3.4 HABITATS

This section describes the effects of NOS operations on definable habitat types throughout the action area. Note that this section does not include a discussion of EFH as defined by the MSA. The discussion and analysis of EFH is presented in Section 3.9.

3.4.1 Affected Environment

Essential habitat features are the defining characteristics of species' habitats that allow the species within a habitat to function in equilibrium. Essential habitat features may include, but are not limited to:

1) Space for individual and population growth and for normal behavior;
2) Food, water, air, light, minerals, and other nutritional or physiological requirements;
3) Cover or shelter; and
4) Sites for breeding, reproduction, or rearing and development of offspring (USFWS, 2017a).

Five habitat types can be found in the action area: freshwater, estuarine, shallow marine, oceanic, and terrestrial. **Figure 3.4-1** illustrates and defines the physical characteristics for each of these five habitats as defined for the purposes of this analysis.

Freshwater: Areas located between the headwaters and the head-of-tide, with negligible salinity (NMFS, 2015a) are classified as freshwater habitat types. The headwaters are the inland source from which a river originates within a basin or watershed; head-of-tide is the inland limit of water affected by tides. Diadromous fish species are those that spend a portion of their life cycle in both fresh water and salt water. These fish species require freshwater habitat as both a supporting environment for early stages of the life cycle and as spawning grounds during later adult stages; the quantity and quality of these areas are of equal importance to these fish as that of marine areas. The majority of waterfowl species also occupy freshwater habitats.

Estuarine: Areas located in a semi-enclosed coastal body of water extending from head-of-tide to a free connection with the open sea where saline sea water is mixed with fresh water are classified as estuarine habitat types (NMFS, 2015a). Estuaries typically have brackish conditions, with variable salinities (depending on the tide stage) in between fresh water and sea water. Many protected species and commercially or recreationally harvested fish species occupy estuarine habitats at one or more stages of their respective life cycles.

Shallow Marine: Areas less than 200 meters (m) (656 feet [ft]) in bottom depth and located between the outer boundary of an estuary or coast (continent or island) and the outer boundary of the U.S. EEZ, usually 200 nautical miles (nm) (370 kilometers [km]) from shore are classified as shallow marine habitat types (NMFS, 2015a). Shallow marine habitats support important structural features, such as seagrass beds and coral reefs, which provide shelter, food, and space for a large number of marine vertebrate and invertebrate species.

Oceanic: Areas greater than 200 m (656 ft) in bottom depth and located between the outer boundary of an estuary or coast (continent or island) and the outer boundary of the U.S. EEZ are classified as oceanic habitat types (NMFS, 2015a). Oceanic habitats support a large number of marine vertebrate and invertebrate species, including protected species.

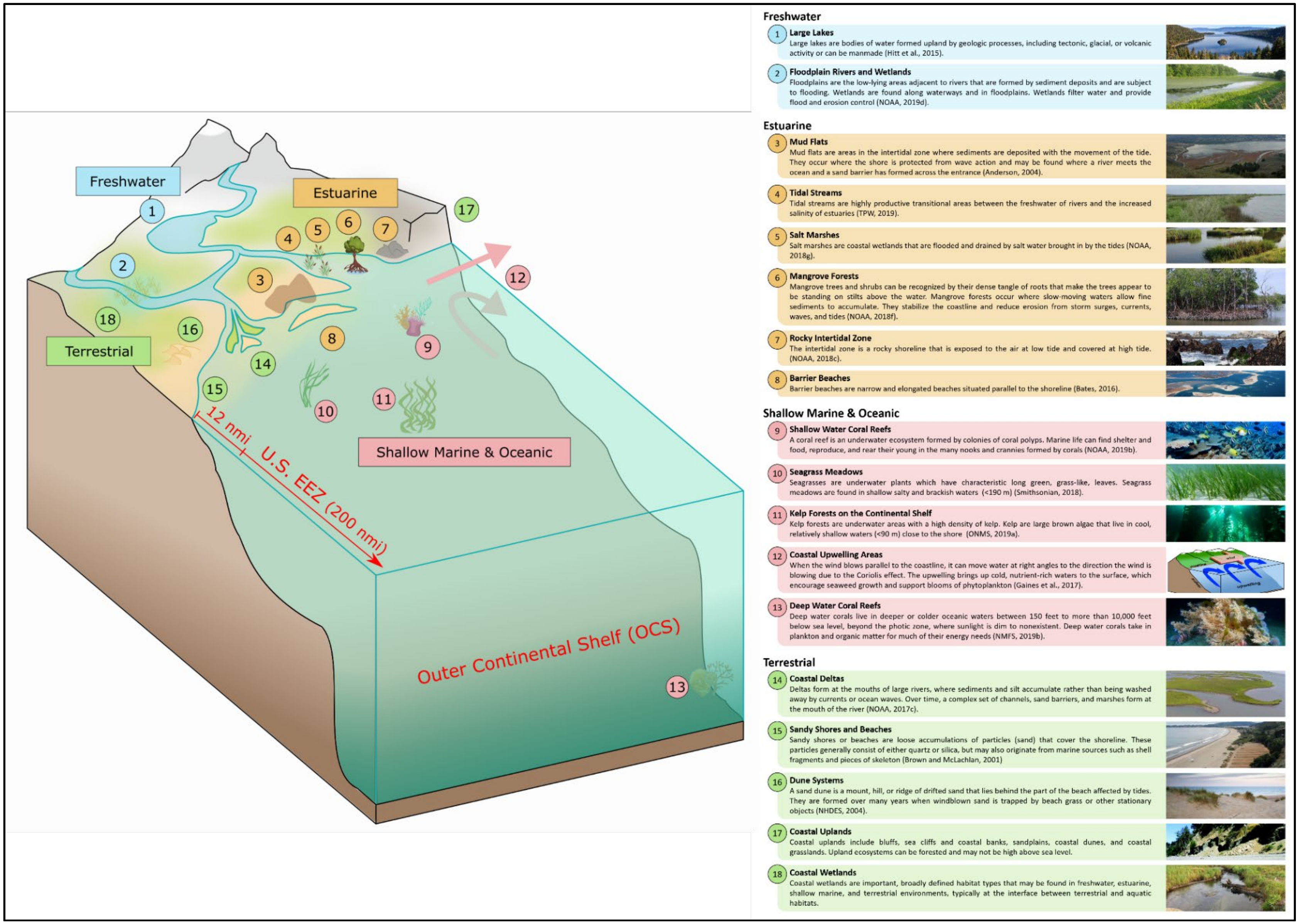
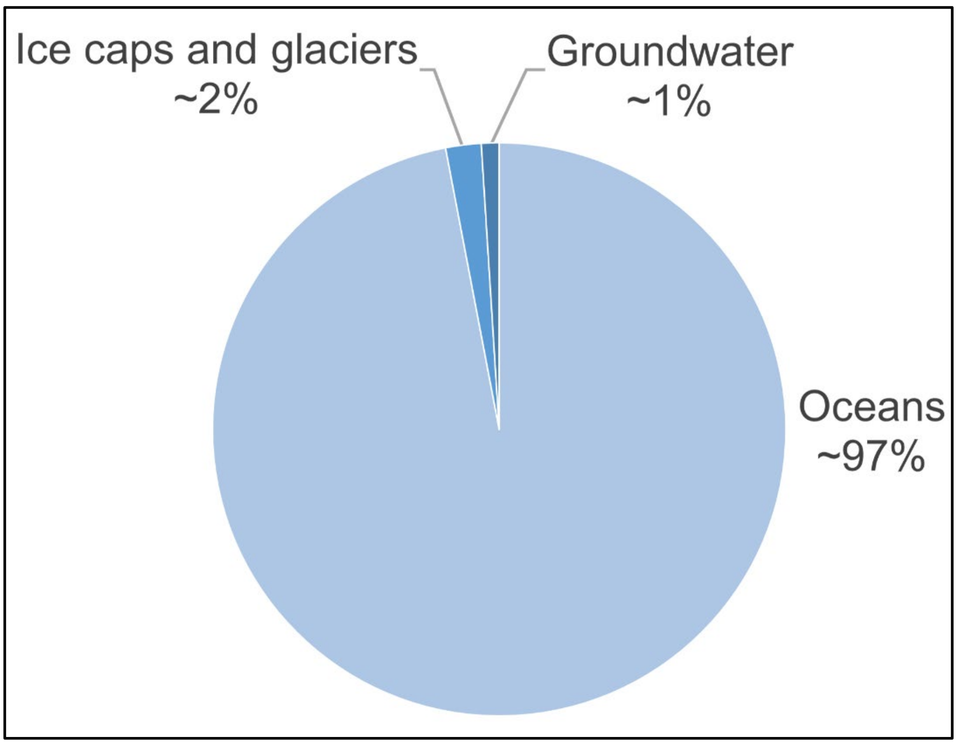


Figure 3.4-1. Habitat Types and Features Present in the Action Area

Terrestrial: Areas located on land, such as coastal deltas, sandy shores or beaches, dune systems, coastal uplands, bluffs/cliffs and headlands, and coastal wetlands are classified as terrestrial habitat types for the purposes of this analysis. Shorelines and coastal wetland habitats provide many dependent species of seabirds, shorebirds, and waterfowl with food, shelter, resting sites, and breeding or nesting areas. Sandy shores and beaches also serve as important nesting habitat for all ESA-listed sea turtles occurring within the EEZ. Terrestrial areas also serve as haul out locations where large numbers of pinnipeds mate, breed, and rear young; they also furnish denning sites for fissipeds such as polar bears.

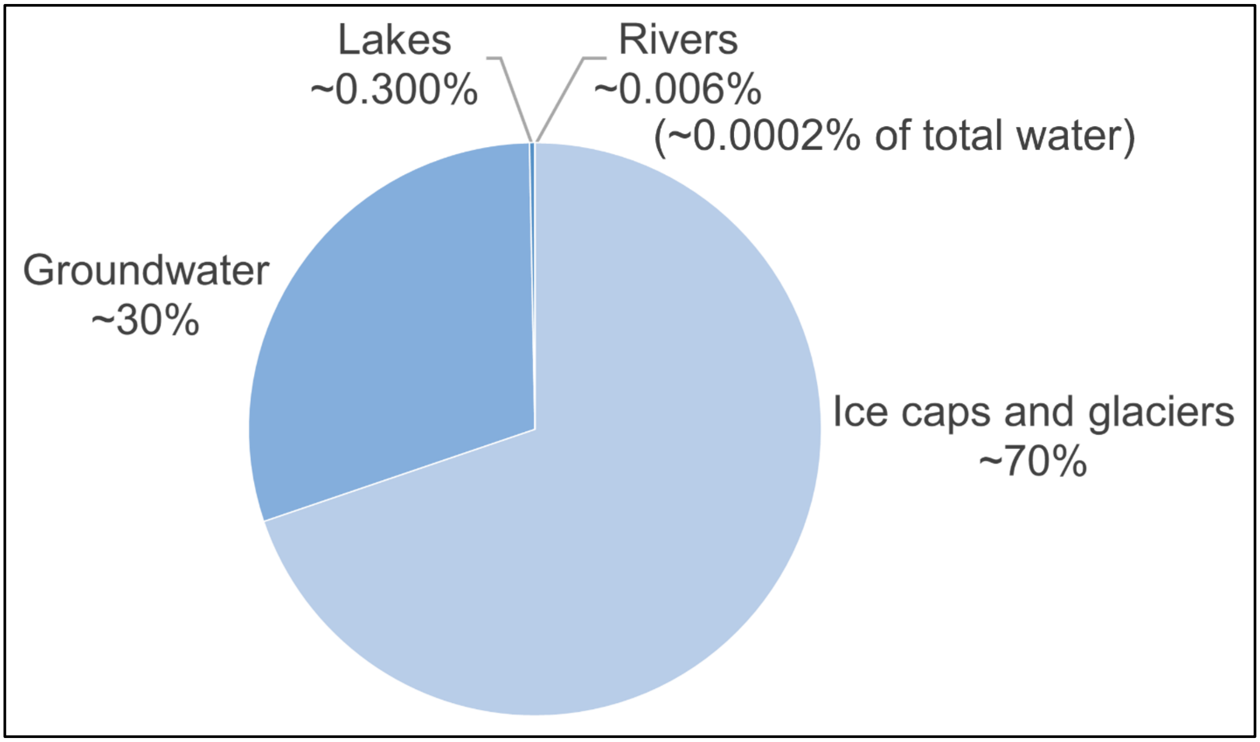
3.4.1.1 Freshwater Areas

Freshwater habitat types consist of rivers, marshes, streams, lakes and ponds that do not have any saltwater concentration. There is only a limited quantity of fresh water available globally to support freshwater habitats. Only three percent of water on the planet is fresh water, as shown in **Figure 3.4-2**. Of this three percent, only a very small proportion of the Earth's fresh water is available as habitat; the majority of global fresh water is frozen in polar ice caps and glaciers or located below the surface of the Earth as groundwater and has only very limited habitat value (**Figure 3.4-3**). Freshwater lakes and rivers make up approximately 0.3 percent of total water and compose such a small proportion of total global water composition that they are not visible in **Figure 3.4-2**.



Source: Hitt et al., 2015

Figure 3.4-2. Global Composition of Water



Source: Hitt et al., 2015

Figure 3.4-3. Global Composition of Freshwater

Despite their limited availability, freshwater habitats support a substantial number of described species and are extremely important ecologically (Hitt et al., 2015), as illustrated by **Table 3.4-1**. The Great Lakes constitute the largest freshwater ecosystem in the world and support approximately 3,500 species of plants and animals, including over 170 species of fish (SeaGrant, 2022).

Table 3.4-1. Comparison of Area and Percent of Described Species for Freshwater, Terrestrial, and Marine Ecosystems

Ecosystem Type	Percent Earth Area	Percent Described Species *
Freshwater	0.8	2.4
Terrestrial	28.4	77.5
Marine	70.8	14.7

Source: Hitt et al., 2015

* Total does not sum to 100 percent because symbiotic species are excluded.

Trends in the quantity and quality of freshwater habitat type areas are assessed and reported through surveys such as the Wadeable Streams Assessment, which shows that in 2004 more than 50 percent of the nation's rivers and streams were in poor biological condition (NMFS, 2015a). Between 2004 and 2013, the proportion of total quality freshwater habitat available in the action area for macroinvertebrates decreased from 27.4 percent to 20.5 percent of all freshwater habitat areas. During this time period, the proportion of freshwater areas in good phosphorous condition also declined (i.e., phosphorous concentrations rose) from 52.8 percent to 34.2 percent, although the proportion of freshwater areas in good nitrogen and in-stream fish habitat condition rose from 46.6 to 55.4 percent and 51.7 to 68.9 percent, respectively (NMFS, 2015a).

3.4.1.2 Estuarine Areas

Estuarine habitat types occur in areas where oceanic salt water mixes with terrestrial freshwater outflows. Estuaries are generally partially enclosed or isolated from open ocean waters, and commonly consist of channels, sloughs, and mud and sand flats. River mouths, lagoons, and bays often contain estuarine habitat features and support at least one life stage for many marine taxa, including macroinvertebrates, fish, and birds. These areas are particularly sensitive to human activities on surrounding lands**.** For example, diking, filling, and other human activities have affected over 70 percent of the estuarine habitat in the Pacific Northwest and California. Generally, estuarine conditions are poorest in the Gulf of Mexico and Greater Atlantic region (EPA, 2012). However, restoration efforts throughout the action area, such as the removal and relocation of dikes and levees, are ongoing and beginning to restore many degraded estuaries (NMFS, 2015a).

Many estuarine areas experience high levels of eutrophication from agricultural or urban runoff, as illustrated in **Figure 3.4-4**. High concentrations of nutrients such as nitrogen and phosphates from fertilizer or detergent runoff can potentially spawn algal blooms within estuaries, which reduce dissolved oxygen (DO), increase turbidity, and generally degrade the habitat value of affected waters.

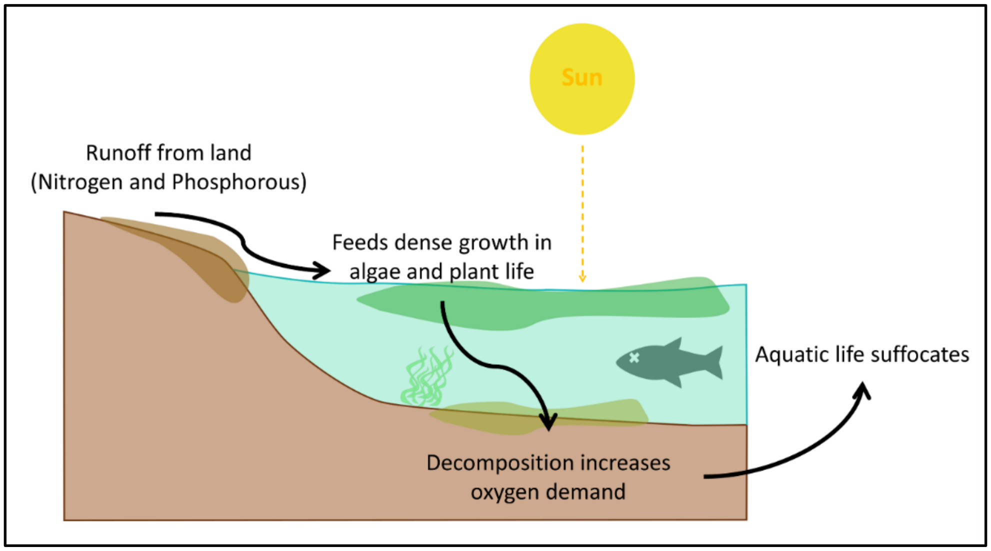
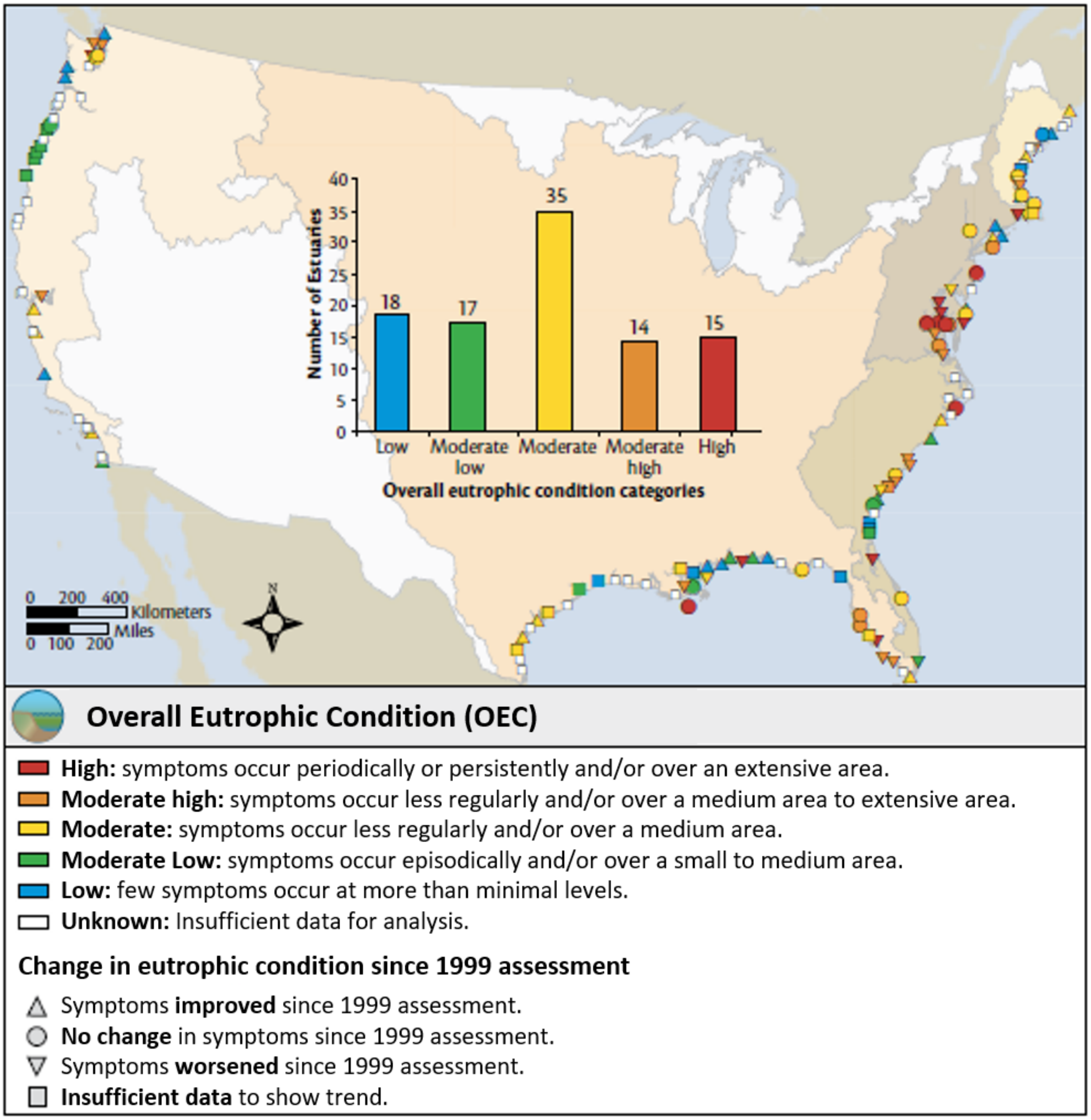


Figure 3.4-4. Eutrophication Process

The 2007 National Estuarine Eutrophication Assessment (Bricker et al., 2007) has characterized overall eutrophication condition from low to high in numerous estuaries nationwide through their collective expression of characteristic symptoms including increased chlorophyll *a*, macroalgae and nuisance/toxic blooms, decreased dissolved oxygen, and submerged aquatic vegetation loss. **Figure 3.4-5** depicts the eutrophication status of these major estuarine habitats in the continental U.S.



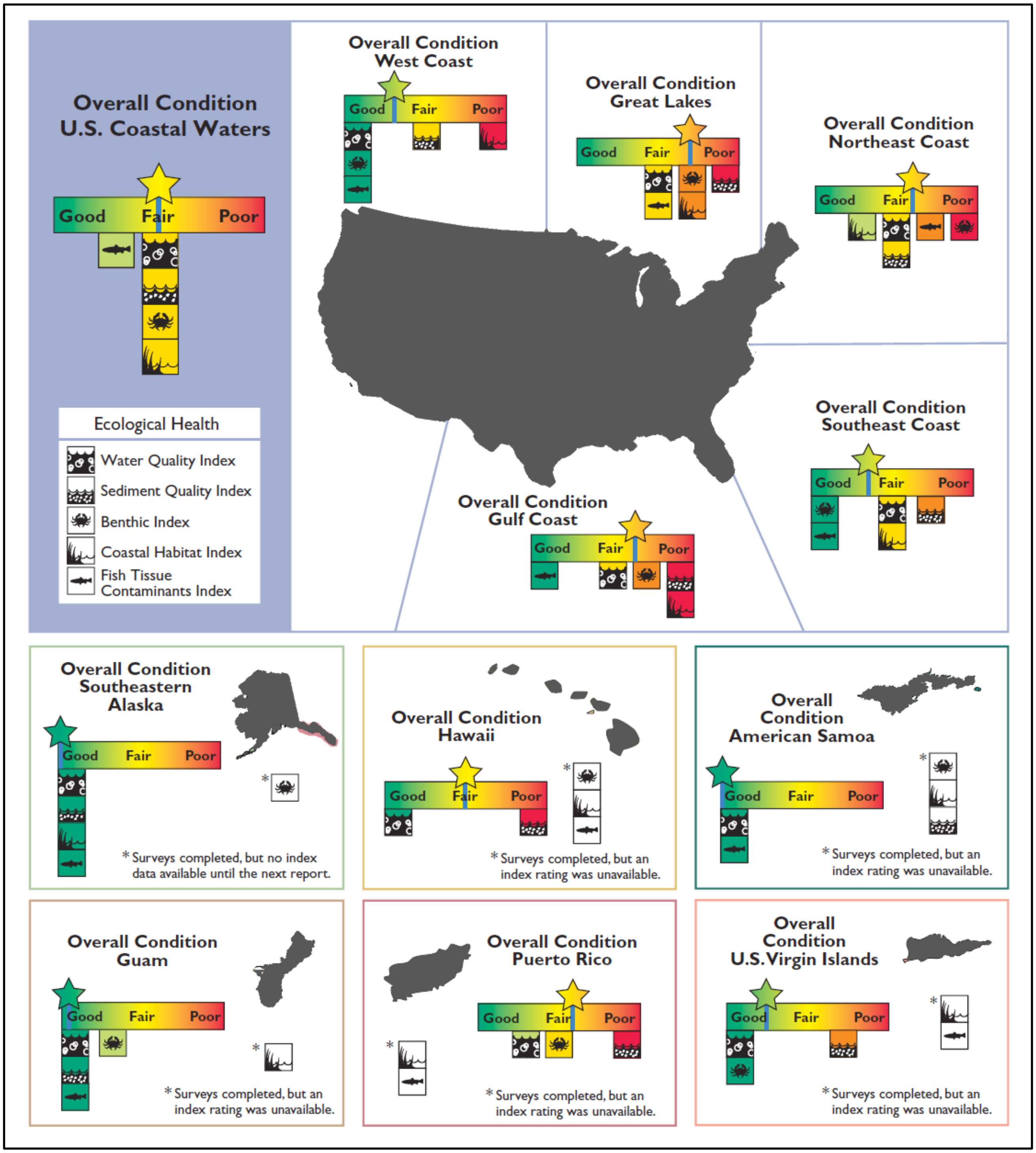
Source: Bricker et al., 2007

*Data for Alaska and Hawai'i are not available.

Figure 3.4-5. Eutrophic Habitat Condition of Major U.S. Estuaries*

3.4.1.3 Shallow Marine and Oceanic Areas

The shallow marine habitat type encompasses all areas less than 200 m (656 ft) in depth between the shoreline and the outer boundary of the U.S. EEZ. These areas are typically separated from deeper waters by underwater topographic features such as shelf breaks or reef walls. The oceanic habitat type encompasses all areas 200 m (656 ft) or greater in depth between the shallow marine habitat areas and the outer boundary of the U.S. EEZ. As a whole, shallow marine and oceanic areas have higher water quality, lower turbidity, less disturbed bottom substrate, lower concentrations of contaminants, and provide more habitat value to dependent species than freshwater areas within the action area (NMFS, 2015a); the National Coastal Condition Report (NCCR) IV rated the overall condition of national coastal waters as 'fair' and fresh waters as 'poor to fair' (EPA, 2012). Regional water condition ratings from the NCCR IV are depicted in **Figure 3.4-6**.



Source: EPA, 2012

Figure 3.4-6. Shallow Marine Habitat Condition by Location

The West Coast, Southeastern Alaska, and Pacific Islands regions contain the best marine and oceanic water quality of all regions in the EEZ, whereas the water quality of the Northeast Coast, Southeast Coast, and Gulf Coast in the Greater Atlantic and Southeast regions are considered only 'fair' (EPA, 2012).

3.4.1.4 Terrestrial Areas

Coastal terrestrial areas are found above the spring high tide limit within coastal areas and are characterized by their proximity to the sea for the purposes of this analysis. Coastal terrestrial habitat features include coastal wetlands, deltas, beaches, bluffs, cliffs, and dunes (**Figure 3.4-1)** that provide valuable ecosystem services such as food, shoreline stabilization, and nesting and breeding grounds for many species, including sensitive ESA-listed sea turtles (Section 3.6) and birds (Section 3.10). Coastal wetlands are particularly important to marine and terrestrial taxa and are explicitly discussed in Section 3.4.1.5.

Rising sea levels and extreme weather events are constantly eroding coastlines throughout the action area, reducing the amount of coastal terrestrial habitat available for dependent species. Erosion rates vary considerably from location to location and year to year, but average 0.6-0.9 m (2-3 ft) annually along the Atlantic coast and over 1.8 m (6 ft) annually in areas bordering the Gulf of Mexico (Heinz Center, 2000). Pacific coastlines tend to erode less than 0.3 m (1 ft) a year, but this lower rate is primarily a result of averaging episodic cliff erosion events, which can erode over 30 m (100 ft) of coastline at one time, over many years (Heinz Center, 2000).

3.4.1.5 Coastal Wetlands

Coastal wetlands include salt water, brackish (mixed salt water and fresh water), and freshwater wetlands located within coastal watersheds that drain into the Atlantic Ocean, Pacific Ocean (including areas surrounding Alaska and the Pacific Islands), Bering Sea, Arctic Ocean, or the Gulf of Mexico. These wetlands can be tidal or non-tidal, fresh water or salt water, and occur in close proximity to fresh water, estuarine, and shallow marine areas, typically at the interface between terrestrial and aquatic habitat types. This broad category includes a wide variety of habitat features, such as marshes, swamps, and mangrove forests as described in **Figure 3.4-1.**

Coastal wetlands compose roughly one third of all wetlands in the U.S. Within the EEZ, the Alaska region has the highest quality coastal wetlands, whereas coastal wetlands in the West Coast region and in the Gulf of Mexico are rated as 'poor' overall (EPA, 2012). As awareness of their ecological and economic importance has increased and a regulatory apparatus has developed to protect them, wetland loss has decreased. Wetland loss is now at a level that is 3 percent of the rate that it was prior to the mid-1970s, but coastal wetlands have experienced a net increase in the wetland loss rate during the period 1998 to 2009. **Table 3.4-2** summarizes coastal wetland losses in the U.S.

Table 3.4-2. Coastal Wetland Losses

Coastal Wetland Type	Timeframe/ Quantity Lost (ac)	Notes
All Coastal Watershed Wetlands	2004-2009/360,000	36 percent increase in average annual loss rate over preceding six-year period
Marine and Estuarine Intertidal Wetlands	2004-2009/95,000	Includes small gains in unvegetated wetlands and scrub/shrub wetlands
Salt Marsh	2004-2009/128,200	Threefold increase in loss rate over preceding six-year period

Coastal Wetland Type	Timeframe/ Quantity Lost (ac)	Notes
Louisiana Wetlands Lost to Open Water	1932-2010/1,206,000	Contributing factors include coastal development, sea level rise, coastal subsidence, storms, and interference with normal erosional and depositional processes within the Mississippi River Delta
Mangroves and Seagrasses	Declining in many areas	Declining due to an excess of suspended sediment associated with poor land-use practices, as well as algal blooms stimulated by excess nutrients
Fresh water	2004-2009/56,000	Human activity, particularly development and some activities related to silviculture, is the leading cause of freshwater wetland loss

Source: NMFS, 2015a

3.4.2 Environmental Consequences for Habitats

The following sections identify and evaluate potential impacts to the five habitat types occurring in the action area under Alternatives A, B, and C. The analysis specifically considers impacts to the following habitat characteristics:

- Space for individual and population growth and for normal behavior;
- Food, water, air, light, minerals, and other nutritional or physiological requirements;
- Cover or shelter; and
- Sites for breeding, reproduction, or rearing and development of offspring.

Activities described in Sections 2.4.1 through 2.4.13 that occur during NOS projects and could be expected to have impacts on habitat characteristics in the action area include crewed vessel operations; anchoring; remotely operated vehicles (ROVs) and autonomous vehicles operations; use of echo sounders, Acoustic Doppler Current Profilers (ADCPs), acoustic communication systems, sound speed data collection equipment, and drop/towed video camera systems; collection of bottom grab samples; installation, maintenance, and removal of tide gauges/buoys and Global Positioning System (GPS) reference stations; and Self-contained Underwater Breathing Apparatus (SCUBA) operations.

3.4.2.1 Methodology

NOS activities could impact habitat characteristics in the action area through: (1) physical impacts to bottom substrate (e.g., from anchoring, collection of bottom grab samples, tide gauge or GPS reference station installation, and SCUBA operations); (2) increase in sedimentation, turbidity, and/or chemical contaminants (e.g., from crewed vessel operations, ROV and autonomous vehicle operations, anchoring, collection of bottom grab samples, installation of tide gauges and GPS reference stations, and SCUBA operations); (3) increased ambient sound levels (e.g., from crewed vessel operations, ROV and autonomous vehicles, use of echo sounders, ADCPs, and acoustic communication systems); (4) facilitated dispersal of invasive species (e.g., from ballast water discharged during crewed vessel operation or organisms attached to hulls, equipment, and anchors); (5) impacts to water column (e.g., from crewed vessel operations, ROVs, and autonomous vehicles, anchoring, use of sound speed data collection equipment and bottom grab samplers, operation of drop/towed cameras and video systems, and SCUBA operations); and (6) terrestrial impacts (e.g., from ground disturbance during installation or removal of tide gauges).

As discussed in Section 3.2.2, significance criteria have been developed for each resource to provide a systematic and consistent approach to identifying and assessing the impacts of the alternatives. The significance criteria for habitats are presented in **Table 3.4-3.**

Table 3.4-3. Impact Significance Criteria for the Analysis of Impacts to Habitats

Impact Descriptor	Context and Intensity	Significance Conclusion
Negligible	Impacts on habitat would be limited to temporary (lasting up to several hours) changes to habitat characteristics of space; nutritional or physiological requirements; cover or shelter; or sites for breeding, reproduction, or rearing (or development) of offspring found within the project area. Impacts on habitat would not cause lasting damage or alteration.	Insignificant
Minor	Impacts would be temporary or short-term (lasting several days to several weeks) changes that would not be outside the natural range of variability to habitat characteristics of space; nutritional or physiological requirements; cover or shelter; or sites for breeding, reproduction, or rearing (or development) of offspring found within the project area. Impacts on habitat would be easily recoverable with no long-term or permanent damage or alteration.	
Moderate	Impacts would be short-term or long-term (lasting several months or longer) changes that would be outside the natural range of variability to habitat characteristics of space; nutritional or physiological requirements; cover or shelter; or sites for breeding, reproduction, or rearing (or development) of offspring found within the project area. Habitat would be damaged or altered potentially over the long term but would continue to support the species dependent on it.	
Major	Short-term or long-term changes well outside the limits of natural variability to habitat characteristics of space; nutritional or physiological requirements; cover or shelter; or sites for breeding, reproduction, or rearing (or development) of offspring found within the project area. Habitat would be degraded over the long term or permanently such that it would no longer possess sustainable habitat requirements.	Significant

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

Under Alternative A, NOS survey effort would continue to cover a total of 2,647,958nm (4,904,017 km) across all five regions over the five-year period. Although the survey effort under Alternative A would vary by year, approximately 47 percent of the total linear 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 and slightly greater in the Alaska Region, which contains approximately 18 percent of the total survey effort. Survey effort in the Great Lakes would compose less than one percent of total survey effort and would continue to average only

2,917nm (5,402km) annually. Major navigable rivers would continue to host an even smaller proportion of activities than the Great Lakes. **Table 3.4-4** presents the expected survey effort under Alternative A for each year by region.

Table 3.4-4. Survey Effort under Alternative A, by Geographic Region by Year

Region	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Survey Effort (in nautical miles)						
Greater Atlantic Region*	64,205	108,557	53,771	49,712	49,712	325,958
Great Lakes	3,383	2,800	2,800	2,800	2,800	14,583
Southeast Region	220,336	210,185	262,450	281,733	281,733	1,256,437
West Coast Region	59,558	57,909	55,973	58,204	58,204	289,848
Alaska Region	93,871	119,974	174,445	41,350	41,327	470,967
Pacific Islands Region	70,210	54,900	69,742	54,948	54,948	304,748

* Survey effort within the Great Lakes is included as part of the total GAR survey effort as well as presented separately.

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 projects, that add nuance to this trend. More than 71 percent of NOS survey effort would occur within shallow marine habitat areas (a depth range of less than 200 m [656 ft]), and approximately 24 percent of NOS survey effort would occur within oceanic habitat areas (a depth range greater than 200 m [656 ft]). The remaining survey work would occur within estuarine habitat areas and freshwater habitat areas. These areas would likely experience relatively lower impacts than shallow marine and oceanic habitat areas. Terrestrial habitat areas would experience the lowest impacts under Alternative A, as terrestrial areas would only be impacted by occasional shore visits in support of the installation, maintenance, and removal of shore-based instrument stations.

3.4.2.2.1 Physical Impacts to Bottom Substrate

Anchoring, collection of bottom grab samples, installation of tide gauges and remote GPS reference systems, dropped/towed camera systems, and SCUBA operations could physically impact bottom substrate in marine, freshwater, and estuarine areas, potentially degrading their habitat value to dependent species.

Anchoring of vessels and dropped or towed camera systems could potentially cause damage to bottom substrate in all aquatic habitat areas, potentially reducing available structure, cover, and nutrient/food availability for dependent species. Anchors, cameras, or their attached chains/lines could drag across or create holes and divots in the bottom substrates of aquatic areas, potentially damaging or destroying underwater vegetation or sea floor structure (note that the term “sea floor” includes lake and river bottoms where NOS activities could occur). This alteration of underwater structure would reduce the availability of shelter and cover necessary for the survival or offspring development of many aquatic taxa. This would particularly affect those organisms at lower levels of the aquatic food chain and could potentially reduce the overall aquatic biodiversity of the area through cascading trophic impacts (i.e., reduced prey availability reduces the abundance of higher-level predators).

Anchoring of vessels used by NOS, however, would not be a common practice. Only large vessels would typically anchor within or near project areas, while the small boats and launches used during NOS projects typically return to port or to the ship each day. Most vessels used by NOS would not anchor except in case of emergency, such as to avoid adverse weather conditions or in the event of an engine malfunction. Vessels would not anchor on coral reefs, and would avoid anchoring on hard bottom areas and in seagrass and abalone areas whenever possible; thus, these sensitive and critical habitat areas[5] and their dependent species would be minimally impacted, if at all. Additionally, NOS would not drag anchor chains and would ensure that anchors are properly secured so as to minimize bottom disturbance. However, it is possible that when a vessel is not collecting data, it may anchor either within the project area or nearby.

Installation of equipment on the sea floor, such as the installation of new moorings for tide buoys or GPS reference stations, would cause relatively small amounts of bottom substrate disturbance. The disturbance could potentially create holes in the bottom sediment and damage or destruction of submerged vegetation/macroalgae and bottom structure. This reduction of underwater structure would reduce the availability of shelter and cover necessary for the survival or offspring development of many aquatic taxa. This would particularly affect those organisms at lower levels of the aquatic food chain and could potentially reduce the overall aquatic biodiversity of the area through cascading trophic impacts (i.e., reduced prey availability reduces the abundance of higher-level predators). NOS would ensure that all instruments placed in contact with the sea floor (including anchors or moorings) are properly secured to avoid the dragging of moorings or lines across the bottom. NOS would also ensure that any buoys attached to the sea floor use the best available mooring systems: all mooring lines and ancillary attachment lines must use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak-links, chains, cables or similar equipment types that prevent lines from looping, wrapping, or entrapping protected species. Buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs must prevent any potential entanglement of listed species while ensuring the safety and integrity of the structure or device. When possible, field crews would use retrievable equipment to avoid abandoning material on the sea floor. Furthermore, the frequency of bottom disturbance is expected to be low since NOS would use existing moorings to anchor installations wherever possible. Only a very small portion of the approximately 32 NOS projects performed annually that include tide gauge installations would involve installation of new moorings. Given the low number of equipment installations, the relatively small area of bottom substrate disturbance, the large geographic separation between installations, and the implementation of vessel operating procedures that avoid physical contact with sensitive substrates (e.g., coral, vegetated bottom, and hard-bottom), the physical impact on bottom habitat from equipment installation is expected to be small and not outside the range of natural variability.

Bottom grab sampling involves the targeted removal of sediment cores in approximately 54 projects annually in shallow marine and oceanic areas throughout the entire action area. Bottom grab samples inherently damage bottom substrate and could potentially reduce or damage existing underwater structure. This could result in reducing the availability of cover and shelter necessary for prey species or immature marine organisms to avoid predation. NOS sediment sampling activities would avoid sampling sensitive bottom substrates such as coral reefs, seagrass beds, and hard bottom areas. Given the low frequency, geographic separation, relatively small area of bottom substrate sampled (e.g., 6x6 inch area and two inches deep), and avoidance of sensitive habitat areas, the physical disturbance of bottom substrate within aquatic habitat areas associated with bottom grab sampling is expected to be very small and not outside the range of natural variability. Additionally, equipment such as AUVs would be programmed and operated to avoid sea floor disturbance, and stiffer line materials would be used for

[5] NMFS issued a final rule to remove Johnson's seagrass (*Halophila johnsonii*) from the federal list of threatened and endangered species on April 14, 2022. To correspond with this action, the critical habitat designation for Johnson's seagrass was also removed.

instrument deployment and kept taut during operations to reduce the potential for entanglement in bottom features such as coral habitats. NOS also operates dropped and towed cameras approximately 1 m (3 ft) above the sea floor, avoiding contact with bottom substrate to the extent possible.

Operations involving SCUBA divers may inadvertently cause disturbance to shallow marine bottom substrates. NOS SCUBA operations would include approximately 248 benthic and fish monitoring projects conducted on hard bottom and coral reef habitats annually; these areas contain shallow marine habitat characteristics necessary for many marine invertebrate and vertebrate species and are particularly sensitive to disturbances. Although just a very small component of NOS projects and mainly related to tide gauge installation/maintenance/removal projects (see Chapter 2), SCUBA divers in these areas could potentially reduce or damage existing underwater structure, reducing the availability of cover and shelter necessary for prey species or immature marine organisms to avoid predation, and potentially inducing cascading impacts throughout the food chain. NOS divers are trained to hover over the sea floor to avoid inadvertent disturbance of sediments and to place or handle equipment such that impacts to bottom habitat are avoided. Divers would not stand or rest on live corals or coral reefs, and bottom contact would only occur in unconsolidated areas or non-living hardbottom. Given the low risk of contact with the sea floor during diver operations and large geographic separation of diving projects throughout the action area, physical disturbances to bottom substrate from SCUBA operations are expected to be minimal and well within the range of natural variation.

The impacts from anchoring, drop/towed camera systems, equipment installation, bottom sample collection, and SCUBA operations under Alternative A would infrequently disrupt small areas of bottom substrate in aquatic habitat areas. These physical disruptions would be short-term and would not reduce the space, shelter/cover, or food availability in aquatic habitat areas outside of the range of natural variability. As such, impacts to all aquatic habitat areas from activities involving physical disturbance to bottom substrate under Alternative A would continue to be **adverse** and **negligible** to **minor,** and therefore **insignificant**.

3.4.2.2.2 Increase in Sedimentation, Turbidity, and/or Chemical Contaminants

Activities such as crewed vessel operations, ROV and autonomous vehicle operations, anchoring, collection of bottom grab samples SCUBA operations, and the installation or maintenance/removal of tide gauges and GPS reference stations could potentially increase the sedimentation, turbidity, and/or chemical contamination of all aquatic habitat areas throughout the action area, degrading their value to dependent species.

Crewed vessel, ROV, and autonomous vehicle operations in conjunction with all activities which physically contact bottom substrate (See 3.4.2.2.1) would increase sedimentation and turbidity in disturbed areas from bottom sediments loosened through displaced water from transiting vessels or physical contact with bottom substrate. High levels of sedimentation and turbidity can potentially cause direct respiratory damage to aquatic species and block sunlight necessary for photosynthesis by aquatic plants, macroalgae, and phytoplankton. These impacts could potentially lower the overall nutrient availability of affected habitat areas and could reduce the cover and structure available to dependent species from submerged vegetation or macroalgae. Furthermore, increases in suspended sediments and turbidity reduce the depth to which sunlight can penetrate, which changes the wavelengths of light reaching fish and benthic species.

Photosynthetic marine species are dependent on sunlight and often have a narrow band of wavelengths of light that they are able to use. Increased sedimentation and turbidity could inhibit photosynthesis in oceanic habitat areas, thus reducing nutrient cycling by marine phytoplankton and reducing shelter and cover provided by submerged plants and macroalgae. Suspended material may also react with dissolved oxygen (DO) in the water and result in temporary or short-term oxygen depletion to aquatic resources (e.g., vegetation and aquatic macroinvertebrates) and could further exacerbate impacts to habitat areas from reduced nutrient and cover availability. NOS crewed vessels, ROVs, and autonomous vehicle operations would be routed to avoid stirring up bottom sediments whenever possible and their impact on sedimentation and turbidity is expected to be minimal. Furthermore, given the low frequency, large degree of geographic separation, and small affected area of activities physically impacting bottom substrate, the resulting increases in sedimentation/turbidity would be very small and would likely settle back to the sea floor or dissipate with prevailing currents and winds relatively quickly (within seconds or minutes).

Crewed vessel, ROV, and autonomous vehicle operations may result in the discharge (mostly unintentional) of harmful substances including bilge water, debris, fuel, oil, and miscellaneous chemicals. The majority of contaminants, including oil and fuel, entering the aquatic environment are less dense than water and float on the surface until they evaporate, typically within several days (Neff et al., 2000). Floating contaminants typically would not affect habitat characteristics below the surface of the water, however contaminants introduced to shallow marine habitat areas could potentially harm seagrass ecosystems close to the water surface and could cause extensive mortality of the seabed (Zieman et al., 1984). Seagrass mortality would reduce the available cover and shelter that many marine species require to avoid predation, reproduce, and rear or develop offspring in addition to reducing food availability for seagrass foragers, including echinoderms, fish, manatees, and sea turtles.

Denser contaminants could also sink below the surface of the water and negatively impact coral colonies in shallow marine habitat areas through mortality, tissue death, reduced growth, impaired reproduction, bleaching, and reduced photosynthetic rates (Cook and Knap, 1983; Burns and Knap, 1989; Ballou et al., 1987). Reduction of corals would reduce the food, structure, and shelter necessary for prey species and would likely reduce the overall biodiversity of the area through cascading impacts throughout the food chain. Chemical contaminants could also cling or adhere to submerged structural features in all aquatic habitat areas, which could serve as an additional exposure vector to fish and aquatic macroinvertebrates and result in changes in growth rates or behavior, injuries, and death of exposed individuals. Bioaccumulation of some toxic chemicals could disproportionately impact higher-level predators which consume contaminated prey items, which could ultimately reduce top-down ecosystem regulation and degrade the nutrient availability of affected habitat areas.

The context and intensity of these impacts are contingent on the size, location, and chemical composition of the source discharge or spill. Small spills rarely occur during NOS activities, and large spills are unlikely given the size of vessels used during NOS projects. Given that operators of vessels used by NOS would strictly adhere to all applicable laws and regulations pursuant to the International Convention for the Prevention of Pollution from Ships (Marine Pollution [MARPOL] 73/78) (restricts onboard hazardous material use and the discharge of contaminants into the marine environment), and the low probability of accidental fuel spills, the likelihood of chemical contamination from vessels used by NOS, ROV, and autonomous vehicle operations would be relatively small. Impacts would be minimal especially when compared to similar disturbance and discharges from the much greater numbers of all other vessels occurring in the EEZ, lakes, and rivers.

Installation and removal of tide gauges or GPS reference stations on land along the shoreline could also increase the turbidity, sedimentation, and chemical contamination of the water column through run-off of disturbed soil. Increased sedimentation and turbidity could potentially lower the overall nutrient availability of affected coastal wetland and shallow marine habitat areas due to reduced photosynthesis by phytoplankton. Photosynthetic inhibition in these areas could also reduce the availability of cover and shelter created by submerged vegetation and macroalgae necessary for many species to avoid predation and develop offspring. Soil runoff also often includes chemical contaminants such as fertilizers or detergents with high levels of nitrates and phosphates. Influxes of nutrients or chemicals in shallow marine, estuarine, and coastal wetland habitat areas could potentially trigger algal blooms. Algal blooms are toxic for many marine species and they reduce DO concentrations, thus reducing the overall habitat quality of the affected area. NOS would only undertake approximately 32 projects that include tide gauge installations annually, and 30 projects that include tide gauge removal annually. Given the low frequency, large degree of geographic separation, relatively small affected area, and application of runoff control procedures during the installation and removal of tide gauges, the resulting increases in turbidity, sedimentation, and chemical contamination from these activities are expected to be minimal and temporary.

Overall, increased sedimentation, turbidity, and chemical contamination from all activities which physically contact bottom substrate under Alternative A would rarely occur and would largely be dissipated by prevailing currents or winds in seconds to minutes. These temporary reductions in water quality are not expected to substantially reduce the availability of space, shelter/cover, nutrients, or breeding/rearing grounds in any of the habitat types found throughout the action area outside the range of natural variability. Larger impacts could occur in the extremely unlikely event of a large spill; however, large spills are not expected to occur given the small size of vessels used in NOS projects and their adherence to hazardous material discharge regulations. As such, impacts to all aquatic habitat areas from increased sedimentation, turbidity, and/or chemical contaminants under Alternative A would continue to be **adverse** and **negligible** to **minor**, and therefore **insignificant**.

3.4.2.2.3 Increased Ambient Sound

Activities such as crewed vessel operations, ROV, and autonomous vehicle operations, and use of underwater acoustic equipment including echo sounders, ADCPs, and acoustic communication systems would increase the ambient sound level of affected aquatic habitats through the production of underwater sound. Increasing the ambient sound level could potentially degrade the habitat value of affected areas which would be manifested through impacts, such as behavioral disruption or injury to biological resources. Underwater sound adversely affects aquatic taxa variably, with effects differing considerably based on the frequency and intensity of the sound and the hearing sensitivity of the affected organism. Increased ambient sound levels are analyzed in this section for their potential impact on the various roles which biological resources have in their habitat, such as predator/prey interactions, as opposed to analyzing the impact on individual species. See Sections 3.5 to 3.10 for detailed discussions of the hearing capability of aquatic taxa present in the action area and the potential impacts on these species from vessel sound and underwater acoustic sources.

Crewed vessel, ROV, and autonomous vehicle operations would generate underwater sound and vibrations at low- to mid-frequencies that overlap with the hearing ranges of many aquatic prey species. Increases in the ambient sound level of aquatic habitat areas transited by vessels could potentially reduce the habitat quality of preferred feeding or breeding grounds and displace disturbed animals from these areas (Slabbekoorn et al., 2010). Increased ambient noise can also mask biologically important sounds which elicit predator-avoidance or mating behaviors, cause hearing loss, and/or generally have an adverse effect on an organism’s stress levels and immune system (NOAA, 2016; Simpson et al., 2016). Reduction of prey species would reduce food and nutrient availability for top-level predators in aquatic habitat areas and could potentially result in cascading impacts throughout the local aquatic food chain and reduce biodiversity.

NOS crewed vessel transits would be infrequent in any given area and the exposure of prey species to vessel sound would be limited to the immediate vicinity of vessels. Exposure to vessel sounds would only persist for the duration of vessel transit through the habitat area. As such, prey species would only be temporarily exposed to vessel sound and likely would not change their behavior or habitat occupancy in the long-term. Furthermore, NOS vessel operations would represent a very small proportion of vessel traffic in the action area; therefore, the potential effects of sounds from vessels used by NOS would be minimal as compared to the aggregate effects from sound generated by all other ship traffic in the action area. The overall contribution to background sound in the ocean from vessels used by NOS would be very small. It would be unlikely that the exposure of prey species to these sounds would exceed the levels and lengths of time that would result in more than minimal adverse effects.

Use of active underwater acoustic sources would involve relatively high frequency, directional, and short duration, repeated signals which could increase the ambient sound environment of aquatic habitat areas. These instruments produce acoustic signals perceptible to several marine prey species; exposure of these marine prey species to this sound could result in the same adverse impacts to shallow marine and oceanic habitat areas as those discussed in the preceding paragraph. However, active acoustic underwater sources are typically only operated while a ship is in motion, thus habitat areas would only be exposed to emitted acoustic energy for a very short duration. Furthermore, these sources are highly directional in nature and the energy of their emitted acoustic signals would drop off rapidly with distance from the source. Therefore, impacts on marine prey species, if any, would be predominantly limited to temporary behavioral and stress-startle response, and likely would not substantially impact the overall habitat quality of any given area.

Sound from vessel operations, which would generate sounds in the mid- and low-level frequencies, are within the hearing range of most prey species, but would be infrequent, geographically widely distributed, and likely to elicit a minimal or temporary response. A majority of the sounds generated by underwater acoustic sources are well above the hearing frequencies of most prey species, thus, unlikely to cause behavioral disturbance and hearing impairment. Thus, activities under Alternative A that create underwater sound would continue to have **adverse** and **negligible** to **minor**, and therefore **insignificant** impacts on habitat.

3.4.2.2.4 Facilitated Dispersal of Invasive Species

Activities such as crewed vessel, ROV, and autonomous vehicle operations and the use of echosounders, sub-bottom profilers, ADCPs, acoustic communication systems, and sound speed data collection equipment entail the use of the same physical equipment and instruments in geographically disparate regions and could potentially facilitate the dispersal and establishment of invasive species in novel areas. This would degrade habitat value for native marine or terrestrial species.

NOS projects occur in all freshwater and marine regions of the action area and can potentially involve transit and surveying across large swaths of the action area using the same physical equipment and instrumentation. These longer voyages or projects could potentially inadvertently transport invasive macroinvertebrate larvae, vertebrate eggs or animals, plant seeds, or algae propagules in ballast water or on equipment surfaces to novel areas, thereby facilitating their dispersal and establishment (Gregory, 2009). Invasive species such as the lionfish (*Petrois spp.*), zebra mussel (*Dreissena polymorpha*), or Japanese wireweed (*Sargassum muticum*) have large numbers of offspring and limited or no natural threats or predators outside of their native habitat, allowing them to outcompete locally endemic species for space and nutrients (TISI, 2014).

Over time, the propagation of invasive species can result in cascading impacts to the local food chain through the extirpation of local predators and prey due to reduced nutrient cycling and availability. These impacts typically reduce the habitat value of affected areas in the long-term or permanently after the establishment of invasive species. These species and their resulting impacts persist until all invasive organisms are removed from a given area through aggressive trapping, harvesting, or use of pesticides such as glyphosate. All NOS projects would implement mandatory invasive species prevention procedures including, but not limited to, vessel and equipment washdown, cleaning, and de-ballasting (exchange of ballast water in open ocean waters for those vessels used by NOS that have ballast tanks). Proper implementation of these procedures would prevent most NOS equipment from serving as exchange vectors for invasive species; however, the possibility for the transmission of some invasive species would likely still exist. The majority of NOS projects would not transit to multiple areas consecutively, and NOS project crews would implement mandatory invasive species control procedures to limit or avoid hull fouling, use anti-fouling coatings, and clean hulls regularly to remove aquatic nuisance species, thus limiting the potential impact to habitat in the action area. Additionally, vessels used by NOS, however, compose only a very small proportion of vessel traffic in the action area and would likely contribute marginally to the overall transmission of invasive species.

NOS equipment and instruments used in consecutive projects in disparate geographically regions could potentially serve as transmission vectors for invasive species which could reduce the habitat value of their area of introduction by outcompeting endemic plants, animals, and algae. These impacts could potentially persist until invasive species are removed from these areas via aggressive management techniques and procedures. However, the vast majority of NOS projects would not transit to multiple areas consecutively and NOS project crews would implement mandatory invasive species control procedures, limiting the potential impact to habitat areas in the action area. Given its relatively low likelihood of occurrence, the **adverse** impact of invasive species dispersal facilitated by activities under Alternative A would likely continue to be **minor** and therefore **insignificant**.

3.4.2.2.5 Impacts to the Water Column

Activities such as crewed vessels, ROVs, and autonomous vehicles use of sound speed data collection equipment and bottom grab samplers, operation of drop/towed cameras and video systems, and SCUBA operations could potentially impact or disturb the water column of habitat areas during the movement of vessels, equipment or personnel.

Wakes from crewed vessels, ROVs, and autonomous vehicles would create turbulence and generate wave and surge effects in the water column. This displacement of water could temporarily disrupt important environmental gradients, including temperature, salinity, DO, turbidity, and nutrient supply. Propellers from vessels could also cause water column destratification and elevated water temperatures. Vessel movement through the water column may disrupt benthic communities in shallow areas and other prey species and cause mortality to floating eggs and larvae by physically damaging them with the hull or other ship parts, including the propulsion system. These disruptions would likely reduce the availability of space, shelter, and nutrients for dependent species within oceanic and shallow marine habitat areas. Disruptions could also potentially affect food chains and ultimately reduce the overall biodiversity of affected areas. However, the vast majority of impacts to habitat areas would be temporary as disturbance would be limited to the immediate vicinity of vessels and would only persist for the duration of transits or projects within the affected area.

Instruments, gear, and personnel that interact with the water column, including sound speed data collection equipment, bottom grab samplers, drop/towed cameras, anchors and chains, and SCUBA divers could temporarily cause turbulence and disturb or displace nearby benthic communities and other prey species. Reduction of prey species would reduce food and nutrient availability for top-level predators in aquatic habitat areas. This could potentially result in cascading impacts throughout the local aquatic food chain and reduce biodiversity. Lines connecting equipment to a vessel could also become entangled with, damage, or kill underwater structural habitat features such as seagrass or corals. Reduction of underwater structure would likely reduce the space, shelter, and cover necessary for the avoidance of predators by prey species and the rearing or development of offspring. Additionally, divers in SCUBA operations that would be conducted as part of various projects would move through the water column, this could temporarily disturb prey species and reduce their availability for higher-level predators. The vast majority of impacts to habitat areas would be temporary as disturbance would be limited to the immediate vicinity of instruments, gear, or personnel and would only persist for the duration of the activity. Mobile species would likely only be minimally displaced from project areas and would not experience long-term changes in the availability of space, structure, shelter, or nutrients outside the range of natural variability.

Vessels, equipment, and personnel used in activities conducted under Alternative A would disrupt the water column in project areas, potentially impacting their habitat quality by disturbing important environmental gradients, structure, and prey availability. However, the vast majority of these impacts would be limited to the immediate vicinity of vessels and would not persist beyond the duration of activities within the area. These temporary disruptions would not likely change the availability of space, shelter, cover, or nutrients necessary for dependent species outside of the range of natural variability. As such, impacts to habitat areas from water column disruptions under Alternative A would continue to be **adverse**, **negligible** and therefore **insignificant.**

3.4.2.2.6 Terrestrial Impacts from Tide Gauge Installation, Maintenance, or Removal

NOS onshore activities, such as the installation, maintenance, and removal of shore-based GPS reference stations and tide gauges, could potentially impact terrestrial habitat areas through disturbance of animals and the disturbance of onshore vegetation or topographical structure.

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 animals, including terrestrial prey species. Repeated disturbances could result in long-term changes in terrestrial prey distributions and could ultimately reduce the overall biodiversity of habitat areas due to reduced nutrient cycling and availability. However, 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 prey behavior; thus, onshore activities are not expected to contribute to any long-term changes in habitat occupancy, avoidance behavior, or energy expenditure in terrestrial prey.

The installation of semi-permanent monitoring equipment such as GPS reference systems and tide gauges could potentially reduce the quantity and quality of coastal terrestrial habitat. Many species of marine and terrestrial animals, including all ESA-listed bird species described in Sections 3.10.1.3.1 and 3.10.1.3.2 and ESA-listed sea turtles, breed and nest along the coast. During onshore activities, vegetation in and adjacent to the project area could be trampled by foot traffic, damaged, or cleared, thereby reducing cover and shelter necessary for terrestrial or marine animals to avoid predation, breed, and nurture offspring. However, the majority of onshore installations would only occupy very small portions of terrestrial habitat and any affected structural components would likely recover post-installation. Onshore installations are not expected to reduce the availability of space, shelter, cover, or nutrients necessary for dependent species in the long term.

Onshore activity would likely only displace terrestrial 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 coastal terrestrial habitat areas and would not likely induce long-term changes in the availability of space, shelter, cover, or nutrients 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 impact to terrestrial habitat areas, from NOS onshore activities under Alternative A would continue to be **adverse**, **negligible** to **minor**, and therefore **insignificant**.

3.4.2.2.7 Conclusion

Under Alternative A, NOS would continue to operate a variety of equipment and technologies to gather data on the marine and coastal environments at the level of effort reflecting current NOS funding levels. Since the effects of impact causing factors on habitat areas throughout the action area range from negligible to minor, the overall impact of Alternative A on habitat areas would continue to be **adverse, minor**, and therefore **insignificant**.

3.4.2.3 Alternative B: Conduct Surveying and Mapping Projects 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 more 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, 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. The types and mechanisms of impacts would remain the same in Alternative B as discussed for Alternative A. Therefore, the difference between the two alternatives is primarily a matter of scale with increased activity levels distributed unevenly among the different types of activities. As such, effects under Alternative B would incrementally increase from those of Alternative A but would not differ fundamentally in type. **Table 3.4-5** presents the expected survey effort under Alternative B for each year by region.

Table 3.4-5. Survey Effort under Alternative B, by Geographic Region by Year

Region	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Survey Effort (in nautical miles)						
Greater Atlantic Region*	70,625	119,413	59,148	54,683	54,683	358,554
Great Lakes	3,722	3,080	3,080	3,080	3,080	16,042
Southeast Region	242,369	231,204	288,695	309,906	309,906	1,382,080
West Coast Region	65,514	63,700	61,571	64,024	64,024	318,833
Alaska Region	103,258	131,971	191,890	45,485	45,460	518,064
Pacific Islands Region	77,231	60,390	76,716	60,443	60,443	335,223

* Survey effort within the Great Lakes is included as part of the total GAR survey effort as well as presented separately.

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 amongst the most disruptive NOS activities to all habitat areas and could contribute to impacts through physical contact with bottom substrate, underwater vessel sound, vessel wake and underwater turbulence, and accidental spills of oil, fuel, or chemical contaminants. 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 or habitat type to substantially increase the context and intensity of impacts (e.g., from negligible to minor). This relationship is consistent for all other impact causing factors from proposed activities, such as bottom substrate or onshore disturbance from the installation, maintenance, and removal of tide gauges and installation GPS reference stations (a combined 367 projects under Alternative A and 377 projects under Alternative B); and bottom substrate disturbance from anchoring, bottom sample collection, and trailing video equipment (a combined 140 projects under Alternative A and 156 projects under Alternative B).

Impacts of Alternative B on habitat areas throughout the action area 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 habitat areas resulting from Alternative A would not cause long-term changes in the availability of space, shelter, cover, or nutrients necessary for dependent species and would not substantially increase in intensity with the increased level of effort of Alternative B. Overall, impacts on habitat areas under Alternative B would be **adverse**, **minor**, and therefore **insignificant**.

3.4.2.4 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 more nautical miles traveled, than Alternatives A and B. 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, an approximately nine percent increase over Alternative B (2,912,753 nm [5,394,419 km] total) and 20 percent increase over Alternative A (2,647,958 nm [4,904,017 km] total) across all regions over the five-year period. The types and mechanisms of impacts would remain the same in Alternative C as discussed for Alternatives A and B. Therefore, the difference between the three alternatives is primarily a matter of scale with increased activity levels distributed unevenly among the different types of activities. As such, effects under Alternative C would incrementally increase from those of Alternative B, but would not differ fundamentally in type. **Table 3.4-6** presents the expected survey effort under Alternative C for each year by region.

Table 3.4-6. Survey Effort under Alternative C, by Geographic Region by Year

Region	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Survey Effort (in nautical miles)						
Greater Atlantic Region*	77,046	130,269	64,526	59,655	59,655	391,149
Great Lakes	4,060	3,360	3,360	3,360	3,360	17,500
Southeast Region	264,403	252,222	314,940	338,080	338,080	1,507,724
West Coast Region	71,470	69,491	67,168	69,845	69,845	347,818
Alaska Region	112,645	143,968	209,334	49,620	49,592	565,160

Region	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Survey Effort (in nautical miles)						
Pacific Islands Region	84,252	65,880	83,690	65,938	65,938	365,698

* Survey effort within the Great Lakes is included as part of the total GAR survey effort as well as presented separately.

Under Alternative C there would be annual crewed vessel operations covering 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 amongst the most disruptive NOS activities to all habitat areas and could contribute to impacts on through physical contact with bottom substrate, underwater vessel sound, vessel wake and underwater turbulence, and accidental spills of oil, fuel, or chemical contaminants. Although the amount of crewed vessel operations would be greater under Alternative C than under Alternative B, the additional 60,000 nm (111,000 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 or habitat type to substantially increase the context and intensity of impact (e.g., from negligible to minor). This relationship is consistent for all other proposed activities contributing potential impacts, such as bottom substrate or onshore disturbance from the installation, maintenance, and removal of tide gauges and installation GPS reference stations (a combined 377 projects under Alternative B and 383 projects under Alternative C); and bottom substrate disturbance from anchoring, bottom sample collection, and trailing video equipment (a combined 156 projects under Alternative B and 173 projects under Alternative C).

Impacts of Alternative C on habitat areas throughout the action area would be the same or slightly, but not appreciably, larger than those discussed above under Alternatives A and B for each impact causing factor. Impacts to habitat areas resulting from Alternatives A and B would not cause long-term decreases in the availability of space, shelter, cover, or nutrients necessary for dependent species and would not substantially increase in intensity with the increased level of effort of Alternative C. Overall, impacts on habitat areas under Alternative C would be **adverse**, **minor**, and therefore **insignificant**.