The latest revision date of Appendix U to the Empire Offshore Wind COP is May 2022. This appendix was not revised as part of the November 2023 submittal; therefore, the date on the Appendix U cover sheet remains as May 2022.

Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2)
Construction and Operations Plan

APPENDIX U

Essential Fish Habitat (EFH) Assessment

Prepared for
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TETRA TECH

MAY 2022

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ACRONYMS AND ABBREVIATIONS

ac	acre
ASMFC	Atlantic States Marine Fisheries Commission
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
CVOW Pilot Project	Coastal Virginia Offshore Wind Pilot Project (formerly the Virginia Offshore Wind Technology Advancement Project)
dB	decibel
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
EFHA Project Area	The offshore area associated with the full build-out of the Lease Area, submarine export cables, and interarray cables. For the purposes of this assessment, the Project Area includes the entire surveyed area in which Project components may be sited.
EIS	Environmental Impact Statement
EMF	electric and magnetic fields
Empire	Empire Offshore Wind LLC
ESA	Endangered Species Act
EW	Empire Wind
FAD	fish aggregating device
FMC	Fishery Management Council
FMP	fishery management plan
FONSI	Finding of No Significant Impact
ft	foot
ft^2	square foot
ha	hectare
HAPC	Habitat Areas of Particular Concern
HDD	horizontal directional drilling
HMS	Highly Migratory Species
kJ	kilojoule
km	kilometer
kV	kilovolt
Lease Area	designated Renewable Energy Lease Area OCS-A 0512
m	meter
m^2	square meter
MAFMC	Mid-Atlantic Fishery Management Council
MBES	multibeam echo sounder

mi	mile
mm	millimeter
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MW	megawatt
NEFMC	New England Fishery Management Council
nm	nautical mile
NMFS	NOAA National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Oceanic and Atmospheric Administration National Marine Fisheries Service
NWI	National Wetlands Inventory
NYSERDA	New York State Energy Research and Development Authority
OCS	Outer Continental Shelf
PDE	Project Design Envelope
SSS	side scan sonar
USACE	U.S. Army Corps of Engineers
Project	The offshore wind project in OCS-A 0512 proposed by Empire Offshore Wind LLC consisting of Empire Wind 1 (EW 1) and Empire Wind 2 (EW 2)
Vineyard Wind	Vineyard Wind Offshore Wind Energy Project

U.1 INTRODUCTION

This Essential Fish Habitat Assessment (EFHA) was prepared in accordance with 50 Code of Federal Regulations (CFR) § 600.920(e)(1) to support the Bureau of Ocean Energy Management (BOEM) during consultation with the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The EFHA analyzes effects of construction, operations, and decommissioning of the Project located in designated Renewable Energy Lease Area OCS-A 0512 (Lease Area) off the coasts of New York and New Jersey and is included as **Appendix U** to the Empire Offshore Wind Construction and Operations Plan (COP). Empire proposes to develop the Lease Area in two wind farms, known as Empire Wind 1 (EW 1) and Empire Wind 2 (EW 2) (collectively referred to hereafter as the Project). The Project will be constructed in the Lease Area approximately 12 nautical miles (nm, 22 kilometers [km])[1] south of Long Island, New York and 16.9 nm (31.4 km) east of Long Branch, New Jersey. For the purposes of this EFHA, the Project Area includes the offshore area associated with the build-out of the Lease Area, submarine export cables, and interarray cables shown in **Figure U-1.** For the purposes of this assessment, the Project Area includes the entire surveyed area in which Project components may be sited.

The fisheries of the United States are managed within a framework of overlapping international, federal, state, interstate, and tribal authorities. Federal jurisdiction includes fisheries in marine waters between the state boundary (3 nm [5.6 km]) and the U.S. Exclusive Economic Zone (200 nm [370 km]) from the coast. Individual states generally have jurisdiction over fisheries in marine waters within 3 nm (5.5 km) of their coasts. In addition to the regional Fishery Management Councils (FMCs) established under the MSA, state resource agencies and multi-state fisheries commissions coordinate management of the shared finfish, shellfish, and anadromous fish. Together with NOAA Fisheries, the FMCs regulate commercial and recreational fishing through fishery management plans (FMPs) for one or more species. NOAA Fisheries' Highly Migratory Species (HMS) Division is responsible for tunas, sharks, swordfish, and billfish in the Atlantic Ocean (NOAA Fisheries 2017). FMCs and NOAA Fisheries' HMS Division are required to identify essential fish habitat (EFH) for each managed species. EFH is defined as the waters and seabed necessary for spawning, breeding, or growth to maturity (16 United States Code § 1802[10]) of finfish, mollusks, crustaceans, and other managed invertebrates.

The potential for interaction of the Project with species and habitats was first evaluated based on spatial overlap of designated EFH shapefiles with the Project Area. The list of species with EFH in the Project Area was then refined to focus on species and life stages with benthic EFH, including demersal food sources, that have the greatest likelihood of exposure to Project-related disturbance.

This EFHA is an appendix to the COP, which presents a comprehensive description of the Project, the affected area, and impacts to numerous resources. Effects on intertidal, estuarine, and marine benthic and pelagic habitats and species (i.e., fishes and invertebrates) are in **Section 5.2 Wetlands and Waterbodies** and **Section 5.5 Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat;** effects on commercial and recreational fisheries are in **Section 8.8 Commercial and Recreational Fishing**. This EFHA cross-references these two COP sections as well as **Appendix H Marine Site Investigation Report** and **Appendix T Benthic Resource Characterization Reports** to support the evaluation of EFH and managed species. The EFHA presents the required components as follows:

[1] Distances throughout the COP are provided as statute miles (mi) or nautical miles (nm) as appropriate, with kilometers in parentheses. For reference, 1 mi equals approximately 0.87 nm or 1.6 km.

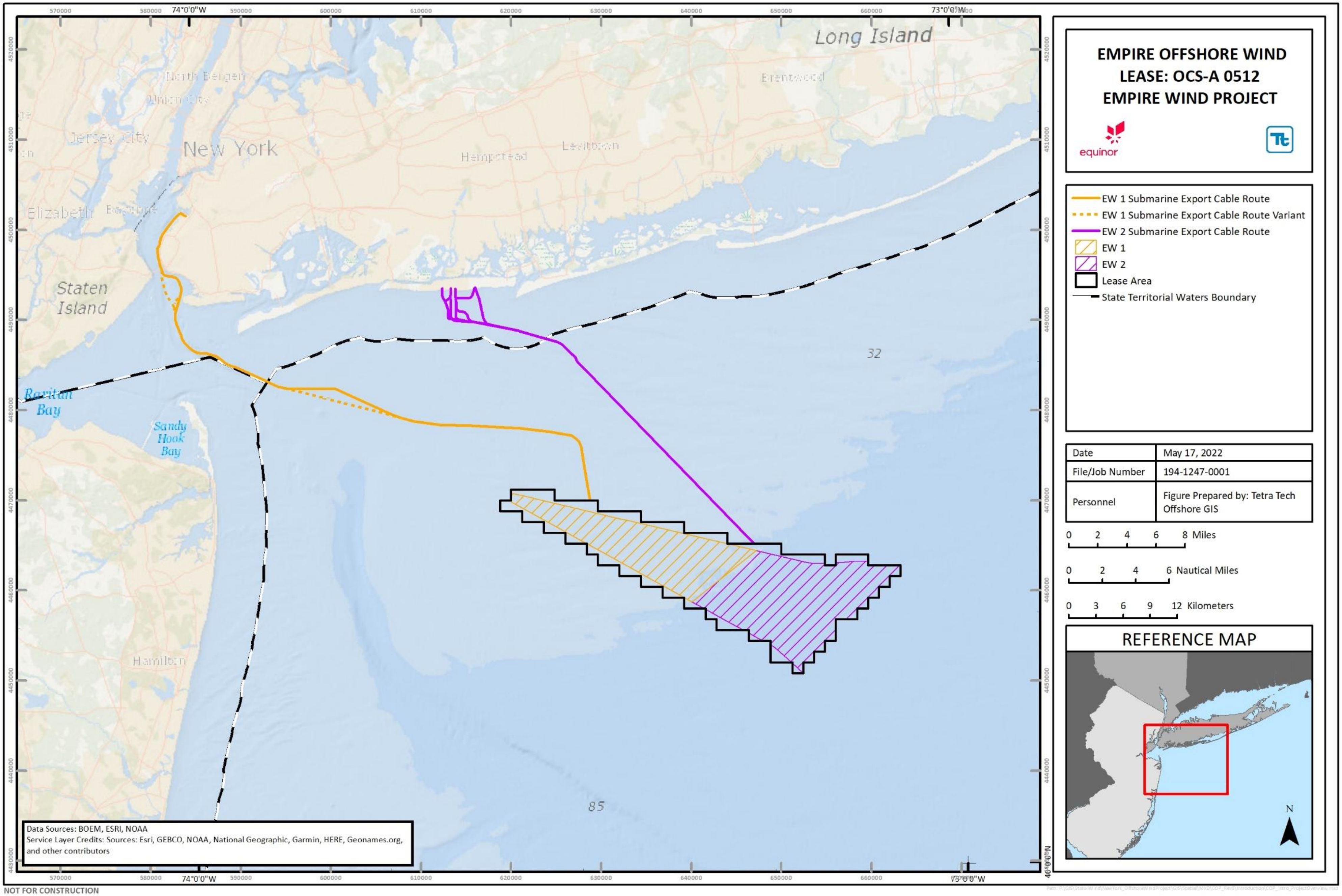

Figure U-1 Project Overview

- Summary of EFH for all life stages of managed species that may be exposed to stressors associated with the Project (**Section U.2**);
- Description of the Project includes definitions of terms and descriptions of construction, operations, and decommissioning activities; and avoidance, minimization, and mitigation measures incorporated into the Project (**Section U.3**);
- Effects on EFH are analyzed in **Section U.4**;
- Conclusions and determination of effect are in **Section U.5**; and
- Literature cited is in **Section U.6**.

Profiles of species with designated EFH in the Project Area are in **Attachment U-1**. For each species, a map and table of acreages of intersection of EFH for each life stage with the Project Area are provided. **Attachment U-2** presents oversized tables, including calculations of the percentage of EFH potentially affected by the Project Area, the typical habitat and prey requirements of each species, and the potential impacts of the Project on species and life stages.

U.2 MANAGED SPECIES IN THE PROJECT AREA

Species with EFH in the Project Area were identified using the NOAA Fisheries Habitat Mapper (NOAA Fisheries 2021), New England Fishery Management Council (NEFMC) Omnibus Amendment 2 (2017), Mid-Atlantic Fishery Management Council (MAFMC) Fisheries Management Plans, NOAA Fisheries' Highly Migratory Species Amendment 10 (2017), EFH source documents, and other reports and published literature.

In the Project Area, NEFMC and MAFMC share authority with NOAA Fisheries to manage and conserve fisheries in federal waters. NOAA Fisheries' Highly Migratory Species Division is responsible for tunas and sharks in the Project Area (NOAA Fisheries 2017). The Atlantic States Marine Fisheries Commission (ASMFC) manages more than two dozen fish and invertebrate species in cooperation with the states and NOAA Fisheries; many of these species are also identified as NOAA Trust Resources. Coastal Migratory Pelagic species are managed jointly by the Gulf of Mexico and South Atlantic Fishery Management Councils from the Mexico/Texas border to New York.

NOAA Fisheries and FMCs may also designate Habitat Areas of Particular Concern (HAPC), defined as a subset of the habitats that a species is known to occupy, to conserve fish habitat in geographical locations particularly critical to the survival of a species. No HAPC has been designated in the Project Area (EFH Mapper, accessed June 23, 2021). All seagrass is HAPC for summer flounder; the nearest seagrass is located inshore of Jones Beach, Long Island, which is 5 nm (9.3 km) from the EW 2 submarine export cable siting corridor. Managed species with designated EFH intersecting the Project Area are listed in **Table U-1**.

Table U-1 Summary of Fisheries Management in the Project Area

New England Fishery Management Council	Mid-Atlantic Fishery Management Council	Gulf of Mexico and South Atlantic FMCs (Coastal Migratory Pelagics)	NOAA Fisheries (Highly Migratory Species)	Atlantic States Marine Fisheries Commission
Atlantic Cod Atlantic Herring b/ Atlantic Sea Scallop Clearnose Skate Haddock Little Skate Monkfish a/ Ocean Pout Pollock Red Hake Silver Hake White Hake Windowpane Flounder Winter Flounder b/ Winter Skate Witch Flounder Yellowtail Flounder	Atlantic Butterfish Atlantic Mackerel Atlantic Surf Clam Black Sea Bass b/ Bluefish b/ Longfin Inshore Squid Ocean Quahog Scup b/ Spiny Dogfish a/ b/ Summer Flounder b/	King Mackerel Spanish Mackerel b/	Atlantic Albacore Tuna Atlantic Bluefin Tuna Atlantic Skipjack Tuna Atlantic Yellowfin Tuna Blue Shark Common Thresher Shark Dusky Shark Sand Tiger Shark Sandbar Shark Shortfin Mako Shark Smoothhound Shark/Smooth Dogfish Tiger Shark White Shark	American Eel American Lobster Atlantic Menhaden Atlantic Striped Bass Atlantic Sturgeon Cobia Horseshoe Crab Jonah Crab Shad and River Herring Tautog Weakfish

Notes:
a/ Joint management by NEFMC and MAFMC
b/ Joint management with ASMFC

U.2.1 Previous EFHA Consultations for U.S. Atlantic Offshore Wind Projects

BOEM conducted a programmatic consultation for the Atlantic offshore wind program with NOAA Fisheries in preparation for the New York Wind Energy Area lease sale. That consultation covered activities related to initial development of wind-powered facilities on the outer continental shelf (OCS) within the designated New York Wind Energy Area, but did not evaluate the construction, operations, or decommissioning of a project. NOAA Fisheries concurred with BOEM that site assessment activities would have no significant effect on EFH if standard operating conditions were adopted (BOEM 2016). Building on BOEM's consultation, Empire has participated in several informal EFH engagement activities with resource agencies. During these meetings, Empire provided NOAA Fisheries a preliminary description of the Project; presented a site-specific survey protocol for characterizing EFH and benthic resources in the Project Area; participated in several meetings with NOAA Fisheries to discuss potential conservation and mitigation measures to minimize adverse effects on EFH and managed species; and requested and received recommendations for developing the EFHA.

Analyses and determinations resulting from EFH consultations on similar offshore wind and cable projects in the Mid-Atlantic Bight are incorporated into this EFHA to the extent practicable. The following recent EFHAs and consultations were reviewed:

Vineyard Wind Offshore Wind Energy Project (Vineyard Wind). BOEM's Final Environmental Impact Statement for Vineyard Wind concluded that impacts to EFH from construction, including pile driving, would be minor or moderate. Adverse impacts during operations and decommissioning would be minor for all factors except reef effects, which would be moderately beneficial. Adverse impacts would be greatest for benthic EFH and species, including skates, flatfish, squid egg mops, and Atlantic sea scallops (BOEM 2019). Mitigation measures in the EFHA include soft-start pile driving, targeted 12-decibel (dB) attenuation with a minimum of 6 dB attenuation in pile-driving sound, and use of mid-line buoys and horizontal directional drilling (HDD) in shallow coastal waters (where feasible) (BOEM 2018a). NOAA Fisheries' Biological Opinion for Vineyard Wind concluded that impacts to Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) would be insignificant or extremely unlikely to occur. The Biological Opinion recommended that the relevant federal agencies support and/or conduct research to monitor project noise levels; track Atlantic sturgeon and other protected species presence in the Lease Area; and document long-term project impacts to regional oceanic and atmospheric conditions, benthic habitat, and species distributions (NOAA Fisheries 2020).

South Fork Wind Farm. BOEM submitted a Biological Assessment and EFHA to NOAA Fisheries in January and April 2021, respectively. The Biological Assessment concluded that the proposed action is not likely to adversely affect Atlantic sturgeon (BOEM 2021a). The EFHA determined that impacts associated with project construction would be greater than those associated with operations and would result in short-term adverse effects that could diminish habitat suitability for certain managed species; furthermore, it concluded that managed species with demersal life stages are more likely to be subjected to long-term or permanent adverse impacts than pelagic species (BOEM 2021b). NOAA Fisheries' Biological Opinion and response to the EFHA are forthcoming.

Revolution Wind Offshore Wind Farm. The Revolution Wind COP included an EFHA to support BOEM's interagency consultation with NOAA Fisheries. The assessment determined that most potential impacts of the project would be temporary and reversible and that benthic communities in the disturbed area would be expected to re-establish within one to three years following construction (INSPIRE Environmental 2020). BOEM submitted a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for Revolution Wind on April 30, 2021 (Federal Register 2021a). Following the public scoping and comment period, BOEM will initiate a formal consultation with NOAA Fisheries to support its assessment of project impacts on EFH for inclusion in the EIS.

Ocean Wind Offshore Wind Farm. The Ocean Wind COP included an EFHA to support BOEM's interagency consultation with NOAA Fisheries. The assessment determined that most impacts to EFH would be short-term and temporary (Ocean Wind, LLC 2021). BOEM submitted a NOI to prepare an EIS for Ocean Wind on March 30, 2021 (Federal Register 2021b). Following the public scoping and comment period, BOEM will initiate a formal consultation with NOAA Fisheries to support its assessment of project impacts on EFH for inclusion in the EIS.

Coastal Virginia Offshore Wind (CVOW) Pilot Project (formerly the Virginia Offshore Wind Technology Advancement Project [VOWTAP]). A formal consultation with NOAA Fisheries was completed in 2015 for VOWTAP on the Atlantic Continental Shelf Offshore Virginia. NOAA Fisheries concurred with BOEM's findings that direct impacts to juvenile and adult life stages of EFH species were expected to be moderate and impacts to larvae and eggs were expected to be negligible. BOEM issued a Finding of No Significant Impact (FONSI) for VOWTAP (BOEM 2015).

Block Island Wind Farm. NOAA Fisheries concurred with the FONSI prepared by the U.S. Army Corps of Engineers (USACE) and BOEM that the Block Island Wind Farm and the Block Island Transmission System would not substantially degrade EFH (USACE 2014). Additional findings of no adverse effects on the Atlantic sturgeon and its benthic prey is in the Biological Opinion for this project (NOAA Fisheries 2015).

Cape Wind. The U.S. Department of Energy adopted an EFHA prepared by the Minerals Management Service (forerunner to BOEM) that found the Cape Wind project would cause minor to negligible effects on EFH (DOE 2012). Although the project was later cancelled, the EFHA was deemed complete and acceptable.

U.2.2 Review of EFH in the Project Area

For most species, EFH is designated by 10-by-10-minute squares based on the analysis of fishery-independent data, habitat features, literature reviews, and best professional judgment of fisheries managers on the occurrence of species and life stages in each square. Fish and invertebrate species with designated EFH in the Project Area were included in this EFHA based on descriptions in fishery management plans (FMPs), the online EFH Mapper[2], and EFH source documents, which are incorporated by reference into this EFHA.

The FMCs classify EFH for managed species in terms of life stages: eggs, larvae, juveniles (neonates), adults, and sometimes spawning adults. Life stages of highly migratory species are grouped in three categories based on common habitat usage: (1) spawning adult, egg, and larva; (2) juvenile and subadult; and (3) adult. Essential fish habitat life stage categories for sharks are defined as neonate, juvenile, and adult (**Table U-2**).

[2] https://www.habitat.noaa.gov/apps/efhmapper/

Table U-2 Designated EFH by Species and Life Stage in the Project Area

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
	Life Stage											
	E	L	J	A	E	L	J	A	E	L	J	A
Atlantic Cod (*Gadus morhua*)	x	x	--	x	x	x	--	x	x	x	--	x
Atlantic Herring (*Clupea harengus*)	--	x	x	x	--	x	x	x	--	x	x	x
Atlantic Sea Scallop (*Placopecten magellanicus*)	x	x	x	x	x	x	x	x	x	x	x	x
Clearnose Skate (*Raja eglanteria*)	--	n/a	--	--	--	n/a	x	x	--	n/a	--	--
Haddock (*Melanogrammus aeglefinus*)	--	x	x	--	--	--	x	--	--	x	--	--
Little Skate (*Leucoraja americanus*)	--	n/a	x	--	--	n/a	x	x	--	n/a	x	x
Monkfish (*Lophius americanus*)	x	x	x	x	x	x	x	x	x	x	--	x
Ocean Pout (*Macrozoarces americanus*)	x	--	x	x	x	--	x	x	x	--	--	x
Pollock (*Pollachius virens*)	--	x	--	--	--	--	--	--	x	x	x	--
Red Hake (*Urophycis chuss*)	x	x	x	x	x	x	x	x	x	x	x	x
Silver Hake (*Merluccius bilinearis*)	x	x	x	--	x	x	--	x	x	x	--	--
White Hake (*Urophycis tenuis*)	--	--	--	--	--	--	--	--	--	--	x	--

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
	Life Stage											
	E	L	J	A	E	L	J	A	E	L	J	A
Windowpane Flounder (*Pseudopleuronectes americanus*)	x	x	x	x	x	x	x	x	x	x	x	x
Winter Flounder (*Glyptocephalus cynoglossus*)	--	x	x	x	x	x	x	x	x	x	x	x
Winter Skate (*Leucoraja ocellata*)	--	n/a	x	x	--	n/a	x	x	--	n/a	x	x
Witch Flounder (*Glyptocephalus cynoglossus*)	x	x	--	x	x	x	--	--	x	x	--	--
Yellowtail Flounder (*Scophthalmus aquosus*)	x	x	x	x	x	x	x	x	x	x	x	x
Atlantic Butterfish (*Peprilus triancanthus*)	x	x	x	--	x	x	x	x	--	x	x	x
Atlantic Mackerel (*Scomber scombrus*)	x	x	x	x	x	x	x	x	x	x	x	x
Atlantic Surfclam (*Spisula solidissima*)	--	--	x	x	--	--	x	x	--	--	x	x
Black Sea Bass (*Centropristis striata*)	--	x	x	x	--	x	x	x	--	x	x	x
Bluefish (*Pomotomus saltatrix*)	x	x	x	x	x	x	x	x	x	x	x	x
Longfin Inshore Squid (*Doryteuthis pealeii*)	x	--	x	x	x	--	x	x	x	--	x	x
Ocean Quahog (*Arctica islandica*)	--	--	x	x	--	--	x	x	--	--	x	x

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
	Life Stage											
	E	L	J	A	E	L	J	A	E	L	J	A
Scup (*Stenotomus chrysops*)	--	--	x	x	x	x	x	x	--	--	x	x
Spiny Dogfish (*Squalus acanthias*) b/	n/a	--	sf	f	n/a	--	sf	f/m	n/a	--	sf	f/m
Summer Flounder (*Paralichthys denatus*)	x	x	x	x	--	x	x	x	x	x	x	x
Atlantic Albacore Tuna (*Thunnus alalonga*)	--	--	x	--	--	--	x	--	--	--	x	--
Atlantic Bluefin Tuna (*Thunnus thynnus*)	--	--	x	x	--	--	x	x	--	--	x	x
Atlantic Skipjack Tuna (*Katsuwonus pelamis*)	--	--	x	x	--	--	x	x	--	--	x	x
Atlantic Yellowfin Tuna (*Thunnus albacres*)	--	--	x	--	--	--	--	--	--	--	--	--
Blue Shark (*Prionace glauca*)	n/a	x	x	x	n/a	--	--	--	n/a	x	x	x
Common Thresher Shark (*Alopias vulpinus*)	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x
Dusky Shark (*Carcharinus obscurus*	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x
Sand Tiger Shark (*Carcharhinus taurus*)	n/a	x	x	--	n/a	x	x	--	n/a	x	x	--
Sandbar Shark (*Carcharinus plumbeus*)	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x
Shortfin Mako Shark (*Isurus oxyrinchus*)	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
	Life Stage											
	E	L	J	A	E	L	J	A	E	L	J	A
Smoothhound Shark / Smooth Dogfish (*Mustelus canis*)	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x
Tiger Shark (*Galeocerdo cuvier)*	n/a	--	x	x	n/a	--	x	x	n/a	--	x	x
White Shark (*Carcharodon carcharias*)	n/a	x	x	x	n/a	x	x	x	n/a	x	x	X

Notes:
A = adult; E = egg; J = juvenile; L = larvae
x = present
-- = not present
a/ For the purposes of this assessment, refers to the surveyed area in which Project components may be sited.
b/ EFH is designated separately for sub-females (sf), females (f), and males (m)
n/a = life stage does not exist for this species
See **Attachment U-2, Table U-2-3** for details

U.2.3 Categories of EFH Habitat

The Project Area provides three general types of EFH that support managed species and their prey: water column, softbottom, and hardbottom (**Table U-3**).

Table U-3 Types of Essential Fish Habitat in Project Area

EFH Category	Representative Habitats
Water Column (including plankton/ichthyoplankton)	All waters from the surface to the ocean floor, including bays, estuaries, and rivers
Benthic – Softbottom	Seabed substrate of soft or unconsolidated sediments (gravel, cobbles, pebbles, sand, clay, mud, silt, and shell fragments)
Benthic – Hardbottom	Seabed substrate of consolidated sediments; boulders; areas of vertical relief such as crevices, overhangs, and walls

U.2.3.1 Water Column and Currents (including Ichthyoplankton)

All waters from the surface to the ocean floor are part of the water column. The entire Project Area is in the photic zone (i.e., top 600 ft [200 m]), where sunlight supports photosynthetic phytoplankton (Karleskint et al. 2006). The water column is particularly important for planktonic eggs and larvae, planktivorous or filter-feeding species/life stages, and migratory pelagic species (NOAA Fisheries 2017; NEFMC 2017). Oceanic currents, temperature, conductivity, pH, dissolved oxygen, and other features of the water column influence the occurrence and abundance of marine fishes in the Project Area, as described in **Section 4.1 Physical and Oceanographic Conditions**.

Bays and estuaries are designated as EFH for spawning, nesting, development, dispersal, and feeding for both year-round residents and seasonal migrants that spend part of their lives offshore. For example, winter flounder spawn in inshore bays and harbors but rear offshore; other flounders spawn offshore but move into estuaries as larvae. Anadromous fishes such as the Atlantic sturgeon, striped bass (*Morone chrysops*), and river herrings (*Alosa* spp.) may use estuaries as temporary stopovers during spawning migrations (NEFMC 2017).

Water depth influences surface and bottom temperatures, light penetration, sediment movement, and other physical and chemical habitat parameters that define EFH. In the Lease Area, water depths are relatively uniform, ranging from 65 to 147 ft (20 to 45 m); about 76 percent of the Lease Area is between 98 and 131 ft (30 and 40 m) deep. Water depths in the two submarine export cable siting corridors generally become shallower between the offshore substations and the submarine export cable landfalls, as shown in **Figure U-2**.

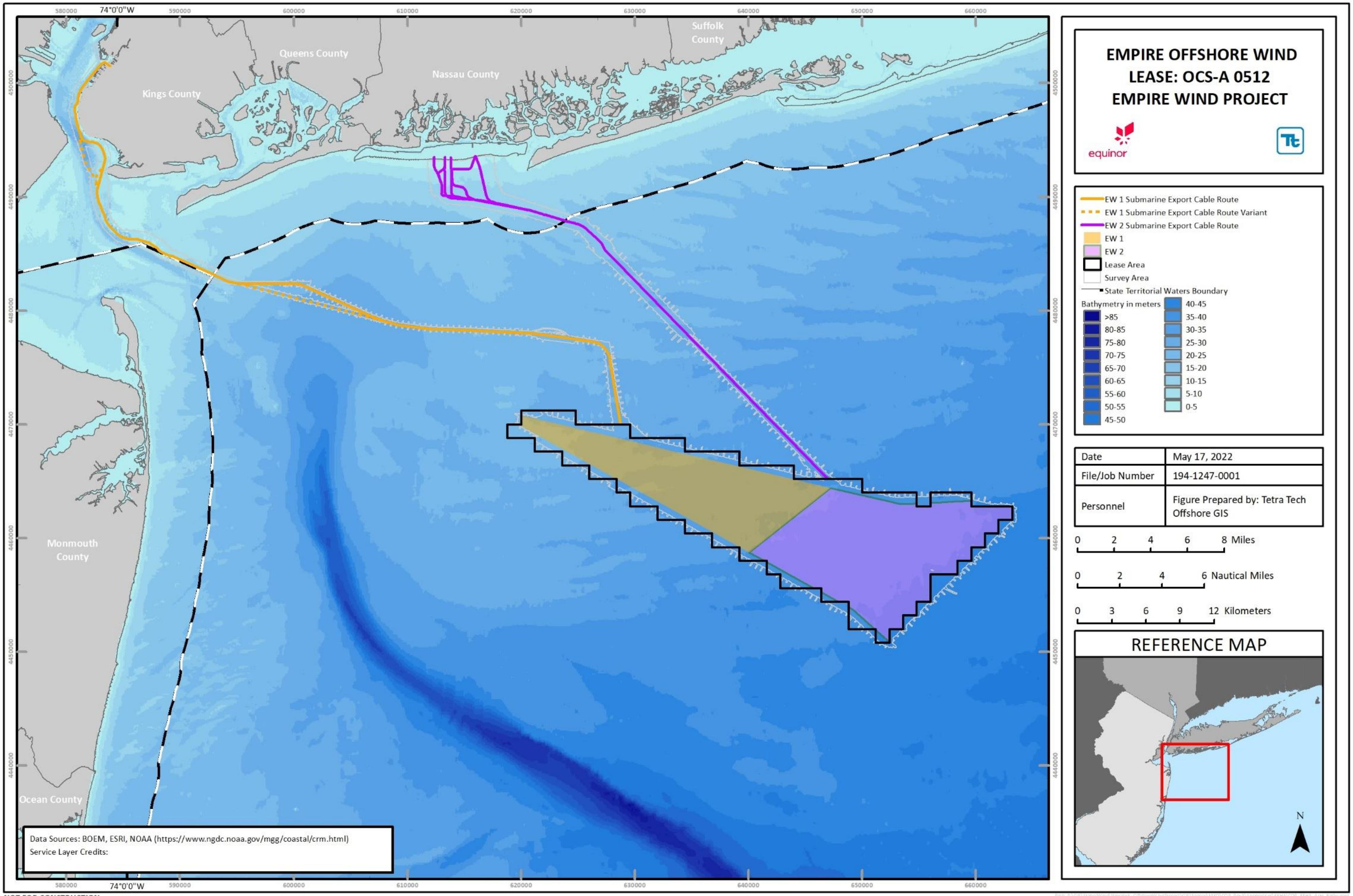

Figure U-2 Bathymetry in Project Area

The water column serves dual functions as EFH: it supports the phytoplankton that sustain marine food webs and it provides a dispersal mechanism for planktonic larvae of many managed species. Phytoplankton (e.g., diatoms, dinoflagellates) thrive where nutrients and sunlight are abundant, such as along the coast of New Jersey where abundant phytoplankton are sustained by nutrients carried to the well-lit surface waters by upwelling. Phytoplankton are consumed by zooplankton (i.e., tiny animals such as copepods and larval forms of crustaceans, bivalves, and other invertebrates) and ichthyoplankton (fish larvae).

The joint contribution of benthic and pelagic habitat components to EFH is evident in the designation of specific bottom types, water depths, and prey sources as essential to managed species (NEFMC 2017). Descriptions of EFH by species and life stage are in **Attachment U-1**; typical depths and prey are summarized in **Attachment U-2**. Benthic-pelagic habitat coupling is essential for the sustainability of a healthy ecosystem that supports the species of interest in the Project Area. Many key benthic life stages depend on pelagic habitats for feeding and/or reproducing. For example, the Atlantic sea scallop's eggs are fertilized on the seafloor, then transform within 24 hours to planktonic larvae. After drifting as planktonic larvae for 5 to 6 weeks (generally southward), juvenile scallops recruit to the substrate where they filter-feed on plankton, enrich the sediment with their wastes, and release the next generation to the overlying water (Munroe et al. 2018). The Atlantic surfclam life history is similar, with a 3- to 4-week planktonic larval stage during which the larvae may be transported far to the south (Cargnelli et al. 1999). After recruiting to the bottom, adult surfclams live out their lives as infauna buried in soft sediment and feeding on plankton filtered from the water column.

The most numerically abundant component of the pelagic fish community in the open waters of the Project Area is the ichthyoplankton assemblage. Buoyant eggs and larvae of most marine fishes in Southern New England can remain in the plankton for weeks to months (Walsh et al. 2015). Plankton were prevalent in acoustic surveys in the Lease Area in 2018, where strong evidence of diel vertical migrations of both plankton and small fish were reported (Battista et al. 2019). The assemblage of species represented in the ichthyoplankton varies seasonally and is strongly influenced by water temperature; patterns of ichthyoplankton assemblages have changed in recent decades, likely in response to climate change (discussed in **Section 5.5**; MAMFC 2017; Walsh et al. 2015).

U.2.3.2 Softbottom EFH

Softbottom habitats include unconsolidated rocks, gravel, cobble, pebbles, sand, clay, mud, silt, and shell fragments as well as the water-sediment interface. Sediments in the Project Area are typical of the Mid-Atlantic Bight, dominated by medium-sized sand and gravel; mean grain size generally diminishes with distance from shore (MAFMC 2016).

Empire conducted extensive surveys of the Lease Area from March 2018 to November 2018 using multibeam echo sounder (MBES), side scan sonar (SSS), digital imagery, and sediment grab samples. Empire conducted initial benthic surveys in the submarine export cable siting corridors in spring 2019 using sediment profile imaging and plan view imaging supplemented by grab samples. To augment the 2019 survey data and characterize previously unsurveyed portions of the EW 2 submarine export cable siting corridor, Empire conducted additional benthic surveys from October 2020 to May 2021. The 2020/2021 surveys collected MBES, SSS, ultra-short baseline, sound velocity profiler, magnetometer, sub-bottom profiler, water quality profiler, digital imagery, and grab sample data.

Grab samples from all surveys were analyzed for particle size distribution, total organic carbon, and benthic infauna to ground-truth the sediment types observed in digital imagery (see **Appendix T**). Benthic habitat in the Lease Area was predominantly rippled sand with high occurrence of faunal beds; broken shells were mixed with the sand across large areas. Benthic habitat in the submarine export cable siting corridors was predominantly rippled sand with unevenly distributed gravels. The previously unsurveyed portions of the EW 2 submarine export cable siting corridor were also dominated by mobile sand, with slightly gravelly sand in topographic lows between bedforms. No soft coral, lobster, seagrass, or squid eggs were observed during any of the benthic surveys.

Empire's geophysical surveys corroborated the characterization of the Lease Area as relatively flat, unconsolidated softbottom dominated by sand and ripples, with small areas of sandy mud and pebbles, low rugosity, and limited habitat variability (see **Appendix H** for additional information; NYSERDA 2017; Guida et al. 2017; Battista et al. 2019). Three composite habitat types were identified based on the approximately 400 samples collected and analyzed by NOAA to support benthic characterization (Battista et al. 2019); most of the Lease Area was characterized as rippled sand or mega-rippled sand with high occurrence of faunal beds.

The 2018, 2019, and 2020/2021 surveys in the Lease Area and submarine export cable siting corridors corroborate the species identified by the EFH Mapper desktop assessment, depicting habitat suitable for temperate, softbottom-associated species and life stages (**Attachment U-1**). Habitat in the Lease Area is generally homogenous, with unconsolidated sediment grain sizes ranging from gravelly muddy sand to sandy gravel. Depths gradually increased from 82 to 135 ft (25 to 41 m) with distance from shore. Sessile and slow moving epifauna observed along transects in the Lease Area are characteristic of this type of habitat (e.g., sand dollars, mobile crustaceans, burrowing anemones, tube-building fauna). Of the managed species with EFH designated in the Lease Area, the ocean quahog, winter skate, and various flounder and hake species were observed throughout the Lease Area in video and image assessments (**Appendix T, Attachment T-2**); more individuals of these species were observed in the deeper waters of the southeastern portion of the Lease Area.

Habitat in the EW 1 and EW 2 submarine export cable siting corridors is similar to the Lease Area; however, sediment grain size is finer in the shallower, nearshore portions of the corridors. Depths gradually decreased from 98 to 23 ft (30 to 7 m) from the Lease Area to the export cable landfall; grain size ranged from silt/clay and very fine sand to gravelly sand (**Appendix T, Attachment T-3**). Sessile and slow moving epifauna observed within the corridors included sand dollars and mussel beds, mobile crustaceans, burrowing anemones, attached hydroids, and tube-building fauna. The only managed species observed during the 2019 surveys was the Atlantic sea scallop in EW 1.

The 2020/2021 surveys in the EW 2 submarine export cable siting corridor recorded maximum depths of 115 ft (35 m), relatively stable spring bottom temperatures (42.3 to 45.5°F [5.7 to 7.5°C]), salinities of 32 to 33 Practical Salinity Units, and unconsolidated sediment ranging from fine to gravelly sand. Of the managed species with EFH designated in the EW 2 submarine export cable siting corridor, the ocean quahog, spiny dogfish, and winter skate were observed in video and image assessments (**Appendix T, Attachments T-5 and T-6**). These species were primarily observed in the offshore portion of the EW 2 submarine export cable siting corridor at depths of 92 to 112 ft (28 to 34 m), fine to gravelly sand, and a mix of sand dollar beds and soft sediment fauna.

Softbottom sediments tend to be dynamic and not easily generalized. Benthic fauna and infauna often rework sediments in the process of feeding and burrowing. In this way, marine organisms can influence the structure, texture, and composition of sediments as well as the horizontal and vertical distribution of organic substances in the sediment. Managed species favoring these unconsolidated bottom habitats for spawning, development, or feeding include several flounders, monkfish, silver and red hake, ocean pout, surfclam, scallop, and others (NEFMC 2017) (see **Attachment U-2, Table U-2-2**).

Representative images of substrate and organisms observed during Empire's 2018 benthic surveys in the Lease Area are shown in **Figure U-4**: These show aggregations of broken shells on a sandy bottom at sample location

ENV10; winter skate on a sandy bottom at ENV72; skate egg cases on pebbly sand at ENV26; and sand dollars and pagurid crab on sand with shell hash at ENV71. The full benthic habitat characterization reports of the Lease Area and submarine export cable siting corridor surveys are in **Appendix T, Attachment T-1 (Site Assessment Plan [SAP] Benthic Survey Report), Attachment T-2 (COP Benthic Habitat Characterization Report: Lease Area), Attachment T-3 (COP Benthic Survey Report: Siting Corridors), Attachment T-4 (COP Benthic Survey Report: EW 1 Submarine Export Cable Siting Corridor), Attachment T-5 (COP Benthic Survey Report: EW 2 Landfall)**; and **Attachment T-6 (COP Benthic Survey Report: EW 2 Submarine Export Cable Siting Corridor)**. Additional interpretation of the seismic data and description of bottom types is in **Appendix H**.

Tidal Wetlands

Tidal wetland habitats are periodically flooded by seawater during high or spring tides and are otherwise exposed to open air. Tidal wetlands in New York State are protected under Article 25 of the Environmental Conservation Law, known as the Tidal Wetlands Act. Under this Act, New York regulates all tidal wetlands and the associated adjacent area. According to the U.S. Fish and Wildlife Service National Wetlands Inventory (NWI), the EW 1 submarine export cable siting corridor and export cable landfall do not intersect tidal wetlands (USFWS 2019). However, EW 2 Landfall C intersects NWI tidal wetlands, covering an area of 1.59 acres (ac, 0.64 hectares [ha]) (**Table U-4** and **Figure U-3**; see **Section 5.2** for a description of impacts to tidal wetlands from open cut trenching and HDD/Direct Pipe activities during construction).

Table U-4 NWI Mapped Wetlands Within the EW 2 Submarine Export Cable Siting Corridor

Route Feature	NWI Classification	Area (ac)
EW 2 Landfall A	No NWI-mapped wetlands within EW 2 Landfall A	0
EW 2 Landfall B	No NWI-mapped wetlands within EW 2 Landfall B	0
EW 2 Landfall C	(M2US2P) Estuarine and Marine Deepwater	1.59
EW 2 Landfall E	No NWI-mapped wetlands within EW 2 Landfall E	0

The south shore of Reynolds Channel exhibits an area classified by NWI as an estuarine and marine wetland feature with an unconsolidated bottom (E2US2N) and by the NYSDEC tidal wetland database as a mudflat (SM). Based on observations during the November 4, 2021 field reconnaissance, the southern bank of Reynolds Channel is highly modified, comprising of a mix of riprap and natural shoreline that quickly transitions to industrial properties.

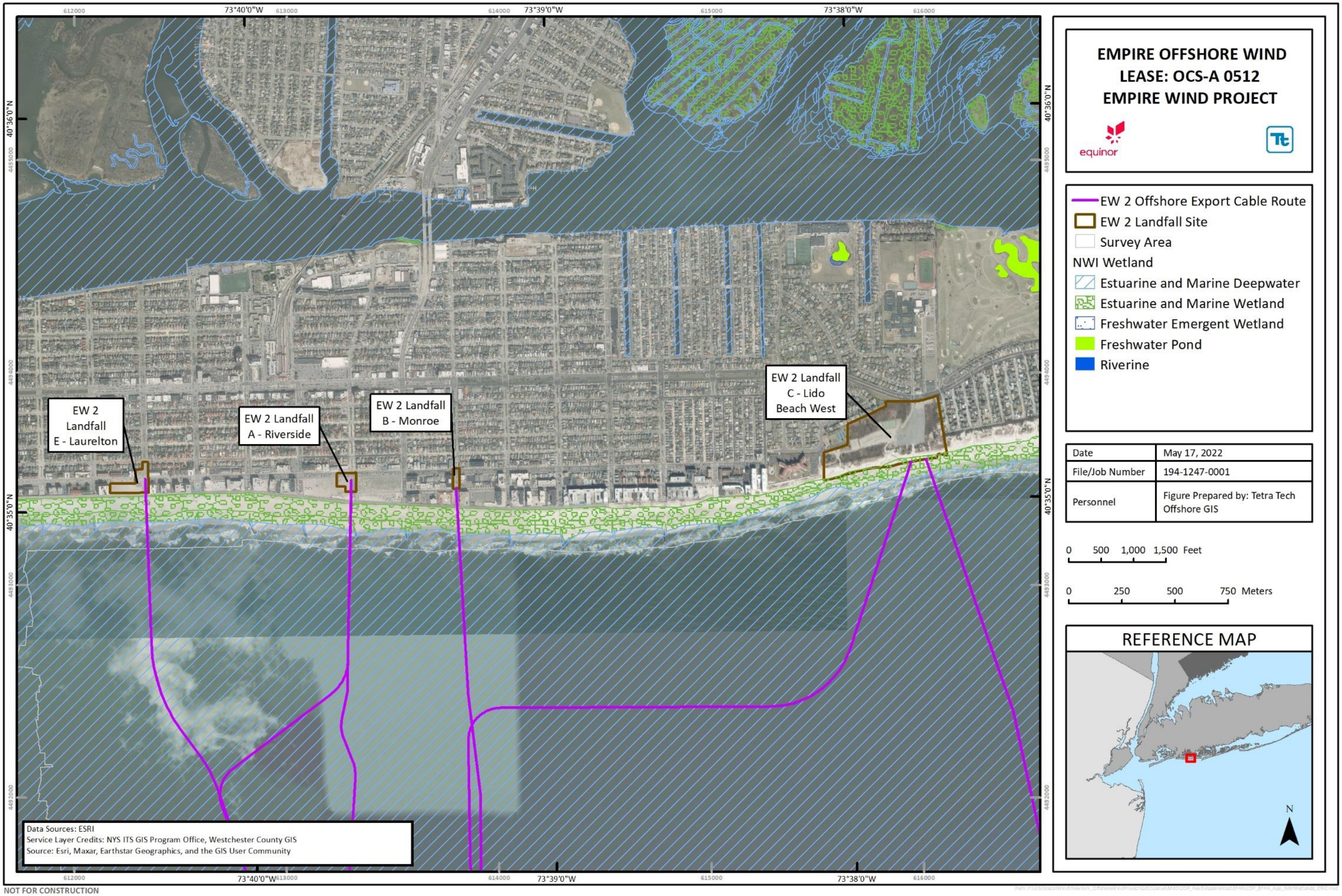

Figure U-3 EW 2 Mapped NWI Tidal Wetlands

U.2.3.3 Hardbottom EFH

No hardbottom was observed in the 2018 surveys of the Lease Area, as discussed above and shown in **Figure U-4**. Limited hardbottom was encountered within the EW 1 submarine export cable siting corridor, immediately north of the nearshore tip of the Lease Area and shown in red as "stronger return" on **Figure U-5**). No hardbottom habitat was observed in the 2019 benthic surveys of the EW 2 submarine export cable siting corridor, as described in **Section U-2.3.2** (**Figure U-5**); similarly, no hardbottom habitat was observed in the 2021 MBES and SSS surveys at or in the vicinity of the EW 2 landfall locations (**Appendix T, Attachment T-5**). However, up to 600 cobbles and boulders (~3 ft [0.9 m]) were detected during the 2020/2021 MBES and SSS surveys in previously unsurveyed portions of the EW 2 submarine export cable siting corridor (**Appendix T, Attachment T-6**). These findings are consistent with other descriptions of the regional geology, which report that most of the natural rocky subtidal bank habitat of the United States Atlantic Coast occurs north of Massachusetts (Aquarone and Adams 2018; Davis 2009; Roman et al. 2000).

Cobbles and boulders were concentrated in the nearshore portion of the EW 2 submarine export cable siting corridor approaching state waters. Lengths and widths of rocks ranged from approximately 0.3 to 6.2 ft (0.1 to 1.9 m) and heights above seabed were up to approximately 3 ft (0.9 m). Cluster of cobbles and boulders overlaid areas of slightly gravelly sand in transects characterized by sand dollar beds, burrowing anemones, and tube-building fauna. Sea lettuce (*Ulva latuca*) was observed growing on shell hash and pebbles, and can be reasonably assumed to also colonize larger boulders. The complex, three-dimensional cobble/boulder/gravelly sand habitat is likely to attract structure-associated managed species, such as black sea bass and scup, as well as attaching life stages, such as longfin inshore squid eggs or Atlantic sea scallop spat. One winter skate was observed over softbottom in a transect located within a boulder aggregation.

Artificial hardbottom in the form of shipwrecks and intentionally placed artificial reefs (yellow dots on **Figure U-6**) provide the only substantial hard structure in the Project Area other than the scattered boulders in the EW 2 submarine export cable siting corridors mentioned above. Six known shipwrecks are mapped in the deeper two-thirds of the Lease Area and numerous others are scattered within the submarine export cable siting corridors, especially in the Lower Bay (**Figure U-6**). New York has a program to place and manage artificial reefs in state waters to enhance fish habitat, largely for recreational anglers and divers. Four of New York's 12 artificial reefs are near enough to the Project Area to serve as demonstrations of potential reef effects of the wind turbine foundations (NYSDEC 2019). Artificial reefs in coastal New York waters are known for these species as well as summer flounder, cod, and several species of edible crab.

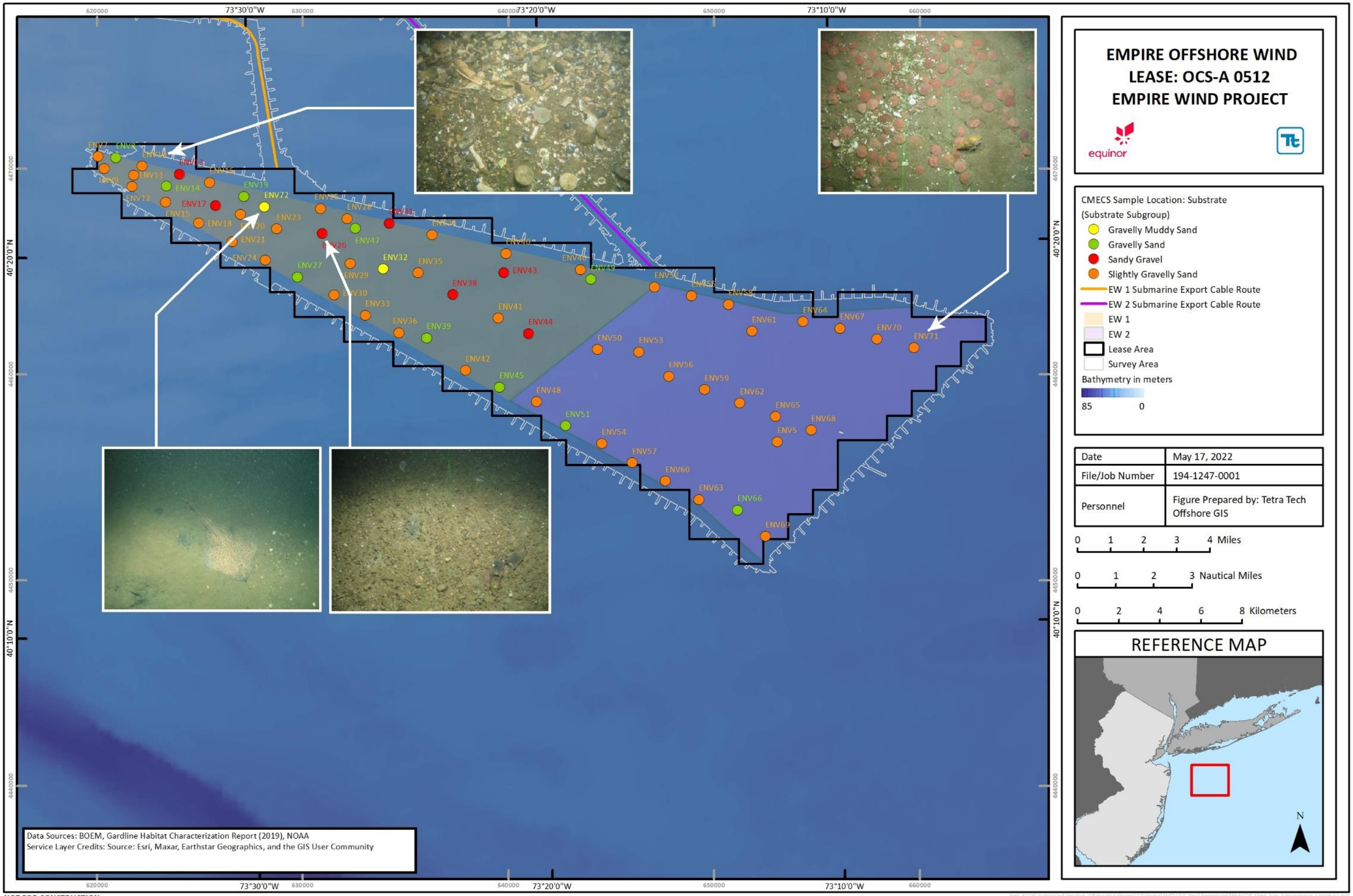

Figure U-4 Representative Plan View Images in Lease Area

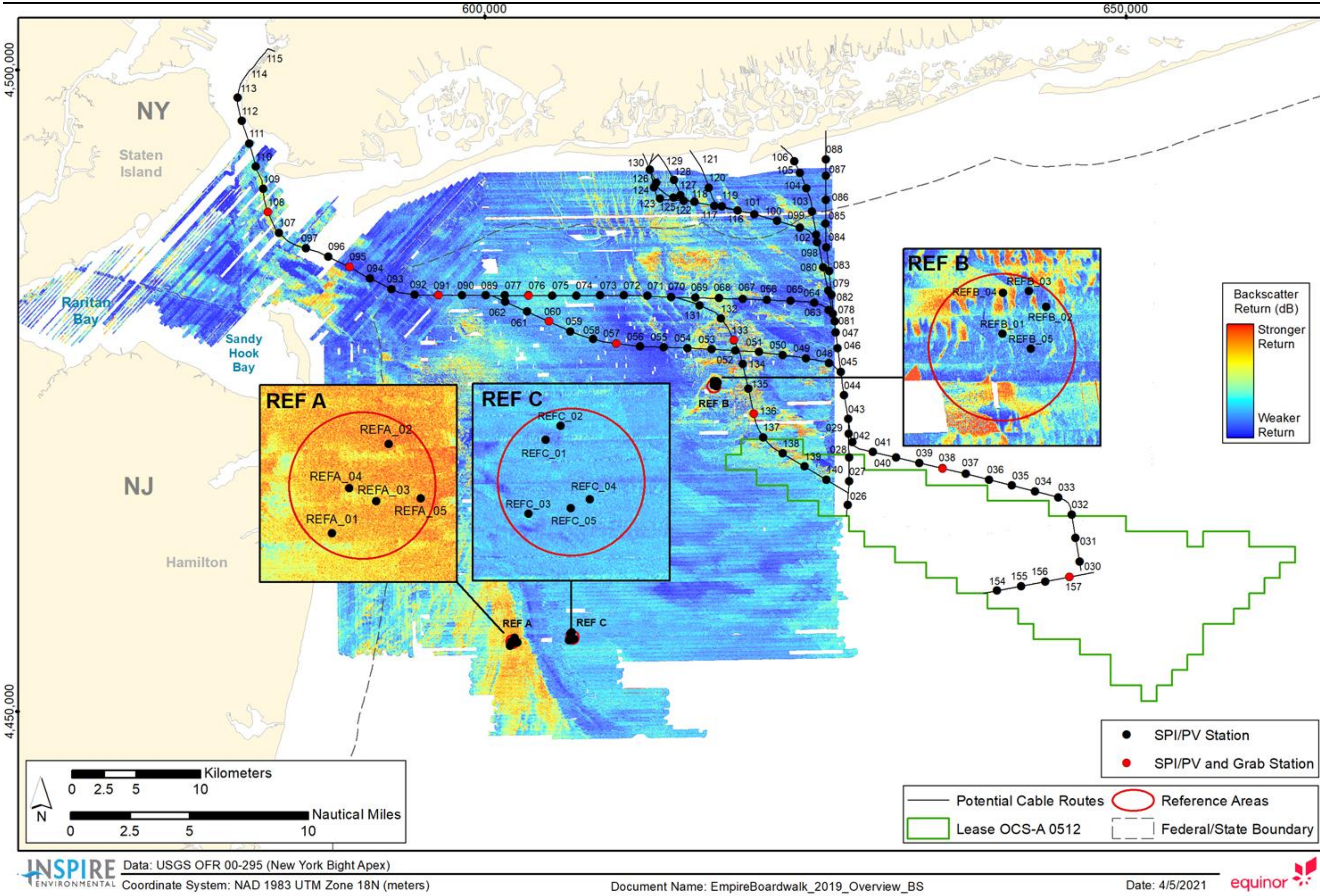

Figure U-5 Limited Occurrence of Hardbottom Habitat Along the EW 1 and EW 2 Submarine Export Cable Siting Corridors

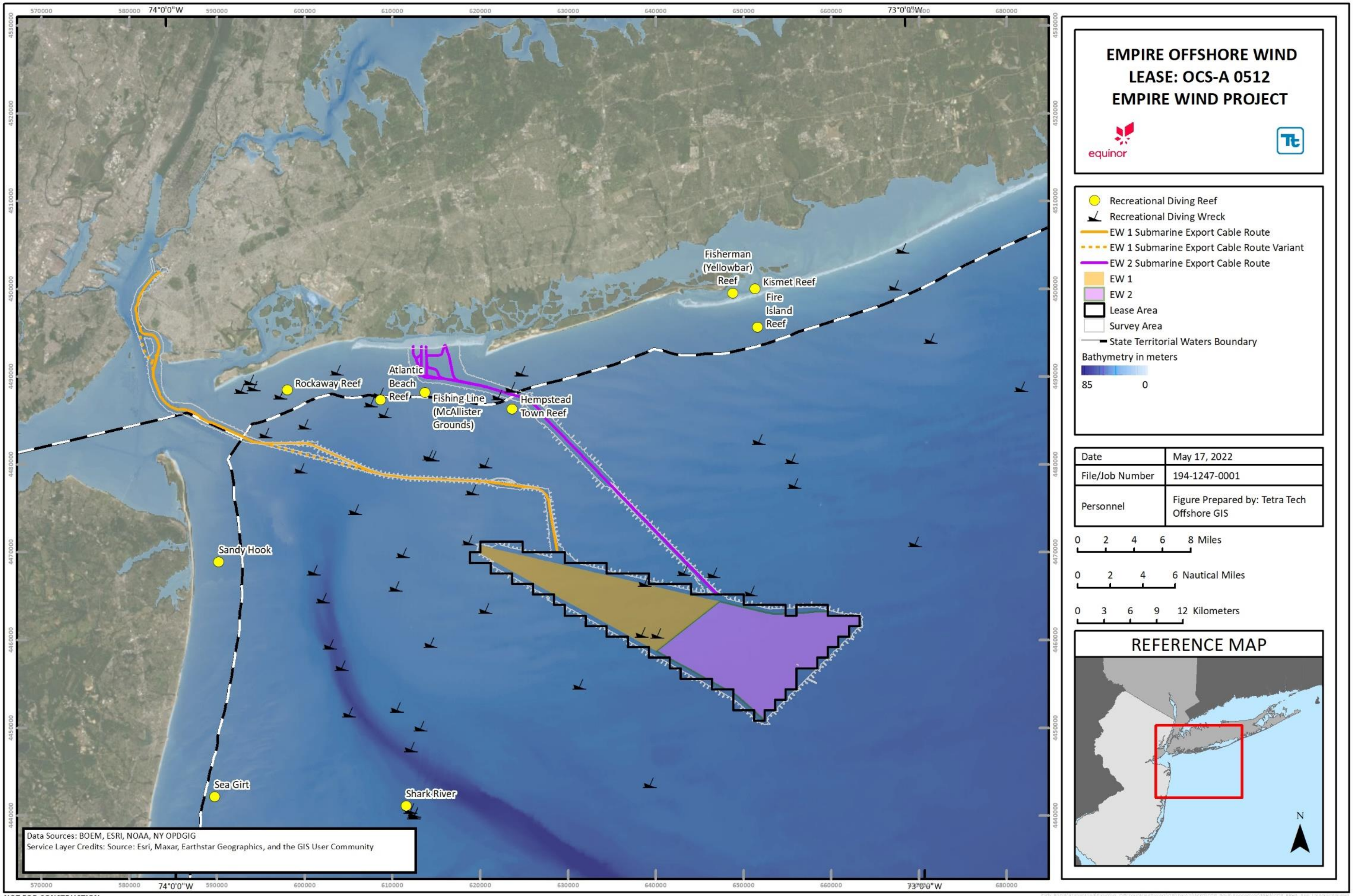

Figure U-6 Shipwrecks and Artificial Reefs in Project Vicinity

U.2.3.4 Other NOAA Trust Resources

In addition to the species with designated EFH discussed above, the potential effects of the Project on several fishes and invertebrates identified as NOAA Trust Resources were evaluated. NOAA Trust Resources expected to occur in the Project Area are listed in **Table U-5**.

Table U-5 Presence of NOAA Trust Resources in the Project Area

Resource	Scientific Name
Shad and river herring	*Alosa* spp.
American eel	*Anguilla rostrata*
Atlantic menhaden	*Brevoortia harengus*
Jonah crab	*Cancer borealis*
Weakfish	*Cynoscion regalis*
Horseshoe crab	*Limulus polyphemus*
Atlantic striped bass	*Morone saxatilis*
Tautog	*Tautoga onitis*

Shad and river herring. River herring (alewife [*Alosa pseudoharengus*] and blueback herring [*Alosa aestivalis*]) migrate through the Upper Bay to spawn in the Hudson River in spring when discharges are typically greatest (USACE 2015b). These species made up 20 percent of the catch of warm-season NEFSC trawls in the Lease Area from 2003 through 2016 (Guida et al. 2017). These two species dominated USACE mid-water trawl samples throughout the New York/New Jersey Harbor (2011 to 2013); American shad (*Alosa sapidissima*) was also reported. These herring were also dominant in nine years of demersal fish surveys in the Lower Bay and Upper Bay (2002-2010) conducted by the USACE (2015a).

American eel. The American eel migrates through the Lower Bay and Upper Bay as it comes and goes from the Hudson River. After hatching and beginning development in pelagic waters offshore, the small glass eels are carried by currents into the Hudson/Raritan Estuary; development continues as they travel farther up the Hudson River. After several months and more morphological changes, the larger silver eels emigrate from the estuary to the open ocean, where maturation and spawning occurs (ASMFC 2015). The American eel, like other anadromous fishes (e.g., shad, river herring, striped bass, and Atlantic sturgeon), is particularly vulnerable to climate change, as it is sensitive to physiological stress of water temperature and acidification as well as increased habitat degradation during river flooding (Hare et al. 2016).

Atlantic menhaden. The Atlantic menhaden is a key forage species in bays and coastal waters (MAFMC 2017). The Atlantic menhaden was among the migratory schooling species that dominated nine years of demersal fish surveys in the Lower Bay and Upper Bay (2002-2010) conducted by the USACE (2015a). Menhaden was one of four species making up 95 percent of all eggs in ichthyoplankton trawls in the Upper and Lower Bays (the others were bay anchovy, wrasses, and windowpane flounder) (USACE 2015b).

Jonah crab. The Jonah crab is commercially and recreationally harvested in the Project Area, although site-specific data are not available. The species is reported to be attracted to rocky habitats with crevices as well as softbottom habitats in the New York Bight, where it feeds on polychaetes and mollusks (ASMFC 2015a). Although its life cycle is poorly known, adult Jonah crabs are reported to move seasonally between nearshore and offshore waters. Species population status and trends are unknown (ASMFC 2015a).

Weakfish. Along the North American Atlantic Coast, the weakfish is most common from New York to North Carolina. Individuals spend most of their lives in coastal waters and migrate inshore to spawn in nearshore sounds, bays, and estuaries. Peak spawning in the New York Bight occurs in May and June (ASMFC 2002). The weakfish stock has been depleted since 2003 (ASMFC 2019a).

Horseshoe crab. Adult and larger juvenile horseshoe crabs overwinter in deep bay waters or on the continental shelf down to 30 meters (ASMFC 2015b), possibly in the Project Area. Local fishing representatives reported a high abundance of horseshoe crabs in the shallow portion of Cholera Bank (Petruny-Parker et al. 2015) adjacent to the western part of the Lease Area. One horseshoe crab was observed during Empire's 2020/2021 benthic survey of the EW 2 submarine export cable siting corridor. Most horseshoe crab spawning occurs south of the Project Area in Delaware Bay and other warm coastal waters.

Striped bass. The striped bass was dominant in nine years of USACE demersal fish surveys in the Lower Bay and Upper Bay (2002-2010) (USACE (2015a). This species is most common in New York waters from April through December. Most striped bass in New York were spawned in the Chesapeake Bay; individuals spawned in the Hudson River migrate north to Cape Cod. The striped bass typically occurs in inshore and coastal waters (e.g., sandy beaches, shallow bays, river mouths); it rarely strays more than 5 mi (8 km) from shore. (Scotti et al. 2010 and references within).

Tautog. Along the North American Atlantic Coast, the tautog is most abundant from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina. Stocks south of Cape Cod have been found up to 40 mi (64 km) offshore at maximum depths of 120 ft (37 m). The 2016 stock assessment separated the Connecticut-New York-New Jersey tautog stock region into two regions: Long Island Sound and New Jersey-New York Bight (ASMFC 2017). The New Jersey-New York Bight region intersects the Project Area and individuals from this stock are likely to be affected by the Project. Peak spawning for tautog in this region occurs from June through July. The 2016 stock assessment indicates this stock is overfished and overfishing is occurring (ASMFC 2017).

U.3 DESCRIPTION OF THE PROPOSED ACTION, INCLUDING MITIGATION AND CONSERVATION MEASURES

Empire proposes to construct and operate the Project as a private commercial enterprise that generates energy using renewable wind resources. The electricity generated by the Project would be delivered into the wholesale electric market(s) associated with New York as part of its efforts to reduce greenhouse gas emissions associated with the use of fossil fuels (see **Section 1 Introduction** for additional detail regarding the purpose and need for the Project).

To allow for meaningful assessments of the Project while concurrently providing Empire reasonable flexibility to make prudent development and design decisions prior to construction, the Project is being permitted within the context of a Project Design Envelope (PDE), in accordance with BOEM's *Draft Guidance Regarding the Use of a Project Design Envelope in a Construction and Operations Plan* (BOEM 2018b). A PDE is defined as "a reasonable range of project designs" associated with various components of the project (e.g., foundation and wind turbine options) (BOEM 2018b). The PDE was used to assess the potential impacts of construction and operations of the Project components that represent the greatest likelihood of impacting EFH and managed species.

For benthic EFH and life stages, the maximum design scenario is the design that disturbs, covers, or converts the largest area of softbottom benthic substrate. The greatest operational impacts are the introduction of hardbottom and vertical infrastructure in the Lease Area. The parameters provided below represent the maximum potential impact from full buildout of the Lease Area (**Table U-6**). The maximum design scenario is the full buildout of EW 1 and EW 2, which incorporates a total of up to 149 structures at any of 176 locations within the Lease Area (147 wind turbines and two offshore substations) with two submarine export cable siting corridors. Impacts of monopile wind turbine foundations were evaluated; piled jackets were considered for the offshore substation foundations (see **Section 5.5** for descriptions).

Table U-6 Summary of Maximum Design Scenario Parameters for Offshore EFH

Parameter	Maximum Design Scenario	Rationale
Construction		
Offshore structures	Based on full buildout of EW 1 and EW 2 (147 wind turbines and 2 offshore substations). EW 1: 57 wind turbines and 1 offshore substation. EW 2: 90 wind turbines and 1 offshore substation.	Representative of the maximum number of structures.
Interarray cables	Based on full buildout of EW 1 and EW 2, with the maximum number of structures (147 wind turbines and 2 offshore substations) to connect. EW 1 Total Length: 116 nm (214 km). EW 2 Total Length: 144 nm (267 km). EW 1 Cable Protection Area: 26.4 ac (10.7 ha) EW 2 Cable Protection Area: 33.0 ac (13.4 ha)	Representative of the maximum length of interarray cables and maximum area of interarray cable protection to be installed.
Submarine export cables	Based on full buildout of EW 1 and EW 2. EW 1 Total Length: 40 nm (74 km). EW 2 Total Length: 26 nm (48 km). EW 1 Cable Protection Area: 20.1 ac (8.1 ha) EW 2 Cable Protection Area: 13.0 ac (5.3 ha)	Representative of the maximum length of new submarine export cables and maximum area of export cable protection to be installed.
Wind turbine foundation Softbottom habitat loss	Monopile with maximum scour protection	Representative of the maximum amount of softbottom benthic habitat lost to foundation and scour protection installation, which would result in the greatest surface area of hard substrate introduced to the Project Area.
Wind turbine foundation Installation method	Monopile	Representative of the foundation option with an installation method that would result in the maximum introduction of underwater noise.

Parameter	Maximum Design Scenario	Rationale
Wind turbine foundation Installation method Underwater noise	Pile driving	Representative of the installation method which would result in the loudest underwater noise generated.
Wind turbine foundation Installation method Physical disturbance	Monopile with maximum scour protection	Representative of the installation method which would result in the maximum volume of sediment disturbance during installation.
Duration of offshore construction	Based on full buildout of EW 1 and EW 2. Based on the maximum number of structures (147 wind turbines and 2 offshore substations), submarine export and interarray cables, and maximum period of cumulative duration for installation.	Representative of the maximum period required to install the offshore components, which has the potential to impact resources in, access to, or enjoyment of the Project Area.
Underwater noise Pile driving: monopiles	Pile diameter: 36 ft (11 m) Max penetration: 180 ft (55 m) Pile hammer nameplate capacity: 5,500 kJ Typical hammer energy: 2,300 kJ Total average pile driving duration per foundation: 3 hours Total duration: 441 hours EW 1: 171 hours EW 2: 270 hours	The longest temporal duration of impact for monopiles, which equates to the maximum number of pile-driving events and the maximum amount of time required to pile all monopiles (active pile driving: EW 1 and EW 2).
Underwater noise Pile driving: piled offshore substations (EW 1 and EW 2)	Pile diameter: 8 ft (2.5 m) Max penetration: 197 ft (60 m) Number of piles per foundation: 12 Pile hammer nameplate capacity: 4,000 kJ Typical hammer energy: 3,200 kJ Total average pile driving duration per foundation: 4.2 hours Total number of piles for: EW 1: 12 EW 2: 12 Total duration of pile driving: EW 1: 50.4 hours EW 2: 50.4 hours	The longest temporal duration of impact for piled jackets for offshore substations and the maximum amount of time required to pile all pile driven jackets for offshore substations (active pile driving for EW 1 and EW 2).
Cofferdam	Vibratory Pile Driving	Representative of the installation method that would generate underwater noise in the nearshore environment.

Parameter	Maximum Design Scenario	Rationale
Project-related vessels Underwater noise	Based on full buildout of EW 1 and EW 2, which corresponds to the maximum amount of structures (147 wind turbines and 2 offshore substations), submarine export and interarray cables, and maximum associated vessels.	Representative of the maximum predicted Project-related vessels for underwater vessel noise.
Operations		
Wind turbines Underwater noise	Based on full buildout of EW 1 and EW 2 (147 wind turbines). EW 1: 57 wind turbines. EW 2: 90 wind turbines.	Representative of the maximum underwater noise generated by operational wind turbines.
Project-related vessels Underwater noise	Based on a full buildout of EW 1 and EW 2 (147 wind turbines, 2 offshore substations, and submarine export and interarray cable routes), and associated vessels and movements for servicing and inspections.	Representative of the maximum predicted Project-related vessels for underwater noise.
Loss of habitat Foundation type	Based on the maximum overall footprint (147 x 4,434 yd^2 [3,707 m^2] for monopiles with scour protection and 2 x 10,396 yd^2 [8,692 m^2] for piled jackets with scour protection). Total 672,590 yd^2 (562,313 m^2) including scour protection.	Representative of the maximum long-term loss of seabed habitat.
EMF Interarray cables	Based on a full build-out of EW 1 and EW 2 (147 wind turbines and 2 offshore substations), which represents the maximum length of interarray cabling. EW 1: 116 nm (214 km). EW 2: 144 nm (267 km).	Representative of the maximum length of interarray cables, which would result in the maximum exposure to EMF within EW 1 and EW 2.
EMF Submarine export cables	Based on a full buildout of EW 1 and EW 2 (2 offshore substations and corresponding submarine export cable routes), which represents the maximum number and length of submarine export cables. EW 1: 40 nm (74 km). EW 2: 26 nm (48 km).	Representative of the maximum number and length of submarine export cables, which would result in the maximum exposure to EMF on the cable routes.

Advances in decommissioning methods/technologies are expected to occur throughout the operations phase of the Project. A full decommissioning plan would be approved by BOEM prior to any decommissioning activities, and potential impacts would be evaluated at that time. BOEM currently requires that infrastructure be fully removed or severed 15 ft (4.6 m) below the sediment surface. Predictive ecosystem modeling indicates that the site-specific benthic-pelagic coupling relationships established during the operational period would be decoupled and regional connectivity would return to pre-construction conditions (van der Molen et al. 2018).

U.3.1 Avoidance, Minimization, and Mitigation Measures

Avoidance, minimization, and mitigation measures, including measures identified in previous offshore wind and subsea cable projects, were incorporated into the Project to minimize impacts to managed fisheries resources and EFH.

Empire has incorporated these measures to avoid, minimize, and mitigate potential impact-producing factors associated with the Project. Selected mitigation and conservation measures are discussed briefly here in the context of impacts on EFH:

- **Project component siting:** BOEM engaged in a multi-year consultation process with relevant regulatory agencies and stakeholders to select a Lease Area that minimized overlap with sensitive benthic habitats (e.g., Cholera Bank). The submarine export cable siting corridors were similarly selected to minimize overlap with sensitive benthic habitats, and submarine export cables will be further micro-sited within the routes to avoid boulders and other fine-scale hardbottom to the extent feasible. These avoidance and conservation measures are intended to minimize impacts of construction on sensitive benthic resources.
- **Ramp up of pile driving equipment:** The initial acoustic stressor associated with pile driving can startle fish and invertebrates within the zone of influence. To allow mobile organisms to leave the area or burrow into the sediment, ramp-up pile driving will be conducted at a reduced hammer energy for the first 0.5 hour of pile driving.
- **Avoidance of seagrass EFH by submarine export cable:** The EW 2 submarine export cable was sited to avoid known seagrass habitat inland of Jones Beach, Long Island, which is 5 nm (9.3 km) from the EW 2 submarine export cable siting corridor.
- **Avoidance of shoreline vegetation:** Shoreline vegetation that could function as EFH would be avoided by using HDD to approach the shore at the export cable landfalls.

In addition to these specific avoidance, minimization, and mitigation measures, Empire and its construction contractors would abide by applicable laws and regulations, such as reducing marine debris, managing ballast water, preventing spills of fuels and other hazardous materials, complying with vessel speed restrictions, and others, as outlined in **Section 5.5**.

U.4 EFFECTS OF THE PROJECT ON EFH

BOEM is required to consult with NOAA Fisheries if a proposed project is expected to adversely affect or substantially degrade EFH. An adverse effect is defined as "any impact which reduces the quality and/or quantity of essential fish habitat," which includes physical, chemical, and biological impacts (NOAA Fisheries 2004). Effects may manifest either directly or indirectly and on any spatial scale, including areas beyond EFH. For example, changes in water quality, benthic communities, or prey availability may constitute an adverse effect on EFH. Most FMPs identify and describe potential fishing and non-fishing impacts to EFH and suggest measures to conserve and enhance EFH.

Stressors potentially associated with the Project were identified based on a review of numerous documents of the following general types:

- Analytical reports for similar actions by other proponents;
- Biological Opinions and EFH consultations prepared by NOAA Fisheries for similar actions;
- Stock assessments, FMP, and other reports prepared by NOAA Fisheries and FMCs;
- Meetings and conversations with fisheries representatives and stakeholders; and
- Peer-reviewed scientific literature.

In general, offshore wind development is associated with changes to benthic habitats (e.g., reef effect, seafloor disturbance, introduction of sound and vibration), although direct cause and effect cannot always be demonstrated. Changes may be beneficial to some species and ecosystem functions (such as increased abundance of species associated with structure) and detrimental to other species (such as species that are sensitive to anthropogenic sound (Degraer et al. 2021). Some regulated commercial fishing activities, such as bottom trawling, are recognized as impacting benthic EFH and managed species (MAFMC 2017). Commercial fishing is also widely acknowledged as impacting the predator-prey dynamics in a given area, especially when one species is disproportionately harvested (MAFMC 2017; NOAA Fisheries 2017). FMPs prepared in accordance with 50 CFR § 600 (Subpart J) also include an evaluation of non-fishing impacts on EFH (NOAA Fisheries 2017; NEFMC 2017 [**Appendix G**]). Under this directive, NOAA Fisheries and the FMCs have evaluated effects of non-fishing activities on the quality and quantity of EFH.

Large-scale regional events such as increased sea temperature and seismic surveys were the only non-fishing activities deemed to impact highly migratory species' EFH; climate change was identified as the primary concern (NOAA Fisheries 2017). Changes in physiochemical oceanic conditions have been implicated in large-scale shifts in species assemblages across the U.S. Atlantic Coast, including Southern New England and the Mid-Atlantic Bight. In conjunction with fishing pressure, increasing ocean temperatures are reported to have caused managed fishery species to shift northward over the past several decades (Lucey and Nye 2010). Global climate change manifests as increases in ocean temperatures, seasonal shifts in thermal stratification of nearshore waters, and decreases in pH (acidification of seawater). These physical and chemical changes affect marine communities as species become redistributed based on their physiological preferences or tolerances (Morley et al. 2018). See **Section 5.5** for a discussion of effects of climate change on fish and invertebrate resources in the Project Area.

The reports are in general agreement that other human impacts to EFH include dredging, filling, mining, impounding waters, diverting waters, thermal discharges, non-point source pollution and sedimentation, introduction of hazardous materials or exotic species, and modifying/converting aquatic habitat. Offshore wind energy facilities are listed as an emerging topic for EFH managers, along with liquefied natural gas facilities and wave and current energy facilities (MAFMC 2016; NEFMC 2017). Effects of the Project on the quantity and quality of EFH were evaluated within the context of these identified impacts.

The potential impacts of the Project would not be uniform across all species, life stages, or habitats. The unit of concern under the MSA is quality and acreage of designated EFH, rather than health or abundance of fish populations per se. Potential impacts of the Project are discussed for categories of EFH described in Section U.2.3: water column, softbottom, and hardbottom. To streamline the EFHA, species were grouped by their relative probability of exposure to impacts of the Project.

U.4.1 Species Least Likely to be Impacted by the Project

Empire identified species that are unlikely to be impacted by the Project based on the likelihood of exposure of each species and life stage to construction and operation impacts (**Table U-7**). In general, pelagic life stages would be least exposed to the Project. The Project would be unlikely to impact pelagic life stages and habitats, as well as larger benthic but mobile life stages. Pelagic life stages would not be exposed to bottom disturbance (e.g., burial, turbidity, sediment deposition) associated with construction. Pelagic and benthic life stages that are mobile can avoid exposure to construction-related activities by temporarily leaving the area. Species that feed on a variety of prey in both rocky and softbottom habitats are less vulnerable to changes in the prey assemblage during the operational period of the Project. Some individuals of these species could be laterally displaced by newly installed hardbottom for a short time but would then move back into the foundation/scour protection area to forage on prey organisms that colonize the new materials.

The species and associated EFH in **Table U-7** are least likely to experience impacts from the Project. Any impacts would be temporary and reversible following construction. The extent of benthic disturbance would be minimized by avoidance, minimization, and mitigation measures described in Section U.3.1.

Table U-7 Species Least Likely to be Impacted by the Project

Species	Pelagic Life Stages	Mobile Life Stages	Forage on Hardbottom a/
Atlantic cod	E, L	A	J, A
Atlantic herring	All	All	--
Clearnose skate	--	All	--
Haddock	L	J	--
Little skate	--	J, A	--
Monkfish	E, L	J, A	J, A
Ocean Pout	--	J, A	J, A
Pollock	L	J	J
Red hake	E, L	J, A	J, A
Silver hake	E, L	J, A	J, A
White hake	n/a	J	--
Witch flounder	E, L	A	--
Butterfish	All	J, A	--
Mackerel	All	J, A	--
Bluefish	All	J, A	--
Spiny dogfish	--	J, A	J, A
All HMS a/	All	All	--

Notes:
A adult; E = egg; J = juvenile; L = larvae
-- does not apply
n/a no EFH for this life stage in the Project Area
HMS highly migratory species (e.g., sharks, tunas)
a/ potential beneficial use of scour protection or vertical structures as foraging sites
See **Attachment U-2, Table U-2-3** for details

U.4.2 Species and Life Stages Most Likely to be Impacted by the Project

Of the species with EFH in the Project Area, Empire has determined that winter flounder, windowpane flounder, winter skate, yellowtail flounder, summer flounder, surfclam, and scallop are most likely to experience impacts from the Project. These species are known to occur in the Project Area and have benthic life stages that are sensitive (e.g., eggs, larvae), sessile (e.g., bivalves), or heavily dependent on softbottom (e.g., flounders) (**Table U-8**). Project-related impacts are discussed below, with an emphasis on these species.

Table U-8 Species and Life Stages Most Likely to be Impacted by the Project

Species	Benthic Life Stages	Sessile Life Stages	Require Softbottom
Winter flounder	E, J, A	E	✓
Windowpane flounder	J, A	--	✓
Winter skate	J, A	--	✓
Yellowtail flounder	J, A	--	✓
Summer flounder	J, A	--	✓
Surfclam	J, A	J, A	✓
Scallop	E, J, A	J	✓

Notes:
A adult; E = egg; J = juvenile; L = larvae
✓ yes
-- does not apply
See **Attachment U-2, Table U-2-3** for details

Some species are expected to aggregate around the hardbottom foundations, scour protection and the underwater portions of the wind turbines. The function of offshore infrastructure as artificial reefs is well-documented (e.g., oil and gas platforms in the Gulf of Mexico and coastal California and wind farms in Europe). The expected development of artificial reefs within the Lease Area is discussed in Section U.4.3.2. Species known to be associated with hardbottom and structure are listed in **Table U-9**.

Table U-9 Species and Life Stages Potentially Attracted to Novel Hardbottom

Species	Attaches to Hard Structure	Associates with Hardbottom/Structures a/
Atlantic scallop	L	--
Longfin inshore squid	E	--
Haddock	--	A
Monkfish	--	A
Ocean pout	--	E, J, A,
Black sea bass	--	J, A
HMS a/	--	J, A

Notes:
A adult; E = egg; J = juvenile; L = larvae

-- does not apply
HMS highly migratory species (e.g., sharks, tunas)
a/ potentially attracted to vertical structures
See **Attachment U-2, Table U-2-3** for details

U.4.3 Impact-Producing Factors and Stressors: Construction

U.4.3.1 Analysis of Potential Construction Impacts

Construction activities (e.g., pile driving; placement of foundations and scour protection; cable laying and armoring; HDD and cofferdam installation; and vessel operations) could affect EFH in various ways. The most widespread effects of construction would be direct injury/mortality of benthic organisms and disturbance of softbottom prey assemblages. The long-term loss of softbottom and addition of artificial reef is discussed as an operational impact in **Section U.4.3.2**.

Potential impacts of construction and operation of the Project on benthic and pelagic invertebrates and fishes are discussed in **Section 5.5**. Of the potential construction impacts, direct disturbance of the seabed during placement of foundations and cables and introduction of noise and vibrations were determined most likely to impact EFH, largely through disturbance of benthic life stages of managed fishes and disruption of some benthic predator-prey interactions. These activities and impacts are discussed in more detail below.

Direct Disturbance of the Seabed During Placement of Foundations and Cables

Immobile or slow-moving demersal life stages of fish and invertebrates (including eggs and larvae) could be injured or killed during pre-lay grapnel runs, pre-sweeping and pre-trenching activities, pile driving for monopile and piled jacket foundations, seabed preparation, anchoring, cable burial and installation, dredging, and armoring activities. All these activities would disturb the seabed directly and crush or bury small sessile benthic organisms.

Pre-lay grapnel runs, pre-sweeping and pre-trenching activities, and dredging, which would be completed throughout the Project Area prior to foundation and cable installation, would disturb the bottom, much as bottom dredges and trawls do. Similarly, placement and dragging of construction vessel anchors would injure or kill organisms by direct contact. However, most construction vessels will maintain position using dynamic positioning systems or jack-up features, limiting the use of anchors. Any anchors would be placed within the previously cleared and disturbed area around the foundations. At Block Island Wind Farm, NOAA Fisheries (2015) estimated that each anchor would temporarily disturb an area of 0.12 ac (0.05 ha). Assuming the Project would require anchors, some of the bottom would be disturbed; however, most of the affected area would be within habitats with prior and ongoing impacts from non-Project-related anchoring, trawling, and dredging. Empire has estimated 0.5 ac (0.2 ha) of disturbance around each wind turbine foundation associated with turbine installation vessels, including the seafloor footprint of jack-up installation vessels.

The extent of softbottom that would be buried by monopile foundations, scour protection, and combined foundation and scour protection is shown in **Table U-10, Table U-11, and Table U-12**, respectively. In addition to the wind turbine foundations, each of the two offshore substations would utilize a piled jacket foundation, with a seabed footprint of 38,750 ft^2 (3,600 m^2) per foundation without scour protection and up to 93,560 ft^2 (8,692 m^2) per foundation with scour protection, resulting in a maximum total benthic habitat conversion for the two offshore substation foundations of 4.3 ac (1.7 ha).

Table U-10 Maximum Design Scenario for Wind Turbine Foundation for Benthic Substrate Burial

Type and Size	Number of Wind Turbines	Foundation diameter at substrate (m)	Foundation Footprint (m^2)	Total Foundation-Buried Substrate (m^2)	Total Foundation-Buried Substrate (ha)
Monopile	147	9.6	95	10,290	1.0

Table U-11 Required Scour Protection by Wind Turbine Foundation Type and Size

Type and Size	Number of Wind Turbines	Foundation Area at Substrate (m^2)	Scour protection around each Foundation (m^2)	Total Scour Protection (ha)
Monopile	147	95	2,756	40.5

Table U-12 Total Habitat Conversion to Hard Bottom by Wind Turbine Foundation Type and Size

Type and Size	Number of Wind Turbines	Foundation diameter at substrate (m)	Foundation Footprint with Scour Protection (m^2)	Total Benthic Habitat Conversion (ha)
Monopile	147	9.6	3,707	54.5

Following the pre-lay grapnel runs and pre-sweeping and pre-trenching activities within the submarine export cable siting corridors, cable-laying equipment would disturb the bottom within a narrower band where the cable would be buried. Burrowing surfclams and other invertebrates that were not previously disturbed by the grapnel would be displaced by the jet plow (or other installation equipment) as the cables were installed. The jet plow would move slowly, which would allow most mobile fish and invertebrates time to move away from the equipment and likely escape injury; soft-bodied sessile invertebrates within the trenched area would be crushed or buried. Mobile predators (e.g., Jonah crab, skates, hake) would likely move into the area to eat the dead and injured invertebrates.

Shelled mollusks would fare better than soft-bodied invertebrates. Burrowing surfclams and other invertebrates that were not previously disturbed by the seabed clearing would be displaced by the jet plow and/or other installation equipment. Mortality of surfclams left behind in the path of a commercial clam dredge is generally assumed to be 12 percent (Kuykendall et al. 2019), although mortality could be considerably lower. Only 1 percent of the surfclams in an experimentally trawled area died from trawl injury (Sabatini 2007). Injury and death of surfclams following commercial dredging are attributed to the direct impact of the dredge teeth. In contrast, the jet plow has no metal teeth and so would not cause physical breakage of surfclam shells. The jet plow would remain in an area for only a few hours, representing a transient impact on fish and invertebrates. Surf clams, ocean quahogs, and other burrowing bivalves would use their muscular foot to reposition themselves at the desired depth in the sediment after the cable installation was complete. The submarine export cable siting corridors were selected to minimize overlap with sensitive benthic habitats, and cables will be further micro-sited within the routes to avoid boulders and other fine-scale hardbottom to the extent feasible. These avoidance, minimization, and mitigation measures are intended to minimize impacts of construction with sensitive benthic resources.

Entrainment of plankton through the jet plow would result in a direct impact to eggs and larvae of managed fish and invertebrates as well as their zooplankton prey. A typical commercial hydraulic clam dredge withdraws up to 2,000 gallons per minute (7,570 liters per minute) during operation; the rate and volume of water intake through the jet plow is expected to be less than that during installation of export and interarray cables. Pelagic eggs/larvae of managed species expected to occur in the cable corridors during jet plowing include mollusks (e.g., longfin squid larvae, scallop larvae, and northern quahog larvae); flatfish (e.g., windowpane flounder, winter flounder, witch flounder, yellowtail flounder, and summer flounder); groundfish (pollock); and others (monkfish, Atlantic herring, Atlantic mackerel, silver hake, butterfish). It is assumed that the jet plow hose takes in water within the water column. Therefore, the entrainment of ichthyoplankton would be limited to the open water immediately surrounding the intake hose within the submarine export cable siting corridors.

Ichthyoplankton entrained through a jet plow pump would be injured by the physical movement through the pump and the high-pressure discharge into the seafloor and resulting plume of suspended sediment. No data were available on the probability of survival of organisms entrained through jet plows, so 100 percent mortality (comparable to cooling water intakes on power plants) was assumed. Jet plowing would occur along narrow centerlines within the submarine export cable siting corridors during a few months at most, affecting a negligible fraction of the EFH for planktonic life stages of managed species in the Project Area. Cable installation is a one-time activity, affecting any given area for no more than a few hours as the jet plow transits through the submarine export cable siting corridor. For comparison, a typical coastal power station can entrain approximately 16 billion eggs and larvae during year-round water withdrawals (BOEM 2019). It is assumed that the jet plow hose withdraws water within the water column. Therefore, the entrainment of ichthyoplankton would be limited to the open water immediately surrounding the intake hose within the submarine export cable siting corridors.

Jet plow water withdrawals represent a negligible fraction of the volume of water in the submarine export cable siting corridor, particularly because the jet plow is continually moving during installation activities. Ichthyoplankton typically have a patchy distribution, make daily vertical migrations, and are transported laterally by currents. Given the short duration of jet plowing in any one area, the dynamics of ichthyoplankton, the depth of water withdrawal, and the high natural mortality rates of early life stages of fish and invertebrates, entrainment through the jet plow would not cause population-wide impacts on managed species.

Introduction of Noise and Vibrations

The Project will generate noise during construction, which could directly and indirectly affect species and life stages with designated EFH intersecting the Project Area. Sudden loud noises can cause behavioral changes, permanent or temporary threshold shifts, injury, or death (Popper and Hastings 2009; Popper et al. 2014; Popper and Hawkins 2016; Andersson et al. 2017; Southall et al. 2019). Extended exposure to mid-level noise or brief exposure to extremely loud sound can cause a permanent threshold shift, which leads to long-term loss of hearing sensitivity. Less-intense noise may cause a temporary threshold shift, resulting in short-term, reversible loss of hearing acuity (Buehler et al. 2015).

Underwater noise associated with pile driving is a function of the type and size of piling, as well as the method of driving. The greatest source of injurious noise in the Lease Area would be pile driving using an impact hammer and the corresponding vibration of the seabed as the pile is driven into the substrate. Empire modeled the use of an impact hammer with maximum energy of 5,500 kJ to install the piles for monopile and piled jacket foundations (see **Appendix M-2 Empire Wind Acoustic and Exposure Modeling**).

The potential impact of underwater noise is influenced by the physiology of the receiver, the magnitude of the sound, and the distance of the receiver from the sound. Fish and invertebrates may be sensitive to sound pressure, particle motion (oscillation of water molecules set in motion by sound), and substrate vibration generated by underwater construction (Popper et al. 2021). While all marine fish and invertebrates can detect particle motion, species and life stages with swim bladders connected to the ear are most sensitive to sound pressure (e.g., yellowfin and bluefin tuna, Atlantic cod, haddock, Atlantic herring, and some eggs and larvae) (Popper and Hawkins 2018; Hawkins and Popper 2018; Popper et al. 2014).

Interim threshold criteria established by a Working Group on Effects of Sound on Fish and Turtles initiated by NOAA Fisheries were finalized under the American National Standards Institute (Popper et al. 2014). Although data were not adequate to derive acoustic criteria for fish or invertebrates, the Working Group did develop general guidelines for predicting acoustic sensitivity from basic morphological traits of fish and invertebrates. Consensus was reached on numeric thresholds for mortality, recoverable injury, and temporary threshold shifts, as well as qualitative risk of masking effects and behavioral responses for fish and invertebrates at three relative distances from the sound source (near, intermediate, and far). Injury thresholds for fish with swim bladders not linked to hearing were applied to eggs and larvae based on morphological similarities because information on these early life stages was not available (Popper et al. 2014). Consensus guidance is summarized in **Table U-13**.

Table U-13 Consensus Guidance on Acoustic Thresholds for Fish and Invertebrates

Morphological Type	Potential or Actual Mortality	Recoverable Injury	Temporary Threshold Shift	Masking	Behavioral Responses
No swim bladder	>219 dB SEL_{cum} or >213 dB peak	>216 dB SEL_{cum} or >213 dB peak	>>186 dB SEL_{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Swim bladder (no hearing)	210 dB SEL_{cum} or >207 dB peak	203 dB SEL_{cum} or >207 dB peak	>186 dB SEL_{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Swim bladder (hearing)	207 dB SEL_{cum} or >207 dB peak	203 dB SEL_{cum} or >207 dB peak	186 dB SEL_{cum}	(N) High (I) High (F) Moderate	(N) High (I) High (F) Moderate
Eggs and larvae	>210 dB SEL_{cum} or >207 dB peak	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Source: Popper et al. (2014)

Notes:

Peak and root mean square sound pressure levels are shown as decibels referenced at 1 micropascal, sound exposure level (SEL) as decibels referenced at 1 micropascal squared-second ($\mu Pa^2 \cdot s$). No data are available to support thresholds for particle motion, so values are given in terms of sound pressure for all fish and invertebrates.

N = Near (tens of meters from the source), I = Intermediate (hundreds of meters), F = Far (thousands of meters).

As more data on the effects of noise on fish and invertebrates become available, the interim noise thresholds may be updated (Popper et al. 2021, Popper and Hawkins 2018). More recent empirical studies suggest that the thresholds may be as much as 20 dB too low for most species (see review by Casper et al. 2016). Guidance from Swiss researchers points to uncertainties in the injury thresholds in Popper et al. (2014) resulting from the confined test chambers where test fish were exposed to noise for 24 minutes with no choice of leaving (Andersson et al. 2017). For example, a cod or herring can swim more than 3,281 ft (1,000 m) in 24 minutes, thus reducing its exposure to injurious noise through avoidance behavior. Even in open water, uncertainties related to interspecific variability suggest that the interim guidelines may be overprotective. Acoustic stressors associated with the Project are not expected to adversely affect Atlantic sturgeon or their prey.

An individual fish would be injured by pile driving noise only if it remained near the pile during installation (NOAA Fisheries 2015). Because the ESA requires protection of individual fish, it is reasonable to conclude that the lack of adverse effect on the Atlantic sturgeon applies equally to species and life stages with designated EFH in the Project Area. Fish and adult squid in the open waters of the Lease Area could readily avoid harmful noise levels by temporarily leaving the area as soon as soft-start pile driving began, if not before. Schools of pelagic fish moved horizontally and vertically when an air gun was shot, but no overall effect of the noise on their diurnal movements was observed (Carroll et al. 2017).

The 2014 interim criteria for predicting acoustic impacts to fish and invertebrates are not reflective of the effect on these taxa of particle motion (Hawkins and Popper 2016) or sediment vibration (Roberts et al. 2016). Fish and invertebrates have been shown to detect and respond to particle motion in small hard-surfaced experimental chambers in the laboratory. Based on these limited studies, juvenile and adult scallops and surfclams would likely respond to the impact hammer sounds and vibrations by "flinching," or closing their valves, which prevents feeding (Day et al. 2017). They would likely resume feeding immediately after the disturbance; the short-term interruption of foraging would not affect the health of individuals or decrease abundance of the local populations of bivalves. However, the environmental field conditions that determine the probability of detection and response of particle motion by organisms in the field cannot be replicated in the laboratory (Popper and Hawkins 2019; Hawkins and Popper 2016). The study of the effects of noise on marine invertebrates has lagged behind similar studies on fish and other vertebrates (de Soto 2016). These logistical limitations have stalled the development of consensus guidelines on predictive impacts of particle motion and vibrations on fish and invertebrates (Andersson et al. 2017).

The effects of noise on squid behavior vary by species, life stage, and individual. Most species of squid can detect particle motion with statocysts (Mooney et al. 2010) and a lateral line (Solé et al. 2018), similar to some fish. However, squid behavioral responses to construction-related noise may vary by species, life stage, and even by individual. A variety of body pattern changes, inking, jetting, and startle responses have been observed in the longfin inshore squid in response to pile-driving, making it difficult to predict potential impacts to the species in advance of construction (Jones et al. 2020). The reaction of squid in the Project Area to pile driving noise cannot necessarily be predicted from observations of fish or other species of squid in the laboratory; the behavior of individual squid in experimental chambers may or may not represent the reaction to pile driving noise by schools of free-swimming squid in the Project Area.

Sessile demersal species such as squid egg mops, demersal fish eggs and larvae, surfclam, scallop, and ocean quahog would be exposed to sound pressure, particle motion, and substrate vibrations throughout the period of pile driving. Surfclam, ocean quahog, and scallops would likely respond to the vibration and sound of the impact hammer by closing their valves or "flinching," which prevents feeding (Charifi et al. 2017; Day et al. 2017). The loss of foraging opportunity resulting from closed valves would be a short-term, reversible, adverse impact on these species; once the disturbance ended, the bivalves would resume feeding.

Substantial commercial harvest of squid occurs in the Lease Area in some years. Despite the limited acreage of EFH for squid eggs in the Lease Area, the Lease Area is reported to support extensive squid spawning (Guida et al. 2017). Effects of acoustic stress on squid reproductive behavior or demersal eggs is unknown. One squid laid eggs on the camera during the air gun test, but the authors could not determine whether the spawning was a reaction to the acoustic stress or simply a response to an available substrate for placing eggs (Fewtrell and McCauley 2012). As discussed above, laboratory data suggest that some cephalopods may be susceptible to injury by loud noises, particularly during early life stages (Solé et al. 2018, 2013). Some adult and hatchling squid could be exposed to and injured by acoustic stressors during pile driving.

Ichthyoplankton have limited ability to flee unfavorable conditions, although more developmentally mature individuals of some species may be capable of directional swimming (Pineda et al. 2007). The sensory cells of newly hatched squid were shown to be susceptible to injury by anthropogenic sound in controlled laboratory studies. When squid hatchlings were exposed to 50-400 Hertz sinusoidal wave sweeps for two hours at a measured sound pressure level of 157±5 dB referenced at 1 micropascal, with peak levels up to 175 dB referenced at 1 micropascal, statocysts and lateral line cells were damaged (Solé et al. 2018). In some larval fish, sensory hair cells were able to regenerate within a few weeks, but the permanence of the damage to squid sensory cells is not known (Solé et al. 2018). Little is known about the effects of loud noises of ichthyoplankton, but monkfish and cod egg survival and abundance were not affected by seismic sounds (Carroll et al. 2017).

Results of Empire's underwater acoustic modeling are presented in **Appendix M-1** and **Appendix M-2**. The assessments indicate that the short duration of pile driving and the limited the extent of harmful noise relative to the extent of habitat available would result in limited effects on marine fauna. These sounds would not cause population-level effects on fish, bivalves, squid, or other invertebrates. These findings are consistent with modeling and field measurements for offshore wind foundations in the Mid-Atlantic Bight and Southern New England that reported only short-term adverse effects on fish, invertebrates, and EFH exposed to pile driving noise (BOEM 2018a, 2015). An individual fish or squid would experience harmful cumulative exposure only if it followed the pile driving equipment throughout the Lease Area for weeks or months, but this is an unlikely scenario.

Individual Atlantic sturgeon could be exposed to pile driving noise briefly but are not expected to remain in the ensonified area for more than a few hours. Even under relatively quiet baseline (non-construction) conditions, individual sturgeon were demonstrated to move throughout the Lease Area rather than remain in a fixed location. It is reasonable to assume that Atlantic sturgeon would respond to the increased activity associated with pile driving by moving away from the zone of influence. Empire is committed to using a soft-start procedure, when pile driving foundations are selected, as part of avoidance, minimization, and mitigation measures for marine mammals and sea turtles, which will also allow fish and other mobile organisms to leave the immediate area to avoid injurious cumulative exposure. Given the extent of suitable habitat outside the construction area, it is reasonable to expect adult fish and squid to relocate temporarily during pile driving (BOEM 2015). Given the naturally high mortality of fish and invertebrate eggs and larvae in the field, injury caused by acoustic pulses during pile driving would not cause population-level effects on any species.

The number of individual fish or invertebrates potentially affected by pile driving noise would be negligible relative to overall abundance of these managed species. Impacts to fish and invertebrates (including ichthyoplankton), would be direct and short-term. Overall, noise associated with pile driving would be temporary and localized.

Vessels used for construction would introduce routine noise into the Project Area. Construction vessel noise does not differ substantively from noise generated by other commercial vessels moving slowly while trawling or idling in an area. Noise generated during cable laying (using jet plow or similar equipment) would be similar to other diesel-powered vessels. The noise of maintenance dredging was determined not to differ from vessel background sounds and to pose no barrier to migratory behavior of fishes in New York Harbor (USACE 2015b). The acoustic impact of vessels on fish and invertebrates would be temporary and localized.

Impacts to Managed Species and Life Stages with Estuarine EFH

Construction impacts to managed species and life stages in estuarine habitats are expected to be similar to those of offshore construction activities. Immobile or slow-moving demersal life stages of estuarine fish and invertebrates (including eggs and larvae) could be injured or killed during pre-lay grapnel runs, pre-sweeping and pre-trenching activities, dredging, and cable burial and installation. Mobile life stages are considered less susceptible to jet plow impacts than passive life stages (e.g., eggs and larvae) as they can rapidly evacuate the area of impact to escape injury. Estuarine eggs and larvae (e.g., those of red and silver hake; summer, windowpane, and winter flounder; longfin inshore squid) would be susceptible to nearshore construction impacts including acoustic impacts from vibratory pile driving, entrainment from jet plow water withdrawals, and sediment suspension and deposition from cable installation activities.

Temporary sheet-pile cofferdams may be installed at the export cable landfalls where the submarine export cables would transition from subsea burial in trenches to placement using HDD. The sheet piles would be placed in a tight configuration around an area approximately 20 ft by 50 ft (6 m by 15 m). Vibratory pile drivers used to install the cofferdams would temporarily elevate underwater sound pressure and particle velocities, which could affect species and life stages with designated EFH intersecting the submarine export cable siting corridors. However, vibratory pile driving is less noisy than the impact pile driving described above. While impact pile driving produces a loud impulse sound that can propagate through the water and substrate, vibratory pile driving produces a continuous sound with peak pressures lower than those observed in pulses generated by impact pile driving. Results of the acoustic analysis of vibratory piling are provided in **Appendix M-1 Underwater Acoustic Assessment: Vibratory Pile Driving**. According to the models, sound from vibratory pile driving may exceed the 210-dB sound exposure level threshold that may yield mortality in eggs and larvae (**Table U-13**) at distances of up to 184 ft (56 m) for EW 1 and 59 ft (18 m) for EW 2. Considering the small area affected and short duration of this activity, noise mitigation is not anticipated for vibratory pile driving in estuarine habitats.

As described above, entrainment of ichthyoplankton through the jet plow would result in direct impacts to eggs and larvae of managed fishes in estuarine habitats. Ichthyoplankton that may occur in estuarine habitats intersecting the submarine export cable siting corridors include longfin inshore squid; summer, windowpane, and winter flounder; and red and silver hake. It is assumed that the jet plow hose takes in water within the water column. Therefore, the entrainment of ichthyoplankton would be limited to the open water immediately surrounding the intake hose within the submarine export cable siting corridors. Given the short duration of jet plowing in any one area, the dynamics of ichthyoplankton, the depth of water withdrawal, and the high natural mortality rates of early life stages of fish and invertebrates, entrainment through the jet plow would not be expected to cause population-wide impacts on managed species.

Species with estuarine life stages exhibit sensitive responses to suspended-sediment exposures. Spawning adults stressed by changes in dissolved oxygen or obstructed passage to spawning habitats have been found to reabsorb their eggs and migrate offshore having spawned fewer batches or without spawning (Evans et al. 2011). Mobile juveniles and adults may exhibit behavioral changes in response to elevated turbidity, including avoidance of the impact area induced by low levels of oxygen (NJDEP 2018). Turbidity also causes light attenuation, which can hinder foraging and localized navigation. These can lead to temporary community shifts as organisms move elsewhere.

Suspended sediments and associated contaminants may also yield physiological effects in estuarine life stages. Sediments can damage gill membranes, which may cause asphyxiation, increased susceptibility to pathogens and parasites, and reduced nitrogen excretion and ion exchange (NJDEP 2018). Furthermore, sediment suspension may cause hydrophobic organic contaminants and heavy metals to desorb from sediments and become readily available for bioaccumulation, which may impact reproduction, development, osmoregulation, and hormones in various species and life stages (NJDEP 2018). The greatest effects are seen in larvae and juveniles, which have smaller, more easily clogged gills and higher oxygen requirements than adults (NJDEP 2018). However, estuarine species and life stages are typically well adapted to disruptive environments and increased turbidity associated with naturally recurring storm events (Tanksi et al. 2014).

Winter flounder and anadromous species (e.g., river herring, striped bass) have been identified as species of concern for construction activities in estuarine habitats. Winter flounder is an estuarine flatfish found in almost all shoal waters along the northwest Atlantic Coast (**Attachment U-1**). Spawning for winter flounder occurs from mid-December to May and occurs later in the season as latitudes increase (ASMFC 2005). In New York Harbor, spawning occurs between January and April, with high egg abundances in February and March (Tanksi et al. 2014). Eggs are demersal and adhesive, and larval growth and survival are influenced by temperature, salinity, dissolved oxygen, and food availability. Habitat alteration caused by construction activities such as dredging, jet plowing, and cable installation, contribute to water quality degradation and winter flounder population declines along the Atlantic Coast (ASMFC 2005). Suspended sediments settling onto attached demersal eggs may cause acute mortality, delayed hatching, or reduced viable hatch (ASMFC 2005). Larvae may suffer from ingestion of suspended sediments, clogging of the gills, and reduced ability to search and capture prey.

In New York Harbor, winter flounder spawning is generally confined to shallow, non-channel habitat (Tanksi et al. 2014). Sediment plumes arising from construction activities in the Harbor have been shown to remain within deeper channel waters and not drift into shallow flats that represent potential spawning habitat (Tanksi et al. 2014). However, to minimize impacts to sensitive life stages in nursery grounds, New York State implements standard dredge restrictions from mid-December to the end of May, and NOAA Fisheries typically implements jet plowing restrictions from January through May for winter flounder; Project-specific construction restrictions may apply in estuarine portions of the submarine export cable corridors.

Anadromous river herring, including alewife and blueback herring, spawn in estuaries, rivers, and lakes in spring (i.e., March through June) (Evans et al. 2011). Larvae use freshwater and brackish water as nursery habitat and juveniles remain in the Hudson River until July (ASMFC 2009). Barriers to historic freshwater spawning, nursery, and rearing habitat have been identified as a critical contributor to diminished river herring populations (ASMFC 2009). Migrating river herring are known to avoid waters with elevated turbidity; therefore, construction activities that would increase suspended sediments may serve as a barrier to estuarine and riverine habitat for spawning adults. Reduced dissolved oxygen and elevated turbidity may further impact the species by clogging larvae and juvenile gills and inhibiting filter feeding (ASMFC 2009; Evans et al. 2011).

Similarly, anadromous striped bass spawn in riverine habitats in spring. Fertilized eggs are pelagic and drift downstream until they hatch into larvae, which utilize river deltas as nurseries; juveniles migrate out of the Hudson River in July (ASMFC 2003). As with river herring, striped bass are susceptible to impacts from suspended sediments. Egg and larval survival are jeopardized by reduced dissolved oxygen levels. Hatching is delayed for striped bass at suspended sediment concentrations of 100 milligrams per liter and mortality may occur at extended exposure to suspended sediment concentrations of 500 milligrams per liter (DOER 2000). To minimize impacts to sensitive life stages of river herring and striped bass, NOAA Fisheries typically implements jet plowing and vibratory pile driving restrictions from March through June; Project-specific jet plowing and vibratory pile driving restrictions may apply in estuarine portions of the submarine export cable corridors.

U.4.3.2 Analysis of Potential Operations Impacts

The presence of wind turbine and offshore substation foundations would alter the surrounding habitat by temporarily disturbing sand ripples and mega-ripples, introducing artificial habitat, changing bottom scour patterns, increasing shade, and introducing continuous artificial light. Energized interarray and submarine export cables would introduce electric and magnetic fields (EMF). These potential stressors were analyzed (**Section 5.5**) and determined to have low probability of impacting any benthic or pelagic habitat, species, or life stage in the Project Area. The COP findings are considered applicable to EFH and are not discussed further in this EFHA.

The most likely measurable long-term effect of Project operations would result from the conversion of softbottom to hardbottom habitat by the placement of foundations, scour protection, and mattresses in the Project Area. Effects of habitat loss and conversion are described below.

Loss of Softbottom Habitat

Operation of the Project would cause long-term disturbance, displacement, and/or modification of softbottom habitat. Up to 134.7 ac (54.5 ha) of mostly softbottom substrate in the Lease Area would be lost through conversion to artificial hard substrate in the form of wind turbine foundations and scour protection, as shown in **Table U-12**, as well as up to 4.3 ac (1.7 ha) for offshore substation foundations and scour protection, and 92 ac (37.2 ha) of interarray and export cable protection (see **Section 5.5**). The species assemblages typically supported by softbottom habitats, such as burrowing invertebrates, juvenile fishes, and sand lance (*Ammodytes* spp.), would be displaced by the hard structures, shifting predators to forage in adjacent suitable softbottom habitat between the wind turbines. Species most likely to be displaced laterally by the foundations and scour protection include those that prefer to feed or shelter in sandy softbottom habitat, including flounders and bivalves (see **Table U-8**). The foundations and rocky scour protection would themselves be colonized by a different assemblage of invertebrates and algae.

Introduction of Hardbottom Habitat and Vertical Structures

The foundations and vertical infrastructure would support a localized artificial reef habitat in the Lease Area and likely act as fish aggregation devices. The rocky area surrounding each foundation would accumulate remains of the attached organisms, such as empty mollusk shells and a rain of enriched fecal particles, known as littoral fall or foundation effect (Causon and Gill 2018; Coates et al. 2014; Goddard and Love 2008). Discarded bivalve shells are known to provide valuable habitat for juvenile ocean pout, little skate, American lobster, red hake, black sea bass, and other species, and to support more species per unit area than habitat with no shells (Coen and Grizzle 2007). Squid egg masses were observed attached to empty ocean quahog shells in the Lease Area (Guida et al. 2017). Organic detritus would accumulate around the foundations and contribute to living food sources available for benthic organisms on the scour protection. Based on studies of well-established oil and gas platforms, enrichment of the benthic community would be detectable only within 3 to 16 ft (1 to 5 m) of the foundation (Bergstrom et al. 2014; Wilhelmsson et al. 2006). Several life stages of species with EFH in the Project Area are expected to use the rocky scour protection as they would any other patches of hardbottom in the area, as discussed in **Section U.4.1 Species Least Likely to be Impacted by the Project**. In particular, the rocky substrate would provide sediment-free structure for attachment of squid eggs and scallop larvae. Adult haddock, monkfish, ocean pout, black sea bass, and scup are known to use hardbottom for foraging or shelter.

A study of small-scale effects of wind farm construction measured variability in grain size, total organic carbon, and benthic species assemblages along 656-ft (200-m) horizontal transects out from the concrete foundations. Organic carbon enrichment was highest in samples near the foundations and decreased with distance along the 656-ft (200-m) transects. Mean grain size was smaller immediately adjacent to the concrete foundations, possibly due to construction activities and the slight slowing of bottom currents as they moved around the foundations. Sediment grain size generally increases with distance from foundations (Methratta 2021); the finer grained low-flow pocket immediately down-current from the foundations provided a sheltered area where both larval recruits and organic matter accumulated and enriched the seafloor (Coates et al. 2014). Monopile foundations would present a narrower profile but have similar effects on bottom conditions. The speed and direction of bottom currents were reported to be unaffected by piled jacket foundations, likely because the water moves through rather than around the foundation (Coates et al. 2014; Reubens et al. 2016).

A maximum of 2.5 ac (1.0 ha) of benthic substrate would be covered by the 147 monopile foundations representative of the maximum design scenario, as shown in **Table U-10**. The scour protection would create up to 100 ac (40.5 ha) of rocky benthic substrate (**Table U-11**). Underwater portions of foundations would be colonized by encrusting and attaching organisms, creating an array of biogenic reefs in the Lease Area wind turbine foundations (Degraer et al. 2018; Hooper et al. 2017a, 2017b; Griffin et al. 2016; Fayram and de Risi 2007). Algae, sponges, tubeworms, bryozoans, hydroids, anemones, blue mussels, barnacles, amphipods, and tunicates would begin recruiting from the plankton shortly after the structures were installed (Causon and Gill 2018; BOEM 2015, 2014; Langhamer 2012; Langhamer et al. 2009; Steimle et al. 2002; Steimle and Zetlin 2000). Attached organisms would create secondary habitat, increase biodiversity, and attract mobile fish and invertebrates that feed on them (Causon and Gill 2018). Jacket foundations for the offshore substations would support a greater variety of attaching and encrusting organisms than monopiles, and also provide more complex shelter for large demersal and pelagic fish and invertebrates.

Studies of colonization of concrete foundations in the North Sea reported no difference in the types of epifauna accumulated on these structures and other marine infrastructure (Kerckhof et al. 2010). Each foundation provided about 6,996.5 ft^2 (650 m^2) of new hard surface for colonization. Foundations on a flat sandy shelf similar to the Lease Area, where the only available hard structure was shipwrecks, were colonized by more than 60 species within a few months of installation. After four years, 84 species of epifauna were reported (Coates et al. 2014). Early colonizing bivalve species often disappeared as succession progressed; after one year, the foundations were dominated by crustaceans (especially juvenile crabs), mollusks, and annelids. The calcareous tubes constructed by polychaetes and amphipods on the foundations provided additional rugosity and microhabitats for smaller organisms, leading to a rich and complex reef community. Seasonal variability was noted, as species richness increased during summer (Kerckhof et al. 2010).

The assemblage of species that colonizes each foundation in the Lease Area would be influenced not only by its available surface area but also by the availability of larval recruits immediately following installation. Planktonic larval assemblages vary throughout the year, so the pattern of colonization and succession would be influenced initially by the time of year when each foundation was installed (Krone et al. 2013, 2017). The dominant northward current in the Mid-Atlantic Bight is the Gulf Stream, which carries ichthyoplankton and pelagic fish into Southern New England from the south (NOAA Fisheries 2017). Planktonic larvae and cool water from the Gulf of Maine are delivered to the Project Area by a cold countercurrent. The quasi-decadal shift in the latitude of the Gulf Stream is reported to cause a subsequent northward shift in some species, such as the silver hake, in response to increases in bottom temperature (Davis et al. 2017). The Project is not expected to interfere with oceanic currents or to disrupt the typical dispersion of eggs and larvae in the region, although cumulative impacts of offshore wind development on the U.S. Atlantic Coast may include changes in thermal stratification (Carpenter et al. 2021).

Within the vast waters of the Project Area, the thin vertical foundations provide a relatively small surface area for settlement. Although the underwater structures would support growth of an artificial reef, the species assemblage that would colonize the structures is not known. Recruitment is influenced by numerous environmental signals in addition to 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 predicted to serve as attachment sites for squid and herring eggs in the North Sea have so far not been demonstrated as such (Vandendriessche et al. 2016). Planktonic life stages of fish would not be directly affected by the introduction of foundations and scour protection.

Colonization of concrete foundations in the North Sea varied on the vertical axis, with more species reported nearer the seafloor (possibly because tube-building species use suspended sediment to construct tubes) (Kerckhof et al. 2010). Overall abundance of mobile demersal megafauna was highest at the bottom of the foundation, perhaps because the bottom anchorage offered shade, shelter, and access to surrounding soft-bottom areas for foraging (Krone et al. 2013). Assemblages of mobile demersal megafauna (large crustaceans and fish) associated with the lower levels of steel jacket foundations and shipwrecks in the German Bight (North Sea) were dominated by *Cancer* crabs (Krone et al. 2013). The upper portions of steel jacket and monopile foundations were colonized by larval edible crab (*Cancer pagurus*), possibly increasing overall production of this species in the offshore subtidal wind farm area (Krone et al. 2017). Related crabs in the Project Area (e.g., Jonah crab, *Cancer borealis*) are expected to use the monopile and jacket foundations in similar ways. The biodiversity and productivity on the foundations could influence the distribution and abundance of predatory fish and invertebrate species (Rein et al. 2013; Reubens et al. 2013). Benthic fish collected within and outside a wind farm in the North Sea had stomachs full of hardbottom prey, suggesting that fish associated with softbottom adjacent to the wind farm responded to the prey associated with the foundations (Degraer et al. 2016).

Because hardbottom and three-dimensional structures in the Project Area are currently limited to shipwrecks and artificial reefs, some structure-oriented species (e.g., black sea bass, ocean pout, red hake, monkfish, and squid eggs) are expected to respond favorably to the habitat created by wind turbine foundations, scour protection, and armoring materials (Guida et al. 2017, NEFMC 2017 and references within). Black sea bass, tautog, scup, lobster, summer flounder, cod, and several species of edible crab are reported at artificial reefs in nearby coastal New York waters. Adult black sea bass do not move far from where they settle as adults; they are currently most abundant in the western third of the Lease Area (Guida et al. 2017). The addition of complex structural habitat would expand the area of settlement habitat to deeper waters and potentially support greater abundance of this species in the area (Guida et al. 2017 and references within). Likewise, adult and subadult tautog prefer structured habitats, particularly in winter, and are expected to take advantage of the newly placed foundations in the Lease Area after construction (ASMFC 2019b). The Jonah crab is reported to be attracted to rocky habitats with crevices as well as softbottom habitats in the New York Bight, where it feeds on polychaetes and mollusks (ASMFC 2019c; NOAA Fisheries 2018).

An offshore wind farm in the United Kingdom reported initial aggregations of European lobster within a newly constructed wind farm; studies on long-term effects on lobster densities are ongoing (Roach et al. 2018). The same reaction of American lobster to the Project cannot be assumed, however, because the Southern New England lobster stock has collapsed, and recruitment is exceedingly low (ASMFC 2018a,b; Le Bris et al. 2018). After several years of steadily declining catches and record low recruitment, only about 2 percent of all Atlantic Coast landings in 2017 came from the Southern New England stock (ASMFC 2018c). Recruitment and growth of young lobsters is most successful in cobble habitats (Collie and King 2016). Although recent research has demonstrated that larval lobster may recruit to firm mud bottoms, unconsolidated sand of the type that dominates the Lease Area provides poor shelter for lobster (Dinning and Rochette 2019). Primary causes of the poor condition of the Southern New England and Mid-Atlantic lobster stock include increasing water temperature and fishing pressure, making recovery of lobster in the Project Area unlikely (ASMFC 2018a).

Lobster fishing within the Lease Area is uncommon and lobstermen do not report the Lease Area as a productive area, since much of it is relatively flat sand and gravel substrate. Despite the overall decline of the lobster stock in the Project Area, recreational harvest occurs in summer and early fall starting about 7 nm (13 km) west of the Lease Area around the subsea extension of the Hudson River Valley known as the "Mud Hole" (Wanko 2018). This feature is also fished by gillnetters and otter trawlers. Fishermen who work the Mud Hole have been consulted in relation to offshore surveys and export cable routes. Lobster pots were so dense in the Mud Hole during 2018 geophysical surveys that Empire's vessels delayed surveying that area due to the risk of snagging tow survey equipment on them. Empire subsequently completed the survey during a period of harvest closure in May 2019. Commercial harvest of lobster and Jonah crab are discussed in more detail in **Section 8.8**.

Evidence for the effects of operational offshore wind farms on distributions of fish and macroinvertebrates in Europe is equivocal. Increases in Atlantic cod and pouting near wind turbine foundations in the Belgian part of the North Sea were reported to reflect better quality forage relative to nearby sources, leading to greater reproductive output (Reubens et al. 2014). Demersal fish abundances were higher near wind turbine foundations than in surrounding softbottom habitats (Wilhelmsson et al. 2006; Bergstrom et al. 2014, 2013). At a wind farm in the Netherlands, an increase in sand eels within the wind farm area was attributed to the attraction of this semi pelagic species to the hardbottom scour protection around the foundations (Rein et al. 2013). Benthic epifauna growing on wind turbines in the North Sea were reported to provide increased feeding opportunities for other fish, which led to a redistribution of fishes in patchy assemblages distributed throughout the wind farm impact area (Stenberg et al. 2015). Likewise, pagurid crab abundance increased on wind turbine foundations and the surrounding rock armoring, which provided crab nursery habitat (Krone et al. 2017). An artificial reef intentionally placed near Sydney Harbor created an "ecological halo" 15 times larger than the reef footprint within which abundance of demersal fishes increased (Reeds et al. 2018). Oil platforms on the California coast, which have similar underwater structure to the jacket foundations proposed for the offshore substations, supported demersal and pelagic juvenile fish that in turn attracted predatory rockfishes (Claisse et al. 2015, 2014). Atlantic sturgeon would likely benefit from the increased prey associated with the rock armoring around the foundations and submarine export and interarray cables (NOAA Fisheries 2015).

A recent meta-analysis of the effect of wind farms on fish abundance concluded that effects are positive, meaning that more fish occur within wind farms than in nearby reference locations (Methratta and Dardick 2019). However, not all studies report strong correlations of fish abundance with offshore wind farms. In the North Sea, an increase in structure-associated fish near a wind farm was reported, but the increase was not clearly attributable to site-specific productivity or immigration from surrounding areas (Rein et al. 2013). A review of operating wind farms in the Belgian part of the North Sea reported no difference in abundances of fish eggs, fish larvae, or squid larvae within and outside of the wind farm (Degraer et al. 2016; Vandendriessche et al. 2016). Neither distribution, abundance, nor reproductive success of the benthic resident eelpout (*Zoarces viviparous*) were affected by a wind farm in the Baltic Sea (Langhamer et al. 2018).

Whether artificial reefs increase or simply redistribute overall productivity is an open question (Shipp and Bortone 2009; Love et al. 2006; Girard et al. 2004). The expansion of structure-associated species into the Lease Area is possible but not guaranteed. Neither demersal fish nor American lobster responded as expected to the increase in hard structure at the Block Island Wind Farm; no effect on the distribution, abundance, or condition of fish was demonstrated (Carey 2017; Wilber et al. 2018). Offshore structures attract most highly migratory fishes (NOAA Fisheries 2017); mahi-mahi and some tuna (e.g., yellowfin [*Thunnus albacares*], bigeye [*Thunnus obesus*]) and sharks (e.g., dusky, whitetip, shortfin mako, common thresher [*Alopias volpinus*]) may be drawn by the abundant prey (Itano et al. 2000; Wilhelmsson and Langhamer 2014) or use the structures as navigational landmarks (Taormina et al. 2018). Schooling forage fish (Brown et al. 2010), sea turtles (Blasi et al. 2016), and marine mammals (Rein et al. 2013) also congregate around offshore structures (Raoux et al. 2017).

Battista et al. (2019) noted that benthic species assemblages are not well-correlated with substrate type in the Lease Area, largely because of the relative uniformity of substrate type in the area. Although the Project would introduce habitat variability and complexity to the area, the extent of artificial reef and the acreage subject to reef effect represents a small fraction of the total softbottom on the Southern New England continental shelf. Effects of the structures on fish and invertebrate populations may vary depending on the species and location (van der Stap et al. 2016; NOAA Fisheries 2015).

Potential impacts of the monopile and piled jacket foundations would differ slightly for various demersal species. The monopile wind turbine foundations would provide largely smooth vertical walls for attachment. Conversely, the piled jacket offshore substation foundation would provide greater surface area for encrusting and attaching organisms and more sheltering area, enhancing the reef effect and increasing potential habitat complexity. The piled jacket would also provide hard surfaces of diverse orientations relative to the largely vertical orientation of the monopiles. Because some species prefer to settle on surfaces with a particular orientation, the piled jacket foundation is expected to support a greater diversity of organisms (Causon and Gill 2018). However, the species assemblage that would colonize each foundation type is expected to vary and cannot be known in advance. Given the highly localized extent of the converted habitat, population-level effects on fish or invertebrate resources would not be measurable.

In summary, the habitat value of operating monopiles and piled jackets would be similar but not identical. The complex structure of a piled jacket foundation would support a more complex reef community than a smooth monopile (Wilhelmsson and Langhamer 2014). The structural complexity of jacket foundations would support a greater diversity of organisms. The monopiles would deflect bottom currents differently than jacket foundations, which allow water to flow through the structure. Placement of scour protection, described above, would mediate effects on bottom currents.

On balance, the impact on Project operations on benthic and pelagic EFH would be either neutral or beneficial to most fish and invertebrates (Hooper et al. 2017b). While the presence of foundations may influence local distributions of demersal fish and invertebrates on a small spatial scale, no population-level effects are expected. Structure-associated species such as black sea bass, scup, squid eggs, Jonah crab, and others may benefit from the expanded habitat. The new infrastructure would neither harm nor benefit demersal species that prefer open sandy bottoms, such as surfclam, ocean quahog, and some flatfish, because sandy bottom is not a limiting feature of the Project Area.

U.4.3.3 Analysis of Potential Decommissioning Impacts

In accordance with 30 CFR Part 585 and other BOEM requirements, Empire will be required to remove and/or decommission all Project infrastructure and clear the seabed of all obstructions. The decommissioning process for the wind turbines, foundations, and offshore substations is anticipated to be the reverse of installation, with Project components transported to an appropriate disposal and/or recycling facility. All foundations/Project components will need to be removed 15 ft (4.6 m) below the mudline (30 CFR § 585.910(a)), unless other methods are deemed suitable through consultation with the regulatory authorities, including BOEM. Submarine export and interarray cables will be retired in place or removed in accordance with a Decommissioning Plan; Empire would need to obtain separate and subsequent approval from BOEM to retire any portion of the Proposed Action in place.

Project components will be decommissioned using a similar suite of vessels, as described in **Table U-14**. Environmental impacts are anticipated to be like those generated by construction and installation activities, as described in **Section U.4.3.1 Analysis of Potential Construction Impacts**. Although EW 1 and EW 2 have an assumed lifetime of approximately 35 years for the purposes of this COP, some installations and components may remain fit for continued service after such time, where Empire may seek to repower such installations if extension is authorized by BOEM. Upon initiation of decommissioning activities, Empire will complete decommissioning within two years of termination of the Lease and either reuse, recycle, or responsibly dispose of all materials removed, unless otherwise authorized by BOEM. Decommissioning activities will be detailed in a Decommissioning Plan, which is subject to an approval process that includes public comment and government agency consultation. The Decommissioning Plan will be developed based on a factor-based approach, utilizing the environmental and socioeconomic factors to determine a strategy and methodology that is appropriate at the time. As part of this plan, Empire will compile an inventory of Project components and detail the methods proposed to decommission the Project components. As Project components are decommissioned, Empire will record and remove from the inventory list, to facilitate confirmation that Project components have been properly removed from the seafloor and that the Project Area is cleared of obstructions.

The types of vessels and total vessel trips required for decommissioning are expected to be approximately the same as or less than construction, as the decommissioning process is anticipated to be the reverse of installation. Surveys are not anticipated to be required for decommissioning. If surveys are required to support decommissioning activities, the equipment used for these surveys will be similar to those permitted for the completed surveys to support construction and will be subject to applicable permitting prior to the initiation of survey.

Table U-14 Summary of Decommissioning Methods and Assumptions

Item	Removal Method	Comments and Assumptions
Wind turbine	Removal of the wind turbines are done using a reversed installation method. Oils, greases, and fuels will be removed in accordance with the Oil Spill Response Plan and relevant safety requirements before the wind turbines are disassembled. Decommissioning of the turbines and towers is assumed to include removal of the rotor, nacelle, blades and tower to be removed in the reversed installation order.	Materials brought onshore to U.S. port for recycling and disposal. Steel in the tower is assumed to be recycled. The blades are assumed to be disposed of at an approved location.
Monopile foundation and transition piece	Removal of the monopile transition piece foundations are done using a reversed installation method. Sediments inside the monopile will be removed by suction prior to cutting, if necessary, and replaced in the depression once the monopile is removed. Diver-assisted or remote-operated hoses may be used to reduce sediment disturbance. Removal of the monopile is assumed to be cut off 15 ft (4.6 m) below the mudline and be lifted off by a heavy lift vessel to a barge prior to decommissioning.	Monopile will be cut below mudline and transported to U.S. port for recycling. Monopiles are assumed to be cut using mechanical cutting, high-pressure water jet, and/or cutting torches designed for underwater use. No pile driving will be required for decommissioning. Steel is assumed to be recycled.
Offshore substation topside	Removal of the topside is done using a reversed installation method. Oils, greases, and fuels will be removed in accordance with the Oil Spill Response Plan and relevant safety requirements before the offshore substation topside is removed. The offshore substation topside is assumed to be lifted off in one piece by a heavy lift vessel to a barge prior to decommissioning.	Transported to Europe or U.S. port for recycling and disposal. Removed fluids would be brought to U.S. port for recycling and disposal. Steel from the topside is assumed to be recycled.
Jacket with piles	The piles are assumed to be cut 15 ft (4.6 m) below the mudline, before the jacket is lifted off in one section by a heavy lift vessel to a barge prior to decommissioning.	Cut below mudline and transported to U.S. port for recycling. Piles are assumed to be cut using mechanical cutting, high-pressure water jet, and/or cutting torches designed for underwater use. No pile driving will be required for decommissioning. Steel from the jacket and piles is assumed to be recycled.
Offshore cables	The submarine export cables and interarray cables are assumed to be lifted out and cut into pieces or reeled in onto barges for transport. Cables be disconnected from wind turbines and the offshore substation before removal. J-tubes will be removed.	Total removal of cable and transported to Europe or U.S. port for recycling. In some places, jet plowing may be used to loosen sediment above the cable. Core material to be recycled.

Item	Removal Method	Comments and Assumptions
Scour protection and rock filling	Alternatives: • Removal of scour protection and rock filling. • Leave scour protection in place, as undisturbed as possible.	Assumed to be removed unless leaving in place is deemed appropriate through consultation with the authorities. Removal of scour protection is assumed to use a dredging vessel. Removed material would be re-used, if possible, or transported to U.S. port for disposal.

U.5 SUMMARY AND DETERMINATION OF EFFECTS ON EFH

The analyses presented in the COP and in this EFHA support Empire's determination of effects for EFH. Expected impacts for each species and life stage in each part of the Project Area are presented in **Attachment U-2, Table U-2-3**, and summarized briefly below. Effects on NOAA Trust Resources would mirror those for species with EFH that have similar habitat and prey requirements.

U.5.1 Summary of Effects on Water Column, Plankton, and Ichthyoplankton

Water column habitats designated as EFH would be temporarily affected during construction and decommissioning of the Proposed Action. The most likely effect on open water near the bottom would be the localized increase in turbidity resulting from equipment disturbing softbottom substrates when structures are installed or removed. During operations, no substantial effect of turbidity or water column EFH would occur. Chemical stressors related to inadvertent releases of fuels and fluids from vessels would be minimized through compliance with applicable U.S. regulatory requirements and the implementation of an agency-approved Oil Spill Response Plan (**Appendix F**) and Emergency Response Plan. Chemical releases from Project-related equipment and vessels would not be distinguishable from the negligible background releases from commercial and recreational vessels already in the Project Area.

During cable installation, the jet plow would be continuously moving at a rate of approximately 656 ft per hour (200 m per hour). Ichthyoplankton would be subject to entrainment for only a few minutes in any one location. The water intake pumps would take in water within the water column, avoiding demersal eggs and larvae. The proportion of early life stages of managed species entrained in the one-time pass of the jet plow would be comparable to similar-sized vessel transiting the Project Area and at least an order of magnitude lower than typical cooling water intakes of coastal power generating stations. Therefore, the potential loss of ichthyoplankton to entrainment through the jet plow would be negligible to minor relative to routine vessel traffic and ongoing permitted water withdrawals in the region.

U.5.2 Summary of Effects on Softbottom Substrate

Up to 139 ac (56.2 ha) of unconsolidated softbottom in the Lease Area would be converted to hardbottom by foundations and scour protection for the duration of the Project, as would up to 92 ac (37.2 ha) seafloor where interarray and export cable protection is used. Immediate direct and indirect long-term effects would occur where foundations were installed and armored. Benthic substrates within the Lease Area are dominated by sandy softbottom habitats, with limited pebbles and shell hash that provide hardbottom attachment sites. During preparation of the seabed for construction, sand waves and ripples would be flattened as necessary, crushing or burying soft-bodied sessile invertebrates in the immediate area. Sessile benthic organisms within or adjacent to the foundation sites and submarine export cable siting corridors would be exposed temporarily to increased turbidity and subsequent sedimentation. Once the foundations and subsea cables were installed, sand waves and ripples would reform; epifauna and shallow infauna would begin recolonizing the softbottom areas, followed by bivalves and other burrowing taxa.

Softbottom sediments on the continental shelf tend to be dynamic and heterogeneous. Benthic fauna and infauna often rework sediments in the process of feeding and burrowing. In this way, marine organisms influence the structure, texture, and composition of sediments as well as the horizontal and vertical distribution of organic substances in the sediment. Softbottom benthic assemblages are generally adapted to the intermittent disturbances caused by storms, currents, and other oceanographic processes (NOAA Fisheries 2018; Latham et al. 2017; BOEM 2016); storms may even speed recovery of softbottom habitats on the continental shelf (Kraus and Carter 2018). When soft sediments are disturbed, recolonization success depends in part on recruitment from the water column (NOAA Fisheries 2018).

Encrusting and attaching species would colonize the foundations, scour protection, and cable mattresses, forming artificial reefs. Mobile species would move into the hardbottom area to forage or take shelter. Neither lights nor sounds associated with the Project would affect softbottom habitat. During decommissioning, some infaunal and epifaunal organisms would likely be crushed or buried. Following decommissioning, softbottom habitat would return to its original condition and be recolonized by individuals from adjacent areas or recruited from the plankton.

U.5.3 Summary of Effects on Hardbottom Substrate

Hardbottom substrate would be introduced in up to 139 ac (56.2 ha) of the Lease Area for the operational duration of the Project, as well as up to 92 ac (37.2 ha) where interarray and export cable protection is used. Within the Lease Area, vertical structure would be introduced to the water column at each wind turbine and offshore substation location. The infrastructure would become colonized by algae and invertebrates and attract mobile fish and invertebrates that favor areas of high rugosity and structure to form a complex living reef. Highly migratory sharks and tuna and other pelagic species would aggregate around the vertical structures to forage or shelter. The primary permanent effect of decommissioning would be the removal of the vertical habitat and the loss of artificial hardbottom. Temporary effects of decommissioning would be nearly identical to those described for construction, namely increased noise, turbidity, and sedimentation. Some organisms that had attached or encrusted on the foundations would be injured or killed when the infrastructure was removed.

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ATTACHMENT U-1
PROFILES OF SPECIES WITH ESSENTIAL FISH HABITAT IN THE PROJECT AREA

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
EFH	essential fish habitat
EFH Assessment Project Area	The offshore area associated with the build out of the Lease Area, submarine export cables, and interarray cables. For the purposes of this assessment, the Project Area includes the entire surveyed area in which Project components may be sited.
EW	Empire Wind
°F	degrees Fahrenheit
ft	feet
Lease Area	BOEM-designated Renewable Energy Lease Area OCS-A 0512
m	meters
MAFMC	Mid-Atlantic Fishery Management Council
MARMAP	Marine Resources, Monitoring, Assessment and Prediction Program
NEFMC	New England Fishery Management Council
NEFSC	New England Fisheries Science Center
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ppt	parts per thousand

U-1.1 MANAGED SPECIES IN THE OFFSHORE PROJECT AREA

The essential fish habitat (EFH) assessment analyzes effects of construction, operation, and decommissioning of the Project located in BOEM-designated Renewable Energy Lease Area OCS-A 0512 (Lease Area) off the coasts of New York and New Jersey.

Species with EFH in the Project Area were identified using the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries, NMFS) Habitat Mapper (2018), New England Fishery Management Council (NEFMC) Omnibus Amendment 2 (2017), Mid-Atlantic Fishery Management Council (MAFMC) Fisheries Management Plans, NOAA Fisheries' Highly Migratory Species Amendment 10 (2017), EFH source documents, and other reports and published literature. Managed species with designated EFH intersecting the Project Area are listed in **Table U-1-1**.

Table U-1-1 Species with Designated Essential Fish Habitat in the Project Area

New England Fishery Management Council	Mid-Atlantic Fishery Management Council	NOAA Fisheries (Highly Migratory Species)
Atlantic Cod	Atlantic Butterfish	Atlantic Albacore Tuna
Atlantic Herring b/	Atlantic Mackerel	Atlantic Bluefin Tuna
Atlantic Sea Scallop	Atlantic Surfclam	Atlantic Skipjack Tuna
Clearnose Skate	Black Sea Bass b/	Atlantic Yellowfin Tuna
Haddock	Bluefish b/	Blue Shark
Little Skate	Longfin Inshore Squid	Common Thresher Shark
Monkfish a/	Ocean Quahog	Dusky Shark
Ocean Pout	Scup b/	Sand Tiger Shark
Pollock	Spiny Dogfish a/, b/	Sandbar Shark
Red Hake	Summer Flounder b/	Shortfin Mako Shark
Silver Hake		Smoothhound Shark/Smooth Dogfish
White Hake		Tiger Shark
Windowpane Flounder		White Shark
Winter Flounder b/		
Winter Skate		
Witch Flounder		
Yellowtail Flounder		

Notes:
a/ Joint management by NEFMC and MAFMC
b/ Joint management with Atlantic States Marine Fisheries Commission (ASMFC)

Essential fish habitat is described below for the 41 species with designated EFH for one or more life stages in the Project Area. For the purposes of this EFHA, the Project Area includes the Lease Area and both the EW 1 and EW 2 submarine export cable siting corridors. The Lease Area and both submarine export cable siting corridors are illustrated on **Figure U-1-1**. The acreages of EFH within the Project Area were calculated using geographic information system tools that measure the intersection of EFH and Project Area shapefiles.

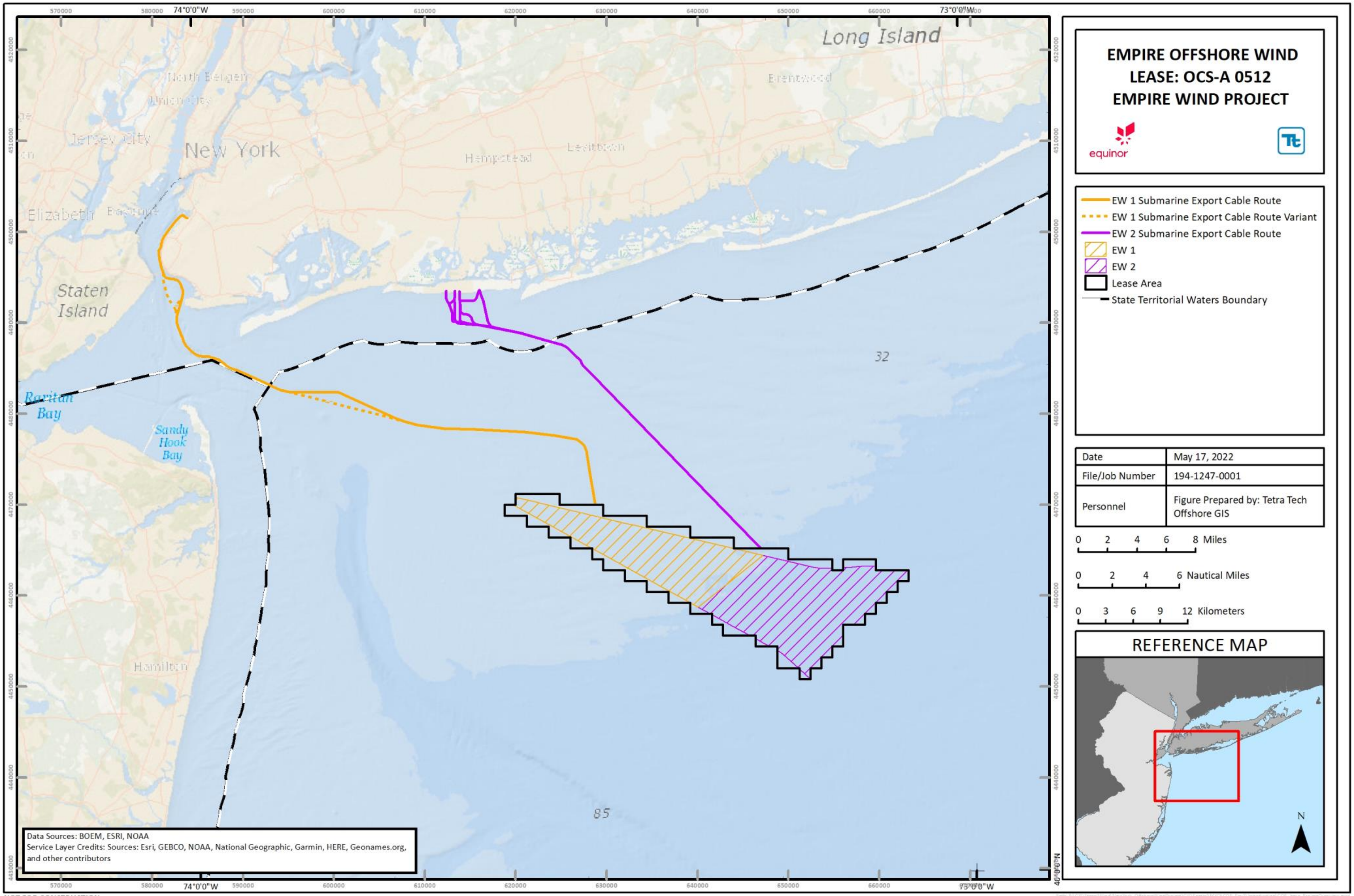

Figure U-1-1 Lease Area and Export Cable Routes

U-1.2 PRESENCE OF EFH IN THE PROJECT AREA BY SPECIES AND LIFE STAGE

U-1.2.1 Species Profiles

Each species with EFH in the Project Area is described below. Acreages of EFH in the Project Area are presented in the following section for all life stages of the 41 species listed in **Table U-1-1**. All designated EFH shown in the shapefiles downloaded from the EFH Mapper (NOAA Fisheries 2018) was assumed present, regardless of the more detailed EFH habitat descriptions in EFH source documents, so that the acreages represent a conservative overestimate of functional EFH in the Project Area.

U-1.2.2 Atlantic Cod (*Gadus morhua*)

Atlantic cod egg EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-2**; **Figure U-1-2**). Pelagic habitat in the Mid-Atlantic region is designated EFH for Atlantic cod eggs from fall to spring in waters less than 230 feet (ft) (70 meters [m]) deep, where temperatures are less than 54 degrees Fahrenheit (°F) (12 degrees Celsius [°C]) and salinities are 32 to 33 parts per thousand (ppt) (NEFMC 2017; Lough 2004). Eggs generally occur in the upper 33 ft (10 m) of the water column, although with increased rainfall and lower salinity they will sink to lower depths (Lough 2004).

Atlantic cod larval EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-2; Figure U-1-2**). Larval cod EFH is pelagic habitat in the Mid-Atlantic region where temperatures are 39 to 46°F (4 to 8°C) in winter and spring and 45 to 54°F (7 to 12°C) in the summer and fall. Most larval cod occur in salinities of 32 to 33 ppt at depths between 164 and 689 ft (50 and 210 m). Larvae move deeper into the water column with age and migrate vertically in reaction to light.

No juvenile cod EFH is designated in the Lease Area or either submarine export cable siting corridor.

Table U-1-2 Atlantic Cod (*Gadus morhua*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	38,958	402	2,995	0	2,145
Larva	55,233	406	4,667	0	2,145
Juvenile	0	0	0	0	0
Adult	79,341	0	5,782	7,880	7,094
Percent of Action Area Covered by EFH by Life Stage					
Egg	49.1%	5.1%	45.0%	0.0%	27.9%
Larva	69.6%	5.2%	70.1%	0.0%	27.9%
Juvenile	0.0%	0.0%	0.0%	0.0%	0.0%
Adult	100.0%	0.0%	86.9%	100.0%	92.1%
EFH Source Documents: Lough 2004; NEFMC 2017 and references within					

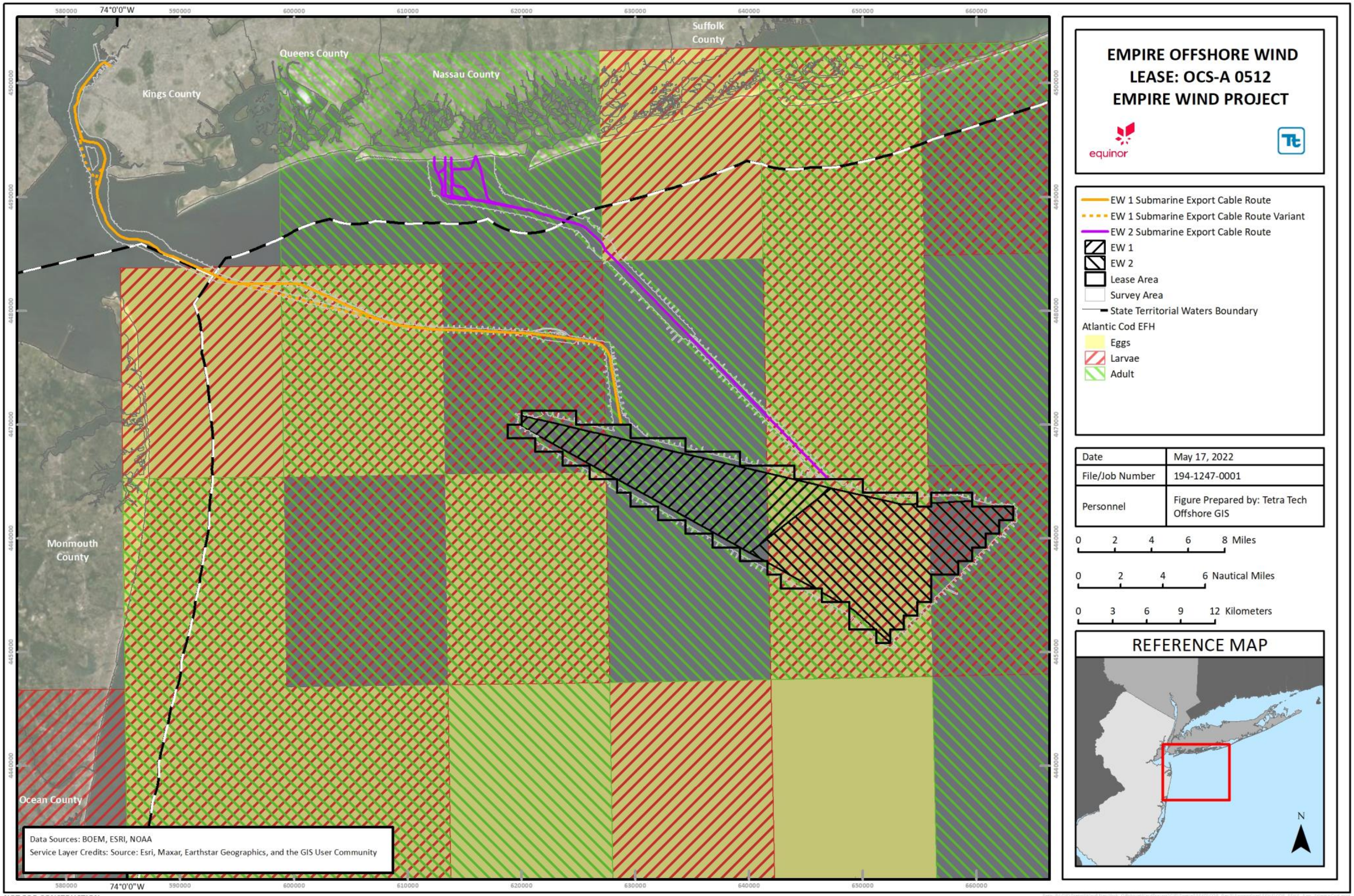

Figure U-1-2 Atlantic Cod (*Gadus morhua*) Designated EFH in Project Area

Atlantic cod adult EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-2**; **Figure U-1-2**). Adult cod EFH is sub-tidal benthic habitat between 98 and 525 ft (30 and 160 m) (NEFMC 2017). Structurally complex hardbottom habitats composed of gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae are essential habitat for adult cod. Adult cod also occur on sandy substrates and deeper slopes of ledges near shore. South of Cape Cod, adults spawn both in nearshore areas and on the continental shelf, usually in water less than 230 ft (70 m) deep. Adult cod prefer temperatures below 50°F (10°C). Adults cannot tolerate fresh water; mortality occurs when salinity drops below 2.3 ppt (Lough 2004).

U-1.2.3 Atlantic Herring (*Clupea harengus*)

No Atlantic herring egg EFH is designated in the Lease Area or either submarine export cable siting corridor.

Atlantic herring larval EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-3**; **Figure U-1-3**). Larval Atlantic herring EFH is pelagic habitat from the upper Mid-Atlantic Bight through the Gulf of Maine, including estuaries and freshwater rivers. During the 4-to-8-month planktonic stage, Atlantic herring are transported from offshore spawning grounds to inshore and estuarine waters where they metamorphose into early-stage juveniles in the spring. Atlantic herring larvae tolerate a wide range of temperatures, salinities, and dissolved oxygen concentrations (Stevenson and Scott 2005). In the New England Fisheries Science Center (NEFSC) Marine Resources, Monitoring, Assessment and Prediction Program (MARMAP) surveys, most Atlantic herring larvae were collected at water temperatures from 48 to 54°F (9 to 12°C). The EW 1 submarine export cable siting corridor intersects with larval Atlantic herring EFH in both federal and state waters. The EW 2 submarine export cable siting corridor intersects with larval EFH only in the area immediately adjacent to the northern boundary of the Lease Area (**Table U-1-3**; **Figure U-1-3**).

Juvenile Atlantic herring EFH is designated in the Lease Area and both submarine export cable siting corridors. Juvenile Atlantic herring EFH is designated throughout rivers, bays, estuaries, and coastal waters to 984 ft (300 m) in the Mid-Atlantic and New England, including Great South Bay and the Hudson River/Raritan Bay (NEFMC 2017). Most of the Lease Area and submarine export cable siting corridors intersect with juvenile EFH (**Table U-1-3**; **Figure U-1-3**). Large schools of 1- and 2-year-old juveniles tolerate low salinity and make limited seasonal inshore-offshore migrations. Older juveniles usually occur in more saline waters. In the Hudson-Raritan estuary, most juveniles were caught in winter, spring, and summer bottom trawls at depths of 13 to 52 ft (4 to 16 m) (Stevenson and Scott 2005). The greatest numbers were collected in waters 59 to 64°F (15 to 18°C) where salinities were 21 to 31 ppt. Catches were biggest in winter and spring, lower in summer, and sparse in fall.

Adult Atlantic herring EFH is designated in the Lease Area and both submarine export cable siting corridors. Adult Atlantic herring EFH is sub-tidal pelagic habitats to 984 ft (300 m) throughout the Mid-Atlantic and New England region, including Great South Bay and the Hudson River/Raritan Bay. Adult and juvenile EFH overlap broadly and intersect almost completely with the Lease Area and submarine export cable siting corridors (**Table U-1-3**; **Figure U-1-3**; NEFMC 2017). Adult Atlantic herring make extensive seasonal migrations between summer/fall spawning grounds in Maine and overwintering areas in Southern New England and the Mid-Atlantic region. It was among the most abundant of the managed, pelagic fishes in the Upper and Lower Bays during seasonal trawl sampling, especially in winter and spring (USACE 2015). Adult Atlantic herring usually remain near the water surface, except when spawning, and prefer temperatures less than 50°F (10°C). Spawning occurs on a variety of bottom types in water up to 295 ft (90 m) deep.

Table U-1-3 Atlantic Herring (*Clupea harengus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	33	6,290	2,123	0	1,101
Juvenile	79,341	7,832	6,655	7,880	7,700
Adult	79,307	7,832	6,655	7,880	6,599
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	80.3%	31.9%	0.0%	14.3%
Juvenile	100.0%	100.0%	100.0%	100.0%	100.0%
Adult	100.0%	100.0%	100.0%	100.0%	85.7%
EFH Source Documents: Stevenson and Scott 2005; NEFMC 2017 and references within					

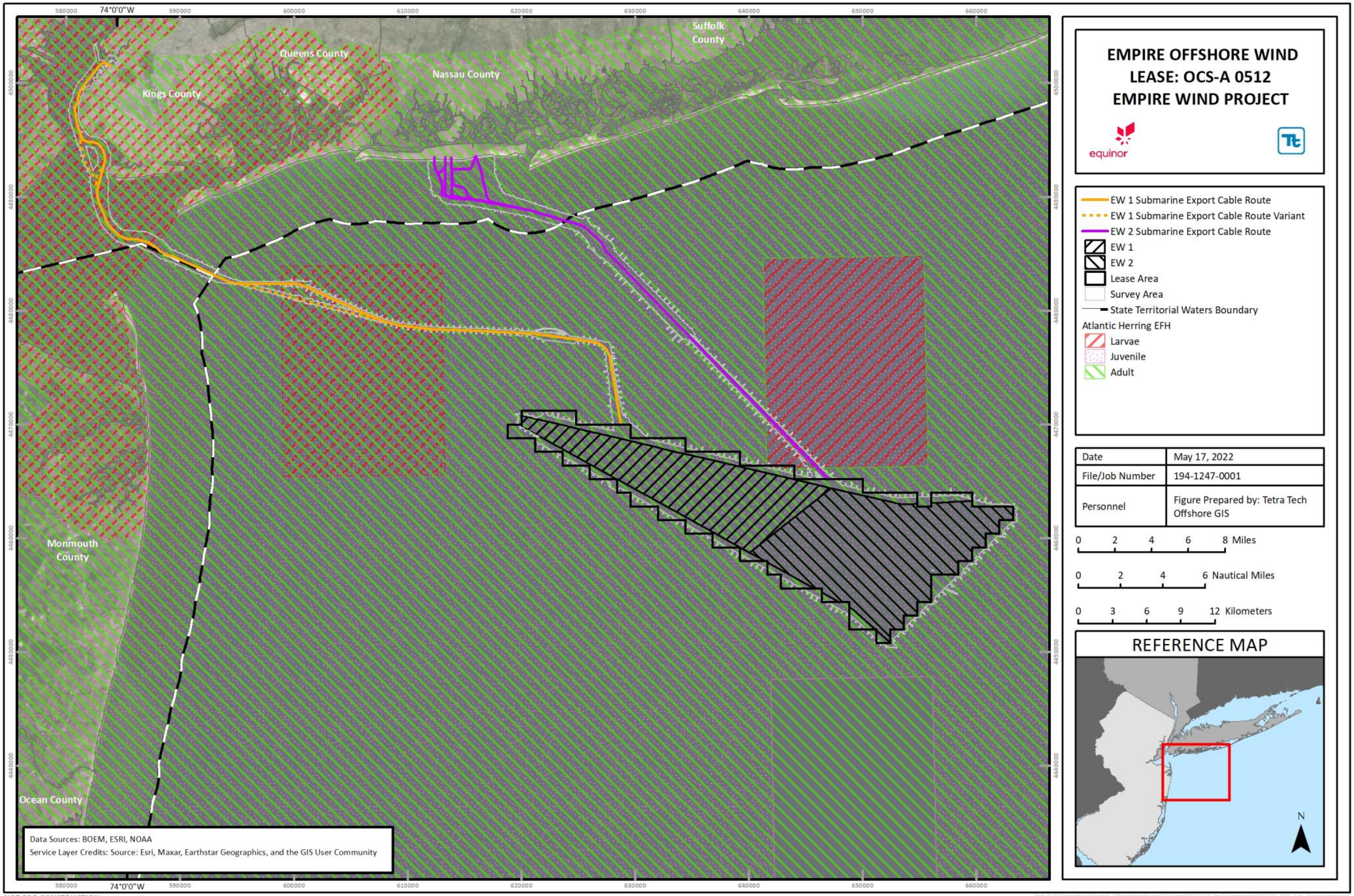

Figure U-1-3 Atlantic Herring (*Clupea harengus*) Designated EFH in Project Area

U-1.2.4 Atlantic Sea Scallop (*Placopecten magellanicus*)

EFH is designated for all life stages of Atlantic sea scallop in the Lease Area and both submarine export cable siting corridors (**Table U-1-4**; **Figure U-1-4**). Designated EFH for the Atlantic sea scallop addresses the entire life cycle: demersal egg, planktonic and benthic larval stages, attached and mobile juvenile forms, and mobile adults. The Lease Area and the federal portion of the EW 1 submarine export cable siting corridor intersect entirely with Atlantic sea scallop EFH; the offshore part of the EW 2 submarine export cable siting corridor also intersects with sea scallop EFH (**Table U-1-4; Figure U-1-4**).

EFH for eggs is designated as benthic habitat inshore and on the continental shelf near adult scallops (NEFMC 2017). Eggs remain on the seafloor for four to five weeks until they develop into the first free-swimming larval stage; scallop eggs maintained at 55 to 63°F (13 to 17°C) in a laboratory hatched 32 days after fertilization (Hart and Chute 2004).

Larval EFH includes both benthic and pelagic habitats inshore and offshore throughout the region (NEFMC 2017). Pelagic larvae (spat) may settle on any hard surface, including shells, pebbles, and gravel, as well as macroalgae and other organisms such as hydroids. Spat attached to immobile hard substrates have higher survival rates than spat settled on shifting sand, which usually die. Larval development is temperature-dependent, with warmer waters increasing growth rate. Larvae develop normally in salinities from 16.9 to 30 ppt (Hart and Chute 2004).

Juvenile Atlantic scallop EFH is benthic habitats in the Mid-Atlantic between 59 and 361 ft (18 and 110 m) (NEFMC 2017). A juvenile scallop leaves its original settling location and attaches to gravel, shells, or small rocks by byssal threads. As it grows, the byssal thread weakens and the scallop becomes an active swimmer.

Adult Atlantic sea scallop EFH is designated in benthic sand and gravel substrates in the Mid-Atlantic between 59 and 361 ft (18 and 110 m), although adults also occur in shallower water. Adult mid-Atlantic scallops often occur in aggregations, primarily in waters from 148 to 246 ft (45 to 75 m) deep. Aggregations can be transient or near-permanent, depending on temperature, food availability, and substrate; in some locations, fronts and currents support aggregations by increasing larval retention near adult spawning beds. Although currents deliver food to adult scallops, bottom currents stronger than 0.56 miles per hour (25 centimeters per second) can inhibit feeding (NEFMC 2017).

Table U-1-4 Atlantic Sea Scallop (*Placopecten magellanicus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
All	79,341	415	6,655	0	5,753
Percent of Action Area Covered by EFH by Life Stage					
All	100.0%	5.3%	100.0%	0.0%	74.7%
EFH Source Documents: Hart and Chute 2004; NEFMC 2017 and references within					

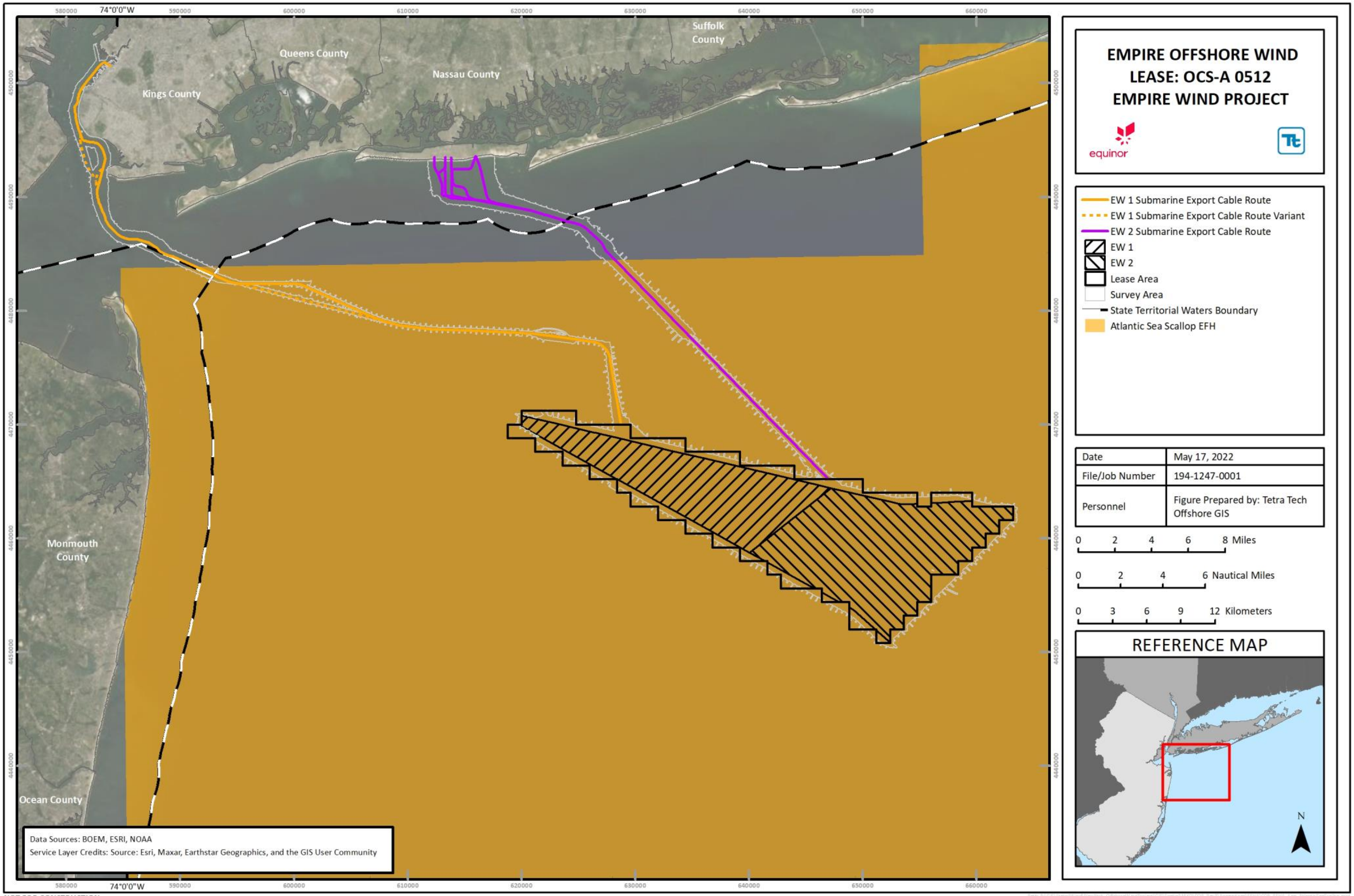

Figure U-1-4 Atlantic Sea Scallop (*Placopecten magellanicus*) Designated EFH in Project Area

U-1.2.5 Clearnose Skate (*Raja eglanteria*)

No EFH for clearnose skate eggs is designated in the Lease Area or either submarine export cable siting corridor. No larval stage exists in skates.

Juvenile clearnose skate EFH is designated in the Lease Area and the EW 1 submarine export cable siting corridor (**Table U-1-5; Figure U-1-5**). EFH for juvenile clearnose skate is sub-tidal benthic habitats in coastal and inner continental shelf waters from New Jersey to Florida, including high salinity zones in the Hudson-Raritan estuary, from the shoreline to 98 ft (30 m), primarily on mud, sand, gravel, and rocky substrates (NEFMC 2017). Juveniles were most abundant in the Hudson-Raritan estuary during spring and fall at about 16 to 23 ft (5 to 7 m), and to 26 ft (8 m) in the summer (Packer et al. 2003a). Within the Project Area, only the nearshore portions of the EW 1 submarine export cable siting corridor intersects with juvenile clearnose skate EFH (**Table U-1-5; Figure U-1-5**).

Adult clearnose skate EFH is designated in the Lease Area and the EW 1 submarine export cable siting corridor. Adult clearnose skate EFH includes high salinity zones of the Hudson/Raritan estuary from the shoreline to 131 ft (40 m) over mud, sand, gravel, and rocky substrates (NEFMC 2017). The adult clearnose skate is rare in the estuary in cooler months but more abundant in summer (Packer et al. 2003a). Adults were most abundant in NEFSC Hudson-Raritan estuary trawls between 16 and 26 ft (5 and 8 m) in spring, summer, and fall (Packer et al. 2003a). Peak spring abundance was in waters of 59 to 63°F (15 to 17°C) and salinities of 26 to 27 ppt. Adults were most common in summer trawls at 72°F (22°C) and salinities of 27 to 29 ppt. In fall, adult clearnose skate abundance was greatest at 61 to 63°F (16 to 17°C) and 26 to 30 ppt salinity. Within the Project Area, only the nearshore portions of the EW 1 submarine export cable siting corridor intersects with adult clearnose skate EFH (**Table U-1-5**; **Figure U-1-5**).

Table U-1-5 Clearnose Skate (*Raja eglanteria*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	0	6,688	873	0	0
Adult	0	7,832	872	0	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	0.0%	85.4%	13.1%	0.0%	0.0%
Adult	0.0%	100.0%	13.1%	0.0%	0.0%
EFH Source Documents: Packer et al. 2003a; NEFMC 2017 and references within					

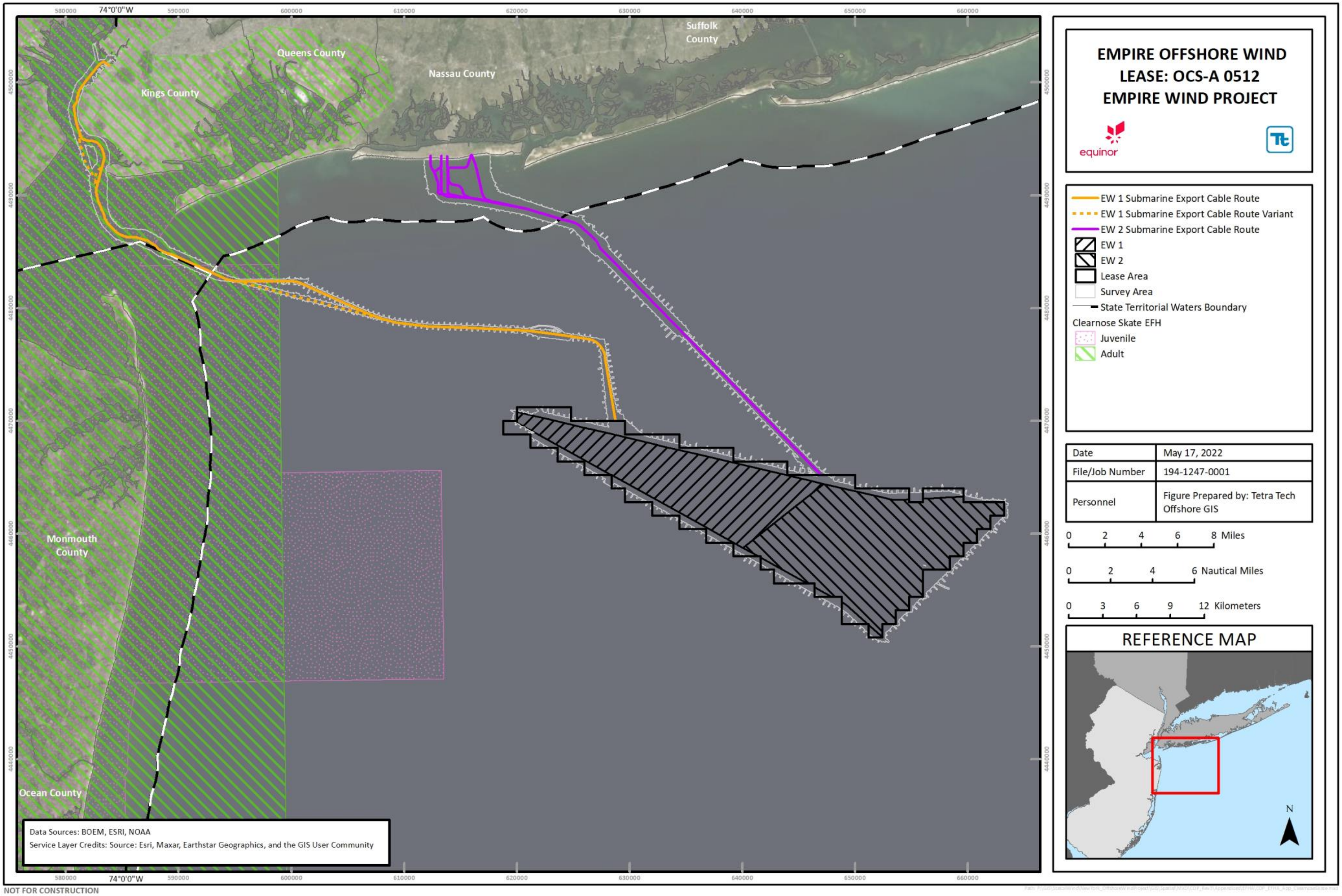

Figure U-1-5 Clearnose Skate (*Raja eglanteria*) Designated EFH in Project Area

U-1.2.6 Haddock (*Melanogrammus aeglefinus*)

Larval haddock EFH is designated in the Lease Area and the EW 2 submarine export cable siting corridor. Larval haddock EFH is designated only in pelagic waters in the central portion of the Lease Area (**Table U-1-6**; **Figure U-1-6**). Larval EFH consists of pelagic habitats in coastal and offshore waters in Southern New England (NEFMC 2017). Larval growth is optimal at temperatures of 45 to 48°F (7 to 9°C) and may slow or stop altogether when the temperature drops below 39°F (4°C) (Brodziak 2005). Most larval haddock are reported from depths of 33 to 164 ft (10 to 50 m), but they sometimes occur down to 492 ft (150 m) (NEFMC 2017).

Juvenile haddock skate EFH is designated in the Lease Area and the EW 1 submarine export cable siting corridor. Juvenile haddock EFH is designated only in the portion of the EW 1 submarine export cable siting corridor in federal waters (**Table U-1-6; Figure U-1-6**). It includes sub-tidal habitats between 131 and 460 ft (40 and 140 m) in Southern New England on hard sand, mixed sand and shell, gravelly sand, and gravelly bottoms (NEFMC 2017). Juvenile haddock occur at temperatures from 40 to 52°F (4.5 to 11°C) (Brodziak 2005). Young-of-the-year rear in nursery areas between Nantucket Shoals and Hudson Canyon.

No EFH for adult haddock is designated in the Lease Area or either submarine export cable siting corridor.

Table U-1-6 Haddock (*Melanogrammus aeglefinus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	17,108	0	0	0	1,102
Juvenile	17,086	0	2,122	0	0
Adult	0	0	0	0	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	21.6%	0.0%	0.0%	0.0%	14.3%
Juvenile	21.5%	0.0%	31.9%	0.0%	0.0%
Adult	0.0%	0.0%	0.0%	0.0%	0.0%

EFH Source Documents: Brodziak 2005; NEFMC 2017 and references within

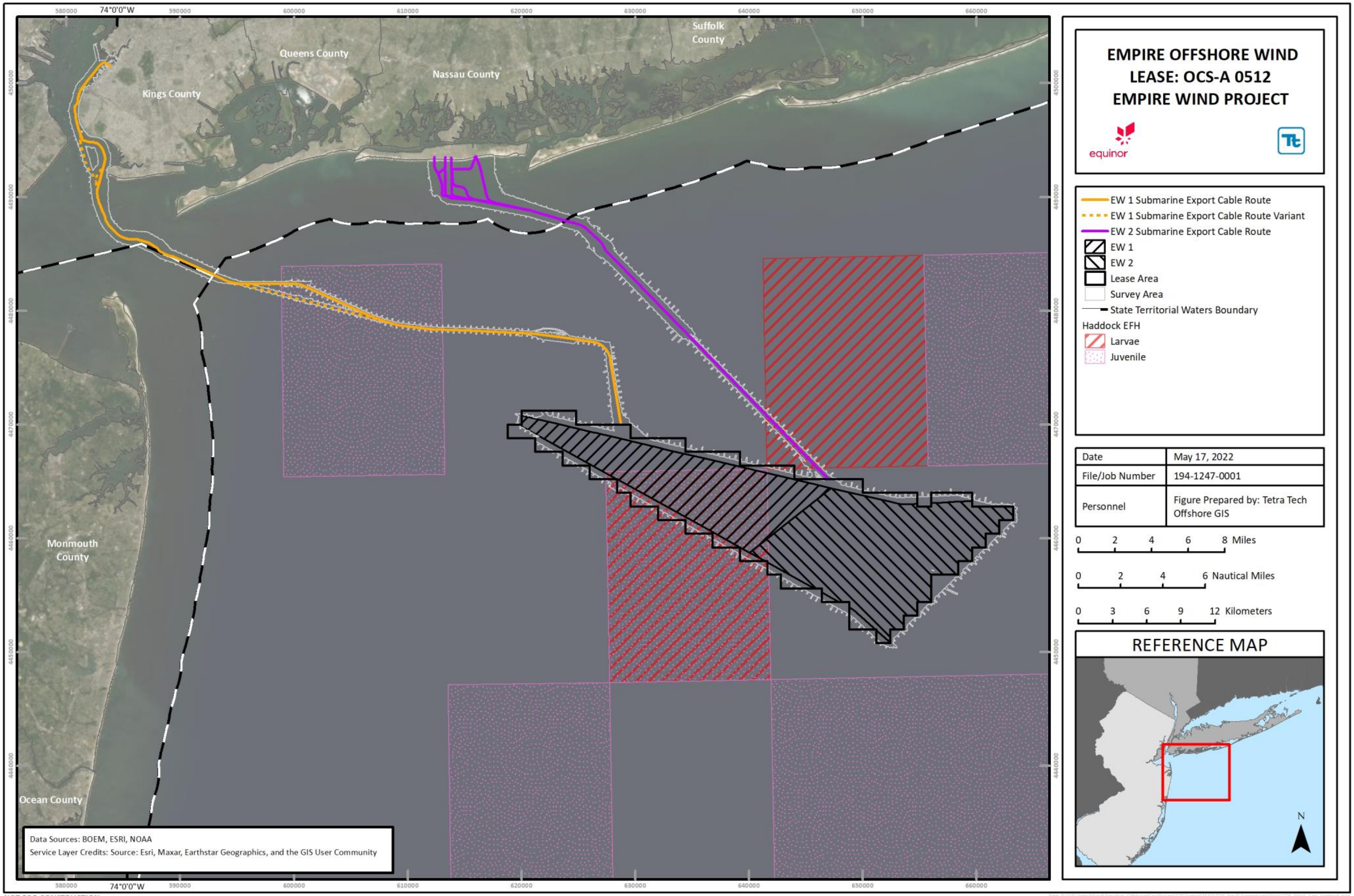

Figure U-1-6 Haddock (*Melanogrammus aeglefinus*) Designated EFH in Project Area

U-1.2.7 Little Skate (*Leucoraja erinacea*)

No EFH for little skate eggs is designated in the Lease Area or either submarine export cable siting corridor. No larval stage exists in skates.

Juvenile little skate EFH is designated in the Lease Area and both submarine export cable siting corridors. Juvenile little skate EFH is intertidal and sub-tidal sand, gravel, and mud substrates in coastal waters in the Mid-Atlantic region as far south as Delaware Bay, including high salinity zones in Hudson-Raritan estuary, to a maximum depth of 262 ft (80 m) (NEFMC 2017). Little skate juveniles tolerate cool fall temperatures down to 41°F (5°C). Juvenile little skate EFH intersects with most of the Lease Area and submarine export cable siting corridors (**Table U-1-7; Figure U-1-7**). Hudson-Raritan trawl surveys reported juveniles were most abundant in waters 39 to 41°F (4 to 5°C) at depths of 16 to 26 ft (5 to 8 m) and salinities of 25 to 32 ppt in winter (Packer et al. 2003b). In spring surveys, juvenile little skate occurred at 20 to 26 ft (6 to 8 m) over a wider temperature range (most abundant between 43 to 48°F [6 to 9°C] and 59 and 63°F [15 to 17°C]). Juveniles congregated in depths of 23 to 72 ft (7 to 22 m) in Ambrose Channel (between Sandy Hook, New Jersey and Long Island, New York) during summer when water temperatures ranged from 57 to 72°F (14 to 22°C); summer salinities in this area were 23 to 32 ppt.

Adult little skate EFH is designated in the Lease Area and both submarine export cable siting corridors. Adult little skate EFH mirrors juvenile habitat but extends to 328 ft (100 m) (NEFMC 2017). Adults were collected in the New York Bight at a mean salinity of 32 ppt and depths less than 148 ft (45 m); temperature ranged from 34 to 70°F (1 to 21°C) (Packer et al. 2003b). Adult little skate EFH intersects with most of the Lease Area and submarine export cable siting corridors (**Table U-1-7**; **Figure U-1-7**). Trawl surveys in Hudson-Raritan Bay reported adults were most abundant in waters between 37 and 39°F (3 and 4°C) at depths of 23 ft (7 m) and salinities between 29 and 34 ppt in winter (Packer et al. 2003b). In spring, adult abundance peaked at 48°F (9°C) at 26 ft (8 m) and salinities between 25 and 29 ppt. Fall surveys reported peak abundance at 54°F (12°C) in depths of 20 to 30 ft (6 to 9 m) and salinities around 29 ppt. Adult little skate were rarely caught in the summer in the Project Area.

Table U-1-7 Little Skate (*Leucoraja erinacea*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	79,307	7,832	6,655	7,880	6,600
Adult	0	6,688	873	2,661	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	100.0 %	100.0%	100.0%	100.0%	85.7%
Adult	0.0%	85.4%	13.1%	33.8%	0.0%
EFH Source Documents: Packer et al. 2003b; NEFMC 2017 and references within					

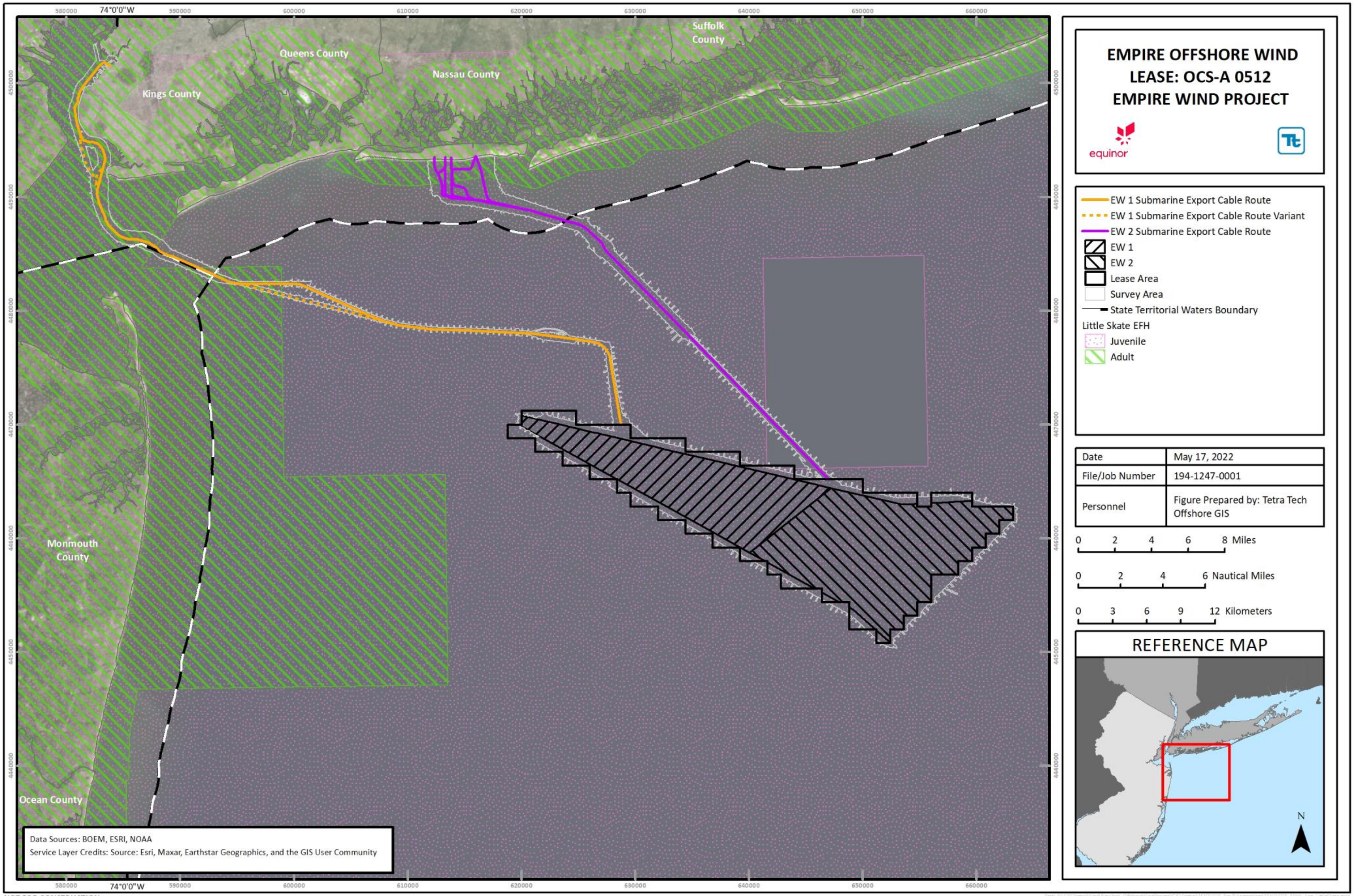

Figure U-1-7 Little Skate (*Leucoraja erinacea*) Designated EFH in Project Area

U-1.2.8 Monkfish (*Lophius americanus*)

Egg and larval monkfish EFH are designated in the Lease Area and both submarine export cable siting corridors. Monkfish egg and larval EFH are designated in pelagic areas inshore and on the continental shelf and slope from Cape Hatteras to Maine (NEFMC 2017). Monkfish eggs float near the sea surface in large mucoidal egg veils for three to four weeks before disintegrating as the larvae hatch. The eggs require surface water temperatures between 39 and 64°F (4 and 18°C) (Steimle et al. 1999a). Larvae occur from the surf zone to depths of 4,920 ft (1,500 m) on the Mid-Atlantic continental slope and are most abundant in waters from 52 to 59°F (11 to 15°C) (Steimle et al. 1999a). The Lease Area and both submarine export cable siting corridors intersect completely with EFH for monkfish eggs and larvae (**Table U-1-8; Figure U-1-8**).

Table U-1-8 Monkfish (*Lophius americanus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg/Larva	79,341	2,644	6,655	7,880	7,700
Juvenile	10,560	0	2,122	0	0
Adult	49,356	0	2,122	712	437
Percent of Action Area Covered by EFH by Life Stage					
Egg/Larva	100.0%	33.8%	100.0%	100.0%	100.0%
Juvenile	13.3%	0.0%	31.9%	0.0%	0.0%
Adult	62.2%	0.0%	31.9%	9.0%	5.7%
EFH Source Documents: Steimle et al. 1999a; NEFMC 2017 and references within					

Juvenile monkfish EFH is designated in the Lease Area and the EW 1 submarine export cable siting corridor. Juvenile monkfish EFH is sub-tidal benthic habitats in depths ranging from 164 to 1,312 ft (50 to 400 m) in the Mid-Atlantic to a maximum depth of 3,280 ft (1,000 m) on the continental slope (NEFMC 2017). Juvenile monkfish EFH includes hard sand, pebbles, gravel, broken shells, and soft mud; juvenile monkfish seek shelter among rocks with attached algae. Young-of-the-year juveniles have been collected primarily on the central Mid-Atlantic shelf. Juveniles are also known to occur in shallow nearshore waters off eastern Long Island and in the Hudson Canyon Shelf Valley. Preferred temperatures range from 36 to 75°F (2 to 24°C) and salinities from 30 to 36 ppt (Steimle et al. 1999a). Juvenile monkfish EFH intersects with the Project Area in federal waters only (**Table U-1-8; Figure U-1-8**).

Adult monkfish EFH is designated in the Lease Area and both submarine export cable siting corridors. Adult monkfish EFH co-occurs with and is similar to juvenile EFH (NEFMC 2017). Essential substrates for monkfish are hard sand, pebbles, gravel, broken shells, and soft mud. Adults prefer soft sediments like fine sand and mud over sand and gravel; both adults and juveniles feed along the edges of rocky areas. Adult monkfish occur where temperatures range up to 75°F (24°C) but are most abundant between 39 and 57°F (4 and 14°C) (Steimle et al. 1999a). Adult monkfish EFH intersects with the Project Area in federal waters only (**Table U-1-8**; **Figure U-1-8**).

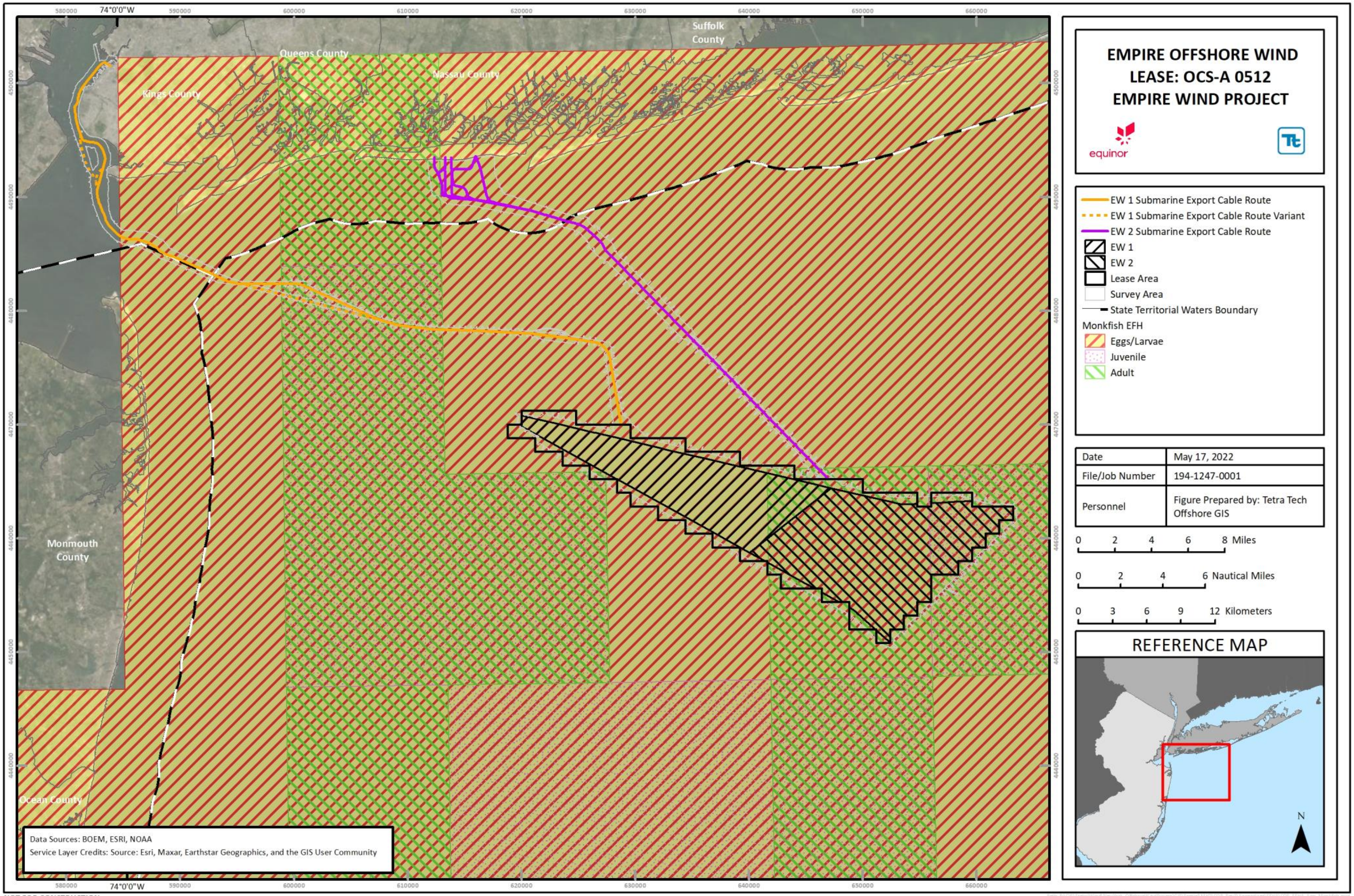

Figure U-1-8 Monkfish (*Lophius americanus*) Designated EFH in Project Area

U-1.2.9 Ocean Pout (*Macrozoarces americanus*)

Ocean pout egg EFH is designated in the Lease Area and both submarine export cable siting corridors. Ocean pout egg EFH consists of hardbottom habitats in the Mid-Atlantic Bight (NEFMC 2017). Eggs are laid in gelatinous masses, generally in sheltered nests, holes, or rocky crevices in depths less than 328 ft (100 m) on rocky bottom habitats. Almost the entire Lease Area is designated EFH for ocean pout eggs (**Table U-1-9; Figure U-1-9**); however, the hardbottom habitat favorable to eggs is rare in the Project Area. Eggs develop best in temperatures less than 50°F (10°C) and salinities from 32 to 34 ppt (Steimle et al. 1999b). Most eggs are spawned in the fall and hatched by mid-winter.

No EFH for larval ocean pout is designated in the Lease Area or either submarine export cable siting corridor.

Juvenile ocean pout EFH is designated in the Lease Area and the EW 1 submarine export cable siting corridor. Juvenile ocean pout EFH is intertidal and sub-tidal benthic habitats on the continental shelf north of Cape May, New Jersey out to a depth of 394 ft (120 m) (NEFMC 2017). Juvenile EFH for ocean pout is designated in the Lease Area and the federal waters of the EW 1 submarine export cable siting corridor (**Table U-1-9; Figure U-1-9**). Juvenile ocean pout EFH occurs on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel. In general, temperatures between 37 and 57°F (3 and 14°C) and salinities greater than 25 ppt are suitable for juvenile ocean pout (Steimle et al. 1999b).

Table U-1-9 Ocean Pout (*Macrozoarces americanus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	79,206	399	6,655	7,168	7,700
Larva	0	0	0	0	0
Juvenile	17,085	0	2,122	0	0
Adult	79,206	402	6,655	7,168	7,700
Percent of Action Area Covered by EFH by Life Stage					
Egg	99.8%	5.1%	100.0%	91.0%	100.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	21.5%	0.0%	31.9%	0.0%	0.0%
Adult	99.8%	5.1%	100.0%	91.0%	100.0%

EFH Source Documents: Steimle et al. 1999b; NEFMC 2017 and references within

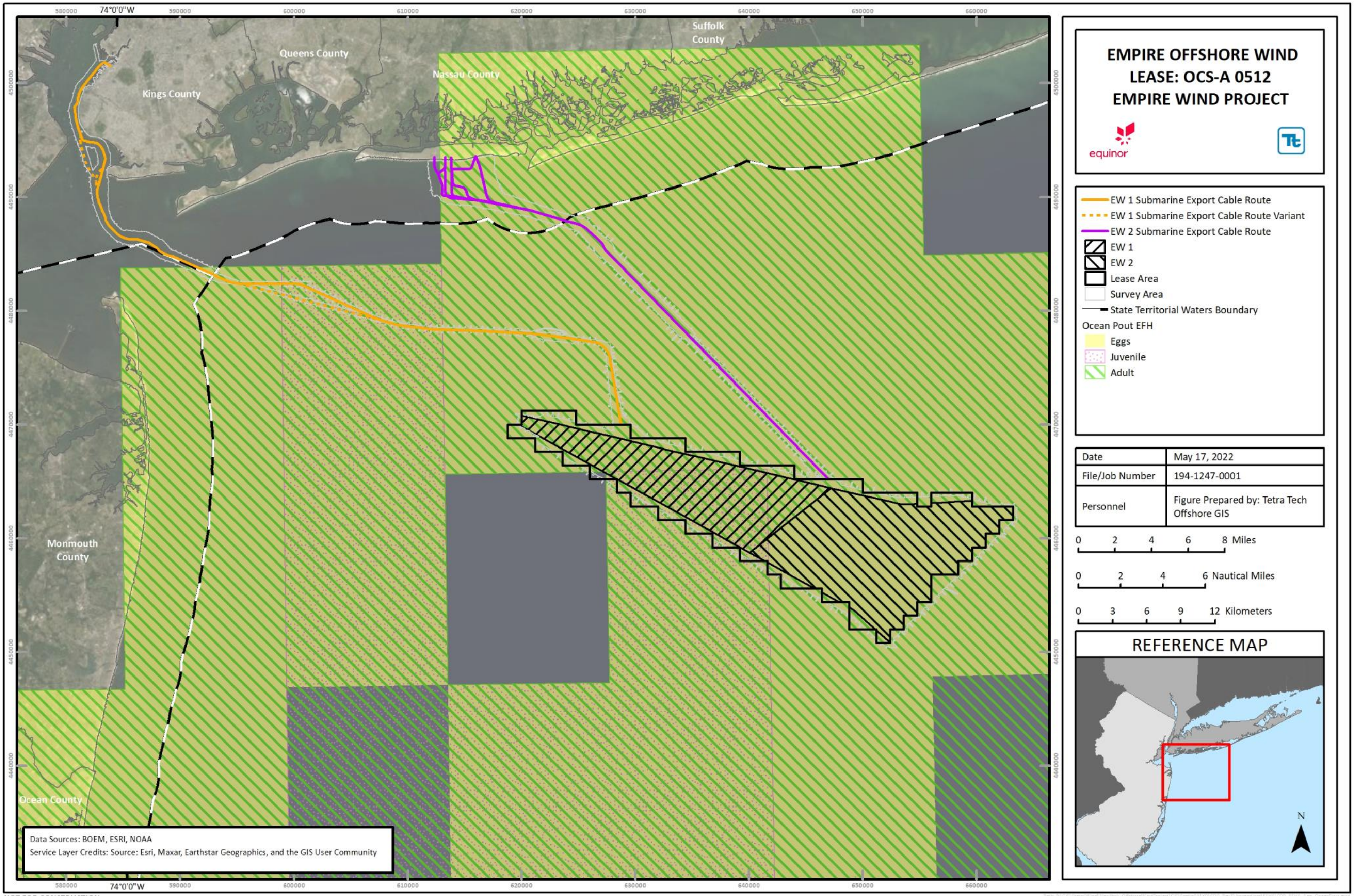

Figure U-1-9 Ocean Pout (*Macrozoarces americanus*) Designated EFH in Project Area

Adult ocean pout EFH is designated in the Lease Area and both submarine export cable siting corridors. Adult ocean pout EFH intersects with the Lease Area and both submarine export cable siting corridors (**Table U-1-9**; **Figure U-1-9**). Adult EFH consists of sub-tidal benthic habitats between 66 and 460 ft (20 and 140 m) in coastal and continental shelf waters north of Cape May, New Jersey, including mud and sand, particularly in association with structure-forming habitat types such as shells, gravel, or boulders (NEFMC 2017). In softer sediments, adult ocean pout 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 ft (100 m). Suitable temperatures generally range from 36 to 57°F (2 to 14°C); salinity tolerance ranges from 32 to 34 ppt (Steimle et al. 1999b).

U-1.2.10 Pollock (*Pollachius virens*)

Pollock egg EFH is designated in the EW 2 submarine export cable siting corridor (**Table U-1-10; Figure U-1-10**). Pelagic habitat is designated EFH in the Mid-Atlantic region for pollock eggs during fall and winter. Peak spawning occurs from November to February over broken substrate; eggs are found in depths ranging from 164 to 820 ft (50 to 250 m), where temperatures are within 35 to 63°F (2 to 17°C) and salinities are between 32 to 32.8 ppt (Cargnelli et al. 1999a).

Larval pollock EFH is designated in the Lease Area and EW 2 submarine export cable siting corridor. Larval pollock EFH is pelagic inshore and offshore habitats in the Mid-Atlantic region (NEFMC 2017) where temperatures range from 36 to 3°F (2 to 17°C). Larvae are most common at depths between 164 and 295 ft (50 and 90 m) (Cargnelli et al.1999a), which intersects with the eastern half of the Lease Area and the EW 2 submarine export cable siting corridor immediately adjacent to the Lease Area (**Table U-1-10; Figure U-1-10**).

Table U-1-10 Pollock (*Pollachius virens*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	606
Larva	38,795	0	0	0	438
Juvenile	0	0	0	2,661	0
Adult	0	0	0	0	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	7.9%
Larva	48.9%	0.0%	0.0%	0.0%	5.7%
Juvenile	0.0%	0.0%	0.0%	33.8%	0.0%
Adult	0.0%	0.0%	0.0%	0.0%	0.0%
EFH Source Documents: Cargnelli et al. 1999a; NEFMC 2017 and references within					

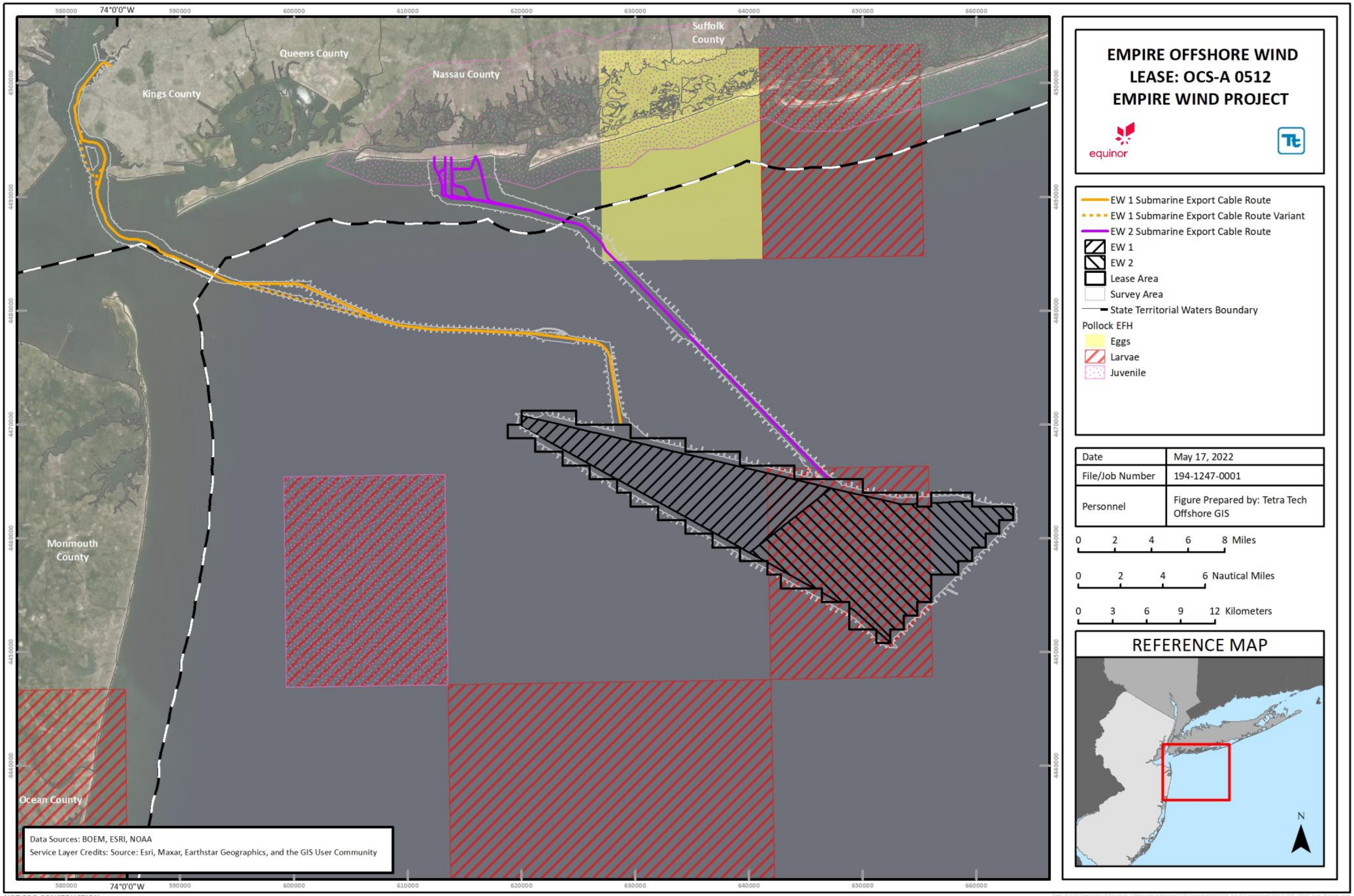

Figure U-1-10 Pollock (*Pollachius virens*) Designated EFH in Project Area

Juvenile pollock EFH is designated only in the EW 2 submarine export cable siting corridor. Juvenile pollock EFH is pelagic habitats between 131 and 591 ft (40 and 180 m) from Long Island to Maine, including western Georges Bank and the Great South Channel. The only juvenile pollock EFH in the Project Area is near the EW 2 landing and an isolated ten-minute square in the Hudson Valley Shelf at the southernmost extreme of the EFH distribution (NEFMC 2017; **Table U-1-10**; **Figure U-1-10**). Juvenile pollock occupy a wide variety of habitats including rocky bottoms, sand, mud, and aquatic vegetation. Juveniles occur at depths from 16 to 820 ft (5 to 250 m) but are most common between 82 and 246 ft (25 and 75 m) (Cargnelli et al. 1999a).

No EFH for pollock adults is designated in the Lease Area or either submarine export cable siting corridor.

U-1.2.11 Red Hake (*Urophycis chuss*)

Red hake egg, larval, and juvenile EFH is designated in the Lease Area and both submarine export cable siting corridors. The Lease Area and both submarine export cable siting corridors intersect broadly with EFH for red hake egg, larval, and juvenile life stages (**Table U-1-11**; **Figure U-1-11**). For eggs and larvae, EFH is pelagic habitats in the Mid-Atlantic, including the Hudson-Raritan Bay (NEFMC 2017). Larvae occur in water temperatures from 46 to 73 °F (8 to 23°C) but are most abundant between 52 and 66°F (11 and 19°C) (Steimle et al. 1999c). Juvenile EFH consists of intertidal and sub-tidal benthic habitats throughout the region on mud and sand substrates, to a maximum depth of 262 ft (80 m). Newly-settled juveniles occur in depressions on the open seabed, and older juveniles commonly associate with complex biogenic habitats (e.g., eelgrass, macroalgae, shells, anemones, polychaete tubes) and artificial reefs; they may seek shelter inside live bivalve shells. Juvenile red hake are most abundant between 37 and 61°F (3 and 16°C) and in salinities greater than 22 ppt (Steimle et al. 1999c).

Adult red hake EFH is designated in the Lease Area and both submarine export cable siting corridors. Adult red hake EFH overlaps with most of the Lease Area and both submarine export cable siting corridors (**Table U-1-11**; **Figure U-1-11**); designated EFH consists of benthic habitats from about 66 to 230 ft (20 to 70 m) in estuaries and coastal waters as far south as Chesapeake Bay (NEFMC 2017). Shell beds, soft sediments, and artificial reefs provide EFH for adult red hake on depressions in softer sediments or in shell beds and on open sandy bottom. Adult red hake occur in waters between 36 and 72°F (2 and 22°C) and at salinities greater than 22 ppt (Steimle et al. 1999c).

Table U-1-11 Red Hake (*Urophycis chuss*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg/Larva/ Juvenile	40,510	7,831	6,655	4,909	6,162
Adult	62,221	6,688	6,655	7,880	6,601
Percent of Action Area Covered by EFH by Life Stage					
Egg/Larva/ Juvenile	51.1%	100.0%	100.0%	62.3%	80.0%
Adult	78.4%	85.4%	100.0%	100.0%	85.7%
EFH Source Documents: Steimle et al. 1999c; NEFMC 2017 and references within					

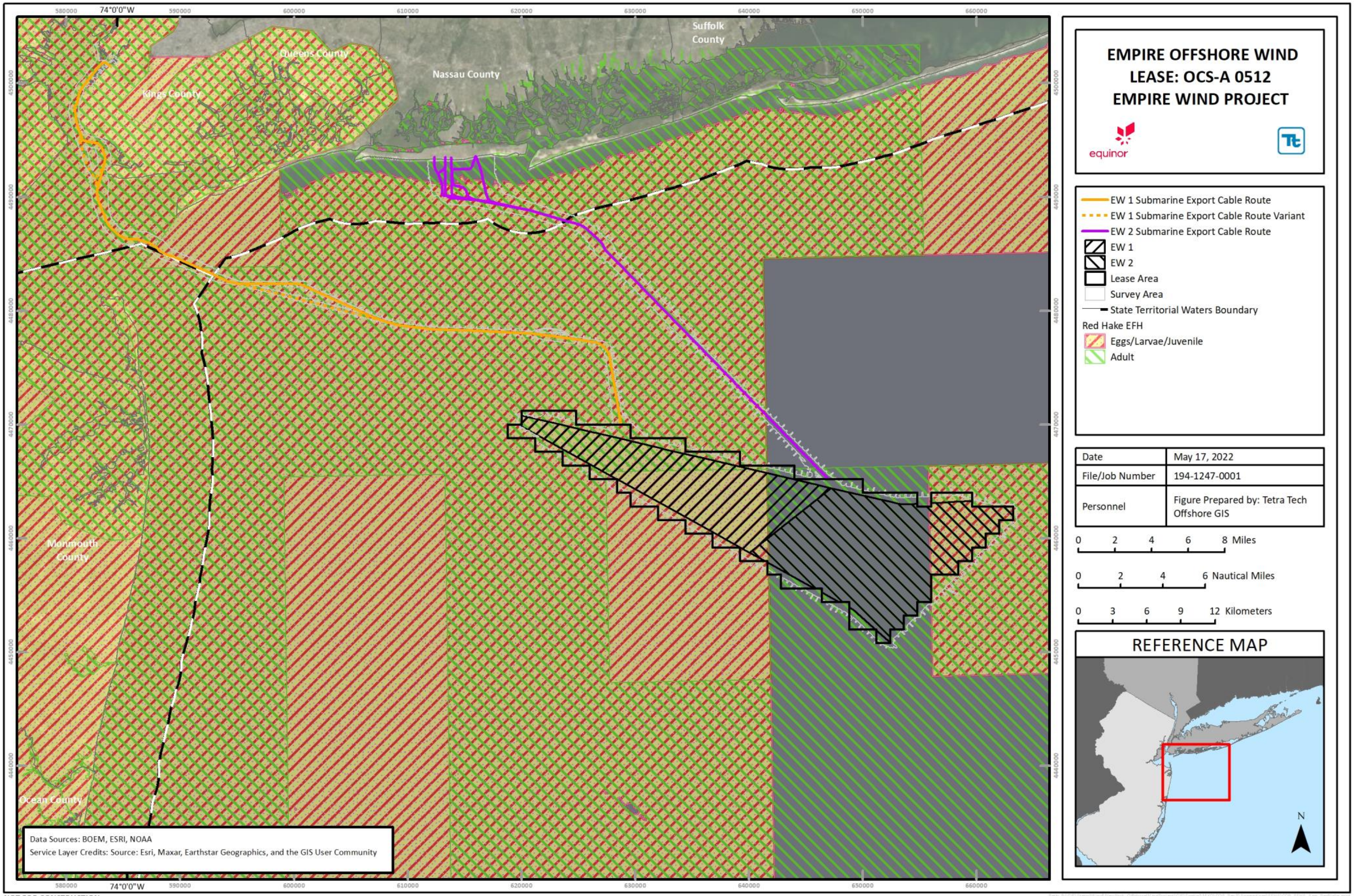

Figure U-1-11 Red Hake (*Urophycis chuss*) Designated EFH in Project Area

U-1.2.12 Silver Hake (*Merluccius bilinearis*)

Egg and larval silver hake EFH are designated in the Lease Area and both submarine export cable siting corridors. Portions of the Lease Area and both submarine export cable siting corridors intersect with EFH for silver hake eggs and larvae, which is designated as pelagic habitat from the Gulf of Maine to Cape May, New Jersey (NEFMC 2017; **Table U-1-12; Figure U-1-12**). The NEFSC MARMAP survey collected silver hake eggs most often from June to September at temperatures between 52 and 63°F (11 and 17°C) (Lock and Packer 2004). Silver hake larvae were most abundant at temperatures between 50 and 61°F (10 and 16°C) from July to October (Lock and Packer 2004).

Table U-1-12 Silver Hake (*Merluccius bilinearis*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg/Larva	51,795	7,725	6,655	0	4,620
Juvenile	4,251	0	0	0	0
Adult	0	398	873	0	0
Percent of Action Area Covered by EFH by Life Stage					
Egg/Larvae	65.3%	98.6%	100.0%	0.0%	60.0%
Juvenile	5.4%	0.0%	0.0%	0.0%	0.0%
Adult	0.0%	5.1%	13.1%	0.0%	0.0%
EFH Source Documents: Lock and Packer 2004; NEFMC 2017 and references within					

Juvenile silver hake EFH is designated in the Lease Area. Juvenile EFH consists of pelagic and sandy benthic habitats on the continental shelf as far south as Cape May, New Jersey at depths greater than 33 ft (10 m) in coastal waters in the Mid-Atlantic (NEFMC 2017). Juvenile silver hake are associated with sandwaves, flat sand with amphipod tubes, empty shells, and biogenic depressions. Juveniles in the New York Bight settle to the bottom at mid-shelf depths on muddy sand substrates to take refuge among amphipod tube mats. NEFSC Hudson-Raritan estuary trawl surveys reported the highest abundance of juvenile silver hake at depths of 39 to 46 ft (12 to 14 m) and salinities around 28 ppt (Lock and Packer 2004).

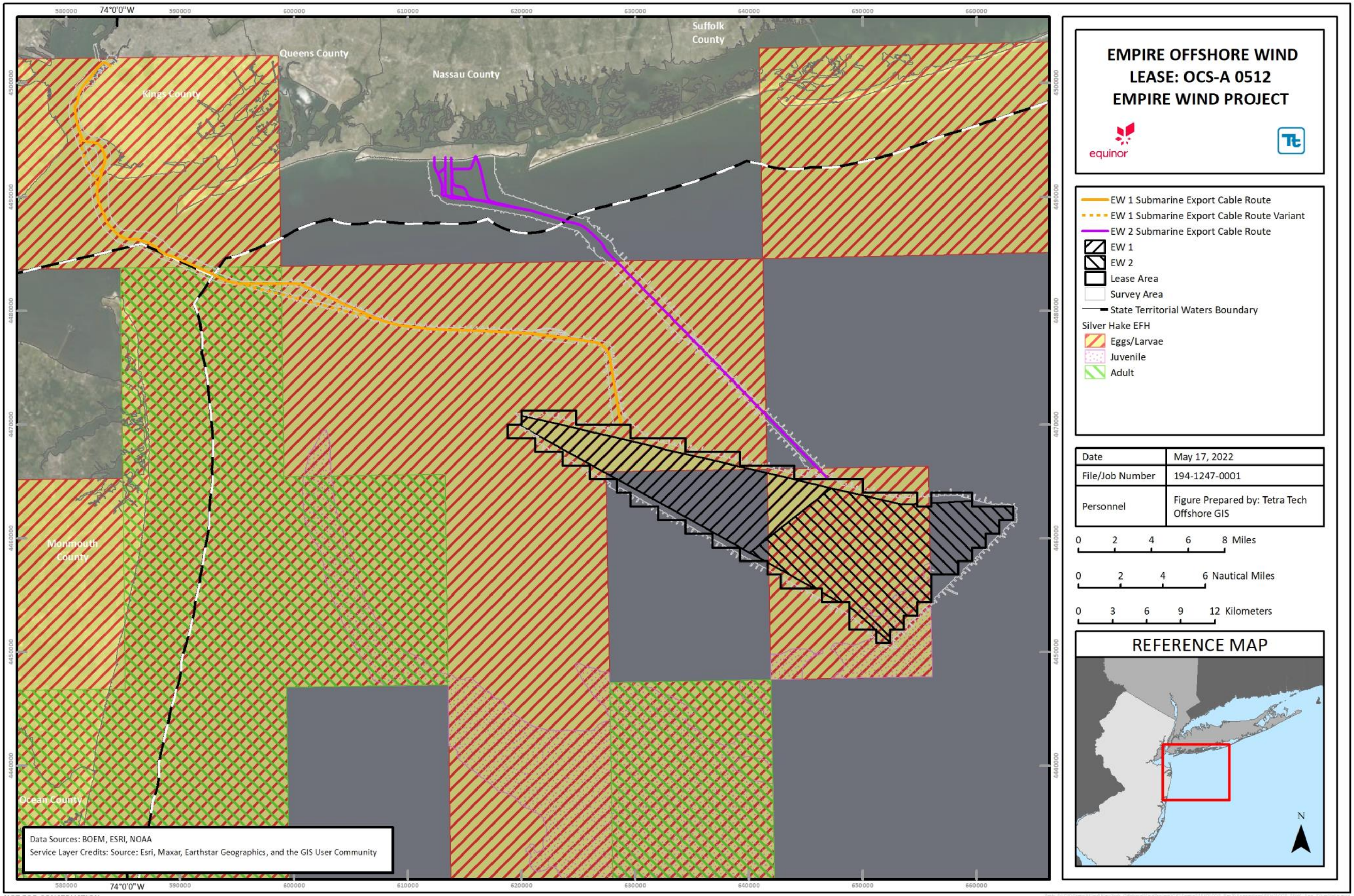

Figure U-1-12 Silver Hake (*Merluccius bilinearis*) Designated EFH in Project Area

Adult silver hake EFH is designated in the EW 1 submarine export cable siting corridor. Adult silver hake EFH is pelagic and benthic habitats at depths between 230 and 1,312 ft (70 and 400 m) on the Outer Continental Shelf in the northern Mid-Atlantic Bight and in some shallower nearshore sandy substrates (NEFMC 2017). The EW 1submarine export cable siting corridor intersects with adult silver hake EFH (**Table U-1-12**; **Figure U-1-12**). Adult silver hake often occur 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 and resting on boulders. In the spring, preferred temperatures range from 45 to 57°F (7 to 14°C) and in autumn from 52 to 68°F (11 to 20°C) (Lock and Packer 2004).

U-1.2.13 White Hake (*Urophycis tenuis*)

No EFH for white hake eggs, larvae, or adults is designated in the Lease Area or either submarine export cable siting corridor.

Juvenile white hake EFH is designated only in the EW 2 submarine export cable siting corridor. Juvenile white hake EFH consists of intertidal and sub-tidal estuarine and marine habitats in Southern New England to a maximum depth of 984 ft (300 m) (NEFMC 2017). Pelagic-phase juveniles remain in the water column for about two months. In nearshore waters, EFH for benthic-phase juveniles occurs on fine-grained, sandy substrates in eelgrass, macroalgae, and unvegetated habitats. In the Mid-Atlantic, most juvenile white hake settle on the continental shelf. Individuals move into deeper waters (greater than 164 ft [50 m]) as they mature (Chang et al. 1999a). Intersection of EFH for juvenile white hake with the Project is limited to the nearshore end of the EW 2 submarine export cable siting corridor (**Table U-1-13**; **Figure U-1-13**).

Table U-1-13 White Hake (*Urophycis tenuis*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	0	0	0	7,168	1,979
Adult	0	0	0	0	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	0.0%	0.0%	0.0%	91.0%	25.7%
Adult	0.0%	0.0%	0.0%	0.0%	0.0%
EFH Source Documents: Chang et al. 1999a; NEFMC 2017 and references within					

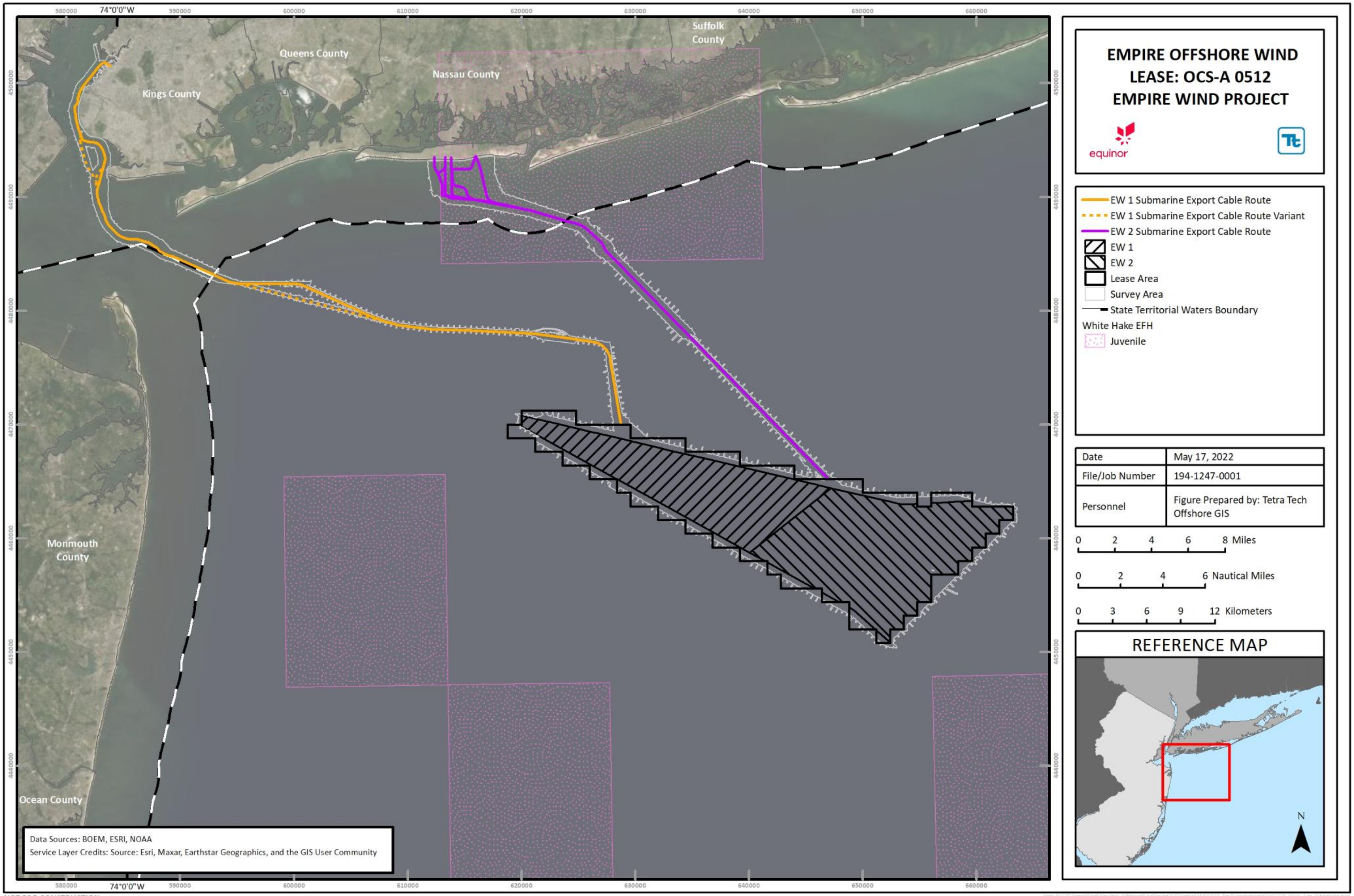

Figure U-1-13 White Hake (*Urophycis tenuis*) Designated EFH in Project Area

U-1.2.14 Windowpane Flounder (*Scophthalmus aquosus*)

All life stages of windowpane flounder have EFH designated in the Lease Area and both submarine export cable siting corridors.

Windowpane flounder eggs and larval EFH consists of pelagic habitats on the continental shelf from Georges Bank to Cape Hatteras, as well as mixed and high salinity zones of coastal bays and estuaries throughout the region, including the Hudson-Raritan estuary (NEFMC 2017). The Lease Area and both submarine export cable siting corridors intersect substantially with egg and larvae EFH for windowpane flounder (**Table U-1-14; Figure U-1-14**).

Juvenile windowpane flounder EFH is intertidal and sub-tidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to northern Florida (NEFMC 2017). In the Project Area, EFH is designated as mud and sand substrates from the intertidal zone to 197 ft (60 m), which intersects with the Lease Area and both submarine export cable siting corridors (**Table U-1-14**; **Figure U-1-14**). Young-of-the-year juveniles prefer sand to mud. Bottom trawl surveys in the Hudson-Raritan estuary reported juveniles were evenly distributed throughout the estuary but were most abundant in deep channels in the winter and summer (Chang et al. 1999b). Juvenile windowpane flounder were most abundant where bottom temperatures ranged from 41 to 73°F (5 to 23°C), depths from 22 to 56 ft (7 to 17 m), and salinities from 22 to 30 ppt.

Adult windowpane flounder EFH is intertidal and sub-tidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to Cape Hatteras, including mixed and high salinity zones in Great South Bay and the Hudson River/Raritan Bay (NEFMC 2017). Designated EFH includes mud and sand substrates from the intertidal zone to a maximum depth of 230 ft (70 m). The entire Lease Area and substantial portions of both submarine export cable siting corridors intersect with adult windowpane flounder EFH (**Table U-1-14; Figure U-1-14**). Adults tolerate a wide range of temperatures, from 32 to 80.2°F (0 to 26.8°C). NEFSC MARMAP surveys caught adult windowpane flounder in spring at depths less than 246 ft (75 m) and in fall at depths less than 164 ft (50 m) (Chang et al. 1999b). Adults were fairly evenly distributed throughout the Hudson-Raritan estuary at depths greater than 82 ft (25 m) where bottom temperature ranged from 32 to 75°F (0 to 24°C) and salinity from 15 to 33 ppt (Chang et al. 1999b).

Table U-1-14 Windowpane Flounder (*Scophthalmus aquosus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	40,545	6,694	6,655	2,661	5,887
Larva	79,341	6,694	6,655	2,661	6,327
Juvenile	30,086	7,832	6,655	7,880	6,162
Adult	79,341	7,832	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
Egg	51.1%	85.5%	100.0%	33.8%	76.5%
Larva	100.0%	85.5%	100.0%	33.8%	82.2%
Juvenile	37.9%	100.0%	100.0%	100.0%	80.0%
Adult	100.0%	100.0%	100.0%	100.0%	100.0%
EFH Source Documents: Chang et al. 1999b; NEFMC 2017 and references within					

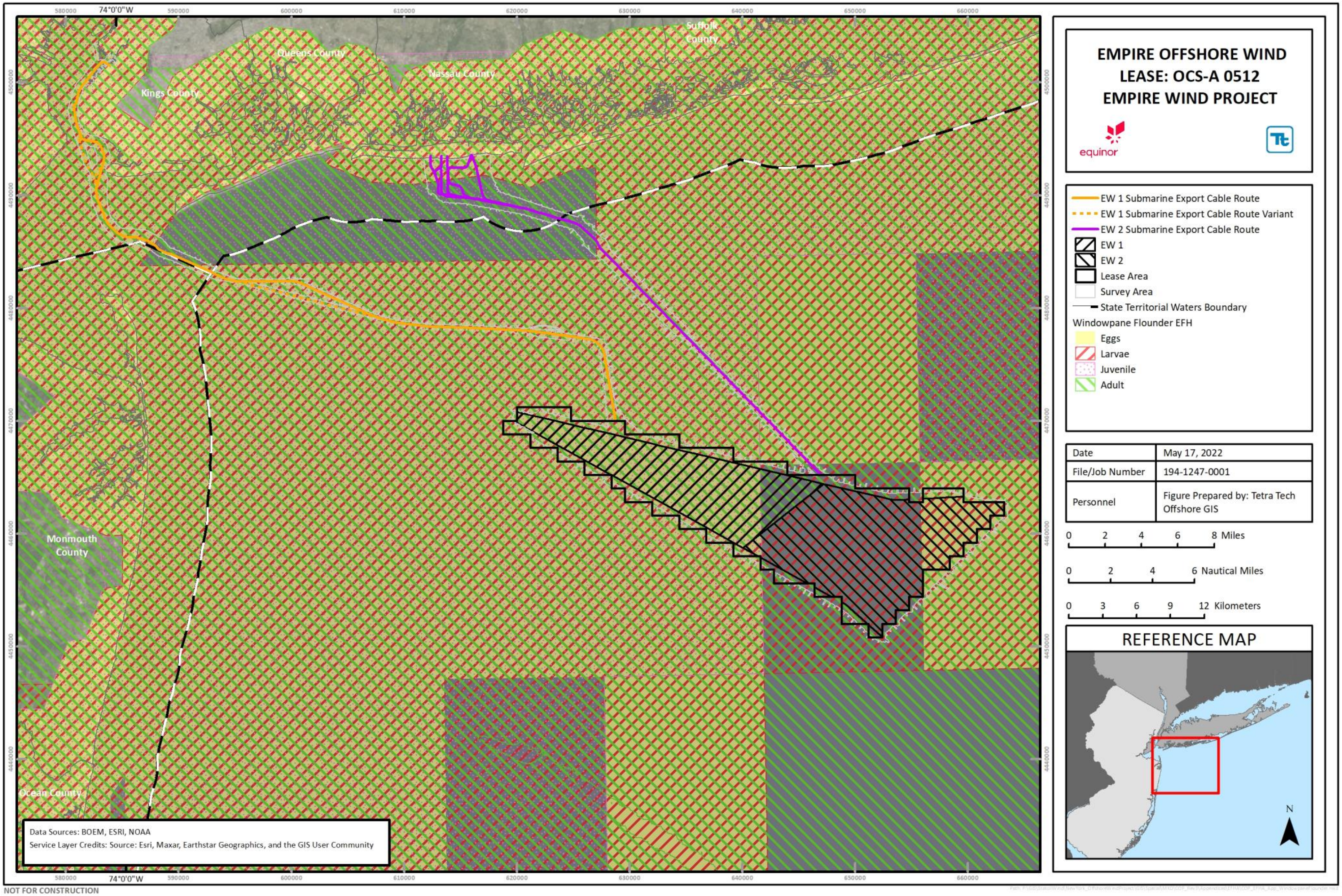

Figure U-1-14 Windowpane Flounder (*Scophthalmus aquosus*) Designated EFH in Project Area

U-1.2.15 Winter Flounder (*Pseudopleuronectes americanus*)

Winter flounder egg EFH is designated only in the two submarine export cable siting corridors. Designated EFH is mixed and high salinity zones in bays and estuaries (NEFMC 2017). Winter flounder egg EFH is sub-tidal estuarine and coastal benthic habitats from mean low water to 16 ft (5 m) from Cape Cod, Massachusetts to Absecon Inlet, New Jersey, including the Hudson-Raritan estuary (NEFMC 2017). No EFH for winter flounder eggs intersects with the Lease Area but virtually all state waters within both submarine export cable siting corridors are designated EFH for eggs (**Table U-1-15; Figure U-1-15**). In estuarine spawning areas, the adhesive eggs are deposited in clusters on a variety of benthic substrates such as mud, muddy sand, sand, gravel, macroalgae, and submerged aquatic vegetation. In New York/New Jersey Harbor, winter flounder eggs were most closely correlated with shallow, sandy habitat (Wilber et al. 2013). Inshore spawning generally occurs in water 56 to 59°F (12 to 15°C) where salinity ranges from 15 to 33 ppt (Pereira et al. 1999). Excessive or continuous sedimentation may reduce hatching success in the affected area.

Larval and adult winter flounder EFH is designated in the Lease Area and both submarine export cable siting corridors. Estuarine, coastal, and continental shelf habitats out to 230 ft (70 m) are designated as EFH for both larval and adult winter flounder from the Gulf of Maine to Absecon Inlet, New Jersey (NEFMC 2017). The entire Lease Area and nearly all of the two submarine export cable siting corridors are designated EFH for larval and adult winter flounder (**Table U-1-15; Figure U-1-15**). Unlike the eggs, winter flounder larvae are pelagic. Eggs spawned offshore may provide an additional source of larval recruitment to estuaries, as the initially-planktonic larvae lose buoyancy and settle to the bottom (Pereira et al. 1999). The tendency of larvae and young juveniles to remain near the bottom in mud or sand may prolong their time in the protective estuarine waters but also make them vulnerable to smothering by sediment deposition (Wilber et al. 2013).

Juvenile winter flounder EFH is designated in the Lease Area and both submarine export cable siting corridors. The entire Lease Area and nearly all of the two submarine export cable siting corridors intersect with designated EFH for juvenile winter flounder (**Table U-1-15**; **Figure U-1-15**), which encompasses benthic habitats on estuarine, coastal, and continental shelf waters from the Gulf of Maine to Absecon Inlet, New Jersey (NEFMC 2017).

Table U-1-15 Winter Flounder (*Pseudopleuronectes americanus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	7,832	765	7,880	2,075
Larva/Adult	79,341	7,832	6,655	7,880	7,700
Juvenile	79,341	7,832	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	100.0%	11.5%	100.0%	26.9%
Larva/Adult	100.0%	100.0%	100.0%	100.0%	100.0%
Juvenile	100.0%	100.0%	100.0%	100.0%	100.0%
EFH Source Documents: Pereira et al. 1999; NEFMC 2017 and references within					

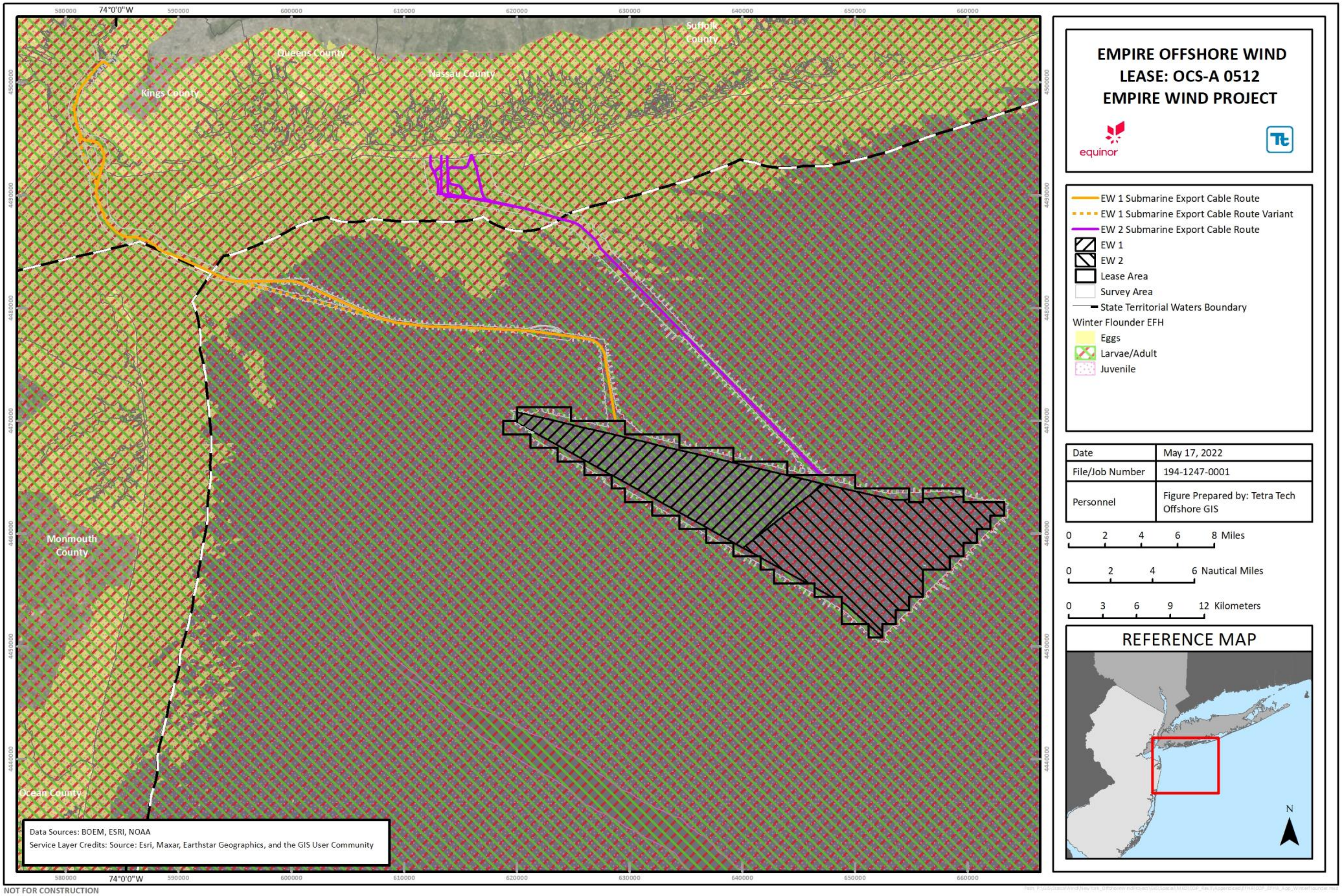

Figure U-1-15 Winter Flounder (*Pseudopleuronectes americanus*) Designated EFH in Project Area

U-1.2.16 Winter Skate (*Leucoraja ocellata*)

No winter skate egg or larval EFH is designated within the Lease Area or either submarine export cable siting corridor.

Juvenile winter skate EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-16**; **Figure U-1-16**). Juvenile winter skate EFH extends to a depth of 295 ft (90 m). NEFSC trawl surveys in the Hudson-Raritan estuary collected juveniles in temperatures between 32 and 45°F (0 and 7°C) in winter and up to 48°F (9°C) in spring. Juvenile winter skate were largely absent during summer and were most abundant in fall when waters were between 41 and 55°F (5 and 13°C) (Packer et al. 2003c). Juvenile winter skate were most often collected at depths of 16 to 26 ft (5 to 8 m) throughout the year, and the few summer collections were from slightly deeper water (23 to 66 ft [7 to 20 m]). Juvenile winter skate prefer salinities near full seawater (23 to 31 ppt).

Adult winter skate EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-16**; **Figure U-1-16**). Adult winter skate EFH consists of subtidal benthic habitats in coastal and continental waters in Southern New England and the Mid-Atlantic region, including high salinity zones in Great South Bay and the Hudson River/Raritan Bay (NEFMC 2017). Adult winter skate EFH is sand, gravel, and mud substrates from inshore to 262 ft (80 m) depth. NEFSC spring trawl surveys collected adult winter skate at nearshore stations throughout the Mid-Atlantic Bight and along Long Island (Packer et al. 2003c). The few adults collected in the Hudson-Raritan estuary during spring and fall were concentrated around the Ambrose and Chapel Hill Channels at the center of the bay.

Table U-1-16 Winter Skate (*Leucoraja ocellata*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	79,341	7,832	6,655	7,880	7,094
Adult	51,828	7,832	6,655	7,880	7,094
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	100.0%	100.0%	100.0%	100.0%	100.0%
Adult	65.3%	100.0%	100.0%	100.0%	92.1%
EFH Source Documents: Packer et al. 2003c; NEFMC 2017 and references within					

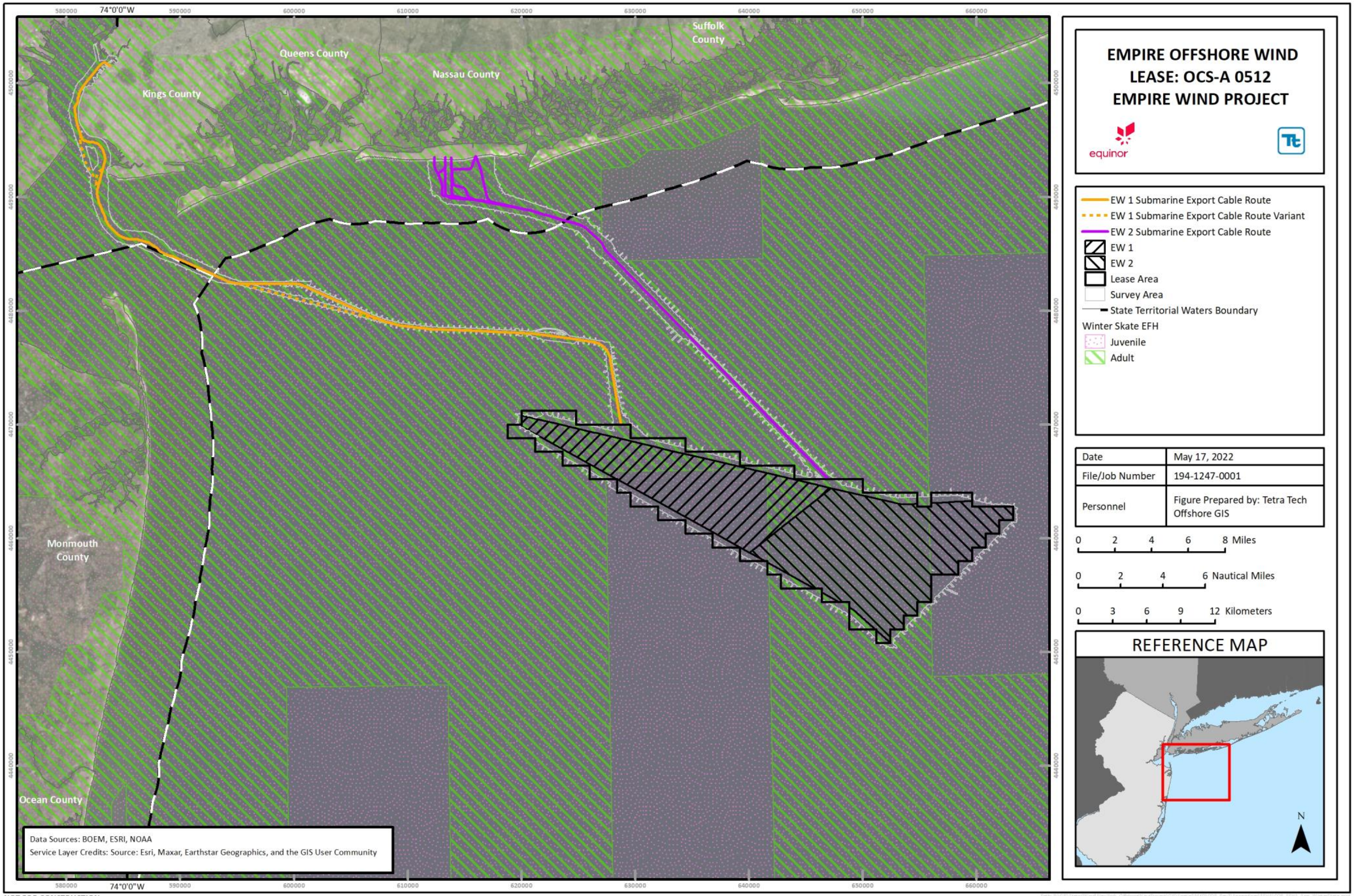

Figure U-1-16 Winter Skate (*Leucoraja ocellata*) Designated EFH in Project Area

U-1.2.17 Witch Flounder (*Glyptocephalus cynoglossus*)

Egg and larval witch flounder EFH are designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-17; Figure U-1-17**). Designated EFH for witch flounder eggs and larvae is pelagic habitats on the continental shelf throughout the Northeast region (NEFMC 2017). Both these early life stages occur in high salinities (Cargnelli et al. 1999b). MARMAP surveys reported witch flounder eggs were most abundant between 39 and 54°F (4 and 12°C) at depths of 164 to 492 ft (50 to 150 m), although eggs also occurred in water as warm as 63°F (17°C) and depths from 33 to 558 ft (10 to 170 m). Larval witch flounder were most abundant between 39 and 55°F (4 and 13°C) in MARMAP surveys with some collections at depths between 98 and 427 ft (30 and 210 m) at temperatures up to 61°F (16°C).

No juvenile witch flounder EFH is designated in the Lease Area or either submarine export cable siting corridor.

Adult witch flounder EFH is designated in the Lease Area (**Table U-1-17; Figure U-1-17**). Adult witch flounder EFH consists of sub-tidal and benthic habitats between 115 and 1,312 ft (35 and 400 m), and as deep as 4,920 ft (1500 m) on the outer continental shelf and slope, over muddy sand substrates (NEFMC 2017). Both adult and juvenile witch flounder occupy temperatures ranging from 32 to 59°F (0 to 15°C) and salinities of 31 to 36 ppt (Cargnelli et al. 1999b).

Table U-1-17 Witch Flounder (*Glyptocephalus cynoglossus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	6,011	0	6,011	0	3,794
Larva	10,593	402	2,995	0	1,101
Juvenile	0	0	0	0	0
Adult	10,427	0	0	0	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	7.6%	0.0%	57.0%	0.0%	14.3%
Larva	13.4%	5.1%	45.0%	0.0%	14.3%
Juvenile	0.0%	0.0%	0.0%	0.0%	0.0%
Adult	13.1%	0.0%	0.0%	0.0%	0.0%
EFH Source Documents: Cargnelli et al. 1999b; NEFMC 2017 and references within					

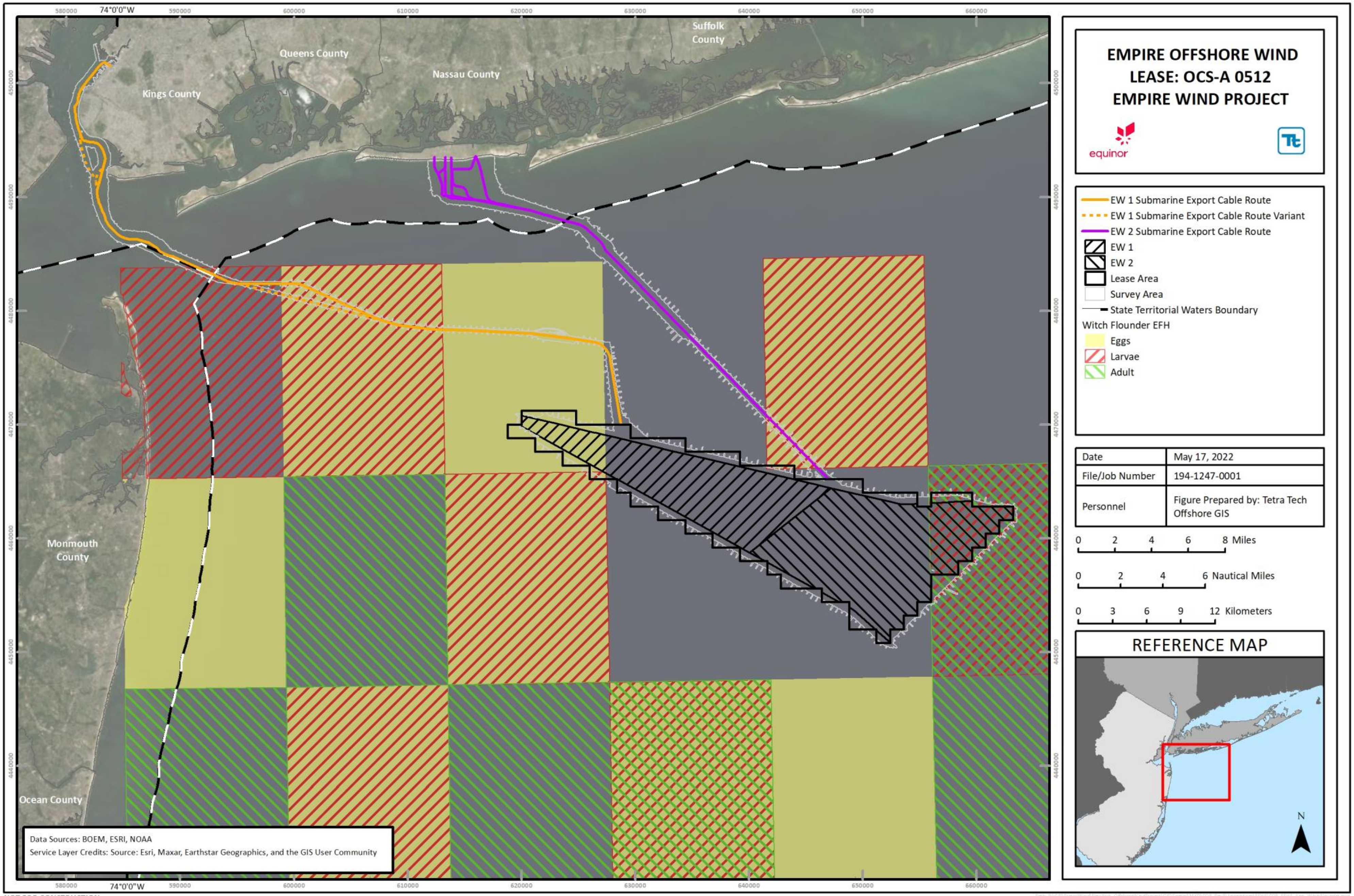

Figure U-1-17 Witch Flounder (*Glyptocephalus cynoglossus*) Designated EFH in Project Area

U-1.2.18 Yellowtail Flounder (*Limanda ferruginea*)

All life stages of yellowtail flounder have EFH designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-18**; **Figure U-1-18**). Yellowtail flounder egg EFH consists of coastal and continental shelf pelagic habitats in the Mid-Atlantic region as far south as the upper Delmarva peninsula (NEFMC 2017) in temperatures ranging from 36 to 59°F (2 to 15°C) and at depths between 33 and 2,460 ft (10 and 750 m). Eggs were most abundant between 98 and 295 ft (30 and 90 m) (Johnson et al. 1999).

Larval EFH consists of coastal marine and continental shelf pelagic habitats from Georges Bank to Cape Hatteras (NEFMC 2017) in temperatures ranging from 41 to 63 ft (5 to 17°C). The larvae make vertical migrations to around 33 ft (10 m) below the sea surface at night and 66 ft (20 m) during the day, although larvae have been reported as deep as 4,100 ft (1,250 m). Larvae are present from March through April in the New York Bight, then move north to Southern New England during the summer (Johnson et al.1999).

Juvenile and adult yellowtail flounder EFH is sub-tidal benthic habitats in coastal waters in the Mid-Atlantic (NEFMC 2017). Juveniles occur on sand and muddy sand between 66 and 262 ft (20 and 80 m) and in the Mid-Atlantic; young-of-the-year juveniles settle to the bottom on the continental shelf primarily at depths of 131 to 230 ft (40 to 70 m) on sandy substrates (Johnson et al.1999). In NEFSC spring bottom trawl surveys, juveniles were collected in water cooler than 52°F (11°C) down to 410 ft (125 m). Fall surveys reported the most juvenile and adult yellowtail flounders in waters from 48 to 55°F (9 to 13°C).

Adult yellowtail flounder occur on sand and sand with mud, shell hash, gravel, and rocky bottoms at depths between 82 and 295 ft (25 and 90 m). Preferred salinities for all life stages of yellowtail flounder are between 32.44 and 33.49 ppt (Johnson et al. 1999). The NEFSC spring bottom trawl survey collected adults at temperatures from 36 to 54°F (2 to 12°C). In autumn surveys, adults were most abundant at temperatures of 46 to 57°F (8 to 14°C). Adults were collected at depths from 49 to 328 ft (15 to 100 m).

Table U-1-18 Yellowtail Flounder (*Limanda ferruginea*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	40,545	410	6,655	0	5,298
Larva	72,317	406	4,667	0	1,539
Juvenile	79,307	7,725	6,655	0	4,620
Adult	79,341	398	6,655	7,880	7,094
Percent of Action Area Covered by EFH by Life Stage					
Egg	51.1%	5.2%	100.0%	0.0%	68.8%
Larva	91.1%	5.2%	70.1%	0.0%	20.0%
Juvenile	100.0%	98.6%	100.0%	0.0%	60.0%
Adult	100.0%	5.1%	100.0%	100.0%	92.1%

EFH Source Documents: Johnson et al. 1999; NEFMC 2017 and references within

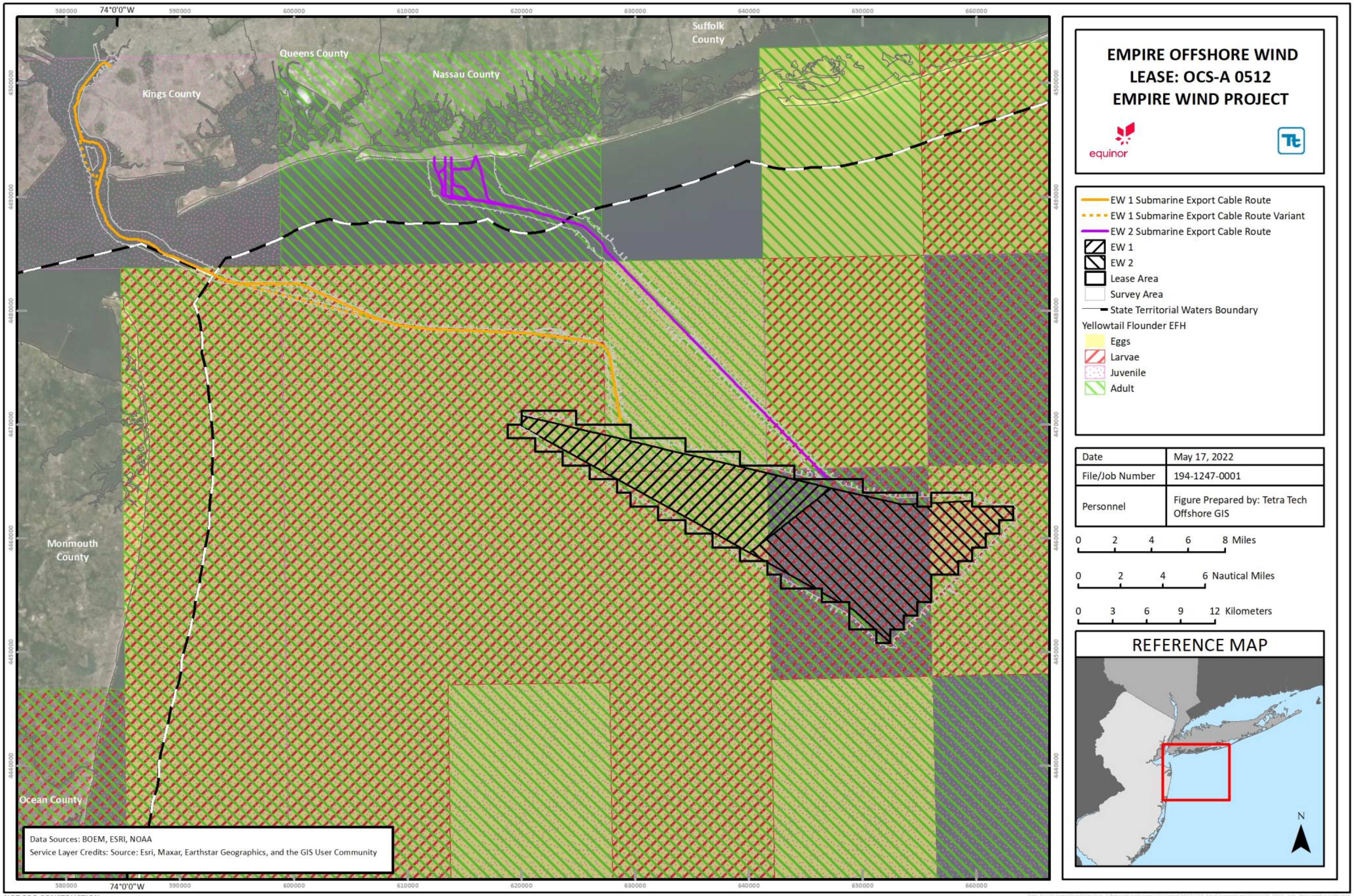

Figure U-1-18 Yellowtail Flounder (*Limanda ferruginea*) Designated EFH in Project Area

U-1.2.19 Atlantic Butterfish (*Peprilus triancanthus*)

Atlantic butterfish egg EFH is designated in the Lease Area and EW 1 submarine export cable siting corridor (**Table U-1-19**; **Figure U-1-19**). Atlantic butterfish egg EFH is pelagic habitats in estuaries and bays from Massachusetts Bay to the south shore of Long Island and on the continental shelf and slope from Georges Bank to Cape Hatteras (MAFMC 2011). Atlantic butterfish egg EFH is designated at depths of 4,920 ft (1,500 m) or less where mean surface water temperatures range from 44 to 71°F (6.5 to 21.5°C). The NEFSC MARMAP ichthyoplankton surveys reported Atlantic butterfish eggs were most abundant at water temperatures between 52 and 63°F (11 and 17°C) (Cross et al. 1999).

Larval Atlantic butterfish EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-19**; **Figure U-1-19**). Larval Atlantic butterfish EFH is pelagic habitat in estuaries and bays from Cape Cod to the Hudson River and on the continental shelf from the Great South Channel to Cape Hatteras. Larval EFH is designated at depths between 135 and 1150 ft (41 and 350 m) where mean surface water temperatures range from 47 to 71°F (8.5 to 21.5°C) (MAFMC 2011). The NEFSC MARMAP ichthyoplankton surveys collected more butterfish larvae in waters 48 to 66°F (9 to 19°C) in depths down to 394 ft (120 m) (Cross et al. 1999).

Table U-1-19 Atlantic Butterfish (*Peprilus triancanthus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	16,268	399	4,667	0	0
Larva	79,206	6,290	3,660	0	5,721
Juvenile	79,341	6,086	6,655	7,880	7,700
Adult	0	4,756	873	713	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	20.5%	5.1%	70.1%	0.0%	0%
Larva	99.8%	80.3%	55.0%	0.0%	74.3%
Juvenile	100.0%	77.7%	100.0%	100.0%	100.0%
Adult	0.0%	60.7%	13.1%	9.0%	0.0%
EFH Source Documents: Cross et al. 1999, MAFMC 2011 and references within					

Juvenile Atlantic butterfish EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-19; Figure U-1-19**). Juvenile Atlantic butterfish EFH is pelagic habitats in estuaries and bays from Massachusetts Bay to Pamlico Sound, North Carolina and on the inner and outer continental shelf from Southern New England to South Carolina (MAFMC 2011). Juvenile EFH ranges from 33 to 920 ft (10 to 280 m) where bottom water temperatures are between 44 and 81°F (6.5 and 27°C) and salinities exceed 5 ppt. Like adult Atlantic butterfish, juveniles are euryhaline and eurythermal, occurring over sand, mud, and mixed substrates (Cross et al. 1999). In the Hudson-Raritan trawl survey, juveniles were collected from the same locations as adults.

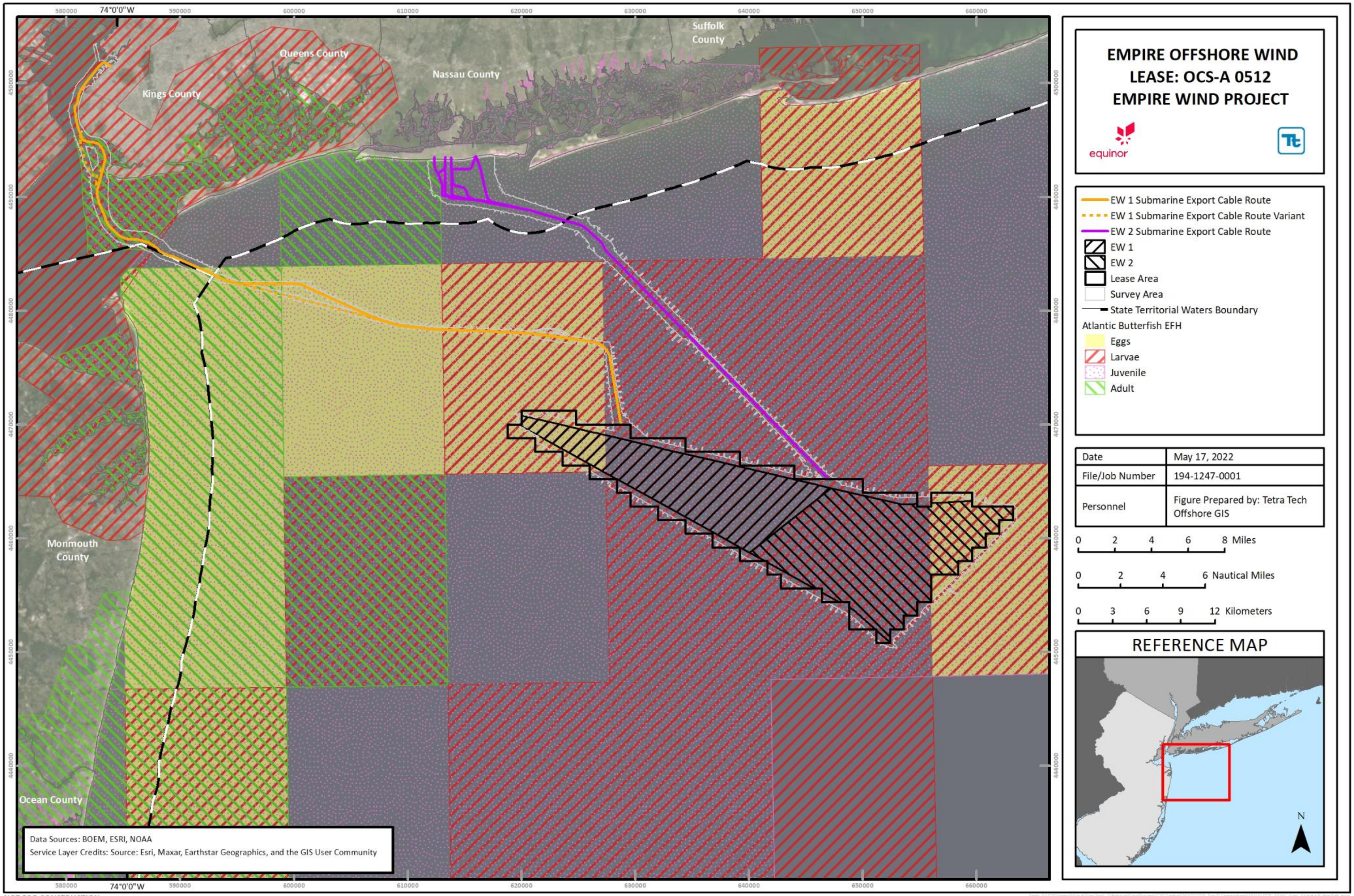

Figure U-1-19 Atlantic Butterfish (*Peprilus triancanthus*) Designated EFH in Project Area

Adult Atlantic butterfish EFH is designated only in both submarine export cable siting corridors (**Table U-1-19; Figure U-1-19**). Adult butterfish EFH is in waters 33 and 820 ft (10 and 250 m) on sand, mud, and mixed substrates (Cross et al. 1999). Adult butterfish tolerate a wide range of temperatures and salinities and begin spawning when temperatures warm to 59°F (15°C). In the Hudson-Raritan trawl survey, adult butterfish were collected at depths of 10 to 75 ft (3 to 23 m), temperatures from 46 to 79°F (8 to 26°C), and salinities between 19 and 32 ppt.

U-1.2.20 Atlantic Mackerel (*Scomber scombrus*)

Atlantic mackerel egg EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-20**; **Figure U-1-20**). Atlantic mackerel egg EFH is pelagic habitats in estuaries and bays from New Hampshire to the south shore of Long Island, New York and on the continental shelf from Georges Bank to Cape Hatteras. Atlantic mackerel egg EFH is designated within this area where depths are 328 ft (100 m) or less and mean surface water temperatures range from 44 to 54.5°F (6.5 to 12.5°C) (MAFMC 2011). NEFSC MARMAP ichthyoplankton surveys reported eggs were most abundant in waters between 45 and 61°F (7 and 16°C) at depths from 98 to 230 ft (30 to 70 m) (Studholme et al. 1999). In April, eggs were most abundant at 33 to 98 ft (10 to 30 m). Peak egg densities moved to deeper waters throughout the summer: 48 to 54°F (9 to 12°C) at 98 to 164 ft (30 to 50 m) in May; 50 to 54°F (10 to 12°C) at 98 to 230 ft (30 to 70 m) in June; and 52 to 73°F (11 to 23°C) at 98 to 230 ft (30 to 70 m) in July and August.

Larval Atlantic mackerel EFH is designated in the Lease Area and both submarine export cable siting corridors. Larval Atlantic mackerel EFH is designated in estuaries and bays from New Hampshire to the south shore of Long Island and on the continental shelf from Georges Bank to Cape Hatteras (MAFMC 2011). Atlantic mackerel larvae typically occur at depths of 69 to 328 ft (21 to 100 m) where mean surface water temperatures are 42 to 53°F (5.5 to 11.5°C). NEFSC MARMAP ichthyoplankton surveys reported peak larval abundance in waters less than 164 ft (50 m) throughout the summer except in July, when the greatest abundance was at 230 ft (70 m) (Studholme et al. 1999).

Juvenile Atlantic mackerel EFH is designated in the Lease Area and both submarine export cable siting corridors. Juvenile EFH is pelagic habitats in estuaries and bays from Maine to the Hudson River and on the continental shelf from Georges Bank to Cape Hatteras. Juveniles occur at depths between 10 and 361 ft (110 m) where water temperatures are 41 to 68°F (5 to 20°C). Juveniles were collected in July otter trawl surveys in the Hudson-Raritan estuary at depths between 16 and 32.2 ft (4.9 and 9.8 m) and water temperatures from 63.7 to 71°F (17.6 to 21.7°C) (Studholme et al. 1999).

Adult Atlantic mackerel EFH is designated in the Lease Area and both submarine export cable siting corridors. Adult Atlantic mackerel EFH is pelagic waters of estuaries and bays from Maine to the Hudson River and on the continental shelf from Georges Bank to Cape Hatteras. Adults occur at depths less than 556 ft (170 m) where temperatures range from 41 to 68°F (5 to 20°C). Adult begin to spawn when temperatures reach 45°F (7°C), with peak spawning occurring between 48 and 57°F (9 and 14°C).

Table U-1-20 Atlantic Mackerel (*Scomber scombrus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	33,528	399	4,667	2,661	1,100
Larva	27,684	399	2,995	2,661	1,100
Juvenile	61,764	4,357	1,672	2,661	1,539
Adult	55,887	4,756	873	2,661	438
Percent of Action Area Covered by EFH by Life Stage					
Egg	42.3%	5.1%	70.1%	33.8%	14.3%
Larva	34.9%	5.1%	45.0%	33.8%	14.3%
Juvenile	77.8%	55.6%	25.1%	33.8%	20.0%
Adult	70.4%	60.7%	13.1%	33.8%	5.7%
EFH Source Documents: Studholme et al. 1999, MAFMC 2011 and references within					

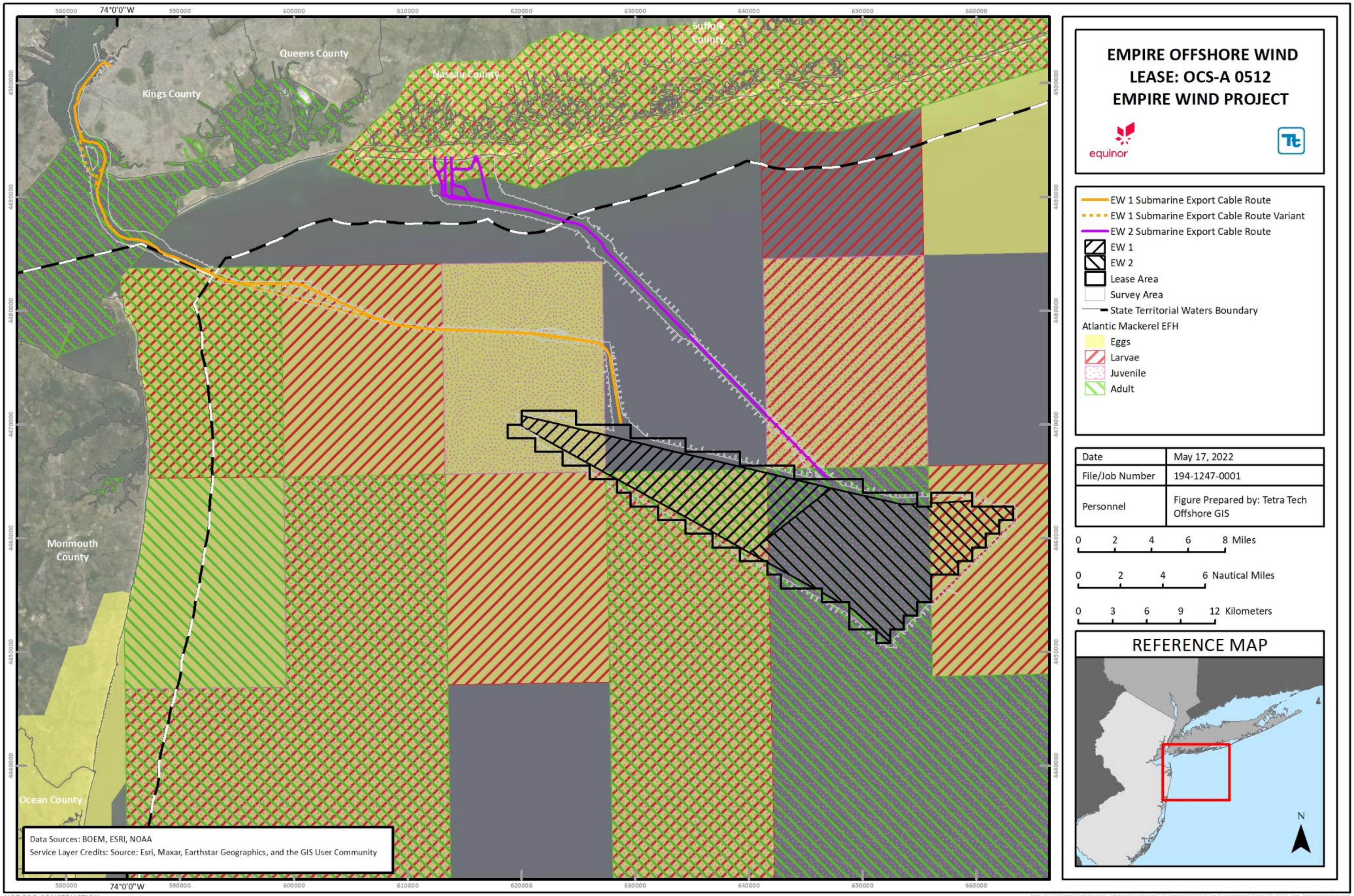

Figure U-1-20 Atlantic Mackerel (*Scomber scombrus*) Designated EFH in Project Area

U-1.2.21 Atlantic Surfclam (*Spisula solidissima*)

No egg or larval Atlantic surfclam EFH is designated in the Lease Area or either submarine export cable siting corridor.

Juvenile and adult Atlantic surfclam EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-21**; **Figure U-1-21**). Adult and juvenile Atlantic surfclam EFH is similar because the age and size at maturity is highly variable (Cargnelli et al. 1999d). Designated EFH is bottom substrate to 3 ft (0.9 m) below the water/sediment interface, within federal and state waters from Maine throughout the Atlantic exclusive economic zone (EEZ), in areas that encompass the top 90 percent of all the ranked ten-minute squares for the area where the surfclam was caught in the NEFSC surfclam and ocean quahog dredge surveys. The Atlantic surfclam is most abundant from the beach zone to 125 ft (38 m), but some individuals occur to 200 ft (60 m) or so. Off the New Jersey coast, the Atlantic surfclam can mature within 3 months of recruiting to the bottom, at a size less than 0.2 inches (5 millimeters) (Cargnelli et al. 1999c). Adults may grow to 8.9 inches (226 millimeters) and live for 31 years. The Atlantic surfclam grows more quickly at higher temperatures, to a point; above 86°F (30°C), burrowing may be inhibited and feeding rate may decrease. Large Atlantic adult surfclams have higher metabolic demands that may not be met by planktonic food sources. Food sources associated with the sea bottom, such as benthic algae and detritus in resuspended sediment, supplement the diets of these large clams (Munroe et al. 2013).

Table U-1-21 Atlantic Surfclam (*Spisula solidissima*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	51,825	0	3,660	0	6,327
Adult	12,896	0	3,660	0	5,889
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	65.3%	0.0%	55.0%	0.0%	82.2%
Adult	16.3%	0.0%	55.0%	0.0%	76.5%
EFH Source Documents: Cargnelli et al. 1999c, MAFMC 1998a, NOAA Fisheries 2018					

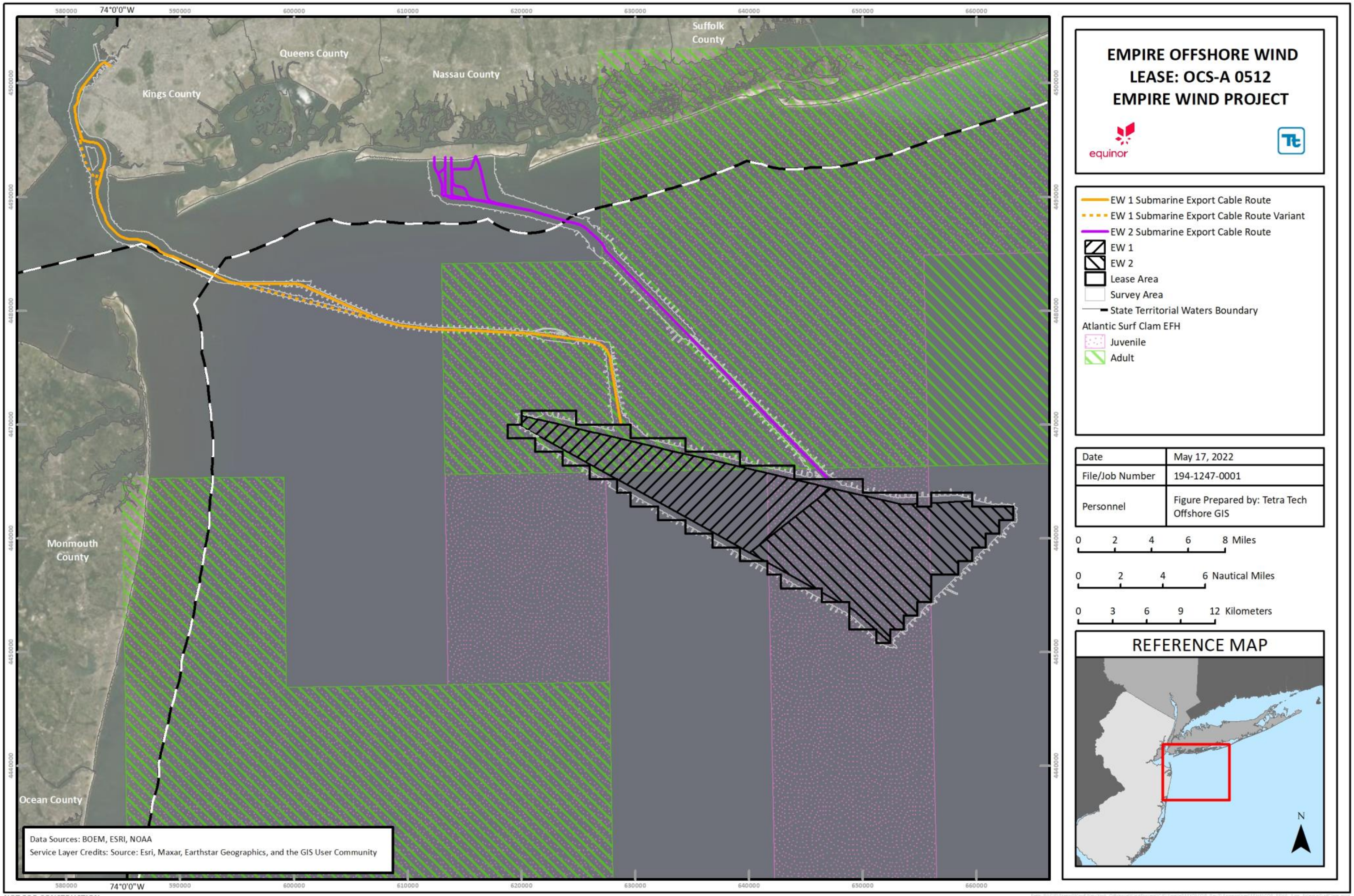

Figure U-1-21 Atlantic Surfclam (*Spisula solidissima*) Designated EFH in Project Area

U-1.2.22 Black Sea Bass (*Centropristis striata*)

No black sea bass egg EFH is designated in the Lease Area or either submarine export cable siting corridor. Larval black sea bass EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-22; Figure U-1-22**). Black sea bass larval EFH is the pelagic waters over the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90 percent of all ranked ten-minute squares of the areas where black sea bass larvae are collected in the MARMAP survey (MAFMC 1998b as cited in NOAA Fisheries 2018). Habitats where larvae transform into juveniles are typically nearshore, including marine estuaries between Virginia and New York. Demersal larvae are associated with structured inshore habitat.

Juvenile black sea bass EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-22; Figure U-1-22**). Inshore, juvenile EFH includes Great South Bay and the Hudson River/Raritan Bay estuaries. Offshore, juvenile black sea bass EFH is the demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all ranked ten-minute squares of the area where juveniles are collected in the NEFSC trawl survey (MAFMC 1998b as cited in NOAA Fisheries 2018). Juvenile black sea bass occur in estuaries and coastal areas between Massachusetts and Virginia in summer and spring where salinities exceed 18 ppt and waters have warmed to at least 43°F (6°C). Juvenile black sea bass associate with rough bottoms, shellfish and eelgrass beds, and artificial structures on sand and shell bottoms. In the Hudson-Raritan estuary spring and fall trawl surveys, juveniles were collected at temperatures between 43 and 73°F (6 and 23°C) at approximately 33 ft (10 m) where salinities were greater than 20 ppt (Steimle et al. 1999d). Additionally, juveniles were collected in some urbanized areas such as oyster beds near Staten Island, eelgrass beds near Brooklyn, and near red beard sponge beds in the Hudson-Raritan estuary.

Table U-1-22 Black Sea Bass (*Centropristis striata*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	33	0	2,122	0	1,100
Juvenile	24,243	398	4,983	7,880	5,556
Adult	51,656	2,644	6,655	7,168	6,600
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	31.9%	0.0%	14.3%
Juvenile	30.6%	5.1%	74.9%	100.0%	72.1%
Adult	65.1%	33.8%	100.0%	91.0%	85.7%

EFH Source Documents: Steimle et al. 1999d, MAFMC 1998b, NOAA Fisheries 2018

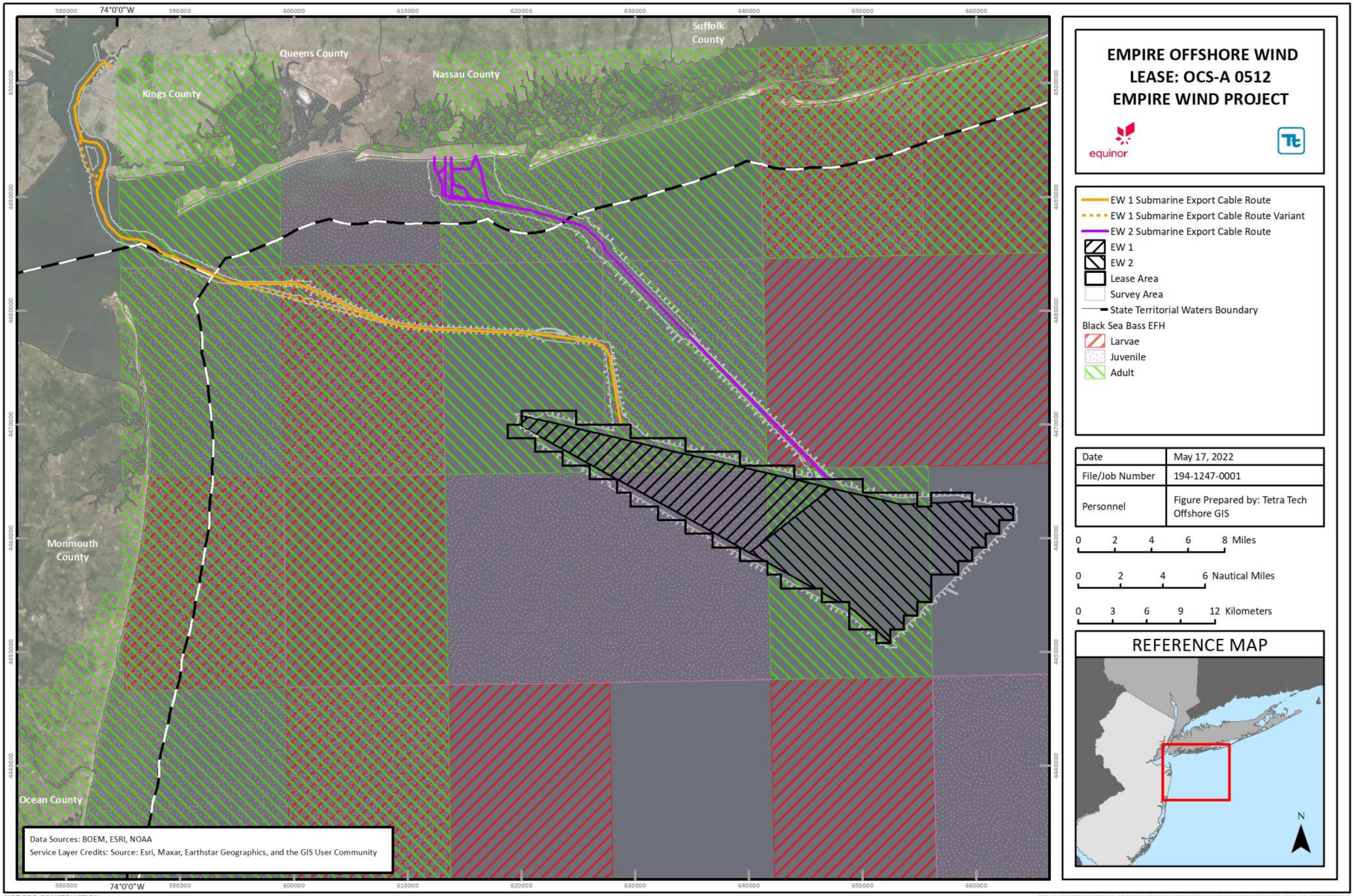

Figure U-1-22 Black Sea Bass (*Centropristis striata*) Designated EFH in Project Area

Adult black sea bass EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-22**; **Figure U-1-22**). Adult black sea bass EFH is inshore estuaries where adults were identified as common, abundant, or highly abundant in the Estuarine Living Marine Resources database for "mixing" and "seawater" salinity zones. Black sea bass occur in estuaries from May through October in natural and artificial structured habitats; adults are often associated with sand and shell bottoms. Adults are rarely collected in waters colder than 43°F (6°C) (MAFMC 1998b as cited in NOAA Fisheries 2018). In the Hudson-Raritan estuary spring trawl surveys, adult black sea bass were collected at bottom temperatures between 6 and 18°C, depths from 23 to 154 ft (7 to 47 m), and salinities from 25 to 30 ppt (Steimle et al 1999d). Offshore, adult black sea bass EFH is the waters over the continental shelf from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all ranked ten-minute squares of the area where juveniles were collected in the NEFSC trawl survey (MAFMC 1998b as cited in NOAA Fisheries 2018). Inshore, adult EFH includes Great South Bay and the Hudson River/Raritan Bay estuaries.

U-1.2.23 Bluefish (*Pomatomus saltatrix*)

Bluefish egg EFH is designated in the Lease Area and both submarine export cable siting corridor (**Table U-1-23; Figure U-1-23**). Bluefish egg EFH is waters over the continental shelf at mid-shelf depths from Montauk Point, New York to Cape Hatteras, North Carolina in the highest 90 percent of the areas where bluefish eggs were collected in the MARMAP surveys (MAFMC 1998c as cited in NOAA Fisheries 2018). Eggs are generally collected between April and August in temperatures greater than 64°F (18°C) in normal shelf salinities greater than 31 ppt. At least three separate cohorts of bluefish spawn independently in spring, summer, and fall, resulting in a prolonged spawning season (ASMFC 2019). No inshore EFH has been designated for bluefish eggs because for spawning to occur higher salinity is required; a limited area of EFH occurs at the mouth of Raritan Bay. During NEFSC MARAP surveys from May to August, bluefish eggs were collected in near-surface temperatures between 46 and 79°F (8 and 26°C) (Shepherd and Packer 2006). All eggs collected in May were in waters of 72°F (22°C), while most collected in June were in waters between 55 and 63°F (13 and 17°C). Eggs were most abundant in July (57 to 79°F [14 to 26°C]) and August (72°F [22°C]). The depth range for all eggs was 98 to 230 ft (30 to 70 m) (median depth 98 ft [30 m]).

Larval bluefish EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-23; Figure U-1-23**). Larval EFH is in pelagic waters over the continental shelf, most commonly deeper than 49 ft (15 m), from Montauk Point, New York south to Cape Hatteras in the highest 90 percent of the areas where bluefish eggs were collected in the MARMAP surveys (MAFMC 1998c as cited in NOAA Fisheries 2018). There is no inshore EFH designation for larvae; a small area of larval EFH is designated near the mouth of the bay. Larvae are collected from April through September in temperatures greater than 64°F (18°C) and in normal shelf salinities greater than 30 ppt. Larvae collected in NEFSC MARMAP surveys from May to September were most concentrated at surface temperatures between 63 and 79°F (17 and 26°C) in depths of 98 to 230 ft (30 to 70 m) (Shepherd and Packer 2006). Limited observations have been reported in the New York Bight, supporting the view that temperatures below 55 to 59°F (13 to 15°C) impede the progress of the larval stages into Mid Atlantic Bight estuaries.

Juvenile bluefish EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-23**; **Figure U-1-23**). Juvenile bluefish EFH is pelagic waters over the continental shelf from Nantucket Island, Massachusetts southward to Cape Hatteras, in the highest 90 percent of the area where juvenile bluefish are collected in the NEFSC trawl survey, as well as all major estuaries between Maine and Florida (MAFMC 1998c as cited in NOAA Fisheries 2018). In NEFSC Hudson-Raritan estuary trawl surveys, juvenile bluefish were collected in waters from 54 to 75°F (12 to 24°C), depths between 16 and 66 ft (5 and 20 m), and salinities from 19 to 32 ppt. Peak juvenile abundance was at salinities between 20 and 29 ppt (Shepherd and Packer 2006). Young-of-the-year juvenile bluefish rear along estuarine and ocean beaches in New York and New Jersey for up to 60 days during summer months to optimize growth before migrating south in the fall (Manderson et al. 2014; Wuenschel et al. 2012).

Adult bluefish EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-23**; **Figure U-1-23**). Adult bluefish EFH is pelagic waters over the continental shelf from Massachusetts to Cape Hatteras, in the highest 90 percent of the area where adult bluefish were collected in the NEFSC trawl survey (NOAA Fisheries 2018). Inshore, adult EFH is all major estuaries between Penobscot Bay, Maine, and St. Johns River, Florida; in the Mid-Atlantic bluefish occur in estuaries from April through October. The adult bluefish is migratory, and distribution varies by size and season. Adult bluefish prefer salinities greater than 25 ppt (NOAA Fisheries 2018) and temperatures warmer than 57°F (14°C) (Shepherd and Packer 2006).

Table U-1-23 Bluefish (*Pomatomus saltatrix*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	167	398	873	0	1,101
Larva	38,962	398	2,995	0	1,539
Juvenile	12,862	7,831	6,655	7,880	6,162
Adult	79,341	7,832	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.2%	5.1%	13.1%	0.0%	14.3%
Larva	49.1%	5.1%	45.0%	0.0%	20.0%
Juvenile	16.2%	100.0%	100.0%	100.0%	80.0%
Adult	100.0%	100.0%	100.0%	100.0%	100.0%
EFH Source Documents: Shepherd and Packer 2006, MAFMC 1998c, NOAA Fisheries 2018					

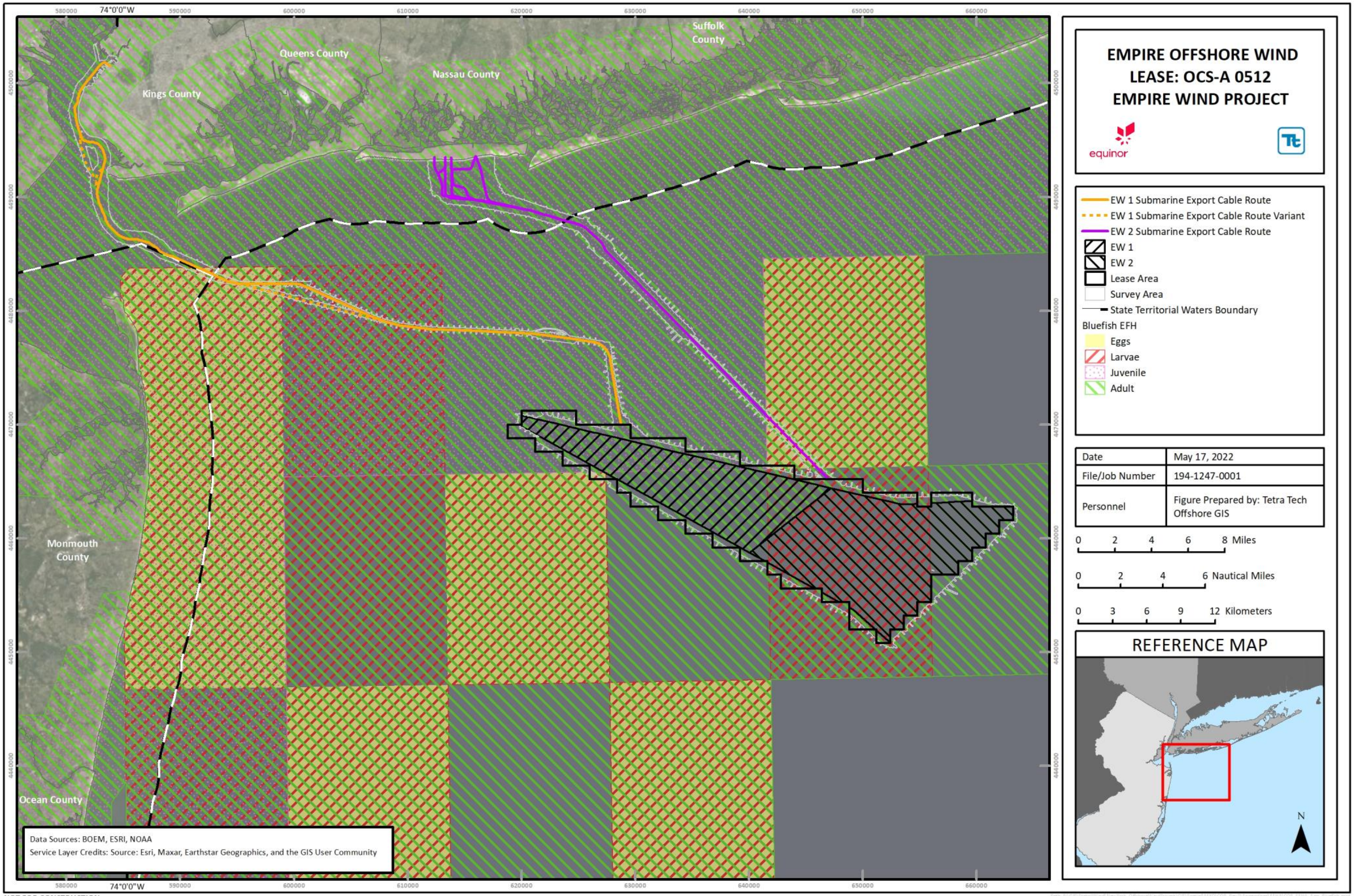

Figure U-1-23 Bluefish (*Pomatomus saltatrix*) Designated EFH in Project Area

U-1.2.24 Longfin Inshore Squid (*Doryteuthis [Amerigo] pealeii*)

Longfin inshore squid egg EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-24; Figure U-1-24**). Longfin inshore squid egg EFH occurs in inshore and offshore bottom habitats from Georges Bank to Cape Hatteras where bottom temperatures are between 50 and 73°F (10 and 23°C), salinities are between 30 and 32 ppt, and at depths less than 164 ft (50 m) (MAFMC 2011). Eggs have also been collected in bottom trawls in deeper water at various places on the continental shelf. Egg masses, or "mops," are demersal and anchored to the substrates on which they are laid including a variety of hardbottom types (shells, lobster pots, piers, fish traps, boulders, and rock), submerged vegetation, sand, and mud.

No larval longfin inshore squid EFH is designated in the Lease Area or either submarine export cable siting corridor.

Juvenile longfin inshore squid EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-24**; **Figure U-1-24**). Pre-recruit/juvenile and recruit/adult EFH is pelagic inshore waters in bays such as Raritan Bay and offshore continental shelf waters from Georges Bank to South Carolina and (MAFMC 2011). Pre-recruit/juvenile longfin inshore squid EFH is designated at depths between 20 and 525 ft (6 and 160 m) where bottom water temperatures range from 47 to 76°F (8.5 to 24.5°C) and salinities are between 28.5 and 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 up into the water column at night and down during the day. Longfin inshore squid pre-recruits/juveniles were collected almost exclusively in the eastern portion of the Hudson-Raritan estuary during spring, summer, and fall surveys. Abundance peaked in the summer and autumn at temperatures between 61 and 68°F (16 and 20°C) at depths of 46 to 49 ft (14 to 15 m), and in salinities of 30 ppt (Cargnelli et al. 1999c).

Table U-1-24 Longfin Inshore Squid (*Doryteuthis [Amerigo] pealeii*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	12,866	7,832	6,655	2,877	4,788
Larva	0	0	0	0	0
Juvenile	79,308	400	4,533	2,661	4,662
Adult	66,317	400	873	0	439
Percent of Action Area Covered by EFH by Life Stage					
Egg	16.2%	100%	100.0%	36.5%	62.2%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	100.0 %	5.1%	68.1%	33.8%	60.0%
Adult	83.6%	5.1%	13.1%	0.0%	5.7%
EFH Source Documents: Cargnelli et al. 1999c, MAFMC 2011 and references within					

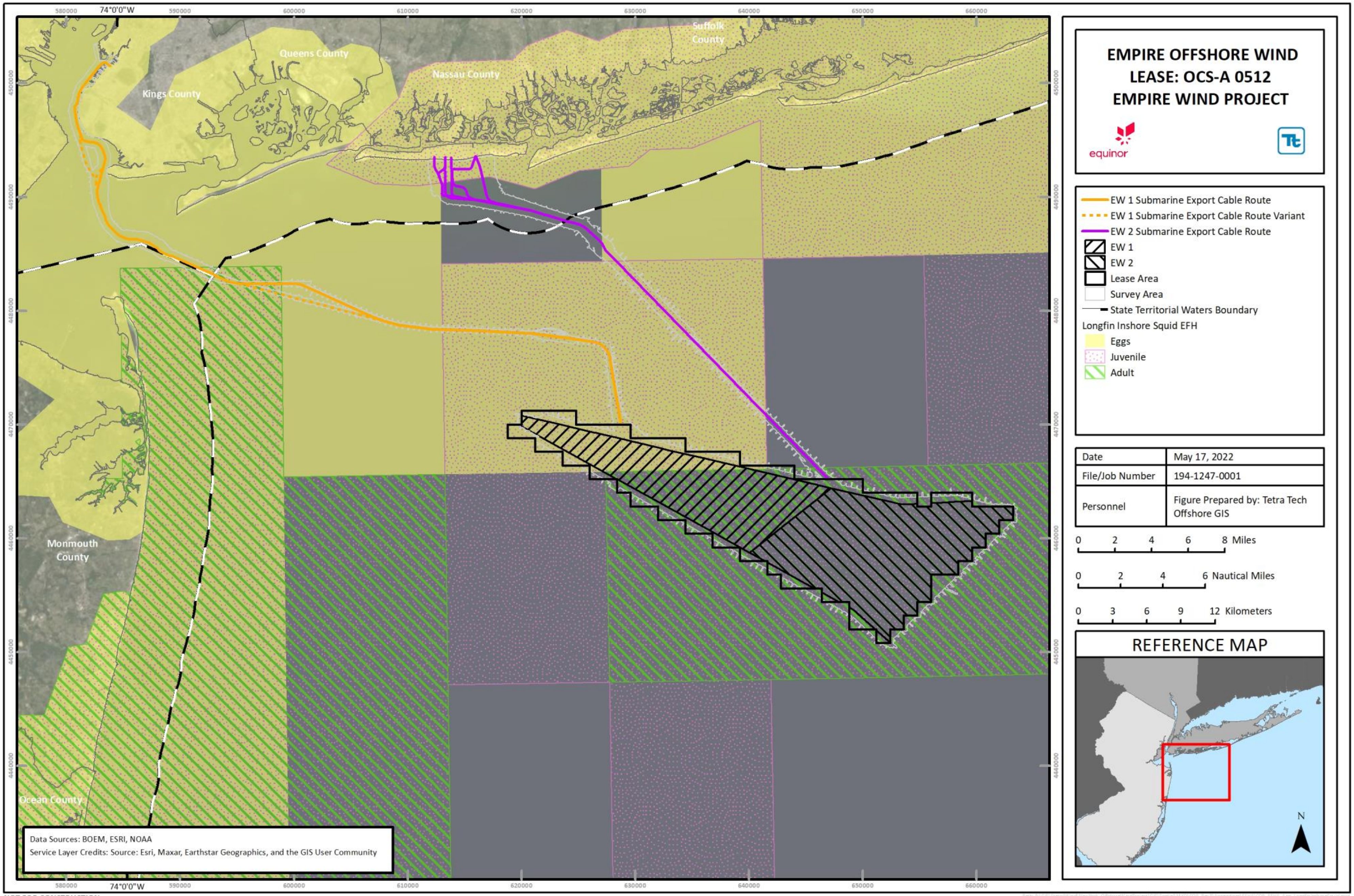

Figure U-1-24 Longfin Inshore Squid (*Doryteuthis [Amerigo] pealeii*) Designated EFH in Project Area

Adult longfin inshore squid EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-24**; **Figure U-1-24**). EFH for recruit/adult longfin inshore squid is generally found over bottom depths between 20 and 656 ft (6 and 200 m) where bottom water temperatures range from 47 to 57°F (8.5 to 14°C) and salinities ranging from 24 to 36.5 ppt (MAFMC 2011). Recruits inhabit the continental shelf and upper continental slope to depths of 1,312 ft (400 m) and migrate offshore in the fall and overwinter in warmer waters along the edge of the shelf. During spring, summer, and fall, adults/recruits were collected in the Hudson-Raritan estuary surveys (Cargnelli et al. 1999c). Highest catches occurred in summer and autumn, and nearly all were collected in the eastern portion of the bay. Adults were most abundant at temperatures between 54 and 63°F (12 and 17°C) in depths ranging from 49 to 59 ft (15 to 18 m) and salinities of 30 ppt.

U-1.2.25 Ocean Quahog (*Arctica islandica*)

No egg or larval ocean quahog EFH is designated in the Lease Area or either submarine export cable siting corridor.

Adult and juvenile ocean quahog EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-25**; **Figure U-1-25**). Adult and juvenile ocean quahog EFH is from the sediment surface to a depth of 3 ft (0.9 m) below the water/sediment interface, within federal waters from Maine throughout the Atlantic EEZ, in areas that encompass the top 90 percent of all the ranked ten-minute squares for the area where ocean quahogs were caught in the NEFSC surfclam and ocean quahog dredge surveys (MAFMC 1998a). Distribution of ocean quahog in the western Atlantic ranges from 30 ft (9 m) to about 800 ft (244 m). The ocean quahog rarely occurs where bottom temperatures exceed 60°F (15.5°C) and may move farther offshore in search of cooler waters. Juvenile ocean quahogs in the Mid-Atlantic Bight are more common between 148 and 246 ft (45 and 75 m); they can survive temperatures as high as 68°F (20°C) and as low as 34°F (1°C) (Cargnelli et al. 1999d). Adult ocean quahog collected in NEFSC trawl surveys were most abundant from Long Island to the Delmarva Peninsula in waters ranging from 42 to 61°F (6 to 16°C).

Table U-1-25 Ocean Quahog (*Arctica islandica*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	55,199	0	1,672	0	438
Adult	62,252	399	6,655	0	5,721
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	69.6%	0.0%	25.1%	0.0%	5.7%
Adult	78.5%	5.1%	100.0%	0.0%	74.3%
EFH Source Documents: Cargnelli et al. 1999d, MAFMC 1998a, NOAA Fisheries 2018					

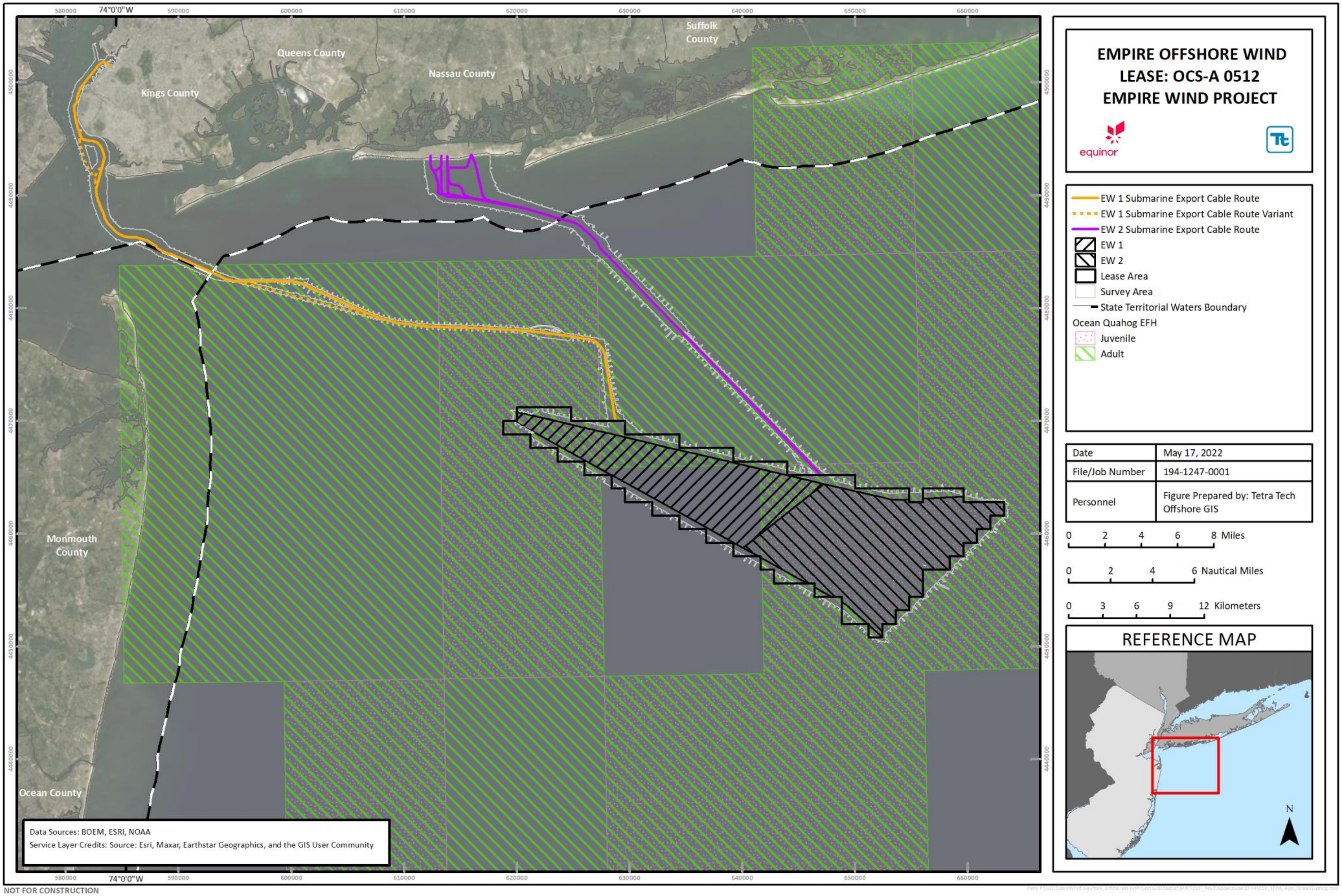

Figure U-1-25 Ocean Quahog (*Arctica islandica*) Designated EFH in Project Area

U-1.2.26 Scup (*Stenotomus chrysops*)

Scup egg and larval EFH is designated only in the EW 1 submarine export cable siting corridor (**Table U-1-26; Figure U-1-26**). Scup eggs and larvae EFH are estuaries where scup eggs were identified as common, abundant, or highly abundant in the Estuarine Living Marine Resources database for "mixing" and "seawater" salinity zones, including the Hudson River/Raritan Bay estuary. Egg and larval EFH are identical. Both egg and larval life stages generally occur in waters between 55 and 74°F (12.7 and 22.7°C) and salinities greater than 15 ppt. Scup eggs are most abundant from Southern New England to coastal Virginia in later spring and summer (May through August). Scup larvae are most abundant in this area from May through September. The NEFSC MARMAP surveys reported a peak in scup larval abundance at 63°F (17°C) in waters less than 164 ft (50 m) (Steimle et al. 1999e). Within the Project Area, egg and larval EFH is designated only within the Lower Bay.

Juvenile scup EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-26; Figure U-1-26**). Juvenile scup EFH is identical to adult EFH. Juveniles generally occur in summer and spring in estuaries and bays between Virginia and Massachusetts in association with sands, mud, mussel and eelgrass beds where water temperatures are warmer than 45°F (7°C) and salinities exceed 15 ppt (MAFMC 1998b as cited in NOAA Fisheries 2018). In the Hudson-Raritan estuary, juveniles were collected at temperatures between 48 and 79°F (9 and 26°C) in salinities ranging from 18 to 33 ppt (Steimle et al. 1999e). In Raritan Bay, juveniles were most abundant at depths from 16 to 39 ft (5 to 12 m).

Table U-1-26 Scup (*Stenotomus chrysops*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	4,357	0	0	0
Larva	0	4,357	0	0	0
Juvenile	79,341	6,083	6,655	7,880	7,700
Adult	79,341	6,083	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	55.6%	0.0%	0.0%	0.0%
Larva	0.0%	55.6%	0.0%	0.0%	0.0%
Juvenile	100.0%	77.7%	100.0%	100.0%	100.0%
Adult	100.0%	77.7%	100.0%	100.0%	100.0%
EFH Source Documents: Steimle et al. 1999e; MAFMC 1998b, NOAA Fisheries 2018					

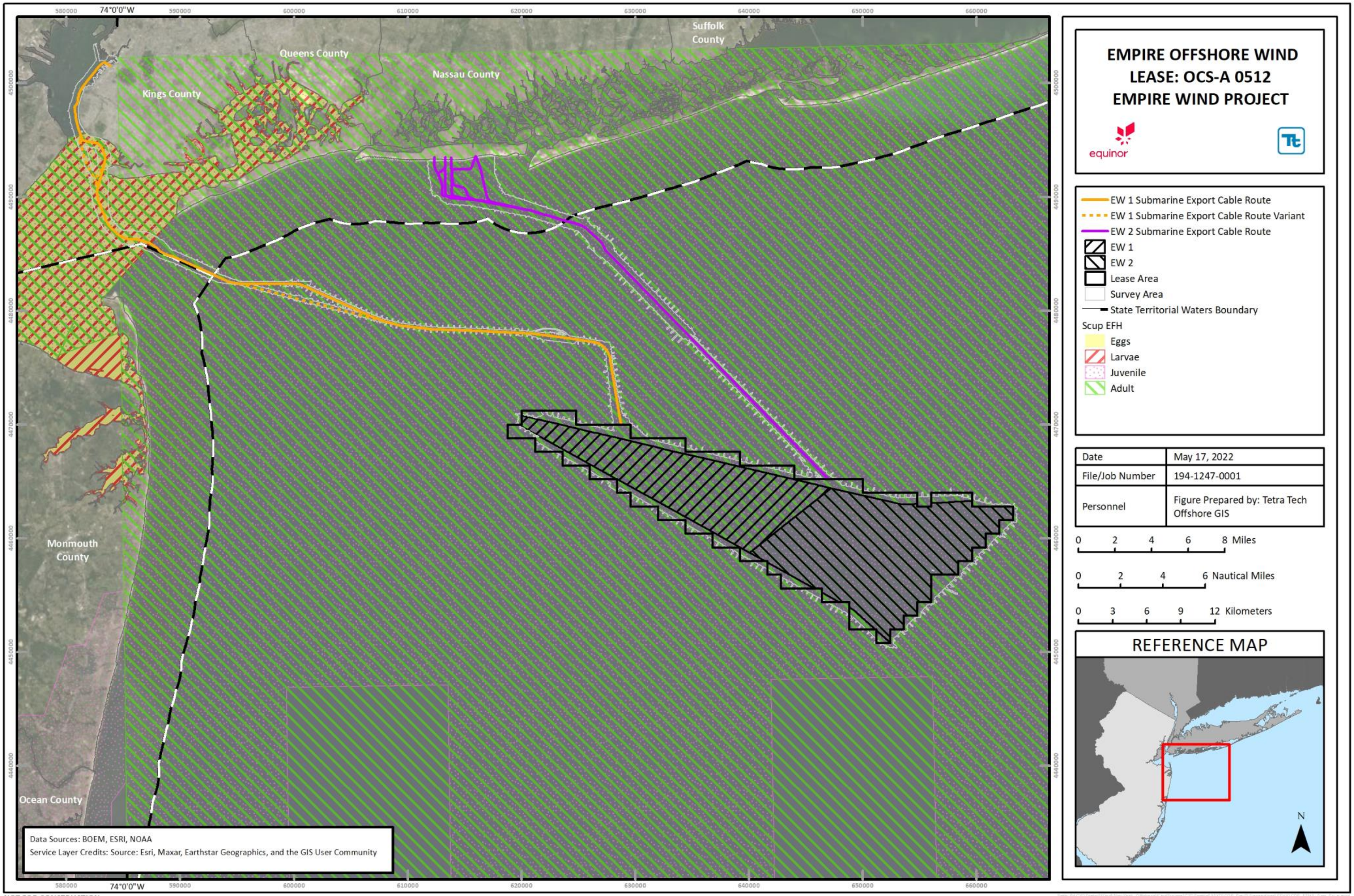

Figure U-1-26 Scup (*Stenotomus chrysops*) Designated EFH in Project Area

Adult scup EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-26**; **Figure U-1-26**). Offshore, adult scup EFH is the waters over the continental shelf from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all ranked ten-minute squares of the area where juvenile scup is collected in the NEFSC trawl surveys (MAFMC 1998b as cited in NOAA Fisheries 2018). Inshore, adult EFH includes Great South Bay and the Hudson River/Raritan Bay estuaries. Adult scup generally winter offshore south of New York from November through April (MAFMC 1998b as cited in NOAA Fisheries 2018). In the Hudson-Raritan estuary, adults were collected at salinities ranging from 20 to 31 ppt (Steimle et al. 1999e).

U-1.2.27 Spiny Dogfish (*Squalus acanthias*)

Sub-adult female and adult female spiny dogfish EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-27**; **Figure U-1-27**). Adult male EFH is designated only in the two submarine export cable siting corridors. Adult and sub-adult spiny dogfish EFH is pelagic and epibenthic habitats throughout the region over a wide range of depths in full seawater (32 to 35 ppt) where bottom temperatures range from 45 to 59°F (7 to 15°C) (MAFMC 2014). Adults and sub-adult females are widely distributed throughout the Mid-Atlantic area in winter and spring when waters are relatively cool, but few remain in the region after temperatures rise above 59°F (15°C) in summer and fall. Designated EFH for sub-adult males is restricted to deeper waters outside the Project Area.

Table U-1-27 Spiny Dogfish (*Squalus acanthias*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Sub-Adult Female	38,796	396	873	7,619	1,818
Adult Female	66,299	396	873	0	437
Adult Male	0	396	873	7,619	1,381
Percent of Action Area Covered by EFH by Life Stage					
Sub-Adult Female	48.9%	5.1%	13.1%	96.7%	23.6%
Adult Female	83.6%	5.1%	13.1%	0.0%	5.7%
Adult Male	0.0%	5.1%	13.1%	96.7%	17.9%
EFH Source Documents: Chang et al. 1999a; NEFMC 2017 and references within					

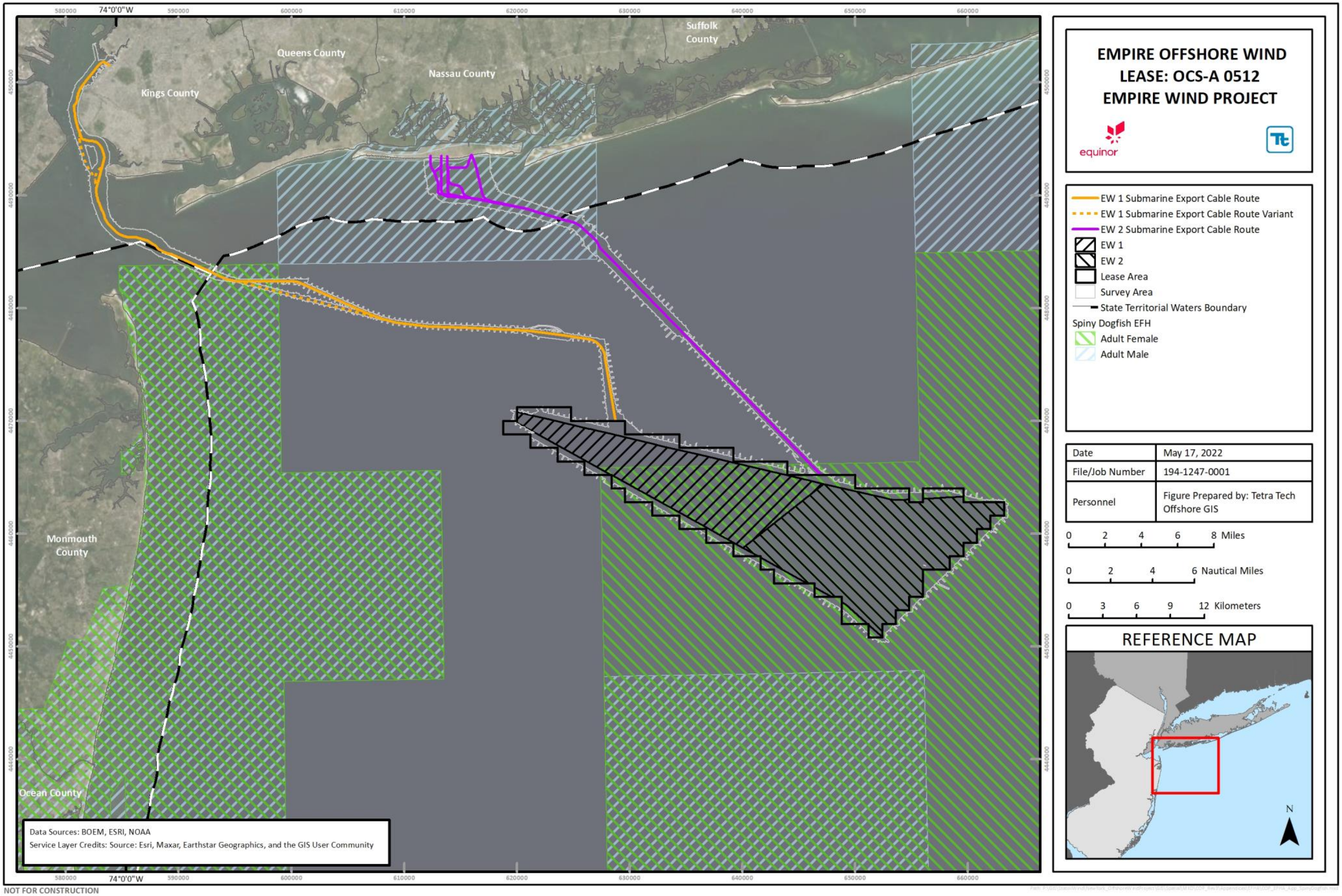

Figure U-1-27 Spiny Dogfish (*Squalus acanthias*) Designated EFH in Project Area

U-1.2.28 Summer Flounder (*Paralichthys denatus*)

Summer flounder egg EFH is designated in the Lease Area and the EW 2 submarine export cable siting corridor (**Table U-1-28; Figure U-1-28**). EFH for summer flounder eggs is the pelagic waters over the continental shelf from the Gulf of Maine to Cape Hatteras in the highest 90 percent of all the ranked ten-minute squares for the area where respective summer flounder life stages were collected in the MARMAP survey (MAFMC 1998b as cited in NOAA Fisheries 2018). The heaviest concentration of eggs was reported between October and May within 9 miles (14.5 km) of the New York shoreline at depths of 30 to 360 ft (9 to 110 m). The NEFSC MARMAP ichthyoplankton surveys from 1978-1987 collected summer flounder eggs in waters between 34 and 73°F (1 and 23°C); peak abundances were in the fall at temperatures between 57 and 63°F (14 and 17°C) (Packer et al. 1999).

Larval summer flounder EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-28; Figure U-1-28**). Summer flounder larval EFH is the pelagic waters of the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90 percent of all the ranked ten-minute squares for the areas where summer flounder larvae were collected in the MARMAP survey (MAFMC 1998b as cited in NOAA Fisheries 2018). Larvae are most abundant 12 to 50 miles (19 to 80 km) from shore at depths of 30 to 230 ft (9 to 70 m). Larvae are more common in the northern Mid-Atlantic from September through February and in the southern Mid-Atlantic Bight from November to May. Larvae tolerate temperatures from 32 to 73°F (0 to 23°C) but are most abundant between 48 and 64°F (9 and 18°C) (Packer et al. 1999).

Juvenile summer flounder EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-28**; **Figure U-1-28**). Juvenile EFH is the waters over the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90 percent of all the ranked ten-minute squares for the area where juveniles are collected in the NEFSC trawl survey (MAFMC 1998b as cited in NOAA Fisheries 2018). Juveniles use inshore estuarine habitats such as salt marsh creeks, seagrass beds, mudflats, and open bay areas, including Great South Bay and the Hudson River/Raritan Bay, as nursery areas when temperatures exceed 36.5°F (2.5°C) and salinities are between 10 and 30 ppt. In the Hudson-Raritan estuary trawl surveys, juveniles were present in small numbers throughout all seasons with slightly elevated abundance in spring (Packer et al. 1999).

Adult summer flounder EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-28**; **Figure U-1-28**). Adult summer flounder EFH is the waters over the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90 percent of all the ranked ten-minute squares for the area where adults ware collected in the NEFSC trawl survey (MAFMC 1998b as cited in NOAA Fisheries 2018). In general, adults inhabit shallow coastal and estuarine waters, including Great South Bay and the Hudson River/Raritan Bay, during warmer months and migrate offshore to the outer continental shelf to depths of 498 ft (152 m) in colder months. In the Hudson-Raritan estuary trawl surveys, adults were present in all seasons except winter (Packer et al. 1999). The highest abundances were collected in deeper waters of the Raritan Channel in the fall, in Sandy Hook Bay in the spring, and in Raritan and Chapel Hill Channels and Raritan and Sandy Hook Bays in the summer.

Table U-1-28 Summer Flounder (*Paralichthys denatus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	167	0	0	0	1,101
Larva	72,321	6,290	3,794	0	1,539
Juvenile	13,001	7,832	6,655	7,880	6,162
Adult	79,341	7,832	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.2%	0.0%	0.0%	0.0%	14.3%
Larva	91.2%	80.3%	57.0%	0.0%	20.0%
Juvenile	16.4%	100.0%	100.0%	100.0%	80.0%
Adult	100.0%	100.0%	100.0%	100.0%	100.0%
EFH Source Documents: Packer et al. 1999; MAFMC 1998b; NOAA Fisheries 2018					

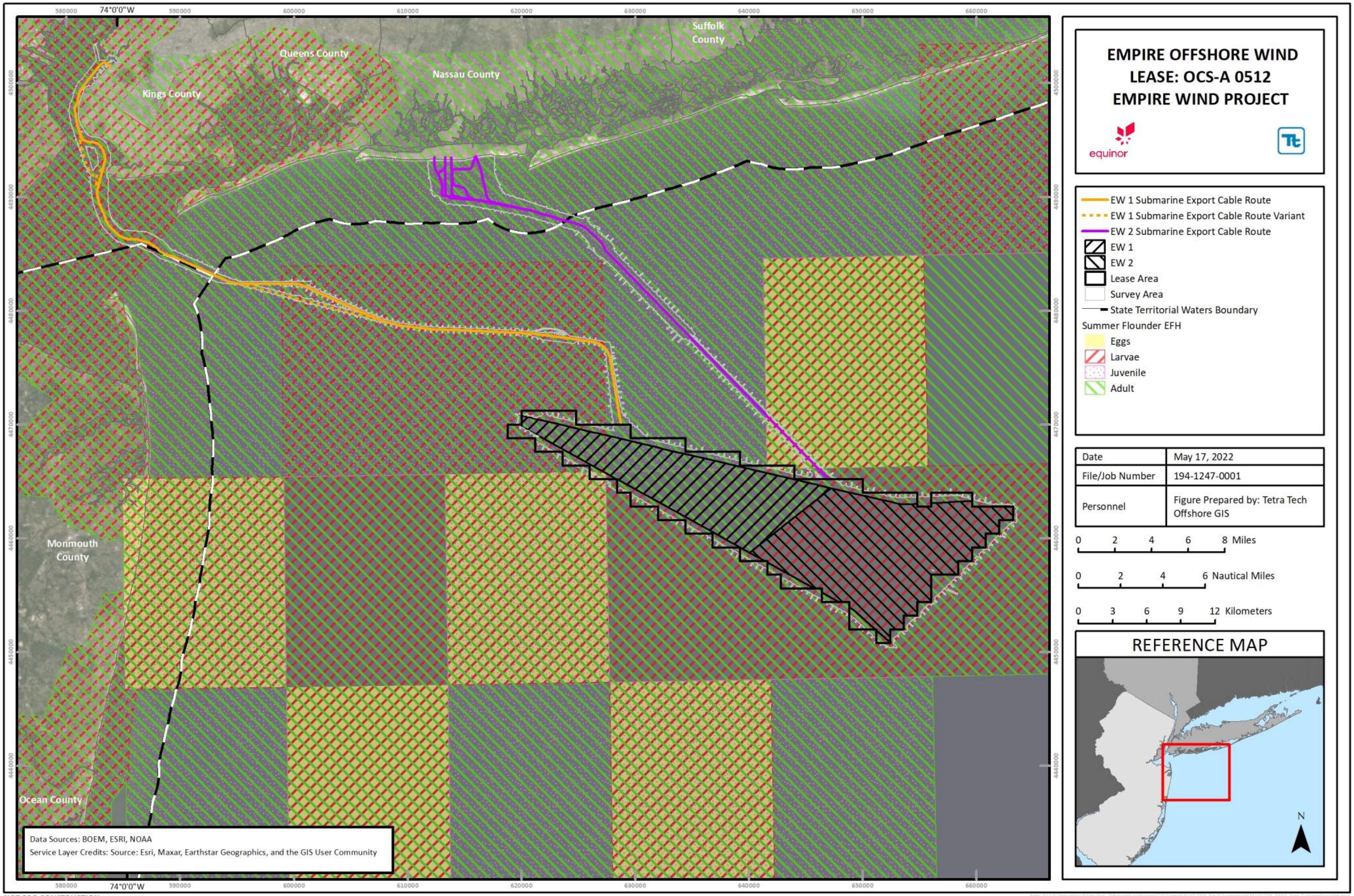

Figure U-1-28 Summer Flounder (*Paralichthys denatus*) Designated EFH in Project Area

U-1.2.29 Atlantic Albacore Tuna (*Thunnus alalonga*)

No egg, larval, or adult Atlantic albacore tuna EFH is designated in the Lease Area or either submarine export cable siting corridor.

Juvenile Atlantic albacore tuna EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-29**; **Figure U-1-29**). Designated EFH for juvenile albacore tuna includes nearshore pelagic habitats from Cape Hatteras to Cape Cod out several miles into deeper waters. The Atlantic albacore tuna is an epipelagic, oceanic species generally associated with surface water temperatures between 60.1 and 66.9°F (15.6 and 19.4°C), although larger individuals have a wider depth and temperature range (NOAA Fisheries 2017). This species travels in groups of similarly-sized individuals that may include other tuna species. Adults are reported to spawn in the spring and summer near the Sargasso Sea in the western tropical Atlantic, although little is known about this part of the life cycle (NOAA Fisheries 2017).

Table U-1-29 Atlantic Albacore Tuna (*Thunnus alalonga*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	78,277	0	1,619	0	3,767
Adult	0	0	0	0	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	98.7%	0.0%	24.3%	0.0%	48.9%
Adult	0.0%	0.0%	0.0%	0.0%	0.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

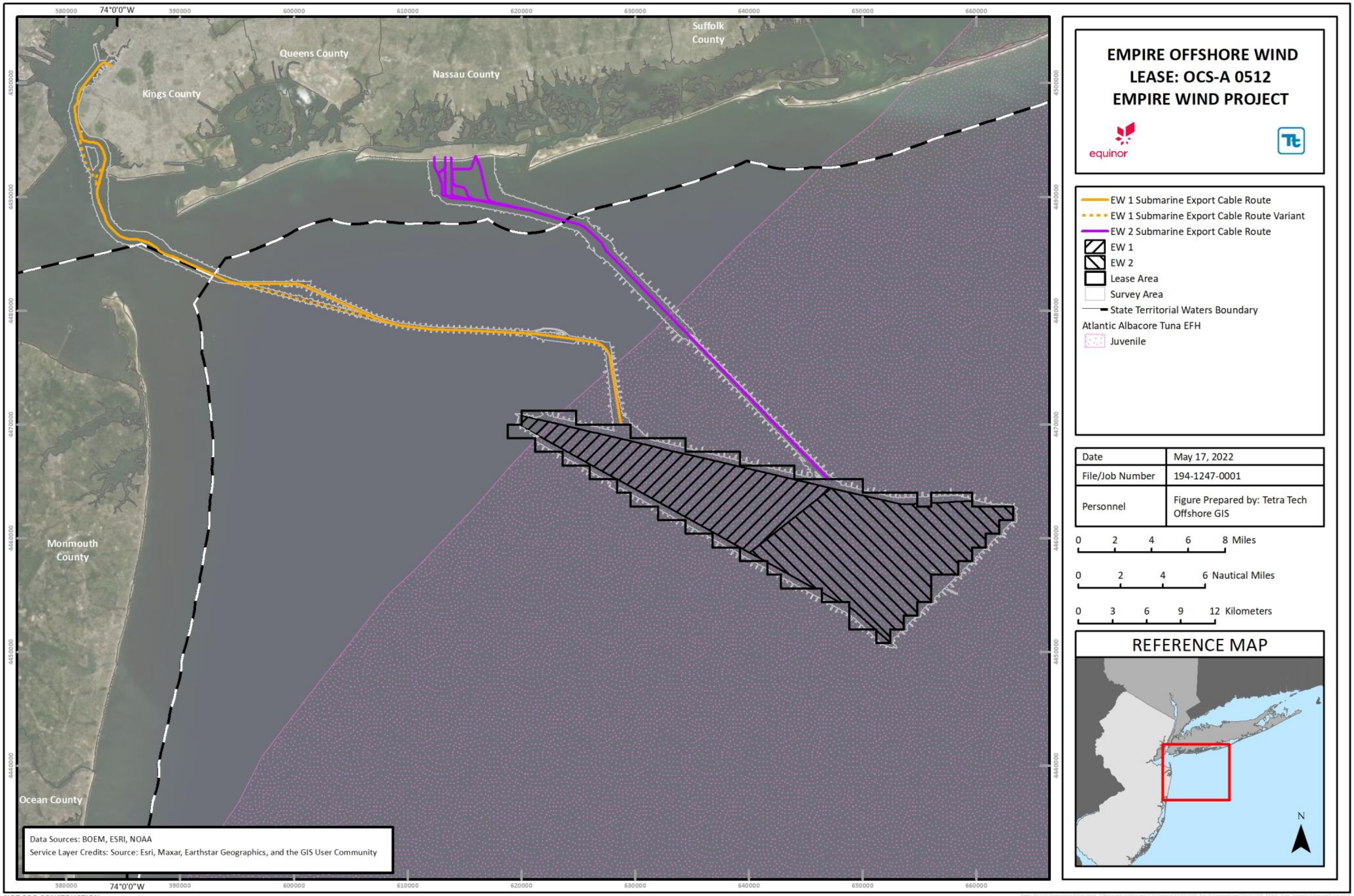

Figure U-1-29 Atlantic Albacore Tuna (*Thunnus alalonga*) Designated EFH in Project Area

U-1.2.30 Atlantic Bluefin Tuna (*Thunnus thynnus*)

No egg or larval Atlantic bluefin tuna EFH is designated in the Lease Area or either submarine export cable siting corridor. Juvenile bluefin tuna EFH extends throughout most of the Project Area (**Table U-1-30; Figure U-1-30**). Juveniles occur in pelagic habitats of the Mid-Atlantic Bight from southern Maine to Cape Lookout, North Carolina from shore to the continental shelf break (excluding Long Island Sound) (NOAA Fisheries 2017). Juvenile EFH is characterized as water temperatures between 39 and 79°F (4 and 26°C), which most often coincides with depths less than 66 ft (20 m) but can extend to 328 ft (100 m) in winter.

Adult Atlantic bluefin tuna EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-30**; **Figure U-1-30**). Designated EFH for adult bluefin tuna is offshore pelagic habitats of Southern New England to coastal areas between Chesapeake and Onslow Bays, North Carolina (NOAA Fisheries 2017). An isolated patch of adult bluefin tuna EFH is co-located with the Lease Area.

The Atlantic bluefin tuna historically ranged from the equator to 45°N (around Nova Scotia) in the western Atlantic, but warming sea temperatures have allowed a range expansion as far north as the Labrador Sea (60°N) (NOAA Fisheries 2017). Most studies indicate that adult bluefin tuna forage during most of the year off the east coast of the United States and Canada, then migrate to the Gulf of Mexico to spawn in April and May. Juvenile and adult bluefin tuna spend most of their time in the upper 33 ft (10 m) of the water column in mean surface temperatures from 61 to 66°F (16 to 19°C) (Lawson et al. 2010). Although the bluefin is generally epipelagic in the open ocean, some individuals move inshore during summer to feed on herring, mackerel, and squid.

Table U-1-30 Atlantic Bluefin Tuna (*Thunnus thynnus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	79,341	0	6,269	7,880	7,700
Adult	27,185	0	4,975	2,609	6,174
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	100.0%	0.0%	94.2%	100.0%	100.0%
Adult	34.3%	0.0%	74.8%	33.1%	80.2%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

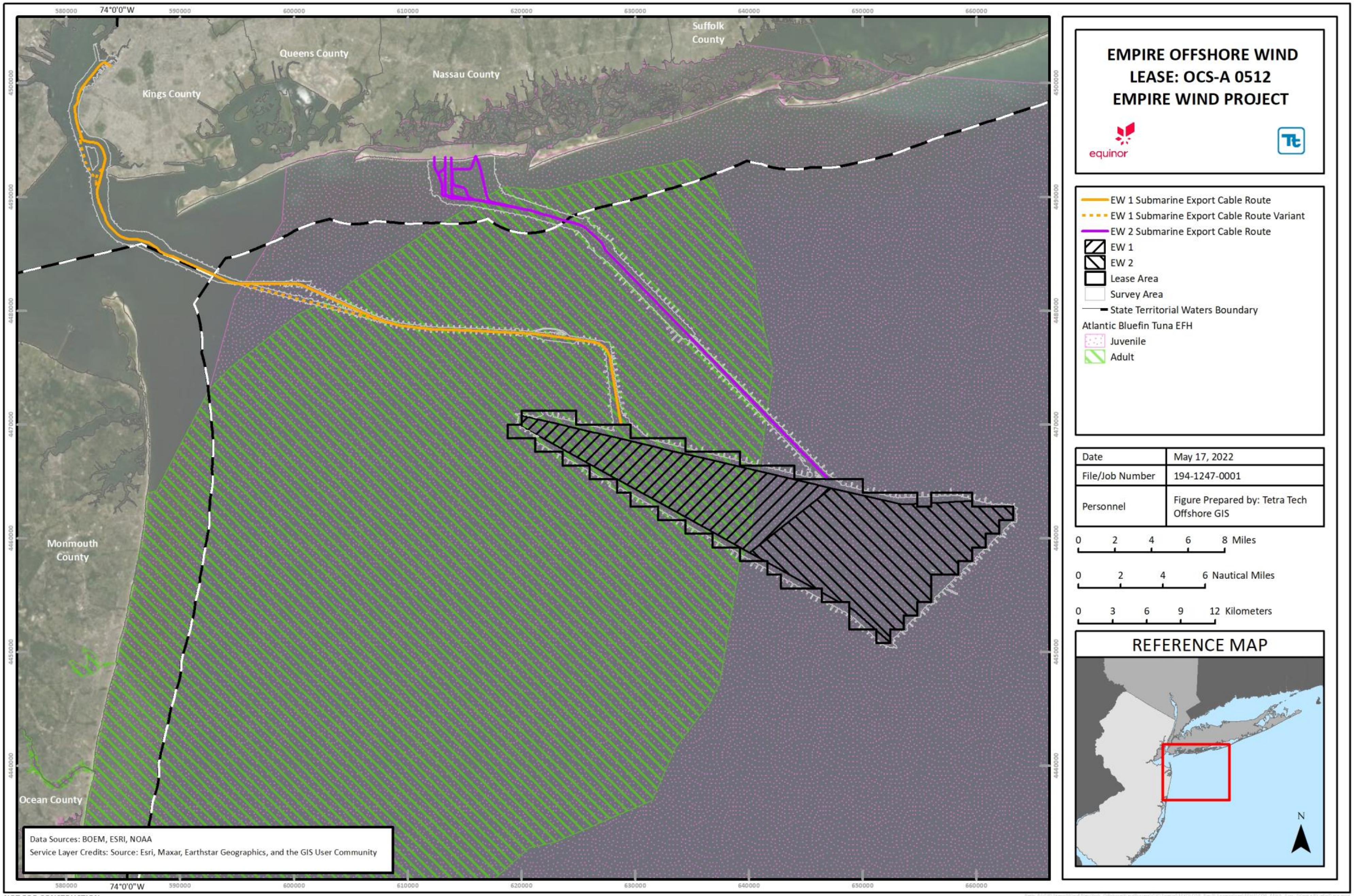

Figure U-1-30 Atlantic Bluefin Tuna (*Thunnus thynnus*) Designated EFH in Project Area

U-1.2.31 Atlantic Skipjack Tuna (*Katsuwonus pelamis*)

No egg or larval Atlantic skipjack tuna EFH is designated in the Lease Area or either submarine export cable siting corridor.

Juvenile and adult Atlantic skipjack tuna EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-31**; **Figure U-1-31**). Juvenile Atlantic skipjack tuna EFH is coastal and offshore habitats between Massachusetts and South Carolina. Juveniles typically occur at depths greater than 66 ft (20 m). The entire Lease Area is EFH for both adult and juvenile skipjack tuna. Designated EFH for adult Atlantic skipjack tuna is coastal and offshore habitats between Massachusetts and Cape Lookout, North Carolina.

In the western Atlantic, the migratory skipjack tuna ranges from Newfoundland to Brazil. Although it is an epipelagic oceanic species, it is known to dive to 853 ft (260 m). Schools of skipjack tuna aggregate at convergences and other oceanic features where prey may be concentrated. This species prefers waters of 80°F (27°C) but tolerates a range of 68 to 88°F (20 to 31°C) (NOAA Fisheries 2017).

Table U-1-31 Atlantic Skipjack Tuna (*Katsuwonus pelamis*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	79,341	0	5,915	0	5,579
Adult	79,341	1,283	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	100.0%	0.0%	88.9%	0.0%	72.5%
Adult	100.0%	16.4%	100.0%	100.0%	100.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

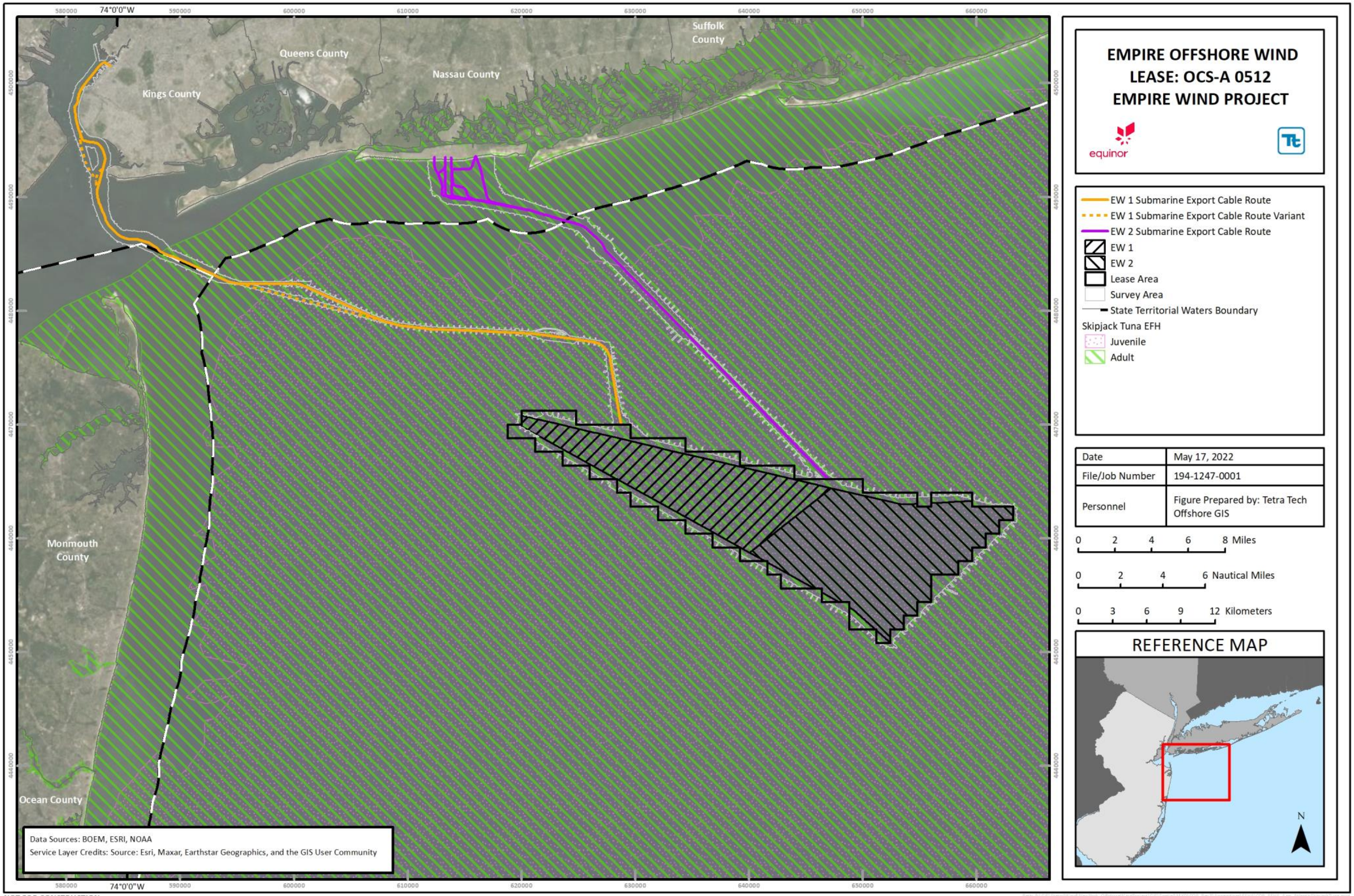

Figure U-1-31 Atlantic Skipjack Tuna (*Katsuwonus pelamis*) Designated EFH in Project Area

U-1.2.32 Atlantic Yellowfin Tuna (*Thunnus albacres*)

No egg, larval, or adult Atlantic yellowfin tuna EFH is designated in the Lease Area or either submarine export cable siting corridor.

Juvenile Atlantic yellowfin tuna EFH is designated only in the extreme southwestern edge of Lease Area (**Table U-1-32**; **Figure U-1-32**). Designated EFH for juvenile Atlantic yellowfin tuna is offshore and coastal habitats from Cape Cod to central Florida. Most EFH for juvenile and adults is in deeper offshore waters; only 4 acres in the extreme southern portion of the Lease Area intersect with juvenile EFH. The yellowfin travels in mixed species schools of highly migratory epipelagic tunas. Like other Atlantic tuna described above, the yellowfin prefers warmer waters (64 to 88°F [18° to 31°C]) and forages on fish and squid in the top 328 ft (100 m) of the water where dissolved oxygen concentrations are greater than 2 parts per million (2 milligrams per liter) (NOAA Fisheries 2017).

Table U-1-32 Atlantic Yellowfin Tuna (*Thunnus albacres*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Egg	0	0	0	0	0
Larva	0	0	0	0	0
Juvenile	108	0	0	0	0
Adult	0	0	0	0	0
Percent of Action Area Covered by EFH by Life Stage					
Egg	0.0%	0.0%	0.0%	0.0%	0.0%
Larva	0.0%	0.0%	0.0%	0.0%	0.0%
Juvenile	0.1%	0.0%	0.0%	0.0%	0.0%
Adult	0.0%	0.0%	0.0%	0.0%	0.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

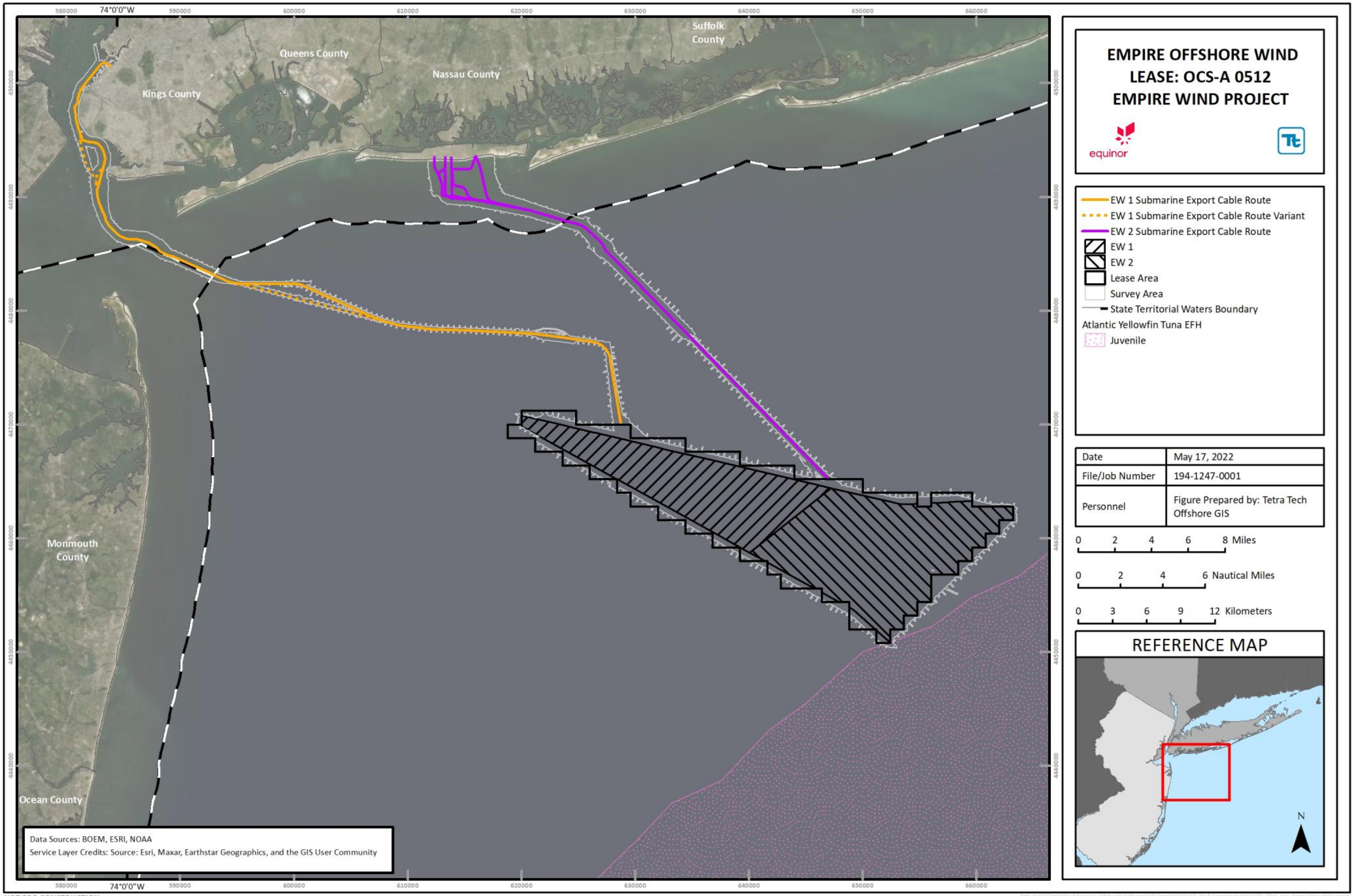

Figure U-1-32 Atlantic Yellowfin Tuna (*Thunnus albacres*) Designated EFH in Project Area

U-1.2.33 Blue Shark (*Prionace glauca*)

Neonate blue shark EFH is designated in the Lease Area and the EW 2 submarine export cable siting corridor. Designated EFH for neonate blue shark is offshore of Cape Cod through New Jersey seaward of the 98 ft (30 m) bathymetric line. Inshore waters such as Long Island Sound are not EFH (NOAA Fisheries 2017).

Juvenile and adult blue shark EFH is designated in the Lease Area and the EW 2 submarine export cable siting corridor (**Table U-1-33; Figure U-1-33**). Adult and juvenile EFH are localized areas in the Atlantic from Georges Bank to North Carolina. Most of the Lease Area intersects with EFH for all life stages of the blue shark.

The wide-ranging, pelagic blue shark occurs primarily in waters at least 590 ft (180 m) deep where temperatures range from 50 to 68°F (10 to 20°C). In the northwest Atlantic, the blue shark occurs over the continental shelf during summer and moves offshore in the fall (NOAA Fisheries 2017). Satellite tagging studies report that this species is associated with the Gulf Stream (Campana et al. 2011).

Table U-1-33 Blue Shark (*Prionace glauca*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Neonate	67,584	0	0	0	2,040
Juvenile/Adult	67,584	0	0	0	2,040
Percent of Action Area Covered by EFH by Life Stage					
Neonate	85.2%	0.0%	0.0%	0.0%	26.5%
Juvenile/Adult	85.2%	0.0%	0.0%	0.0%	26.5%
EFH Source Documents: Chang et al. 1999a; NEFMC 2017 and references within)					

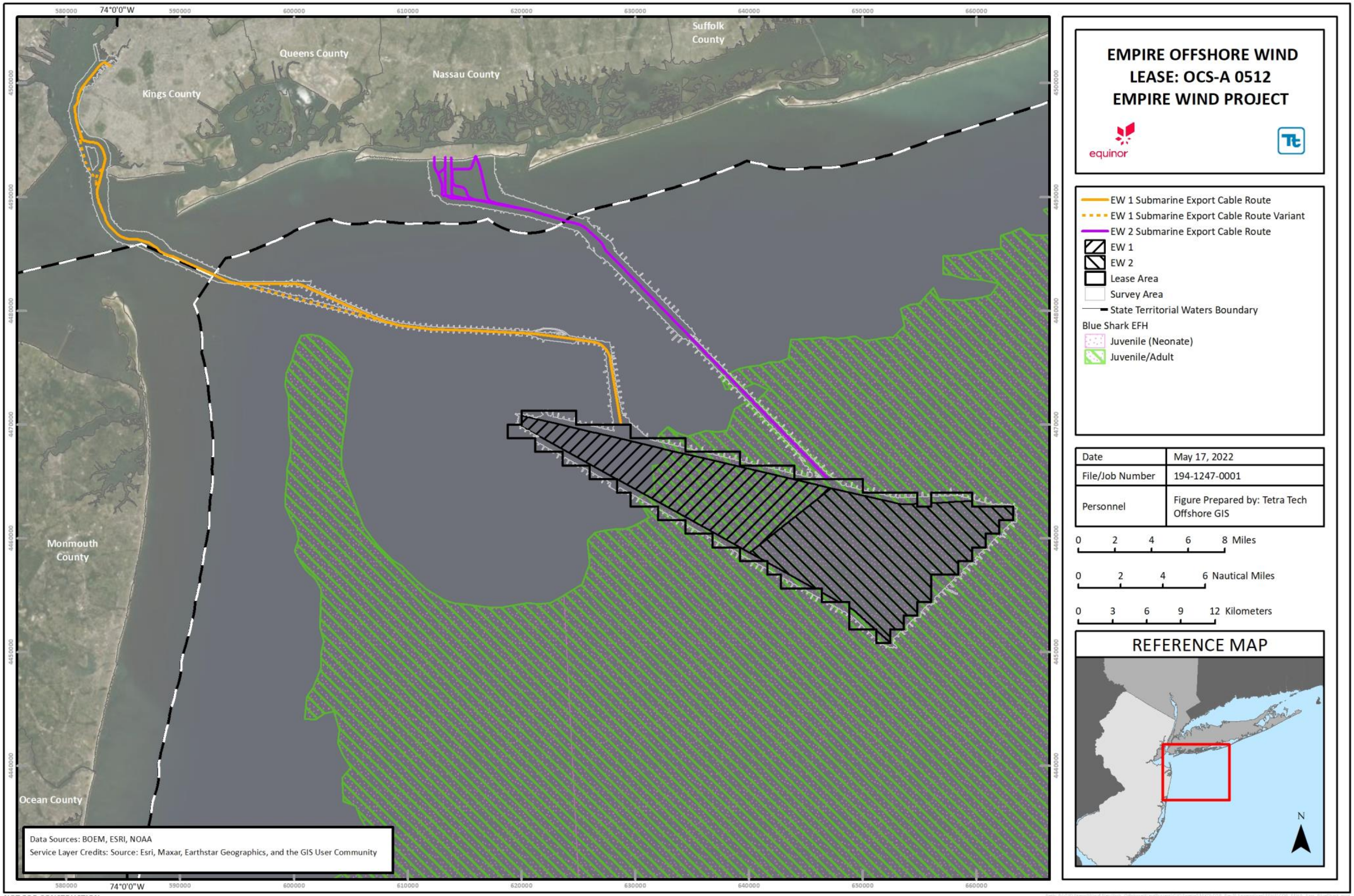

Figure U-1-33 Blue Shark (*Prionace glauca*) Designated EFH in Project Area

U-1.2.34 Common Thresher Shark (*Alopias vulpinus*)

The EFH for all life stages of common thresher shark is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-34; Figure U-1-34**). The habitat requirements of the common thresher shark are not known well enough to designate separate EFH for different life stages. Designated EFH for all life stages of this species ranges from the coast to the EEZ from Georges Bank to Cape Lookout, North Carolina (NOAA Fisheries 2017), intersecting with the entire Project Area. The common thresher shark occurs throughout the Atlantic Ocean but is more abundant near land (NOAA Fisheries 2017). It feeds broadly on squid, small fish, and pelagic crabs.

Table U-1-34 Common Thresher Shark (*Alopias vulpinus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
All Stages	79,341	2,409	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
All Stages	100.0%	30.8%	100.0%	100.0%	100.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

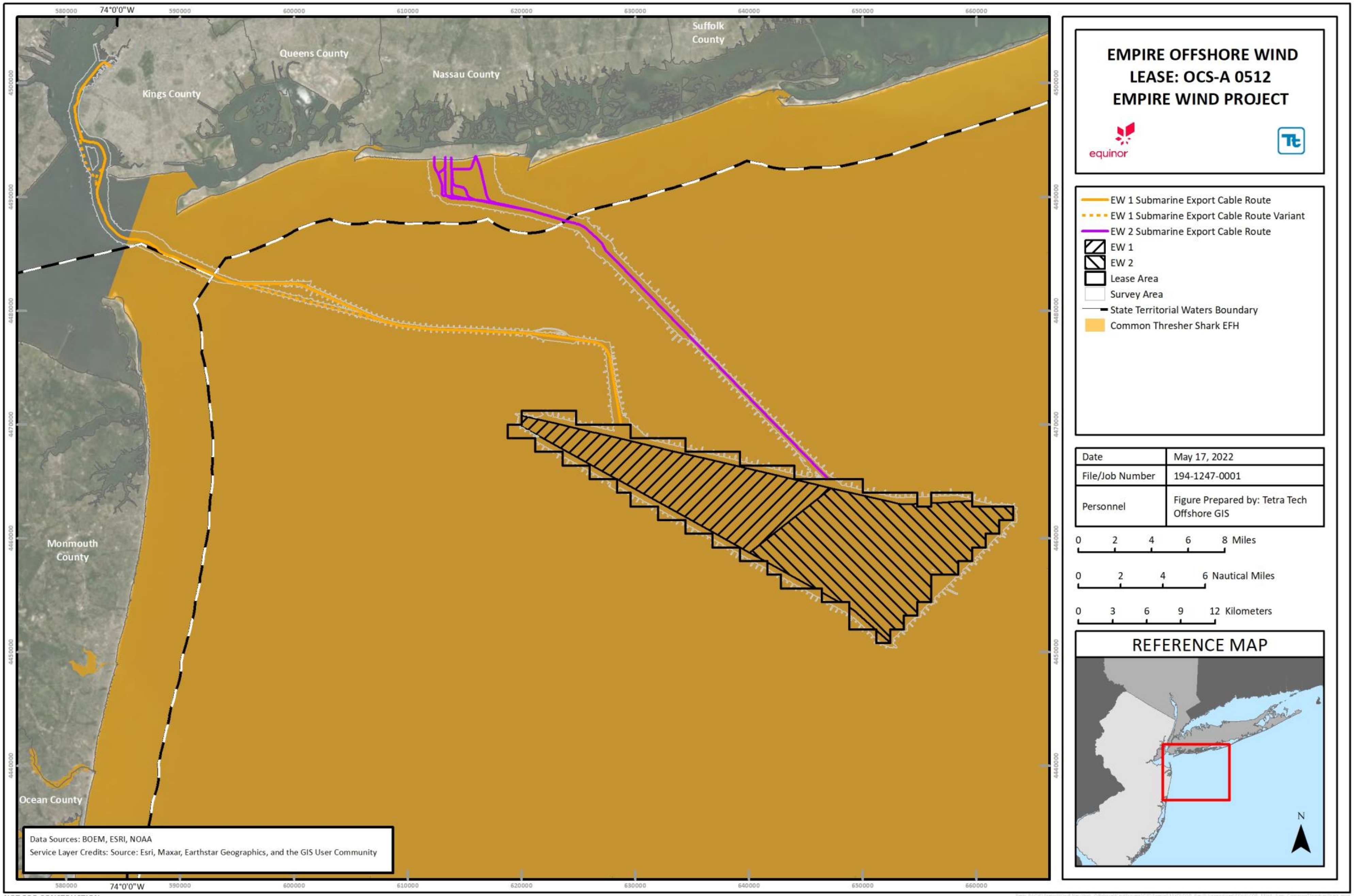

Figure U-1-34 Common Thresher Shark (*Alopias vulpinus*) Designated EFH in Project Area

U-1.2.35 Dusky Shark (*Carcharhinus obscurus*)

Neonate dusky shark EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-35; Figure U-1-35**). Designated EFH for juvenile and adult dusky shark is the coastal and pelagic waters inshore of the continental shelf break (less than 656 ft [200 m]) from Cape Cod to Georgia. In Southern New England, EFH extends seaward of Martha's Vineyard, Block Island, and Long Island, including pelagic waters from Nantucket Shoals and the Great South Channel to the edge of the EEZ.

Juvenile and adult dusky shark EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-35**; **Figure U-1-35**). Adult and juvenile EFH is identical, but adults tend to occur in deeper waters (NOAA Fisheries 2017). Neonate dusky shark EFH includes offshore areas from Southern New England to Cape Lookout, North Carolina. Neonates rear in coastal nursery areas where water temperatures range from 64.6 to 72°F (18.1 to 22.2°C) and salinities from 25 to 35 ppt. The seaward extent of EFH in the Atlantic Ocean is 197 ft (60 m) (NOAA Fisheries 2017).

The dusky shark is common in warm temperate Atlantic waters where it makes seasonal north-south migrations. It is a large migratory species which moves north-south with the seasons (NOAA Fisheries 2017).

Table U-1-35 Dusky Shark (*Carcharhinus obscurus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Neonate	79,341	875	6,655	7,880	7,700
Juvenile/Adult	79,341	0	5,925	0	5,579
Percent of Action Area Covered by EFH by Life Stage					
Neonate	100.0%	11.2%	100.0%	100.0%	100.0%
Juvenile/Adult	100.0%	0.0%	88.9%	0.0%	72.5%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

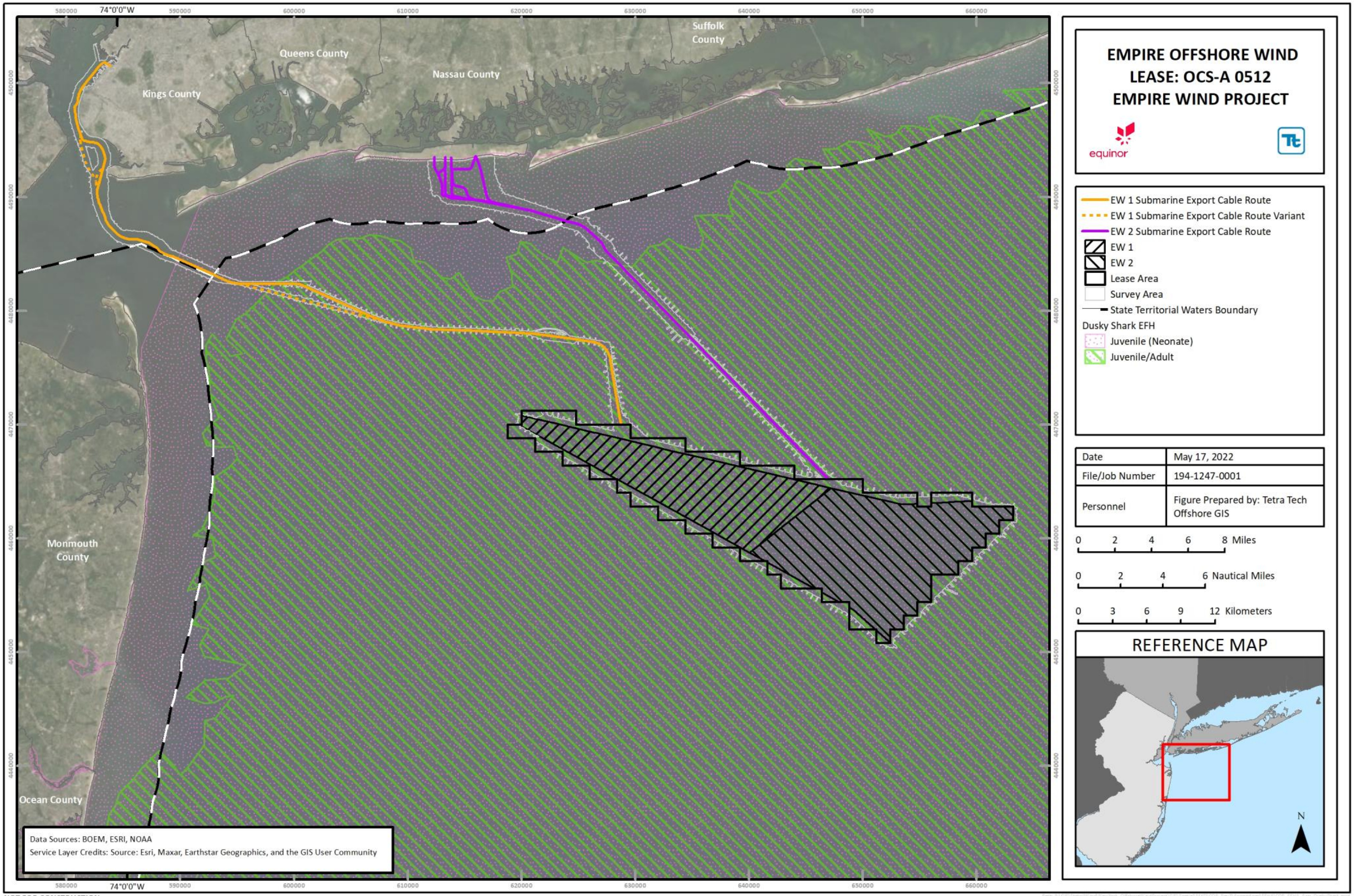

Figure U-1-35 Dusky Shark (*Carcharhinus obscurus*) Designated EFH in Project Area

U-1.2.36 Sand Tiger Shark (*Carcharhinus taurus*)

Neonate and juvenile sand tiger shark EFH are designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-36**; **Figure U-1-36**). Sand tiger shark neonate EFH is from Massachusetts to Florida, specifically in bays and coastal sounds (including Sandy Hook Bay) (NOAA Fisheries 2017). Juvenile EFH is designated at depths of 23 to 92 ft (7 to 28 m) from Massachusetts to New York in sand and mud areas where temperatures range from 66 to 77°F (19 to 25°C) and salinities are between 23 and 30 ppt (NOAA Fisheries 2017). In the Project Area, EFH for neonates and juveniles overlap completely.

No adult sand tiger shark EFH is designated in the Lease Area or either submarine export cable siting corridor.

The sand tiger shark is a large coastal species occurring in tropical and warm temperate waters worldwide; it often ranges into coastal waters as shallow as 13 ft (4 m) (NOAA Fisheries 2017). In North America, the sand tiger shark gives birth to two pups in March and April, likely in the southern part of its range. Neonates migrate northward to rear in estuaries and coastal sounds in the Mid-Atlantic Bight.

Table U-1-36 Sand Tiger Shark (*Carcharhinus taurus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Neonate/ Juvenile	79,341	1,563	6,655	7,880	7,700
Adult	0	0	0	0	0
Percent of Action Area Covered by EFH by Life Stage					
Neonate/ Juvenile	100.0%	20.0%	100.0%	100.0%	100.0%
Adult	0.0%	0.0%	0.0%	0.0%	0.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

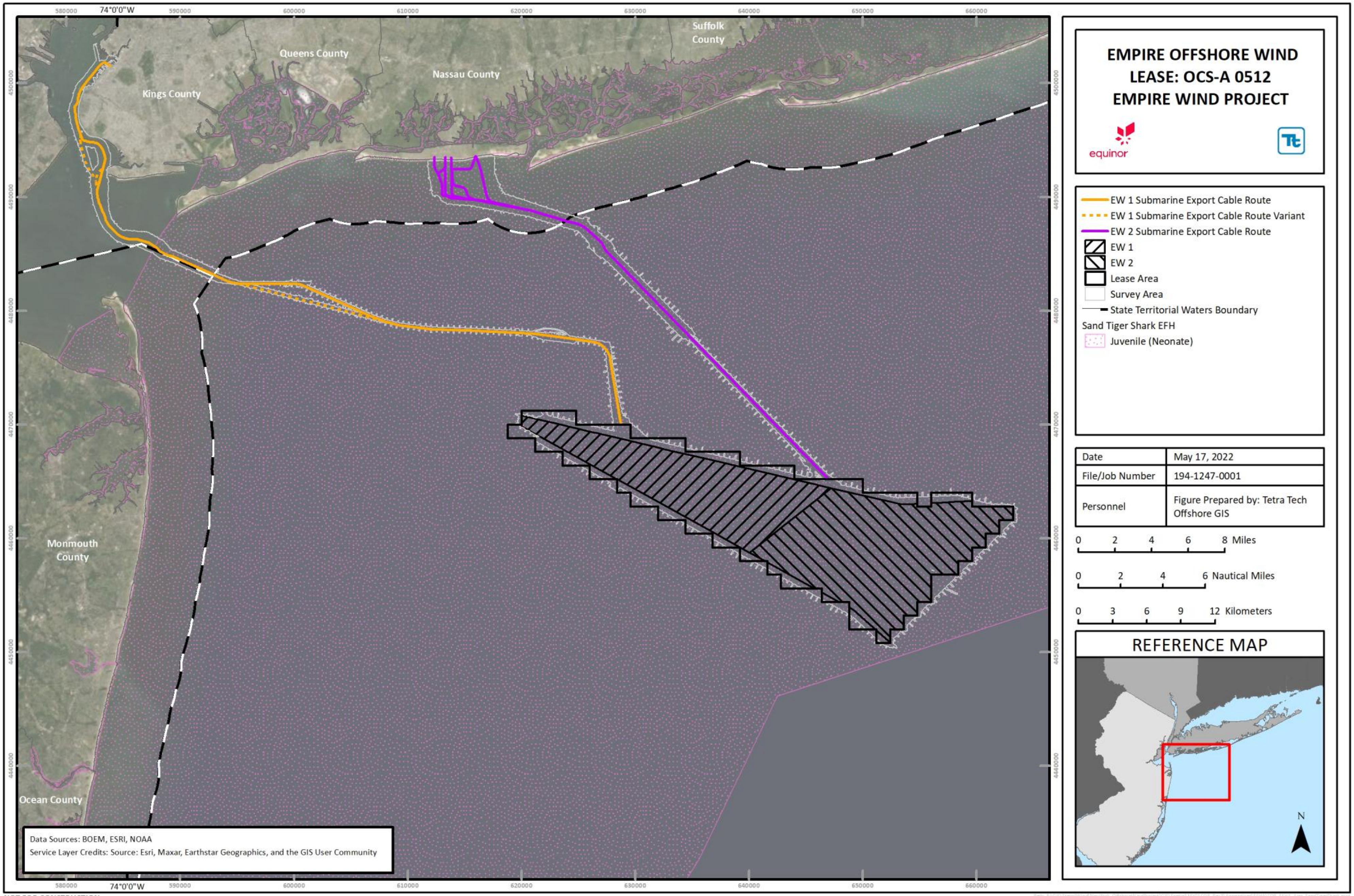

Figure U-1-36 Sand Tiger Shark (*Carcharhinus taurus*) Designated EFH in Project Area

U-1.2.37 Sandbar Shark (*Carcharhinus plumbeus*)

Neonate and juvenile sandbar shark EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-37; Figure U-1-37**). Neonate sandbar sharks rear in nursey areas from New York to North Carolina, where neonate EFH is designated in sand, mud, shell, and rocky benthic habitats. Neonate sandbar sharks prefer water from 59 to 86°F (15 to 30°C), salinities between 15 and 35 ppt, and depths of 2.6 to 75 ft (0.8 to 23 m). Juvenile sandbar sharks prefer temperatures between 68 and 75°F (20 and 24°C) and depths from 7.9 to 20.1 ft (2.4 to 6.4 m); juvenile EFH is designated on the Atlantic coast between Southern New England and Georgia (NOAA Fisheries 2017). Adult sandbar shark EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-37; Figure U-1-37**). Designated EFH for adult sandbar shark on the Atlantic coast includes coastal areas from Southern New England to the Florida Keys, ranging from inland waters to the continental shelf break (NOAA Fisheries 2017).

The North Atlantic population of the sandbar shark migrates seasonally from Cape Cod to the western Gulf of Mexico, often segregating by sex outside the mating season (April through July) (NOAA Fisheries 2017). This benthic species occurs most often at 66 to 180 ft (20 to 55 m) but has been reported at 656 ft (200 m). Sandbar shark nursey areas occur in shallow coastal waters from Martha's Vineyard, MA to south Florida.

Table U-1-37 Sandbar Shark (*Carcharhinus plumbeus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Neonate	79,341	0	5,583	2,615	7,700
Juvenile	79,341	850	6,655	7,880	7,700
Adult	79,341	2,232	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
Neonate	100.0%	0.0%	83.9%	33.2%	100.0%
Juvenile	100.0%	10.9%	100.0%	100.0%	100.0%
Adult	100.0%	28.5%	100.0%	100.0%	100.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

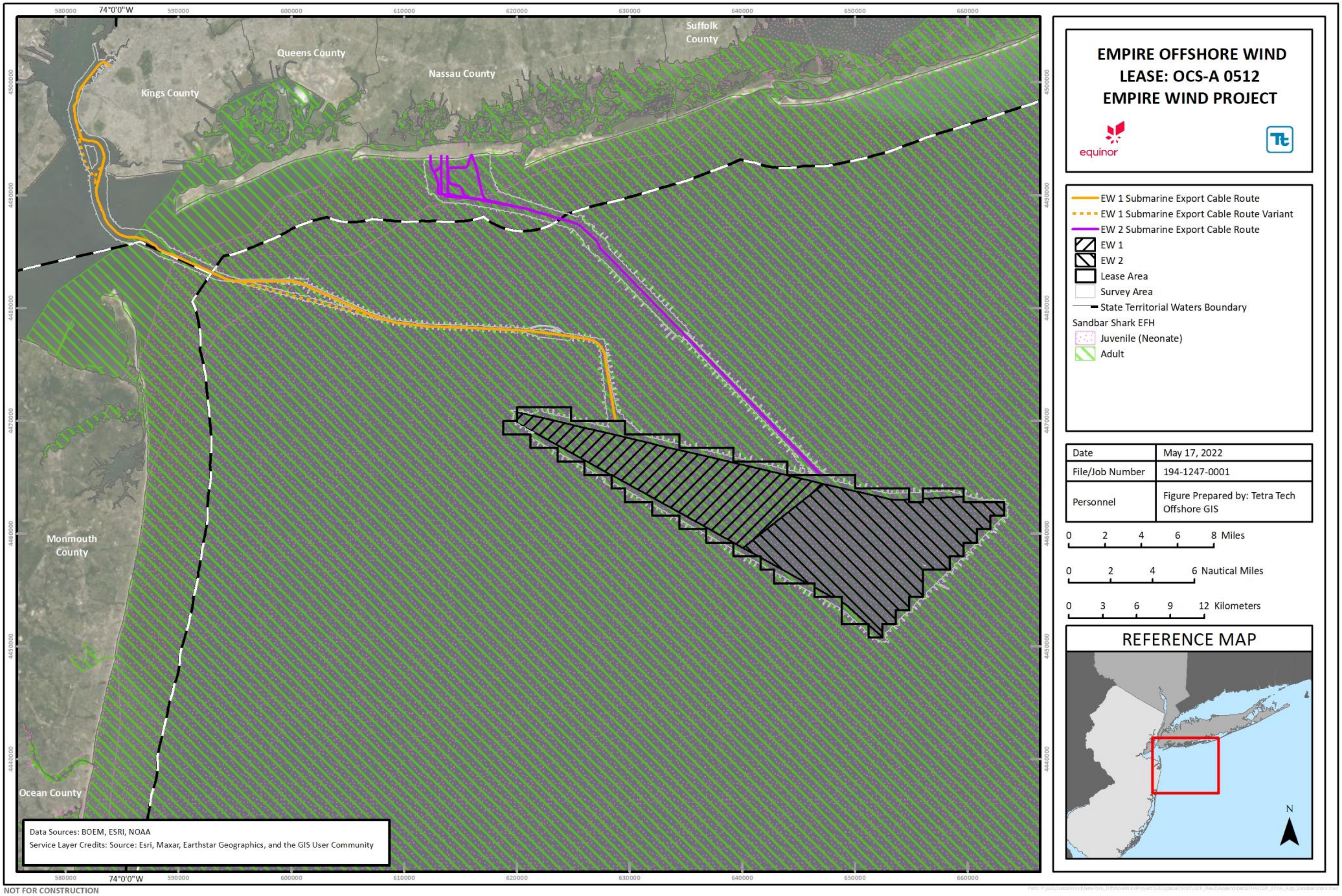

Figure U-1-37 Sandbar Shark (*Carcharhinus plumbeus*) Designated EFH in Project Area

U-1.2.38 Shortfin Mako Shark (*Isurus oxyrinchus*)

EFH for all life stages of shortfin mako shark is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-38; Figure U-1-38**). The habitat requirements of the shortfin mako shark are not known well enough to designate separate EFH for different life stages. Designated EFH for all life stages of this species is coastal and offshore habitats between Cape Cod, Massachusetts and Cape Lookout, North Carolina, excluding bays and estuaries (NOAA Fisheries 2017).

The shortfin mako shark occurs worldwide in warm and temperate waters. Little is known about its migratory patterns or reproductive seasonality, although pregnant shortfin mako sharks have been reported between 20 and 30°N or S latitude (NOAA Fisheries 2017).

Table U-1-38 Shortfin Mako Shark (*Isurus oxyrinchus*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
All Stages	79,341	0	3,498	0	5,027
Percent of Action Area Covered by EFH by Life Stage					
All Stages	100.0%	0.0%	52.6%	0.0%	65.3%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

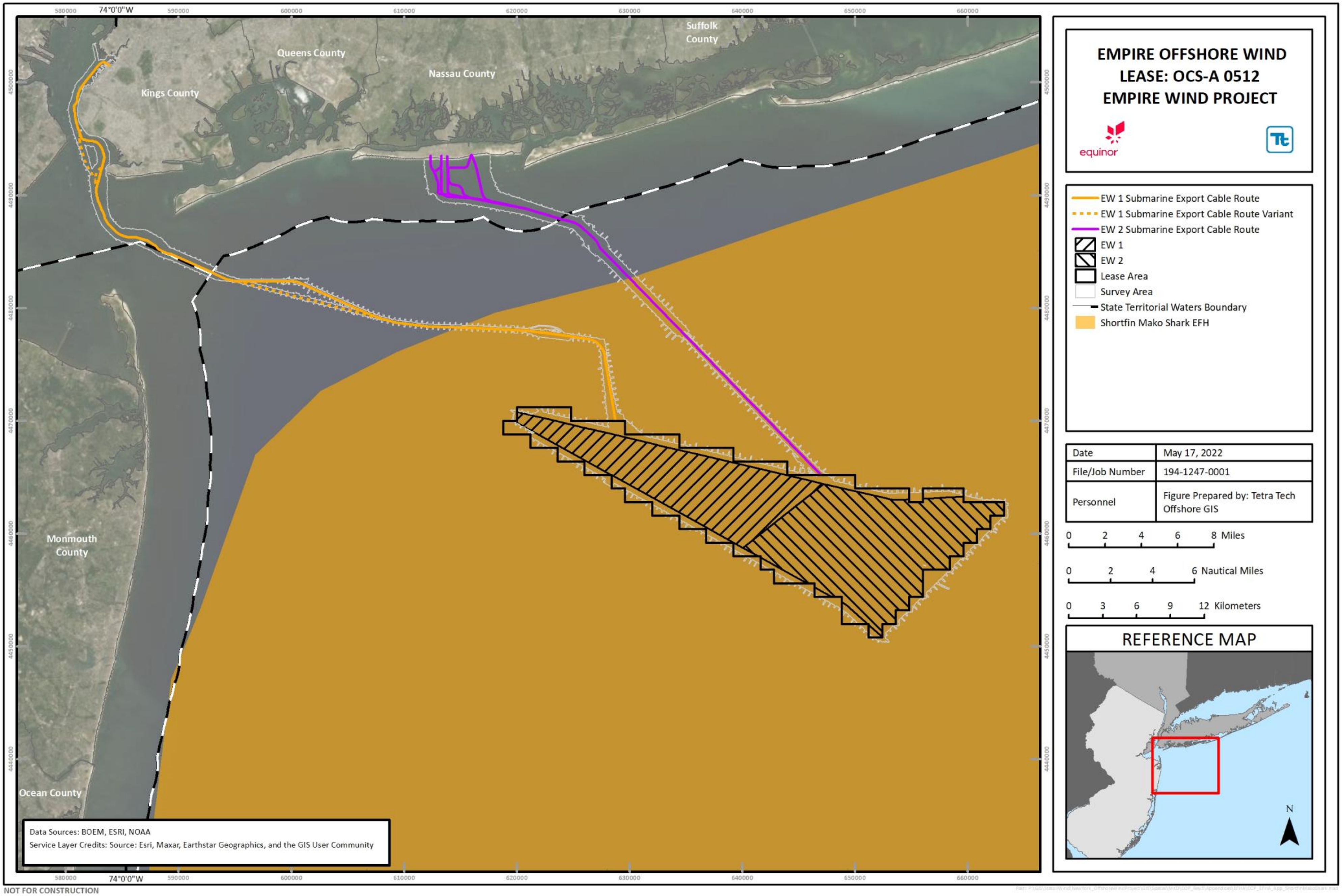

Figure U-1-38 Shortfin Mako Shark (*Isurus oxyrinchus*) Designated EFH in Project Area

U-1.2.39 Smoothhound Shark / Smooth dogfish (*Mustelus canis*)

EFH for all life stages of smoothhound shark (also known as smooth dogfish) is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-39; Figure U-1-39**). The habitat requirements of the smoothhound shark are not known well enough to designate separate EFH for different life stages. Designated EFH for all life stages of the Atlantic stock of smoothhound shark is coastal areas from Cape Cod Bay to South Carolina, including inshore bays and estuaries such as Long Island Sound (NOAA Fisheries 2017). The entire Project Area intersects with EFH for smoothhound shark.

The smoothhound shark is most common near the bottom from the continental shelf to inshore waters. As bottom temperatures warm to about 43°F (6°C) in the spring, the smoothhound shark migrates north along the coast; its maximum temperature tolerance is 81°F (27°C). Mating occurs from May through September. Neonates rear in estuaries and inshore marsh creeks during June and July, then the young of the year migrate to open waters in October.

Table U-1-39 Smoothhound Shark/ Smooth Dogfish (*Mustelus canis*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
All Stages	75,189	7,614	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
All Stages	94.8%	97.2%	100.0%	100.0%	100.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

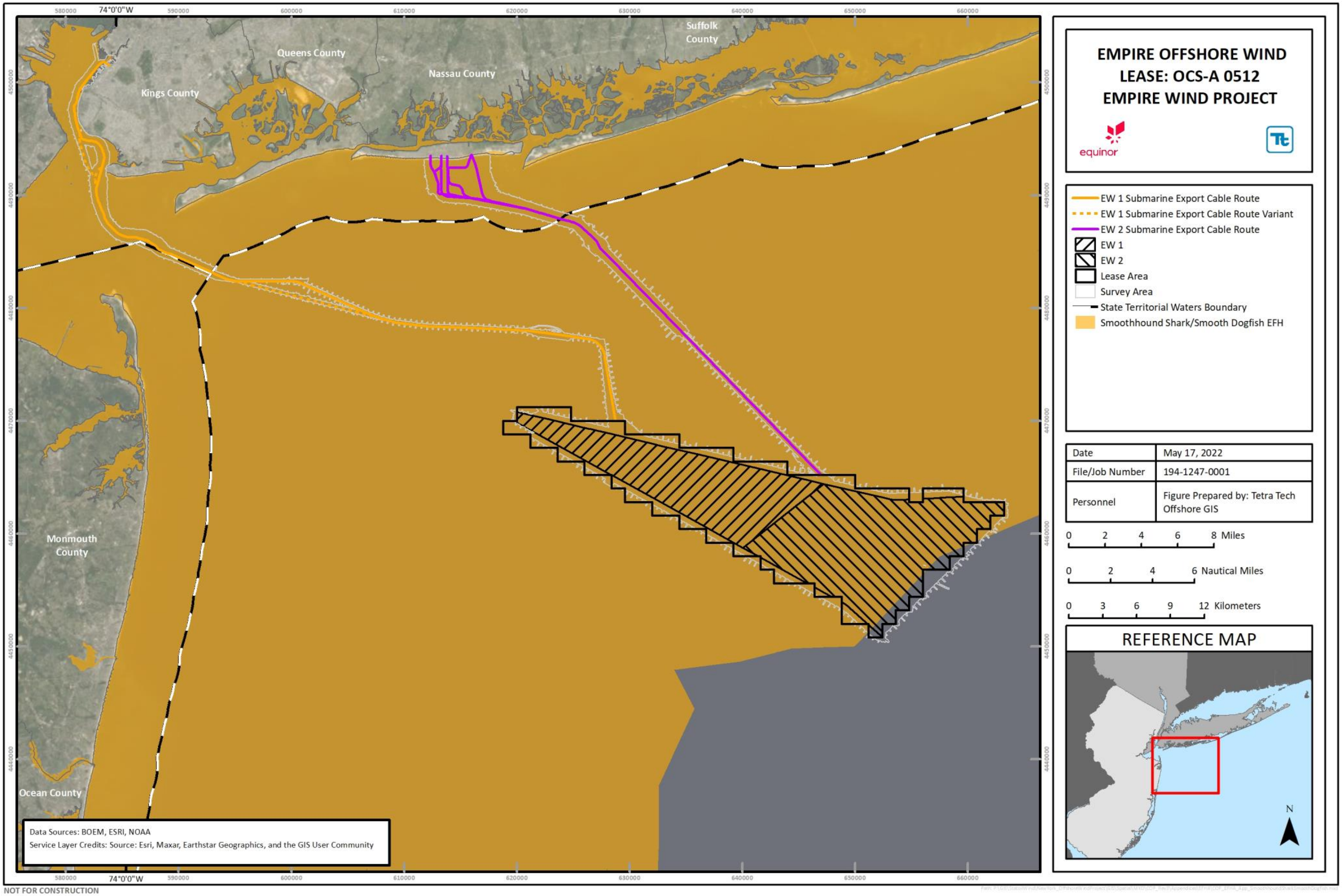

Figure U-1-39 Smoothhound Shark/Smooth Dogfish (*Mustelus canis*) Designated EFH in Project Area

U-1.2.40 Tiger Shark (*Galeocerdo cuvier*)

Juvenile and adult tiger shark EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-40; Figure U-1-40**). Designated EFH for juvenile (3.3 to 8.9 ft [1.0 to 2.7 m] total length) and adult (at least 8.9 ft [2.7 m] total length) tiger shark is offshore pelagic waters on the continental shelf from Georges Bank to the Florida Keys. The tiger shark is rarely encountered north of the Mid-Atlantic Bight (NOAA Fisheries 2017).

The tiger shark occurs in warm coastal and offshore waters from approximately 40 to 0°N latitude. The tiger shark migrates both horizontally across the Atlantic Ocean and vertically to depths of more than 656 ft (200 m). Between dives, it commonly occurs in the top 16 ft (5 m) of the water column. Offshore waters south of Cape Hatteras, North Carolina are reported to be nursery areas, although little information is available (NOAA Fisheries 2017).

Table U-1-40 Tiger Shark (*Galeocerdo cuvier*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Juvenile/Adult	79,341	0	5,120	1,692	7,700
Percent of Action Area Covered by EFH by Life Stage					
Juvenile/Adult	100.0%	0.0%	76.9%	21.5%	100.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

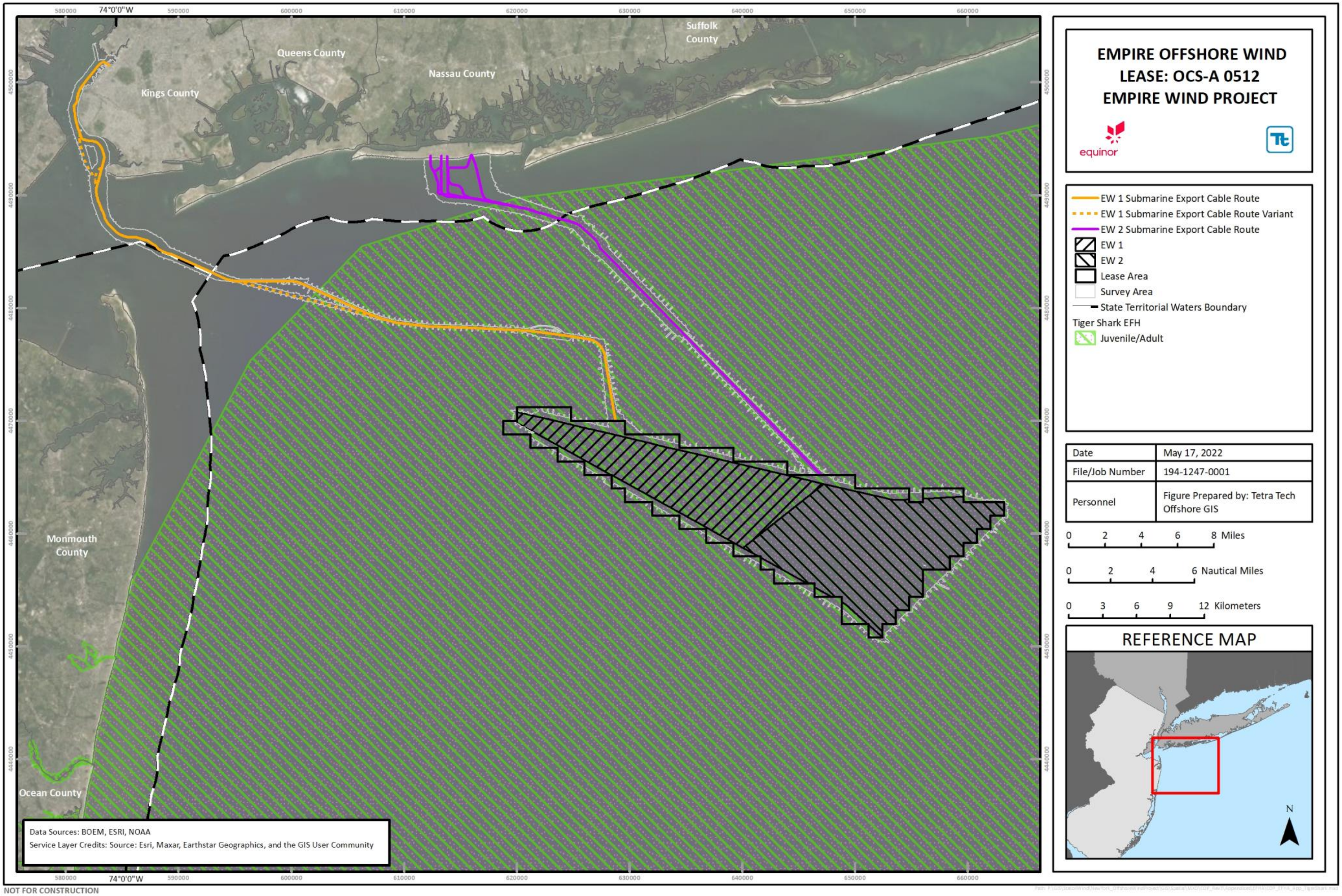

Figure U-1-40 Tiger Shark (*Galeocerdo cuvier*) Designated EFH in Project Area

U-1.2.41 White Shark (*Carcharodon carcharias*)

Neonate, juvenile, and adult while shark EFH is designated in the Lease Area and both submarine export cable siting corridors (**Table U-1-41; Figure U-1-41**). Designated EFH for neonates includes inshore waters out to 65 miles (105 kilometers) between Cape Cod and Ocean City, New Jersey. Adult and juvenile EFH includes inshore waters to habitats 65 miles (105 kilometers) from shore where water temperatures are 48 to 82°F (9 to 28°C). The white shark is most common in waters of 57 to 73°F (14 to 23°C) between Cape Ann, Massachusetts and Long Island, New York. Almost the entire Project Area is EFH for adult, neonate, and juvenile white shark.

The white shark is a poorly-known apex predator that occurs in coastal and offshore waters (NOAA Fisheries 2017). It occurs sporadically throughout its range but is seasonally common in New England and the Mid-Atlantic Bight (Curtis et al. 2014; Casey and Pratt 1985). Tagged white sharks were reported to exhibit seasonal site-fidelity over several years in Southern New England (Skomal and Chisholm 2014). In general, the white shark is reported to prefer water temperatures from 48 to 83°F (9 to 28°C) in waters less than 328 ft (100 m) (Casey and Pratt 1985). Large individuals (at least 10 ft [3 m]) occur throughout the western North Atlantic, but smaller individuals (less than 6.5 ft [2 m]) are common only in the Mid-Atlantic Bight, especially on the continental shelf between Cape Hatteras and Cape Cod. The Mid-Atlantic Bight has been suggested as a mating and nursey area for the white shark, although empirical data supporting this assertion is limited.

Table U-1-41 White Shark (*Carcharodon carcharias*) Designated EFH in Project Area

Action Area	Lease Area	EW 1 Submarine Export Cable Siting Corridor		EW 2 Submarine Export Cable Siting Corridor	
		State	Federal	State	Federal
Total Project Acreage	**79,341**	**7,832**	**6,655**	**7,880**	**7,700**
EFH Acreage in Action Area by Life Stage					
Neonate	79,341	0	6,152	7,877	7,700
Juvenile/Adult	79,341	1,188	6,655	7,880	7,700
Percent of Action Area Covered by EFH by Life Stage					
Neonate	100.0%	0.0%	92.4%	100.0%	100.0%
Juvenile/Adult	100.0%	15.2%	100.0%	100.0%	100.0%
EFH Source Documents: NOAA Fisheries 2017 and references within, 2018					

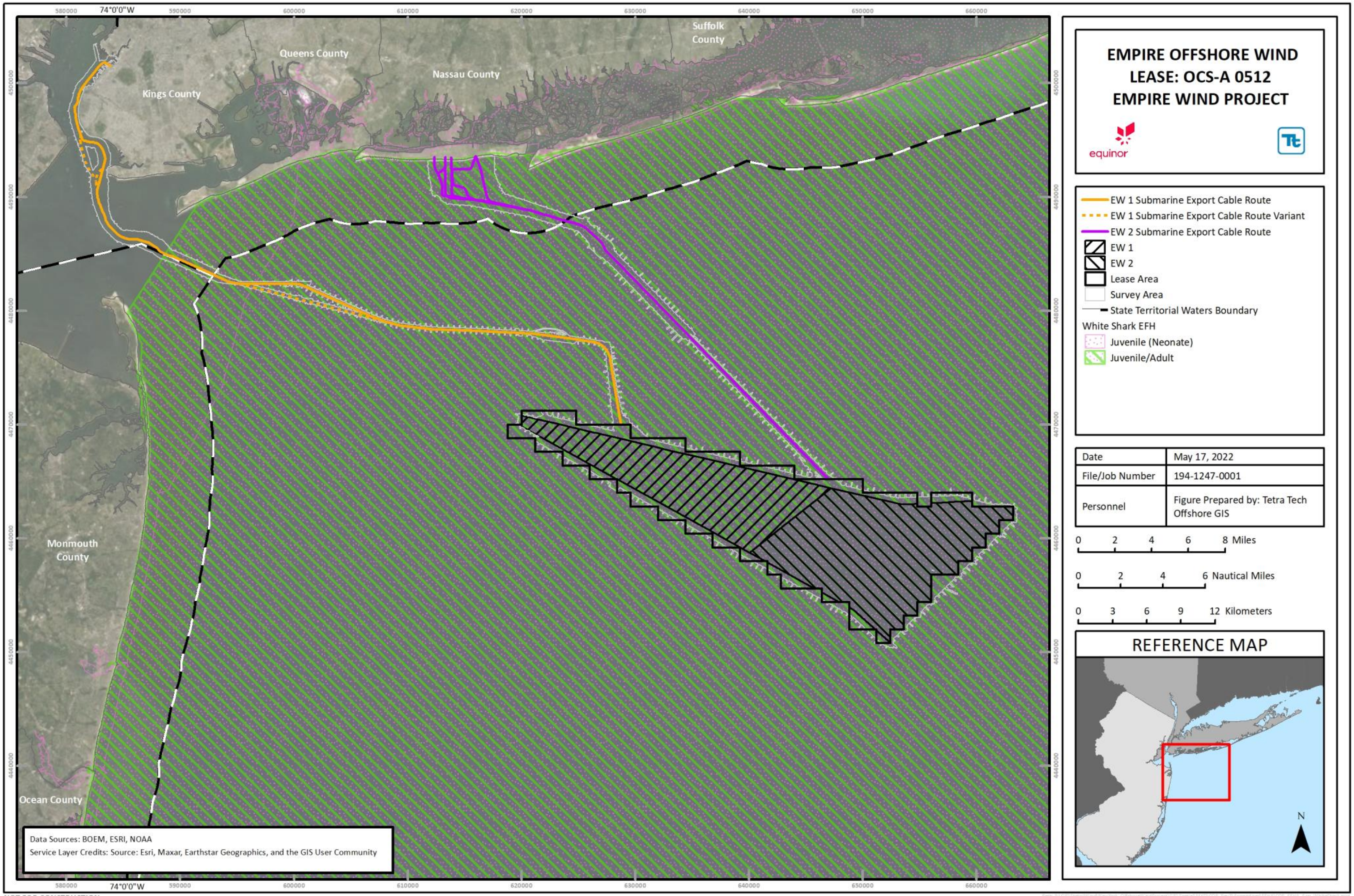

Figure U-1-41 White Shark (*Carcharodon carcharias*) Designated EFH in Project Area

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ATTACHMENT U-2
OVERSIZED TABLES

TABLES

Table U-2-1 EFH in the Project Area

Species	Life Stage	Lease Area a/		EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
		Acres of EFH	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH
Atlantic Cod	Adult	79,341	0.157%	5,782	0.011%			7,094	0.014%	7,880	0.016%
	Eggs	38,958	0.090%	2,995	0.007%	402	0.001%	2,145	0.005%		
	Larvae	55,233	0.111%	4,667	0.009%	406	0.001%	2,145	0.004%		
Atlantic Herring	Adult	79,307	0.085%	6,655	0.007%	7,832	0.008%	6,599	0.007%	7,832	0.008%
	Juvenile	79,341	0.076%	6,655	0.006%	7,832	0.008%	7,700	0.007%	7,880	0.008%
	Larvae	33	0.000%	2,123	0.009%	6,290	0.028%	1,101	0.005%		
Atlantic Sea Scallop	ALL	79,341	0.138%	6,655	0.012%	415	0.001%	5,753	0.010%		
Clearnose Skate	Adult			872	0.003%	7,832	0.029%				
	Juvenile			873	0.003%	6,688	0.020%				
Haddock	Juvenile	14,086	0.041%	2,122	0.005%						
	Larvae	17,108	0.090%					1,102	0.006%		
Little Skate	Adult			873	0.002%	6,688	0.012%			2,661	0.005%
	Juvenile	79,307	0.146%	6,655	0.012%	7,832	0.014%	6,600	0.012%	7,880	0.014%
Monkfish	Adult	49,356	0.083%	2,122	0.004%			438	0.001%	712	0.001%
	Eggs/Larvae	79,341	0.085%	6,655	0.007%	2,644	0.003%	7,700	0.008%	7,880	0.008%
	Juvenile	10,560	0.019%	2,122	0.004%						
Ocean Pout	Adult	79,206	0.214%	6,655	0.018%	402	0.001%	7,700	0.021%	7,168	0.019%
	Eggs	79,206	0.268%	6,655	0.023%	399	0.001%	7,700	0.026%	7,168	0.024%
	Juvenile	17,085	0.075%	2,122	0.009%						

Table U-2-1 EFH in the Project Area (continued)

Species	Life Stage	Lease Area a/		EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
		Acres of EFH	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH
Pollock	Egg							606	0.002%		
	Juvenile									2,661	0.009%
	Larvae	38,795	0.110%					438	0.001%		
Red Hake	Adult	62,221	0.061%	6,655	0.007%	6,688	0.007%	6,601	0.006%	7,880	0.008%
	Eggs/Larvae/ Juvenile	40,510	0.072%	6,655	0.012%	7,832	0.014%	6,162	0.011%	4,909	0.009%
Silver Hake	Adult			873	0.002%	398	0.001%				
	Eggs/Larvae	51,795	0.084%	6,655	0.011%	7,725	0.013%	4,620	0.008		
	Juvenile	4,251	0.010%								
White Hake	Juvenile							1,979	0.003%	7,168	0.012%
Windowpane Flounder	Adult	79,341	0.123%	6,655	0.010%	7,832	0.012%	7,700	0.012%	7,880	0.012%
	Eggs	40,545	0.107%	6,655	0.018%	6,694	0.018%	5,887	0.016%	2,661	0.007%
	Juvenile	30,086	0.046%	6,655	0.010%	7,832	0.012%	6,162	0.009%	7,880	0.012%
	Larvae	79,341	0.197%	6,655	0.017%	6,694	0.017%	6,327	0.016%	2,661	0.007%
Winter Flounder	Eggs			765	0.003%	7,832	0.028%	2,075	0.008%	7,880	0.029%
	Juvenile	79,341	0.205%	6,655	0.017%	7,832	0.020%	7,700	0.020%	7,880	0.020%
	Larvae/Adult	79,341	0.172%	6,655	0.014%	7,832	0.017%	7,700	0.017%	7,880	0.017%
Winter Skate	Adult	51,828	0.102%	6,655	0.013%	7,832	0.015%	7,094	0.014%	7,880	0.016%
	Juvenile	79,341	0.137%	6,655	0.011%	7,832	0.013%	7,700	0.013%	7,880	0.014%
Witch Flounder	Adult	10,427	0.019%								

Table U-2-1 EFH in the Project Area (continued)

Species	Life Stage	Lease Area a/		EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
		Acres of EFH	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH
	Eggs	6,011	0.026%	3,794	0.016%			1,101	0.005%		
	Larvae	10,593	0.036%	2,995	0.010%	402	0.001%	1,101	0.004%		
Yellowtail Flounder	Adult	79,341	0.159%	6,655	0.013%	398	0.001%	7,094	0.014%	7,880	0.016%
	Eggs	40,545	0.124%	6,655	0.020%	410	0.001%	5,298	0.016%		
	Juvenile	79,037	0.206%	6,655	0.017%	7,725	0.020%	4,620	0.012%		
	Larvae	72,317	0.220%	4,667	0.014%	406	0.001%	1,539	0.005%		
Atlantic Butterfish	Adult			873	0.001%	4,756	0.007%			713	0.001%
	Eggs	16,268	0.051%	4,667	0.015%	399	0.001%				
	Juvenile	79,341	0.122%	6,655	0.010%	6,086	0.009%	7,700	0.012%	7,880	0.012%
	Larvae	79,206	0.202%	3,660	0.009%	6,290	0.016%	5,721	0.015%		
Atlantic Mackerel	Adult	55,887	0.108%	873	0.002%	4,756	0.009%	438	0.001%	2,661	0.005%
	Eggs	33,528	0.115%	4,667	0.016%	399	0.001%	1,100	0.004%	2,661	0.009%
	Juvenile	61,764	0.113%	1,672	0.003%	4,357	0.008%	1,539	0.003%	2,661	0.005%
	Larvae	27,684	0.147%	2,995	0.016%	399	0.002%	1,100	0.006%		
Atlantic Surfclam	Adult	12,896	0.057%	3,660	0.016%			5,889	0.026%		
	Juvenile	51,825	0.187%	3,660	0.013%			6,327	0.023%		
Black Sea Bass	Adult	51,658	0.120%	6,655	0.015%	2,644	0.006%	6,600	0.015%	7,168	0.017%
	Juvenile	24,243	0.053%	4,983	0.011%	398	0.001%	5,556	0.012%	7,880	0.017%
	Larvae	33	0.000%	2,122	0.009%			1,100	0.009%		
Bluefish	Adult	79,341	0.038%	6,655	0.003%	7,832	0.004%	7,700	0.004%	7,880	0.004%

Table U-2-1 EFH in the Project Area (continued)

Species	Life Stage	Lease Area a/		EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
		Acres of EFH	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH
	Eggs	167	0.000%	873	0.002%	398	0.001%	1,101	0.003%		
	Juvenile	12,862	0.009%	6,655	0.005%	7,832	0.005%	6,162	0.004%	7,880	0.006%
	Larvae	38,962	0.033%	2,995	0.003%	398	0.000%	1,539	0.001%		
Longfin Inshore Squid	Adult	66,317	0.122%	873	0.002%	400	0.001%	439	0.001%		
	Eggs	12,866	0.058%	6,655	0.030%	7,832	0.035%	4,788	0.022%	2,877	0.013%
	Juvenile	79,308	0.169%	4,533	0.010%	400	0.001%	4,622	0.010%	2,661	0.006%
Ocean Quahog	Adult	61,252	0.280%	6,655	0.030%	399	0.002%	5,721	0.026%		
	Juvenile	55,199	0.295%	1,672	0.009%			438	0.002%		
Scup	Adult	79,341	0.139%	6,655	0.012%	6,083	0.011%	7,700	0.014%	7,880	0.014%
	Eggs					4,357	0.110%				
	Juvenile	79,341	0.151%	6,655	0.013%	6,083	0.012%	7,700	0.015%	7,880	0.015%
	Larvae					4,357	0.110%				
Spiny Dogfish	Adult Female	66,299	0.111%	873	0.001%	396	0.001%	437	0.001%		
	Adult Male			873	0.001%	396	0.001%	1,381	0.002%	7,619	0.012%
	Sub-Female	38,796	0.012%	873	0.001%	396	0.001%	1,818	0.003%	7,619	0.011%
Summer Flounder	Adult	79,341	0.071%	6,655	0.006%	7,832	0.007%	7,700	0.007%	7,880	0.007%
	Eggs	167	0.001%					1,101	0.008%		
	Juvenile	13,001	0.015%	6,655	0.008%	7,832	0.009%	6,162	0.007%	7,880	0.009%
	Larvae	72,321	0.105%	3,794	0.006%	6,290	0.009%	1,539	0.002%		
Albacore Tuna	Juvenile	78,277	0.042%	1,619	0.001%			3,767	0.002%		

Table U-2-1 EFH in the Project Area (continued)

Species	Life Stage	Lease Area a/		EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
		Acres of EFH	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH
Bluefin Tuna	Adult	27,185	0.010%	4,975	0.002%			6,174	0.002%	2,609	0.001%
	Juvenile	79,343 1	0.134%	6,269	0.011%			7,700	0.013%	7,880	0.013%
Skipjack Tuna	Adult	79,341	0.037%	6,655	0.003%	1,283	0.001%	7,700	0.004%	7,880	0.004%
	Juvenile	79,341	0.028%	5,915	0.002%			5,579	0.002%		
Yellowfin Tuna	Juvenile	108	0.000%								
Blue Shark	Juvenile/Adult	67,584	0.066%					2,040	0.002%		
	Neonate	67,584	0.175%					2,040	0.005%		
Common Thresher Shark	ALL	79,341	0.096%	6,655	0.008%	2,409	0.003%	7,700	0.009%	7,880	0.010%
Dusky Shark	Juvenile/Adult	79,341	0.057%	5,915	0.004%			5,579	0.004%		
	Neonate	79,341	0.261%	6,655	0.022%	875	0.003%	7,700	0.025%	7,880	0.026%
Sand Tiger Shark	Neonate/Juvenile	79,341	0.155%	6,655	0.013%	1,563	0.003%	7,700	0.015%	7,880	0.015%
Sandbar Shark	Adult	79,341	0.050%	6,655	0.004%	2,232	0.001%	7,700	0.005%	7,880	0.005%
	Juvenile	79,341	0.135%	6,655	0.011%	850	0.001%	7,700	0.013%	7,880	0.013%
	Neonate	79,341	0.314%	5,583	0.022%			7,700	0.030%	2,615	0.010%
Shortfin Mako Shark	ALL	79,341	0.053%	3,498	0.002%			5,027	0.003%		
Smoothhound Shark Complex (Atlantic Stock)	ALL	75,189	0.168%	6,655	0.015%	7,614	0.017%	7,700	0.017%	7,880	0.018%

Table U-2-1 EFH in the Project Area (continued)

Species	Life Stage	Lease Area a/		EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/			
		Acres of EFH	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH	Acres of EFH in Federal Waters	% of Total EFH	Acres of EFH in State Waters	% of Total EFH
Tiger Shark	Juvenile/Adult	79,341	0.042%	5,120	0.003%			7,700	0.004%	1,692	0.001%
White Shark	Juvenile/Adult	79,341	0.229%	6,655	0.019%	1,188	0.003%	7,700	0.041%	7,880	0.023%
	Neonate	79,341	0.420%	6,152	0.033%			7,700	0.041%	7,877	0.042%

Note:
a/ For the purposes of this assessment, refers to the surveyed area in which Project components may be sited .

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
Atlantic cod	1	Juveniles	Mean high water-120	Structurally-complex intertidal and sub-tidal habitats, including eelgrass, mixed sand and gravel, and rocky habitats (gravel pavements, cobble, and boulder) with and without attached macroalgae and emergent epifauna	Sand lance, crabs, herring
		Adults	30-160	Structurally complex sub-tidal hard bottom habitats with gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae, also sandy substrates and along deeper slopes of ledges	
Atlantic herring	4	Larvae	0-300	Pelagic; estuaries and bays	Copepods, planktonic eggs and larvae of bivalves and barnacles; filter or bite at zooplankton within gape limit
		Juveniles	0-300; most 4-16		
		Adults	Subtidal-300	Pelagic except when spawning over varied bottom types to 90 m deep	Amphipods, copepods, euphausiids
Atlantic sea scallop	3	Eggs	18-110	Inshore and offshore benthic habitats (see adults)	n/a
		Larvae	No data	Inshore and offshore pelagic and benthic habitats: pelagic larvae ("spat"), settle on variety of hard surfaces, including shells, pebbles, and gravel and to macroalgae and other benthic organisms such as hydroids	
		Juveniles	18-110	Benthic habitats initially attached to shells, gravel, and small rocks (pebble, cobble), later free-swimming juveniles found in same habitats as adults	Phytoplankton and microzooplankton
		Adults	18-110	Benthic habitats with sand and gravel substrates	

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
Clearnose Skate	4	Juveniles	0-30	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom	Polychaetes, amphipods, mysids, *Crangon* shrimp, mantis shrimps, crabs (e.g., *Cancer*, mud, hermit, spider crabs), bivalves, squids, small fishes (e.g., soles, weakfish, butterfish, scup)
		Adults	0-40		
Haddock	4	Juveniles	40-140	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel	Indiscriminate; young juveniles eat pelagic prey (e.g., phytoplankton, copepods, invertebrate eggs) then switch to benthic prey (e.g., ophiuroids, polychaetes, echinoderms, small decapods, small fishes)
		Adults	50-160	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel and adjacent to boulders and cobbles along the margins of rocky reefs	Indiscriminate; sedentary or slow-moving invertebrates (e.g., crustaceans, annelids, polychaetes, mollusks, echinoderms); few fish
Little skate	4	Juveniles	Mean high water-80	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud	Broad diet: polychaetes, amphipods, crabs, squid, and small fish (e.g., butterfish and scup)
		Adults	Mean high water-100		
Monkfish	3	Juveniles	50-400 in the Mid-Atlantic	Sub-tidal benthic habitats on a variety of habitats, including hard sand, pebbles, gravel, broken shells, and soft mud, also seek shelter among rocks with attached algae	Lie-in-wait predator on fish, mollusks, crustaceans

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
		Adults	50-400 in the Mid-Atlantic	Sub-tidal benthic habitats on hard sand, pebbles, gravel, broken shells, and soft mud, but seem to prefer soft sediments, and, like juveniles, forage at the edges of rocky areas	
Ocean pout	3	Eggs	<100	Sub-tidal hard bottom habitats in sheltered nests, holes, or rocky crevices	n/a
		Juveniles	Mean high water-120	Intertidal and sub-tidal benthic habitats on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel	Soft infauna, sand dollars, scallops and other mollusks, crabs
		Adults	20-140	Sub-tidal benthic habitats on mud and sand, particularly in association with structure forming habitat types (i.e., shells, gravel, or boulders)	
Pollock	4	Larva	50-90	Pelagic waters	Pelagic plankton
		Juveniles	Mean high water-180 in GOM, LIS, Narragansett Bay	Intertidal and sub-tidal pelagic and benthic rocky bottom habitats with attached macroalgae, small juveniles in eelgrass beds, older juveniles move into deeper water habitats also occupied by adults	Diet varies with size: euphausiids; crustaceans, sand lance, squid, Atlantic herring
Red hake	4	Juveniles	Mean high water-80	Intertidal and sub-tidal soft bottom habitats, esp. those that that provide shelter, such as depressions in muddy substrates, eelgrass, macroalgae, shells, anemone and polychaete tubes, on artificial reefs, and in live bivalves (e.g., scallops)	Small benthic and pelagic crustaceans (e.g., larval shrimp and crabs, mysids, euphausiids, and amphipods; dominant prey changes seasonally
		Adults	50-750 on shelf and slope, as shallow as 20 inshore	Sub-tidal benthic habitats in shell beds, on soft sediments (usually in depressions), also found on gravel and hard bottom and artificial reefs	Crustaceans, demersal and pelagic fish, squid

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
Silver hake	3	Juveniles	40-400 in Gulf of Maine, >10 in Mid-Atlantic	Pelagic and sandy sub-tidal benthic habitats in association with sand-waves, flat sand with amphipod tubes, shells, and in biogenic depressions	Euphausiids, shrimp, amphipods, and decapods
		Adults	>35 in Gulf of Maine, 70- 400 on Georges Bank and in the Mid-Atlantic	Pelagic and sandy sub-tidal benthic habitats, often in bottom depressions or in association with sand waves and shell fragments, also in mud habitats bordering deep boulder reefs, on over deep boulder reefs in the southwest Gulf of Maine	Fish, crustaceans, squid; larger adults eat hake and other schooling fishes (e.g., young herring, mackerel, menhaden, alewives, sand lance, silversides), crustaceans, squids
White hake	4	Juveniles	Mean high water – 300	Intertidal and sub-tidal estuarine and marine habitats on fine- grained, sandy substrates in eelgrass, macroalgae, and un- vegetated habitats	Polychaetes, small shrimps, other crustaceans
		Adults	100-400 offshore Gulf of Maine, >25 inshore Gulf of Maine, to 900 on slope	Sub-tidal benthic habitats on fine-grained, muddy substrates and in mixed soft and rocky habitats	Small fishes (including own species), shrimps, other crustaceans.
Windowpane flounder	3	Eggs	Inshore bays	Mixed and high salinity zones of coastal bays and estuaries throughout the region including the Hudson-Raritan estuary	n/a
		Larvae	Inshore bays		Plankton
		Juveniles	Mean high water – 60	Intertidal and sub-tidal benthic habitats on mud and sand substrates	Polychaetes, small Crustaceans (especially mysids).
		Adults	Mean high water – 70		Polychaetes, small crustaceans (e.g., mysids, shrimp), small fishes (e.g., hakes, tomcod).

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
Winter flounder	1	Eggs	0-5 south of Cape Cod, 0-70 Gulf of Maine and Georges Bank	Sub-tidal estuarine and coastal benthic habitats on mud, muddy sand, sand, gravel, submerged aquatic vegetation, and macroalgae	n/a
		Larvae	0-70	Pelagic, then demersal	Zooplankton, small soft-bodied invertebrates
		Juveniles	Mean high water – 60	Intertidal and sub-tidal benthic habitats on a variety of bottom types, such as mud, sand, rocky substrates with attached macro algae, tidal wetlands, and eelgrass; young-of-the-year juveniles on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks	Young juveniles: copepods and harpacticoids; later juveniles shift to adult diet
		Adults	Mean high water – 70	Intertidal and sub-tidal benthic habitats on muddy and sandy substrates, and on hard bottom on offshore banks; for spawning adults, also see EFH for eggs	Omnivorous, opportunistic; varied fish and invertebrates (e.g., polychaetes, amphipods, bivalves)
Winter skate	4	Juveniles	0-90	Sub-tidal benthic habitats on sand and gravel substrates; also mud	Polychaetes, amphipods, rock crabs, shrimps, razor clams, isopods, and bivalves. Larger adults also eat fish (e.g., smaller skates, eels, alewives, blueback herring, menhaden, smelt, sand lance, chub mackerel, butterfish, cunners, sculpins, silver hake, and tomcod).
		Adults	0-80		
Witch flounder	1	Juveniles	50-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates	Polychaetes and squid

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
		Adults	35-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates	Mostly polychaetes, with some echinoderms, crustaceans, and mollusks
Yellowtail flounder	1, 2, 3	Juveniles	20-80	Sub-tidal benthic habitats on sand and muddy sand	Polychaetes, amphipods, sand dollars
		Adults	25-90	Sub-tidal benthic habitats on sand and sand with mud, shell hash, gravel, and rocks	Mostly crustaceans
Butterfish	3	Eggs	0-1500	Estuaries and bays and continental slope	Variety of planktonic and pelagic prey
		Larvae	41-350		
		Juveniles	10-280	Estuaries and bays and continental shelf over sand, mud, and mixed substrates	
		Adults	10-250		
Atlantic mackerel	1, 2	Eggs	>100	Pelagic: estuaries and bays and continental slope	Variety of planktonic and pelagic prey
		Larvae	12-100		
		Juveniles	10-110		
		Adults	<170		
Atlantic surfclam	4	Juveniles and adults	Surf zone to about 61, abundance low >38	In substrate to depth of 3 ft	Plankton
Black sea bass	3	Juveniles	Inshore in summer and spring	Estuaries and coastal waters; benthic habitats with rough bottom, shellfish and eelgrass beds, artificial reefs and other man-made structures in sandy-shelly areas; offshore clam beds and shell patches in winter	Small benthic crustaceans (isopods, amphipods, small crabs, sand shrimp, copepods), mysids, small fish, polychaetes

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
		Adults	Offshore on winter		*Summer inshore*: crustaceans (including juvenile lobster), small fish, pelagic squid, baitfish; *Winter offshore*: sand dollar, sea star, clams, polychaetes, squid, butterfish
Bluefish	1, 3	Eggs	30-70	Mid-shelf pelagic	n/a
		Larvae		Pelagic; surface 17 to 26 °C; rare in New York bight	Copepods
		Juveniles	5-20	estuarine and ocean beaches in New York and New Jersey	Variety of fish, crustaceans, polychaetes (based on availability)
		Adults	varies	Estuaries with surface temperature > 14 °C	Anchovy, squids, clupeids, butterfish
Longfin inshore squid	4	Eggs	<50	Bottom hard bottom (shells, lobster pots, piers, fish traps, boulders, and rock), submerged vegetation, sand, and mud	n/a
		Juveniles	6-160	Most abundant summer/fall at 14 to 15 m in Hudson/Raritan Estuary	Varies with size: plankton, euphausiids, arrow worms, small crabs, Polychaetes, shrimp
		Adults	6-200	Most abundant summer/fall at 15 to 18 m in Hudson/Raritan Estuary	Squid and fish (e.g., silver hake, mackerel, herring, menhaden, sand lance, bay anchovy, weakfish, silversides

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
Ocean quahog	4	Juveniles and adults	9-244	In substrate to depth of 3 ft	Plankton
Scup	3	Eggs/larvae	<50	Lower Bay	Plankton
		Juveniles	No information	Benthic habitats, in association with inshore sand and mud substrates, mussel and eelgrass beds, artificial reefs	Seasonally variable: mix of hard-surface epifauna and sand bottom infaunal prey, (e.g., razor clams, hydroids, blue mussels, anemones, mysids, copepods, amphipods, polychaetes, other small crustaceans
		Adults	No information, generally overwinter offshore	Benthic habitats	Crustaceans, polychaetes, mollusks, small squid, plant detritus, hydroids, sand dollars, bivalves, small fish (diet overlaps with winter flounder in Hudson/Raritan Bay)
Spiny dogfish	3	Female sub-adults; Female adults; Male adults	Wide depth range; Wide depth range; Wide depth range	Benthic and epibenthic	Fish (herring), squid, scallops, polychaetes, ctenophores

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
Summer flounder	3	Eggs	9-110	Pelagic	n/a
		Larvae	9-70	Pelagic	Plankton, copepods
		Juveniles	To maximum 152	Benthic habitats, including inshore estuaries, salt marsh creeks, seagrass beds, mudflats, and open bay areas (including Hudson/Raritan Bay); may prefer sand near submerged aquatic vegetation	Polychaetes, infaunal invertebrates, bivalve siphons, small fish
		Adults	To maximum 152 in colder months	Benthic habitats	Opportunistic feeders on fish (e.g., windowpane, winter flounder, northern pipefish, menhaden, bay anchovy, red hake, silver hake, scup, Atlantic silverside, sand lance, bluefish, weakfish, mummichog) and invertebrates (e.g., rock crabs, squids, shrimps, bivalves, gastropods, worms, sand dollars)
Atlantic Albacore Tuna	4	Juveniles;	Varied	Epipelagic; dives to 500 m	Opportunistic: fishes, cephalopods
Atlantic Bluefin Tuna	4	Juveniles; Adult	Varied	Epipelagic (top 10 m)	Bluefish, herring, mackerel, and squid
Atlantic Skipjack Tuna	4	Juveniles; Adults	>20	Epipelagic but dives to 260 m; coastal and offshore waters >20 °C	Opportunistic: fishes, cephalopods, and crustaceans
Atlantic Yellowfin Tuna	4	Juveniles	>50	Pelagic; top 100 m of deep offshore waters	Fish and squid
Blue Shark	4	Neonate; Juvenile; Adult	>180	Pelagic	Bluefish

Table U-2-2 Habitat and Prey Requirements for Species with Designated EFH in the Project Area (continued)

Species	Stock Status a/	Life Stage b/	Depth (meters) b/	Habitat Type and Description b/	Typical Prey c/
Common Thresher Shark	4	All	Varied	Pelagic	Squid, small fish, and pelagic crabs.
Dusky Shark	1, 2	Neonate	4.3-15.5	Pelagic	No data
		Juvenile; Adult	<60-200	Pelagic; dives to 400 m	
Sand Tiger Shark	4	Neonate; Juvenile	7-28	Bays and coastal sounds over sand and mud	Menhaden, crab, clearnose skate
Sandbar Shark	1	Neonate	0.8-23	Sand, mud, shell, and rocky benthic habitats	Benthic prey
		Juvenile	2.4-6.4	Pelagic	Pelagic fish
		Adult	20-55	Benthic	Benthic and pelagic fish (e.g., bluefish)
Shortfin Mako Shark	1, 2	All	varied	Pelagic	Swordfish, tuna, other sharks, clupeids, needlefishes, crustaceans, cephalopods; switch to bluefish in spring
Smoothhound Shark / Smooth Dogfish	4	All	Inshore-200	Benthic	Crabs, lobster, small bony fish
Tiger Shark	4	Juvenile; Adult	0-200m	Offshore epipelagic; dives to >200 m	No data
White Shark	4	Neonate	<100	Pelagic	Pelagic fish
		Juvenile/Adult	40-100		Grey seal

Notes:
a/ NOAA Fisheries Stock Status Update as of September 30, 2019; 1=overfished; 2=overfishing; 3=recovered; 4=not mentioned
b/ NMFS (2018) DEIS Jonah Crab, Table 6
c/ See EFH Source documents listed in Attachment J-1.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Atlantic Cod	x	x	--	x	x	x	--	x	x	x	--	x	
Construction: Noise, turbidity, direct injury of sessile life stage													Eggs and larvae are pelagic; juveniles and adults are mobile and can avoid injury.
Operations: Change in benthic habitat				✓+									Eggs and larvae are pelagic; foundations may increase cover for predators, including adult cod; rocky scour protection may provide suitable hardbottom habitat for adults.
Operations: Reduction of/change in prey species				✓									Eggs and larvae are pelagic; foundations, scour protection, and armored subsea cables may alter species assemblage but not affect availability of prey for adult cod.
Atlantic Herring	--	x	x	x	--	x	x	x	--	x	x	x	
All Project Activities													All life stages are pelagic; the project would not affect pelagic prey.

Notes:
a/ For the purposes of this assessment, refers to the surveyed area in which Project components may be sited.
b/ EFH is designated separately for sub-females (sf), females (f), and males (m)

Legend:
x: EFH for this life stage is designated in the portion of the Project Area indicated
n/a: Not applicable (life stage doesn't occur in this species)
--: No EFH for this life stage is designated in the portion of the Project Area indicated
A: Adult E: Egg L: Larva (and neonate sharks) J: Juvenile
✓: Likely adverse impact
+: Likely beneficial effect
Grey: Negligible or no adverse impact

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Atlantic Sea Scallop	x	x	x	x	x	x	x	x	x	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Demersal eggs, spat, and settled scallops could be directly injured or killed during construction; greatest injury would be within the foundation footprints and subsea cable trenches.
Operations: Change in benthic habitat	✓	+	+	✓	✓	✓	✓	✓	✓	✓	✓	✓	Eggs settling on rocky scour protection may be less viable than those settling on natural bottoms; conversely, foundations may provide additional settling and development area for spat and juveniles. Foundations would not support adult scallops, which prefer sand and gravel substrates.
Operations: Reduction of/change in prey species													No change in pelagic prey species is expected.
Clearnose Skate	--	n/a	--	--	--	n/a	x	x	--	n/a	--	--	
Construction: Noise, turbidity, direct injury of sessile life stage													Juveniles and adults could be injured or temporarily disturbed during foundation and cable installation, but impacts would be minimal because these life stages are mobile and construction vessels move slowly.
Operations: Change in habitat or prey species or													Operations would have no effect on EFH or prey for juveniles or adults; the Project Area is at the extreme northern edge of EFH.
Haddock	--	x	x	--	--	--	x	--	--	x	--	--	
Construction: Noise, turbidity, direct injury of sessile life stage			✓										Larvae are pelagic; juveniles rear in hard sand, gravel; scattered gravelly sand near boulders; minimal suitable habitat in Lease Area or offshore cable installation corridors.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Operations: Change in benthic habitat			✓										Some areas of gravelly sand in Lease Area would be covered by foundations and scour protection, displacing juvenile haddock to adjacent sandy areas
Operations: Reduction of/change in prey species													No reduction in prey would occur.
Little Skate	--	n/a	x	--	--	n/a	x	x	--	n/a	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage			✓				✓	✓			✓	✓	Juveniles and adults in sand, gravel, and mud could be injured or temporarily disturbed during construction, but impacts would be minimal because these life stages are mobile.
Operations: Change in benthic habitat													Operations would have minimal effect on juvenile EFH; juveniles would forage in sandy areas surrounding foundations and scour protection.
Operations: Reduction of/change in prey species			✓										Scour protection and armored subsea cables may alter assemblage of prey species near foundations, but adequate sandy substrate would remain abundant nearby.
Monkfish	x	x	x	x	x	x	x	x	x	x	-	x	
Construction: Noise, turbidity, direct injury of sessile life stage				✓				✓				✓	Eggs and larvae are pelagic; juveniles in Hudson Shelf Valley could be temporarily dislocated during submarine export cable installation; adults in eastern half of Lease Area and the EW Gowanus and BW Oceanview offshore cable installation corridors through the Hudson Shelf Valley would be temporarily dislocated during construction.
Operations: addition of hardbottom				+									Edges of rocky scour protection would likely provide suitable foraging habitat.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Ocean Pout	x	--	x	x	x	--	x	x	x	--	--	x	
Construction: Noise, turbidity, direct injury of sessile life stage	✓				✓				✓				Demersal eggs may be directly harmed by construction. Juveniles and adults are mobile and could avoid injury.
Operations: addition of hardbottom	+		+	+									Rocky scour protection would provide crevices for eggs. Juveniles and adults can benefit from foraging on rocky bottoms.
Operations: Reduction of/change in prey species			✓										Some change in prey assemblage; lateral foraging displacement.
Pollock	--	x	--	--	--	--	--	--	x	x	x	--	
Construction: Noise, turbidity, direct injury of sessile life stage													Eggs and larvae are pelagic. Juveniles are mobile; can avoid construction in submarine export cable routes.
Operations: addition of hardbottom													Older juveniles prefer rocky substrate; EFH limited to Hudson Shelf Valley.
Operations: Reduction of/change in prey species													Prey species unaffected.
Red Hake	x	x	x	x	x	x	x	x	x	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage			✓				✓				✓		Juveniles prefer softbottom, could be disturbed during construction.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Operations: addition of hardbottom													Older juveniles and adults likely to use scour protection and adjacent sandy areas.
Operations: Reduction of/change in prey species													Broad diet of benthic and pelagic prey.
Silver Hake	x	x	x	--	x	x	--	x	x	x	--	--	
Construction: Noise, turbidity, direct injury of sessile life stage			✓										Juveniles prefer softbottom, could be disturbed during construction.
Operations: addition of hardbottom													Older juveniles and adults likely to use scour protection and adjacent sandy areas.
Operations: Reduction of/change in prey species													Broad diet of benthic and pelagic prey.
White Hake	--	--	--	--	--	--	--	--	--	--	x	--	
Construction: Noise, turbidity, direct injury of sessile life stage													Limited EFH for juveniles in two offshore cable installation corridors.
Operations: addition of hardbottom													Limited in offshore cable installation corridors.
Operations: Reduction of/change in prey species													No loss of prey.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Windowpane Flounder	x	x	x	x	x	x	x	x	x	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage			✓	✓			✓	✓			✓	✓	Eggs and larvae are pelagic; some injury to benthic juveniles and adults during construction.
Operations: addition of hardbottom			✓	✓			✓	✓			✓	✓	Prefer softbottom; likely lateral foraging displacement away from rocky scour protection.
Operations: Reduction of/change in prey species			✓	✓			✓	✓			✓	✓	Some loss of crustaceans and polychaetes in hardbottom areas; adults would likely move to edges or into open softbottom.
Winter Flounder	--	x	x	x	x	x	x	x	x	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage					✓		✓	✓	✓		✓	✓	Demersal eggs in offshore cable installation corridors could be affected by construction; larvae are pelagic; juveniles and adults are mobile but could be affected by construction in inshore waters; likely able to avoid construction in Lease Area.
Operations: addition of hardbottom			✓	✓			✓	✓			✓	✓	Prefer softbottom; likely lateral foraging displacement away from rocky scour protection.
Operations: Reduction of/change in prey species			✓	✓			✓	✓			✓	✓	Juveniles and adults are omnivorous and opportunistic foragers; no effect on prey availability.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Winter Skate	--	n/a	x	x	--	n/a	x	x	--	n/a	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage													Juvenile and adults are mobile and likely to avoid construction.
Operations: addition of hardbottom			✓	✓									Juveniles and adults prefer mud and sand; would likely be displaced by hardbottom in the Lease Area.
Operations: Reduction of/change in prey species													Broad diet; not likely to experience prey shortage.
Witch Flounder	x	x	--	x	x	x	--	--	x	x	--	--	
Construction: Noise, turbidity, direct injury of sessile life stage													Eggs and larvae are pelagic; adults are mobile and likely to avoid construction in Lease Area (small area of adult EFH in far offshore Lease Area).
Operations: addition of hardbottom													Very limited adult EFH in far eastern portion of Lease Area; some lateral displacement likely during full buildout.
Operations: Reduction of/change in prey species													Very limited adult EFH in far eastern portion of Lease Area; no substantial effect on prey.
Yellowtail Flounder	x	x	x	x	x	x	x	x	x	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage			✓				✓				✓		Eggs and larvae are pelagic; juveniles are mobile but could be affected by construction; adults are likely to temporarily relocate to avoid construction.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Operations: addition of hardbottom			✓				✓				✓		Juveniles may shift laterally away from foundations and scour protection into sandy softbottom; adults can live on rocky substrates.
Operations: Reduction of/change in prey species													Juveniles and adults have varied invertebrate diet (e.g., polychaetes, crustaceans, sand dollars) available in softbottom habitats.
Atlantic Butterfish	x	x	x	--	x	x	x	x	--	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage													All life stages pelagic: eggs and larvae in estuaries/bays, juveniles and adults both inshore and offshore.
Operations: addition of hardbottom													Unaffected by hardbottom; may aggregate around vertical structures in Lease Area.
Operations: Reduction of/change in prey species													Planktonic and pelagic prey unlikely to be affected by construction or operations.
Atlantic Mackerel	x	x	x	x	x	x	x	x	x	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage													All life stages pelagic; unlikely to be affected by construction or operations.
Operations: addition of hardbottom													Unaffected by hardbottom; may aggregate around vertical structures in Lease Area.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Operations: Reduction of/change in prey species													Planktonic and pelagic prey unlikely to be affected by construction or operations.
Atlantic Surfclam	--	--	x	x	--	--	x	x	--	--	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage			✓	✓			✓	✓			✓	✓	Juveniles and adults are sessile; individuals in construction areas likely to be adversely affected.
Operations: addition of hardbottom			✓	✓			✓	✓			✓	✓	Surfclam cannot burrow in hardbottom; permanent habitat loss.
Operations: Reduction of/change in prey species													Planktonic prey unlikely to be adversely affected.
Black Sea Bass	--	x	x	x	--	x	x	x	--	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage													Larvae are pelagic; juveniles and adults are mobile and can avoid construction.
Operations: addition of hardbottom				+									Juveniles and adults associate with artificial structures; possible increase in habitat value in Lease Area.
Operations: Reduction of/change in prey species													Varied diet of infauna and epifauna; likely foraging throughout Lease Area.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Bluefish	x	x	x	x	x	x	x	x	x	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage													All life stages are pelagic.
Operations: addition of hardbottom													Unaffected by hardbottom; may aggregate around vertical structures in Lease Area.
Operations: Reduction of/change in prey species													Summer migrant; eats mostly other fish; unlikely to be adversely affected by construction or operations.
Longfin Inshore Squid	x	--	x	x	x	--	x	x	x	--	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage	✓				✓				✓				Demersal eggs could be injured during construction.
Operations: addition of hardbottom	+				+				+				Foundations and scour protection would provide suitable attachment sites for eggs.
Operations: Reduction of/change in prey species													No reduction in prey availability.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Ocean Quahog	--	--	x	x	--	--	x	x	--	--	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage			✓	✓			✓	✓			✓	✓	Juveniles and adults are sessile; individuals in construction areas likely to be adversely affected.
Operations: addition of hardbottom			✓	✓			✓	✓			✓	✓	Ocean quahog cannot burrow in hardbottom; permanent habitat loss.
Operations: Reduction of/change in prey species													Planktonic prey unlikely to be adversely affected.
Scup	--	--	x	x	x	x	x	x	--	--	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage					✓	✓							Eggs and larvae in the Lower Bay could be adversely affected by cable installation; juvenile and adult are mobile and able to avoid most construction effects.
Operations: addition of hardbottom													Juveniles and adults occur over hardbottom and soft bottom.
Operations: Reduction of/change in prey species													Broad diet of hard-surface epifauna and soft-bottom infauna; no substantial change in prey availability.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Spiny Dogfish b/	n/a	--	sf	f	n/a	--	sf	f/m	n/a	--	sf	f/m	
Construction: Noise, turbidity, direct injury of sessile life stage													All life stages are mobile; effects of construction are unlikely.
Operations: addition of hardbottom													Widespread use of hardbottom and softbottom habitat.
Operations: Reduction of/change in prey species													Broad diet of pelagic and benthic, prey (e.g., herring, squid, scallops, polychaetes); no change expected.
Summer Flounder	x	x	x	x	--	x	x	x	x	x	x	x	
Construction: Noise, turbidity, direct injury of sessile life stage			✓	✓			✓	✓			✓	✓	Eggs and larvae are pelagic; benthic juveniles and adults may be adversely affected by construction.
Operations: addition of hardbottom			✓	✓									May displace juveniles and adults to soft-bottom habitats in Lease Area.
Operations: Reduction of/change in prey species													Opportunistic forager with wide diet; no reduction in softbottom prey expected.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Atlantic Albacore Tuna	--	--	x	--	--	--	x	--	--	--	x	--	
Operations: Addition of vertical structure			+										Epipelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.
Atlantic Bluefin Tuna	--	--	x	x	--	--	x	x	--	--	x	x	
Operations: Addition of vertical structure			+										Epipelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.
Atlantic Skipjack Tuna	--	--	x	x	--	--	x	x	--	--	x	x	
Operations: Addition of vertical structure			+	+									Epipelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.
Atlantic Yellowfin Tuna	--	--	x	--	--	--	--	--	--	--	--	--	
Operations: Addition of vertical structure			+										Pelagic; negligible area of juvenile EFH in Lease Area.
Blue Shark	n/a	x	x	x	n/a	--	--	--	n/a	x	x	x	
Operations: Addition of vertical structure			+	+									Pelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.
Common Thresher Shark	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x	
Operations: Addition of vertical structure			+	+									Pelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
Dusky Shark	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x	
Operations: Addition of vertical structure			+	+									Pelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.
Sand Tiger Shark	n/a	x	x	--	n/a	x	x		n/a	x	x	--	
Operations: Addition of vertical structure													Live in bays and coastal sounds, largely epipelagic; unlikely to be adversely affected by construction or operations.
Sandbar Shark	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x	
Operations: Addition of vertical structure			✓	✓									Overfished; neonates and adults are pelagic and have benthic prey; highly migratory; likely to be adversely affected by construction and operations.
Shortfin Mako Shark	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x	
Operations: Addition of vertical structure			+	+									Pelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.
Smoothhound Shark / Smooth Dogfish	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x	
Operations: Addition of vertical structure													Benthic but transient in the Project Area; eats variety of prey; unlikely to be adversely affected by construction or operations.
Tiger Shark	n/a	--	x	x	n/a	--	x	x	n/a	--	x	x	
Operations: Addition of vertical structure			+	+									Pelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.

Table U-2-3 Summary of Potential Impacts on EFH for Species and Life Stages in the Project Area (continued)

Managed Species	Lease Area a/				EW 1 Submarine Export Cable Siting Corridor a/				EW 2 Submarine Export Cable Siting Corridor a/				Supporting Information
	Life Stage												
	E	L	J	A	E	L	J	A	E	L	J	A	
White Shark	n/a	x	x	x	n/a	x	x	x	n/a	x	x	x	
Operations: Addition of vertical structure			+	+									Pelagic; potential beneficial effect on juveniles and adults using vertical structures as foraging sites.

Notes:
a/ For the purposes of this assessment, refers to the surveyed area in which Project components may be sited.
b/ EFH is designated separately for sub-females (sf), females (f), and males (m)

Legend:
x: EFH for this life stage is designated in the portion of the Project Area indicated
n/a: Not applicable (life stage doesn't occur in this species)
--: No EFH for this life stage is designated in the portion of the Project Area indicated
A: Adult E: Egg L: Larva (and neonate sharks) J: Juvenile
✓: Likely adverse impact
+: Likely beneficial effect
Grey: Negligible or no adverse impact

ATTACHMENT U-3
MAPBOOKS