3.9 Essential Fish Habitat

This section discusses the affected environment and environmental consequences that would result under each alternative for EFH for fish and aquatic macroinvertebrates in the action area. EFH occurs in both the marine and freshwater environments, although none had been designated in the Great Lakes.

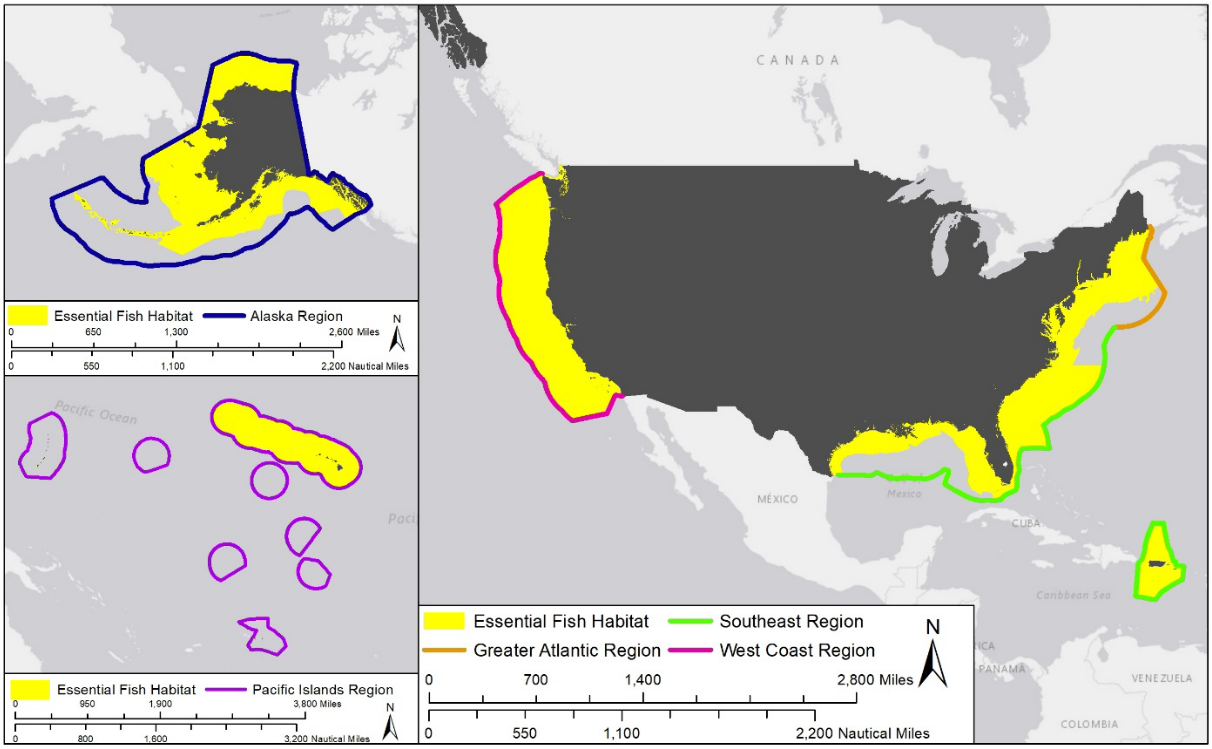
3.9.1 Affected Environment

As discussed in Section 3.3, Congress passed the MSA in 1976 and reauthorized it in 1996 as the Sustainable Fisheries Act. The MSA established eight regional Fishery Management Councils (FMCs) – North Pacific, Pacific, Western Pacific, Gulf of Mexico, Caribbean, South Atlantic, Mid-Atlantic, New England – and mandated that Fishery Management Plans (FMPs) be developed to responsibly manage fish and invertebrate species in waters within the U.S. EEZ. Under the reauthorization, NMFS was required to designate and conserve EFH for species managed under existing FMPs. This was intended to minimize, to the extent practicable, any adverse effects on habitat caused by human activities and to encourage the conservation and enhancement of such habitat (BOEM, 2014a).

EFH is defined as “those waters and substrate necessary for fish for spawning, breeding, feeding, or growth to maturity” (16 U.S.C §1801 [10]). The final rule summarizing EFH regulation (50 CFR Part 600) outlines additional interpretation of the EFH definition. Waters, as defined previously, include “aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate.” Substrate includes “sediment, hard bottom, structures underlying the waters, and associated biological communities.” “Necessary” is defined as “the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem.” Fish includes “finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds,” and “spawning, breeding, feeding or growth to maturity” covers the complete life cycle of those species of interest. Ecologically, EFH includes waters and substrate that include distribution and range zones such as migration corridors, spawning areas, and rocky reefs, as well as water characteristics such as turbidity zones and salinity gradients. EFH is not only a geographic area where a species occurs, but an all-encompassing habitat designation.

EFH regulations provide guidance to FMCs to identify and define EFH, clarify the intent of key terms, and require that federal agencies consult with NMFS when planning or authorizing activities that could affect EFH. NMFS works with the FMCs to designate EFH, which has been described for more than 1,000 managed species to date.

The area encompassed by the Proposed Action and alternatives extends from the shoreline to the seaward boundary of the U.S. EEZ. A large portion of these waters has been designated EFH for one or more species managed pursuant to the MSA. EFH also occurs in estuarine and freshwater habitat such as rivers, ponds, and wetlands. **Figure 3.9-1** shows the large extent of EFH as it covers most of the U.S. EEZ.



Source: NMFS, 2019a

Figure 3.9-1. EFH in the U.S. EEZ

EFH designations are based on interpretations of the best available scientific information on the general distribution of managed species within fisheries, and their habitat-related densities, growth, reproduction, or survival rates within habitats, and/or production rates by habitat (50 C.F.R. §600.815 (a)(1)(iii)). The available science is mostly limited to general distributions, and given that there are several life stages (eggs, larvae, juveniles and adults) and numerous representative species within all fisheries for which EFH has been designated, the EFH designations across regions are broad. Designations are primarily based on the species' position in the water column (e.g., demersal, pelagic), and include broad biogeographic and bathymetric areas (0-400 m [0-1,312 ft] depth in a region), and general habitat types. Fish habitat includes the substrate and benthic resources (e.g., submerged aquatic vegetation, shellfish beds, salt marsh wetlands), as well as the water column, and prey species. EFH includes all types of aquatic habitats such as wetlands, coral reefs, seagrass (**Figure 3.9-2**), muddy and rocky substrates in state and federal waters, and rivers where fish spawn, breed, feed, or grow to maturity.

Figure 3.9-2. Seagrass EFH

Photo Credit: NMFS

Within the EFH designations, Habitat Areas of Particular Concern (HAPCs) have been identified; these are high-priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function. HAPCs are discrete subsets of EFH and comprise specific sites or habitat types that meet one or more considerations including: being of particular ecological importance to the long-term sustainability of managed species; being of a rare type; and/or being especially susceptible to degradation or development (50 C.F.R. §600.815 (a)(8)). More than 100 HAPCs have been identified across all regions for enhanced EFH conservation. Several FMCs have designated discrete habitat areas as HAPC, while others have broadly designated all areas of a specific habitat type as HAPC.

EFH has been designated in the waters inside of the 320-km (200-mi) U.S. EEZ boundary in the eight FMC regions. Each EFH is described below by text and a map using the best scientific information available for each fish stock. Each of the FMCs has developed EFH descriptions in either separate documents or as amendments to existing FMPs. NMFS maintains an online EFH Mapper for viewing the spatial distributions of fish species, their life stages, and important habitats; it displays maps for EFH, HAPCs, and EFH areas protected from fishing (NMFS, 2019a).

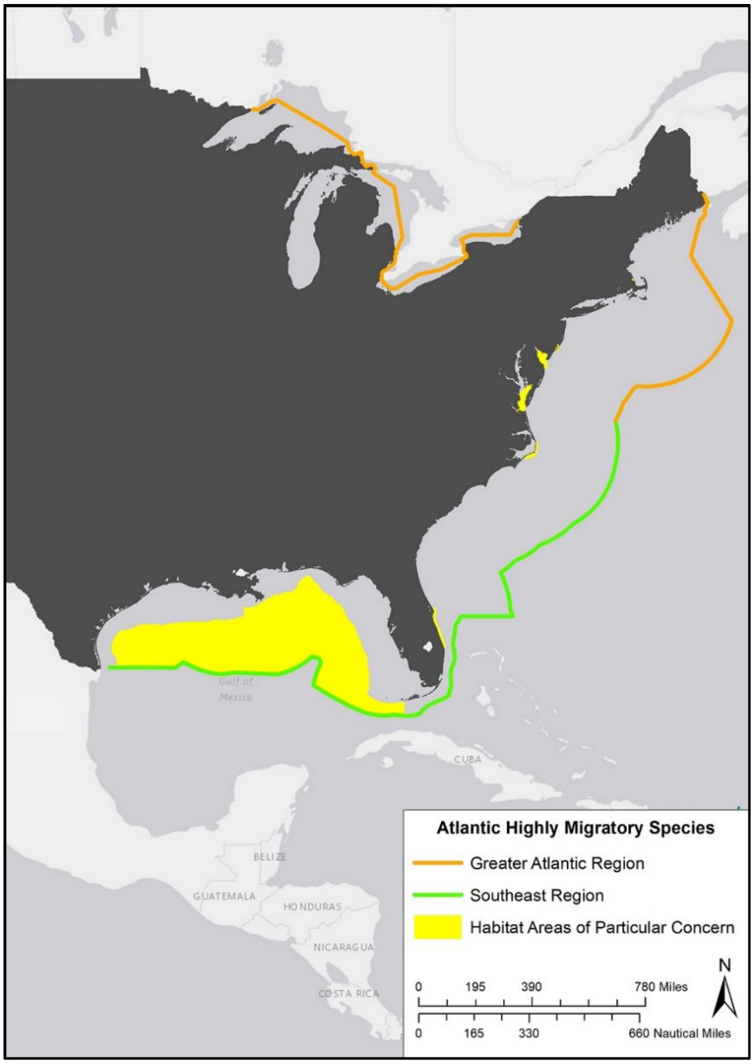
3.9.1.1 Regional Distribution

This section summarizes region-specific EFH and HAPCs for fish and marine macroinvertebrates. Most species found in federal waters are managed by FMCs through the development and implementation of an FMP. However, highly migratory species (HMS) such as Atlantic tunas, sharks, and billfish are different in that they are found throughout the Atlantic Ocean and in the Caribbean and must be managed both domestically and internationally. As a result, NMFS has primary authority for identifying and describing EFH in FMPs for HMS. NMFS has identified geographic areas, rather than specific habitat types as EFH for these fisheries (see **Table 3.9-1** and **Figure 3.9-3**). Detailed descriptions of EFH and HAPC designations for HMS are available in the Atlantic HMS FMP (NMFS, 2019b).

Table 3.9-1. EFH and HAPCs for Atlantic HMS

Fisheries	EFH	HAPC
Highly Migratory Species	Overall: waters of New England, Mid-Atlantic, South Atlantic, Gulf of Mexico, and the U.S. Caribbean.	For bluefin tuna: west of 86° west longitude and seaward of the 100-m (328-ft) isobath, extending from the 100-m (328-ft) isobath to the EEZ in the Gulf of Mexico. For sharks: waters off Chesapeake Bay, Virginia and Maryland; Plymouth-Duxbury-Kingston Bay in Massachusetts; Delaware Bay, Delaware; Great Bay, New Jersey; the Outer Banks off North Carolina; and Titusville to Jupiter off Florida coast.

Source: NMFS, 2019b



Source: NMFS, 2019a

Figure 3.9-3. HAPCs for Atlantic HMS

3.9.1.1.1 Greater Atlantic Region

Two FMCs occur in the Greater Atlantic Region: the New England FMC and the Mid-Atlantic FMC. EFH for various life stages of numerous fish species occurs in this region, including Atlantic salmon (*Salmo salar*), Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*), bluefish (*Pomatomus saltatrix*), monkfish (*Lophius piscatorius*), spiny dogfish (*Squalus acanthias*), and multiple species of groundfish and skates such as Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), red drum (*Sciaenops ocellatus*), pollock (*Pollachius* spp.), hake (Merlucciidae), and flounder (Pleuronectidae, Paralichthyidae, and Bothidae) (NEFMC, No Date; MAFMC, No Date). EFH for HMS occurring in the Greater Atlantic Region, including blue marlin, white marlin, and sailfish, are discussed above in Section 3.9.1.1 and shown in **Table 3.9-1**. For aquatic macroinvertebrates, EFH has been delineated for Atlantic surf clam (*Spisula solidissima*), deep-sea red crab (Chaceon quinquedens), two species of squid (*Doryteuthis pealeii* and *Illex illecebrosus*), and Atlantic sea scallop (*Placopecten magellanicus*) (NMFS, 2019a).

On January 3, 2018, NMFS approved all of the updated EFH and all of the recommended HAPC designations as part of the New England FMC's recommendations for the Omnibus EFH Amendment 2

(OHA2). OHA2 was initiated in 2004 to review and update the EFH components of all the New England FMC's FMPs.

A large proportion of the marine waters and habitats off the coasts of Maine and the states south of Maine to North Carolina, and marine waters within the full 200-mile Greater Atlantic Region EEZ have been designated as EFH for 15 different fisheries managed by the New England and Mid-Atlantic FMCs (see **Table 3.9-2**). EFH includes the coastal and offshore waters from the surface to the sea floor and various bottom substrate and habitat types in the Gulf of Maine, Georges Bank, southern New England, the middle Atlantic south to Cape Hatteras, North Carolina; waters over the continental shelf south of Cape Hatteras through Key West, Florida (some EFH designations extend into the Southeast Region); the Slope Sea and Gulf Stream between latitudes 29° north and 40° north; various bays and estuaries along the eastern coast; and all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of New England which are designated as EFH for the eggs, larvae, juveniles and/or adults for one or a combination of the managed species. Within these boundaries, one or more of the MSA-managed species are associated with certain water temperature regimes, oxygen saturation levels and salinities, and various seafloor substrates and habitat types.

HAPCs in New England and the Mid-Atlantic have been designated as discrete spatial areas and habitat types as listed in **Table 3.9-2** and shown in **Figure 3.9-4** and include all canyons HAPCs and seamounts HAPCs. In addition to the HAPCs listed in the table, the following areas have been designated for a variety of managed species as part of OHA2:

- The Cashes Ledge Habitat Closure Area was designated as the Cashes Ledge HAPC;
- The existing Western Gulf of Maine Habitat Closure Area was designated as the Jeffreys Ledge/Stellwagen Bank HAPC; and
- Eleven canyons or groupings of canyons south of Georges Bank and offshore of the Mid-Atlantic Bight were designated as HAPCs.

Detailed descriptions of EFH and HAPC designations in New England and the Mid-Atlantic are available in the New England and Mid-Atlantic FMCs' multiple FMPs (NEFMC, No Date; MAFMC, No Date).

Table 3.9-2. EFH and HAPCs for the Greater Atlantic Region

Fisheries	EFH	HAPC
New England		
Northeast Multispecies (Groundfish)	Overall: pelagic waters down to 1,250 m (4,101 ft) depth that meet certain temperature and salinity regimes, and bottom down to 700 m (2,297 ft) depth supporting aquatic vegetation; substrate of soft mud, clay, sand, or gravel; and rough or rocky bottom locations along slopes of the outer banks in Gulf of Maine, Georges Bank, southern New England, middle Atlantic south to Cape Hatteras,	Northern Edge Juvenile Cod HAPC: covers approximately 187 nm^2 on the northeastern edge of Georges Bank up to 120 m depth. Inshore Juvenile Cod HAPC: inshore areas of the Gulf of Maine and Southern New England between 0-20 m (0-66 ft) depth. Great South Channel Juvenile Cod HAPC: the area north of 41° north latitude, west of 69° west longitude,

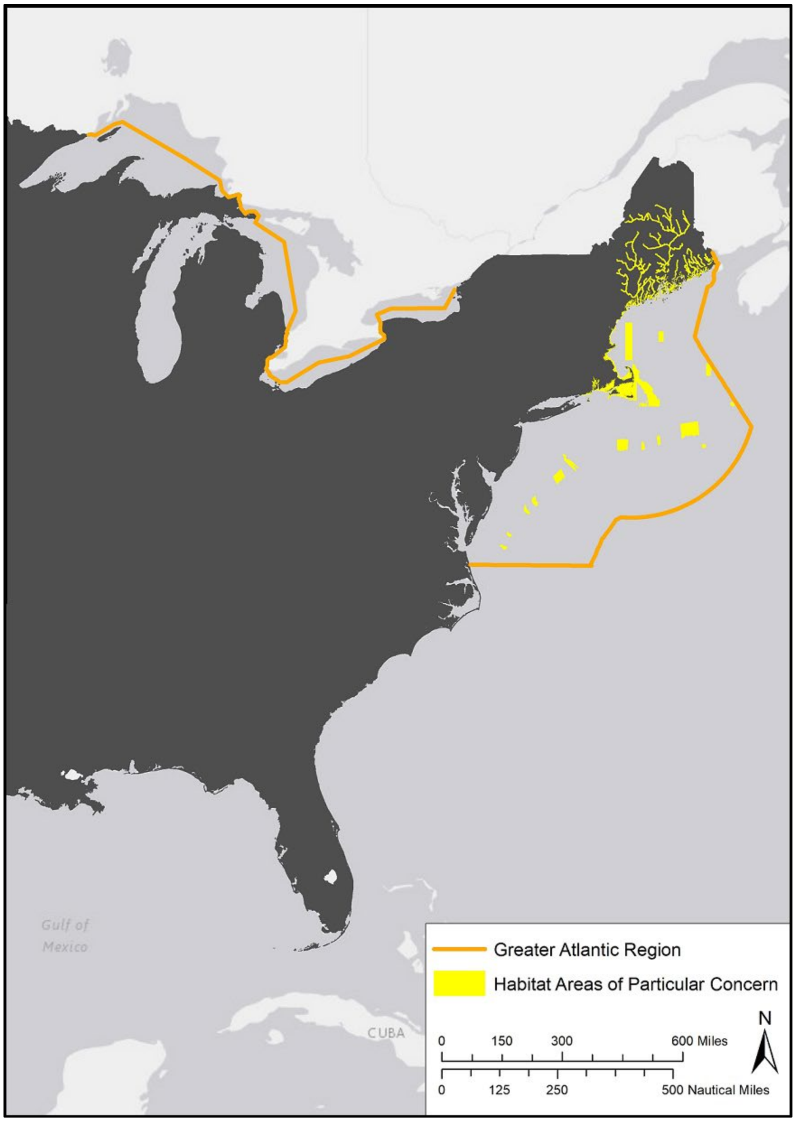
Fisheries	EFH	HAPC
	North Carolina; also a range of estuaries along the coasts.	south of 42° 15' north latitude, and east of 70° west longitude; offshore habitats between 30 and 120 m (98 and 394 ft) depth.
Atlantic Sea Scallop	Overall: coastal and offshore waters to the EEZ limit that meet certain temperature and salinity regimes, and bottom supporting red algae, hydroids, amphipod tubes and bryozoans and/or substrate of gravelly sand, sand, shell fragments, and pebbles, cobble and silt in the Gulf of Maine, Georges Bank, southern New England, and the mid-Atlantic south to the Virginia-North Carolina border; also various bays and estuaries along the coasts.	None
Atlantic Herring	Overall: coastal and offshore waters to the EEZ limit that meet certain temperature and salinity regimes, and bottom supporting aquatic macrophytes and substrate of gravel, sand, cobble, and shell fragments in the Gulf of Maine and Georges Bank and southern New England.	None
Atlantic Deep-Sea Red Crab	Overall: water column from the surface to the sea floor that meets certain temperature, dissolved oxygen (DO), and salinity regimes along the entire depth range along the southern flank of the outer continental shelf and slope, including two seamounts, from Georges Bank, Maine south to Cape Hatteras, North Carolina; and bottom within the depths of 200 – 1,800 m (5,905 ft) of the continental slope with substrates of silts, clays, and all silt-clay-sand composites.	Bear and Retriever Seamounts HAPC: the tops of Bear and Retriever seamounts that overlap spatially with the proposed EFH designation are designated as a HAPC.
Skates	Overall: down to 750 m (2,461 ft) depth of soft substrate, including sand and mud bottoms, mud with echinoid and ophiuroid fragments, broken shells, and shell and pteropod ooze; and substrate of	None

Fisheries	EFH	HAPC
	gravel and pebbles on offshore banks of the Gulf of Maine, Georges Bank through the Mid-Atlantic Bight to Cape Hatteras, North Carolina.	
Atlantic Salmon	Overall: all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut that meet a set of conditions, and oceanic pelagic waters of the continental shelf off southern New England north throughout the Gulf of Maine.	Eleven rivers in Maine: Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, Sheepscot, Kennebec, Penobscot, St. Croix, and Tunk Stream.
Small Mesh Multispecies (Whiting/Hake)	Overall: pelagic waters along the outer continental shelf of Georges Bank and southern New England south to Cape Hatteras, North Carolina; water depths less than 1,250 m (4,101 ft)	None
Mid-Atlantic		
Atlantic Mackerel, Squid, and Butterfish	Overall: inshore, offshore, and pelagic waters down to 1,829 m (6,000 ft) depth along the continental shelf from Maine through Cape Hatteras, North Carolina; also, a range of estuaries along the coasts.	None
Summer Flounder, Scup, and Black Sea Bass	Overall: water column down to 152 m (499 ft) depth including demersal waters and bottom that is rough, structured, muddy, sandy, or supporting shellfish and eelgrass beds along continental shelf from Gulf of Maine to Cape Hatteras, North Carolina; also, a range of estuaries along the coasts.	For summer flounder: HAPC consists of all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH on continental shelf and estuaries from Cape Cod, Massachusetts to Cape Canaveral, Florida*.
Atlantic Bluefish	Overall: pelagic waters over continental shelf from Nantucket Island, Massachusetts south to Cape Hatteras; and south of Cape Hatteras over continental shelf through Key West, Florida*, the Slope Sea and Gulf Stream between	None

Fisheries	EFH	HAPC
	latitudes 29° north and 40° north; also, a range of estuaries along the coasts.	
Tilefish	Overall: semi-lithified clay substrates within a preferred temperature range, which generally correspond to a depth contour of 100 to 300 m (328 to 984 ft); outer continental shelf and slope from U.S.-Canada boundary to the Virginia-North Carolina boundary.	Clay outcrop/pueblo six habitats within four canyon areas (Norfolk, Veatch, Lydonia, and Oceanographer canyons), within the same depth contour identified as EFH.
Atlantic Surf Clams and Ocean Quahogs	Overall: substrate to a depth of 245 m (804 ft) within the EEZ. Ocean quahog: continental shelf from southern New England and Georges Bank to Virginia. Surf clam: continental shelf from southwestern Gulf of Maine to Cape Hatteras, North Carolina.	None
Joint		
Monkfish	Overall: coastal and offshore waters to the EEZ limit that meet certain temperature and salinity ranges, and bottom of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud between 15 – 1,000 m (49 to 3,281 ft) depths in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras, North Carolina.	None
Spiny Dogfish	Overall: continental shelf waters between 10-450 m (33 to 1,476 ft) depth in the Gulf of Maine through Cape Hatteras, North Carolina; continental shelf waters south of Cape Hatteras through Florida*; also, a range of estuaries along the coasts.	None

Sources: NEFMC, 2016; NEFMC, 2018; NEFMC, No Date; MAFMC, No Date

*Note that some EFH and HAPC designations extend into the Southeast Region.

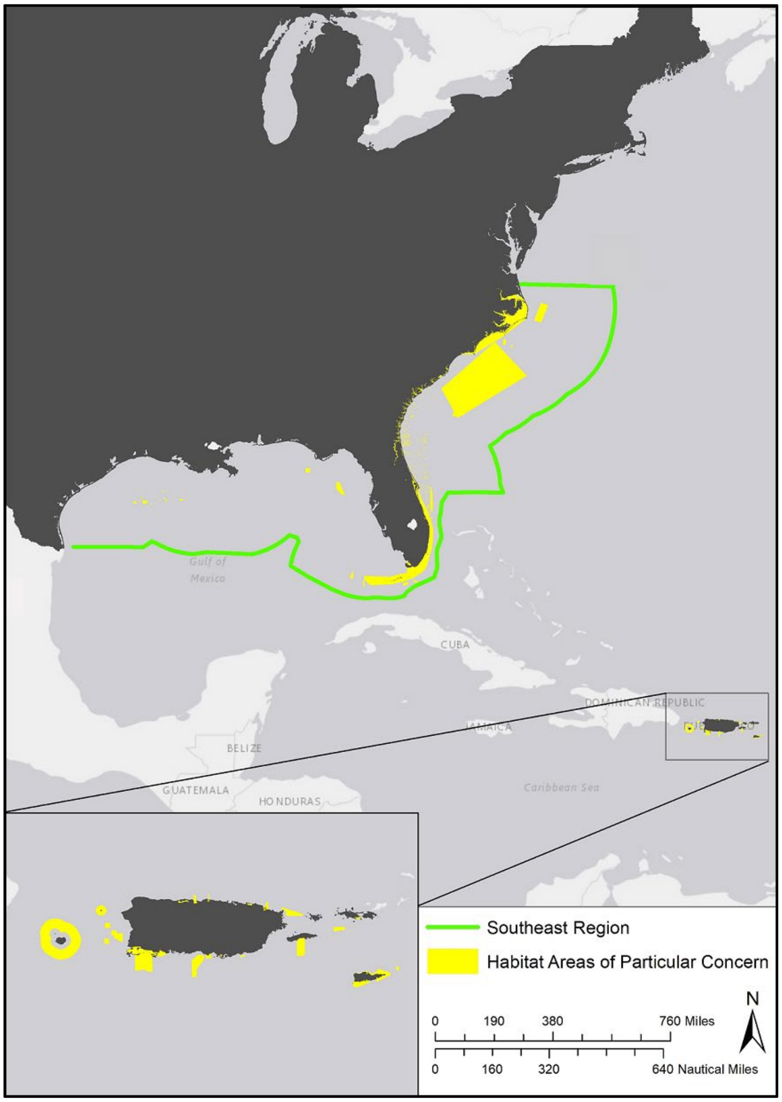


Source: NMFS, 2019a

Figure 3.9-4. HAPCs in the Greater Atlantic Region

3.9.1.1.2 Southeast Region

Three FMCs occur in the Southeast Region: the South Atlantic FMC, the Gulf of Mexico FMC, and the Caribbean FMC. EFH for various life stages of numerous fish species occurs in this region, including mackerel, cobia (*Rachycentron canadum*), wahoo (*Acanthocybium solandri*), snapper (*Lutjanus* spp.), grouper (Epinephelinae), and red drum (SAFMC, No Date; Gulf Council, No Date; CFMC, No Date). EFH for HMS occurring in the Southeast Region, including blue marlin, white marlin, and sailfish, are discussed above in Section 3.9.1.1 and shown in **Table 3.9-1**. For aquatic macroinvertebrates, EFH has been established in the Gulf of Mexico for corals (Anthozoa), shrimp, and spiny lobster (Palinuridae). In the South Atlantic and Caribbean, EFH has been established for corals, golden crab (*Chaceon fenneri*), spiny lobster, and queen conch (*Strombus gigas*). In addition, EFH for sargassum (Phaeophyceae), a seaweed found in free-floating offshore mats throughout the waters of the South Atlantic that is harvested for use in the feed supplement industry, occurs in this region. The sargassum mats provide crucial habitat for a wide variety of marine organisms in the open ocean, including pelagic species such as tuna, dolphin, wahoo, and billfish, as well as sea turtles and marine birds. EFH in the Southeast Region is discussed below for each FMC area: South Atlantic, Gulf of Mexico, and Caribbean. HAPCs in the Southeast Region are mapped in **Figure 3.9-5**.



Source: NMFS, 2019a

Figure 3.9-5. HAPCs in the Southeast Region

3.9.1.1.2.1 South Atlantic

A large proportion of the marine waters and habitat inside of the U.S. EEZ off the coasts of North Carolina and southward through to east Florida and Key West have been designated as EFH for eight fisheries managed by the South Atlantic FMC (see **Table 3.9-3**). EFH includes estuarine inshore habitats; various marine offshore habitats throughout the South Atlantic EEZ; the South- and Mid-Atlantic Bights; and the Gulf Stream in the South Atlantic Region EEZ. Estuarine inshore habitats consist of estuarine emergent vegetation, estuarine shrub/scrub, seagrass, oyster reefs and shell banks, intertidal flats, palustrine emergent and forested, and the estuarine water column. Marine offshore habitats include live/hard bottom, coral and coral reefs, artificial/manmade reefs, pelagic sargassum, and water column habitat.

HAPCs have been designated for all of the fisheries, many of which are identified for multiple managed species as listed in **Table 3.9-3**. HAPCs include: coastal inlets and Atlantic coast estuaries; pelagic and benthic sargassum; various discrete sites, bays, and sounds; marine protected areas and ridges; state-designated nursery habitats; various hardbottom areas; irregular bottom; mud-clay bottoms; and various habitat types such as coral reefs, *Phragmatopoma* reefs, manganese outcroppings, mangroves, seagrass, oyster/shell habitat, and sandy shoals.

Detailed descriptions of EFH and HAPC designations in the South Atlantic are available in the South Atlantic FMC's Habitat Plan, and the South Atlantic FMCs' multiple FMPs (SAFMC, No Date).

Table 3.9-3. EFH and HAPCs for the Southeast Region - South Atlantic

Fisheries	EFH	HAPC
Coral, Coral Reefs, and Live/Hard Bottom	Overall: hard substrate, mud, and silt bottoms in subtidal to outer shelf depths within a wide range of salinity and light penetration throughout the South Atlantic EEZ.	Big Rock; The Point; Hurl Rocks; Charleston Bump; Ten-Fathom Ledge; Georgetown Hole; The Point off Jupiter Inlet; The Hump off Islamorada; The Marathon Hump; The "Wall"; Hoyt Hills; Gray's Reef National Marine Sanctuary (NMS); eight deepwater Snapper Grouper Marine Protected Areas (MPAs); Oculina Banks; Biscayne Bay; Biscayne National Park; Florida Keys National Marine Sanctuary; Cape Lookout; Cape Fear; Stetson Reefs; Savannah and East Florida Lithoherms; Miami Terrace; Pourtals Terrace; Blake Ridge Diapir; Florida Bay; and Card Sound. All coastal inlets and Atlantic coast estuaries with high numbers of Spanish mackerel and cobia. All state-designated nursery habitats of particular importance to shrimp and snapper-grouper; state-identified overwintering areas; localities of known or likely periodic spawning aggregations. Pelagic and benthic sargassum; all hermatypic coral habitats and reefs; Stetson-Miami Terrace deepwater coral; shrimp fishery access areas; golden crab fishery access areas;
Dolphin and Wahoo	Overall: Gulf Stream in the Atlantic EEZ; Charleston Gyre, Florida Current, and pelagic sargassum.	
Golden Crab	Overall: seven habitat types (a flat foraminferan ooze habitat; distinct mounds, primarily of dead coral; ripple habitat; dunes; black pebble habitat; low outcrop; and soft-bioturbated habitat) throughout the U.S. continental shelf from Chesapeake Bay south through the Florida Straits and into the Gulf of Mexico and the Gulf Stream.	
South Atlantic Shrimp	Overall: inshore estuarine nursery areas (including intertidal marshes, mangroves, and seagrass) and offshore marine habitats used for spawning and growth to maturity (including terrigenous and biogenic sand bottom and blue/black and white calcareous mud), and all interconnecting water bodies from North Carolina through the Florida Keys, shelf current systems near Cape Canaveral, and the Gulf Stream.	
Snapper-Grouper	Overall: coral reefs, live/hard bottom, macroalgae, estuarine emergent vegetated wetlands	

Fisheries	EFH	HAPC
	(saltmarshes, brackish marsh); tidal creeks; estuarine scrub/shrub; oyster reefs and shell banks; unconsolidated bottom; submerged aquatic vegetation, artificial reefs and outcroppings from shore up to 610 m (2,000 ft) depth where the annual water temperature range is sufficiently warm to maintain populations; spawning area in the water column above the adult habitat and the additional pelagic environment, including sargassum; and Gulf Stream.	various hardbottom areas from 0-30 m depth (0-98 ft); irregular bottom comprising troughs and terraces intermingled with sand, mud, or shell hash bottom; mud-clay bottoms in depths of 150-300 m (492-984 ft); irregular bottom habitats along the shelf edge in 45-65 m (148-213 ft) depth, shelf break; upper slope along the 150-225 m (492-738 ft) contour; *Phragmatopoma* reefs off central and central east coast Florida; manganese outcroppings on the Blake Plateau; mangrove habitat; seagrass habitat; oyster/shell habitat; sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras; various offshore pelagic areas and associated benthic habitats.
Pelagic Sargassum Habitat	Where it occurs in the South Atlantic EEZ and in the state waters off of North Carolina, South Carolina, Georgia, and the east coast of Florida, including the Gulf Stream.	
Coastal Migratory Pelagics (Mackerel and Cobia) – Managed jointly by the Gulf of Mexico and South Atlantic FMCs	Overall: all coastal inlets; all state-designated nursery habitats of particular importance to coastal migratory pelagics; high salinity bays, estuaries, and seagrass habitat; sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters and sargassum from the surf to the shelf break zones shoreward of the Gulf stream; the Gulf Stream; and the South Atlantic and Mid-Atlantic Bights.	
Atlantic Spiny Lobster – Managed jointly by the Gulf of Mexico and South Atlantic FMCs	Overall: nearshore shelf/oceanic waters; shallow subtidal bottom; seagrass habitat; unconsolidated bottom; coral and live/hard bottom habitat; sponges; algal communities; mangrove habitat; and the Gulf Stream.	

Source: SAFMC, No Date

3.9.1.1.2.2 Gulf of Mexico

A large proportion of the marine waters and habitat inside of the U.S. EEZ off the coasts of Texas and states east of Texas through to western Florida and Key West have been designated as EFH for the fisheries managed by the Gulf of Mexico FMC (see **Table 3.9-4**). EFH includes the waters and substrates from estuarine waters to depths of 100 fathoms (approximately 183 m [600 ft]) in the entire Gulf of Mexico and the total distribution of coral species and life stages throughout the Gulf of Mexico. EFH habitat types include: estuarine and marine water column; estuarine emergent wetlands; submerged aquatic vegetation; algal flats and non-vegetated bottoms; mangrove wetlands; live (hard) bottoms and mud, sand, shell, and rock substrates; and coral reefs.

HAPCs have been designated for one or more of the fisheries as 18 spatially discrete sites in waters off Florida, Texas, and Louisiana as listed in **Table 3.9-4**. These areas predominantly contain living coral reefs or hard bottom habitat with known coral colonies, and include various protected areas, ridges and reefs.

Detailed descriptions of EFH and HAPC designations in the Gulf of Mexico are available in the Gulf of Mexico FMCs' multiple FMPs (Gulf Council, No Date).

Table 3.9-4. EFH and HAPCs for the Southeast Region – Gulf of Mexico

Fisheries	EFH	HAPC
Coral and Coral Reefs	Overall: the total distribution of coral species and life stages throughout the Gulf of Mexico including the East and West Flower Garden Banks, Florida Middle Grounds, southwest tip of the Florida reef tract, and predominant patchy hard bottom offshore of Florida from approximately Crystal River south to the Keys and scattered along the pinnacles and banks from Texas to Mississippi at the shelf edge.	18 areas primarily for protecting coral and hard bottom as identified within Coral FMP: Off of Florida: Madison-Swanson Marine Reserve; Tortugas North; Tortugas South; Florida Middle Grounds; and Pulley Ridge. Topographic features (reefs and banks) off of Texas/Louisiana: West Flower Garden Banks; East Flower Garden Banks; Stetson Bank; 29 Fathom Bank; MacNeil Bank; Rezak Sidner Bank; Rankin Bright Bank; Geyer Bank; McGrail Bank; Bouma Bank; Sonnier Bank; Alderdice Bank and Jakkula Bank. Coral HAPCs for reefs and banks; Alabama Alps Reef, AT047, AT357, Florida Keys National Marine Sanctuary, Garden Banks 299, Garden Banks 535, Green Canyon 140 and 272, Green Canyon 234, Green Canyon 354, Green Canyon 852, Harte Bank, L&W Pinnacle and Scamp Reef, MacNeil, the Mississippi canyons (118, 751, and 885), Rough Tongue Bank, South Reed Site, Southern Bank, Steamboat Lumps,
Red Drum	Overall: all Gulf of Mexico estuaries; waters and substrates extending from Vermilion Bay, Louisiana to the eastern edge of Mobile Bay, Alabama out to depths of 25 fathoms (approximately 46 m [151 ft]); waters and substrates extending from Crystal River, Florida to Naples, Florida between depths of 5 and 10 fathoms (9-18 m [29-59 ft]); waters and substrates extending from Cape Sable, Florida to the boundary between the areas covered by the Gulf of Mexico FMC and the South Atlantic FMC between depths of 5 and 10 fathoms (9-18 m [29-59 ft]).	
Gulf of Mexico Shrimp	Overall: Gulf of Mexico waters and substrates extending from the U.S./Mexico border to Fort Walton Beach, Florida from estuarine waters	

Fisheries	EFH	HAPC
	out to depths of 100 fathoms (183 m [600 ft]); waters and substrates extending from Grand Isle, Louisiana to Pensacola Bay, Florida between depths of 100 and 325 fathoms (183-594 m [600-1,949 ft]); waters and substrates extending from Pensacola Bay, Florida to the boundary between the areas covered by the Gulf of Mexico FMC and the South Atlantic FMC out to depths of 35 fathoms (64 m [210 ft]), with the exception of waters extending from Crystal River, Florida to Naples, Florida between depths of 10 and 25 fathoms (18-46 m [59-151 ft]) and in Florida Bay between depths of 5 and 10 fathoms (9-18 m [29-59 ft]).	West Florida Wall, The Edges, and the Viosca Knolls (826 and 862/906).
Reef Fish	Overall: Gulf of Mexico waters and substrates extending from the U.S./Mexico border to the boundary between the areas covered by the Gulf of Mexico FMC and the South Atlantic FMC from estuarine waters out to depths of 100 fathoms (183 m [600 ft]).	
Stone Crab	Overall: all Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the U.S./Mexico border to Sanibel, Florida from estuarine waters out to depths of 10 fathoms (9-18 m [30-59 ft]); waters and substrates extending from Sanibel, Florida to the boundary between the areas covered by the Gulf of Mexico FMC and the South Atlantic FMC from estuarine waters out to depths of 15 fathoms (27 m [89 ft]).	
Coastal Migratory Pelagics (Mackerel and Cobia) – Managed jointly by the Gulf of Mexico and South Atlantic FMCs	Overall: Gulf of Mexico waters and substrates extending from the U.S./Mexico border to the boundary between the areas covered by the Gulf of Mexico FMC and the South Atlantic FMC from estuarine waters	

Fisheries	EFH	HAPC
	out to depths of 100 fathoms (183 m [600 ft]).	
Atlantic Spiny Lobster – Managed jointly by the Gulf of Mexico and South Atlantic FMCs	Overall: Gulf of Mexico waters and substrates extending from Tarpon Springs, Florida to Naples, Florida between depths of 5 and 10 fathoms (9-18 m); waters and substrates extending from Cape Sable, Florida to the boundary between the areas covered by the Gulf of Mexico FMC and the South Atlantic FMC out to depths of 15 fathoms (27 m [89 ft]).	

Source: Gulf Council, No Date

3.9.1.1.2.3 United States Caribbean

A large proportion of the marine waters and habitat inside of the U.S. EEZ off the coasts of Puerto Rico and the U.S. Virgin Islands have been designated as EFH for the five fisheries managed by the Caribbean FMC (see **Table 3.9-5**). All waters from mean high water to the outer boundary of the EEZ and all substrates from mean high water to 100 fathoms (183 m [600 ft]) depth are designated as EFH for the eggs, larvae, juveniles and/or adults for one or more of the managed species. The various habitat types included are: estuarine and marine water column, salt marshes, seagrass, intertidal flats, salt ponds, sandy beaches, rocky shores, mangrove wetlands, live (hard) bottoms, mud, sand, shell, and rock substrates, and corals and coral reefs.

HAPCs have been designated for two of the fisheries as listed in **Table 3.9-5**, with the intent that the HAPCs protect the life stages of all managed species. The HAPCs include: eight reef fish spawning locations in Puerto Rico, St. Croix and St. Thomas; and 37 Ecologically Important Habitat areas in Puerto Rico, St. Thomas, and St. Croix. The HAPC locations sometimes overlap with refuges, bays, and banks and include a variety of habitat types such as coral and coral reefs, mangrove lagoons, seagrass beds, and coastal wetlands.

Detailed descriptions of EFH and HAPC designations in the U.S. Caribbean are available in the Caribbean FMCs' multiple FMPs (CFMC, No Date).

Table 3.9-5. EFH and HAPCs for the Southeast Region – U.S. Caribbean

Fisheries	EFH	HAPC
Reef Fish	Overall: all waters from mean high water to the outer boundary of the EEZ and all substrates from mean high water to 100 fathoms (183 m [600 ft]) depth.	Eight reef fish spawning locations: four in Puerto Rico, two in St. Croix, and two in St. Thomas. 18 Ecologically Important Habitat areas: 11 in Puerto Rico, two in St. Thomas, and four in St. Croix.

Fisheries	EFH	HAPC
		Areas/sites/habitat types include refuges, reefs, seagrass beds, bays, banks, and mangrove lagoons.
Queen Conch	Overall: all waters from mean high water to the outer boundary of the EEZ and seagrass, benthic algae, coral, live/hard bottom and sand/shell substrates from mean high water to 100 fathoms (183 m [600 ft]) depth.	None – no HAPC has been designated for the queen conch fishery in this region.
Spiny Lobster	Overall: all waters from mean high water to the outer boundary of the EEZ and seagrass, benthic algae, mangrove, coral, and live/hard bottom substrates from mean high water to 100 fathoms (183 m [600 ft]) depth.	None – no HAPC has been designated for the spiny lobster fishery in this region.
Coral and Reef Associated Plants and Invertebrates	Overall: all waters from mean low water to the outer boundary of the EEZ and coral and hard bottom substrates from mean low water to 100 fathoms (183 m [600 ft]) depth.	19 Ecologically Important Habitat areas: 13 in Puerto Rico and six in St. Croix. Areas contain corals and are in some cases identified at a scale (e.g., state forest) that includes a variety of other habitat types such as mangroves, seagrass beds, and coastal wetlands.

Source: CFMC, No Date

3.9.1.1.3 West Coast Region

One FMC occurs in the West Coast Region: the Pacific FMC. EFH for various life stages of numerous fish species occur in this region, including over 90 species of groundfish such as rockfish (Sebastes), Pacific ocean perch (*Sebastes alutus*), Dover sole (*Solea solea*), arrowtooth flounder (*Atheresthes stomias*), lingcod (*Ophiodon elongatus*), sablefish (*Anoplopoma fimbria*), spiny dogfish, leopard shark (*Triakis semifasciata*), and California skate (*Raja inornata*); Pacific salmon (*Oncorhynchus* spp.); Pacific halibut (*Hippoglossus stenolepis*); HMS such as thresher sharks (*Alopias* spp.), shortfin mako shark (*Isurus oxyrinchus*), blue shark (*Prionace glauca*), tuna (*Thunnus* spp.), striped marlin (*Kajikia audax*), swordfish (*Xiphias gladius*), and mahimahi (*Coryphaena hippurus*); and coastal pelagic species such as Pacific sardine (*Sardinops sagax*), Pacific mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*), and anchovy (Engraulidae) (PFMC, No Date). Along the coast of California, EFH for aquatic macroinvertebrates has been designated for squid and several species of krill.

A large proportion of the waters in the EEZ off the coasts of Washington, Oregon, and California have been designated as EFH for the approximately 119 individual fish species within four fisheries as managed by the Pacific FMC (see **Table 3.9-6**). EFH includes all freshwater water bodies occupied by Council-managed salmon; substrate down to 3,500 m (11,483 ft) depth and estuarine and marine waters from the high tide line to the EEZ limit offshore of Washington, Oregon, and California; seamounts in depths greater than 3,500 m (11,483 ft). Areas designated as HAPCs not already identified as EFH are designated as EFH for the eggs, larvae, juveniles and/or adults for one or more of the salmon, groundfish, coastal pelagic, and/or HMS. Within these boundaries, one or more of the federally managed species are associated with water temperature regimes bounded by 13°C and 31°C; (55 and 88 °F) oxygen saturation levels greater than 60 percent; and different prey such as anchovies, squid, and herring.

HAPCs in the West Coast Region have been designated for two of the fisheries, defined primarily as habitat types as listed in **Table 3.9-6** and shown in **Figure 3.9-6**. For salmon, HAPCs include complex channels and floodplain habitats, thermal refugia, spawning habitat, estuaries, and marine and estuarine submerged aquatic vegetation. For groundfish, HAPCs include estuaries, canopy-forming kelp, seagrass, and rocky reefs plus several areas of interest which include all waters and sea bottom within the 3 nm (6 km) territorial boundary off Washington, several seamounts and banks off of Oregon and California, Monterey Canyon, and areas of the Channel Islands NMS offshore from each of the states.

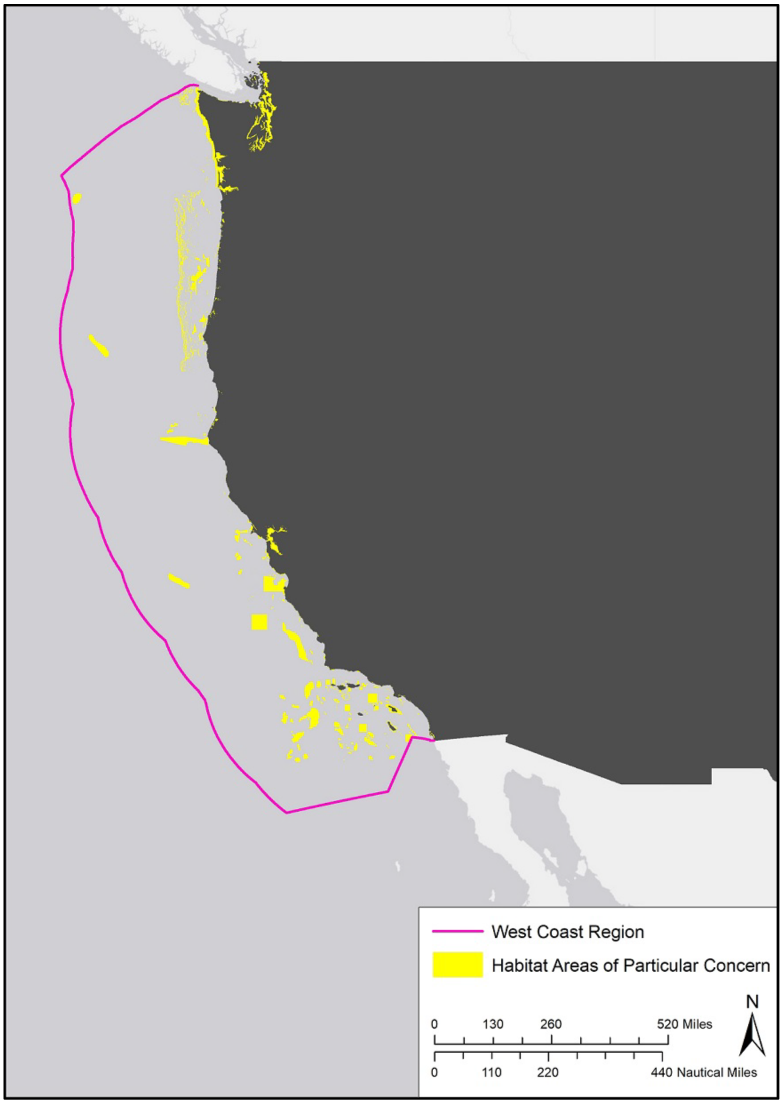
Detailed descriptions of EFH and HAPC designations in the West Coast Region are available in the Pacific FMC's four FMPs (PFMC, No Date).

Table 3.9-6. EFH and HAPCs for the West Coast Region

Fisheries	EFH	HAPC
Pacific Coast Salmon	Overall: all freshwater water bodies currently or historically occupied by Council-managed salmon within the USGS 4th field hydrologic units (HU), and estuarine and marine areas that extend from the extreme high tide line in nearshore and tidal submerged environments to the EEZ limit offshore of Washington, Oregon, and California north of Point Conception. Also, marine areas off Alaska designated as salmon EFH by the North Pacific FMC for stocks also managed by the North Pacific FMC.	Complex channels and floodplain habitats, thermal refugia, spawning habitat, estuaries, and marine and estuarine submerged aquatic vegetation. With the exception of estuaries, none of these HAPCs have been comprehensively mapped, and some may vary in location and extent over time.
Pacific Coast Groundfish	Overall: all waters and substrates down to 3,500 m (11,483 ft) depth from mean higher high water level (MHHW) on shoreline or the upriver extent of saltwater intrusion; seamounts in depths greater than 3,500 m (11,483 ft) as mapped in the EFH assessment GIS, and areas designated as HAPCs not already identified by the above criteria.	Estuaries, canopy-forming kelp, seagrass, and rocky reefs, plus several "areas of interest" which include: all waters and sea bottom from the MHHW out to the 3 nm (6 km) boundary off Washington, and several seamounts and banks off Oregon and California, Monterey Canyon, and areas of the Channel Islands National Marine Sanctuary.

Fisheries	EFH	HAPC
Coastal Pelagic Species	Overall: all marine and estuarine waters from the shoreline to the EEZ limit offshore of California, Oregon, and Washington, and above the thermocline where sea surface temperatures range between 10°C and 26°C (50 and 80 °F).	None – no HAPC has been designated for the coastal pelagic species fishery in this region.
West Coast HMS	Overall: coastal, epipelagic, mesopelagic, and oceanic waters extending beyond the 11 m (36 ft) isobath to the EEZ boundary offshore of California, Oregon, and Washington. Associated with water temperature regimes bounded by 10°C and 31°C (50 and 88 °F); and different prey such as anchovies, squid and herring.	None – no HAPC has been designated for West Coast HMS in this region.

Source: PFMC, No Date



Source: NMFS, 2019a

Figure 3.9-6. HAPCs in the West Coast Region

3.9.1.1.5 Alaska Region

One FMC occurs in the Alaska Region: the North Pacific FMC. EFH for various life stages of numerous fish species occurs in this region, including Alaskan stocks of Pacific salmon, halibut, Pacific herring (*Clupea pallasii*), and approximately 25 species of groundfish including walleye pollock (*Gadus chalcogrammus*), Greenland turbot (*Reinhardtius hippoglossoides*), sablefish, Atka mackerel (*Pleurogrammus monopterygius*), cods (*Gadus* spp.), sole, flounders (Pleuronectiformes), sculpins (Cottoidea), skates (Rajidae), and rockfish (NPFMC, No Date). In Alaskan waters of the Bering Sea and Aleutian Islands, EFH for aquatic macroinvertebrates have been established for octopus (Octopoda), weathervane scallop (*Patinopecten caurinus*), tanner crab (*Chionoecetes bairdi* and *C. opilio*), snow crab (*Chionoecetes opilio*), and red king crab (*Paralithodes camtschaticus*).

A large proportion of the waters and habitat in the EEZ off the coast of Alaska have been designated EFH for over 66 individual fish species within six fisheries as managed by the Alaska FMC (see **Table 3.9-7**). All marine waters above the entire continental shelf, slope, and deep basins off the coast of Alaska including the Gulf of Alaska (GOA), Bering Sea and Aleutian Islands (BSAI), Chukchi Sea, and Arctic Ocean from the mean higher tide line to the EEZ limit; bottom down to 100 m (328 ft) depth (inner and middle continental shelf) in Arctic waters south of Cape Lisburne, and bottom down to 200 m (656 ft) depth (inner, middle and deep shelf) in concentrated areas of the GOA and BSAI are designated as EFH for the eggs, larvae, juveniles and/or adults for one or more of the BSAI ground fish, GOA ground fish, BSAI crab, salmon, scallops and/or Arctic fisheries species. The various substrate types across the continental shelf, slope, and basins above which water column has been designated EFH include: sand, mud, rock, gravel, cobble, vegetated areas, crevices, overhangs, vertical walls, high-relief living habitats such as coral and larger sponges, and biogenic structures such as boltenia, bryozoans, ascidians, and shell hash.

HAPCs in the Alaska Region have been designated for one or more of the fisheries using a site-based approach as listed in **Table 3.9-7** and shown in **Figure 3.9-7**. These include Alaska Seamount Habitat Protection Areas, Bowers Ridge Habitat Conservation Zone, GOA Coral Habitat Protection Areas; Aleutian Islands Coral Habitat Protection Areas, GOA Slope Habitat Conservation Areas, and Skate Nursery Areas.

Detailed descriptions of EFH and HAPC designations in the Alaska Region are available in the North Pacific FMC's six FMPs (NPFMC, No Date).

Table 3.9-7. EFH and HAPCs for the Alaska Region

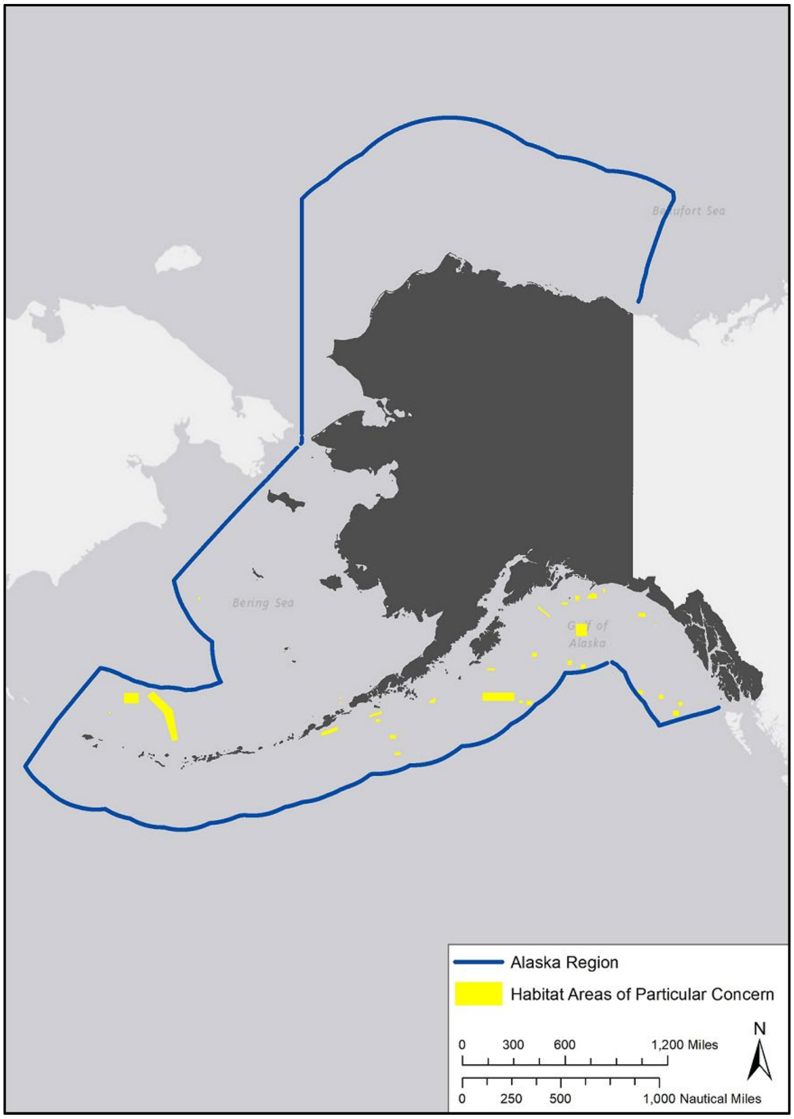
Fisheries	EFH	HAPC
Bering Sea and Aleutian Islands Groundfish	Overall: water column within bays and island passages, and along the entire shelf (0 to 200 m [0 to 656 ft]), upper, intermediate, and lower slope (200 to 3,000 m [656 to 9,843 ft) throughout the BSAI over various substrates such as sand, gravel, and cobble substrates of rock and in vegetated areas of vertical relief, such as crevices, overhangs, vertical walls, coral, and larger sponges.	Bowers Ridge Habitat Conservation Zone: Bowers Ridge and Ulm Plateau) Alaska Seamount Habitat Protection Area: Bowers Seamount
Gulf of Alaska Groundfish	Overall: water column within bays and island passages, and along the entire shelf (0 to 200 m [0 to 656 ft]), upper and intermediate slope (200 to 1,000 m [656 to 3,281 ft]) and deep shelf gulleys throughout the GOA over various substrate of rock, cobble, gravel, sands, and muds, and in vegetated areas of vertical relief, such as crevices, overhangs, vertical walls, coral, and larger sponges.	Alaska Seamount Habitat Protection Areas: Dickens, Denson, Brown, Welker, Dall, Quinn, Giacomini, Kodiak, Odyssey, Patton, Chirikof & Marchand, Sirius, Derickson, Unimak, and Bowers Seamounts. GOA Coral Habitat Protection Areas: Cape Ommaney, Fairweather Ground NW Area, and Fairweather Ground Southern Area
Bering Sea and Aleutian Islands Crab	Overall: bottom habitats along the along the entire shelf (0 to 200 m [0	Aleutian Islands Coral Habitat Protection Areas: Great Sitkin

Fisheries	EFH	HAPC
	to 656 ft]) and entire slope (200 to 3,000 m [656 to 9,843 ft]) and basins (more than 3,000 m [9,843 ft]) throughout the BSAI where there are substrates consisting of sand, mud, rock, cobble, gravel and biogenic structures such as boltenia, bryozoans, ascidians, and shell hash also coral, and vertical substrates, such as boulders, vertical walls, ledges, and deep water pinnacles.	Island, Cape Moffett Island, Adak Canyon, Bobrof Island, Ulak Island, and Semisopochnoi Island Aleutian Islands Habitat Conservation Area: the entire Aleutian Islands groundfish management subarea Alaska Seamount Habitat Protection Area: Bowers Seamount Bowers Ridge Habitat Conservation Zone: Bowers Ridge, Ulm Plateau
Alaska Scallops	Overall: the sea floor along the entire shelf (0 to 200 m [0 to 656 ft]) shelf in concentrated areas of the GOA and BSAI where there are substrates of clay, mud, sand, and gravel that are generally elongated in the direction of current flow.	Alaska Seamount Habitat Protection Areas: Dickens, Denson, Brown, Welker, Dall, Quinn, Giacomini, Kodiak, Odessey, Patton, Chirikof & Marchand, Sirius, Derickson, Unimak, and Bowers Seamounts. Bowers Ridge Habitat Conservation Zone: Bowers Ridge, Ulm Plateau GOA Coral Habitat Protection Areas: Cape Ommaney, Fairweather Ground NW Area, and Fairweather Ground Southern Area GOA Coral Habitat Protection Area Aleutian Islands Habitat Conservation Area: the entire Aleutian Islands groundfish management subarea Aleutian Islands Coral Habitat Protection Areas: Great Sitkin Island, Cape Moffett Island, Adak Canyon, Bobrof Island, Ulak Island, and Semisopochnoi Island

Fisheries	EFH	HAPC
		GOA Slope Habitat Conservation Area: Yakutat, Cape Suckling, Kayak Island, Middleton Island east, Middleton Island west, Cable, Albatross Bank, Shumagin Island, Sanak Island, Unalaska and Island.
Alaska Salmon	Overall: marine waters off the coast of Alaska from the mean higher tide line to the EEZ limit including the GOA, Eastern Bering Sea, Chukchi Sea, and Arctic Ocean along the entire shelf (0 to 200 m [0 to 656 ft]) and slope (200 to 3,000 m [656 to 9,843 ft]); estuarine areas; fresh waters identified in Alaska Department of Fish and Game's *Catalogue of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes*, and specific gravel substrate spawning areas.	Aleutian Islands Coral Habitat Protection Areas Aleutian Islands Habitat Conservation Area: the entire Aleutian Islands groundfish management subarea GOA Slope Habitat Conservation Areas Alaska Seamount Habitat Protection Areas Bowers Ridge Habitat Conservation Zone Gulf of Alaska Coral Habitat Protection Areas Skate Nursery Areas: six areas in the eastern Bering Sea where relatively high concentrations of skate eggs occur for several skate species
Arctic Fishery	Overall: pelagic and epipelagic waters from the nearshore to offshore areas along the entire shelf (0 to 200 m [0 to 656 ft]) and upper slope (200 to 500 m [656 to 1,640 ft]) throughout Arctic Ocean (including waters often associated with ice floes in deeper water, under nearshore ice in sand and gravel substrates) and bottom habitats along the inner and middle (0 to 100 m [0 to 328 ft]) shelf in Arctic waters south of Cape Lisburne wherever	None – no HAPC has been designated for the arctic fishery in this region.

Fisheries	EFH	HAPC
	there are substrates consisting mainly of mud.	

Source: NPFMC, No Date



Source: NMFS, 2019a

Figure 3.9-7. HAPCs in the Alaska Region

3.9.1.1.6 Pacific Islands Region

One FMC occurs in the Pacific Islands Region: the Western Pacific FMC. EFH for various life stages of numerous fish species occurs in this region, including bottom fish such as snappers (Lutjanidae), jacks (Carangidae), and groupers; coral reef fish (**Figure 3.9-8**) such as goatfish (Mullidae), squirrelfish and soldierfish (Holocentridae), parrotfish (Scaridae), and surgeonfish (Acanthuridae); and pelagic fish such as albacore (*Thunnus alalunga*), yellowfin tuna (*Thunnus albacares*), skipjack tuna (*Katsuwonus pelamis*), mahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), blue marlin (*Makaira nigricans*), swordfish

(*Xiphias gladius*), and sharks (Selachimorpha) (WP Council, 2019a). EFH for aquatic macroinvertebrates has been delineated for several coral reef ecosystems.

A large proportion of the marine waters in the EEZ surrounding the Hawaiian Archipelago, the Mariana Islands, American Samoa, and the Pacific Remote Island Areas (PRIAs) have been designated as EFH for over one thousand representative species within five fisheries as managed by the Western Pacific Regional FMC (see **Table 3.9-8**). EFH include the entire marine water column from the 0 to 1,000 m (0 to 3,281 ft) depth from the shoreline out to the EEZ limit, and all bottom from the shoreline down to 700 m (2,297 ft) depth around each of the U.S. Pacific Islands are designated as EFH for the eggs, larvae, juveniles and/or adults of one or more of the coral reef ecosystem, bottomfishes, crustacean, precious coral, and/or pelagic fisheries species. The types of habitats types within these EFH designations include: mangrove, lagoon, estuarine, seagrass beds, soft substrate, coral reef/hard substrate, patch reefs, surge zone, deep-slope terraces, and pelagic/open ocean.

Figure 3.9-8. Coral Reef EFH in the Pacific Islands Region

Photo Credit: NMFS

The definitions for EFH in the Pacific Islands Region changed broadly in 2019. Certain bottomfish, coral reef ecosystem, precious coral, and crustacean management unit species were reclassified as ecosystem component species, and the scientific and local names of certain species were updated (84 FR 2767, February 8, 2019).

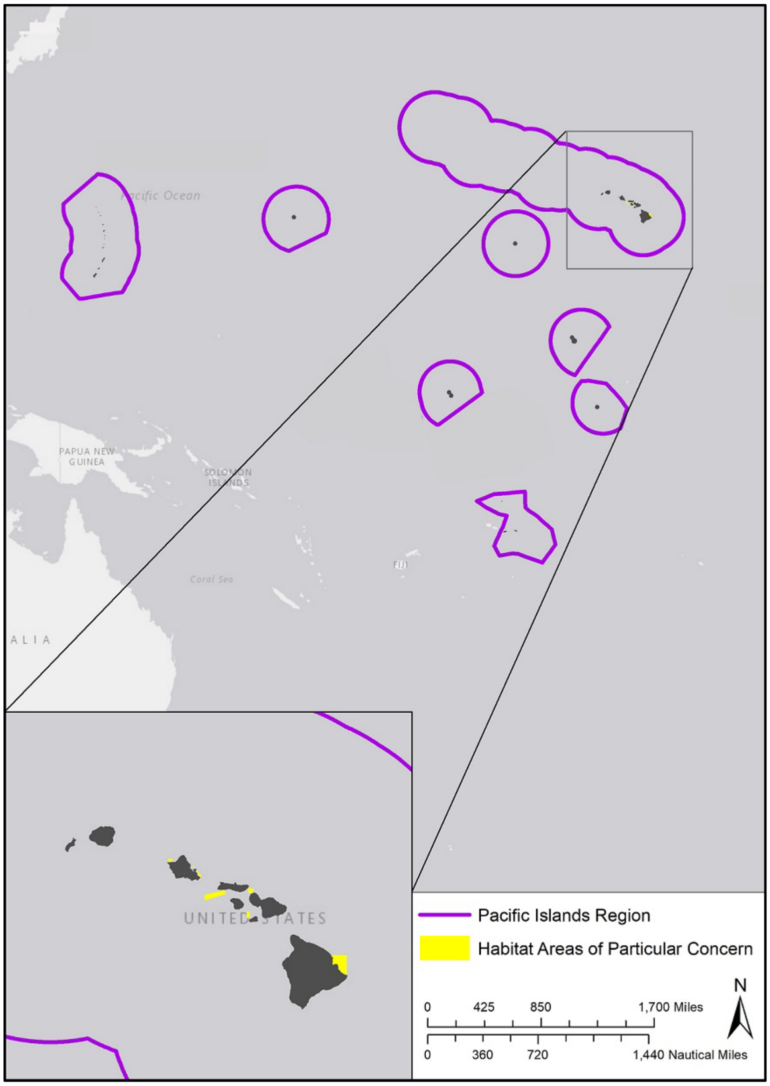
HAPCs have been designated for all fisheries primarily defined in terms of habitat types within defined depth contours as listed in **Table 3.9-8** and shown in **Figure 3.9-9**. HAPCs include the water column habitat, escarpments/slopes, banks with summits, MPAs, and research sites.

Detailed descriptions of EFH and HAPC designations in the U.S. Pacific Islands Region are available in the Western Pacific Regional FMC’s five place-based Fishery Ecosystem Plans (FEPs) for the American Samoa Archipelago, Hawai’i Archipelago, Mariana Archipelago, Pacific Remote Island Areas, and Pacific Pelagic fisheries (WP Council, 2020). Updated and amended EFH and HAPC descriptions can be found in the most current Annual Stock Assessment and Fishery Evaluation Reports for each of these five place-based fisheries (WP Council, 2019b).

Table 3.9-8. EFH and HAPCs for the Pacific Islands Region

Fisheries	EFH	HAPC
Bottomfish and Seamount Groundfish: Hawai'i Archipelago, Marianas Archipelago, American Samoa Archipelago, and Pacific Remote Island Areas regions	Overall: the water column and all bottom habitat extending from the shoreline to the outer boundary of the EEZ to a depth of 200 fathoms (400 m [1,312 ft]); and all EEZ waters and bottom habitat bounded by latitude 29°–35° north and longitude 171° E–179° west between 100 and 300 fathoms (200 and 600 m [1,312 and 1,969 ft]).	All escarpments and slopes between 20-140 fathoms (40-280 m [131-918 ft]) throughout the Western Pacific Region; three known areas of juvenile opakapaka habitat (two off Oahu and one off Molokai).
Crustaceans: Hawai'i Archipelago, Marianas Archipelago, American Samoa Archipelago, and Pacific Remote Island Areas regions	Overall: water column from the shoreline to the outer limit of the EEZ down to a depth of 75 fathoms (150 m [492 ft]) throughout the Western Pacific Region; bottom habitat from the shoreline to a depth of 50 fathoms (100m [328 ft]); associated outer reef slopes at depths between 300-700 m (984-2,297 ft).	All banks with summits less than or equal to 30 m (15 fathoms) from the surface.
Precious Corals: Hawai'i Archipelago, Marianas Archipelago, American Samoa Archipelago, and Pacific Remote Island Areas regions	Six known beds of precious corals located off Keahole Point, Makapuu, Kaena Point, Wespac bed, Brooks Bank, and 180 Fathom Bank; three black coral beds between Milolii and South Point on Hawai'i, Auau Channel between Maui and Lanai, and the southern border of Kauai.	Makapuu bed, Wespac bed, Brooks Banks bed; for Black Corals, the Auau Channel.
Coral Reef Ecosystem: Pacific Remote Island Areas region	Overall: water column and all benthic substrate from the shoreline to the outer boundary of the EEZ to a depth of 50 fathoms (100 m [328 ft]).	All no-take MPAs identified in the Coral Reef Ecosystem FMP, all Pacific remote islands, as well as numerous existing MPAs, research sites, and coral reef habitats throughout the western Pacific.
Pelagics: Pacific Remote Island Areas and Pacific Pelagic regions	Overall: water column down to a depth of 500 fathoms (1,000 m [3,281 ft]) from the shoreline to the outer limit of the EEZ.	The water column from the surface down to a depth of 500 fathoms (1,000 m [3,281 ft]) above all seamounts and banks with summits shallower than 1,000 fathoms (2,000 m [6,562 ft]) within the EEZ.

Sources: WP Council, 2019a; WP Council, 2020



Source: NMFS, 2019a

Figure 3.9-9. HAPCs in the Pacific Islands Region

3.9.2 Environmental Consequences for Essential Fish Habitat

This section discusses potential impacts of NOS activities associated with Alternatives A, B, and C on EFH, including HAPCs. Impacts on the managed species, fish (Section 3.7.2) and aquatic macroinvertebrates (Section 3.8.2), for which EFH is designated are discussed separately in their respective sections. Activities described in Sections 2.4.1 through 2.4.13 that occur on NOS projects and that could be expected to impact EFH include operation of crewed sea-going surface vessels; operation of ROVs and autonomous vehicles; use of echo sounders, ADCPs, acoustic communication systems, and sound speed data collection equipment; anchoring; collection of bottom grab samples; operation of drop/towed cameras and video systems; installation, maintenance, and removal of tide gauges and GPS reference stations; and SCUBA operations.

3.9.2.1 Methodology

Adverse effects to EFH that could result from proposed NOS activities are discussed by the stressors that may occur. These stressors include: (1) physical impacts to bottom habitat (e.g., from anchoring, collection of bottom grab samples, tide gauge installation, operation of ROVs and autonomous vehicles, and SCUBA operations); (2) increase in sedimentation, turbidity, and/or chemical contaminants (e.g., from operation of crewed sea-going vessels, operation of ROVs and autonomous vehicles, anchoring, collection of bottom grab samples, installation of tide gauges and GPS reference stations, and SCUBA operations); (3) increase in ambient sound (e.g., from operation of crewed sea-going vessels, operation of ROVs and autonomous vehicles, use of echo sounders, ADCPs, and acoustic communication systems); (4) impacts to the water column (e.g., from operation of crewed sea-going vessels, operation of 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 (5) dispersal of invasive species (e.g. from ballast water discharged during crewed vessel operation or organisms attached to hulls, equipment, and anchors). Note that use of the term "sea floor" in the analysis below also includes lake and river bottoms where NOS activities could occur.

As discussed in Section 3.2.2, significance criteria were developed for each resource analyzed in this PEIS to provide a structured framework for assessing impacts from the alternatives and the significance of the impacts. The significance criteria for EFH are shown in **Table 3.9-9**.

Table 3.9-9. Significance Criteria for the Analysis of Impacts to EFH

Impact Descriptor	Context and Intensity	Significance Conclusion
Negligible	Impacts on EFH would be temporary and minimal (e.g., placement of an object on the sea floor which increases turbidity) with no lasting damage or alteration.	Insignificant
Minor	Impacts on EFH would be easily recoverable (e.g., short-term placement of an object on the sea floor which increases turbidity or causes loss of small area of vegetation) with no long-term or permanent damage or alteration. Effects on EFH would be temporary and minimal.	
Moderate	EFH would be damaged or altered potentially over the long term but would continue to support the species reliant on it. Effects on EFH would be not temporary and not minimal.	
Major	EFH would be degraded over the long term or permanently so that it would no longer support a sustainable fishery and would cause the population of a managed species to become stressed, less productive, or unstable. Effects on EFH would be not temporary and substantial.	Significant

3.9.2.2 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, excluding survey effort in the Great Lakes, NOS projects are estimated to cover a total of 2,633,374 nm (4,877,009 km) across all five regions over the five-year period. Although the survey effort under Alternative A would vary by year (see **Table 3.5-6**), over the five-year period for proposed projects the greatest number of nautical miles surveyed would be in the Southeast Region (approximately 47 percent). The survey effort in each of the other four regions is approximately 10 percent over five years, and slightly greater in the Alaska Region where the survey effort would be somewhat higher overall (approximately 18 percent). In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location of surveys, physical contact with bottom habitat, and population density of prey, that add nuance to this trend.

Impacts of Alternative A on EFH and HAPCs are discussed below for each of the stressors introduced above. Potential impacts could occur in all of the geographic regions as EFH is extensive and covers a large majority of the EEZ. By region, there are 108 HAPC sites in the Southeast Region, 93 sites in the Greater Atlantic Region, 38 sites in the Alaska Region, 34 sites in the West Coast Region, and one site in the Pacific Islands Region. This indicates that by far the greatest number of projects, along with associated potential impacts, could occur in HAPC areas in the Southeast Region and Greater Atlantic Region, and the fewest by far could occur in the Pacific Islands Region.

3.9.2.2.1 Physical Impacts to Bottom Habitat

Activities that could result in physical disturbances or damage to the sea floor and bottom substrate consist of anchoring, collection of bottom grab samples, installation of tide gauges and remote GPS reference systems, operation of ROVs and autonomous vehicles, and SCUBA operations.

Anchoring of vessels and installation of equipment on the sea floor can cause damage to EFH/HAPCs consisting of corals and vegetated bottom, potentially reducing available structure, cover, and nutrient/food availability for dependent species. Anchor chains, or their attached chains/lines, could drag across the sea floor, potentially destroying submerged vegetation and seafloor structure, and creating a circular scour hole; the anchor itself would create a hole or divot in the bottom habitat. 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 survey launches used during NOS projects generally return to port or to the ship each day. Most vessels used by NOS would not anchor, except in an emergency, such as to avoid adverse weather conditions or in the unlikely event of an engine malfunction. Vessels would not anchor on coral reefs and would avoid anchoring in hard bottom areas in abalone critical habitat and seagrass whenever possible; thus, these sensitive habitats 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; there are approximately 55 projects with a planned anchoring component annually.

Installation of equipment on the sea floor, such as new moorings for tide buoys, would cause relatively small footprints of bottom substrate disturbance (approximately 1 square meter (3 ft), see Section 2.4.12). The disturbance could potentially create holes in the bottom sediment and damage or destruction of submerged vegetation/macroalgae and bottom structure. Additionally, infauna may be disturbed, removed, or destroyed in the immediate area where the buoy is installed. A decrease of underwater structure could reduce the availability of shelter and cover necessary for the survival or offspring development of many aquatic taxa. This could 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). During all buoy deployment and retrieval operations, buoys should be lowered and raised slowly to minimize risk to ESA-listed species and benthic habitat. 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 undertake approximately 32 projects that include tide gauge installations annually, but only a portion of these would involve installation of new moorings. Given the low number of equipment installations, the relatively small area of bottom substrate disturbance, and the large geographic separation between installations, the physical impact on bottom habitat from equipment installation is expected to be small.

Bottom sediment sample collection involves targeted removal of sediment cores in approximately 54 projects annually across 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 would not collect bottom samples for sediment verification on coral reefs or hard bottom areas. Sediment sampling activities would not target substrates such as coral reefs, seagrass beds, or hard bottom areas. Bottom sampling may adversely affect EFH through the temporary suspension of sediment and the potential removal or disturbance of infauna. Given that the sampling activities would be infrequent and geographically widespread across the action area, that the area of bottom habitat sampled would be very small (e.g., 15 x 15 cm [6 x 6 in] area and 5 cm [2 in] deep), and that physical contact with sensitive habitat would be avoided, the physical disturbance to bottom habitat associated with bottom grab sampling is expected to be minimal. Additionally, stiffer line materials would be used for instrument deployment and kept taut during operations to reduce the potential for entanglement in bottom features such as coral habitats.

ROVs and autonomous vehicles would be operated by NOS to maintain a slow speed and height above the sea floor. The use of AUVs may adversely affect EFH through unplanned contact with bottom habitats, which may cause physical damage or through the localized and temporary resuspension of bottom sediments if height above the sea floor cannot be maintained. Such adverse effects would occur accidentally and are expected to be rare.

Operations involving SCUBA divers may inadvertently disturb bottom substrates in EFH/HAPCs. NOS SCUBA operations would include approximately 248 benthic and fish monitoring projects conducted on hard bottom and coral reef habitats annually; these areas would contain shallow marine habitat characteristics necessary for many marine invertebrate and vertebrate species and are particularly sensitive to disturbances. Although SCUBA operations represent a very small component of NOS projects (mainly related to tide gauge installation/maintenance/removal projects), 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. 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.

Any damage to bottom habitat would not have lasting effects on EFH as unvegetated softbottom habitat would shift and reform and coral reefs, seagrass beds, abalone habitat, and hard bottom habitat would be avoided. In general, physical damage to the sea floor recovers within 1.5 years through water currents and natural sedimentation (Stevenson et al., 2004). Overall, activities under Alternative A that would involve physical disturbance of the sea floor and bottom habitat would continue to have **adverse** and **negligible** to **minor** impacts as the effects on EFH would be recoverable with no long-term damage or alteration. Impacts of Alternative A on EFH, including HAPCs, would be **insignificant**.

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

Activities that could result in an increase in sedimentation, turbidity, or chemical contamination consist of crewed vessel operations, operation of ROVs and autonomous vehicles, anchoring, collection of bottom grab samples, tide gauge and GPS reference station installation or maintenance/removal, and SCUBA operations.

Crewed vessel, ROV, and autonomous vehicle operations, in conjunction with all activities which physically contact bottom substrate, would increase sedimentation and turbidity in disturbed areas from bottom sediments loosened through displaced water from transiting vessels or physical contact with bottom substrate. Increased sedimentation and turbidity can potentially cause respiratory damage to aquatic species (e.g., damage to fish gills) and block sunlight necessary for photosynthesis by aquatic plants, macroalgae, and phytoplankton. These impacts could potentially lower the overall nutrient availability of affected EFH 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. Divers would not stand or rest on live corals/coral reefs, and bottom contact would only be in unconsolidated areas or non-living hard bottom. NOS would ensure that all instruments placed in contact with the sea floor are properly secured to minimize bottom disturbance.

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 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 EFH from reduced nutrient and cover availability. Since most fish can avoid highly turbid areas, they may temporarily relocate to undisturbed areas until suspended sediments settle. 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).

An increase in chemical contaminants can reduce fitness and cause mortality of exposed organisms. Often, contaminants entering the marine environment are lighter than water, and thus float on the surface where most of them evaporate within a few days (Neff et al., 2000). However, this property of some contaminants may lead to greater exposure of seagrass ecosystems which could cause extensive mortality of the seabed, with the associated loss of juvenile fish and invertebrates due to the loss of habitat (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 prey species such as aquatic macroinvertebrates and fish.

For those chemical contaminants that sink, the effects on coral colonies may include mortality, tissue death, reduced growth, impaired reproduction, bleaching, and reduced photosynthetic rates (Cook and Knap, 1983; Burns and Knap, 1989; Ballou et al., 1987). The effects of chemical contaminants and sedimentation/turbidity would range from superficial exposure of fish and aquatic macroinvertebrates to ingestion, sub-lethal effects and reduced fitness (due to adverse effects on sensory systems, growth, behavior, and/or bio-accumulation), and fatality. 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 EFH 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. To minimize impacts, all hazardous or regulated materials would be handled in accordance with applicable laws, and crew members would be appropriately trained in materials storage and usage.

Mortality of phytoplankton and zooplankton from oil and fuel spills could indirectly affect marine mammals which feed on them. However, even if a large amount of plankton were affected, it can recover rapidly due to high reproductive rates, rapid replacement by cells from adjacent waters, widespread distribution, and exchange with tidal currents. Thus, the impact of changes in water quality, including an accidental spill on a pelagic phytoplankton community would not be substantial.

Operation of crewed vessels and of ROVs and autonomous vehicles may result in discharge (mostly unintentional) of harmful substances including bilge water, debris, fuel, oil, and miscellaneous chemicals. NOS would undertake projects covering 518,000 nm (959,000 km) of crewed vessel operations annually and 28,600 nm (53,000 km) of ROV and autonomous vehicles movement annually. In shallow waters, propellers from boats can cause increased turbidity and contamination by resuspending bottom materials. Equipment such as AUVs would be programmed and operated so as to avoid seafloor disturbance. 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 applicable laws and regulations pursuant to MARPOL 73/78 that restrict onboard hazardous material use and the discharge of contaminants into the marine environment, and that the probability of accidental fuel spills is very low, increases in sedimentation, turbidity, and chemical contamination would be relatively small, especially when compared to similar disturbance and discharges from the much greater number of all other vessels occurring in the EEZ, lakes, and rivers.

Installation and removal of tide gauges on land along the shoreline could also increase the turbidity, sedimentation, and chemical contamination of the water column through run-off of any soil disturbed during installation/removal on land and disturbance of bottom sediments from new buoy moorings in the water. The installation of buoys may have adverse impacts on EFH through direct contact with the sea floor or nearby habitat. During the installation process, temporary increases in sedimentation and turbidity may occur through the suspension of bottom sediments or drill cuttings (i.e., particles of rock/hard bottom). 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. However, when a tide gauge is installed on land, it would be located beyond the mean high tide line so any disturbed sediments from installation would not reach the water. NOS would undertake approximately 32 projects that include tide gauge installations annually, and 30 projects that include tide gauge removal annually. Given that the activities would be conducted infrequently and geographically widespread across the action area, that the footprints of disturbance would be small, and that installation and removal procedures would be applied to control sediment runoff, increases in turbidity and sedimentation are expected to be minimal.

Anchoring (in approximately 55 projects annually), bottom grab sampling (approximately 54 projects annually), and other physical contact with bottom habitat may stir up sediments resulting in increased turbidity and sedimentation. The footprints of impact on bottom sediments would be relatively small and the sediment stirred up limited in quantity. NOS would ensure that anchors are properly secured so as to minimize bottom disturbance. Any sediments that are re-suspended would likely settle back to the sea floor relatively quickly (within seconds or minutes in the immediate area) following disturbance; fine sediments, however, may drift and disperse. Given that bottom sediments would be stirred up infrequently and activities would be dispersed across the widespread action area, increases in turbidity and sedimentation are expected to be minimal.

Changes in water quality from increased sedimentation, turbidity, and chemical contamination due to these activities would include short-term reductions in water clarity and light availability that would subside shortly after activities cease. Any discharges released during vessel operation would be minimized through adherence to MARPOL laws and regulations. Overall, the likelihood of occurrence of an accidental fuel spill from a vessel used by NOS would continue to be very low. Along with the activities under Alternative A that would increase sedimentation, turbidity, and/or chemical discharges in EFH, this scenario would continue to have **adverse** and **negligible** impacts as water quality in EFH would be able to recover with no long-term damage or alteration. In the event that an accidental spill does occur, the volume of oil, fuel, and/or chemical contaminants would be fairly small given the amounts of fuel and other chemicals that vessels used by NOS typically carry for onboard consumption, and along with handling hazardous and regulated materials in accordance with applicable laws, and having crew members appropriately trained in materials storage and usage, the impact on EFH would be **adverse** and **minor**. Impacts of Alternative A on EFH, including HAPCs, would continue to be **insignificant**.

3.9.2.2.3 Increase in Ambient Sound

Activities that could result in an increase in underwater sound consist of operation of crewed vessels, operation of ROVs and autonomous vehicles, and use of underwater acoustic equipment including echo sounders, ADCPs, and acoustic communication systems. Increases in underwater sound may adversely affect different life stages of fish and aquatic macroinvertebrate prey species (prey is a potential habitat characteristic of EFH). See Section 3.7 Fish and Section 3.8 Aquatic Macroinvertebrates for full discussions of the hearing capabilities of fish and aquatic macroinvertebrates and the potential impacts on these species from vessel sound and underwater acoustic sources. 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.

Operation of crewed vessels (approximately 518,000 nm [959,000 km] annually) and of ROV and autonomous vehicles (approximately 28,600 nm [53,000 km] annually) would generate underwater sound and vibrations at low- to mid-frequencies that overlap with the hearing ranges of aquatic prey species. Underwater sound would not adversely affect structural EFH but may affect mobile fish that are prey species by temporarily altering behavior. Behavioral changes can result in animals leaving feeding or breeding grounds (Slabbekoorn et al., 2010) or becoming more susceptible to mortality through decrease predator-avoidance responses (Simpson et al., 2016). Noise can also mask biologically important sounds and alter the natural soundscape, cause hearing loss, and/or have an adverse effect on an organism's stress levels and immune system (NOAA, 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. However, the exposure of prey species to vessel sound would be limited for aquatic macroinvertebrates (see Section 3.8), somewhat greater for fish but still with negligible to minor impacts (see Section 3.7), and the responses temporary in nature as activities would be infrequent in any given area and geographically widespread across the entire action area. Furthermore, the potential effects of sounds associated with vessel operations, which would be infrequent in any given area and at the most represent only a negligible proportion of total vessel traffic in the action area (Section 2.4.1), would be minimal as compared to the effects from sound generated by all other ship traffic in the EEZ. The overall contribution to background sound in the ocean from vessels used by NOS would be negligible. 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. 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 EFH 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 EFH as those discussed in the preceding paragraph. NOS would annually undertake projects covering 479,000 nm (887,000 km) of single beam, multibeam, and side scan sonar use; approximately 3,210 nm (5,940 km) of sub-bottom profiler use; approximately 5,890 nm (10,900 km) using ADCPs; and approximately 24 projects using acoustic communication systems. As with vessels, sound from underwater acoustic sources would not adversely affect structural EFH but may temporarily alter the behavior of mobile fish that are prey species. All of these instruments involve the production of an acoustic signal, but they are usually only operated while a ship is in motion, so any area would be exposed to acoustic energy for a very short duration. Furthermore, many of the associated sounds would be intermittent in use and highly directional in nature, and the energy of the signal would drop off rapidly with distance from the source (as opposed to the low frequency sounds emitted by vessels which can travel farther in water). Thus, any potential impacts on prey species would be limited to temporary behavioral and stress-startle responses. Also, more importantly, adverse impacts are unlikely to occur due to the much higher frequencies of these instruments relative to the hearing capabilities of most prey species, except for a few species of shad and herring (as discussed in Section 3.7 Fish).

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 the most prey species, thus unlikely to cause behavioral disturbance and hearing impairment. Thus, activities under Alternative A that would create underwater sound would continue to have **adverse** and **negligible** to **minor** impacts on EFH. Impacts of Alternative A on EFH, including HAPCs, would continue to be **insignificant**.

3.9.2.2.4 Impacts to Water Column

Impacts to the water column could be caused by vessels or equipment moving through the water column in activities including operation of crewed sea-going vessels, operation of 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.

NOS would undertake projects covering 518,000 nm (959,000 km) annually with operation of crewed vessels and projects covering 28,600 nm (53,000 km) annually with ROVs and autonomous vehicles. Wakes from crewed sea-going vessels and from ROVs and autonomous vehicles would create turbulence and generate wave and surge effects in the water column where habitat gradients would be temporarily disrupted, 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 EFH. Disruptions could also potentially affect food chains and ultimately reduce the overall biodiversity of affected areas. However, the vast majority of impacts to EFH 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. Also, all vessels in coastal waters would operate in a manner to minimize propeller wash and seafloor disturbance, and transiting vessels would follow deep-water routes (e.g., marked channels), as practicable.

Instruments and gear that interact with the water column, including sound speed data collection equipment, bottom grab samplers, drop/towed cameras, and 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 EFH. 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 submerged aquatic vegetation such as seagrass and 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, but mainly as a component of tide gauge installation/maintenance/removal, would move through the water column, temporarily disturbing both vertebrate and invertebrate prey species. The vast majority of impacts to EFH 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 prey species would likely only be minimally displaced from project areas as they would not likely move too far away and are expected to return once water column turbulence ceases; they would not experience long-term changes in the availability of space, structure, shelter, or nutrients outside the range of natural variability.

Impacts to the water column from vessels and equipment under Alternative A would continue to be **adverse** and **negligible** as effects on EFH would be easily recoverable with no long-term damage or alteration. Impacts of Alternative A on EFH, including HAPCs, would continue to be **insignificant**.

3.9.2.2.5 Dispersal of Invasive Species

Dispersal of invasive species could be caused by ballast water discharged during crewed vessel operation, or organisms attached to hulls, equipment, and anchors. The use of the same physical equipment and instruments in geographically disparate regions could potentially facilitate the dispersal and establishment of invasive species in new areas.

Invasive species can outcompete, displace native species, and alter biodiversity and ecosystem function. Invasive species such as zebra mussels (*Dreissena polymorpha*) and lionfish (*Petrois* spp.) have large numbers of offspring and limited or no natural threats or predators outside of their native habitat, allowing them to outcompete locally native species for space and nutrients (TISI, 2014). Invasive seagrass can displace native species of seagrass, affect fish species assemblage, and decrease fish abundance through associated changes in habitat complexity (Becking et al., 2014). Additionally, invasive algae can overgrow and kill coral through smothering and shading, resulting in the reduction in biodiversity and coral cover (RRN, 2022). 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.

NOS would undertake projects covering 518,000 nm (959,000 km) of crewed vessel operations annually and 28,600 nm (53,000 km) of ROV and autonomous vehicles movement annually. NOS projects would occur in all 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).

While NOS vessel operations may unintentionally introduce or spread invasive species, the most common pathways for the introduction of invasive species in marine systems is shipping (i.e., ballast water and hull biofouling), aquaculture, canal construction, aquarium trade, and the live seafood trade (Molnar et al., 2008). The impact of NOS activities would be miniscule in comparison, and it is unlikely that NOS activities would involve the release of ballast water discharge. Vessel operations could also contribute to the spread of invasive and nuisance species through hull fouling and anchoring. Anchoring may dislodge non-native or nuisance algae or seagrass, facilitating its spread; however, anchoring would be conducted infrequently. NOS equipment and instruments used in consecutive projects in disparate geographically areas could also potentially serve as transmission vectors for invasive species. However, 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, thus limiting the potential impact to EFH in the action area.

All NOS projects, however, would include 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. NOS project vessels, 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.

Given the relatively low likelihood of occurrence, the adverse impact on EFH, including HAPCs, of invasive species dispersal facilitated by NOS activities under Alternative A would continue to be **adverse** and **negligible** to **minor**, and therefore **insignificant**.

3.9.2.2.6 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 NOS fiscal year 2019 funding levels. Since the effects of impact causing factors on EFH range from negligible to minor, the overall impact of Alternative A on EFH, including HAPCs, would be **adverse** and **minor**; thus, impacts of Alternative A would be **insignificant**.

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

The same stressors on EFH considered under Alternative A are considered under Alternative B. Under Alternative B, all of the projects and equipment operations proposed in Alternative A would continue but at a higher level of effort, although the percentage of nautical miles covered by projects in each region would be the same as under Alternative A. Thus, the greatest level of effort would be in the Southeast Region (with over 50 percent of the survey effort); 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). In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location of surveys, physical contact with bottom habitat, and population density of prey, that add nuance to this trend.

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 and activities, and thus more nautical miles traveled, than Alternative A. Under Alternative B, excluding survey effort in the Great Lakes, NOS projects would cover a total of 2,896,712 nm (5,364,710 km) across all five regions over the five-year period. Overall, vessels used by NOS would cover an additional 263,337 nm (487,701 km) under Alternative B (see **Table 3.5-14**) as compared to Alternative A (2,633,374 nm [4,877,009 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 a matter of scale with an increased activity level, although distributed unevenly among the different types of activities, leading to a corresponding, incremental increase in effects under Alternative B as compared to Alternative A.

For example, under Alternative B there would be projects using 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 could contribute to impacts on EFH related to increases in sedimentation/turbidity, and/or chemical contamination, increases in sound, and impacts to the water column. Although the amount of crewed vessel operations would be greater under Alternative B than under Alternative A, additional crewed vessel operations projects covering 59,000 nm (111,000 km) across five regions would result in greater impacts overall, but not so great that the magnitude of a particular impact-causing factor would increase (e.g., from negligible to minor). This would also be the case for other proposed activities contributing to potential impacts, such as underwater acoustic sound from echo sounders, ADCPs, and acoustic communication systems; and bottom disturbance from anchoring, collection of bottom grab samples, tide gauge installation, and SCUBA operations.

Although NOS would add more widespread adoption of new techniques, protocols, and technologies to more efficiently perform surveying, mapping, charting, and related data gathering under Alternative B as compared to Alternative A, impacts of Alternative B on EFH and HAPCs would be the same or slightly, but not appreciably, larger than those discussed above under Alternative A for each stressor. Overall, impacts of Alternative B on EFH would be **adverse, minor,** and **insignificant**.

3.9.2.4 Alternative C: Upgrades and Improvements with Greater Funding Support

The same stressors of EFH considered under Alternatives A and B are considered under Alternative C. Under Alternative C, all of the projects and equipment operation proposed in Alternatives A and B would continue but at a higher level of effort, although the percentage of nautical miles in each region would be the same as under Alternatives A and B. In addition, there would be an overall funding increase of 20 percent relative to Alternative B, thus the level of project activity would increase further. The greatest level of effort would be in the Southeast Region (with over 50 percent of the survey effort); the other four regions would be at similar levels of effort (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). In general, it is expected that level of effort and overall impacts trend together (i.e., greater impacts where the survey effort is higher), but there are other factors, such as location of surveys, physical contact with bottom habitat, and population density of prey, that add nuance to this trend.

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, and thus more nautical miles traveled, than Alternatives A and B. Under Alternative C, excluding survey effort in the Great Lakes, NOS projects would cover a total of 3,160,049 nm (5,852,411 km) across all five regions over the five-year period. Overall, there would be an additional survey effort of 263,337 nm (487,701 km) covered by vessels used by NOS under Alternative C (see **Table 3.5-21**) as compared to Alternative B (2,896,712 nm [5,364,710 km] total), and an additional 526,675 nm (975,402 km) as compared to Alternative A (2,633,374 nm [4,877,009 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 across all regions over the five-year period. Therefore, the difference between the alternatives is a matter of scale with an increased activity level, although distributed unevenly among the different types of activities, leading to a corresponding, incremental increase in effects under Alternative C as compared to Alternatives A and B. As discussed under Alternative B, the additional projects and nautical miles traveled under Alternative C across all five regions would result in greater impacts on EFH overall, but not so great that the magnitude of a particular stressor would increase (e.g., from negligible to minor).

Alternative C would be similar to Alternative B, plus it would consist of NOS program implementation with an overall funding increase of 20 percent relative to Alternative B. However, impacts of Alternative C on EFH and HAPCs would be the same or slightly, but not appreciably, larger than those discussed above under Alternatives A and B for each stressor. Overall, impacts of Alternative C on EFH would be **adverse, minor,** and **insignificant**.

3.9.2.5 Conclusion

Proposed NOS projects in the action area across all five regions would be associated with physical impacts to bottom habitat, increases in sedimentation, turbidity, and/or chemical contamination, increases in underwater sound, impacts to the water column, and dispersal of invasive species.

A subset of NOS projects would involve physical contact with the sea floor. Where this results in physical disturbance to bottom habitat, the disturbance is expected to be temporary and negligible to minor in nature. The adverse effects from physical disturbance on EFH are expected to be temporary and minimal.

The NOS projects with a potential to increase sedimentation, turbidity, and chemical contamination in EFH would be geographically widespread and expected to result in only temporary to short-term, localized, and negligible to minor reductions to water quality. Additionally, the likelihood of occurrence of an accidental spill from a vessel used by NOS would be very low. Thus, the adverse effects from an increase in sedimentation, turbidity, and chemical contamination in EFH would be temporary and minimal.

Sound generated by proposed NOS underwater acoustic sources would be well above the hearing frequencies of the majority of prey species and managed species. The active sources in the mid-frequencies would be within hearing of a few species, such as Atlantic herring, and the passive and incidental sources that generate sounds in the low-level frequencies would be within the hearing range of most prey and managed species. However, these sound sources would be infrequent, geographically widely distributed, and the sound emitted would be miniscule compared to all other vessel sound in the EEZ. The sounds that are audible to prey and managed species, most of which would be associated with vessel operations, would likely elicit negligible to minor responses as many of the sounds would be temporary in duration and not likely detectable at an appreciable distance from vessels used by NOS. Thus, the adverse effects from increased sound on EFH would be temporary and minimal.

Impacts to the water column would temporarily cause destratification and turbulence, could disturb or displace nearby benthic communities and other prey species, and could damage or kill submerged aquatic vegetation. However, NOS projects would be geographically widespread and expected to result in only temporary, localized, negligible impacts on the water column. Thus, adverse effects on EFH would be temporary and minimal.

Dispersal of invasive species could cause displacement of native species and altered biodiversity and ecosystem function in EFH. However, it is unlikely that NOS activities would involve the release of ballast water discharge, anchoring would be conducted infrequently, and NOS project crews would implement mandatory invasive species control procedures to limit or avoid hull fouling. Given the low likelihood of occurrence, the adverse effects from invasive species dispersal in EFH would be minimal.