Technical Report

Essential Fish Habitat Assessment

Revolution Wind Offshore Wind Farm

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List of Acronyms

ASMFC	Atlantic States Marine Fisheries Commission
CMECS	Coastal and Marine Ecological Classification Standard
EEZ	exclusive economic zone
EFH	essential fish habitat
ESA	Endangered Species Act
HAPC	Habitat Area of Particular Concern
ICCAT	International Commission for the Conservation of Atlantic Tunas
IPF	impact-producing factor
Lease	Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf OCS-A 0486
Lease Area	BOEM-designated Renewable Energy Lease Area OCS-A 0486
MEC	munitions and explosives of concern
MHW	mean high water
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NOAA Fisheries	National Marine Fisheries Service
O&M	operations and maintenance
OCS	Outer Continental Shelf
OnSS	onshore substation
OSS	offshore substation
Project	Revolution Wind Farm Project
Project Area	Proposed Wind Farm Area, Export Cable Corridor, and all onshore project facility locations including the Onshore Transmission Cable Corridor, and Onshore Substation
RIGIS	Rhode Island Geographic Information System
RWEC	Revolution Wind Farm Export Cable
RWEC-RI	Revolution Wind Farm Export Cable-Rhode Island State Waters
RWEC-OCS	Revolution Wind Farm Export Cable-Outer Continental Shelf
RWF	Revolution Wind Farm

TJB	transition joint bay
U.S.C.	United States Code
UXO	unexploded explosive ordnance
WTG	wind turbine generator

1.0 INTRODUCTION

1.1 Description of the Proposed Action

Revolution Wind, LLC (Revolution Wind), a 50/50 joint venture between Orsted North America Inc. (Orsted NA) and Eversource Investment LLC (Eversource), proposes to construct and operate the Revolution Wind Farm Project (hereinafter referred to as the Project). The wind farm portion of the Project will be located in federal waters on the Outer Continental Shelf (OCS) in the designated Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0486 (Lease Area). The Lease Area is approximately 20 statute miles (mi) (17.4 nautical miles [nm], 30 kilometers [km]) south of the coast of Rhode Island (Figure 1.1-1).

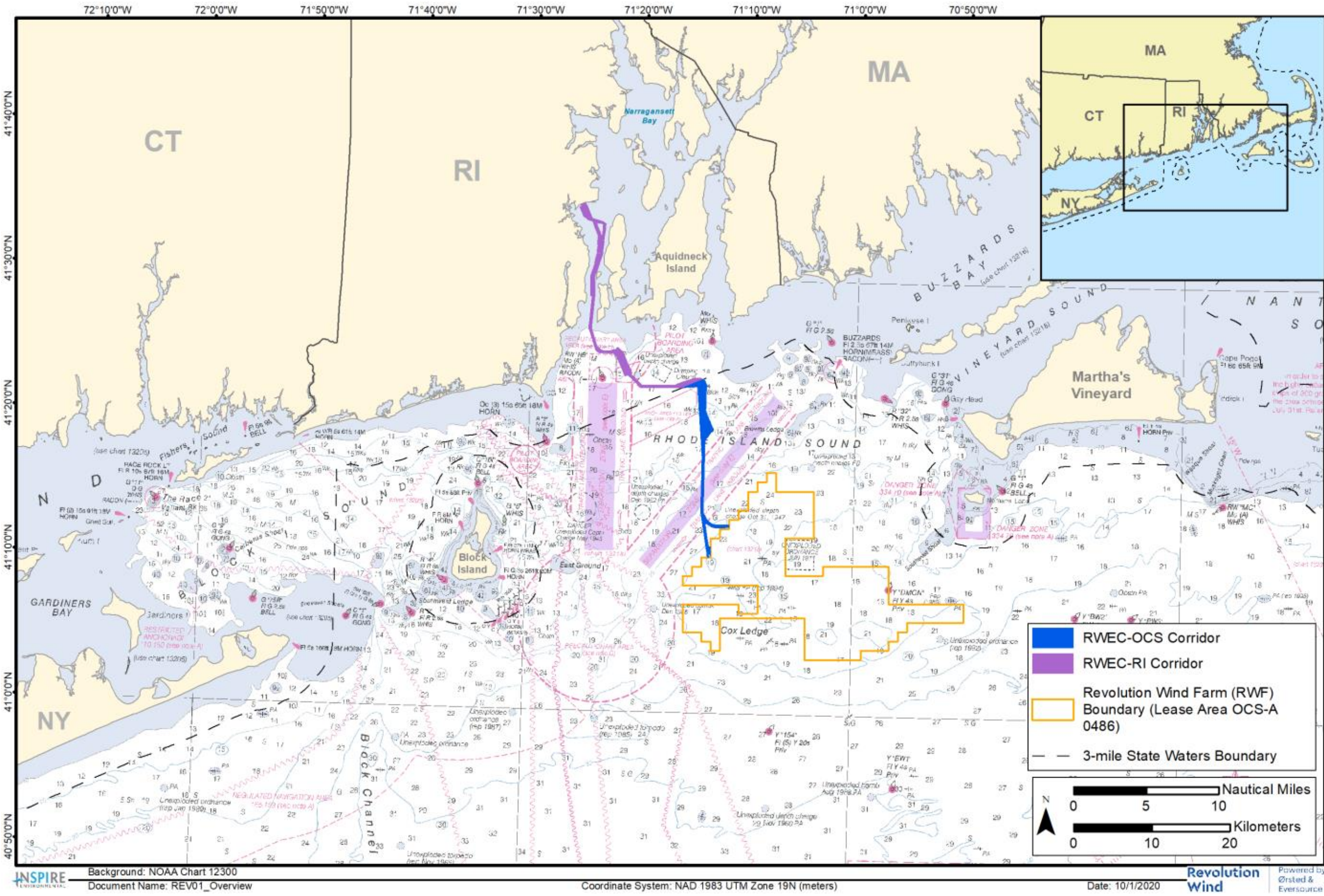

Figure 1.1-1 Map of the Project Area, including the Potential Export Cable Corridor and Revolution Wind Farm.

The Project will be comprised of both offshore and onshore components, which are described in detail in Section 3 of the Construction and Operations Plan.

Offshore:

- up to 100 Wind Turbine Generators (WTGs) connected by a network of Inter-Array Cables (IAC);
- up to two Offshore Substations (OSSs) connected by an OSS-Link Cable; and

- up to two submarine export cables (referred to as the RWEC), generally co-located within a single corridor.

Onshore:

- a landfall location located at Quonset Point in North Kingstown, Rhode Island (referred to as the Landfall Work Area);
- up to two underground transmission circuits (referred to as the Onshore Transmission Cable), co-located within a single corridor; and
- a new Onshore Substation (OnSS) located adjacent to the existing Davisville Substation with up to two interconnection circuits (overhead or underground) connecting the OnSS to the existing substation.

The Project's components are further grouped into four general categories: the Revolution Wind Farm (RWF), inclusive of the WTGs, OSSs, IAC, and OSS-Link Cable; the RWEC–OCS, inclusive of up to 25 mi (40 km) of the RWEC in federal waters; the RWEC–RI State Waters, inclusive of up to 23 mi (37 km) of the RWEC in state waters; and Onshore Facilities, inclusive of an up to 328-foot (ft) (100-meter [m]) segment of the RWEC, Landfall Work Area, Onshore Transmission Cable, and OnSS (including interconnection circuits). Power from the RWF will be delivered to the electric grid via two distinct transmission cable segments: the RWEC and the Onshore Transmission Cable. The intersect of the RWEC and Onshore Transmission Cable will occur at co-located transition joint bays (TJBs), which will be located at the Landfall Work Area. Multiple landfall sites are currently being evaluated within the Landfall Work Area.

The Project will be commissioned and operational by end of Q4 2023. Revolution Wind assumes all permits will be obtained in Q3 2022. It is further assumed construction will begin by the end of Q3 2022 with installation of the onshore components and initiation of seabed preparation activities (clearing of debris and obstructions).

1.2 Regulatory Context and Resource Definition

Coastal and marine natural resources in the United States are governed and managed by multiple entities at the federal, state, interstate, and tribal level. The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), passed in 1976, established eight regional fishery management councils for the conservation and management of fisheries from 3 to 200 miles (4.8 to 322 km, 2.6 to 133.8 nm) off the U.S. coast. Fisheries and stocks within 3 nm (5.6 km) of shore are managed by state governments. In the greater Atlantic region, management of certain fisheries that are shared coastal resources is coordinated through the Atlantic States Marine Fisheries Commission (ASMFC). The MSFCMA was revised and amended in 1996 with the passage of the Sustainable Fisheries Act to strengthen conservation and increase the focus on sustainability, in part by requiring the identification of essential fish habitat (EFH) (16 United States Code [U.S.C.] 1801-1884). The MSFCMA was again revised and reauthorized in 2007, with additional conservation and management requirements to further the effort against overfishing, support conservation, and improve fisheries science research (16 U.S.C. 1801-1884).

The MSFCMA was established, along with other goals, to promote the protection of EFH in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined in the MSFCMA as those waters (e.g., aquatic areas and their associated physical, chemical, and biological properties used by fish) and substrate (e.g., sediment, hard bottom, underlying structures, and associated biological communities) necessary for the spawning, feeding, or growth to maturity of managed fish species. Managed species include marine, estuarine, and anadromous finfish; mollusks; and crustaceans.

1.3 Regulatory Coordination and Required Permits

Federal agencies that authorize, fund, or undertake activities that may adversely affect EFH must consult with the National Oceanic Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries). An adverse effect includes direct or indirect physical, chemical, or biological alterations, including changes to waters or substrate, species and their habitat, other ecosystem components, or the quality and/or quantity of EFH. Although absolute criteria have not been established for conducting EFH consultations, the guidelines issued by NOAA Fisheries recommend consolidated EFH consultations with interagency coordination procedures required by other statutes, such as the National Environmental Policy Act (NEPA) or the Endangered Species Act (ESA), to reduce duplication and improve efficiency. Generally, the EFH consultation process includes the following steps:

1. Notification – The action agency provides notification of the action to NOAA Fisheries.
2. EFH Assessment – The action agency prepares and submits an EFH Assessment that includes both identification of affected EFH and an assessment of effects. Required elements of the assessment include a description of the proposed action; an analysis of the potential adverse effects of that action on EFH and the managed species; the federal action agency's conclusions regarding the effects of the action on EFH; and proposed environmental protection measures, if applicable.
3. EFH Conservation Recommendations – After reviewing the EFH Assessment, NOAA Fisheries provides recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH.
4. Agency Response – Within 30 days of receiving the recommendations, the action agency must respond to NOAA Fisheries with information on how it will proceed with the action. The response must include a description of measures proposed by the agency to avoid, mitigate, or offset the impact of the activity on EFH. For any conservation recommendation that is not adopted, the action agency must explain its reason to NOAA Fisheries for not following the recommendation.

This technical report was prepared to provide federal permitting authorities (e.g., BOEM, ACOE) with the information necessary to complete EFH consultation with NOAA Fisheries, as well as to facilitate BOEM's review of the Project under NEPA.

1.4 Contents of This Technical Report

Section 2.0 of this technical report describes the species and life stages with designated EFH, as well as Habitat Areas of Particular Concern (HAPCs), that may occur within the RWF area and/or the RWEC corridor. Potential impacts and environmental protection measures are discussed in Section 3.0.

2.0 AFFECTED ENVIRONMENT

2.1 Methodology

EFH data and text descriptions were downloaded from the NOAA Habitat Conservation EFH Mapper, an online mapping application (NOAA Fisheries, 2019a) and supplemented with additional literature sources where necessary. EFH data were queried using GIS software based on RWF and RWEC Project components and manually verified. A 0.5-mile buffer centered on the RWEC route was assumed in order to query the data.

2.2 Baseline Conditions

2.2.1 Offshore

The RI-MA WEA is located offshore on the northeastern Atlantic continental shelf in Rhode Island Sound. The waters in the vicinity of the RWF and RWEC are transitional waters that separate Narragansett Bay and Long Island Sound from the outer continental shelf (OCS). Organisms that inhabit in these areas are adapted to survive in this dynamic environment. In general, the benthic communities of these OCS areas are diverse, with lower densities of organisms than in the northern portion of the Mid-Atlantic Bight and in deeper areas of the OCS (MMS, 2007). The RI-MA WEA is composed of a mix of soft and hard bottom environments defined by dominant sediment grain size and composition. Due to light requirements, SAV beds are limited to shallower depths and thus, do not occur within the RI-MA WEA. However, SAV beds are found in parts of Narragansett Bay, Rhode Island, through which the RWEC-RI transits before making landfall.

Based on data from site-specific benthic habitat surveys conducted for the Project (Benthic Assessment; INSPIRE Environmental, 2020), across the vast majority of the RWEC-OCS and the northern region of the RWF, the predominant habitat type was sand sheet, aside from a cluster of 4 stations in the northern center of the RWF that consisted of a variety of habitat types including patchy pebbles on sand with mobile gravel, patchy cobbles and boulders on sand, and sand with mobile gravel. Other regions of the RWF such as the southwest region of the RWF and the central and southern portions of the RWF, tended to have more heterogeneous habitat types composed of patchy pebbles on sand with mobile gravel, patchy cobbles on sand, and patchy boulders on sand. As a result of the more heterogeneous physical composition and generally coarser substrates, these benthic environments harbored more diverse epifaunal assemblages compared to the northern region of the RWF and the RWEC-OCS stations.

In general, stations sampled along the RWEC-RI were low in environmental complexity, consisting mainly of sand sheet habitat type. The exception was stations located in central Narragansett Bay, which were characterized by the Coastal and Marine Ecological Classification Standard (CMECS) Biotic Subclass Attached Fauna and included the habitat types of mollusk bed (or shells) on mud and patchy cobbles on sand. Along the RWEC-RI there were spatial trends associated with the observed biological and physical features. The up-estuary stations were generally characterized by finer substrate, dominated by soft-sediment fauna, higher turbidity, and more reduced sediments. The mid-bay stations were characterized by mussel and *Crepidula* beds with other attached organisms including barnacles, sponges, and macroalgae. The stations at the mouth of Narragansett Bay and the stations leading offshore to the 3-mile state water boundary were generally dominated by soft sediment infauna.

Benthic communities have experienced increased water temperatures in the Project Area in the past several decades, and average pH is expected to continue to decline as seawater becomes more saturated with carbon dioxide (Saba et al., 2016). Acidification of seawater is associated with decreased survival and health of organisms with calcareous shells (such as the Atlantic scallop, blue clam, and hard clam), but less is known about direct effects of acidification on cartilaginous and bony fishes.

Modeled scenarios of decreasing seawater pH predict a substantial decline in the harvestable stock of the Atlantic scallop, with collateral loss of economic value (Rheuban et al., 2018). Numerous benthic and pelagic species are predicted to shift their ranges northward and into deeper waters in response to increasing water temperatures

(Selden et al., 2018; Kleisner et al., 2017). The ranges of dozens of groundfish species in New England waters have shifted northward and into deeper waters in response to increasing water temperatures (Pinsky et al., 2013; Nye et al., 2009) and more species are predicted to follow (Selden et al., 2018; Kleisner et al., 2017). The black sea bass, identified as particularly sensitive to habitat alteration (Guida et al., 2017), has been increasing in abundance over the past several years, and is expected to continue its expansion in southern New England as water temperatures increase (Kuffner, 2018; McBride et al., 2018). Several pelagic forage species have been increasing in the Project Area, including butterfish, scup, squid (Collie et al., 2008) and Atlantic mackerel (McManus et al., 2018). Perhaps counterintuitively, distributions of other species are reported to be shifting southward, including spiny dogfish, little skate, and silver hake (Walsh et al., 2015). It has been suggested that the spiny dogfish may replace the Atlantic cod as a major predator in southern New England as the cod is driven north by warm waters that the spiny dogfish tolerates well (Selden et al., 2018). Further temperature increases in southern New England are expected to exceed the global ocean average by at least a factor of two, and ocean circulation patterns are projected to change (Saba et al., 2016). Distributional shifts are occurring in both demersal and pelagic species, perhaps mediated by changes in spawning locations and dates (Walsh et al., 2015). Southern species, including some highly migratory species such as mahi that prefer warmer waters, are expected to follow the warming trend and become more abundant in the area (Walsh et al., 2015; South Atlantic Fishery Management Council, 2003). Climate change may also be affecting the migrations of anadromous fish in the region. The herrings, shad, and sturgeon were identified as having high biological sensitivity to adverse effects of climate change (Hare et al., 2016). In addition to physiological effects of temperature and pH, anadromous fishes face a physical risk caused by flooding in their spawning rivers.

Modeling predicts that bottom temperatures in southern New England will become too warm to support larval development of the commercially valuable American lobster, causing this species to move offshore and northward (Rheuban et al., 2017). Lobster catches have declined in recent decades, which may be attributable to increases water temperatures and associated increases in shell disease (Groner et al., 2018; Jaini et al., 2018; Collie and King, 2016; Wahle et al., 2015). Egg-bearing female lobsters occur in warm coastal water in spring but may aggregate offshore for spawning where waters are cooler and strong currents are favorable for larval transport (Carloni et al., 2018). Larval lobster may be transported from Georges Bank to Rhode Island waters by currents along the continental shelf during the 2 to 9 weeks of development to recruitment size (Carloni et al., 2018).

2.2.2 Coastal

The RWEC will make landfall at Quonset Point in North Kingstown, Rhode Island, where multiple locations for the Landfall Work Area are being evaluated. Given that multiple locations are under consideration, a Landfall Envelope has been identified to characterize the range of baseline conditions that may be affected by the Landfall Work Area. Coastal habitats within the Landfall Envelope and vicinity include coastal beach, coastal dune, and tidal salt marsh habitats (Figure 2-2-1). These habitats were delineated, photographed, characterized, and mapped during 2019 and 2020 field surveys to identify baseline conditions (Onshore Natural Resources & Biological Assessment; VHB, 2020).

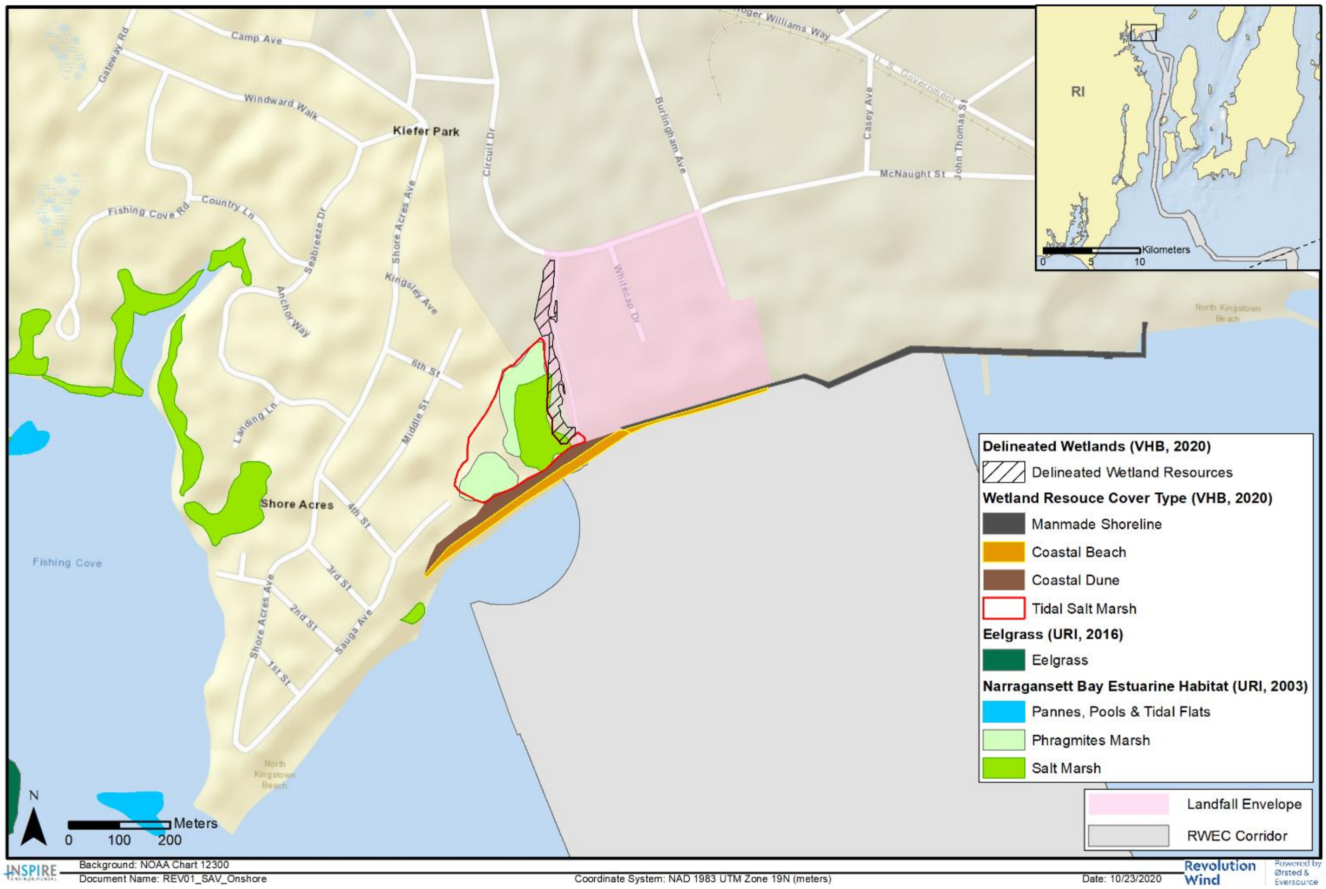

Figure 2.2-1 Tidally-influenced Habitats within the Project Area

Most of the coastal habitats in the area proximate to the Landfall Envelope are disturbed from previous anthropogenic uses. At Blue Beach, the open beach habitat consists of sand and the dune vegetation is made up of American beach grass (*Ammophila breviligulata*), seaside goldenrod (*Solidago sempervirens*), rough cocklebur (*Xanthium strumarium*), prickly lettuce (*Lactuca serriola*), switch grass (*Panicum virgatum*), spotted knapweed (*Centaurea stoebe*), orangegrass (*Hypericum gentianoides*), common evening-primrose (*Oenothera biennis*), and spearscale orache (*Atriplex patula*). Non-native plant species were observed within the coastal beach and coastal dune area, but none of these species are documented as invasive. The landward side of the coastal dune at Blue Beach transitions to tidal salt marsh. This wetland is likely infrequently inundated during extremely high tides and storm surge events. The central area of the marsh bordering Blue Beach is dominated by saltmeadow cordgrass (*Spartina patens*) and the perimeter is mostly composed of common reed (*Phragmites australis*), maritime marsh-elder (*Iva frutescens*) and groundsel tree (*Bacharis halimifolia*). The common reed that occurs along the perimeter of the tidal salt marsh is considered invasive. A tidal channel (potentially manmade) flows through the length of the saltmarsh and connects to the inland freshwater forested swamp near the Blue Beach access path from Circuit Drive.

Th eastern reach of Blue Beach has been altered with a seawall and riprap revetment such that the sandy beach is exposed only during low tides. Vegetation that occurs at the base of the seawall and along the top of the seawall includes spotted knapweed, common milkweed (*Asclepias syriaca*), prickly lettuce, and American pokeweed (*Phytolacca americana*). Spotted knapweed is a weedy invasive species that occurs along the top of the seawall.

2.2.3 Essential Fish Habitat Designations

Within the RWF area, 40 species of fish and invertebrates have designated EFH for various life stages (Table 2.2-1). Within the 0.5-mile (800-m) corridor around the RWEC centerline, 39 species of fish and invertebrates have designated EFH with the RWEC-OCS, and 32 species have designated EFH within the RWEC-RI. Full descriptions of each of these species and life stages are provided in Section 2.2.5.

Table 2.2-1 EFH Designations for Species in the RWF and RWEC

Table 2.2-1			
Species	**Life Stages within RWF**	**Life Stages within RWEC-OCS**	**Life Stages within RWEC-RI**
New England Finfish			
Atlantic cod (*Gadus morhua*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile Adult
Atlantic herring (*Clupea harengus*)	Larvae, Juvenile, Adult	Larvae, Juvenile, Adult	Larvae, Juvenile, Adult
Atlantic wolfish (*Anarhichas lupus*)	Egg, Larvae, Juvenile, Adult	-	-
Haddock (*Melanogrammus aeglefinus*)	Egg, Larvae, Juvenile	Larvae, Juvenile	-
Monkfish (*Lophius americanus*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Egg, Larvae
Ocean pout (*Zoarces americanus*)	Egg, Juvenile, Adult	Egg, Juvenile, Adult	Egg, Juvenile, Adult
Pollock (*Pollachius virens*)	Egg, Larvae, Juvenile	Egg, Larvae, Juvenile	Juvenile
Red hake (*Urophycis chuss*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult
Silver hake (*Merluccius bilinearis*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Adult
White hake (*Urophycis tenuis*)	Larvae, Juvenile	Larvae, Juvenile	Juvenile
Windowpane flounder (*Scophthalmus aquosus*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult
Winter flounder (*Pseudopleuronectes americanus*)	Larvae, Juvenile, Adult	Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult
Witch flounder (*Glyptocephalus cynoglossus*)	Egg, Larvae	Egg, Larvae	-
Yellowtail flounder (*Limanda ferruginea*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Juvenile, Adult
Mid-Atlantic Finfish			
Atlantic butterfish (*Peprilus triacanthus*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult
Atlantic mackerel (*Scomber scombrus*)	Egg, Larvae, Juvenile	Egg, Larvae, Juvenile	Egg, Larvae, Juvenile, Adult
Black sea bass (*Centropristis striata*)	Juvenile, Adult	Juvenile, Adult	Juvenile, Adult
Bluefish (*Pomatomus saltatrix*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Juvenile, Adult
Scup (*Stenotomus chrysops*)	Juvenile, Adult	Juvenile, Adult	Egg, Larvae, Juvenile, Adult
Summer flounder (*Paralichthys dentatus*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Larvae, Juvenile, Adult
Invertebrates			
Atlantic sea scallop (*Placopecten magellanicus*)	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult	Egg, Larvae, Juvenile, Adult
Atlantic surfclam (*Spisula solidissima*)	-	Adult	Juvenile, Adult
Longfin inshore squid (*Doryteuthis pealeii*)	Egg, Juvenile, Adult	Egg, Juvenile, Adult	Egg, Juvenile, Adult
Northern shortfin squid (*Illex illecebrosus*)	Adult	-	-
Ocean quahog (*Arctica islandica*)	Juvenile, Adult	Juvenile, Adult	-
Highly Migratory Species			
Albacore tuna (*Thunnus alalunga*)	Juvenile, Adult	Juvenile, Adult	Juvenile
Bluefin tuna (*Thunnus thynnus*)	Juvenile, Adult	Juvenile, Adult	Juvenile, Adult
Skipjack tuna (*Katsuwonus pelamis*)	Juvenile, Adult	Adult	Adult
Yellowfin tuna (*Thunnus albacares*)	Juvenile, Adult	Juvenile, Adult	Juvenile
Skates			

Table 2.2-1			
Species	**Life Stages within RWF**	**Life Stages within RWEC-OCS**	**Life Stages within RWEC-RI**
Little skate (*Leucoraja erinacea*)	Juvenile, Adult	Juvenile, Adult	Juvenile, Adult
Winter skate (*Leucoraja ocellata*)	Juvenile, Adult	Juvenile, Adult	Juvenile, Adult
Sharks			
Basking shark (*Cetorhinus maximus*)	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult	-
Blue shark (*Prionace glauca*)	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult	-
Common thresher shark (*Alopias vulpinus*)	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult
Dusky shark (*Carcharhinus obscurus*)	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult	-
Sand tiger shark (*Carcharias taurus*)	Neonate, Juvenile	Neonate, Juvenile	Neonate, Juvenile
Sandbar shark (*Carcharhinus plumbeus*)	Juvenile, Adult	Juvenile, Adult	Juvenile, Adult
Shortfin mako shark (*Isurus oxyrinchus*)	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult	-
Smoothhound shark complex (Atlantic stock) (*Mustelus canis*)	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult
Spiny dogfish (*Squalus acanthias*)	Sub-adult male, Sub-adult female, Adult male, Adult female	Sub-adult male, Sub-adult female, Adult male, Adult female	Sub-adult female, Adult male
White shark (*Carcharodon carcharias*)	Neonate, Juvenile, Adult	Neonate, Juvenile, Adult	Neonate

2.2.4 Habitat Areas of Particular Concern

Within the areas designated as EFH for various species, particular areas termed Habitat Areas of Particular Concern (HAPCs) are also identified. HAPCs are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation, but this designation does not confer any particular protections.

The RWEC-RI corridor crosses HAPC for juvenile Atlantic cod in Rhode Island state waters. The juvenile cod HAPC is a subset of the area designated as juvenile cod EFH, and is defined as the inshore areas of the Gulf of Maine and Southern New England between 0 to 66 feet (0 to 20 m), relative to mean high water, as shown in Map 245 of the Final Omnibus EFH Amendment 2 (New England Fishery Management Council [NEFMC], 2017). This HAPC contains structurally complex rocky-bottom habitat that provides juvenile cod with protection from predation and supports a wide variety of prey items (NEFMC, 2017).

Maps for summer flounder HAPC are not available for the Project Area, but it is defined as 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. Juvenile and adult summer flounder EFH is present within the RWF area, RWEC-OCS, and RWEC-RI, but summer flounder HAPC, if present, is most likely to occur within Narragansett Bay and nearshore portions of the Project Area. The Project does not cross known areas of submerged aquatic vegetation, but during the site-specific benthic habitat surveys, isolated patches of attached macroflora were observed at four stations along the RWEC in Narraganset Bay. Based on GIS analysis of available eelgrass mapping for Narragansett Bay (Rhode Island Geographic Information System [RIGIS], 2017), a small section of eelgrass is present on the western side of Dutch Island, approximately 679 feet (207 m) from the proposed RWEC cable centerline. The next closest area of mapped eelgrass is on the western side of Conanicut Island, approximately 1,411 feet (430 m) from the RWEC cable centerline. See the Benthic Assessment (INSPIRE Environmental, 2020) for a detailed description of benthic habitats in the Project Area.

2.2.5 Essential Fish Habitat Species and Life Stages

2.2.5.1 New England Finfish Species

2.2.5.1.1 Atlantic Cod

Atlantic cod have two separate stocks managed by NOAA Fisheries, the Gulf of Maine stock, and the Georges Bank stock. Atlantic cod range from Greenland to Cape Hatteras, North Carolina, but are most common on Georges Bank and in the western Gulf of Maine (NOAA Fisheries, 2019b). Atlantic cod can be found at depths between 32 and 492 feet (10 and 150 m), and spawn near the seafloor from winter to early spring (NOAA Fisheries, 2019b). They are top predators in demersal habitats, and feed on a variety of invertebrates and fish. They prefer muddy, gravelly, or rocky substrates. Atlantic cod are historically an important commercial and recreational species and are still fished at low levels; however, as of the 2017 stock assessment, both stocks are considered overfished, and are currently subject to overfishing (Northeast Fisheries Science Center [NEFSC], 2017a). Atlantic cod EFH designations are listed below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Eggs: EFH is pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as shown on Map 38 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and in the high salinity zones of the bays and estuaries listed in Table 19 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017).

Larvae: EFH is pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as shown on Map 39 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and in the high salinity zones of the bays and estuaries listed in Table 19 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017).

Juveniles: EFH is intertidal and subtidal benthic habitats in the Gulf of Maine, southern New England, and on Georges Bank, to a maximum depth of 394 feet (120 m) (see Map 40 in NEFMC [2017]), including high salinity zones in the bays and estuaries listed in Table 19 of NEFMC (2017). Structurally complex habitats, including eelgrass, mixed sand and gravel, and rocky habitats (gravel pavements, cobble, and boulder) with and without attached macroalgae and emergent epifauna, are essential habitats for juvenile cod. In inshore waters, young-of-the-year juveniles prefer gravel and cobble habitats and eelgrass beds after settlement, but in the absence of predators also utilize adjacent unvegetated sandy habitats for feeding. Survival rates for young-of-the-year cod are higher in more structured rocky habitats than in flat sand or eelgrass; growth rates are higher in eelgrass. Older juveniles move into deeper water and are associated with gravel, cobble, and boulder habitats, particularly those with attached organisms. Gravel is a preferred substrate for young-of-the-year juveniles on Georges Bank and they have also been observed along the small boulders and cobble margins of rocky reefs in the Gulf of Maine.

Adults: EFH is subtidal benthic habitats in the Gulf of Maine, south of Cape Cod, and on Georges Bank, between 98 and 525 feet (30 and 160 m) (see Map 41 in NEFMC [2017]), including high salinity zones in the bays and estuaries listed in Table 19 of NEFMC (2017). Structurally complex hard bottom habitats composed of gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae are essential habitats for adult cod. Adult cod are also found on sandy substrates and frequent deeper slopes of ledges along shore. South of Cape Cod, spawning occurs in nearshore areas and on the continental shelf, usually in depths less than 230 feet (70 m).

2.2.5.1.2 Atlantic Herring

Atlantic herring are managed in one stock complex encompassing Georges Bank and the Gulf of Maine, with two major spawning components. Atlantic herring are a small schooling fish found on both sides of the North Atlantic. In the western North Atlantic, Atlantic herring range from Labrador, Canada to Cape Hatteras, North Carolina (NOAA Fisheries, 2019c) and are highly concentrated in Georges Bank, the Gulf of Maine, and Nantucket Shoals (Reid et al., 1999). In the region of interest, Atlantic herring are typically present in the winter at average depths of about 120 to 360 feet (36 to 110 m) (Collette and Klein-MacPhee, 2002). They feed on zooplankton, krill, and fish larvae, and are an important species in the food web of the northwest Atlantic (NOAA Fisheries, 2019c). Spawning grounds are limited to rocky, gravelly, or pebbly bottom and on clay, from 12 to 180 feet (3 to 55 m) deep (Collette and Klein-MacPhee, 2002). Atlantic herring are an important commercial fishery in New England and their stock biomass is currently well above target levels (NOAA Fisheries, 2019c). According to the 2018 stock assessment, Atlantic herring are not overfished, and not currently subject to overfishing (NEFSC, 2018a).

The Atlantic herring EFH designations are reproduced below for the life stages found within the Project Area. Larvae, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Larvae: EFH is inshore and offshore pelagic habitats in the Gulf of Maine, on Georges Bank, and in the upper Mid-Atlantic Bight, as shown on Map 99 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and in the bays and estuaries listed in Table 30 of NEFMC (2017). Atlantic herring have a very long larval stage, lasting 4–8 months, and are transported long distances to inshore and estuarine waters where they metamorphose into early stage juveniles in the spring.

Juveniles: EFH is intertidal and subtidal pelagic habitats to 984 feet (300 m) throughout the region, as shown on Map 100 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the bays and estuaries listed in Table 30 of NEFMC (2017). One and two-year old juveniles form large schools and make limited seasonal inshore-offshore migrations. Older juveniles are usually found in water temperatures of 37 to 59 °F (3 to 15 °C) in the northern part of their range and as high as 72 °F (22 °C) in the Mid-Atlantic. Young-of-the-year juveniles can tolerate low salinities, but older juveniles avoid brackish water.

Adults: EFH is subtidal pelagic habitats with maximum depths of 984 feet (300 m) throughout the region, as shown on Map 100 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the bays and estuaries listed in Table 30 of NEFMC (2017). Adults make extensive seasonal migrations between summer and fall spawning grounds on Georges Bank and the Gulf of Maine and overwintering areas in southern New England and the Mid-Atlantic region. They seldom migrate beyond a depth of about 328 feet (100 m) and—unless they are preparing to spawn—usually remain near the surface. They generally avoid water temperatures above 50 °F (10 °C) and low salinities. Spawning takes place on the bottom, generally in depths of 41–194 feet (5–90 m) on a variety of substrates.

2.2.5.1.3 Atlantic Wolffish

The Atlantic wolffish is found on both sides of the North Atlantic and infrequently in the Arctic. In the northwestern Atlantic, they range from Davis Strait, Canada, to Cape Hatteras, North Carolina (Fisheries and Oceans Canada, 2018a). In U.S. waters, the species is managed as a single stock. Atlantic wolffish prefer colder water temperatures and prey mainly on brittle stars, sea urchins, crabs, and shrimp (Fisheries and Oceans Canada, 2018a). Adult Atlantic wolffish generally move inshore to spawn during the spring and summer, establishing nesting sites on boulders and in rocky crevices, which are guarded by the males until the eggs hatch in late summer and early fall (Fisheries and Oceans Canada, 2018a). According to the 2017 stock assessment, Atlantic wolffish are overfished and not currently experiencing overfishing (NEFSC, 2017a).

The Atlantic wolffish EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area.

Eggs: EFH is subtidal benthic habitats at depths less than 328 feet (100 m) within the geographic area shown on Map 43 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017). Wolffish egg masses are hidden under rocks and boulders in nests.

Larvae: EFH is pelagic and subtidal benthic habitats within the geographic area shown on Map 43 of NEFMC (2017). Atlantic wolffish larvae remain near the bottom for up to six days after hatching, but gradually become more buoyant as the yolk sac is absorbed.

Juveniles: EFH is subtidal benthic habitats at depths of 230 to 604 feet (70 to 184 m) within the geographic area shown on Map 43 of NEFMC (2017). Juvenile Atlantic wolffish do not have strong substrate preferences.

Adults: EFH is subtidal benthic habitats at depths less than 568 feet (173 m) within the geographic area shown on Map 43 of NEFMC (2017). Adult Atlantic wolffish have been observed spawning and guarding eggs in rocky habitats in less than 98 feet (30 m) of water in the Gulf of St. Lawrence and Newfoundland and in deeper (164 to 328 feet [50 to100 m]) boulder reef habitats in the Gulf of Maine. Egg masses have been collected on the Scotian Shelf in depths of 328 to 426 feet (100 to 130 m), indicating that spawning is not restricted to coastal waters. Adults are distributed over a wider variety of sand and gravel substrates once they leave rocky spawning habitats, but are not caught over muddy bottom.

2.2.5.1.4 Haddock

In the western North Atlantic, haddock range from Newfoundland to Cape May, New Jersey, with the highest abundance on Georges Bank and in the Gulf of Maine (NOAA Fisheries, 2019d). Haddock in U.S. waters are managed as two stocks: the Gulf of Maine stock and the Georges Bank stock. Haddock are found at depths ranging from 59 to 1,148 feet (15 to 350 m) and there is a very minimal seasonal difference between depths aside from a slightly wider range of depths in the fall (Cargnelli et al., 1999a). Haddock prefer gravely, pebbly, clay, and sandy substrates and avoid ledges and large rocks (Collette and Klein-MacPhee, 2002). They spawn on eastern Georges Bank, to the east of Nantucket Shoals, and along the Maine coast between January and June (NOAA Fisheries, 2019d). Haddock prey items include mollusks, worms, crustaceans, sea stars, sea urchins, sand dollars, brittle stars, fish eggs, and occasionally small fish such as herring (NOAA Fisheries, 2019d). Adults sometimes eat small fish, especially herring. As of the 2017 stock assessment, the Georges Bank and Gulf of Maine stocks are not overfished and are not subject to overfishing (NEFSC, 2017a).

The haddock EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, and juveniles have EFH within the RWF area, and larvae and juveniles have EFH within the RWEC-OCS corridor.

Eggs: EFH is pelagic habitats in coastal and offshore waters in the Gulf of Maine, southern New England, and on Georges Bank, as shown on Map 44 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017).

Larvae: EFH is pelagic habitats in coastal and offshore waters in the Gulf of Maine, the Mid-Atlantic, and on Georges Bank, as shown on Map 45 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017).

Juveniles: EFH is subtidal benthic habitats between 131 and 459 feet (40 and 140 m) in the Gulf of Maine, on Georges Bank and in the Mid-Atlantic region, and as shallow as 66 feet (20 m) along the coast of Massachusetts, New Hampshire, and Maine, as shown on Map 46 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017). Young-of-the-year juveniles settle on sand and gravel on Georges Bank, but are found predominantly on gravel pavement areas within a few months after settlement. As they grow, they disperse over a greater variety of substrate types on the bank. Young-of-the-year haddock do not inhabit shallow, inshore habitats.

2.2.5.1.5 Monkfish

Monkfish are found in the northwest Atlantic Ocean from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras, NC. In U.S. waters, the monkfish fishery is divided into two management areas, north and south of Georges Bank. According to the 2013 stock assessment, monkfish are not overfished and are not subject to overfishing in either management area (NEFSC, 2013). Monkfish can tolerate a wide range of temperatures and depths, and migrate seasonally to spawn and feed (NOAA Fisheries, 2019e). Monkfish are present from summer to fall from the tideline down to 2,160 feet (658 m) (Collette and Klein-MacPhee, 2002). Monkfish prefer hard sand, pebbly bottom, gravel, and broken shells for their habitats (Collette and Klein-MacPhee, 2002). Monkfish spawn from February to October, producing very large buoyant mucoidal egg “veils.” They are opportunistic feeders with prey including a wide range of benthic and pelagic fish and invertebrate species along with sea birds, and diving ducks. Monkfish ambush their prey through rapidly opening their mouth, creating a vacuum, and sucking the prey into their needle-like, backward curving teeth (NOAA Fisheries, 2019e). They also have a small, dangling appendage in the back of their mouth to attract small fish.

The monkfish EFH designations are reproduced below for the life stages found within the Project Area. Eggs, larvae, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor. In the RWEC-RI corridor, only EFH for eggs and larvae is present.

Eggs and Larvae: EFH is pelagic habitats in inshore areas, and on the continental shelf and slope throughout the Northeast region, as shown on Map 82 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017). Monkfish larvae are more abundant in the Mid-Atlantic region and occur over a wide depth range, from the surf zone to depths of 3,281 to 4,921 feet (1,000 to 1,500 m) on the continental slope. Monkfish egg veils and larvae are most often observed during the months from March to September.

Juveniles: EFH is subtidal benthic habitats in depths of 164 to 1,312 feet (50 to 400 m) in the Mid-Atlantic, between 66 and 1,312 feet (20 and 400 m) in the Gulf of Maine, and to a maximum depth of 3,281 feet (1,000 m) on the continental slope, as shown on Map 83 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017). A variety of habitats are essential for juvenile monkfish, including hard sand, pebbles, gravel, broken shells, and soft mud; they also seek shelter among rocks with attached algae. Juveniles collected on mud bottom next to rock-ledge and boulder fields in the western Gulf of Maine were in better condition than juveniles collected on isolated mud bottom, indicating that feeding conditions in these edge habitats are better. Young-of-the-year juveniles have been collected primarily on the central portion of the shelf in the Mid- Atlantic, but also in shallow nearshore waters off eastern Long Island, up the Hudson Canyon shelf valley, and around the perimeter of Georges Bank. They have also been collected as deep as 2,953 feet (900 m) on the continental slope.

Adults: EFH is subtidal benthic habitats in depths of 164 to 1,312 feet (50 to 400 m) in southern New England and Georges Bank, between 66 and 1,312 feet (20 and 400 m) in the Gulf of Maine, and to a maximum depth of 3,281 feet (1,000 m) on the continental slope, as shown on Map 84 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017). EFH for adult monkfish is composed of hard sand, pebbles, gravel, broken shells, and soft mud. They seem to prefer soft sediments (fine sand and mud) over sand and gravel, and, like juveniles, utilize the edges of rocky areas for feeding.

2.2.5.1.6 Ocean Pout

The ocean pout is currently managed in two stocks, northern and southern, and ranges from Labrador, Canada to Virginia (Steimle et al., 1999a). This finfish is typically present in southern New England from late summer to winter. According to the 2017 stock assessment, ocean pout is overfished and is not currently experiencing overfishing (NEFSC, 2017a). Ocean pout are found in habitats that contain sandy mud, “sticky” sand, broken bottom, or pebbles and gravel (Collette and Klein-MacPhee, 2002). Juveniles and adults feed by filtering sediment for prey items, which include polychaetes, mollusks, crustaceans, and echinoderms (Steimle et al., 1999a). They spawn in protected habitats, such as rock crevices and man-made artifacts, where they lay eggs and engage in nest-guarding behavior (Steimle et al., 1999a).

The ocean pout EFH designations are reproduced below for the life stages found within the Project Area. Eggs, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Eggs: EFH is hard bottom habitats on Georges Bank, in the Gulf of Maine, and in the Mid-Atlantic Bight (see Map 48 in NEFMC [2017]), as well as the high salinity zones of the bays and estuaries listed in Table 20 of NEFMC (2017). Eggs are laid in gelatinous masses, generally in sheltered nests, holes, or rocky crevices. EFH for ocean pout eggs occurs in depths less than 328 feet (100 m) on rocky bottom habitats.

Juveniles: EFH is intertidal and subtidal benthic habitats in the Gulf of Maine and on the continental shelf north of Cape May, New Jersey, on the southern portion of Georges Bank, and in the high salinity zones of a number of bays and estuaries north of Cape Cod, extending to a maximum depth of 394 feet (120 m) (see Map 49 and Table 20 in NEFMC [2017]). EFH for juvenile ocean pout occurs on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel.

Adults: EFH is subtidal benthic habitats between 66 and 459 feet (20 and 140 m) in the Gulf of Maine, on Georges Bank, in coastal and continental shelf waters north of Cape May, New Jersey, and in the high salinity zones of a number of bays and estuaries north of Cape Cod (see Map 50 and Table 20 in NEFMC, 2017). EFH for adult ocean pout includes mud and sand, particularly in association with structure-forming habitat types; i.e., shells, gravel, or boulders. In softer sediments, they burrow tail first and leave a depression on the sediment surface. Ocean pout congregate in rocky areas prior to spawning and frequently occupy nesting holes under rocks or in crevices in depths less than 328 feet (100 m).

2.2.5.1.7 Pollock

Pollock range throughout the northwestern Atlantic Ocean and are most commonly found on the western Scotian Shelf and in the Gulf of Maine (NOAA Fisheries, 2019f). They spawn multiple times per season between November through February over hard, stony, or rocky ocean bottoms in the Gulf of Maine and on Georges Bank. Smaller pollock in inshore waters prey on small crustaceans and fish, and larger pollock prey predominantly on fish, but their diet also includes euphausiids and mollusks (NOAA Fisheries, 2019f; Cargnelli et al., 1999b). Pollock are a schooling species with a semi-pelagic lifestyle, and they can be found throughout the water column (Cargnelli et al., 1999b). Pollock are managed as a single stock, and according to the 2017 stock assessment, they are not overfished and are not currently subject to overfishing (NEFSC, 2017a).

The pollock EFH designations are reproduced below for the life stages found within the Project Area. Eggs, larvae, and juvenile life stages have EFH within the RWF area and RWEC-OCS corridor. Within the RWEC-RI corridor, EFH is only present for juveniles.

Eggs: EFH is pelagic inshore and offshore habitats in the Gulf of Maine, on Georges Bank, and in southern New England, as shown on Map 51 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the bays and estuaries listed in Table 21 of (NEFMC, 2017).

Larvae: EFH is pelagic inshore and offshore habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as shown on Map 52 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the bays and estuaries listed in Table 21 of (NEFMC, 2017).

Juveniles: EFH is inshore and offshore pelagic and benthic habitats from the intertidal zone to 591 feet (180 m) in the Gulf of Maine, in Long Island Sound, and Narragansett Bay, between 131 and 591 feet (40 and 180 m) on western Georges Bank and the Great South Channel (see Map 53 in NEFMC [2017]), and in mixed and full salinity waters in a number of bays and estuaries north of Cape Cod (Table 21 in NEFMC [2017]). EFH for juvenile pollock consists of rocky bottom habitats with attached macroalgae (rockweed and kelp) that provide refuge from predators. Shallow water eelgrass beds are also essential habitats for young-of-the-year pollock in the Gulf of Maine. Older juveniles move into deeper water into habitats also occupied by adults.

2.2.5.1.8 Red Hake

Red hake are managed as two stocks, the Gulf of Maine and Northern Georges Bank (northern) stock, and the Southern Georges Bank and Mid-Atlantic (southern) stock (Steimle et al., 1999b; NOAA Fisheries, 2019g). Red hake range from Newfoundland to North Carolina, but are most abundant from the western Gulf of Maine through southern New England waters (NOAA Fisheries, 2019g). During warmer seasons, red hake are common at depths greater than 328 feet (100 m), and during colder months, their depth range is from 90 to 1,214 feet (30 to 370 m) (Steimle et al., 1999b). Red hake prey consists primarily of crustaceans and fish such as haddock, silver hake, sea robins, sand lance, mackerel, and small red hake (NOAA Fisheries, 2019g). This groundfish species prefers deep water environments with bottom habitat consisting of both soft and pebbly substrate. Spawning occurs uniformly from Georges Bank to Nova Scotia and typically occurs nearshore as early as June and continues through fall (Collette and Klein-MacPhee, 2002). According to the 2018 stock assessment, both the northern and southern stocks are not considered overfished and are not currently subject to overfishing (Alade and Traver, 2018).

The red hake EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Eggs and Larvae: EFH is pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid- Atlantic, as shown on Map 77 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and in the bays and estuaries listed in Table 27 of NEFMC (2017).

Juveniles: EFH is intertidal and subtidal benthic habitats throughout the region on mud and sand substrates, to a maximum depth of 262 feet (80 m), as shown on Map 77 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the bays and estuaries listed in Table 27 of NEFMC (2017). Bottom habitats providing shelter are essential for juvenile red hake, including mud substrates with biogenic depressions, substrates providing biogenic complexity (e.g., eelgrass, macroalgae, shells, anemone and polychaete tubes), and artificial reefs. Newly settled juveniles occur in depressions on the open seabed. Older juveniles are commonly associated with shelter or structure and often found inside live bivalves.

Adults: EFH is benthic habitats in the Gulf of Maine and the outer continental shelf and slope in depths of 164 to 2,461 feet (50 to 750 m) (see Map 78 in NEFMC [2017]) and as shallow as 66 feet (20 m) in a number of inshore estuaries and embayments (see Table 27 in NEFMC [2017]) as far south as Chesapeake Bay. Shell beds, soft sediments (mud and sand), and artificial reefs provide essential habitats for adult red hake. They are usually found in depressions in softer sediments or in shell beds and not on open sandy bottom. In the Gulf of Maine, they are much less common on gravel or hard bottom, but they are reported to be abundant on hard bottoms in temperate reef areas of Maryland and northern Virginia.

2.2.5.1.9 Silver Hake

Two stocks of silver hake are managed in U.S. waters, the Gulf of Maine and Northern Georges Bank (northern) stock and the Southern Georges Bank and Mid-Atlantic (southern) stock, which includes southern silver hake and offshore hake (NOAA Fisheries, 2019h). Silver hake are found from Cape Sable, Nova Scotia to Cape Hatteras, North Carolina and are concentrated in deep basins in the Gulf of Maine and along the continental slope in winter and spring. White hake are voracious nocturnal feeders, preying on fish, crustaceans and squid (NOAA Fisheries, 2019h; Lock and Packer, 2004). White hake spawn along the coast of the Gulf of Maine from Cape Cod to Grand Manan Island, on southern and southeastern Georges Bank, and in southern New England to the south of Martha's Vineyard (NOAA Fisheries, 2019h). Peak spawning occurs from May to June in the southern area of their range, and from July to August in the northern area of their range (NOAA Fisheries, 2019h). The 2018 stock assessment concluded that the both the northern and southern stock are not overfished and are not currently subject to overfishing (Alade and Traver, 2018).

The silver hake EFH designations are reproduced below for the life stages found within the Project Area. Eggs, larvae, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Within the RWEC-RI corridor, EFH is designated for eggs, larvae, and adults.

Eggs and Larvae: EFH is pelagic habitats from the Gulf of Maine to Cape May, New Jersey, including Cape Cod and Massachusetts Bays (see Map 74 and Table 26 in NEFMC [2017]).

Juveniles: EFH is pelagic and benthic habitats in the Gulf of Maine, including the coastal bays and estuaries listed in Table 26 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and on the continental shelf as far south as Cape May, New Jersey, at depths greater than 33 feet (10 m) in coastal waters in the Mid-Atlantic and between 131 and 1,312 feet (40 and 400 m) in the Gulf of Maine, on Georges Bank, and in the middle continental shelf in the Mid-Atlantic, on sandy substrates (see Map 75 in NEFMC [2017]). Juvenile silver hake are found in association with sand-waves, flat sand with amphipod tubes, and shells, and in biogenic depressions. Juveniles in the New York Bight settle to the bottom at mid-shelf depths on muddy sand substrates and find refuge in amphipod tube mats.

Adults: EFH is pelagic and benthic habitats at depths greater than 115 feet (35 m) in the Gulf of Maine and the coastal bays and estuaries listed in Table 26 of NEFMC (2017), between 230 and 1,312 feet (70 and 400 m) on Georges Bank and the outer continental shelf in the northern portion of the Mid-Atlantic Bight, and in some shallower locations nearer the coast, on sandy substrates (see Map 76 of NEFMC [2017]). Adult silver hake are often found in bottom depressions or in association with sand waves and shell fragments. They have also been observed at high densities in mud habitats bordering deep boulder reefs, resting on boulder surfaces, and foraging over deep boulder reefs in the southwestern Gulf of Maine. This species makes greater use of the water column (for feeding, at night) than red or white hake.

2.2.5.1.10 White Hake

White hake range from the Gulf of St. Lawrence to the Mid-Atlantic Bight, and the population is divided into two stocks: a Canadian stock primarily occurring in the Gulf of St. Lawrence and Scotian Shelf, and a U.S. stock primarily occurring in the Gulf of Maine and on Georges Bank. Their range also includes estuaries along the continental shelf to the submarine canyons of the upper continental slope, as well as the deep, muddy basins of the Gulf of Maine (Chang et al., 1999a). Early juveniles are pelagic before settling to muddy and fine-grained sandy bottom or eelgrass habitats. Older juveniles feed on polychaetes, shrimps, and other crustaceans. Adults are demersal, prefer fine grained, muddy substrates, and feed predominantly on fish (Chang et al., 1999a). The timing and extent of spawning in southern New England waters is not well defined, but is thought to occur in early spring in deep waters along the continental slope (Chang et al., 1999a). The most recent stock assessment for the U.S. stock of white hake concluded that the stock is not overfished and not currently subject to overfishing (NEFSC, 2017a).

The white hake EFH designations are reproduced below for the life stages found within the Project Area. Larvae and juvenile life stages have EFH within the RWF area and RWEC-OCS corridor. Within the RWEC-RI corridor, only EFH for juveniles is present.

Larvae: EFH is pelagic habitats in the Gulf of Maine, in southern New England, and on Georges Bank, as shown in Map 56 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017). Early stage white hake larvae have been collected on the continental slope, but cross the shelf-slope front and use nearshore habitats for juvenile nurseries. Larger larvae and pelagic juveniles have been found only on the continental shelf.

Juveniles: EFH is intertidal and subtidal estuarine and marine habitats in the Gulf of Maine, on Georges Bank, and in southern New England, including mixed and high salinity zones in a number of bays and estuaries north of Cape Cod (see Table 22 in NEFMC [2017]), to a maximum depth of 984 feet (300 m) (see Map 57 in NEFMC [2017]). Pelagic phase juveniles remain in the water column for about 2 months. In nearshore waters, EFH for benthic phase juveniles occurs on fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats. In the Mid-Atlantic, most juveniles settle to the bottom on the continental shelf, but some enter estuaries, especially those in southern New England. Older young-of-the-year juveniles occupy the same habitat types as the recently-settled juveniles but move into deeper water (>164 feet [50 m]).

2.2.5.1.11 Windowpane Flounder

The windowpane flounder range extends from the Gulf of St. Lawrence to Florida, but the species is most abundant from Georges Bank to Chesapeake Bay (Chang et al., 1999b). Windowpane flounder is managed as two stocks: the Gulf of Maine-Georges Bank (northern) stock and the Southern New England-Middle Atlantic Bight (southern) stock. Windowpane flounder spawning is thought to begin in February or March in inshore waters, peaking in the Mid-Atlantic Bight in May, and extending into Georges Bank during the summer (Chang et al., 1999b). Windowpane flounder typically prefer sandy bottom habitats and range from just below the tide line to 150 feet (46 m) deep (Collette and Klein-MacPhee, 2002). They feed on small crustaceans and various fish larvae, including hakes and tomcod (Chang et al., 1999b). The 2017 stock assessments concluded that the northern stock of windowpane flounder is overfished, but not currently experiencing overfishing, and the southern stock is not overfished and not experiencing overfishing (NEFSC, 2017a).

The windowpane flounder EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Eggs and Larvae: EFH is pelagic habitats on the continental shelf from Georges Bank to Cape Hatteras and in mixed and high salinity zones of coastal bays and estuaries throughout the region (see Map 59, Map 60, and Table 23 in NEFMC [2017]).

Juveniles: EFH is intertidal and subtidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to northern Florida, as shown on Map 61 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including mixed and high salinity zones in the bays and estuaries listed in Table 23 of NEFMC (2017). EFH for juvenile windowpane flounder is found on mud and sand substrates and extends from the intertidal zone to a maximum depth of 197 feet (60 m). Young-of-the-year juveniles prefer sand over mud.

Adults: EFH is intertidal and subtidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to Cape Hatteras, as shown on Map 62 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including mixed and high salinity zones in the bays and estuaries listed in Table 23 of NEFMC (2017). Essential fish habitat for adult windowpane flounder is found on mud and sand substrates and extends from the intertidal zone to a maximum depth of 230 feet (70 m).

2.2.5.1.12 Winter Flounder

Winter flounder is managed as three stocks: the Gulf of Maine stock, Georges Bank stock, and the Southern New England/Mid-Atlantic stock (NOAA Fisheries, 2019i). Winter flounder range from the Gulf of St. Lawrence to North Carolina, and are found in estuaries and on the continental shelf. Winter flounder prefer muddy, sandy, cobbled, gravelly, or boulder substrate in mostly nearshore environments (Pereira et al., 1999). Winter flounder spawn over sandy bottoms and algal mats in shallow nearshore habitats during the winter and spring (NFMS, 2019i). They are opportunistic feeders, and prey items include polychaetes, amphipods, shrimp, clams, capelin eggs, and fish (Pereira et al., 1999; NOAA Fisheries, 2019i). The 2017 stock assessment concluded that spawning stock biomass of the Georges Bank stock has been increasing since 2005, and the stock is not overfished and not subject to overfishing (NEFSC, 2017a). The Southern New England/Mid-Atlantic stock is overfished, but not currently experiencing overfishing (NEFSC, 2017a). The results for the Gulf of Maine stock were highly uncertain. The authors were unable to determine an abundance estimate for the Gulf of Maine stock, but concluded that it is not currently subject to overfishing (NEFSC, 2017a).

The winter flounder EFH designations are reproduced below for the life stages found within the Project Area. Larvae, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Egg, larvae, juvenile, and adult life stages have EFH within the RWEC-RI corridor.

Eggs: EFH is subtidal estuarine and coastal benthic habitats from mean low water to 16 feet (5 m) from Cape Cod to Absecon Inlet (39° 22’ N), and as deep as 230 feet (70 m) on Georges Bank and in the Gulf of Maine (see Map 63 in NEFMC [2017]), including mixed and high salinity zones in the bays and estuaries listed in Table 24 of NEFMC (2017). The eggs are adhesive and deposited in clusters on the bottom. Essential habitats for winter flounder eggs include mud, muddy sand, sand, gravel, macroalgae, and submerged aquatic vegetation. Bottom habitats are unsuitable if exposed to excessive sedimentation which can reduce hatching success.

Larvae: EFH is estuarine, coastal, and continental shelf water column habitats from the shoreline to a maximum depth of 230 feet (70 m) from the Gulf of Maine to Absecon Inlet (39° 22’ N), and including Georges Bank, as shown on Map 65 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including mixed and high salinity zones in the bays and estuaries listed in Table 24 of NEFMC (2017). Larvae hatch in nearshore waters and estuaries or are transported shoreward from offshore spawning sites where they metamorphose and settle to the bottom as juveniles. They are initially planktonic but become increasingly less buoyant and occupy the lower water column as they get older.

Juveniles: EFH is estuarine, coastal, and continental shelf benthic habitats from the Gulf of Maine to Absecon Inlet (39° 22’ N), and including Georges Bank, as shown on Map 64 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and in mixed and high salinity zones in the bays and estuaries listed in Table 24 of NEFMC (2017). Essential fish habitat for juvenile winter flounder extends from the intertidal zone (mean high water) to a maximum depth of 197 feet (60 m) and occurs on a variety of bottom types, such as mud, sand, rocky substrates with attached macroalgae, tidal wetlands, and eelgrass. Young-of-the-year juveniles are found inshore on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks. They tend to settle to the bottom in soft-sediment depositional areas where currents concentrate late-stage larvae and disperse into coarser-grained substrates as they get older.

Adults: EFH is estuarine, coastal, and continental shelf benthic habitats extending from the intertidal zone (mean high water) to a maximum depth of 230 feet (70 m) from the Gulf of Maine to Absecon Inlet (39° 22’ N), and including

Georges Bank, as shown on Map 65 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and in mixed and high salinity zones in the bays and estuaries listed in Table 24 of NEFMC (2017). EFH for adult winter flounder occurs on muddy and sandy substrates, and on hard bottom on offshore banks. In inshore spawning areas, EFH includes a variety of substrates where eggs are deposited on the bottom.

2.2.5.1.13 Witch Flounder

Witch flounder are managed as a single stock and in U.S. waters, range from the Gulf of Maine to Cape Hatteras, North Carolina (Cargnelli et al., 1999c). Witch flounder spawn from April to November in the Gulf of Maine/Georges Bank region, and from April to August in the Mid-Atlantic Bight, peaking in the summer in both regions (Cargnelli et al., 1999c). Primary prey items include polychaetes, crustaceans, mollusks, and echinoderms. As of the 2017 stock assessment, witch flounder is overfished, overfishing status is unknown, and the condition of the stock is poor (NEFSC, 2017a).

The witch flounder EFH designations are reproduced below for the life stages found within the Project Area. EFH for eggs and larvae is present within the RWF area and RWEC-OCS corridor.

Eggs and Larvae: EFH is pelagic habitats on the continental shelf throughout the Northeast region, as shown on Map 66 and Map 67 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017).

2.2.5.1.14 Yellowtail Flounder

In U.S. waters, yellowtail flounder are managed as three stocks: the Gulf of Maine/Cape Cod stock, the Georges Bank stock, and the Southern New England/Mid-Atlantic stock. Yellowtail flounder range from Newfoundland to Chesapeake Bay (NOAA Fisheries, 2019j). These bottom-dwelling finfish prefer habitats with a mixture of sand and mud (Collette and Klein-MacPhee, 2002; Johnson et al., 1999), and spawn during the spring and summer (NFMS, 2019j). Adult prey items consist mainly of benthic macrofauna such as crustaceans and worms (NOAA Fisheries, 2019j; Johnson et al., 1999). As of the 2017 stock assessment (NEFSC, 2017a), all three stocks are overfished, currently subject to overfishing, and drastically below the biomass target level. (Johnson et al., 1999).

The yellowtail flounder EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Juvenile and adult life stages have EFH within the RWEC-RI corridor.

Eggs: EFH is coastal and continental shelf pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region as far south as the upper Delmarva peninsula, as shown on Map 70 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the high salinity zones of the bays and estuaries listed in Table 25 of NEFMC (2017).

Larvae: EFH is coastal marine and continental shelf pelagic habitats in the Gulf of Maine, and from Georges Bank to Cape Hatteras, as shown on Map 71 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the high salinity zones of the bays and estuaries listed in Table 25 of NEFMC (2017).

Juveniles: EFH is subtidal benthic habitats in coastal waters in the Gulf of Maine and on the continental shelf on Georges Bank and in the Mid-Atlantic as shown on Map 72 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the high salinity zones of the bays and estuaries listed in Table 25 of NEFMC (2017). EFH for juvenile yellowtail flounder occurs on sand and muddy sand between 66 and 262 feet (20 and 80 m). In the Mid-Atlantic, young-of-the-year juveniles settle to the bottom on the continental shelf, primarily at depths of 131 to 230 feet (40 to 70 m), on sandy substrates.

Adults: EFH is subtidal benthic habitats in coastal waters in the Gulf of Maine and on the continental shelf on Georges Bank and in the Mid-Atlantic as shown on Map 73 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the high salinity zones of the bays and estuaries listed in Table 25 of NEFMC (2017). EFH for adult yellowtail flounder occurs on sand and sand with mud, shell hash, gravel, and rocks at depths between 82 and 295 feet (25 and 90 m).

2.2.5.2 Mid-Atlantic Finfish Species

2.2.5.2.1 Atlantic Butterfish

The Atlantic butterfish is a semi-pelagic fish that tends to form loose schools and ranges from Newfoundland to Florida (NOAA Fisheries, 2019k). They are most commonly found from the Gulf of Maine to Cape Hatteras, North Carolina (Cross et al., 1999; NFMS, 2019k). Butterfish are managed as one stock in the northern region (New England to Cape Hatteras) and two stocks south of Cape Hatteras. Butterfish are present in New England waters from spring to fall and are found from the surface to 180 feet (54 m) deep in the summer, but as deep as 690 feet (210 m) in the winter (Collette and Klein-MacPhee, 2002). Butterfish prefer sandy bottom environments rather than rocky environments. Spawning occurs on the continental shelf and in nearshore areas and is very common in Long Island Sound and the New York Bight (Cross et al., 1999). As of the 2018 stock assessment (Adams, 2018), Atlantic butterfish are not overfished and not subject to overfishing.

The Atlantic butterfish EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Eggs: EFH is pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to the south shore of Long Island, New York, in Chesapeake Bay, and on the continental shelf and slope, primarily from Georges Bank to Cape Hatteras, North Carolina. EFH for Atlantic butterfish eggs is generally found over bottom depths of 4,921 feet (1,500 m) or less where average temperatures in the upper 656 feet (200 m) of the water column are 43.7 to 70.7 °F (6.5 to 21.5 °C).

Larvae: EFH is pelagic habitats in inshore estuaries and embayments in Boston harbor, from the south shore of Cape Cod to the Hudson River, and in Delaware and Chesapeake bays, and on the continental shelf from the Great South Channel (western Georges Bank) to Cape Hatteras, North Carolina. EFH for Atlantic butterfish larvae is generally found over bottom depths between 134 and 1148 feet (41 and 350 m) where average temperatures in the upper 656 feet (200 m) of the water column are 47 to 71 °F (8.5 to 21.5 °C).

Juveniles: EFH is pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to Pamlico Sound, North Carolina, in inshore waters of the Gulf of Maine and the South Atlantic Bight, and on the inner continental shelf and OCS from southern New England to South Carolina. EFH for juvenile Atlantic butterfish is generally found over bottom depths between 32 and 918 feet (10 and 280 m) where bottom water temperatures are between 43 and 80 °F (6.5 and 27 °C) and salinities are above 5 ppt. Juvenile butterfish feed mainly on planktonic prey.

Adults: EFH is pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to Pamlico Sound, North Carolina, inshore waters of the Gulf of Maine and the South Atlantic Bight, on Georges Bank, on the inner continental shelf south of Delaware Bay, and on the OCS from southern New England to South Carolina. EFH for adult Atlantic butterfish is generally found over bottom depths between 32 and 820 feet (10 and 250 m) where bottom water temperatures are between 40 and 81 °F (4.5 and 27.5 °C) and salinities are above 5 ppt. Spawning probably does not occur at temperatures below 59 °F (15 °C). Adult butterfish feed mainly on planktonic prey, including squids and fishes.

2.2.5.2.2 Atlantic Mackerel

In the northwestern Atlantic, Atlantic mackerel range from Labrador to North Carolina (NOAA Fisheries, 2019l). They are a pelagic, schooling species and are managed as a single stock. Mackerel spawn off the coast (10 to 30 miles offshore) in deeper waters in two groups. The southern group primarily spawns in the Mid-Atlantic Bight from April to May, and the northern group spawns in the Gulf of St. Lawrence in June and July (NOAA Fisheries, 2019l). There is no known preferred breeding habitat (Collette and Klein-MacPhee, 2002). Atlantic mackerel prey on crustaceans (e.g., copepods, krill, and shrimp), fish, and ascidians (sea squirts) (NOAA Fisheries, 2019l). Prior to the 2018 stock assessment, the status of Atlantic mackerel was unknown (NOAA Fisheries, 2019l). The 2018 stock assessment concluded that Atlantic mackerel are overfished, subject to overfishing, and have been overfished for nearly a decade (NEFSC, 2018b).

The Atlantic mackerel EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, and juvenile life stages have EFH within the RWF area and RWEC-OCS corridor. Egg, larvae, juvenile, and adult life stages have EFH within the RWEC-RI corridor.

Eggs: EFH is pelagic habitats in inshore estuaries and embayments from Great Bay, New Hampshire to the south shore of Long Island, New York, inshore and offshore waters of the Gulf of Maine, and on the continental shelf from Georges Bank to Cape Hatteras, North Carolina (mostly north of 38°N). EFH for Atlantic mackerel eggs is generally found over bottom depths of 328 feet (100 m) or less with average water temperatures of 43 to 54 °F (6.5 to 12.5 °C) in the upper 59 feet (15 m) of the water column.

Larvae: EFH is pelagic habitats in inshore estuaries and embayments from Great Bay, New Hampshire to the south shore of Long Island, New York, inshore waters of the Gulf of Maine, and on the continental shelf from Georges Bank to Cape Hatteras, North Carolina (mostly north of 38°N). EFH for Atlantic mackerel larvae is generally found over bottom depths between 68 and 328 feet (21 and 100 m) with average water temperatures of 42 to 52 °F (5.5 to 11.5 °C) in the upper 656 feet (200 m) of the water column.

Juveniles: EFH is pelagic habitats in inshore estuaries and embayments from Passamaquoddy Bay and Penobscot Bay, Maine to the Hudson River, in the Gulf of Maine, and on the continental shelf from Georges Bank to Cape Hatteras, North Carolina. EFH for juvenile Atlantic mackerel is generally found over bottom depths between 32 and 360 feet (10 and 110 m) and in water temperatures of 41 to 68 °F (5 to 20 °C). Juvenile Atlantic mackerel feed primarily on small crustaceans, larval fish, and other pelagic organisms.

Adults: EFH is pelagic habitats in inshore estuaries and embayments from Passamaquoddy Bay, Maine to the Hudson River, and on the continental shelf from Georges Bank to Cape Hatteras, North Carolina. EFH for adult Atlantic mackerel is generally found over bottom depths less than 558 feet (170 m) and in water temperatures of 41 to 68 °F (5 to 20 °C). Spawning occurs at temperatures above 45 °F (7 °C), with a peak between 48 and 57 °F (9 and 14 °C). Adult Atlantic mackerel are opportunistic predators feeding primarily on a wider range and larger individuals of pelagic crustaceans than juveniles, but also on fish and squid.

2.2.5.2.3 Black Sea Bass

The black sea bass is a demersal finfish species that range from Nova Scotia to Florida and is managed as two stocks: Mid-Atlantic and South-Atlantic (NOAA Fisheries, 2019m). Black sea bass spend the summer in northern inshore waters at depths of less than 120 feet (37 m) and spend the winter in southern offshore waters at depths of 240 to 540 feet (73 to 165 m) (ASMFC, 2019a). Black sea bass prefer structured habitats such as reefs, pilings, jetties, shipwrecks, and lobster pots along the continental shelf (Steimle et al., 1999c; ASMFC, 2019a). Black sea bass spawn in May along the North Carolina coast, then spawn from the middle of May until the end of June in New Jersey, New York, and southern New England waters (Collette and Klein-MacPhee, 2002). Black sea bass consume a variety of prey items, but prefer crabs, shrimp, worms, small fish, and clams (NOAA Fisheries, 2019m). The most recent stock assessments for black sea bass concluded that both the Mid-Atlantic and South Atlantic stocks are not overfished and not subject to overfishing (NEFSC, 2017b; Southeast Data Assessment and Review [SEDAR], 2018).

The black sea bass EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Juveniles: Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the exclusive economic zone [EEZ]), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90 percent of all the ranked squares of the area where juvenile black sea bass are collected in the NEFSC trawl survey. Inshore, EFH is the estuaries where black sea bass are identified as being common, abundant, or highly abundant in the Estuarine Living Marine Resources (ELMR) database for the "mixing" and "seawater" salinity zones. Juveniles are found in the estuaries in the summer and spring. Generally, juvenile black sea bass are found in waters warmer than 43 °F (6 °C) with salinities greater than 18 ppt and coastal areas between Virginia and Massachusetts, but winter offshore from New Jersey and south. Juvenile black sea bass are usually found in association with rough bottom, shellfish and eelgrass beds, and man-made structures in sandy-shelly areas; offshore clam beds and shell patches may also be used for over-wintering.

Adults: Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90 percent of all the ranked 10-minute squares of the area where adult black sea bass are collected in the NEFSC trawl survey. Inshore, EFH is the estuaries where adult black sea bass were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Black sea bass are generally found in estuaries from May through October. Wintering adults (November through April) are generally offshore, south of New York to North Carolina. Temperatures above 43 °F (6 °C) seem to be the minimum requirements. Structured habitats (natural and man-made), sand, and shell are usually the substrate preference.

2.2.5.2.4 Bluefish

Bluefish are a migratory species that is found throughout the world in most temperate coastal regions except the eastern Pacific. In the U.S., they range from Maine to eastern Florida and are managed as a single stock (NOAA Fisheries, 2019n). Bluefish generally school by size, concentrating between Maine and Cape Hatteras, North Carolina in the summer, and offshore between Cape Hatteras and Florida in the winter (ASMFC, 2019b). Bluefish spawn multiple times in spring and summer, with discrete groups spawning at different times (NOAA Fisheries, 2019n; ASMFC, 2019b). Bluefish are voracious, opportunistic predators, preying on squid and fish, particularly menhaden and smaller fish such as silversides (NOAA Fisheries, 2019n; ASMFC, 2019b). Based on the most recent stock assessment, bluefish are not overfished and not subject to overfishing (NEFSC, 2015).

The bluefish EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Juvenile and adult life stages have EFH within the RWEC-RI corridor.

Eggs: North of Cape Hatteras, EFH is pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) at mid-shelf depths, from Montauk Point, New York south to Cape Hatteras in the highest 90 percent of the area where bluefish eggs were collected in the Marine Resources Monitoring, Assessment, and Prediction (MARMAP) surveys. Bluefish eggs are generally not collected in estuarine waters and thus there is no EFH designation inshore. Generally, bluefish eggs are collected between April through August in temperatures greater than 64 °F (18 °C) and normal shelf salinities (>31 ppt).

Larvae: North of Cape Hatteras, EFH is pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) most commonly above 59 feet (15 m), from Montauk Point, New York south to Cape Hatteras, in the highest 90 percent of the area where bluefish larvae were collected during the MARMAP surveys. EFH also includes the "slope sea" and Gulf Stream between latitudes 29° 00 N and 40° 00 N. Bluefish larvae are not generally collected inshore so there is not EFH designation inshore for larvae. Generally, bluefish larvae are collected April through September in temperatures greater than 64 °F (18 °C) in normal shelf salinities (>30 ppt).

Juveniles: North of Cape Hatteras, EFH is pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) from Nantucket Island, Massachusetts south to Cape Hatteras, in the highest 90 percent of the area where juvenile bluefish are collected in the NEFSC trawl survey. EFH also includes the "slope sea" and Gulf Stream between latitudes 29° 00 N and 40° 00 N. Inshore, EFH is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Generally juvenile bluefish occur in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from May through October, and South Atlantic estuaries March through December, within the "mixing" and "seawater" zones. Distribution of juveniles by temperature, salinity, and depth over the continental shelf is undescribed.

Adults: North of Cape Hatteras, EFH is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from Cape Cod Bay, Massachusetts south to Cape Hatteras, in the highest 90 percent of the area where adult bluefish were collected in the NEFSC trawl survey. Inshore, EFH is all major estuaries between

Penobscot Bay, Maine and St. Johns River, Florida. Adult bluefish are found in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from April through October, and in South Atlantic estuaries from May through January in the "mixing" and "seawater" zones. Bluefish adults are highly migratory, and distribution varies seasonally and according to the size of the individuals comprising the schools. Bluefish are generally found in normal shelf salinities (>25 ppt).

2.2.5.2.5 Scup

Scup are a migratory, schooling species found in the northwest Atlantic Ocean, primarily between Cape Cod, Massachusetts, and Cape Hatteras, North Carolina (NOAA Fisheries, 2019o). Scup are currently managed as two stocks, the Mid-Atlantic/New England stock, and the South Atlantic stock. Scup spend the winter in offshore waters between southern New Jersey and Cape Hatteras, migrating to more northern and inshore waters when water temperatures begin to rise in spring and summer (ASMFC, 2019c). Scup are known to congregate in nearshore areas of New England from early April to December, at depths between 270 and 420 feet (82 to 128 m) (Collette and Klein-MacPhee, 2002). Scup spawn over weedy or sandy areas in southern New England between Massachusetts Bay and the New York Bight between May and August, with peak spawning activity taking place in June (NOAA Fisheries, 2019o). Scup prefer smooth to rocky bottom habitats and usually form schools around such bottoms, feeding on demersal invertebrates. The 2017 stock assessment for the Mid-Atlantic/New England stock indicated that scup are not overfished and not currently subject to overfishing (NEFSC, 2017c). The population status of the South Atlantic stock has not been assessed (NOAA Fisheries, 2019o).

The scup EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Egg, larvae, juvenile, and adult life stages have EFH within the RWEC-RI corridor.

Eggs: EFH is estuaries where scup eggs were identified as common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. In general, scup eggs are found from May through August in southern New England to coastal Virginia, in waters between 55 and 73 °F (12 to 23 °C) and in salinities greater than 15 ppt.

Larvae: EFH is estuaries where scup were identified as common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. In general, scup larvae are most abundant nearshore from May through September, in waters between 55 and 73 °F (12 to 23 °C) and in salinities greater than 15 ppt.

Juveniles: Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90 percent of all the ranked 10-minute squares of the area where juvenile scup are collected in the NEFSC trawl survey. Inshore, EFH is the estuaries where scup has been identified as common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. In general, juvenile scup are found during the summer and spring in estuaries and bays between Virginia and Massachusetts, in association with various sands, mud, mussel, and eelgrass bed type substrates and in water temperatures greater than 45 °F (7 °C) and salinities greater than 15 ppt.

Adults: Offshore, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90 percent of all the ranked 10-minute squares of the area where adult scup are collected in the NEFSC trawl survey. Inshore, EFH is the estuaries where scup has been identified as common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally, wintering adults (November through April) are usually offshore, south of New York to North Carolina, in waters above 45 °F (7 °C).

2.2.5.2.6 Summer Flounder

Summer flounder are found in inshore and offshore waters from Nova Scotia to the east coast of Florida, concentrating in the Mid-Atlantic region from Cape Cod, Massachusetts to Cape Fear, North Carolina (NOAA Fisheries, 2019p; ASMFC, 2019d). Summer flounder are managed as a single stock. Summer flounder move offshore in the fall to depths of 120 to 600 feet (37 to 183 m) to spawn (ASMFC, 2019d). Spawning peaks in October and November, and larvae migrate to inshore coastal and estuarine nursey areas (NOAA Fisheries, 2019p; ASMFC, 2019d). Adult summer flounder prefer sandy habitats, but can be found in a variety of habitat with both mud and sand substrates (Packer et al., 1999). Summer flounder are ambush predators, and prey opportunistically on fish and invertebrates including sea worms, squid, shrimp, and other crustaceans (ASFMC, 2019d). The 2019 stock assessment concluded that summer flounder are not overfished and not subject to overfishing (NEFSC, 2019).

The summer flounder EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Larvae, juvenile, and adult life stages have EFH within the RWEC-RI corridor.

Eggs: North of Cape Hatteras, EFH is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90 percent of the all the ranked 10-minute squares for the area where summer flounder eggs are collected in the MARMAP survey. In general, summer flounder eggs are found between October and May, being most abundant between Cape Cod and Cape Hatteras, with the heaviest concentrations within 9 miles (14.5 km, 7.8 nm) of shore off New Jersey and New York. Eggs are most commonly collected at depths of 30 to 360 feet (9 to 110 m).

Larvae: North of Cape Hatteras, EFH is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90 percent of all the ranked 10-minute squares for the area where summer flounder larvae are collected in the MARMAP survey. Inshore, EFH is all the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database, in the "mixing" (defined in ELMR as 0.5 to 25.0 ppt) and "seawater" (defined in ELMR as greater than 25 ppt) salinity zones. In general, summer flounder larvae are most abundant nearshore (12 to 50 miles [19 to 80.5 km, 10.4 to 43.4 nm] from shore) at depths between 30 to 230 feet (9 to 70 m). They are most frequently found in the northern part of the Mid-Atlantic Bight from September to February, and in the southern part from November to May.

Juveniles: North of Cape Hatteras, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90 percent of all the ranked 10-minute squares for the area where juvenile summer flounder are collected in the NEFSC trawl survey. Inshore, EFH is all the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database for the "mixing" and "seawater" salinity zones. In general, juveniles use several estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas in water temperatures greater than 37 °F (3 °C) and salinities from 10 to 30 ppt range.

Adults: North of Cape Hatteras, EFH is the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90 percent of all the ranked 10-minute squares for the area where adult summer flounder are collected in the NEFSC trawl survey. Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally, summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore on the outer continental shelf at depths of 500 feet (152 m) in colder months.

2.2.5.3 Invertebrates

2.2.5.3.1 Atlantic Sea Scallop

The Atlantic sea scallop is managed as a single stock that ranges from Newfoundland to Cape Hatteras, North Carolina (NOAA Fisheries, 2019q). Atlantic sea scallop occur along the continental shelf, typically at depths ranging from 59 to 360 feet (18 to 110 m), and are generally found in seabed areas with coarse substrates consisting of firm sand, gravel, shells, and rocks (Hart and Chute, 2004). The sea scallop spawning season is usually in the late summer or early fall, and spawning may also occur in the spring in the Mid-Atlantic Bight (NOAA Fisheries, 2019q). The 2018 stock assessment concluded that Atlantic sea scallop are not overfished and are not subject to overfishing (NEFSC, 2018a).

The Atlantic sea scallop EFH designations are reproduced below for the life stages found within the Project Area. Egg, larvae, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Eggs: EFH is benthic habitats in inshore areas and on the continental shelf as shown on Map 97 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), in the vicinity of adult scallops. Eggs are heavier than seawater and remain on the seafloor until they develop into the first free-swimming larval stage.

Larvae: EFH is benthic and water column habitats in inshore and offshore areas throughout the region, as shown on Map 97 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017). Any hard surface can provide an essential habitat for settling pelagic larvae ("spat"), including shells, pebbles, and gravel. They also attach to macroalgae and other benthic organisms such as hydroids. Spat attached to sedentary branching organisms or any hard surface have greater survival rates; spat that settle on shifting sand do not survive.

Juveniles: EFH is benthic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic, as shown on Map 97 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), in depths of 59 to 361 feet (18 to 110 m). Juveniles (0.2 to 0.5 inch [5 to 12 mm] shell height) leave the original substrate on which they settle (see spat, above) and attach themselves with byssal threads to shells, gravel, and small rocks (pebble, cobble), preferring gravel. As they grow older, they lose their byssal attachment. Juvenile scallops are relatively active and swim to escape predation. While swimming, they can be carried long distances by currents. Bottom currents stronger than 10 cm/sec retard feeding and growth. In laboratory studies, maximum survival of juvenile scallops occurred between 34 and 59 °F (1.2 and 15 °C) and above salinities of 25 ppt. On Georges Bank, age 1 juveniles are less dispersed than older juveniles and adults and are mainly associated with gravel-pebble deposits. Essential habitats for older juvenile scallops are the same as for the adults (gravel and sand).

Adults: EFH is benthic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic, as shown on Map 97 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017). Essential habitats for older juvenile and adult sea scallops are found on sand and gravel substrates in depths of 59 to 361 feet (18 to 110 m), but they are also found in shallower water and as deep as 591 feet (180 m) in the Gulf of Maine. In the Mid-Atlantic they are found primarily between 148 and 246 feet (45 and 75 m) and on Georges Bank they are more abundant between 197 and 295 feet (60 and 90 m). They often occur in aggregations called beds which may be sporadic or essentially permanent, depending on how suitable the habitat conditions are (temperature, food availability, and substrate) and whether oceanographic features (fronts, currents) keep larval stages in the vicinity of the spawning population. Bottom currents stronger than 25 cm/sec inhibit feeding. Growth of adult scallops is optimal between 50 and 59 °F (10 and 15 °C) and they prefer full strength seawater.

2.2.5.3.2 Atlantic Surfclam

The Atlantic surfclam ranges from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina. The species prefers sandy habitats along the continental shelf (Cargnelli et al., 1999d), and is most abundant on Georges Bank, the south shore of Long Island, and along the coasts of New Jersey and the Delmarva Peninsula (NOAA Fisheries, 2019r). Atlantic surfclam spawn in the late spring through the early fall (NOAA Fisheries, 2019r). According to the most recent stock assessment, Atlantic surfclam are not overfished and not subject to overfishing (NEFSC, 2016).

The Atlantic surfclam EFH designations are reproduced below for the life stages found within the Project Area. Adults have EFH designated within the RWEC-OCS corridor, and juveniles and adults have EFH designated within the RWEC-RI corridor.

Juveniles and Adults: EFH is throughout the substrate, to a depth of 3 feet (1 m) below the water/sediment interface, within federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ, in areas that encompass the top 90 percent of all the ranked 10-minute squares for the area where surfclams were caught in the NEFSC surfclam and ocean quahog dredge surveys. Surfclams generally occur from the beach zone to a depth of about 200 feet (656 m), but beyond about 125 feet (52 m) abundance is low.

2.2.5.3.3 Longfin Inshore Squid

The longfin squid is a pelagic, schooling species that ranges from Newfoundland to the Gulf of Venezuela. In U.S. waters, longfin inshore squid are managed as a single stock and are most abundant between Georges Bank and Cape Hatteras, North Carolina (NOAA Fisheries, 2019s). Longfin inshore squid have a very short life span (less than 1 year), and spawn year-round with peak productions in winter and summer (NOAA Fisheries, 2019s). Juvenile longfin inshore squid feed on plankton, and adults are aggressive hunters that feed on fish, crustaceans, and their own species (NOAA Fisheries, 2019s). The 2017 stock assessment concluded that longfin inshore squid are not overfished, but there was not enough information to determine whether the stock is experiencing overfishing (Hendrickson, 2017).

The longfin inshore squid EFH designations are reproduced below for the life stages found within the Project Area. Egg, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Eggs: EFH for longfin inshore squid eggs occurs in inshore and offshore bottom habitats from Georges Bank southward to Cape Hatteras. EFH for eggs is generally found where bottom water temperatures are between 50 and 73 °F (10 and 23 °C), salinities are between 30 and 32 ppt and depth is less than 164 feet (50 m). Longfin inshore squid eggs have also been collected in bottom trawls in deeper water at various places on the continental shelf. Like most loliginid squids, longfin inshore squid egg masses or “mops” are demersal and anchored to the substrates on which they are laid, which include a variety of hard bottom types (e.g., shells, lobster pots, piers, fish traps, boulders, and rocks), submerged aquatic vegetation (e.g., *Fucus* sp.), sand, and mud.

Juveniles (Pre-Recruits): EFH is pelagic habitats in inshore and offshore continental shelf waters from Georges Bank to South Carolina, in the southwestern Gulf of Maine, and in embayments such as Narragansett Bay, Long Island Sound, and Raritan Bay. EFH is generally found over bottom depths between 20 and 525 feet (6 and 160 m) where bottom water temperatures are 47 to 76 °F (8.5 to 24.5 °C) and salinities are 28.5 to 36.5 ppt. Pre-recruits migrate offshore in the fall where they overwinter in deeper waters along the edge of the shelf. They make daily vertical migrations, moving in the water column at night and down in the daytime. Small immature individuals feed on planktonic organisms while larger individuals feed on crustaceans and small fish.

Adults (Recruits): EFH is pelagic habitats in inshore and offshore continental shelf waters from Georges Bank to South Carolina, in inshore waters of the Gulf of Maine, and in embayments such as Narragansett Bay, Long Island Sound, Raritan Bay, and Delaware Bay. EFH is generally found over bottom depths between 20 and 656 feet (6 and 200 m) where bottom water temperatures are 47 to 57 °F (8.5 to 14 °C) and salinities are 24 to 36.5 ppt. Recruits inhabit the continental shelf and upper continental slope to depths of 1,312 feet (400 m). They migrate offshore in the fall and overwinter in warmer waters along the edge of the shelf. Like the pre-recruits, they make daily vertical migrations. Individuals larger than 4.7 inches (12 cm) feed on fish and those larger than 6.3 inches (16 cm) feed on fish and squid. Females deposit eggs in gelatinous capsules which are attached in clusters to rocks, boulders, and aquatic vegetation and on sand or mud bottom, generally in depths less than 164 feet (50 m).

2.2.5.3.4 Northern Shortfin Squid

The northern shortfin squid is a highly migratory species found in the northwest Atlantic Ocean between the Labrador Sea and the Florida Straits (Hendrickson and Holmes, 2004). In U.S. waters, northern shortfin squid are managed as a single stock. Northern shortfin squid have a very short life span (less than 1 year). The species migrates onto the continental shelf in the spring, and migrates offshore in the late autumn, presumably to a winter spawning site (Hendrickson and Holmes, 2004). Winter habitats of the species are not well known, and the only confirmed spawning area is located in the Mid-Atlantic Bight at depths of 371 to 1,237 feet (113 to 377 m) (Hendrickson and Holmes, 2004). It is unknown whether the stock of northern shortfin squid is overfished or experiencing overfishing, as relative abundance and biomass indices are highly variable and lacking a trend (Mid-Atlantic Fishery Management Council and NOAA Fisheries, 2018).

The northern shortfin squid EFH designation for adults is reproduced below; this is the only life stage with EFH within the RWF area. Northern shortfin squid EFH is not found within the RWEC-OCS or RWEC-RI corridor.

Adults (Recruits): EFH is pelagic habitats on the continental shelf and slope from Georges Bank to South Carolina, and in inshore and offshore waters of the Gulf of Maine. EFH for adult northern shortfin squid is generally found on the shelf over bottom depths between 135 and 1,312 feet (41 and 400 m) where bottom temperatures are 40.1 to 58.1 °F (4.5 to 14.5 °C) and salinities are 34.5 to 36.5 ppt. They have also been caught in bottom trawls as deep as 8,202 feet (2,500 m) in waters beyond the edge of the shelf and on Bear Seamount. Adults make daily vertical migrations, moving up in the water column at night and down in the daytime. They feed primarily on fish and euphausiids and are also cannibalistic (larger females consume smaller males).

2.2.5.3.5 Ocean Quahog

Ocean quahog are managed as a single stock and range from Newfoundland to Cape Hatteras. The highest concentrations of ocean quahog are found are south of Nantucket to the Delmarva Peninsula in offshore waters (Cargnelli et al., 1999e). The species prefers medium- to fine-grain sand, sandy mud, and silty sand (Cargnelli et al., 1999e). Ocean quahogs spawn once a year in the summer or fall, but the spawning season can be extended over several months (NOAA Fisheries, 2019t). The 2017 stock assessment concluded that ocean quahog are not overfished and not subject to overfishing (NEFSC, 2017d).

The ocean quahog EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area and RWEC-OCS corridor.

Juveniles and Adults: EFH is throughout the substrate, to a depth of 3 feet (1 m) below the water/sediment interface, within federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ, in areas that encompass the top 90 percent of all the ranked 10-minute squares for the area where ocean quahogs were caught in the NEFSC surfclam and ocean quahog dredge surveys. Distribution in the western Atlantic ranges in depths from 30 feet (9 m) to about 800 feet (244 m). Ocean quahogs are rarely found where bottom water temperatures exceed 60 °F (16 °C) and occur progressively further offshore between Cape Cod and Cape Hatteras.

2.2.5.4 Highly Migratory Species

2.2.5.4.1 Albacore Tuna

Albacore Tuna is a circumglobal, epipelagic species that is managed in three stocks: North Atlantic, South Atlantic, and Mediterranean (NOAA Fisheries, 2017). They travel in large schools that are sometimes mixed with other tuna species (NOAA Fisheries, 2019u). Albacore tuna forage down to depth of 1,640 feet (500 m), preying opportunistically on a wide variety of fishes and invertebrates (NOAA Fisheries, 2017). Albacore tuna spawn in the spring and summer in the western tropical areas of the Atlantic, and then they move northward and use the central and northern portions of the Atlantic as their wintering area (NOAA Fisheries, 2017). The most recent stock assessment concluded that the North Atlantic stock of albacore tuna is not overfished, has rebuilt to target population levels, and is not subject to overfishing (International Commission for the Conservation of Atlantic Tunas [ICCAT], 2016a).

The albacore tuna EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Within the RWEC-RI corridor, only juveniles have EFH.

Juveniles and Adults: EFH is offshore, pelagic habitats of the Atlantic Ocean from the outer edge of the U.S. EEZ through Georges Bank to pelagic habitats south of Cape Cod, and from Cape Cod to Cape Hatteras, North Carolina. EFH also includes offshore pelagic habitats near the outer U.S. EEZ between North Carolina and Florida, and offshore pelagic habitats associated with the Blake Plateau. EFH also includes offshore pelagic habitats in the western and central Gulf of Mexico.

2.2.5.4.2 Bluefin Tuna

Bluefin tuna are a highly migratory, epipelagic species managed in two stocks: western and eastern, separated by the 45° W meridian (NOAA Fisheries, 2017). In the western Atlantic, bluefin tuna range from Newfoundland to the Gulf of Mexico (NOAA Fisheries, 2019v). Bluefin tuna are thought to forage off the eastern U.S. and Canadian coasts from June through March, migrating to spawning grounds in the Gulf of Mexico, Bahamas, and the Straits of Florida in April and May, and then generally moving back to foraging grounds of the Gulf Stream and North American continental shelf and slope waters, including the South and Mid-Atlantic Bight, the Gulf of Maine, and the Nova Scotia Shelf (NOAA Fisheries, 2017). Adult bluefin tuna feed opportunistically on a variety of schooling fish, cephalopods, and benthic invertebrates, including silver hake, Atlantic mackerel, Atlantic herring, krill, sandlance, and squid (NOAA Fisheries, 2017). The 2017 stock assessment concluded that the western Atlantic bluefin tuna stock is not subject to overfishing, but the information was insufficient to determine whether the stock status is overfished (ICCAT, 2017; NOAA Fisheries, 2019v).

The bluefin tuna EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Juveniles: EFH is coastal and pelagic habitats of the Mid-Atlantic Bight and the Gulf of Maine, between southern Maine and Cape Lookout, from shore (excluding Long Island Sound, Delaware Bay, Chesapeake Bay, and Pamlico Sound) to the continental shelf break. EFH in coastal areas of Cape Cod are located between the Great South Passage and shore. EFH follows the continental shelf from the outer extent of the U.S. EEZ on Georges Bank to Cape Lookout. EFH is associated with certain environmental conditions in the Gulf of Maine (61 to 66 °F (16 to 19 °C); 0 to 131 feet (0 to 40 m) deep). EFH in other locations associated with temperatures ranging from 39 to 79 °F (4 to 26 °C), often in depths of less than 66 feet (20 m) (but can be found in waters that are 131–328 feet (40–100 m) in depth in winter).

Adults: EFH is located in offshore and coastal regions of the Gulf of Maine the mid-coast of Maine to Massachusetts; on Georges Bank; offshore pelagic habitats of southern New England; from southern New England to coastal areas between the mouth of Chesapeake Bay and Onslow Bay, North Carolina; from coastal North Carolina south to the outer extent of the U.S. EEZ, inclusive of pelagic habitats of the Blake Plateau, Charleston Bump, and Blake Ridge. EFH also consists of pelagic waters of the central Gulf of Mexico from the continental shelf break to the seaward extent of the U.S. EEZ between Apalachicola, Florida and Texas.

2.2.5.4.3 Skipjack Tuna

The skipjack tuna is a circumglobal, epipelagic species that is managed as two stocks, eastern and western. Skipjack tuna in the western Atlantic range are found in tropical and warm-temperate waters from Newfoundland to Brazil (NOAA Fisheries, 2017). They are a schooling species, and have been known to associate with birds, drifting objects, whales, sharks, and other tunas (NOAA Fisheries, 2017). Skipjack tuna feed opportunistically on a variety of fishes, cephalopods, crustaceans, mollusks, and sometimes other skipjack tuna (NOAA Fisheries, 2017; NOAA Fisheries, 2019w). The species spawns throughout the year in warm equatorial waters and from spring to early fall in subtropical waters (NOAA Fisheries, 2017). Based on the 2014 stock assessment, western Atlantic skipjack tuna are not overfished and not subject to overfishing (ICCAT, 2014).

The skipjack tuna EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area. Within the RWEC-OCS corridor and RWEC-RI corridor, only adults have EFH.

Juveniles: EFH is offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts), coastal and offshore habitats between Massachusetts and South Carolina, localized areas off Georgia and South Carolina, and from the Blake Plateau through the Florida Straits. EFH also includes offshore waters in the central Gulf of Mexico from Texas through the Florida Panhandle. In all areas, juveniles are found in waters greater than 66 feet (20 m).

Adults: EFH is coastal and offshore habitats between Massachusetts and Cape Lookout, North Carolina and localized areas in the Atlantic off South Carolina and Georgia, and the northern east coast of Florida. EFH in the Atlantic Ocean is also located on the Blake Plateau, in the Florida Straits through the Florida Keys, and areas in the central Gulf of Mexico, offshore in pelagic habitats seaward of the southeastern edge of the West Florida Shelf to Texas.

2.2.5.4.4 Yellowfin Tuna

The yellowfin tuna is a circumglobal, epipelagic species found in tropical and temperate waters (NOAA Fisheries, 2017). In the western Atlantic, yellowfin tuna are managed as a single stock and spawn from May to August in the Gulf of Mexico and from July to November in the southeastern Caribbean (NOAA Fisheries, 2019x). The species travel in schools, with juveniles found at the surface in mixed schools with other tuna species (NOAA Fisheries, 2017). Yellowfin tuna feed primarily in surface waters down to a depth of 328 feet (100 m), preying on a wide variety of fish and invertebrates (NOAA Fisheries, 2017). According to the 2016 stock assessment, Atlantic yellowfin tuna are not overfished and are not currently subject to overfishing (ICCAT, 2016b).

The yellowfin tuna EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Within the RWEC-RI corridor, only juveniles have EFH.

Juveniles: EFH is offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank and Cape Cod, Massachusetts. EFH also includes offshore and coastal habitats from Cape Cod to the mid-east coast of Florida and the Blake Plateau, locally distributed areas in the Florida Straits and off the southwestern edge of the West Florida Shelf, the central Gulf of Mexico from the Florida Panhandle to southern Texas, and localized areas southeast of Puerto Rico.

Adults: EFH is offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank and Cape Cod, Massachusetts. EFH also includes offshore and coastal habitats from Cape Cod to North Carolina, offshore pelagic habitats of the Blake Plateau. EFH in the Gulf of Mexico spans throughout much of the offshore pelagic habitat from the West Florida Shelf to the continental shelf off southern Texas.

2.2.5.5 Skates

2.2.5.5.1 Little Skate

The little skate is a demersal species that ranges from Nova Scotia to Cape Hatteras and is most abundant in the northern Mid-Atlantic Bight and on Georges Bank (Packer et al., 2003a). Little skate are managed as a single stock as part of the Northeast Skate Complex. The little skate is present in New England year-round, and mating may take place at any time throughout the year, although there is evidence that most egg cases are found fully or partially developed from late October to January and from June to July (Packer et al., 2003a). Little skate primarily prey on decapod crustaceans, amphipods, and polychaetes, and to a lesser extent, isopods, bivalves, and fishes (Packer et al., 2003a). According to the 2016 stock status update, little skate are not overfished and not experiencing overfishing (Sosebee, 2017).

The little skate EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Juveniles: EFH is intertidal and subtidal benthic habitats in coastal waters of the Gulf of Maine and in the Mid-Atlantic region as far south as Delaware Bay, and on Georges Bank, extending to a maximum depth of 262 feet (80 m), as shown on Map 90 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and including high salinity zones in the bays and estuaries listed in Table 28 of NEFMC (2017). EFH for juvenile little skates occurs on sand and gravel substrates, but they are also found on mud.

Adults: EFH is intertidal and subtidal benthic habitats in coastal waters of the Gulf of Maine and in the Mid-Atlantic region as far south as Delaware Bay, and on Georges Bank, extending to a maximum depth of 328 feet (100 m), as shown on Map 91 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), and including high salinity zones in the bays and estuaries listed in Table 28 of NEFMC (2017). EFH for adult little skates occurs on sand and gravel substrates, but they are also found on mud.

2.2.5.5.2 Winter Skate

Winter skate range from the Gulf of St. Lawrence in Canada to Cape Hatteras, North Carolina, and have concentrated populations on Georges Bank and the northern section of the Mid-Atlantic Bight (Packer et al., 2003b; NOAA Fisheries, 2019y). Winter skate are managed as a single stock as part of the Northeast Skate Complex (NOAA Fisheries, 2019y). Mating is thought to take place year-round, though female winter skates with fully formed egg capsules are more abundant in summer and fall (Packer et al., 2003b). Winter skate primarily prey on polychaetes and amphipods, followed by decapod crustaceans, isopods, bivalves, and fishes (Packer et al., 2003b). According to the most recent stock assessment, winter skate are not overfished and not experiencing overfishing (Sosebee, 2017).

The winter skate EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Juveniles: EFH is subtidal benthic habitats in coastal waters from eastern Maine to Delaware Bay and on the continental shelf in southern New England and the Mid-Atlantic region, and on Georges Bank, from the shoreline to a maximum depth of 295 feet (90 m), as shown on Map 92 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the high salinity zones of the bays and estuaries listed in Table 28 of NEFMC (2017). EFH for juvenile winter skates occurs on sand and gravel substrates, but they are also found on mud.

Adults: EFH is subtidal benthic habitats in coastal waters in the southwestern Gulf of Maine, in coastal and continental shelf waters in southern New England and the Mid-Atlantic region, and on Georges Bank, from the shoreline to a maximum depth of 262 feet (80 m), as shown on Map 93 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017), including the high salinity zones of the bays and estuaries listed in Table 28 of NEFMC (2017). EFH for adult winter skates occurs on sand and gravel substrates, but they are also found on mud.

2.2.5.6 Sharks

2.2.5.6.1 Basking Shark

The basking shark is a large, migratory species found in subpolar and cold temperate seas throughout the world (NOAA Fisheries, 2017). In the western Atlantic, basking sharks are found in coastal regions from April to October, with the highest abundance in May through August (NOAA Fisheries, 2017). Basking shark are filter-feeders that feed swimming forward with an opened mouth to filter planktonic prey. Little is known about the reproductive habits of basking shark, though aggregations of basking shark displaying courtship behaviors are thought to associate with persistent thermal fronts in areas of high prey density (NOAA Fisheries, 2017). Harvest of basking shark is prohibited in the U.S., and the species is listed as “Vulnerable” on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (Fowler, 2009). A stock assessment has not been conducted for basking shark (NOAA Fisheries, 2017).

The basking shark EFH designations are reproduced below for the life stages found within the Project Area. Neonate, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor.

Neonate/Young-of-the-Year (YOY), Juveniles and Adults: At this time, insufficient data are available to differentiate EFH between size classes; therefore, EFH designations for all life stages have been combined and are considered the same. EFH is the Atlantic east coast from the Gulf of Maine to the northern Outer Banks of North Carolina, and from mid-South Carolina to coastal areas of northeast Florida. Aggregations of basking sharks were observed from the south and southeast of Long Island, east of Cape Cod, and along the coast of Maine, in the Gulf of Maine and near the Great South Channel, approximately 59 miles (95 km) southeast of Cape Cod, Massachusetts as well as approximately 47 miles (75 km) south of Martha’s Vineyard and 56 miles (90 km) south of Moriche’s Inlet, Long Island. These aggregations tend to be associated with persistent thermal fronts within areas of high prey density.

2.2.5.6.2 Blue Shark

The blue shark is a common pelagic shark that ranges widely in tropical, subtropical, and temperate waters (NOAA Fisheries, 2017). In the western Atlantic Ocean, they range from Newfoundland to Argentina (Fisheries and Oceans

Canada, 2018b). Blue shark migrate great distances and prefer deep, clear, blue waters, usually with temperatures between 50 and 68 °F (10 and 20 °C) and depths greater than 591 feet (180 m) (NOAA Fisheries, 2017). Blue sharks are thought to have an annual reproductive cycle, and nursery areas appear to be in open oceanic waters in the higher latitudes of the its range (NOAA Fisheries, 2017). Blue shark prey mostly on squid and pelagic schooling fishes, and are known to feed opportunistically on marine mammal and turtle carcasses (Fisheries and Oceans Canada, 2018b). The 2015 stock assessment concluded that blue shark are not overfished and not experiencing overfishing, though the authors acknowledged a high level of uncertainty in the results (ICCAT, 2015).

The blue shark EFH designations are reproduced below for the life stages found within the Project Area. Neonate, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor.

Neonates/YOY: EFH includes the Atlantic in areas offshore of Cape Cod through New Jersey, seaward of the 98 foot (30 m) bathymetric line (and excluding inshore waters such as Long Island Sound). EFH follows the continental shelf south of Georges Bank to the outer extent of the U.S. EEZ in the Gulf of Maine.

Juveniles and Adults: EFH includes localized areas in the Atlantic Ocean in the Gulf of Maine, from Georges Bank to North Carolina, South Carolina, Georgia, and off Florida.

2.2.5.6.3 Common Thresher Shark

The common thresher shark is a pelagic shark found in warm and temperate coastal and oceanic waters around the world, with higher abundance near land (NOAA Fisheries, 2017). In the northwest Atlantic Ocean, they are found from Newfoundland to Cuba. Common thresher shark prey on squid, pelagic crabs, and small fishes such as anchovy, sardines, hakes, and small mackerels (NOAA Fisheries, 2017). Common thresher shark mating is thought to occur in the late summer and fall, with females giving birth in spring (NOAA Fisheries, 2017; NOAA Fisheries, 2019z). A stock assessment has not been conducted for common thresher shark (NOAA Fisheries, 2019z).

The common thresher shark EFH designations are reproduced below for the life stages found within the Project Area. Neonate, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Neonate/YOY, Juveniles, and Adults: At this time, insufficient data are available to differentiate EFH between the juvenile and adult size classes; therefore, EFH is the same for those life stages. EFH is located in the Atlantic Ocean, from Georges Bank (at the offshore extent of the U.S. EEZ boundary) to Cape Lookout, North Carolina; and from Maine to locations offshore of Cape Ann, Massachusetts. EFH occurs with certain habitat associations in nearshore waters of North Carolina, especially in areas with temperatures from 65 to 70 °F (18.2 to 20.9 °C) and at depths from 15 to 45 feet (4.6 to 13.7 m).

2.2.5.6.4 Dusky Shark

The dusky shark is a migratory species found in warm and temperate waters over the continental shelf throughout the Atlantic, Pacific, and Indian Oceans (NOAA Fisheries, 2017). The reproductive habits of dusky shark are not well known, but the species is thought to give birth in Bulls Bay, South Carolina in April and May, and in the Chesapeake Bay, Maryland in June and July (NOAA Fisheries, 2017). The shallow, coastal waters of Massachusetts serve as nursery habitat for young dusky sharks. Dusky shark prey on a variety of fishes, squid, and other elasmobranchs such as dogfish, catsharks, skates, and rays (Fisheries and Oceans Canada, 2018c; Musick et al., 2009a). Harvest of dusky shark is prohibited in the U.S., and the species is listed as “Vulnerable” on the IUCN Red List of Threatened Species (Musick et al., 2009a). The most recent stock assessment concluded that dusky shark are overfished and subject to overfishing (SEDAR, 2016).

The dusky shark EFH designations are reproduced below for the life stages found within the Project Area. Neonate, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor.

Neonate/YOY: EFH in the Atlantic Ocean includes offshore areas of southern New England to Cape Lookout, North Carolina. Specifically, EFH is associated with habitat conditions including temperatures from 65 to 72 °F (18.1 to

22.2 °C), salinities of 25 to 35 ppt and depths at 14 to 51 feet (4.3 to 15.5 m). The seaward extent of EFH for this life stage in the Atlantic is 197 feet (60 m) in depth.

Juveniles and Adults: EFH is the coastal and pelagic waters inshore of the continental shelf break (< 656 feet [200 m] in depth) along the Atlantic east coast from habitats offshore of southern Cape Cod to Georgia, including the Charleston Bump and adjacent pelagic habitats. The inshore extent for these life stages is the 66 foot (20 m) bathymetric line, except in habitats of southern New England, where EFH is extended seaward of Martha's Vineyard, Block Island, and Long Island. EFH also includes pelagic habitats of southern Georges Bank and the adjacent continental shelf break from Nantucket Shoals and the Great South Channel to the eastern boundary of the United States EEZ. Adults are generally found deeper (to 6,562 feet [2,000 m]) than juveniles; however, there is overlap in the habitats utilized by both life stages. In the Gulf of Mexico, EFH includes offshore waters of the western and north Gulf, at and seaward of the continental shelf break, and in proximity to numerous banks along the continental shelf edge (e.g., Ewing and Sackett Bank). The continental shelf edge habitat from Desoto Canyon west to the Mexican border is important habitat for adult dusky sharks.

2.2.5.6.5 Sand Tiger Shark

Sand tiger shark are a large, coastal species found in tropical and warm temperate waters around the world, often in very shallow water (13 feet [4 m]) (NOAA Fisheries, 2017). In the northwestern Atlantic, mature sand tiger shark males and juveniles are found between Cape Cod and Cape Hatteras, and mature and pregnant females are found between Cape Hatteras and Florida (NOAA Fisheries, 2017). Sand tiger reproductive habits are not well known, but in the northwestern Atlantic they are thought to give birth in March and April. In the southern portions of its range, females are believed to give birth in the winter, with neonates migrating northward to summer nurseries such as Narragansett Bay (NOAA Fisheries, 2017). Sand tiger sharks feed on a variety of bony fishes, as well as other elasmobranchs. Harvest of sand tiger shark is prohibited in the U.S., and the species is listed as "Vulnerable" on the IUCN Red List of Threatened Species (Pollard and Smith, 2009).

The sand tiger shark EFH designations are reproduced below for the life stages found within the Project Area. Neonate and juvenile life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Neonate/YOY and Juveniles: Neonate EFH ranges from Massachusetts to Florida, specifically the Plymouth, Kingston, Duxbury Bay system, Sandy Hook, and Narragansett Bays as well as coastal sounds, lower Chesapeake Bay, Delaware Bay (and adjacent coastal areas), Raleigh Bay and habitats surrounding Cape Hatteras. Juvenile EFH includes habitats between Massachusetts and New York (Plymouth, Kingston, Duxbury Bay system), and between mid-New Jersey and the mid-east coast of Florida. EFH can be described via known habitat associations in the lower Chesapeake Bay and Delaware Bay (and adjacent coastal areas) where temperatures range from 66 to 77 °F (19 to 25 °C), salinities range from 23 to 30 ppt at depths of 9 to 23 feet (2.8 to 7.0 m) in sand and mud areas, and in coastal North Carolina habitats with temperatures from 66 to 81 °F (19 to 27 °C), salinities from 30 to 31 ppt, depths of 27 to 45 feet (8.2 to 13.7 m), in rocky and mud substrate or in areas surrounding Cape Lookout that contain benthic structure.

2.2.5.6.6 Sandbar Shark

The sandbar shark is a large, coastal species found in subtropical and warm temperate waters. In the northwestern Atlantic, sandbar shark range from Cape Cod to the western Gulf of Mexico (NOAA Fisheries, 2017). Sandbar sharks prefer bottom habitats and are most commonly found in 66 to 180 feet (20 to 55 m) of water, and occasionally at depths of about 656 feet (200 m) (NOAA Fisheries, 2017). The species preys on a variety of bony fishes, other elasmobranchs, mollusks, and crustaceans (Musick et al., 2009b). Sandbar sharks migrate seasonally, and males and females segregate during most of the year (NFMS, 2017). Mating and birthing activities are thought to peak between April and July, with most near-term pregnant and postpartum females observed in the Florida Keys (NOAA Fisheries, 2017). In U.S. waters, sandbar shark nursery areas consist of shallow coastal waters from Cape Canaveral, Florida to Martha's Vineyard, Massachusetts. The 2017 stock assessment indicated that sandbar shark are overfished and not experiencing overfishing (Southeast Data and Assessment Review, 2017).

The sandbar shark EFH designations are reproduced below for the life stages found within the Project Area. Juvenile and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Juveniles: EFH includes coastal portions of the Atlantic Ocean between southern New England (Nantucket Sound, Massachusetts) and Georgia in water temperatures ranging from 68 to 75 °F (20 to 24 °C) and depths from 7.9 to 21 feet (2.4 to 6.4 m). Important nurseries include Delaware Bay, Delaware, and New Jersey; Chesapeake Bay, Virginia; Great Bay, New Jersey; and the waters off Cape Hatteras, North Carolina. For all EFH, water temperatures range from 59 to 86 °F (15 to 30 °C), salinities range from 15 to 35 ppt, water depth ranges from 2.6 to 75 feet (0.8 to 23 m), and substrate includes sand, mud, shell, and rocky habitats. EFH in the Gulf of Mexico includes localized areas off Apalachicola Bay, Florida.

Adults: EFH in the Atlantic Ocean includes coastal areas from southern New England to the Florida Keys, ranging from inland waters of Delaware Bay and the mouth of Chesapeake Bay to the continental shelf break. EFH in the Gulf of Mexico includes coastal areas between the Florida Keys and Anclote Key, Florida; areas offshore of the Big Bend region; coastal areas of the Florida panhandle and Gulf coast between Apalachicola and the Mississippi River; and habitats surrounding the continental shelf between Louisiana and south Texas. Adults commonly use habitats in the West Florida Shelf, off Cape San Blas, and cool, deep, clear water offshore of Texas and Louisiana.

2.2.5.6.7 Shortfin Mako Shark

The shortfin mako shark is a highly migratory, pelagic species found in warm and warm-temperate waters around the world. In eastern U.S. waters, shortfin mako shark are found from New England to Florida, in the Gulf of Mexico, and in the Caribbean Sea. Shortfin mako prey on fast-moving fishes such as swordfish, tuna, and other sharks, as well as other bony fishes, marine mammals, crustaceans, and cephalopods (NOAA Fisheries, 2017; NOAA Fisheries, 2019aa). Shortfin mako reproductive habits and mating grounds are not well known, but mating is thought to occur from summer to fall and pregnant females have only been captured between 20 and 30° N or S latitude (NOAA Fisheries, 2017; NOAA Fisheries, 2019aa). According to the 2017 stock assessment, shortfin mako shark are overfished and subject to overfishing (ICCAT, 2017).

The shortfin mako shark EFH designations are reproduced below for the life stages found within the Project Area. Neonate, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor.

Neonate/YOY, Juveniles, and Adults: At this time, available information is insufficient for the identification of EFH by life stage, therefore all life stages are combined in the EFH designation. EFH in the Atlantic Ocean includes pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts) to Cape Cod (seaward of the 656-foot [200 m] bathymetric line); coastal and offshore habitats between Cape Cod and Cape Lookout, North Carolina; and localized habitats off South Carolina and Georgia. EFH in the Gulf of Mexico is seaward of the 656-foot (200 m) isobaths in the Gulf of Mexico, although in some areas (e.g., northern Gulf of Mexico by the Mississippi delta) EFH extends closer to shore. EFH in the Gulf of Mexico is located along the edge of the continental shelf off Fort Myers to Key West (southern West Florida Shelf), and extends from the northern central Gulf of Mexico around Desoto Canyon and the Mississippi Delta to pelagic habitats of the western Gulf of Mexico that are roughly in line with the Texas/Louisiana border.

2.2.5.6.8 Smoothhound Shark Complex (Atlantic Stock)

The smoothhound shark complex consists of three species: smooth dogfish (*Mustelus canis*), Florida smoothhound (*Mustelus norrisi*), and Gulf smoothhound (*Mustelus sinusmexicanus*). Due to the difficulty in differentiating these three species, EFH is designated for these sharks as a complex. However, smooth dogfish is the only smoothhound shark complex species found in the Atlantic, so for the purposes of this report, we focus solely on smooth dogfish.

Smooth dogfish is a common, demersal coastal shark species that ranges from Massachusetts to northern Argentina, typically inhabiting inshore waters down to 656 feet (200 m) (NOAA Fisheries, 2017). Smooth dogfish migrate seasonally, congregating between the Chesapeake Bay and southern North Carolina in the winter, and moving along the coast in the spring as waters warm (NOAA Fisheries, 2017). Smooth dogfish primarily consume large crustaceans such as crabs and American lobster. During the spring in New England waters, smooth dogfish are also known to feed on small bony fishes (NOAA Fisheries, 2017). Mating is through to occur between May and September, and research suggests that estuaries are critically-important nursery habitats in the Mid-Atlantic Bight (NOAA Fisheries, 2017). The 2015 stock assessment indicated that smooth dogfish are not overfished and not experiencing overfishing (Southeast Data and Assessment Review, 2015).

The smoothhound shark complex EFH designations are reproduced below for the life stages found within the Project Area. Neonate, juvenile, and adult life stages have EFH within the RWF area, RWEC-OCS corridor, and RWEC-RI corridor.

Neonate/YOY, Juveniles, and Adults: At this time, available information is insufficient for the identification of EFH for this life stage, therefore all life stages are combined in the EFH designation. Smoothhound shark EFH identified in the Atlantic is exclusively for smooth dogfish. EFH in Atlantic coastal areas ranges from Cape Cod Bay, Massachusetts to South Carolina, inclusive of inshore bays and estuaries (e.g., Pamlico Sound, Core Sound, Delaware Bay, Long Island Sound, Narragansett Bay, etc.). EFH also includes continental shelf habitats between southern New Jersey and Cape Hatteras, North Carolina.

2.2.5.6.9 Spiny Dogfish

The spiny dogfish is found in temperate and subarctic areas of the North Atlantic and North Pacific Oceans. In the northwest Atlantic, their range extends from Labrador to Florida, which the highest concentrations between Nova Scotia and Cape Hatteras, North Carolina (NOAA Fisheries, 2019ab). Spiny dogfish migrate seasonally, moving north in the spring and summer and south in the fall and winter (ASMFC, 2019e). In Southern New England, spiny dogfish abundance is highest in the fall (ASMFC, 2019e). Mating and birthing take place during the winter on offshore wintering grounds (ASMFC, 2019e; NOAA Fisheries, 2019ab). Spiny dogfish are opportunistic feeders, with smaller individuals primarily preying on crustaceans, and larger individuals preying on jellyfish, squid, and schooling fishes (NOAA Fisheries, 2019ab). The 2018 stock assessment concluded that Atlantic spiny dogfish are not overfished and not subject to overfishing (NOAA Fisheries, 2019ab).

The spiny dogfish EFH designations are reproduced below for the life stages found within the Project Area. Sub-adult male, sub-adult female, adult male, and adult female life stages have EFH within the RWF area and RWEC-OCS corridor. Sub-adult female and adult male life stages have EFH within the RWEC-RI corridor.

Sub-Adult Females: EFH is pelagic and epibenthic habitats throughout the region. Sub-adult females are found over a wide depth range in full salinity seawater (32–35 ppt) where bottom temperatures range from 44.6 to 59 °F (7 to 15 °C). Sub-adult females are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59 °F (15 °C).

Sub-Adults Males: EFH is pelagic and epibenthic habitats, primarily in the Gulf of Maine and on the outer continental shelf from Georges Bank to Cape Hatteras. Sub-adult males are found over a wide depth range in full salinity seawater (32–35 ppt) where bottom temperatures range from 44.6 to 59 °F (7 to 15 °C). Sub-adult males are not as widely distributed over the continental shelf as the females and are generally found in deeper water. They are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59 °F (15 °C).

Adult Females: EFH is pelagic and epibenthic habitats throughout the region. Adults are found over a wide depth range in full salinity seawater (32–35 ppt) where bottom temperatures range from 44.6 to 59 °F (7 to 15 °C). They are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59 °F (15 °C).

Adult Males: EFH is pelagic and epibenthic habitats throughout the region. Adults are found over a wide depth range in full salinity seawater (32–35 ppt) where bottom temperatures range from 44.6 to 59 °F (7 to 15 °C). They are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59 °F (15 °C).

2.2.5.6.10 White Shark

The white shark is a large species found in coastal and offshore waters of cold and temperate seas (NOAA Fisheries, 2017). In the northwestern Atlantic, white shark range sporadically from Newfoundland to the Gulf of Mexico, but are most abundant on the continental shelf between Cape Hatteras and Cape Cod (NOAA Fisheries, 2017). White shark are seasonally common in some locations, including New England in the summer (NOAA Fisheries, 2017). Juvenile white sharks prey primarily on fish, but shift to a diet of mostly marine mammals as they grow (NOAA Fisheries, 2017). The reproductive habits of white sharks and locations of nursery areas are not well known. Harvest of white shark is prohibited in the U.S., and the species is listed as "Vulnerable" on the IUCN Red List of Threatened Species (Fergusson et al., 2009).

The white shark EFH designations are reproduced below for the life stages found within the Project Area. Neonate, juvenile, and adult life stages have EFH within the RWF area and RWEC-OCS corridor. Within the RWEC-RI corridor, only neonates have EFH.

Neonate/YOY: EFH includes inshore waters out to 65 miles (105 km) from Cape Cod, Massachusetts, to an area offshore of Ocean City, New Jersey.

Juveniles and Adults: Known EFH includes inshore waters to habitats 65 miles (105 km) from shore, in water temperatures ranging from 48 to 82 °F (9 to 28 °C), but more commonly found in water temperatures from 57 to 73 °F (14 to 23 °C) from Cape Ann, Massachusetts, including parts of the Gulf of Maine, to Long Island, New York, and from Jacksonville to Cape Canaveral, Florida.

2.3 Summary of EFH in the Project Area

Tables 2.3-1 and 2.3-2 summarize early (i.e., eggs, larvae) and late (i.e., neonate, juveniles, adults) benthic life stages of species with designated EFH in the Project Area, provide a description of preferred habitat, and provide an assessment of whether the preferred habitat is present in the Project Area. Tables 2.3-3 and 2.3-4 summarize the early and late pelagic life stages of species with designated EFH in the Project Area.

Table 2.3-1 Habitat Preferences of Early Benthic Life Stages with EFH in the Project Area

Table 2.3-1				
Species	**Life Stage**	**Location**	**Description of Preferred Habitat**	**Preferred Habitat Present in Project Area?**
Finfish				
Atlantic wolffish	Egg	RWF	Subtidal benthic habitats. Egg masses are hidden under rocks and boulders in nests.	Yes
	Larvae	RWF	Pelagic and subtidal benthic habitats.	Yes
Ocean pout	Egg	RWF, RWEC-OCS, RWEC-RI	Hard bottom habitats – sheltered nests, holes, and crevices.	Limited
Winter flounder	Egg	RWEC-RI	Bottom habitats with a substrate of mud, muddy sand, sand, gravel, macroalgae, and submerged aquatic vegetation.	Yes
	Larvae	RWF, RWEC-OCS, RWEC-RI	Pelagic and bottom habitats.	Yes
Invertebrates				
Atlantic sea scallop	Egg	RWF, RWEC-OCS, RWEC-RI	Coarse substrates of gravel, shells, and rocks.	Yes
	Larvae	RWF, RWEC-OCS, RWEC-RI	Hard surfaces for pelagic larvae to settle, including shells, pebbles, and gravel. Larvae also attach to macroalgae and other benthic organisms such as hydroids.	Yes
Longfin inshore squid	Egg	RWF, RWEC-OCS, RWEC-RI	Egg masses or "mops" are laid on a variety of substrates, including hard bottom (shells, lobster pots, fish traps, boulders, and rocks), submerged aquatic vegetation (e.g. *Fucus*), sand, and mud.	Yes

Table 2.3-2 Habitat Preferences of Late Benthic Life Stages with EFH in the Project Area

Table 2.3-2				
Species	**Life Stage**	**Location**	**Description of Preferred Habitat**	**Preferred Habitat Present in Project Area?**
Finfish				
Atlantic cod	Juvenile	RWF, RWEC-OCS, RWEC-RI	Bottom habitats with a substrate of gravel or cobble, and boulder habitats, especially those with attached organisms.	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Bottom habitats with a substrate of rocks, pebbles, gravel, or boulders. Also found on sandy substrates.	Yes
Atlantic wolffish	Juvenile	RWF	Subtidal benthic habitats. Juveniles do not have strong substrate preferences	Yes
	Adult	RWF	Subtidal benthic habitats, including a wide variety of sand and gravel substrates. Rocky spawning habitats.	Yes
Black sea bass	Juvenile	RWF, RWEC-OCS, RWEC-RI	Usually found in association with rough-bottom, shellfish and eelgrass beds, and man-made structures in sandy-shelly areas. Offshore clam beds and shell patches may also be used during the winter.	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Usually structured habitats (natural and man-made), sand, and shell substrates.	Yes
Haddock	Juvenile	RWF, RWEC-OCS	Young-of-the-year juveniles settle on sand and gravel but are found predominantly on gravel pavement areas.	Yes

Table 2.3-2				
Species	**Life Stage**	**Location**	**Description of Preferred Habitat**	**Preferred Habitat Present in Project Area?**
			As they grow, they disperse over a greater variety of substrate types.	
Monkfish	Juvenile and Adult	RWF, RWEC-OCS	Bottom habitats with substrates of a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or soft mud.	Yes
Ocean pout	Juvenile	RWF, RWEC-OCS, RWEC-RI	Bottom habitats on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel.	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Mud and sand, particularly in association with structure-forming habitat types (i.e., shells, gravel, boulders).	Yes
Pollock	Juvenile	RWF, RWEC-OCS, RWEC-RI	Rocky bottom habitats with attached macroalgae (rockweed and kelp).	No
Red hake	Juvenile	RWF, RWEC-OCS, RWEC-RI	Intertidal and subtidal benthic habitats on mud and sand substrates. Bottom habitats providing shelter, including mud substrates with biogenic depressions, substrates providing biogenic complexity (e.g., eelgrass, macroalgae, shells, anemone and polychaete tubes), and artificial reefs. Newly settled juveniles occur in depressions on the open seabed. Older juveniles are commonly associated with shelter or structure and often found inside live bivalves.	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Shell beds, soft sediments (mud and sand), and artificial reefs. Usually found in depressions in softer sediments or in shell beds and not on open sandy bottom.	Yes
Scup	Juvenile	RWF, RWEC-OCS, RWEC-RI	Associated with various sands, mud, mussel, and eelgrass bed substrates	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Prefer smooth to rocky bottom habitats.	Yes
Silver hake	Juvenile	RWF, RWEC-OCS	Sandy substrates; found in association with sand waves, flat sand with amphipod tubes, and shells, and in biogenic depressions.	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Pelagic and benthic habitats, including sandy substrates, bottom depressions, mud habitats bordering deep boulder reefs, boulder habitat, and associated with sand waves and shell fragments.	Yes
Summer flounder	Juvenile	RWF, RWEC-OCS, RWEC-RI	Prefer sandy or muddy bottom habitats. Use estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas.	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Prefer sandy or muddy bottom habitats. Inhabit shallow coastal and estuarine waters.	Yes
White hake	Juvenile	RWF, RWEC-OCS, RWEC-RI	Fine-grained, sandy substrates in eelgrass, macroalgae, and unvegetated habitats.	Yes
Windowpane flounder	Juvenile and Adult	RWF, RWEC-OCS, RWEC-RI	Bottom habitats with a substrate of mud or sand.	Yes
Winter flounder	Juvenile	RWF, RWEC-OCS, RWEC-RI	Variety of bottom types such as mud, sand, rocky substrates with attached macroalgae, tidal wetlands, and eelgrass. Young-of-the-year juveniles are found inshore on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks. They tend to settle to the bottom in soft-sediment depositional areas and disperse into coarser-grained substrates as they get older.	No

Table 2.3-2				
Species	**Life Stage**	**Location**	**Description of Preferred Habitat**	**Preferred Habitat Present in Project Area?**
	Adult	RWF, RWEC-OCS, RWEC-RI	Muddy and sandy substrates, and on hard bottom on offshore banks.	Yes
Yellowtail flounder	Juvenile	RWF, RWEC-OCS, RWEC-RI	Sand and muddy sand.	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Sand and sand with mud, shell hash, gravel, and rocks.	Yes
Invertebrates				
Atlantic sea scallop	Juvenile	RWF, RWEC-OCS, RWEC-RI	Bottom habitats with a substrate of shells, gravel, and small rocks (pebble, cobble), preferring gravel.	Yes
	Adult	RWF, RWEC-OCS, RWEC-RI	Bottom habitats with sand and gravel substrates.	Yes
Atlantic surfclam	Juvenile	RWEC-RI	Sandy habitats along the continental shelf.	Yes
	Adult	RWEC-OCS, RWEC-RI	Sandy habitats along the continental shelf.	Yes
Ocean quahog	Juvenile and Adult	RWF, RWEC-OCS	Prefers medium to fine sandy bottom with mud and silt.	Yes
Skates				
Little skate	Juvenile and Adult	RWF, RWEC-OCS, RWEC-RI	Bottom habitats with a sandy or gravelly substrate, or mud.	Yes
Winter skate	Juvenile and Adult	RWF, RWEC-OCS, RWEC-RI	Bottom habitats with a substrate of sand and gravel or mud.	Yes
Sharks [1]				
Spiny dogfish	Sub-adult male, Adult female	RWF, RWEC-OCS	Pelagic and epibenthic habitats.	Yes
	Sub-adult female, Adult male	RWF, RWEC-OCS, RWEC-RI	Pelagic and epibenthic habitats.	Yes

[1] The neonate/young-of-the year life stage for shark species is more similar to a juvenile life stage than a larval life stage. Thus, neonate/young-of-the year is considered to be a "late" life stage for the purpose of this analysis.

Table 2.3-3 Early Pelagic Life Stages with EFH in the Project Area

Table 2.3-3		
Species	**Life Stage**	**Location**
Finfish		
Atlantic butterfish	Egg, Larvae	RWF, RWEC-OCS, RWEC-RI
Atlantic cod	Egg, Larvae	RWF, RWEC-OCS, RWEC-RI
Atlantic herring	Larvae	RWF, RWEC-OCS, RWEC-RI
Atlantic mackerel	Egg, Larvae	RWF, RWEC-OCS, RWEC-RI
Atlantic wolffish	Larvae	RWF
Bluefish	Egg, Larvae	RWF, RWEC-OCS
Haddock	Egg	RWF

Table 2.3-3		
Species	**Life Stage**	**Location**
	Larvae	RWF, RWEC-OCS
Monkfish	Egg, Larvae	RWF, RWEC-OCS, RWEC-RI
Pollock	Egg, Larvae	RWF, RWEC-OCS
Red hake	Egg, Larvae	RWF, RWEC-OCS, RWEC-RI
Scup	Egg, Larvae	RWEC-RI
Silver hake	Egg, Larvae	RWF, RWEC-OCS, RWEC-RI
Summer flounder	Egg	RWF, RWEC-OCS
	Larvae	RWF, RWEC-OCS, RWEC-RI
White hake	Larvae	RWF, RWEC-OCS
Windowpane flounder	Egg, Larvae	RWF, RWEC-OCS, RWEC-RI
Winter flounder	Larvae	RWF, RWEC-OCS, RWEC-RI
Witch flounder	Egg, Larvae	RWF, RWEC-OCS
Yellowtail flounder	Egg, Larvae	RWF, RWEC-OCS
Invertebrates		
Atlantic sea scallop	Larvae	RWF, RWEC-OCS, RWEC-RI

Table 2.3-4 Late Pelagic Life Stages with EFH in the Project Area

Table 2.3-4		
Species	**Life Stage**	**Location**
Finfish		
Atlantic butterfish	Juvenile, Adult	RWF, RWEC-OCS, RWEC-RI
Atlantic herring	Juvenile, Adult	RWF, RWEC-OCS, RWEC-RI
Atlantic mackerel	Juvenile	RWF, RWEC-OCS, RWEC-RI
	Adult	RWEC-RI
Bluefish	Juvenile, Adult	RWF, RWEC-OCS, RWEC-RI
Pollock	Juvenile	RWF, RWEC-OCS, RWEC-RI
Silver hake	Adult	RWF, RWEC-OCS, RWEC-RI
White hake	Juvenile	RWF, RWEC-OCS, RWEC-RI
Invertebrates		
Longfin inshore squid	Juvenile, Adult	RWF, RWEC-OCS, RWEC-RI
Northern shortfin squid	Adult	RWF
Highly Migratory Species		
Albacore tuna	Juvenile	RWF, RWEC-OCS, RWEC-RI
	Adult	RWF, RWEC-OCS
Bluefin tuna	Juvenile, Adult	RWF, RWEC-OCS, RWEC-RI
Skipjack tuna	Juvenile	RWF
	Adult	RWF, RWEC-OCS, RWEC-RI
Yellowfin tuna	Juvenile	RWF, RWEC-OCS, RWEC-RI
	Adult	RWF, RWEC-OCS
Sharks [1]		

Table 2.3-4		
Species	**Life Stage**	**Location**
Basking shark	Neonate, Juvenile, Adult	RWF, RWEC-OCS
Blue shark	Neonate, Juvenile, Adult	RWF, RWEC-OCS
Common thresher shark	Neonate, Juvenile, Adult	RWF, RWEC-OCS, RWEC-RI
Dusky shark	Neonate, Juvenile, Adult	RWF, RWEC-OCS
Sand tiger shark	Neonate, Juvenile	RWF, RWEC-OCS, RWEC-RI
Sandbar shark	Juvenile, Adult	RWF, RWEC-OCS, RWEC-RI
Shortfin mako shark	Neonate, Juvenile, Adult	RWF, RWEC-OCS
Smoothhound shark complex (Atlantic stock)	Neonate, Juvenile, Adult	RWF, RWEC-OCS, RWEC-RI
Spiny dogfish	Sub-adult male, Adult female	RWF, RWEC-OCS
	Sub-adult female, Adult male	RWF, RWEC-OCS, RWEC-RI
White shark	Neonate	RWF, RWEC-OCS, RWEC-RI
	Juvenile, Adult	RWF, RWEC-OCS

[1] The neonate/young-of-the year life stage for shark species is more similar to a juvenile life stage than a larval life stage. Thus, neonate/young-of-the year is considered to be a “late” life stage for the purpose of this analysis.

3.0 ENVIRONMENTAL CONSEQUENCES AND PROTECTION MEASURES

3.1 Impact Assessment

Potential impacts are characterized as direct or indirect and categorized by Project phase. Anticipated impacts are characterized as short-term or long-term. Consistent with NEPA (40 C.F.R. § 1508.8.), evaluations in this report consider both detrimental (or negative) and beneficial impacts of the Project.

- *Direct or Indirect*: Direct effects are those occurring at the same place and time as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity.
- *Short-term or Long-term Impacts*: Short- or long-term impacts do not refer to any defined period. In general, short-term impacts are those that occur only for a limited period or only during the time required for construction activities. Impacts that are short-lived, such as noise from routine maintenance work during operations, may also be short-term if the activity is short in duration and the impact is restricted to a short, defined period. Long-term impacts are those that are likely to occur on a recurring or permanent basis or impacts from which a resource does not recover quickly. In general, direct impacts associated with construction and decommissioning are considered short-term because they will occur within the approximate 1-year construction phase. Indirect impacts are determined to be either short-term or long-term depending on if resource recovery may take several years. Impacts associated with Operations & Maintenance (O&M) are considered long-term because they occur over the life of the Project (i.e., 25 years per the Lease but could be extended up to 35 years.
- *Proposed Environmental Protection Measures* – If measures are proposed to avoid or minimize potential impacts, the impact evaluation included consideration of these environmental protection measures.

Different impact-producing factors (IPFs) may result in varying levels of impact on EFH and the species/life stages that associate with those habitats. IPFs that could impact EFH include seafloor disturbance, sediment suspension and deposition, habitat alteration, noise, traffic, lighting, discharges and releases, and trash and debris.

Impacts on EFH vary by habitat, species, and life stage as discussed below, with some species/life stages being more vulnerable than others. The analysis of impacts on EFH are discussed separately for the RWF and RWEC in the following sections. The IPFs are further subdivided into IPFs during the construction and decommissioning phases of the Project and the O&M phase of the Project. The construction and decommissioning phases are grouped as activities and equipment usage are similar between these two phases.

3.1.1 Revolution Wind Farm

IPFs resulting in potential impacts on EFH in the RWF area are described in Table 3.1-1 for the construction and decommissioning phases and in Table 3.1-2 for the O&M phase. At the end of the Project's operational life, the Project will be decommissioned in accordance with a detailed decommissioning plan to be developed in compliance with applicable laws, regulations, and BMPs at that time. All of the impacts associated with these activities are anticipated to be similar to or less than those described for construction, unless otherwise noted.

Table 3.1-1 IPFs and Impact Characterization for EFH within the RWF during Construction and Decommissioning

Table 3.1-1						
IPF	**Project Activity**	**Impact Characterization for on EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
Seafloor Disturbance	Seafloor preparation	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Impacts on EFH associated with seafloor preparation will primarily be associated with species that have benthic/demersal early life stages (eggs and larvae, Table 2.3-1) and later life stages (neonates, juveniles, and adults, Table 2.3-2) and prefer the types of habitats that will be disturbed by seafloor preparation. These activities could cause injury or mortality to benthic/demersal species, affect their habitat, and disrupt their spawning. Similarly, seafloor-disturbing activities could result in a small loss of spawning habitat for Atlantic cod, as studies completed in other regions suggest that cod often demonstrate spawning site fidelity, returning to the same fine-scale bathymetric locations year after year to spawn (Hernandez et al. 2013; Siceloff and Howell 2013; Zemeckis et al., 2014a). However, such homing behavior has not yet been documented amongst individual cod in southern New England, although conventional tagging studies suggest there is little dispersal during the winter spawning season (Cadrin et al., 2020). An active Atlantic cod winter spawning ground has been identified in a broad geographical area that includes Cox Ledge and surrounding locations (Zemeckis et al. 2014b; Dean et al., 2020). In southern New England, cod spawn primarily from December through May (Dean et al., 2020; Langan et al., 2020). There is currently a BOEM funded acoustic telemetry study to better understand the distribution and habitat use of spawning cod on and around Cox Ledge. Additionally, in a sampling effort on Cox Ledge by Kovach et al. (2010), the majority of Atlantic cod collected were in spawning condition. Atlantic cod were not among the consistently prevalent (top 25) species collected during multi-year sampling by otter trawl and beam trawl in areas that included Cox Ledge (Malek et al., 2014). Given the availability of similar surrounding habitat, Project activities are not expected to result in measurable impacts on spawning Atlantic cod. Non-lethal impacts on EFH are expected to be short-term as the direct effects will cease after seafloor preparation is completed in a given area and only a small portion of the available EFH in the area will be disturbed. Impacts on species with designated EFH that have pelagic early and/or later life stages within the RWF (Tables 2.3-3 and 2.3-4) are expected to be limited, as pelagic habitats will not be directly affected by seafloor preparation. However, these species may temporarily vacate the area of disturbance. Decommissioning activities are expected to cause similar impacts as construction, but these impacts would be shorter in duration. Impacts on EFH associated with boulder clearance and related seafloor preparation activities are expected to be direct and short-term. Boulders relocated during seafloor preparation will be in new locations and may be in new physical configurations in relation to other boulders. Concerning these spatial and physical attributes, the boulders are not expected to return to pre-project conditions. However, relatively rapid (< 1 year) recolonization of these boulders is expected (Guarinello and Carey, 2020) and will return these boulders to their pre-project habitat function. Additionally, if relocation results in aggregations of boulders, these new features could serve as high value refuge habitat for juvenile lobster and fish as they may provide more complexity and opportunity for refuge than surrounding patchy habitat.
	In-situ MEC/UXO disposal	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Direct impacts on EFH associated with seafloor disturbance from in-situ MEC/UXO disposal are expected to result in similar direct impacts on EFH as seafloor preparation. Impacts on EFH will be primarily associated with species that have

Table 3.1-1						
IPF	**Project Activity**	**Impact Characterization for on EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages** [1]	**Benthic/ Demersal Late Life Stages** [1]	**Pelagic Late Life Stages** [1]	
						benthic/demersal life stages. In-situ MEC/UXO disposal could cause injury or mortality, affect their habitat, or cause behavioral reactions.
	Impact pile driving and/or vibratory pile driving/foundation installation	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Direct impacts on EFH associated with seafloor disturbance from impact pile driving and/or vibratory pile driving and installation of the foundations (WTG and OSS) and scour protection are expected to result in similar direct impacts on EFH as seafloor preparation. Impacts on EFH will be primarily associated with species that have benthic/demersal life stages. Impact pile driving and/or vibratory pile driving and foundation installation could crush benthic/demersal species, particularly eggs and larvae, but also less mobile older life stages that do not vacate the area. **Minimal** impacts on EFH are expected for pelagic species because they are not expected to be near the seafloor during work activities or subject to crushing or injury through placement of the piles and foundations or removal of the foundations during decommissioning.
	RWF IAC and OSS-Link Cable installation	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Direct impacts on EFH associated with the IAC and OSS-Link Cable installation are expected to result in similar impacts as those discussed for seafloor preparation, as the IAC will be installed in the same area that will have been disturbed during seafloor preparation. Decommissioning activities are expected to cause similar impacts as construction, but these impacts would be shorter in duration. Additionally, fish eggs and larvae (ichthyoplankton), as well as zooplankton, are expected to be entrained during hydraulic dredging and jet trencher embedment of the IAC. Jet trencher and hydraulic dredging equipment use seawater to circulate through hydraulic motors and jets during installation. Although this seawater is released back into the ocean, it is assumed that all entrained eggs, larvae, and zooplankton will be killed. These losses are expected to be low and short-term. A previous assessment conducted for the South Fork Wind Farm found that the total estimated losses of zooplankton and ichthyoplankton from jet trencher entrainment were less than 0.001% of the total zooplankton and ichthyoplankton abundance present in the study area, which encompassed a linearly buffered region of 15 km around the SFEC and 25 km around the SFWF (INSPIRE Environmental, 2018). Only early life stages may be affected by jet plow entrainment; later life stages will not be affected. Limited research has been conducted on the potential impacts of hydraulic dredge entrainment, but because the volumes of water used by dredges are relatively small, the entrainment rates of ichthyoplankton are generally thought to be only a small proportion of the total local production (Reine and Clark, 1998; Reine et al., 1998). Egg and larval life stages are most likely to experience lethal impacts (Wenger et al., 2017), but later life stages could also be entrained by hydraulic dredging, with benthic species or species occurring in high densities having the highest risk (Drabble, 2012; Reine et al., 1998). However, the entrainment rates for mobile species are considered to be low, and mortality rates of entrained fish may also be low (Wenger et al., 2017; Drabble, 2012; Reine et al., 1998). Jet plow and hydraulic dredge entrainment losses are not expected to result in large losses of zooplankton, ichthyoplankton, or later life stages, and population-level impacts on EFH species are not anticipated.
	Vessel anchoring (including spuds)	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Direct impacts on EFH associated with vessel anchoring (including spuds) are similar to those discussed in seafloor preparation.

Table 3.1-1

IPF	Project Activity	Impact Characterization for on EFH				Discussion
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
Habitat Alteration	In-situ MEC/UXO disposal	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	<u>Direct Impacts</u>: Direct impacts on EFH associated with habitat alteration from in-situ MEC/UXO disposal are expected to result in similar direct impacts on EFH as seafloor preparation. Impacts on EFH will be primarily associated with species that have benthic/demersal life stages. In-situ MEC/UXO disposal could cause injury or mortality, affect their habitat, or cause behavioral reactions.
	Seafloor preparation Impact pile driving and/or vibratory pile driving/foundation installation RWF IAC and OSS-Link Cable installation Vessel anchoring (including spuds)	*Indirect, long-term*	*Indirect, long-term*	*Indirect, long-term*	*Indirect, long-term*	<u>Indirect Impacts</u>: Immediately following impact-producing activities, species with designated EFH are expected to move back into the area; however, in areas of sediment disturbance and/or areas with increased sedimentation, demersal/benthic habitat recovery and benthic infaunal and epifaunal species abundances may take up to 1 to 3 years to recover to pre-impact levels, based on the results of a number of studies on benthic recovery (e.g., AKRF, Inc. et al., 2012; Germano et al., 1994; Hirsch et al., 1978; Kenny and Rees, 1994). This recovery time may result in an indirect, long-term impact on designated EFH for species with benthic/demersal life stages. Recolonization of sediments by epifaunal and infaunal species and the return of mobile fish and invertebrate species will allow this area to continue to serve as foraging habitat for EFH species. Pelagic species/life stages may be indirectly affected by the temporary reduction of benthic forage species, but these impacts are expected to be small given the availability of similar habitats in the area. Other species may be attracted to the disruption and prey on dislodged benthic species or other species injured or flushed during seafloor preparation, IAC and OSS-Link Cable installation, and vessel anchoring activities. During decommissioning, foundations and other facilities will be removed to a depth of 15 ft (4.6 m) below the mudline, unless otherwise authorized by BOEM (30 CFR § 585.910(a)). Decommissioning would result in the reversal of beneficial effects for species and life stages that inhabited the structures during the life of the Project. Over time, the disturbed area is expected to revert to pre-construction conditions, which would result in a beneficial impact for species and life stages that inhabit soft bottom habitats. Overall, habitat alteration from decommissioning is expected to cause minimal impacts because similar soft and hard bottom habitats are already present in and around the RWF (Benthic Assessment; INSPIRE Environmental, 2020), and the conversion of a relatively small area of habitat is unlikely to result in substantial effects, as any effect observed will be limited to the immediate vicinity of the individual structures.
Sediment Suspension and Deposition	In-situ MEC/UXO disposal Seafloor preparation Impact pile driving and/or vibratory pile driving/foundation installation RWF IAC and OSS-Link Cable installation Vessel anchoring (including spuds)	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	<u>Direct Impacts</u>: Seafloor-disturbing activities will result in temporary increases in sediment suspension and deposition. Sediment transport modeling was performed using RPS' Suspended Sediment Fate (SSFATE) model, which is a three-dimensional model developed jointly with the USACE and the Environmental Research Development Center. SSFATE is a well-known model that has been successfully applied in projects around the globe to simulate the sediment transport from dredging, cable and pipeline burial operations, sediment dumping, dewatering operations, and other sediment-disturbing activities. SSFATE computes TSS concentrations released into the water column and predicts the transport, dispersion, and settling of the suspended sediment. RPS also performed hydrodynamic modeling using their 3-dimensional HYDROMAP modeling system to simulate water levels, circulation patterns, and water volume flux through the study area and to provide hydrodynamic input (spatially and temporally varying currents) for input into the sediment transport model. The models, inputs, and results are described in detail in the Hydrodynamic and Sediment Transport Modeling Report (RPS, 2020).

Table 3.1-1						
IPF	**Project Activity**	**Impact Characterization for on EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
						Several model simulations were run to evaluate the concentrations of suspended sediments, spatial extent and duration of sediment plumes, and the seafloor deposition resulting from cable burial activities. The grain size distributions used for modeling were based on samples collected during field studies performed for the project (Fugro, 2019), which indicate the sediments are predominately coarse grained in the RWF. For the RWF IAC, a representative segment of 7,392 ft (2,253 m) of installation was simulated and the modeling results indicate that sediment plumes with TSS concentrations exceeding the ambient conditions by 100 mg/L could extend up to 1,273 feet (388 m) feet from the cable centerline. The plume is expected to be mostly contained within the bottom of the water column. The model estimated that the elevated TSS concentrations would be of short duration and expected to return to ambient conditions in less than 6.7 hours following the cessation of cable burial activities. The modeling results indicate that sedimentation from IAC burial may exceed 0.4 inch (10 mm) of deposition up to 89 feet (27 m) from the cable and could cover up to 2.6 acres (1.1 ha). Sediment suspension and deposition associated with decommissioning activities are expected to be similar to those from cable burial, but slightly lower in magnitude. Most marine species have some degree of tolerance to higher concentrations of suspended sediment because storms, currents, and other natural processes regularly result in increases in turbidity (MMS, 2009). However, these increases in sediment suspension and deposition may cause temporary impacts on benthic/demersal EFH. Direct impacts could include mortality, injury, or temporary displacement of the organisms living on, in, or near the seafloor. Sediment deposition on eggs or larvae may result in smothering, potentially resulting in mortality (MMS, 2007). Larger benthic organisms such as shellfish as may be able to extend feeding tubes and respiratory structures above the sediment (United Kingdom Department for Business Enterprise and Regulatory Reform, 2008). Maurer et al. (1986) found that several species of marine benthic infauna (including the clam *Mercenaria mercenaria*) exhibited little to no mortality when buried under up to 3 inches (8 cm) of various types of sediment (from predominantly silt-clay to pure sand). Demersal/benthic early life stages in or near the area of disturbance would likely be most affected, but these impacts are not expected to result in population-level effects. Pelagic species could also be affected, but are expected to temporarily vacate the area to avoid the disturbance and pelagic habitat quality is expected to quickly return to pre-disturbance levels.
Noise	In-situ MEC/UXO disposal	Direct, short-term	Direct, short-term	Direct, short-term	Direct, short-term	Direct Impacts: Impacts from noise associated with high order methods for in-situ MEC/UXO disposal have been assessed (See Underwater Acoustic Modeling Report Appendix P). Injury to fish from exposures to blast pressure is attributed to compressive damage to tissue surrounding the swim bladder and gastrointestinal tract. The unmitigated distances for mortality or injury likely leading to mortality range from 145 m (476 ft) from the 2.3 kg (5 lb) charge to 847 m (2,779 ft) from the 454 kg (1,000 lb) charge. With a 10 dB reduction due to mitigation, the distances are reduced to range from 49 m (161 ft) from the 2.3 kg (5 lb) charge to 290 m (951 ft) from the 454 kg (1,000 lb) charge. A qualitative assessment of non-injurious effects from explosive sources was also conducted. Injuries that are recoverable ("recoverable injuries") include fin hematomas, capillary dilation, and loss of sensory hair cells. It is estimated that there is a high probability of "recoverable injury" occurring at near distances (i.e., within a few tens of meters) for all fishes and also at intermediate distances (i.e., within a few hundreds of meters) for fishes

Table 3.1-1

IPF	Project Activity	Impact Characterization for on EFH: Benthic/ Demersal Early Life Stages [1]	Pelagic Early Life Stages [1]	Benthic/ Demersal Late Life Stages [1]	Pelagic Late Life Stages [1]	Discussion
						with a swim bladder (Popper et al., 2014). There is a low probability of "recoverable injury" occurring at intermediate distances for fishes with no swim bladder and at far distances (i.e., beyond 1,000 meters) for all fish species. There is a high probability of TTS at near distances for all fishes and also at intermediate distances for fishes with a swim bladder involved in hearing (Popper et al., 2014). There is a moderate probability of TTS at intermediate distances for fishes with no swim bladder and fishes where the swim bladder is not involved in hearing. There is a low probability of TTS for all fishes at far distances. There is a high probability of behavioral response at near distances for all fishes and also at intermediate distances for fishes with a swim bladder (Popper et al., 2014). There is a moderate probability of behavioral response at intermediate distances for fishes with no swim bladder. There is a low probability for behavioral response for all fishes at far distances. The acoustic energy from a UXO detonation is of such short duration that masking is not an issue.
	Impact pile driving and/or vibratory pile driving	Direct, short-term	Direct, short-term	Direct, short-term	Direct, short-term	Direct Impacts: To evaluate the levels of underwater noise likely to be generated during construction, modeling was conducted using JASCO's Marine Operations Noise model (MONM) and Full Wave Range Dependent Acoustic Model (FWRAM). These models combine the outputs of the source model with the spatial and temporal environmental context (e.g., location, oceanographic conditions, and seabed type) to estimate acoustic sound fields. For impact hammering of monopile foundations, the physical injury peak sound pressure threshold of 206 dB (re 1 µPa) for finfish, is predicted to be exceeded within a maximum range of 337 ft (115 m) from the sound source. Accumulated sound exposure levels of 187 dB (re 1 $\mu Pa^2 \cdot sec$) and 183 dB (re 1 $\mu Pa^2 \cdot sec$) were predicted to be exceeded within a maximum distance of 5.8 miles (9,275 m) and 7.8 miles (12,550 m), respectively. The finfish behavioral disturbance threshold of 150 dB (re 1 µPa RMS) is predicted to be exceeded within a maximum distance of 6.8 miles (10,888 m) from the sound source. Full modeling results are available in the Underwater Acoustic Analysis (Küsel et al., 2021). Sound exposure guidelines and regulations designed to protect finfish are described in terms of sound pressure levels, but the observable effects of high intensity noise sources on finfish may actually be caused by exposure to particle motion (Popper and Hawkins, 2018). However, the particle motion levels associated with a high intensity noise source are difficult to measure and isolate from sound pressure levels. There is currently very limited understanding of the potential effects of particle motion on finfish and invertebrates. All fishes (including elasmobranchs) detect and use particle motion, even for those fishes that are also sensitive to sound pressure (Popper and Hawkins, 2019). Fishes that do not possess a swim bladder (sharks, mackerel, flatfish), as well as fishes with a swim bladder distant from the ear (salmon, tuna, most teleosts) are thought to primarily be sensitive to particle motion (Hawkins et al., 2020). Fishes with the swim bladder close to the ear (Atlantic cod, eels) or where the swim bladder is connected to the ear (herrings) are able to detect sound pressure as well as particle motion (Hawkins et al., 2020). In these finfish, the swim bladder and other gas-filled organs may act as a type of acoustic transformer, converting sound pressure into particle motion (Popper and Hawkins, 2018). The movement of these organs may indirectly stimulate the otolith structures such that fishes experience particle motion both from the noise source and from this indirect signal (Popper and Hawkins, 2018). Cephalopods, including cuttlefish, octopus, and squid species, are likely sensitive to particle motion rather than sound pressure (e.g. Packard et al., 1990; Mooney et al., 2010), with the

Table 3.1-1

IPF	Project Activity	Impact Characterization for on EFH				Discussion
		Benthic/ Demersal Early Life Stages [1]	Pelagic Early Life Stages [1]	Benthic/ Demersal Late Life Stages [1]	Pelagic Late Life Stages [1]	
						lowest particle motion thresholds reported at 1 to 2 Hz (Packard et al., 1990). Particle motion thresholds were measured for longfin squid between 100 and 300 Hz, with a threshold of 110 dB re 1 µPa reported at 200 Hz (Mooney et al., 2010). No other studies have measured particle motion. Cephalopods appear to be particularly sensitive to low frequency sound. Solé et al. (2017) estimated that trauma onset may begin to occur in cephalopods at sound pressure levels (SPL_{rms}) from 139 to 142 dB re 1 µPa at one-third octave bands centered at 315 Hz and 400 Hz. A recent study found impulsive pile driving noise resulted in a change in squid (*Doryteuthis pealeii*) behavior, with squid exhibiting body pattern changes, inking, jetting, and startle responses (Jones et al., 2020). Sessile invertebrates such as bivalves may respond to sound exposure by closing their valves (e.g. Kastelein, 2008; Roberts et al., 2015; Solan et al., 2016) much as they do when water quality is temporarily unsuitable. In one study, the duration of valve closure was shown to increase with increasing vibrational strength (Roberts et al., 2015). Clams may respond to anthropogenic noise by reducing activity and moving to a position above the sediment-water interface. In response to noise associated with pile driving at the RWF, it is expected that finfish and mobile macroinvertebrates would temporarily relocate during construction and would not be in the areas of greatest acoustic stressors. Slow start (ramp up) of pile driving equipment would allow mobile species to move out of the area and not be subject to mortality or injury but they may still experience some direct impact, such as behavioral responses. For exposed species, noise from impact pile driving and/or vibratory pile driving may temporarily reduce habitat quality. However, population-level impacts of impact pile driving and/or vibratory pile driving noise are not expected. Pile driving will be suspended during the winter months, thereby avoiding potential noise impacts that may disrupt the spawning activity of Atlantic cod. In conclusion, impact pile driving and/or vibratory pile driving is expected to result in a direct impact on EFH for both pelagic and demersal life stages, but this impact will be short-term as once pile driving is completed, the habitat suitability is expected to return to pre-pile driving conditions.
	Vessel noise, construction equipment noise, aircraft noise	Direct, short-term	Direct, short-term	Direct, short-term	Direct, short-term	Direct Impacts: Short-term impacts on EFH could occur due to vessel noise, construction equipment noise (exclusive of impact pile driving and/or vibratory pile driving noise), and/or aircraft noise during construction and decommissioning. Sounds created by mechanical/hydro-jet plows, vessels, or aircraft are continuous or non-impulsive sounds, which have different characteristics underwater and impacts on marine life. Limited research has been conducted on underwater noise from mechanical/hydro-jet plows. Generally, the noise from this equipment is expected to be masked by louder sounds from vessels. Also, as most noise generated by these pieces of equipment will be below the sediment surface and associated with the high-pressure jets, noise levels are not expected to result in injury or mortality on EFH species, but may cause finfish to temporarily vacate the area. The duration of noise at a given location will be short, as vessels will only be present for a short period at any given location along the cable corridor. Helicopters will be used for crew transfers between the WTGs and shore. Underwater noise associated with helicopters is generally brief as compared with the duration of audibility in the air (Richardson et al., 1995).

Table 3.1-1						
IPF	**Project Activity**	**Impact Characterization for on EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
						Vessel noise may also cause mobile EFH species to temporarily vacate the area. Vessel sound source levels have been shown to cause several different effects in behavior, TTS, auditory masking, and blood chemistry. The most common behavioral responses are avoidance, alteration of swimming speed and direction, and alteration of schooling behavior (Vabø et al., 2002; Handegard and Tjøstheim, 2005; Sarà et al., 2007; Becker et al., 2013). These studies also demonstrated that the behavioral changes generally were temporary or that fish habituated to the noises. EFH species in the vicinity of Project vessels may be affected by vessel noise but the duration of the disturbance will occur over a very short period at any given location. Direct impacts on EFH may result from a temporary degradation of habitat for species that vacate the area due to elevated noise levels. However, the noise generated by vessel and aircrafts will be similar to the range of noise from existing vessel and aircraft traffic in the region, and are not expected to substantially affect the existing underwater noise environment.
Discharges and Releases	Hazardous materials spills Wastewater discharge	Direct, short-term	Direct, short-term	Direct, short-term	Direct, short-term	Direct Impacts: Routine discharges of wastewater (e.g., gray water or black water) or liquids (e.g., ballast, bilge, deck drainage, stormwater) may occur from vessels, WTGs, or the OSS during construction and decommissioning; however, those discharges and releases are not anticipated to result in impacts because all vessel waste will be offloaded, stored, and disposed of in accordance with all applicable local, state and federal laws and regulations, such as the Environmental Protection Agency (EPA) and U.S. Coast Guard (USCG) requirements for discharges and releases to surface waters. In addition, compliance with applicable Project-specific management practices and requirements will minimize the potential for adversely impacting water quality and marine life. The construction/decommissioning of the RWF is not anticipated to lead to any spills of hazardous materials into the marine environment. Minor releases of hazardous materials could result in direct and indirect, short-term impacts on EFH. The impacts of spills are caused by either the physical nature of the material (e.g., physical contamination and smothering) or by its chemical components (e.g., toxic effects and bioaccumulation). Minor releases of hazardous materials could also result in indirect impacts on fish and invertebrate species if the spilled materials affect their eggs and food sources. Impacts would depend on the depth and volume of the spill, as well as the properties of the material spilled. All vessels participating in the construction of the RWF will comply with USCG requirements for management of onboard fluids and fuels, including maintaining and implementing spill prevention, control, and countermeasure (SPCC) plans. Vessels will be navigated by trained, licensed vessel operators who will adhere to navigational rules and regulations and vessels will be equipped with spill handling materials adequate to control or clean up an accidental spill. Best management practices (BMPs) for fueling and power equipment servicing will be incorporated into the Project's Emergency Response Plan and Oil Spill Response Plan (ERP/OSRP). Accidental releases are minimized by containment and clean-up measures detailed in the OSRP. Given these measures and the very low likelihood of an inadvertent release, impacts on EFH are not anticipated.
Marine Trash and Debris		Direct, short-term	Direct, short-term	Direct, short-term	Direct, short-term	Direct Impacts: The release of trash and debris into offshore waters potentially may occur from any on-water activities. Certain types of trash and debris could be accidentally lost overboard during construction and decommissioning, with subsequent effects on EFH.

Table 3.1-1						
IPF	**Project Activity**	**Impact Characterization for on EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
						USCG and EPA regulations require operators to develop waste management plans, post informational placards, manifest trash sent to shore, and use special precautions such as covering outside trash bins to prevent accidental loss of solid materials. Also, BOEM lease stipulations require adherence to Notice to Lessee (NTL) 2015-G03, which instructs operators to exercise caution in the handling and disposal of small items and packaging materials, requires the posting of placards at prominent locations on offshore vessels and structures, and mandates a yearly marine trash and debris awareness training and certification process. As such, measures will be implemented prior to and during construction to avoid, minimize, and mitigate impacts related to trash and debris disposal. Given these measures, impacts from trash and debris on EFH are not anticipated.
Traffic	See Seafloor Disturbance, Noise, Sediment Suspension and Deposition, and Lighting IPFs.					
Lighting	Construction and vessel lighting	Direct, short-term	Direct, short-term	Direct, short-term	Direct, short-term	<u>Direct Impacts</u>: Artificial lighting during construction/decommissioning at the RWF will be associated with navigational and deck lighting on vessels from dusk to dawn. The response of fish species to artificial lights is highly variable and depends on a number of factors such as the species, life stage, and the intensity of the light. Small organisms are often attracted to lights, which in turn attract larger predators to feed on the prey aggregations. Other species may avoid artificially illuminated areas. Artificial lighting may disrupt the diel vertical migration patterns of fish and this may affect species richness and community composition (Nightingale et al., 2006; Phipps, 2001). It could also increase the risk of predation and disruption of predator/prey interactions and result in the loss of opportunity for dark-adapted behaviors including foraging and migration (Orr et al., 2013). Artificial lighting associated with construction and decommissioning would be temporary and limited relative to the surrounding areas. Lighting will be limited to the minimum necessary to ensure safety and to comply with applicable regulations. Additionally, no underwater lighting is proposed. Artificial lighting is not expected to result in measurable impacts on EFH.

[1]Early life stages include eggs and larvae. Late life stages include neonates, juveniles, and adults.

Table 3.1-2 IPFs and Impact Characterization for EFH within the RWF during Operations and Maintenance

Table 3.1-2						
IPF	**Project Activity**	**Impact Characterization for EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages** [1]	**Benthic/ Demersal Late Life Stages** [1]	**Pelagic Late Life Stages** [1]	
Seafloor Disturbance	Foundations (WTG and OSS)	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Seafloor disturbance during O&M of the RWF may occur during non-routine maintenance of bottom-founded infrastructure (e.g., foundations, scour protection). These maintenance activities are expected to result in similar impacts on EFH as those discussed for construction/decommissioning (Table 3.1-1), although the extent of disturbance would be limited to specific areas.
	RWF IAC and OSS-Link Cable non-routine O&M	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Minimal impacts on EFH are expected from operation of the IAC and OSS-Link Cable themselves, as they will be buried beneath the seabed. However, non-routine maintenance may involve sediment-disturbing activities. These maintenance activities are expected to result in similar direct impacts on EFH as those discussed for construction/decommissioning (Table 3.1-1), although the extent of the disturbance would be limited to specific areas along the cable corridor.
	Vessel anchoring (including spuds)	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: During O&M, anchoring will be limited to vessels required to be onsite for an extended duration. Impacts on EFH resulting from potential vessel anchoring during O&M activities are expected to be similar to those discussed in Table 3.1-1.
Habitat Alteration	Foundations RWF IAC and OSS-Link Cable non-routine O&M	***Indirect, long-term***	***Indirect, long-term***	***Indirect, long-term***	***Indirect, long-term***	Indirect Impacts: Once constructed, the RWF will result in changes to seafloor topography and hydrodynamics because of the presence of foundations, scour protection, and cable protection. In previous assessments, offshore structures have not been shown to change the strength or direction of regional oceanic currents that transport eggs and larvae of marine fishes (RI CRMC, 2010; DONG Energy et al., 2006). Larval recruitment of EFH species from the water column is not anticipated to be affected by the RWF structures because the vertical foundations represent a miniscule surface area within the surrounding waters, and recruitment is generally influenced by numerous environmental signals other than the presence of physical structure (including stage of larval development, temperature, prey availability, and chemical odor of conspecifics) (McManus et al., 2018; Pineda et al., 2007). Foundations have been hypothesized as serving as attachment sites for eggs of squid and herrings in the North Sea, but data so far are lacking (Vandendriessche et al., 2016). Planktonic life stages of EFH species would not be directly affected by the introduction of foundations and scour protection. The seafloor overlaying the majority of buried IAC and OSS-Link Cable (where cable protection will not exist) is expected to return to pre-construction conditions over time and no long-term changes to sediment mobility and depositional patterns are expected. The presence of the foundations, associated scour protection, and cable protection may result in both negative and beneficial indirect impacts on EFH due to conversion of habitat from primarily soft-bottom to hard-bottom. Habitat conversion is expected to cause a shift in species assemblages towards those found in rocky reef/rock outcrop habitat; this is known as the "reef effect" (Wilhelmsson et al., 2006; Reubens et al., 2013). This effect is also well known from other anthropogenic structures in the sea, such as oil platforms, artificial reefs piers, and shipwrecks (Claudet and Pelletier, 2004; Wilhelmsson et al., 2006; Seaman, 2007; Langhamer and Wilhelmsson, 2009). The use of gravel, boulders, and/or concrete mats will create new hard substrate, and this substrate is expected to be initially colonized by barnacles, tube-forming species, hydroids, and other fouling species found on existing hard bottom habitat in the region. Mobile

Table 3.1-2						
IPF	**Project Activity**	**Impact Characterization for EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
						organisms, such as lobsters and crabs, may also be attracted to and occur in and around the foundation in higher numbers than surrounding areas. Monopiles attract a range of attached epifauna and epiflora, including barnacles and filamentous algae (Petersen and Malm, 2006). Jacket foundations (which may be used for the OSS) provide a more complex structure than monopile foundations, and may increase habitat complexity through more suitable fouling surfaces and increased protection from predators (MMS, 2009). As these foundations extend from below the seafloor to above the surface of the water, there is expected to be a zonation of macroalgae from deeper growing red foliose algae and calcareous algae, to kelps and other species, including those that may grow in subtidal, intertidal, and splash zone areas. Foundations and cable protection typically also have crevices that increase structural complexity of the area and attract finfish and invertebrate species seeking shelter. EFH for species that have life stages associated with soft-bottom habitats may experience long-term impacts, as available habitat will be slightly reduced. EFH for species and life stages that inhabit hard bottom habitats may experience a beneficial effect, depending on the quality of the habitat created by the foundations and scour protection, and the quality of the benthic community that colonizes that habitat. Overall, habitat alteration is expected to cause minimal impacts because similar soft and hard bottom habitats are already present in and around the RWF (Benthic Assessment; INSPIRE Environmental, 2020), and the conversion of a relatively small area of habitat is unlikely to result in substantial effects, as any "reef effect" observed will be limited to the immediate vicinity of the individual structures. Given the availability of similar surrounding habitat and the limited area of habitat conversion, O&M of the RWF is not expected to result in measurable impacts on spawning Atlantic cod. The potential effects of removal of Project structures during decommissioning are discussed in Table 3.1-1.
Sediment Suspension and Deposition	RWF IAC and OSS-Link Cable Vessel anchoring (including spuds)	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	Direct Impacts: Increases in sediment suspension and deposition during the O&M phase will result from vessel anchoring and non-routine maintenance activities that require exposing the IAC and/or OSS-Link Cable. Direct impacts on EFH resulting from sediment suspension and deposition during the O&M phase are expected to be similar to those discussed for the construction and decommissioning phase (Table 3.1-1), but on a more limited spatial scale.
Noise	Vessel and aircraft noise	*Direct, long-term*	*Direct, long-term*	*Direct, long-term*	*Direct, long-term*	Direct Impacts: Impacts on EFH from ship and aircraft (i.e., helicopter) noise during O&M of the RWF are expected to be similar to those discussed for the construction/decommissioning phase (Table 3.1-1), though lesser in extent. The noise generated by vessel and aircrafts will be similar to the range of noise from existing vessel and aircraft traffic in the region, and are not expected to substantially affect the existing underwater noise environment.
	WTG operational noise	*Direct, long-term*	*Direct, long-term*	*Direct, long-term*	*Direct, long-term*	Direct Impacts: The underwater noise levels produced by WTGs are expected to be within the hearing ranges of fish. Depending on the noise intensity, these noises could disturb or displace fisheries species within the surrounding area or cause auditory masking (MMS, 2007). Noise levels from operation of the RWF WTGs are not expected to result in injury or mortality, and finfish may become habituated to the operational noise (Thomsen et al., 2006; Bergström et al., 2014). Lindeboom et al. (2011) found no difference in the residency times of juvenile cod around monopiles between periods of WTG operation or when WTGs were out-of-order. This study also found that sand eels did not avoid the wind farm. In a similar study, the abundance of cod, eel, shorthorn sculpin, and goldsinny wrasse, were found to be higher near WTGs, suggesting that potential noise impacts from operation did not override

Table 3.1-2						
IPF	**Project Activity**	**Impact Characterization for EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
						the attraction of these species to the artificial reef habitat (Bergström et al., 2013). Based on the available literature, operational noise from the WTGs is expected to have minimal impacts on EFH.
Electric and Magnetic Fields	RWF IAC and OSS-Link Cable	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	Direct Impacts: Operation of the WTGs does not generate electric and magnetic fields (EMF); however, once the IAC and OSS-Link Cables become energized, the cables will produce a magnetic field, both perpendicularly and in a lateral direction around the cables. The cable will be shielded and, where feasible, buried beneath the seafloor and will otherwise be protected. Shielded electrical transmission cables do not directly emit electrical fields into surrounding areas, but are surrounded by magnetic fields that can cause induced electrical fields in moving water (Gill et al., 2012). Exposure to EMF could be short- or long-term, depending on the mobility of the species/life stage. A modeling analysis of the magnetic fields and induced electric fields anticipated to be produced during operation of the RWF IAC, OSS-Link Cable, and RWEC was performed and results are included in the Offshore Electric- and Magnetic-Field Assessment (Exponent, 2020). That assessment also summarizes data from field studies conducted to assess impacts of EMF on marine organisms. These studies constitute the best source of evidence to assess the potential impacts on finfish and invertebrate behavior or distribution in the presence of energized cables. Compared to fish and elasmobranchs, relatively little is known about the response of marine invertebrates to EMF. Field surveys on the behavior of large crab species and lobster at submarine cable sites (Love et al., 2017; Hutchison et al., 2018) indicate that the Project's calculated magnetic-field levels are not likely to impact the distribution and movement of large epibenthic crustaceans. Ancillary data and observations from these field studies also suggest that cephalopod behavior is similarly unaffected by the presence of 60-Hz AC cables. Based on the modeling results and existing evidence, the EMF associated with the cables will be below the detection capability of invertebrate species. The available laboratory-generated research regarding the effects of 50- or 60-Hz on fish behavior do not indicate that produced fields will have adverse effects on magnetosensitive and electrosensitive species. Controlled laboratory studies conducted with eel and salmon (Richardson et al., 1976; Armstrong et al., 2015; Orpwood et al., 2015) support the conclusion that EMF produced by 50-75 Hz AC cables do not alter the behavior of magnetosensitive fish species, indicating that high frequency EMF is not easily detected by magnetosensitive migratory fish species. Laboratory studies assessing the EMF detection abilities indicate that the EMF detection ability of elasmobranchs decreases as the source frequency increases over 20 Hz, and suggest that elasmobranchs are unlikely to easily detect electric fields produced by 50/60 Hz power sources (Andrianov et al., 1984; Kempster et al., 2013). In a laboratory study, demersal catshark were exposed to magnetic fields produced by a 50-Hz source and did not exhibit any significant behavioral changes (Orr, 2016). Field studies have also concluded that energized power cables neither attract nor repel elasmobranchs (Love et al., 2016). Based on the available information, EMF produced by 50/60 Hz power sources is unlikely to be detected by elasmobranchs, and is unlikely to cause changes in elasmobranch behavior or distribution. Love et al. (2016) conducted a series of surveys between 2010 and 2014 to track fish populations at both energized and unenergized 60-Hz submarine cables off the California

Table 3.1-2						
IPF	**Project Activity**	**Impact Characterization for EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
						coast. These studies were designed to assess whether EMF produced by the energized cable had any in situ effects on the distribution of marine species. Over three years of observations, no differences in fish communities at energized and unenergized cable sites were noted, indicating that EMF had no effect on fish distributions, although the physical structure of the unburied cables did attract a higher number of fish versus sediment bottoms, creating a “reef effect” (Love et al., 2016). Additionally, multiple fish surveys have been conducted at existing offshore windfarm sites. Results from these studies strongly indicate that operating windfarms and cables do not adversely affect the distributions of resident fish populations. Nearly 10 years of pre- and post-operational data from the Horns Rev Offshore Wind Farm site near Denmark indicate “no general significant changes in the abundance or distribution patterns of pelagic and demersal fish” (Leonhard et al., 2011), including species similar to those expected to inhabit the RWF. Researchers did note an increase in fish species associated with hard ground and vertical features, especially around WTG footings (Leonhard et al., 2011). Based on the modeling results and existing evidence, EMF associated with the IAC and OSS-Link Cable is not expected to adversely affect the populations or distributions of EFH species in the Project Area. These conclusions are consistent with the findings of a previous comprehensive review of the ecological impacts of marine renewable energy projects, where it was determined that there has been no evidence demonstrating that EMF at the levels expected from marine renewable energy projects will cause an effect (negative or positive) on any species (Copping et al., 2016). Moreover, a 2019 BOEM report that assessed the potential for AC EMF from offshore wind facilities to affect marine populations concluded that, for the southern New England area, no negative effects are expected for populations of key commercial and recreational fish species (Snyder et al., 2019). Based on this information, it is not expected that EFH species will be measurably affected by EMF from the cables.
Discharges and Releases	Hazardous materials spills Wastewater discharge	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	<u>Direct Impacts</u>: As discussed for the construction/decommissioning phase, routine discharges of wastewater or liquids (e.g., ballast, bilge, deck drainage, stormwater) are not anticipated to result in impacts because all vessel waste will be offloaded, stored, and disposed of in accordance with all applicable local, state and federal regulations. In addition, compliance with applicable Project-specific management practices and requirements will minimize the potential for adversely impacting water quality and marine life. The operation of the RWF is not anticipated to lead to any spills of hazardous materials into the marine environment. Per the information requirements outlined in 30 CFR 585.626, a list of solid and liquid wastes generated, including disposal methods and locations, as well as federally regulated chemical products, is found in the Project’s ERP/OSRP. The WTG and the OSS will be designed for secondary levels of containment to prevent accidental discharges of hazardous materials to the marine environment. Most maintenance will occur inside the WTGs, thereby reducing the risk of a spill, and no oils or other wastes are expected to be discharged during maintenance activities. All vessels participating in O&M of the RWF will comply with USCG requirements for management of onboard fluids and fuels, including maintaining and implementing SPCC plans. Vessels will be navigated by trained, licensed vessel operators who will adhere to navigational rules and regulations and vessels will be equipped with spill handling materials adequate to control or clean up an accidental spill. Best management practices (BMPs) for

Table 3.1-2

IPF	Project Activity	Impact Characterization for EFH: Benthic/ Demersal Early Life Stages [1]	Pelagic Early Life Stages [1]	Benthic/ Demersal Late Life Stages [1]	Pelagic Late Life Stages [1]	Discussion
						fueling and power equipment servicing will be incorporated into the Project's ERP/OSRP. Accidental releases will be minimized by containment and clean-up measures detailed in the OSRP. Given these measures and the very low likelihood of an inadvertent release, potential impacts of a hazardous material spill on EFH are not anticipated.
Marine Trash and Debris		***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: As discussed in Table 3.1-1, vessels will adhere to the USCG and EPA marine trash regulations, as well as BOEM guidance, and trash and debris generated during O&M of the RWF will be contained on vessels or at staging areas until disposal at an approved facility. Measures will be implemented prior to and during construction to avoid, minimize, and mitigate impacts related to trash and debris disposal. Given these measures, potential impacts from trash and debris on EFH are not anticipated.
Traffic	See Seafloor Disturbance, Noise, Sediment Suspension and Deposition, and Lighting IPFs.					
Lighting	RWF operational lighting	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	Direct Impacts: Artificial lighting during O&M will be associated with vessels, the WTGs, and the OSS for operational safety and security purposes. The response of fish species to artificial lights is highly variable and depends on a number of factors such as the species, life stage, and the intensity of the light. Small organisms are often attracted to lights, which in turn attract larger predators to feed on the prey aggregations. Other species may avoid artificially illuminated areas. However, lighting will be limited to the minimum necessary to ensure safety and to comply with applicable regulations. Because of the limited area that will have artificial lighting relative to the surrounding areas, and because no underwater lighting is proposed, overall impacts on EFH are expected to be minimal.

[1]Early life stages include eggs and larvae. Late life stages include neonates, juveniles, and adults.

3.1.2 Revolution Wind Export Cable

IPFs resulting in potential impacts on EFH associated with the RWEC are described in Table 3.1-3 for the construction and decommissioning phases and in Table 3.1-4 for the O&M phase. At the end of the Project's operational life, the Project will be decommissioned in accordance with a detailed decommissioning plan to be developed in compliance with applicable laws, regulations, and BMPs at that time. All of the impacts associated with these activities are anticipated to be similar to or less than those described for construction, unless otherwise noted. The impacts discussed in this section apply to both the RWEC-OCS and RWEC-RI, though the impacts would vary slightly by habitat composition, which differs slightly between the nearshore and offshore portions of the RWEC corridor.

Table 3.1-3 IPFs and Impact Characterization for EFH for the RWEC during Construction and Decommissioning

Table 3.1-3						
IPF	**Project Activity**	**Impact Characterization for EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
Seafloor Disturbance	Seafloor preparation	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Direct impacts on benthic species and life stages from seafloor preparation are expected to be similar to those discussed in Table 3.1-1, with the exception of shallower areas being affected as the RWEC-RI nears landfall. These shallower areas are expected to have slightly different species assemblages than the deeper offshore areas near the RWF. For example, winter flounder eggs present in the shallow portions of the RWEC-RI corridor could be affected by seafloor disturbance if construction activities take place during the spawning period. Based on coordination with RIDEM and NOAA NMFS to-date, Revolution Wind is planning construction activities within RI State Waters to occur between the day after Labor Day and February 1 to avoid and minimize impacts to winter flounder and shellfish. As discussed in Section 2.2, the up-estuary stations sampled during the benthic survey conducted for the Project were generally characterized by finer substrate, dominated by soft-sediment fauna, higher turbidity, and more reduced sediments. The mid-bay stations were characterized by mussel and *Crepidula* beds with other attached organisms including barnacles, sponges, and macroalgae. The stations at the mouth of Narragansett Bay and the stations leading offshore to the 3-mile state water boundary were generally dominated by soft sediment infauna. The results of the benthic survey (Benthic Assessment; INSPIRE Environmental, 2020) did not indicate the presence of beds for EFH shellfish species within the RWEC-RI corridor, however, the mussel and *Crepidula* beds could serve as foraging or nursery habitat for certain finfish species. Disturbance of this shellfish bed habitat is not anticipated to result in population-level effects on EFH species, as only a small area would be affected, and similar habitat is common within the Bay. Seafloor preparation is expected to have limited impacts on EFH for species that have pelagic early or later life stages. Decommissioning activities are expected to cause similar impacts as construction, but these impacts would be shorter in duration.
	In-situ MEC/UXO disposal	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Direct impacts on EFH associated with seafloor disturbance from in-situ MEC/UXO disposal are expected to result in similar direct impacts on EFH as seafloor preparation. Impacts on EFH will be primarily associated with species that have benthic/demersal life stages. In-situ MEC/UXO disposal could cause injury or mortality, affect their habitat, or cause behavioral reactions.
	RWEC installation	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Direct impacts on EFH associated with the RWEC installation/ decommissioning are expected to result in similar impacts as those for seafloor preparation. Construction of the RWEC landfall would be accomplished with either HDD methodology. A cofferdam may be used to allow for a dry environment during construction and for managing sediment, contaminated soils, and bentonite (from HDD operations). Impacts associated with the installation of a cofferdam (if necessary) would be similar to those discussed for seafloor preparation, but on a smaller scale. The cofferdam will be a temporary structure used during construction only. Therefore, no conversion of habitat is expected, and the cofferdam will be removed prior to the O&M phase. In addition, as described in Table 3.1-1, fish eggs and larvae (ichthyoplankton), as well as zooplankton, are expected to be entrained and killed during hydraulic dredging and jet trencher embedment of the RWEC. These losses are expected to be very low and short-term. A previous assessment conducted for the South Fork Wind Farm found that the total

Table 3.1-3

IPF	Project Activity	Impact Characterization for EFH				Discussion
		Benthic/ Demersal Early Life Stages [1]	Pelagic Early Life Stages [1]	Benthic/ Demersal Late Life Stages [1]	Pelagic Late Life Stages [1]	
						estimated losses of zooplankton and ichthyoplankton from jet trencher entrainment were less than 0.001% of the total zooplankton and ichthyoplankton abundance present in the study area, which encompassed a linearly buffered region of 15 km around the SFEC and 25 km around the SFWF (INSPIRE Environmental, 2018). Limited research has been conducted on the potential impacts of hydraulic dredge entrainment, but because the volumes of water used by dredges are relatively small, the entrainment rates of ichthyoplankton are generally thought to be only a small proportion of the total fish production (Reine and Clark, 1998; Reine et al., 1998). Jet plow and hydraulic dredge entrainment losses are not expected to result in large losses of zooplankton, ichthyoplankton, or later life stages, and population-level impacts on EFH species are not anticipated. A small amount of tidal salt marsh, and coastal beach/dune habitat may be affected during installation of the RWEC-RI. At this time, multiple landfall options are being considered within the Landfall Work Area, so it is not possible to quantify the areal extent of temporary or permanent impacts on these habitats. However, the Landfall Work Area would total up to 2.5 acres and would be sited to avoid and minimize impacts on wetland resources to the maximum extent practicable. If the Landfall Work Area is situated near the western end of the Landfall Envelope, use of the HDD method would minimize impacts on coastal habitats. Disturbance of tidally-influenced habitats could result in a direct, long-term impact on EFH for species that utilize these habitats, though this impact would be limited given the availability of similar habitat in the general area. Additionally, the tidal salt marsh at Blue Beach is located above MHW and is likely infrequently inundated only during extremely high tides and storm surge events. The perimeter of the salt marsh is mostly composed of invasive common reed (*Phragmites australis*) and is unlikely to function as high-quality habitat for EFH species.
	Vessel anchoring (including spuds)	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	<u>Direct Impacts</u>: Direct impacts on EFH associated with vessel anchoring (including spuds) are similar to those discussed in seafloor preparation.
Habitat Alteration	In-situ MEC/UXO disposal	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	<u>Direct Impacts</u>: Direct impacts on EFH associated with habitat alteration from in-situ MEC/UXO disposal are expected to result in similar direct impacts on EFH as seafloor preparation. Impacts on EFH will be primarily associated with species that have benthic/demersal life stages. In-situ MEC/UXO disposal could cause injury or mortality, affect their habitat, or cause behavioral reactions.
	Seafloor Preparation RWEC installation Vessel anchoring (including spuds)	***Indirect, long-term***	***Indirect, long-term***	***Indirect, long-term***	***Indirect, long-term***	<u>Indirect Impacts:</u> As discussed for the construction/decommissioning of the RWF (Table 3.1-1), in areas of sediment disturbance and/or areas with increased sedimentation, benthic habitat recovery and benthic infaunal and epifaunal species abundances may take up to 1 to 3 years to recover to pre-impact levels, based on the results of a number of studies on benthic recovery (e.g., AKRF, Inc. et al., 2012; Germano et al., 1994; Hirsch et al., 1978; Kenny and Rees, 1994). This recovery time may result in an indirect, long-term impact on designated EFH for species with benthic/demersal life stages. Recolonization of sediments by epifaunal and infaunal species and the return of mobile fish and invertebrate species will allow this area to continue to serve as foraging habitat for EFH species. Pelagic species/life stages may be indirectly affected by the temporary reduction of benthic forage species, but these impacts are expected to be very limited given the availability of similar habitats in the area. Other species may be attracted to the disruption and prey on dislodged benthic

Table 3.1-3						
IPF	**Project Activity**	**Impact Characterization for EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages [1]**	**Benthic/ Demersal Late Life Stages [1]**	**Pelagic Late Life Stages [1]**	
						species or other species injured or flushed during seafloor preparation, RWEC installation, and vessel anchoring activities. During decommissioning, facilities will be removed to a depth of 15 ft (4.6 m) below the mudline, unless otherwise authorized by BOEM (30 CFR § 585.910(a)). Decommissioning would result in the reversal of beneficial effects for species and life stages that inhabited the cable protection (concrete mattresses or rock structures) during the life of the Project. Over time, the disturbed area is expected to revert to pre-construction conditions, which would result in a beneficial impact for species and life stages that inhabit soft bottom habitats. Overall, habitat alteration from decommissioning is expected to cause minimal impacts because similar soft and hard bottom habitats are already present in and around the RWEC corridor (Benthic Assessment; INSPIRE Environmental, 2020), and the conversion of a relatively small area of habitat is unlikely to result in substantial effects, as any effect observed will be limited to the immediate vicinity of the individual structures.
Sediment Suspension and Deposition	Seafloor Preparation In-situ MEC/UXO disposal RWEC installation Vessel anchoring (including spuds)	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: As discussed in Table 3.1-1, seafloor-disturbing activities will result in temporary increases in sediment suspension and deposition. Sediment transport modeling was performed using RPS' SSFATE model to evaluate the concentrations of suspended sediments, spatial extent and duration of sediment plumes, and the seafloor deposition resulting from Project cable burial activities. The modeling results indicate that sediment plumes with TSS concentrations exceeding the ambient conditions by 100 mg/L could extend up to 4,528 feet (1,380 m) from the RWEC-RI centerline in state waters, and up to 1,542 feet (470 m) from RWEC-OCS centerline in federal waters. The plume is expected to be mostly contained within the bottom of the water column, though in shallower waters it may occupy most of the water column due to the water depth. For the RWEC-OCS, predicted TSS concentrations above ambient for any single circuit installation do not persist in any given location for greater than 24 hours, and in most locations (>75 % of the affected area) concentrations return to ambient within 8 hours. This maximum was predicted to occur along a part of the route that will only see one circuit installation. The maximum duration above ambient along the portion of the RWEC where two circuits will be installed was predicted to be 14 hours per circuit. This corresponds to a total of 28 hours above ambient, however the two 14-hour periods will likely be separated by time. For installation of one circuit of the RWEC-RI, predicted TSS concentrations above ambient do not persist in any given location for greater than 16.3 hours, and in most locations (>75 % of the affected area) concentrations return to ambient within 4 hours). For installation of two circuits, the maximum plume exposure is doubled at 32.6 hours, however, the two 16.3-hour periods will likely be separated by time. The modeling results indicate that sedimentation from RWEC burial may exceed 0.4 inch (10 mm) of deposition up to 919 feet (280 m) from the cable centerline in state waters and up to 328 feet (100 m) in federal waters. This thickness of sedimentation could cover up to 1,126 acres (4,556,760 m^2) in state waters, and 1,020 acres (4,127,794 m^2) in federal waters. For the cable landfall, TSS concentrations exceeding ambient conditions by 100 mg/L could extend up 580 ft (177 m) from the centerline and plume concentrations above ambient could persist for 256 hours for the HDD. This duration is longer relative to the water jet assisted cable installation due to the slower installation rate of the activity and since both trenching and backfilling for two circuits are included. Sedimentation greater than 0.4 in (10 mm) may extend up to 509 ft (155 m) from the centerline and could cover up to 19 acres (76,890 m^2). The models, inputs, and results are

Table 3.1-3						
IPF	Project Activity	Impact Characterization for EFH				Discussion
		Benthic/ Demersal Early Life Stages [1]	Pelagic Early Life Stages [1]	Benthic/ Demersal Late Life Stages [1]	Pelagic Late Life Stages [1]	
						described in detail in the Hydrodynamic and Sediment Transport Modeling Report (Exponent, 2020). Sediment suspension and deposition associated with decommissioning activities are expected to be similar, but slightly lower in magnitude. Similar to those discussed in Table 3.1-1, direct impacts on EFH from sediment suspension and deposition are expected to be similar to those discussed for construction of the RWF, with greater impacts on sessile and slow-moving benthic species/life stages compared to mobile and pelagic species/life stages. Winter flounder eggs are a sensitive resource within Narragansett Bay. Previous experiments have shown that a viable hatching rate of winter flounder eggs is reduced when the eggs are buried by as little as one half of one egg diameter, approximately 0.05 centimeter of sediment (Berry et al., 2003). In other laboratory experiments, winter flounder eggs were found to be affected by a sedimentation level of 0.065 centimeter, and almost complete mortality was observed when deposition exceeded 0.25 centimeter (Berry et al., 2011), Winter flounder eggs could be affected by construction of the RWEC-RI if sedimentation is experienced in these shallow waters during the spawning period. Given the high natural mortality that occurs during the early life history stages, adverse effects of burial at the population level are expected to be limited and only measurable in the immediate vicinity of the construction workspace. Revolution Wind will employ best management practices to minimize potential sedimentation impacts on winter flounder eggs in shallow waters. Revolution Wind will also coordinate with applicable regulatory agencies to define and comply with seasonal restrictions to minimize impacts on winter flounder and other sensitive finfish species.
Noise	Vibratory pile driving (cofferdam)	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: The cofferdam at the RWEC landfall, if required, may be installed as either a sheet piled structure into the sea floor or a gravity cell structure placed on the sea floor using ballast weight. Sheet pile installation would require the use of a vibratory hammer to drive the sidewalls and endwalls into the seabed, which may take approximately up to 3 days. Vibratory devices use oscillatory hammers or spinning counterweights that vibrate the pile and cause the sediment surrounding the pile to liquefy, allowing the pile to move easily into or out of the sediment. Vibratory pile driving is considered a continuous low-frequency noise source because the device continuously vibrates until the pile reached the desired depth. Vibratory devices generally have sound source levels 10 to 20 dB lower than impact hammers, and the sound level generated rises relatively slowly (California Department of Transportation, 2009). Vibratory pile driving associated with the cofferdam is not anticipated to result in exceedance of the injury threshold for fish, however, noise from pile driving may temporarily reduce habitat quality, result in behavioral changes, or cause mobile species to temporarily vacate the area. Noise impacts on EFH species from vibratory pile driving may result in limited short-term impacts, as the habitat suitability is expected to return to pre-pile driving conditions shortly after cessation of the pile driving activity.
	Vessel noise, construction equipment noise, aircraft noise, in-situ MEC/UXO disposal	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Direct impacts on EFH resulting from vessel, construction equipment, aircraft noise, and in-situ MEC/UXO disposal during construction and decommissioning are expected to be similar to those discussed in Table 3.1-1.

Table 3.1-3

IPF	Project Activity	Impact Characterization for EFH: Benthic/ Demersal Early Life Stages [1]	Pelagic Early Life Stages [1]	Benthic/ Demersal Late Life Stages [1]	Pelagic Late Life Stages [1]	Discussion
Discharges and Releases	Hazardous materials spills Wastewater discharges	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	Direct Impacts: Impacts associated with wastewater discharges or an inadvertent release of hazardous material during construction or decommissioning of the RWEC are expected to be similar to those discussed in Table 3.1-1.
Marine Trash and Debris		*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	Direct Impacts: Impacts associated with marine trash and debris are expected to be similar to those discussed in Table 3.1-1.
Traffic	See Seafloor Disturbance, Noise, Sediment Suspension and Deposition, and Lighting IPFs.					
Lighting	Vessel and construction lighting	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	*Direct, short-term*	Direct Impacts: During construction and decommissioning activities, lighting will be associated with the vessels that will be installing or decommissioning the RWEC. Direct impacts on EFH from artificial lighting are expected to be short-term because the vessels are expected to pass quickly along the RWEC corridor during cable installation. As discussed in Table 3.1-1, artificial lighting associated with cable installation would be temporary and limited relative to the surrounding areas. Lighting will be limited to the minimum necessary to ensure safety and to comply with applicable regulations. Additionally, no underwater lighting is proposed. Impacts on EFH due to artificial lighting are expected to be minimal.

[1]Early life stages include eggs and larvae. Late life stages include neonates, juveniles, and adults.

Table 3.1-4 IPFs and Impact Characterization for EFH for the RWEC during Operations and Maintenance

Table 3.1-4						
IPF	**Project Activity**	**Impact Characterization for EFH**				**Discussion**
		Benthic/ Demersal Early Life Stages [1]	**Pelagic Early Life Stages** [1]	**Benthic/ Demersal Late Life Stages** [1]	**Pelagic Late Life Stages** [1]	
Seafloor Disturbance	RWEC non-routine O&M	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Minimal impacts on EFH are expected from operation of the RWEC, as it will be buried beneath the seabed, where feasible, and will otherwise be protected. Seafloor disturbance during O&M of the RWEC will be limited to non-routine maintenance that may require uncovering and reburial of the cables, as well as maintenance of cable protection where present. These maintenance activities are expected to result in similar direct impacts on EFH as those discussed for construction/decommissioning (Table 3.1-1), although the extent of disturbance would be limited to specific areas along the RWEC corridor.
	Vessel anchoring (including spuds)	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Impacts on EFH resulting from potential vessel anchoring during O&M activities are expected to be similar to those discussed in Table 3.1-1.
Habitat Alteration	RWEC O&M	***Indirect, long-term***	***Indirect, long-term***	***Indirect, long-term***	***Indirect, long-term***	Indirect Impacts: Cable protection (e.g., concrete mattresses) may be placed in select areas along the RWEC. The introduction of engineered concrete mattresses or rock to areas of the seafloor can cause local disruptions to circulation, currents, and natural sediment transport patterns, though these impacts as expected to be limited given the miniscule surface area associated with the cable protection compared to the surrounding waters. Under normal circumstances, these segments of the RWEC are expected to remain covered as accretion of sediment covers the cable and associated cable protection (where applicable). In non-routine situations, these segments may be uncovered, and re-burial might be required (for buried portions of the RWEC). The seafloor overlaying the majority of buried RWEC (where cable protection will not exist) is expected to return to pre-construction conditions over time and no long-term changes to sediment mobility and depositional patterns are expected. Indirect impacts on EFH associated with O&M activities for the RWEC are expected to result in similar impacts as those discussed for the IAC and OSS-Link Cable in Table 3.1-1, but will be limited in spatial extent. The protection of the cable may result in the long-term conversion of soft-bottom habitat to hard-bottom habitat. Similar to the foundations, this cable protection may have a long-term impact on EFH for species associated with soft-bottom habitats and a long-term beneficial impact on EFH for species associated with hard-bottom habitats, depending on the quality of the habitat created by the cable protection, and the quality of the benthic community that colonizes that habitat. The potential effects of removal of Project structures during decommissioning are discussed in Table 3.1-2.
Sediment Suspension and Deposition	RWEC non-routine O&M Vessel anchoring (including spuds)	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Increases in sediment suspension and deposition during the O&M phase may result from vessel anchoring and non-routine maintenance activities that require exposing portions of the RWEC. Direct impacts on EFH resulting from sediment suspension and deposition during the O&M phase are expected to be similar to those discussed for the construction and decommissioning phase (Table 3.1-1), but on a more limited spatial scale.
Noise	Vessel and aircraft noise	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	Direct Impacts: Impacts on EFH from ship and aircraft noise during O&M of the RWEC are expected to be similar to those discussed for the construction/decommissioning phase (Table 3.1-1), though lesser in extent.
Electric and Magnetic Fields	RWEC operations	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	Direct Impacts: Once the RWEC becomes energized, the cables will produce a magnetic field, both perpendicularly and in a lateral direction around the cables. The cable will be shielded, where feasible, and buried beneath the seafloor, and will otherwise be protected. Shielded electrical transmission cables do not directly emit electrical fields into surrounding areas, but are surrounded by magnetic fields that can cause induced electrical fields in

Table 3.1-4

IPF	Project Activity	Impact Characterization for EFH: Benthic/ Demersal Early Life Stages [1]	Pelagic Early Life Stages [1]	Benthic/ Demersal Late Life Stages [1]	Pelagic Late Life Stages [1]	Discussion
						moving water (Gill et al., 2012). Exposure to EMF could be short- or long-term, depending on the mobility of the species. A modeling analysis of the magnetic fields and induced electric fields anticipated to be produced during operation of the RWF IAC, OSS-Link Cable, and RWEC was performed and results are included in the Offshore Electric- and Magnetic-Field Assessment (Exponent, 2020). That assessment also summarizes data from field studies conducted to assess impacts of EMF on marine organisms. As discussed for the RWF IAC and OSS-Link Cable in Table 3.1-2, behavioral effects and/or changes in EFH species abundance and distributions due to EMF are not expected. These conclusions are consistent with the findings of a previous comprehensive review of the ecological impacts of marine renewable energy projects, where it was determined that there has been no evidence demonstrating that EMF at the levels expected from marine renewable energy projects will cause an effect (negative or positive) on any species (Copping et al., 2016). Moreover, a 2019 BOEM report that assessed the potential for AC EMF from offshore wind facilities to affect marine populations concluded that, for the southern New England area, no negative effects are expected for populations of key commercial and recreational fish species (Snyder et al., 2019). Based on this information, it is not expected that EFH species will be measurably affected by EMF from the cables.
Discharges and Releases	Hazardous materials spills Wastewater discharges	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Impacts associated with wastewater discharges or an inadvertent release of hazardous material during O&M of the RWEC are expected to be similar to those discussed in Table 3.1-1.
Marine Trash and Debris		***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	***Direct, short-term***	Direct Impacts: Impacts associated with marine trash and debris are expected to be similar to those discussed in Table 3.1-1.
Traffic	See Seafloor Disturbance, Noise, Sediment Suspension and Deposition, and Lighting IPFs.					
Lighting	Vessel lighting	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	***Direct, long-term***	Direct Impacts: Artificial lighting during O&M of the RWEC will be associated only with vessels. However, lighting will be limited to the minimum necessary to ensure safety and to comply with applicable regulations. Because of the limited area that will have artificial lighting relative to the surrounding areas, and because no underwater lighting is proposed, overall impacts on EFH are expected to be minimal.

[1]Early life stages include eggs and larvae. Late life stages include neonates, juveniles, and adults.

3.2 Summary of Impacts

3.2.1 Summary of Impacts on EFH from RWF IPFs

Based on the IPFs discussed in Tables 3.1-1 and 3.1-2, species with a completely pelagic lifestyle are generally expected to be less negatively affected than demersal or benthic species. Overall, during construction, O&M, and decommissioning of the RWF, impacts on EFH species with benthic/demersal life stages are expected to be exposed to direct impacts from noise associated with impact pile driving and/or vibratory pile driving of foundations, other noise sources, seafloor disturbance, and sediment suspension/deposition, and indirect impacts from habitat alteration. EFH species with pelagic life stages are expected to be exposed to direct impacts from impact pile driving and/or vibratory pile driving noise and other construction/decommissioning noise sources, and indirect impacts from habitat alteration. Potential impacts from other IPFs are anticipated to be minimal. Potential long-term impacts may result from the conversion of soft-bottom habitat to hard-bottom habitat associated with the WTG foundations, scour protection, and protection of the OSS-Link Cable and IAC. These long-term impacts would be reversed following decommissioning of the Project. None of the IPFs are expected to result in population-level effects on EFH species, due to the limited scale and intensity of the Project activities, the availability of similar habitat in the surrounding area, and the implementation of avoidance, minimization, and mitigation measures.

3.2.1.1 EFH Species Least Likely to Experience Impacts

Of the species with EFH designated within the RWF area, those that are least likely to experience impacts have both pelagic early and late life stages, only have EFH associated with pelagic environments, and/or do not have preferred habitat present in the RWF area. They include the species and life stages listed in Table 3.2-1 below.

Table 3.2-1 EFH Species Least Likely to Experience Impacts – RWF

Table 3.2-1					
Species	**Egg**	**Larvae**	**Neonate**	**Juvenile**	**Adult**
New England Finfish					
Atlantic herring (*Clupea harengus*)		●		●	●
Pollock (*Pollachius virens*)				●	
Winter flounder (*Pseudopleuronectes americanus*)	●				
Witch flounder (*Glyptocephalus cynoglossus*)	●	●			
Mid-Atlantic Finfish					
Atlantic butterfish (*Peprilus triacanthus*)	●	●		●	●
Atlantic mackerel (*Scomber scombrus*)	●	●		●	
Bluefish (*Pomatomus saltatrix*)	●	●		●	●
Invertebrates					
Northern shortfin squid (*Illex illecebrosus*)					●
Highly Migratory Species					
Albacore tuna (*Thunnus alalunga*)				●	●
Bluefin tuna (*Thunnus thynnus*)				●	●
Skipjack tuna (*Katsuwonus pelamis*)				●	●
Yellowfin tuna (*Thunnus albacares*)				●	●
Sharks					
Basking shark (*Cetorhinus maximus*)			●	●	●
Blue shark (*Prionace glauca*)			●	●	●
Common thresher shark (*Alopias vulpinus*)			●	●	●
Dusky shark (*Carcharhinus obscurus*)			●	●	●
Sand tiger shark (*Carcharias taurus*)			●	●	

Table 3.2-1					
Species	**Egg**	**Larvae**	**Neonate**	**Juvenile**	**Adult**
Sandbar shark (*Carcharhinus plumbeus*)				●	●
Shortfin mako shark (*Isurus oxyrinchus*)			●	●	●
Smoothhound shark complex (Atlantic stock) (*Mustelus canis*)			●	●	●
White shark (*Carcharodon carcharias*)			●	●	●

3.2.1.2 EFH Species Most Likely to Experience Impacts

Of the species with EFH designated within the RWF area that also have preferred habitat present, those with benthic/demersal early and/or late life stages are the most likely to experience impacts as a result of construction, O&M, and/or decommissioning of the RWF. The species and associated life stages most likely to experience some level of short-term or long-term, direct or indirect impact are listed in Table 3.2-2 below.

Conversion of soft-bottom habitat to hard-bottom habitat associated with the WTGs, scour protection, and protection of the OSS-Link Cable and IAC may have a long-term beneficial effect species with life stages with a preference for hard-bottom habitats (e.g., gravel, rock, boulders, artificial reefs), depending on the quality of the newly-created hard-bottom habitat, and the quality of the benthic community that colonizes that habitat. These species and life stages that may experience a long-term, beneficial effect are listed in Table 3.2-3.

Note that some species could experience both negative and beneficial impacts at different phases of the Project. Thus, the same species and life stages may appear in both Table 3.2-2 and Table 3.2-3.

Table 3.2-2 EFH Species Most Likely to Experience Negative Impacts – RWF

Table 3.2-2					
Species	**Egg**	**Larvae**	**Neonate**	**Juvenile**	**Adult**
New England Finfish					
Atlantic cod (*Gadus morhua*)				●	●
Atlantic wolfish (*Anarhichas lupus*)	●	●		●	●
Haddock (*Melanogrammus aeglefinus*)				●	
Monkfish (*Lophius americanus*)				●	●
Ocean pout (*Zoarces americanus*)	●			●	●
Red hake (*Urophycis chuss*)				●	●
Silver hake (*Merluccius bilinearis*)				●	●
White hake (*Urophycis tenuis*)				●	
Windowpane flounder (*Scophthalmus aquosus*)				●	●
Winter flounder (*Pseudopleuronectes americanus*)		●		●	●
Yellowtail flounder (*Limanda ferruginea*)				●	●
Mid-Atlantic Finfish					
Black sea bass (*Centropristis striata*)				●	●
Scup (*Stenotomus chrysops*)				●	●
Summer flounder (*Paralichthys dentatus*)				●	●
Invertebrates					
Atlantic sea scallop (*Placopecten magellanicus*)	●	●		●	●
Longfin inshore squid (*Doryteuthis pealeii*)	●				

Table 3.2-2					
Species	**Egg**	**Larvae**	**Neonate**	**Juvenile**	**Adult**
Ocean quahog (*Arctica islandica*)				●	●
Skates					
Little skate (*Leucoraja erinacea*)				●	●
Winter skate (*Leucoraja ocellata*)				●	●
Sharks					
Spiny dogfish (*Squalus acanthias*)				●[1]	●

[1] Includes sub-adult males and sub-adult females.

Table 3.2-3 EFH Species That May Experience Beneficial Effects – RWF

Table 3.2-3					
Species	**Egg**	**Larvae**	**Neonate**	**Juvenile**	**Adult**
New England Finfish					
Atlantic cod (*Gadus morhua*)				●	●
Atlantic wolfish (*Anarhichas lupus*)	●				●
Haddock (*Melanogrammus aeglefinus*)				●	
Monkfish (*Lophius americanus*)				●	●
Ocean pout (*Zoarces americanus*)	●			●	●
Pollock (*Pollachius virens*)				●	
Red hake (*Urophycis chuss*)				●	●
Silver hake (*Merluccius bilinearis*)					●
Yellowtail flounder (*Limanda ferruginea*)					●
Mid-Atlantic Finfish					
Black sea bass (*Centropristis striata*)				●	●
Scup (*Stenotomus chrysops*)					●
Invertebrates					
Atlantic sea scallop (*Placopecten magellanicus*)	●	●		●	●
Longfin inshore squid (*Doryteuthis pealeii*)	●				
Skates					
Little skate (*Leucoraja erinacea*)				●	●
Winter skate (*Leucoraja ocellata*)				●	●

3.2.2 Summary of Impacts on EFH from RWEC IPFs

Based on the IPFs discussed in Tables 3.1-3 and 3.1-4, species with a completely pelagic lifestyle are generally expected to be less negatively affected than demersal or benthic species. Overall, during construction, O&M, and decommissioning of the RWEC, impacts on EFH species with benthic/demersal life stages are expected to be exposed to direct impacts from seafloor disturbance, sediment suspension/deposition, and noise IPFs, and indirect impacts from habitat alteration. EFH species with pelagic life stages are expected to be exposed to direct impacts from noise. Potential impacts from other IPFs are anticipated to be minimal. Potential long-term impacts may result from the conversion of soft-bottom habitat to hard-bottom habitat associated with the protection of the RWEC. These long-term impacts would be reversed following decommissioning of the Project. None of the IPFs are expected to result in population-level effects on EFH species, due to the limited scale and intensity of the Project activities, the availability of similar habitat in the surrounding area, and the implementation of avoidance, minimization, and mitigation measures.

3.2.2.1 EFH Species Least Likely to Experience Impacts

Of the species with EFH designated within the RWEC area, those that are least likely to experience impacts have both pelagic early and late life stages, only have EFH associated with pelagic environments, and/or do not have preferred habitat present in the RWF area. They include the species and life stages listed in Table 3.2-4 below.

Table 3.2-4 EFH Species Least Likely to Experience Impacts – RWEC

Table 3.2-4					
Species	**Egg**	**Larvae**	**Neonate**	**Juvenile**	**Adult**
New England Finfish					
Atlantic herring (*Clupea harengus*)		●		●	●
Pollock (*Pollachius virens*)				●	
Witch flounder (*Glyptocephalus cynoglossus*)	●	●			
Mid-Atlantic Finfish					
Atlantic butterfish (*Peprilus triacanthus*)	●	●		●	●
Atlantic mackerel (*Scomber scombrus*)	●	●		●	●
Bluefish (*Pomatomus saltatrix*)	●	●		●	●
Highly Migratory Species					
Albacore tuna (*Thunnus alalunga*)				●	●
Bluefin tuna (*Thunnus thynnus*)				●	●
Skipjack tuna (*Katsuwonus pelamis*)					●
Yellowfin tuna (*Thunnus albacares*)				●	●
Sharks					
Basking shark (*Cetorhinus maximus*)			●	●	●
Blue shark (*Prionace glauca*)			●	●	●
Common thresher shark (*Alopias vulpinus*)			●	●	●
Dusky shark (*Carcharhinus obscurus*)			●	●	●
Sand tiger shark (*Carcharias taurus*)			●	●	
Sandbar shark (*Carcharhinus plumbeus*)				●	●
Shortfin mako shark (*Isurus oxyrinchus*)			●	●	●
Smoothhound shark complex (Atlantic stock) (*Mustelus canis*)			●	●	●
White shark (*Carcharodon carcharias*)			●	●	●

3.2.2.2 EFH Species Most Likely to Experience Impacts

Of the species with EFH designated within the RWEC area that also have preferred habitat present, those with benthic/demersal early and/or late life stages are the most likely to experience impacts as a result of construction, O&M, and/or decommissioning of the RWEC. The species and associated life stages most likely to experience some level of short-term or long-term, direct or indirect impact are listed in Table 3.2-5 below.

Conversion of soft-bottom habitat to hard-bottom habitat associated with the cable protection may have a long-term beneficial effect on species with life stages with a preference for hard-bottom habitats (e.g., gravel, rock, boulders, artificial reefs), depending on the quality of the newly-created hard-bottom habitat, and the quality of the benthic community that colonizes that habitat. These species and life stages that may experience a long-term, beneficial effect are listed in Table 3.2-6.

Note that some species could experience both negative and beneficial impacts at different phases of the Project. Thus, the same species and life stages may appear in both Table 3.2-5 and Table 3.2-6.

Table 3.2-5 EFH Species Most Likely to Experience Negative Impacts – RWEC

Table 3.2-5					
Species	**Egg**	**Larvae**	**Neonate**	**Juvenile**	**Adult**
New England Finfish					
Atlantic cod (*Gadus morhua*)				●	●
Haddock (*Melanogrammus aeglefinus*)				●	
Monkfish (*Lophius americanus*)				●	●
Ocean pout (*Zoarces americanus*)	●			●	●
Red hake (*Urophycis chuss*)				●	●
Silver hake (*Merluccius bilinearis*)				●	●
White hake (*Urophycis tenuis*)				●	
Windowpane flounder (*Scophthalmus aquosus*)				●	●
Winter flounder (*Pseudopleuronectes americanus*)	●			●	●
Yellowtail flounder (*Limanda ferruginea*)				●	●
Mid-Atlantic Finfish					
Black sea bass (*Centropristis striata*)				●	●
Scup (*Stenotomus chrysops*)				●	●
Summer flounder (*Paralichthys dentatus*)				●	●
Invertebrates					
Atlantic sea scallop (*Placopecten magellanicus*)	●	●		●	●
Atlantic surfclam (*Spisula solidissima*)				●	●
Longfin inshore squid (*Doryteuthis pealeii*)	●				
Ocean quahog (*Arctica islandica*)				●	●
Skates					
Little skate (*Leucoraja erinacea*)				●	●
Winter skate (*Leucoraja ocellata*)				●	●
Sharks					
Spiny dogfish (*Squalus acanthias*)				● [1]	●

[1] Includes sub-adult males and sub-adult females.

Table 3.2-6 EFH Species That May Experience Beneficial Effects – RWEC

Table 3.2-6					
Species	**Egg**	**Larvae**	**Neonate**	**Juvenile**	**Adult**
New England Finfish					
Atlantic cod (*Gadus morhua*)				●	●
Haddock (*Melanogrammus aeglefinus*)				●	
Monkfish (*Lophius americanus*)				●	●
Ocean pout (*Zoarces americanus*)	●			●	●
Pollock (*Pollachius virens*)				●	
Red hake (*Urophycis chuss*)				●	●
Silver hake (*Merluccius bilinearis*)					●
Yellowtail flounder (*Limanda ferruginea*)					●
Mid-Atlantic Finfish					
Black sea bass (*Centropristis striata*)				●	●
Scup (*Stenotomus chrysops*)					●
Invertebrates					
Atlantic sea scallop (*Placopecten magellanicus*)	●	●		●	●
Longfin inshore squid (*Doryteuthis pealeii*)	●				
Skates					
Little skate (*Leucoraja erinacea*)				●	●
Winter skate (*Leucoraja ocellata*)				●	●

3.3 Proposed Environmental Protection Measures

To ensure that impacts associated with the RWF and RWEC are minimized, Revolution Wind will implement the following environmental protection measures to reduce potential impacts on finfish and EFH. These measures are based on protocols and procedures successfully implemented for similar offshore projects.

- To the extent feasible, installation of the IACs, OSS-Interlink Cable, and RWEC will occur using equipment such mechanical cutter, mechanical plow, or jet plow.
- To the extent feasible, the IAC, OSS-Link Cable, and RWEC will target a burial depth of 4 to 6 ft (1.2 to 1.8 m) below seabed. The target burial depth will be determined based on an assessment of seabed conditions, seabed mobility, the risk of interaction with external hazards such as fishing gear and vessel anchors, and a site-specific Cable Burial Risk Assessment.
- Dynamic Positioning (DP) vessels will be used for installation of the IAC, OSS-Link Cable, and RWEC to the extent practicable. DP vessels minimize seafloor impacts, as compared to use of a vessel relying on multiple anchors.
- A plan for vessels will be developed prior to construction to identify no-anchor areas to avoid documented sensitive resources.
- Revolution Wind is committed to collaborative science with the commercial and recreational fishing industries pre-, during, and post-construction. Fisheries monitoring studies are being planned to assess the impacts associated with the Project on economically and ecologically important fisheries resources. These studies will be conducted in collaboration with the local fishing industry and will build upon monitoring efforts being conducted by affiliates of Revolution Wind at other wind farms in the region.

- Revolution Wind will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.
- Accidental spill or release of oils or other hazardous materials offshore will be managed through the Project's ERP/OSRP.
- A ramp-up or soft-start will be used at the beginning of each pile segment during impact pile driving and/or vibratory pile driving to provide additional protection to mobile species in the vicinity by allowing them to vacate the area prior to the commencement of pile-driving activities.
- Construction and operational lighting will be limited to the minimum necessary to ensure safety and compliance with applicable regulations.
- All vessels will comply with USCG and EPA regulations that require operators to develop waste management plans, post informational placards, manifest trash sent to shore, and use special precautions such as covering outside trash bins to prevent accidental loss of solid materials. Vessels will also comply with BOEM lease stipulations that require adherence to Notice to Lessee (NTL) 2015-G03, which instructs operators to exercise caution in the handling and disposal of small items and packaging materials, requires the posting of placards at prominent locations on offshore vessels and structures, and mandates a yearly marine trash and debris awareness training and certification process.

4.0 CONCLUSIONS

Project-related impacts on EFH would vary for different species and life stages based on several factors including their lifestyle, degree of dependence on the substrate, diet, habitat preferences, and the amount of suitable habitat present in the area. Most of the potential impacts on EFH will be temporary and reversible as natural processes are expected to return the disturbed areas to pre-construction conditions apart from new manmade structures on the seafloor and in the water column. In addition, the extent of anticipated habitat impact is small relative to the availability of similar habitat in the region.

Construction impacts will largely be associated with the disturbance of benthic habitats in the Project Area. Based on the results of a number of studies on benthic recovery (e.g., AKRF, Inc. et al., 2012; Germano et al., 1994; Hirsch et al., 1978; Kenny and Rees, 1994), the affected benthic communities in the disturbed area are expected to re-establish within 1 to 3 years as native assemblages recolonize the affected area or a new community develops as a result of immigration of organisms from nearby areas or from larval settlement. Regardless of foundation type(s) installed, existing habitats will be converted to hard substrate with installation of the WTG foundations (inclusive of scour protection) and with the installation of cable protection along the IAC, OSS-Link Cable, and RWEC. However, following construction, these areas of new hard substrate may be suitable for colonization by sessile benthic species and may provide additional habitat for fish and invertebrate species that inhabit hard bottom habitats. Beneficial effects for these species would be dependent on their habitat preferences, the quality of the newly-created hard-bottom habitat, and the quality of the benthic community that colonizes the new habitat. These long-term impacts would be reversed following decommissioning of the Project. Additional impacts on EFH from operations and maintenance of the RWF and RWEC would be primarily associated with routine and non-routine maintenance activities that may require excavation of sediment within a small area. The temporary displacement of these sediments would impact benthic and demersal EFH in the vicinity, but the impact would be limited considering the small area affected and the long period of time between maintenance activities. Operational impacts of vessel noise, traffic, and lighting are considered to be minimal relative to existing marine use activities in the area.

Decommissioning activities associated with the Project, similar to construction activities, will result in temporary disturbances to EFH and EFH species, but effects and recovery rates are expected to be similar to those described for construction.

The overall impacts on EFH associated with the construction, operation, and decommissioning of the RWF and RWEC are considered to be limited and are not likely to result in population-level effects on EFH species or life stages.

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