or energy expenditure as a result of reduced prey availability from ocean acidification is not expected to substantially affect sea turtle individuals or populations.

Air emissions or their resulting contribution to ocean acidification would not cause any mortality or direct injury to sea turtles. Sea turtle macroinvertebrate prey populations could potentially be affected by ocean acidification, but any changes in population size would be well within the natural range of variability. Sea turtles are not expected to experience any long-term changes in habitat availability, habitat use, or energy expenditure from air emissions as the amount of emissions from project vessels would be negligible when compared to emissions from all other vessel activity in the action area. Thus, impacts to sea turtles and sea turtle habitat, including critical habitat, from air emissions would continue to be **adverse, negligible to minor** due to the ability of air emissions to travel beyond the immediate project area, and therefore **insignificant**.

3.6.2.2.8 Conclusion

Although the effects of impact causing factors on sea turtles and their associated habitat range from **negligible to moderate, moderate** impacts are only expected in the very unlikely occurrence of an accidental spill of oil, fuel, or chemicals. Since all other impacts range from **negligible to minor**, the overall impact of Alternative A on sea turtles and their habitat, including designated critical habitat, would continue to be **adverse and minor**; therefore, impacts of Alternative A would continue to be **insignificant**.

3.6.2.3 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, excluding survey effort in the Great Lakes which would not impact sea turtles, NOS survey effort would cover a total of 3,630,047 nm (6,722,848km) across all five regions over the six-year period. Overall, survey effort would cover an additional 330,004 nm (611,168km) under Alternative B (see **Table 3.5-14**), a 10 percent increase over Alternative A (3,300,043nm [6,111,680 km] total) across all regions over the six-year period. Thus, the greatest number of nautical miles surveyed each year would be in the Southeast Region (with over 50 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 16 percent), but this area is only rarely visited by sea turtles. 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 and depth of surveys, hearing frequency of the animals, and population density of sea turtles, that add nuance to this trend.

Under Alternative B there would be crewed vessel operations covering 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 sea turtle populations and could contribute to impacts on sea turtles and sea turtle habitat through visual disturbance, direct collision, vessel sound, vessel wake and underwater turbulence, trailing equipment, 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 sea turtles and sea turtle habitat, including designated critical habitat, would be the same or slightly, but not appreciably, larger than those discussed above under Alternative A for each impact causing factor given that impacts do not scale proportionally with survey effort. Impacts to sea turtles resulting from Alternative A do not cause long-term changes in habitat use or behavior and would not substantially increase in intensity with the increased survey effort of Alternative B. Overall, impacts on sea turtles and their habitat, including designated critical habitat, would be **adverse, minor**, and therefore **insignificant**.

3.6.2.4 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 Alternatives A and B. Under Alternative C, excluding survey effort in the Great Lakes which would not impact sea turtles, NOS survey effort would cover a total of 3,960,052 nm (7,334,015 km) across all five regions over the six-year period. Overall, NOS survey effort would cover an additional 330,004 nm (611,168 km) under Alternative C (see **Table 3.5-21**), an approximate nine percent increase over Alternative B (3,630,047 nm [6,722,848km] total) and 20 percent increase over Alternative A (3,300,043 nm [6,111,680 km] total) across all regions over the six-year period. Thus, the greatest number of nautical miles surveyed each year would be in the Southeast Region (with over 50 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 17 percent), but this area is only rarely visited by sea turtles. 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 and depth of surveys, hearing frequency of the animals, and population density of sea turtles, that add nuance to this trend.

Under Alternative C, crewed vessel operations would cover 637,000 nm (1,180,000 km), as compared to the 577,000 nm (1,070,000 km) under Alternative B and the 518,000 nm (959,000 km) under Alternative A. Vessel operations are among the most disruptive NOS activities to sea turtle populations and could contribute to impacts on sea turtles and their habitat through visual disturbance, direct collision, vessel sound, vessel wake and underwater turbulence, trailing equipment, 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 sea turtles and sea turtle habitat, including designated critical habitat, would be the same or slightly, but not appreciably, larger than those discussed above under Alternative A for each impact causing factor. Impacts to sea turtles resulting from Alternative A do not cause long-term changes in habitat use or behavior and would not substantially increase in intensity with the increased survey effort of Alternative C. Overall, impacts on sea turtles and their habitat, including designated critical habitat, would be **adverse, minor, and therefore insignificant**.

3.6.2.5 Endangered Species Act Effects Determination

All species of sea turtles occurring within the action area are listed under the ESA, and federal agencies are required under the ESA to formally determine whether their actions may affect sea turtles 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 only used 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.

Sea turtles cannot hear the frequencies emitted by active underwater acoustic sources. Furthermore, due to the mobile and temporary nature of the projects, the small area of the sea floor affected during the projects relative to the entire EEZ, and the possibility of sea turtles and their prey temporarily moving away from sounds, the impacts of sound propagation from active underwater acoustic sources to sea turtles would be discountable.

The proposed amount of vessel traffic associated with activities would be small in comparison to all the other non-project related vessel traffic in the EEZ. Disturbances from increased vessel traffic, including sound, presence and movement, water column disruption, and accidental waste discharge would be temporary to short-term and would likely only temporarily affect sea turtles. Because sound disturbance would be of temporary or of short duration and would occur infrequently in any given project area, the response by sea turtles to sound, wakes, and increased traffic from project vessels would be discountable.

The likelihood of an accidental spill is very low, and exposure of sea turtles and critical habitats to oil, fuel, and other contaminants is not expected. Thus, effects from chemical contamination on sea turtles are not likely to occur.

Although underwater activities and equipment, such as ROVs, ADCPs, bottom samplers, drop cameras, and SCUBA divers could temporarily disturb and displace nearby sea turtles, effects would be temporary and negligible. No large areas of seafloor disturbance by NOS underwater equipment and activities is planned or expected. Thus, the response to underwater equipment and activities by sea turtles would be discountable.

Onshore activities, such as aircraft use and the installation of onshore equipment, could potentially disturb and displace sea turtles from sensitive nesting areas, although if this occurs, it would be on a small scale and not widespread. No substantial changes in sea turtle behavior or habitat use are expected in response to onshore activity; the response of sea turtles to onshore activity would be discountable.

NOS concludes that the Proposed Action “May Affect, but Not Likely to Adversely Affect” all sea turtle species occurring in the action area, as listed in **Table 3.6-1**, except hawksbill turtles in the GAR. This species very rarely occurs within GAR and likely would not be encountered during any NOS projects or activities occurring under any of the action alternatives. As such, NOS concludes that the proposed project would only contribute “discountable” effects to hawksbill turtles within the GAR.

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 sea turtles. Critical habitat may be minimally disturbed through short-term displacements or reductions of sea turtle prey and forage but would remain functional to maintain viability of dependent species. Due to the potential for effects that could range from negligible to moderate as described in Sections 3.6.2.2-4, the Proposed Action “May Affect, but Not Likely to Adversely Affect” the designated critical habitat occurring in the action area as listed in **Table 3.6-1**.