Construction and Operations Plan

Appendix W - Essential Fish Habitat Assessment

September 30, 2022

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Construction and Operations Plan
Kitty Hawk North Wind Project
Lease Area OCS-A 0508

Appendix W
Essential Fish Habitat Assessment

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ACRONYMS AND ABBREVIATIONS

°C	degree Celsius
µm	micrometer
ASMFC	Atlantic States Marine Fisheries Commission
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
Company	Kitty Hawk Wind, LLC
COP	Construction and Operations Plan
CVOW	Coastal Virginia Offshore Wind
DPS	Distinct Population Segment
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
EIS	Environmental Impact Statement
EMF	electric and magnetic fields
ESA	Endangered Species Act
ESP	electrical service platform
FMC	Fishery Management Council
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
ha	hectare
HAPC	Habitat Area of Particular Concern
HDD	horizontal directional drilling
km	kilometer
Lease Area	the designated Renewable Energy Lease Area OCS-A 0508
m	meter
m^2	square meter
MAFMC	Mid-Atlantic Fishery Management Council
MAG	magnetometer
MBES	Multibeam echo sounder
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEFMC	New England Fishery Management Council
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	NOAA National Marine Fisheries Service
O&M	Operations and Maintenance

OCS	Outer Continental Shelf
PDE	Project Design Envelope
Project	Kitty Hawk North Wind Project
review area	the portions of the Wind Development Area and offshore export cable corridor that could be directly or indirectly affected by the construction, O&M, and decommissioning of the Project
SAFMC	South Atlantic Fishery Management Council
SAP	Site Assessment Plan
SBP	sub bottom profiler
SSS	side scan sonar
TVG	transverse gradiometer
UHRS	ultra-high-resolution seismic
U.S.	United States
U.S.C.	United States Code
VMRC	Virginia Marine Resources Commission
Wind Development Area	approximately 40 percent of the Lease Area in the northwest corner closest to shore (19,411 ha)
WEA	Wind Energy Area
WTG	Wind Turbine Generator

W.1 INTRODUCTION

Kitty Hawk Wind, LLC (the Company), a wholly owned subsidiary of Avangrid Renewables, LLC, proposes to construct, own, and operate the Kitty Hawk North Wind Project (the Project), which will be located in the designated Renewable Energy Lease Area OCS-A 0508 (Lease Area). The Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS) was awarded through the Bureau of Ocean Energy Management (BOEM) competitive renewable energy lease auction of the Wind Energy Area (WEA) offshore of North Carolina. The Lease Area covers 49,536 hectares (ha) and is located approximately 44 kilometers (km) offshore of Corolla, North Carolina.

At this time, the Company proposes to develop approximately 40 percent of the Lease Area in the northwest corner closest to shore (19,441 ha, referred to as the Wind Development Area). The Project will connect from the electrical service platform (ESP) through offshore export cables (within a designated corridor) and onshore export cables to the new onshore substation in the City of Virginia Beach, Virginia, where the renewable electricity generated will be transmitted to the electric grid. For the purposes of this Essential Fish Habitat Assessment (EFHA), the review area includes the portions of the Wind Development Area and offshore export cable corridor that could be directly or indirectly affected by the construction, operations and maintenance (O&M), and decommissioning of the Project (Figure W-1).

Tidal waters and state waters (within 5.6 km [3 nautical miles] of shore) in the review area are under the jurisdiction of the Commonwealth of Virginia. Fishery resources in these waters are managed by the Virginia Marine Resources Commission (VMRC), which may share responsibility for some managed species with the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NOAA Fisheries) and/or the Atlantic States Marine Fisheries Commission (ASMFC).

Fishery resources in the federal portion of the review area are managed jointly by NOAA Fisheries and Fishery Management Councils (FMCs) created under the Magnuson-Stevens Fisheries Conservation and Management Act (MSA), specifically the New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council (MAFMC), South Atlantic Fishery Management Council (SAFMC), and Gulf of Mexico Fishery Management Council (GMFMC). Commercial and recreational fisheries are regulated for each species or stock through fishery management plans (FMPs), which require designation of essential fish habitat (EFH) and habitat areas of particular concern (HAPC), as needed. Designated EFH for each species or stock is defined as the waters and seafloor necessary for spawning, breeding, or growth to maturity (16 United States Code [U.S.C.] § 1802(10)). FMCs, Commissions, and Divisions may also designate HAPC, which are areas of EFH critical to the survival of given species. Because fish cross administrative boundaries, management authority is determined by species rather than location.

Under the MSA, federal agencies are required to consult with NOAA Fisheries regarding any actions authorized, funded, undertaken, or proposed to be authorized, funded, or undertaken under their jurisdiction. BOEM must consult with NOAA Fisheries (Greater Atlantic Regional Fisheries Office [GARFO] or Southeast Regional Office [SERO]) for any proposed offshore wind projects located along the United States (U.S.) Atlantic Coast. This EFHA was prepared in accordance with 50 Code of Federal Regulations (CFR) § 600.920(e)(1) to support BOEM in consultation with GARFO and SERO under the MSA. Potential impacts of construction, O&M, and decommissioning of the Project on managed species with designated EFH for one or more life stage in the review area are discussed. Benthic habitat maps of the review area were prepared according to GARFO's Updated Recommendations for Mapping Fish Habitat to ensure benthic habitat information presented in this EFHA is sufficient for BOEM to meet consultation requirements (NOAA Fisheries 2021a).

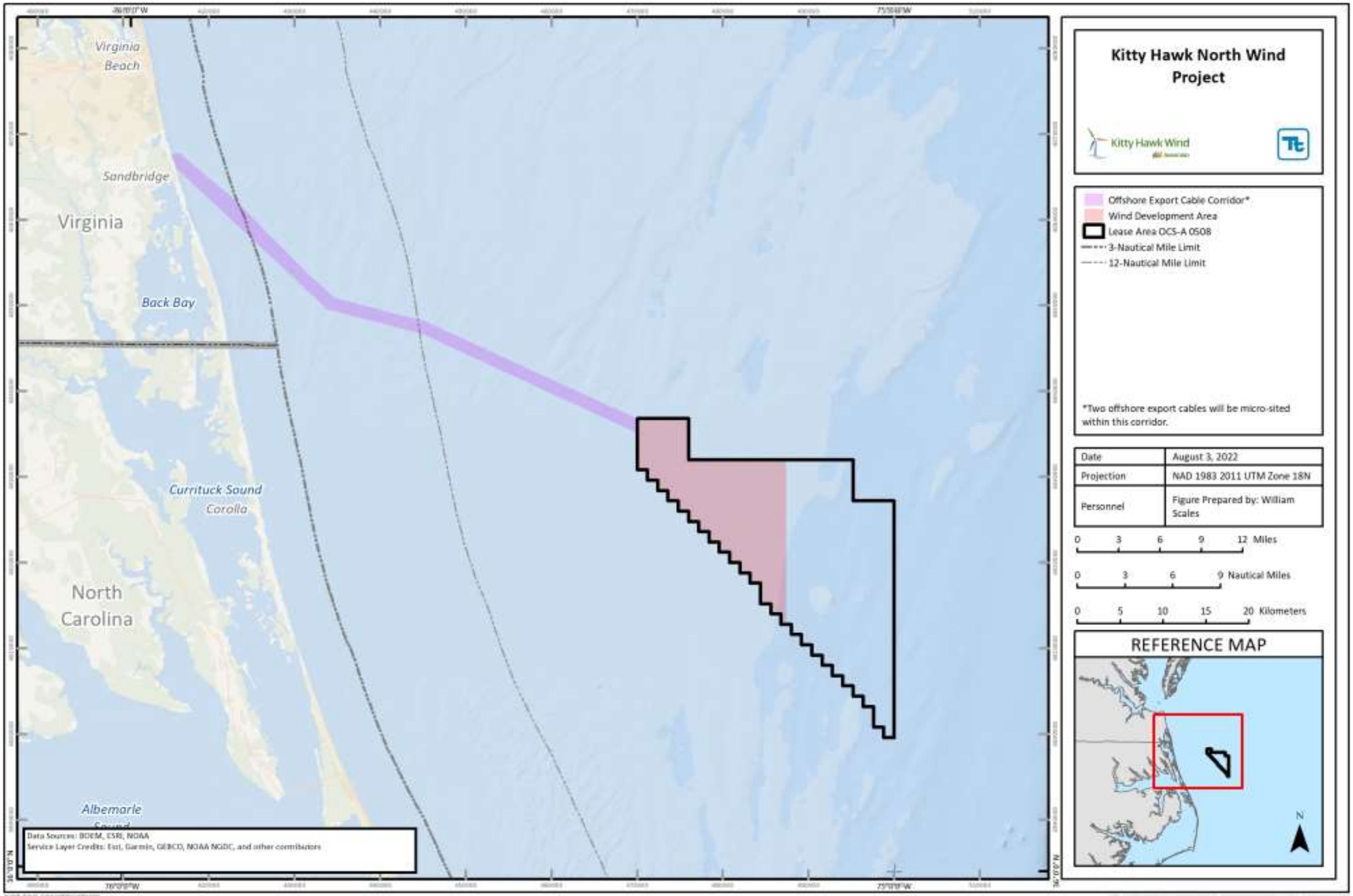

Figure W-1 Review Area Overview

The Kitty Hawk EFHA is a supplementary filing to the Project's Construction and Operations Plan (COP), which presents a comprehensive description of the Project, affected environments, and potential impacts to physical, biological, cultural, and socioeconomic resources. A description of the affected physical and biological environments, as well as potential impacts to benthic and pelagic resources, is presented in Section 4.1, Physical and Oceanographic Conditions; Section 4.2, Water Quality; and Section 5.4, Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat. This EFHA cross-references these COP sections and associated appendices, including Appendix M, Sediment Transport Analysis; Appendix P, Underwater Acoustic Assessment; and Appendix V, Benthic Resource Characterization Reports.

The EFHA includes the following components:

- Summary of designated EFH for any species and life stage that may be exposed to impact-producing factors associated with the Project (Section W.2).
- Description of the Project; construction, O&M, and decommissioning activities; and avoidance, minimization, and mitigation measures proposed by the Company (Section W.3).
- Potential effects on designated EFH in the review area (Section W.4).
- A summary of effects (Section W.5).
- Literature cited (Section W.6).

Profiles of managed species with designated EFH for one or more life stage in the review area are presented in Attachment W-1. The profiles include species life histories, habitat and forage requirements, and acreages of EFH in the review area. The potential impacts of the Project on each managed species and life stage in the review area are presented in Attachment W-2.

W.2 MANAGED SPECIES IN THE REVIEW AREA

The demersal and pelagic habitats of the Mid-Atlantic Bight support approximately 600 fish species (BOEM 2014a). BOEM and NOAA Fisheries characterized fisheries resources within the Kitty Hawk WEA as having few to no structure-forming fauna, notable differences in species assemblages and relative abundances between warm and cold seasons, and a taxa-rich system (Guida et al. 2017). In federal waters of the review area, species and stocks are managed by NEFMC, MAFMC, SAFMC, and GMFMC. Additionally, NOAA Fisheries' Highly Migratory Species (HMS) Division is responsible for tunas, sharks, swordfish, and billfish in these waters (NOAA Fisheries 2017).

State regulatory bodies manage commercial and recreational fisheries in state and tidal waters according to their own structure of agencies and plans. In state waters of the review area, species and stocks are managed by VMRC, which shares responsibility for some managed species with ASMFC. The VMRC Fisheries Management Division's Fisheries Plans and Statistics Department monitors the state's finfish and shellfish fisheries and develops management plans with assistance from Fisheries Management Advisory Committees composed of representatives of fisheries interest groups.

Furthermore, the federal Coastal Zone Management Act of 1972 encouraged coastal states to develop and implement coastal zone management plans to conserve and enhance coastal habitat and living resources. The North Carolina Department of Environmental Quality's Division of Coastal Management and Virginia Department of Environmental Quality's Coastal Zone Management Program are responsible for the implementation of federally approved coastal zone management programs in the review area.

Benthic or pelagic EFH has been designated for one or more life stages of 37 managed species in the review area. Designated EFH in the review area was identified using the NOAA Fisheries EFH Mapper

(2021), NEFMC Omnibus Amendment 2 (2017), MAFMC Fisheries Management Plans, SAFMC Final Comprehensive Amendment (1998), NOAA Fisheries HMS Amendment 10 (2017), and NOAA Fisheries EFH source documents. The Company further refined this list of designated EFH by conducting extensive surveys of the review area using sub-bottom profiler (SBP), ultra-high-resolution seismic (UHRS), side scan sonar (SSS), multibeam echosounder (MBES), and magnetometer/transverse gradiometer (MAG/TVG), digital imagery, and direct analysis of grain size distribution and infaunal communities in sediment grab samples. The results of these surveys conducted in February and October-November 2020 are described in detail in Appendix V, Benthic Resource Characterization Reports, and incorporated by reference in this EFHA.

Table W-1 summarizes the managed species expected to occur seasonally or year-round in the review area. Detailed EFH designations and life history profiles for the 37 federally managed species in the review area are provided in Attachment W-1. No HAPC has been designated in the review area (NOAA Fisheries 2021b).

Table W-1 Species in the Review Area Managed by Federal and Regional Entities

Common Name	Scientific Name	EFH Designated in the Review Area
NEFMC		
Atlantic cod	*Gadus morhua*	Egg, Larva
Atlantic herring b/	*Clupea harengus*	Juvenile, Adult
Atlantic sea scallop	*Placopecten magellanicus*	All
Clearnose skate	*Raja eglanteria*	Juvenile, Adult
Monkfish a/	*Lophius americanus*	All
Pollock	*Pollachius virens*	Larva
Red hake	*Urophycis chuss*	Adult
Windowpane Flounder	*Scophthalmus aquosus*	All
Winter skate	*Leucoraja ocellata*	Juvenile
Witch flounder	*Glyptocephalus cynoglossus*	Egg, Larva
Yellowtail flounder	*Limanda ferruginea*	Larva
MAFMC		
Atlantic butterfish	*Peprilus triacanthus*	All
Atlantic mackerel	*Scomber scombrus*	Juvenile, Adult
Atlantic surfclam	*Spisula solidissima*	Juvenile, Adult
Black sea bass b/	*Centropristis striata*	Larva, Juvenile, Adult
Bluefish b/	*Pomatomus saltatrix*	All
Longfin inshore squid	*Doryteuthis (Amerigo) pealeii*	Egg, Juvenile, Adult
Northern shortfin squid	*Illex illecebrosus*	Juvenile
Scup b/	*Stenotomus chrysops*	Juvenile, Adult
Spiny dogfish b/	*Squalus acanthias*	Sub-female, Adult Female/Male
Summer flounder b/	*Paralichthys dentatus*	All
SAFMC & GMFMC		
Snapper grouper	Epinephelidae; Lutjanidae	All
Spiny lobster	Palinuridae	All

Common Name	Scientific Name	EFH Designated in the Review Area
NOAA Fisheries HMS Division		
Albacore tuna	*Thunnus alalonga*	Juvenile
Atlantic angel shark	*Squatina dumeril*	All
Atlantic bluefin tuna	*Thunnus thynnus*	All
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	Juvenile, Adult
Atlantic skipjack tuna	*Katsuwonus pelamis*	Juvenile, Adult
Atlantic yellowfin tuna	*Thunnus albacares*	Juvenile
Blacktip shark	*Carcharhinus limbatus*	Juvenile, Adult
Common thresher shark	*Alopias vulpinus*	All
Dusky shark	*Carcharhinus obscurus*	All
Sand tiger shark	*Carcharhinus taurus*	All
Sandbar shark	*Carcharhinus plumbeus*	All
Scalloped hammerhead shark	*Sphyrna lewini*	Juvenile, Adult
Smoothhound shark complex / smooth dogfish	*Mustelus canis*	All
Tiger shark	*Galeocerdo cuvier*	All
Notes: a/ Joint management by NEFMC and MAFMC b/ Joint management with ASMFC		

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

BOEM Atlantic Outer Continental Shelf Environmental Assessments: Under the MSA, BOEM must consult with NOAA Fisheries for any proposed offshore wind projects located along the U.S. Atlantic Coast. Prior BOEM consultations with GARFO include pre-COP activities, such as leasing and Site Assessment Plan (SAP) development for offshore wind projects, including New Jersey, Delaware, Maryland, and Virginia (BOEM 2012); Rhode Island and Massachusetts (BOEM 2013); Massachusetts (BOEM 2014b); North Carolina (BOEM 2015a); and New York (BOEM 2016). These Environmental Assessments (EA) did not evaluate project-specific construction, O&M, or decommissioning activities.

In 2011, NOAA Fisheries concluded that although proposed offshore wind projects in the Mid-Atlantic WEAs may adversely affect EFH, impacts would be temporary and insubstantial given the limited spatial extent of the proposed activities (BOEM 2012). In correspondence with BOEM, NOAA Fisheries listed four EFH conservation recommendations:

- Removal of "important fishing grounds…from consideration for leasing to protect key habitat for federally managed species."
- Cooperation with MAFMC and NOAA Fisheries "to identify and preserve other areas ecologically important to production of fish resources and traditional fishing grounds throughout the geographical range covered by the proposed NEPA action."
- Development of "guidance on studies and methodologies for site characterization activities" in cooperation with NOAA Fisheries to ensure NOAA Trust Resources are adequately characterized within Lease Areas.

- Submission of future SAPs to NOAA Fisheries for review and comment (BOEM 2012).

NOAA Fisheries concurred with BOEM's Finding of No Significant Impact (FONSI) for EFH in the Mid-Atlantic WEAs and other Atlantic OCS WEAs (BOEM 2012, 2013, 2014b, 2015a, 2016). Analyses and determinations resulting from other, project-specific EFH consultations on the Atlantic OCS similar to the Kitty Hawk North Wind Project are described briefly in this section and incorporated into the present EFHA to the extent practicable.

Vineyard Wind Offshore Energy Project (Massachusetts; Lease Area OCS-A 0501): BOEM initiated a formal MSA consultation with NOAA Fisheries in 2018 for the Vineyard Wind Offshore Energy Project. To support the consultation, BOEM prepared an EFHA that examined the acoustic impacts of pile driving and vessel presence; temporary benthic habitat loss or disturbance; turbidity and suspended sediment; sediment deposition; water withdrawal; and permanent habitat loss. The EFHA determined that EFH impacts would be life-stage specific but that acoustic impacts from pile driving could affect all species and life stages. It concluded that demersal (i.e., seafloor-associated) species with designated EFH in benthic habitats would be more likely to experience impacts than species with designated EFH in pelagic habitats (BOEM 2019). BOEM also initiated a formal Endangered Species Act (ESA) consultation with NOAA Fisheries in 2018. NOAA Fisheries prepared a Biological Opinion that determined that the impacts of the project to Atlantic sturgeon would be insignificant or extremely unlikely to occur (NOAA Fisheries 2020). The Biological Opinion recommended monitoring measures, including recording project noise levels; tracking Atlantic sturgeon and other protected species presence in the vicinity of the project; and documenting long-term project impacts to regional oceanographic conditions, benthic habitat, and species distributions (NOAA Fisheries 2020).

Revolution Wind Offshore Wind Farm (Rhode Island; Lease Area OCS-A 0486): Revolution Wind, LLC prepared an EFHA to support BOEM's interagency consultation with NOAA Fisheries for the Revolution Wind Offshore Wind Farm. The EFHA identified temporary and reversible impacts to EFH associated with construction of the project and long-term impacts to EFH associated with the conversion of softbottom to hardbottom habitat (INSPIRE Environmental 2020). The EFHA determined that benthic communities in the project area would be expected to re-establish within one to three years following construction. BOEM issued a Notice of Intent to prepare an EIS for Revolution Wind on 30 Apr 2021 and will initiate a formal consultation with NOAA Fisheries to support its assessment of project impacts following the public scoping and comment period (Federal Register 2021a).

Ocean Wind Offshore Wind Farm (New Jersey; Lease Area OCS-A 0498): Ocean Wind, LLC prepared an EFHA to support BOEM's interagency consultation with NOAA Fisheries for the Ocean Wind Offshore Wind Farm. The EFHA identified short-term and temporary impacts to EFH from pile driving and long-term impacts to EFH associated with the conversion of softbottom to hardbottom habitat (Ocean Wind, LLC 2021). BOEM issued a Notice of Intent to prepare an EIS for Ocean Wind on 30 Mar 2021 and will initiate a formal consultation with NOAA Fisheries to support its assessment of project impacts following the public scoping and comment period (Federal Register 2021b).

Coastal Virginia Offshore Wind (CVOW) Pilot Project (formerly the Virginia Offshore Wind Technology Advancement Project; Lease Area OCS-A 0497): BOEM initiated a formal MSA consultation with NOAA Fisheries in 2014 for the CVOW Pilot Project. To support the consultation, BOEM prepared EA that examined acoustic impacts, electric and magnetic fields (EMF), habitat disturbance, and habitat changes to EFH in the project area (BOEM 2015b). NOAA Fisheries concurred with BOEM's determination that the project would adversely affect the quality of EFH offshore Virginia temporarily, but that these impacts would not substantially affect the quality and quantity of EFH in the inner-shelf zone over the life of the project. Direct impacts to juvenile and adult life stages of managed species are expected to be moderate and temporary, while direct impacts to egg and larval life are expected to be negligible. NOAA Fisheries provided four conservation recommendations on pile-driving soft start procedures, cable protection, acoustic monitoring, and environmental resource monitoring. These recommendations were incorporated by BOEM into the standard operating conditions for marine protected species and EFH in Appendix A of the Revised EA (BOEM 2015b).

South Fork Wind Farm (Rhode Island; Lease Area OCS-A 0517): BOEM has initiated formal ESA and MSA consultations with NOAA Fisheries for the South Fork Wind Farm. To support these consultations, BOEM submitted a Biological Assessment and EFHA to NOAA Fisheries in January and April 2021, respectively. The Biological Assessment determined that the project is unlikely to adversely affect Atlantic sturgeon (BOEM 2021a). The EFHA separated impact-producing factors by wind farm area and export cable area and identified the following impact-producing factors: seafloor disturbance, sediment suspension and deposition, noise, traffic, lighting, discharges and releases, trash and debris, and EMF. The EFHA determined that construction, installation, and conceptual decommissioning would have minor adverse effects on EFH resulting from noise, water quality-related impacts, seabed disturbance, lighting, EMF, and vessel activity (BOEM 2021b). NOAA Fisheries' Biological Opinion and response to the EFHA are forthcoming.

Block Island Wind Farm (Rhode Island): Deepwater Wind prepared an EFHA to support BOEM's consultation with NOAA Fisheries for the Block Island Wind Farm (Deepwater Wind 2012). The EFHA identified minor, short-term, localized disturbance to EFH from Wind Turbine Generator (WTG) installation and cable laying activities; minimal permanent alteration of EFH; temporary sediment disturbance resulting in minor, short-term, and localized increases in total suspended solids; minor, short-term acoustic impacts from pile driving; and no impacts from EMF (Deepwater Wind 2012). BOEM and the U.S. Army Corps of Engineers jointly issued a FONSI for EFH in the project area (USACE 2014). BOEM subsequently initiated a formal MSA consultation with NOAA Fisheries, which concurred with the determination of the FONSI (USACE 2014).

Cape Wind Energy Project (Massachusetts): The U.S. Department of Energy adopted a Final Environmental Impact Statement (EIS) prepared by the U.S. Department of the Interior Minerals Management Service (forerunner to BOEM) for the Cape Wind Energy Project (MMS 2009; DOE 2012). The Final EIS included an EFHA evaluating potential effects of the construction, O&M, and decommissioning of the project and a record of MSA consultation with NOAA Fisheries. The EFHA examined impacts to benthic EFH, pelagic EFH, and water quality; mortality, injury, and displacement of managed species; impingement and entrainment of managed species from water withdrawals; acoustic impacts; reef effect; EMF; rotor shadow effect; currents and sediment transport; and spills and accidental releases. Although the project did not continue, NOAA Fisheries deemed the EFHA to be complete and concurred with the Minerals Management Service determination that the project would have minor to negligible impacts to EFH (MMS 2009; DOE 2012).

W.2.2 Review of EFH in the Project Area

EFH for managed species is designated for separate life stages with distinct habitat needs: egg, larva, juvenile, and adult. Skate species lack a larval stage; shark species lack an egg stage. The neonate stage is represented by newborns and pups aged less than one year. For most species, EFH is designated in 10-by-10-minute squares based on regional habitat features informed by literature reviews, fishery-independent data, and the best professional judgement of fisheries managers.

Designated EFH for managed species and life stages intersecting the review area is presented in Table W-2.

Table W-2. Species and Life Stage EFH Designated in the Review Area

Managed Species	Wind Development Area				Offshore Export Cable Corridor							
					Federal Waters				State Waters			
	Life Stage											
	E	L	J	A	E	L	J	A	E	L	J	A
Atlantic butterfish	X	X	X	X	X	X	X	X	-	-	X	X
Atlantic cod	-	X	-	-	X	X	-	-	X	-	-	-
Atlantic herring	-	-	X	X	-	-	X	X	-	-	-	X
Atlantic mackerel	-	-	X	X	-	-	X	X	-	-	-	X
Atlantic sea scallop	X	X	X	X	X	X	X	X	-	-	-	-
Atlantic surfclam	-	-	X	X	-	-	X	-	-	-	-	-
Black sea bass	-	X	X	X	-	X	X	X	-	-	X	X
Bluefish	X	X	X	X	X	X	X	X	-	-	X	X
Clearnose skate	-	n/a	X	X	-	n/a	X	X	-	n/a	X	X
Longfin inshore squid	-	-	X	X	X	-	X	X	X	-	-	-
Monkfish	X	X	X	-	X	X	-	X	X	X	-	X
Northern shortfin squid	-	-	X	-	-	-	-	-	-	-	-	-
Pollock	-	-	-	-	-	X	-	-	-	-	-	-
Red hake	-	-	-	X	-	-	-	X	-	-	-	-
Scup	-	-	X	X	-	-	X	X	-	-	X	X
Snapper grouper unit	X	X	X	X	X	X	X	X	-	-	-	-
Spiny dogfish	n/a	-	-	X	n/a	-	-	X	n/a	-	-	X
Spiny lobster unit	X	X	X	X	X	X	X	X	-	-	-	-
Summer flounder	X	X	X	X	X	X	X	X	-	-	X	X
Windowpane flounder	X	-	X	X	X	X	X	X	X	-	X	-
Winter skate	-	n/a	-	-	-	n/a	X	-	-	n/a	-	-
Witch flounder	-	X	-	-	X	X	-	-	X	-	-	-
Yellowtail flounder	-	X	-	-	-	X	-	-	-	-	-	-
Highly Migratory Species												
Albacore tuna	-	-	X	-	-	-	X	-	-	-	X	-
Atlantic angel shark	n/a	X	X	X	n/a	X	X	X	n/a	X	X	X
Atlantic bluefin tuna	X	X	X	X	X	X	X	X	-	-	X	X
Atlantic sharpnose shark	n/a	-	-	X	n/a	-	X	X	n/a	-	X	X
Atlantic skipjack tuna	-	-	X	X	-	-	X	X	-	-	-	X
Atlantic yellowfin tuna	-	-	X	-	-	-	X	-	-	-	X	-
Blacktip shark	n/a	-	-	-	n/a	-	X	X	n/a	-	X	X
Common thresher shark	n/a	X	X	X	n/a	X	X	X	n/a	X	X	X
Dusky shark	n/a	X	X	X	n/a	X	X	X	n/a	X	-	-
Sand tiger shark	n/a	X	X	X	n/a	X	X	X	n/a	X	X	X
Sandbar shark	n/a	-	X	X	n/a	X	X	X	n/a	X	X	X

Managed Species	Wind Development Area				Offshore Export Cable Corridor							
					Federal Waters				State Waters			
	Life Stage											
	E	L	J	A	E	L	J	A	E	L	J	A
Scalloped hammerhead shark	n/a	-	X	X	n/a	-	X	X	n/a	-	-	-
Smoothhound shark complex / Smooth dogfish	n/a	X	X	X	n/a	X	X	X	n/a	X	X	X
Tiger shark	n/a	X	X	X	n/a	-	X	X	n/a	-	X	X

Notes:
X EFH for this life stage is designated in the given portion of the Offshore Project Area
- No EFH for this life stage is designated in the given portion of the Offshore Project Area
n/a No EFH is designated for this life stage
A Adult (including sub-female)
E Egg
L Larva (or neonate shark)
J Juvenile

W.2.3 Categories of EHF Habitat

Three broad categories of EFH support managed species in the review area: water column (pelagic habitat), softbottom (benthic habitat), and hardbottom (benthic habitat; Table W-3).

Table W-3. Categories of EFH in Review Area

Category	Representative Habitats in Review Area
Water Column (Pelagic Habitat)	All waters and associated currents from the seafloor to the sea surface, including bays and estuaries.
Softbottom (Benthic Habitat)	Seafloor substrates characterized by soft, unconsolidated sediments (e.g., silt, mud, clay, sand, gravel, pebbles, cobbles, shell fragments)
Hardbottom (Benthic Habitat)	Seafloor substrates characterized by complex, three-dimensional artificial reef habitat, including ships and other intentionally deployed materials

W.2.3.1 Pelagic Habitat – Water Column EFH

Pelagic habitats are the open waters from the seafloor to the sea surface. Such habitats vary by depth, distance from shore, light penetration, temperature, turbidity, and other physical and chemical characteristics. Water depth and temperature are key influences on the horizontal and vertical distribution of fish and macroinvertebrates in the water column (see Section 4.1, Physical and Oceanographic Conditions). Dynamic water quality parameters such as conductivity, dissolved oxygen, and pH may be influenced by currents, local weather and broad climactic events, anthropogenic activities, and other processes (see Section 4.2, Water Quality).

A Northeast Fishery Science Center oceanic database contains conductivity, temperature, and depth records with profiles of water column salinity, including those recorded by seasonal trawl surveys that intersected the Wind Development Area from 2003 to 2016 (Guida et al. 2017). The full range of salinity recorded during this period (30.0 to 35.7 Practical Salinity Units) falls entirely within the euhaline range and represents a stable range of variation with regards to organismal physiology (Guida et al. 2017).

The U.S. Environmental Protection Agency National Coastal Condition Report IV rated North Carolina and Virginia shorelines near the landfall as "fair" to "poor," but offshore areas as "good" to "fair" (EPA 2012). Dissolved oxygen may be influenced by anthropogenic factors, including wastewater treatment equipment, stormwater runoff, and agricultural runoff, which may yield occasional algal blooms and subsequent hypoxia in the nearshore portions of the review area (VDEQ 2020). Offshore waters in the review area are expected to have adequate dissolved oxygen (more than 5 milligrams/liter) to support marine organisms (BOEM 2015a).

Mean water depth in the Wind Development Area is approximately 20 meters (m), with a range of 15 to 45 m (Guida et al. 2017). Depths increase seaward along a roughly northwest to southeast gradient. Bathymetric contours are shown in Figure W-1. The Company corroborated these depth gradients in benthic characterization surveys conducted in February and October-November 2020; depths in the offshore export cable corridor gradually increased from 12 m nearshore to 35 m at the northwest corner of the Wind Development Area, while depths in the Wind Development Area increased from 27 to 57 m along a northwest to southeast gradient (Appendix V, Benthic Resource Characterization Reports).

Water temperatures in the Wind Development Area vary with depth and season. As described in Section 4.1, Physical and Oceanographic Conditions, seasonal variations span up to 20 degrees Celsius (°C) at the surface and 12°C at the bottom of the water column (Guida et al. 2017). Thermal stratification begins in April, as ambient temperatures raise surface water temperatures, and increases until a maximum surface-to-bottom thermal gradient of up to 12°C is achieved in August (Guida et al. 2017). These fluctuations can trigger physiological processes (e.g., gonadal development) and behaviors (e.g., migration). As Mid-Atlantic Bight waters warm, warm temperate species move in from the south. When water temperatures drop during winter, warm temperate species migrate back south and cold temperate species move in from the north (BOEM 2014a).

Diverse assemblages of fish eggs and larvae (ichthyoplankton) comprise the largest portion of the pelagic fish community in the review area (BOEM 2014a), especially where cold water from the Mid-Atlantic Bight Cold Pool meets warm water from the Gulf Stream and forms a dynamic faunal transition zone (Hare et al. 2001, 2002; Grothues and Cowen 1999). Buoyant eggs and larvae of many marine fish and macroinvertebrates remain suspended in the plankton for weeks to months, facilitating extensive distribution (DoN 2008; Hare et al. 2001, 2002). Eggs and larvae of cold temperate species from northern waters dominate the review area in winter, while subtropical and tropical eggs and larvae from the Gulf Stream and other southern sources are most abundant during summer (Hare et al. 2001; Grothues and Cowen 1999; Doyle et al. 1993). Many coastal pelagic species in the review area (e.g., Atlantic butterfish, bluefish, scup) are associated with structured bottom habitats but migrate in response to changes in temperature, salinity, dissolved oxygen and large-scale circulation (DoN 2008). Atlantic menhaden, Atlantic mackerel, and small herrings are the dominant coastal pelagic forage species in the Mid-Atlantic Bight; these schooling species tend to be short-lived, fast-maturing, and highly fecund (MAFMC 2017). Abundances of forage fish tend to rise and fall asynchronously, and interannual variability in species recruitment can drive peaks in abundance for a given species unrelated to standing stock (Bethoney et al. 2016). Many species, such as longfin inshore squid and northern shortfin squid, begin their lives as forage species and transition to predators as they mature.

Small coastal pelagic forage fish serve as an intermediate step in energy transfer between zooplankton and larger epipelagic predatory fish (e.g., sharks, tunas), which tend to be highly migratory (NOAA Fisheries 2017; BOEM 2014a). These opportunistic predators are known to associate with natural and artificial flotsam, which provides foraging and nursery habitat. Skipjack and yellowfin tunas, for example, feed upon small fish attracted to *Sargassum* floats (Rudershausen et al. 2010; Casazza and Ross 2008; Moser et al. 1998). As many as 80 fish species, as well numerous invertebrates, are closely associated with *Sargassum* floats at some point in their life cycle. Floating *Sargassum* has therefore been designated as EFH for snappers, groupers, and coastal migratory pelagic species (NOAA Fisheries 2017; SAFMC 1998).

W.2.3.2 Benthic Habitat – Softbottom EFH

Soft, unconsolidated sediments (e.g., silt, mud, clay, sand, gravel, pebbles, cobbles, shell fragments) characterize softbottom habitats. The continental shelf in the Mid-Atlantic Bight north of Cape Hatteras is characterized as softbottom sediments dominated by fine sand and punctuated by gravel and silt/sand mixes (Milliman 1972). The substrate in the Wind Development Area is consistent with this regional pattern, including unconsolidated sediments comprised of gravel (larger than 2,000 micrometers [µm]), sand (62.5 to 2,000 µm), silt (4 to 62.5 µm), clay (less than 4 µm), and shell debris (Williams et al. 2006). Such sediments are not always flat or featureless, but may form structures at various spatial scales, including large shoals, medium sandwaves, and smaller sand ripples (McBride and Moslow 1991). The presence, stability, and form of these features are influenced by the complex interplay between latitude, water depth, prevailing currents, wave energy, and proximity to shore and river discharge. Such features influence the distributions of benthic and demersal species and are therefore crucial to understanding community assemblages in the review area (Scharf et al. 2006; Slacum et al. 2006; Diaz et al. 2003).

In 2019 and 2020, the Company conducted geophysical and benthic characterization surveys in the review area to characterize the seafloor and shallow subsurface sediments, identify hazards, and support benthic habitat mapping. Geophysical surveys were conducted from July 2019 through February 2020 using SBP, UHRS, SSS, MBES, and MAG/TVG data. Surficial sediments consisted mostly of unconsolidated sand, gravel, silt, and clay, categorized as shelf sediments, back-barrier sediments, and marsh/fluvial estuarine sediments deposited on the shelf during cycles of sea level fluctuations (Figure W-2). Sand ripples were the predominant seafloor feature in the review area. Ridges and associated shallow channel depressions were observed throughout, as were hummocky sediment features resulting from oscillating water flows. Some megaripples, defined as bedforms with 5 to 60 m wavelength and 0.5 to 1.5 m height, were observed in the northwest section of the offshore export cable corridor. Analyses confirmed the presence of a sediment fan of unconsolidated material in the western two-thirds of the Lease Area and isolated fine-grained and gravelly patches (Guida et al. 2017).

The Company's benthic characterization surveys were conducted in February and October-November 2020 using benthic grab and digital imagery 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. Survey results depicted habitat suitable for warm temperate softbottom-associated species and life stages, corroborating the results of the EFH Mapper desktop analysis (Table W-2). Habitat observed in the review area was generally homogenous, with 80 percent of all grab samples classified as sand or finer; only 20 percent of grab samples contained 5 percent or more gravel (Figure W-2 shows the results of October-November 2020 survey). Complete survey results are in Appendix V, Benthic Resource Characterization Reports.

Epifauna observed in both the Wind Development Area and offshore export cable corridor were characteristic of Mid-Atlantic Bight softbottom habitat and included anemones, burrowing clams, portunid and hermit crabs, sea stars, sea urchins, shrimp, whelks, and polychaete worms. Of the managed species with designated EFH in the review area, Atlantic angel shark, Atlantic butterfish, Atlantic surfclam, Atlantic sharpnose shark, black sea bass, and clearnose skate were observed in digital images throughout the review area over softbottom areas. Shell hash, mobile epifauna, Naticid and Rajid eggs were prominent in digital images. Results are described in detail in Appendix V, Benthic Resource Characterization Reports.

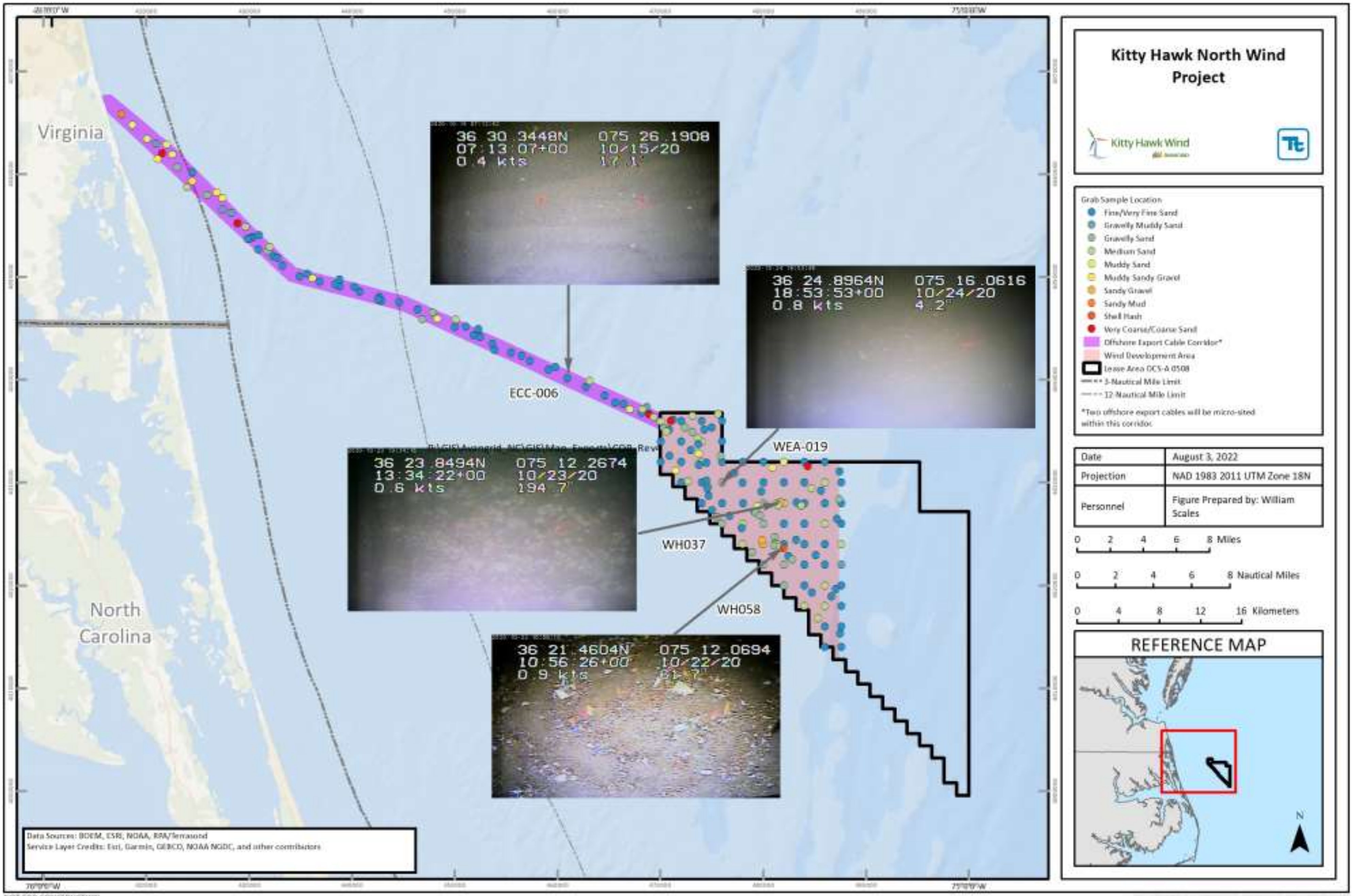

Figure W-2 Representative Plan View Images of Review Area Habitat and Species Observed in November-December 2020 Survey

The Company's surveys are supplemented by publicly available databases, technical literature, and site-specific reports of the review area. In anticipation of the development of novel WEAs, BOEM and NOAA Fisheries surveyed potential offshore lease areas on the Atlantic OCS to characterize benthic resources and evaluate potential impacts of development (Guida et al. 2017). Benthic resources in the Kitty Hawk WEA, which includes the Wind Development Area, were characterized using existing data on physical features and site-specific beam trawls and sediment grabs. The Wind Development Area was described as flat and gently sloping seaward, with near-zero rugosity. Benthic community analyses identified infaunal communities dominated by annelids and epifaunal communities comprised of arthropods and mollusks. Grab samples did not contain any mussels, corals, sponges, or other species known to create biogenic structural habitat (Guida et al. 2017).

The uniform softbottom substrates and associated infaunal and epifaunal assemblages of the Mid-Atlantic Bight support an array of managed demersal species. Site-specific surveys in the review area reported Atlantic sea scallop, Atlantic surfclam, black sea bass, flounders, hakes, scup, skates, and smooth and spiny dogfish (Guida et al. 2017; BOEM 2014a). Species aggregations in the review area vary with proximity to the coastline. Hakes and flounders are more typical of the inner shelf (18 to 30 m), while skates species occur more often at intermediate depths (30 to 50 m; BOEM 2014a; Love and Chase 2007).

W.2.3.3 Benthic Habitat – Hardbottom EFH

Naturally occurring hardbottom and complex reef habitats are rare in the Mid-Atlantic Bight. Geophysical data and underwater imagery collected during Company surveys identified exclusively unconsolidated soft sediments; no hardbottom, aquatic vegetation, or evidence of important biogenic habitat was detected in the review area. Furthermore, no artificial substrate (e.g., derelict fishing gear, military expended materials, shipwrecks, other marine debris) was detected in the surveys.

Although no shipwrecks or artificial reefs are charted in the Wind Development Area, five shipwrecks within or directly adjacent to the offshore export cable corridor provide complex, three-dimensional substrate (Figure W-3). Artificial reefs provide vertical relief and structural complexity in the form of crevices and interstitial spaces; such complexity offers refuge to vulnerable species and life stages from predation and energy-draining currents, as well as a robust forage base of reef-associated benthic invertebrates and demersal fishes.

W.2.3.4 Benthic-Pelagic Coupling

Benthic-pelagic coupling refers to energy transfer between the seafloor and water column as organisms eat, produce waste, and then decompose. In assigning specific substrate types, water depths, and foraging habitat as essential to managed species, EFH designations explicitly recognize the joint contributions of benthic and pelagic habitats. Most marine organisms are neither wholly benthic nor wholly pelagic, but instead rely on the habitat continuum to support them throughout their lives. For example, Atlantic sea scallop eggs are fertilized in benthic habitats on the seafloor, then transform into planktonic larvae suspended in pelagic habitats. After five to six weeks in the plankton, juvenile scallops settle to the seafloor where they filter-feed on plankton, enrich the sediment with their waste, and release a new generation to repeat this cycle (Munroe et al. 2018). Likewise, the black sea bass spawns on the continental shelf, where fertilized eggs drift in the plankton for about two days before transforming into pelagic larvae that can travel up to 80 km along the coast before settling to the seafloor. Adults spend the rest of their lives in coastal benthic habitats, often associated with structures (Watanabe 2011).

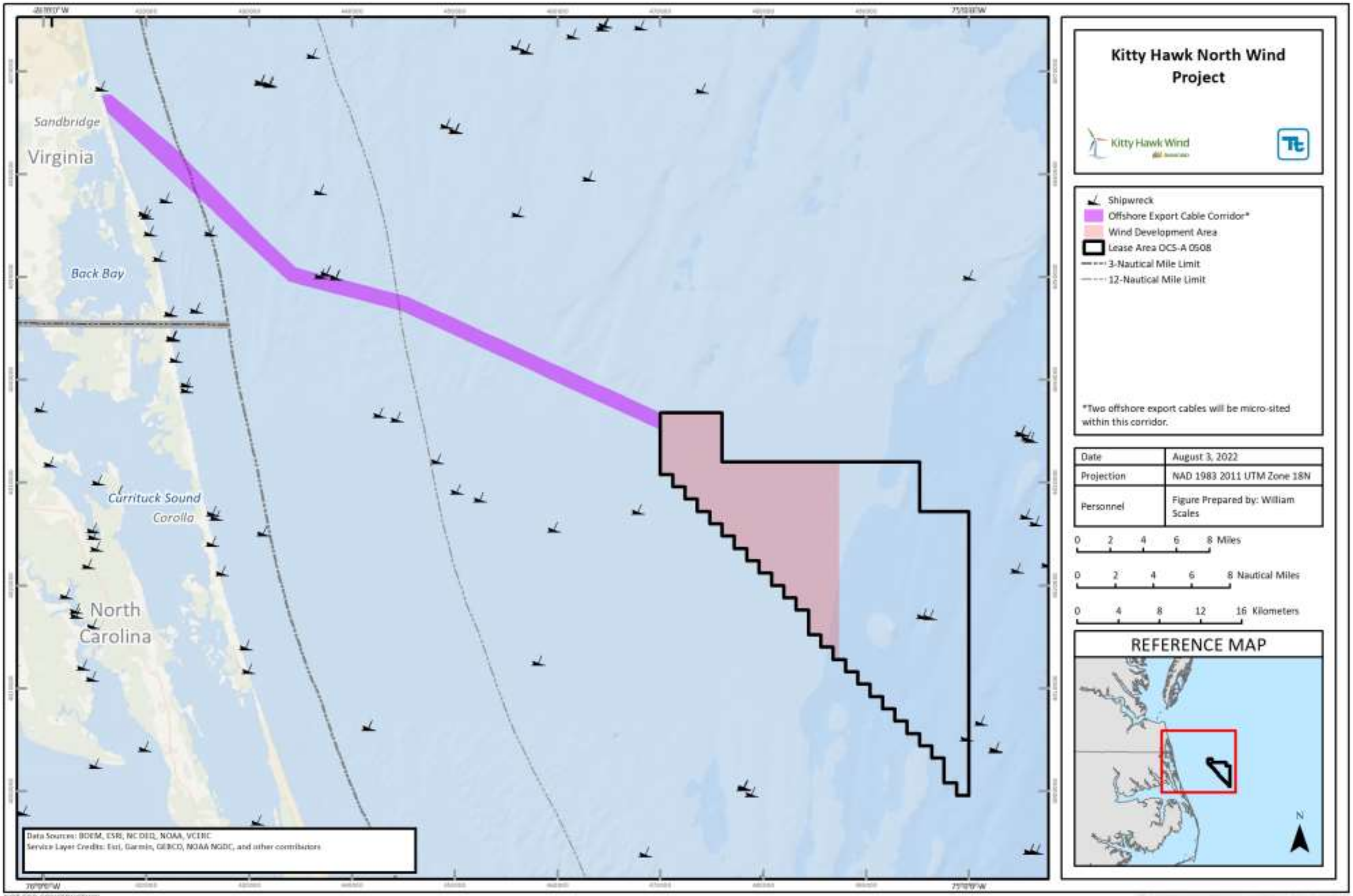

Figure W-3 Shipwrecks and Artificial Reefs in the Vicinity of the Review Area

Together, benthic substrates and overlying pelagic waters provide supportive habitat for demersal and pelagic fish and invertebrates. These marine communities are supported by phytoplankton that thrive in the photic zone where nutrients are abundant. The coasts of North Carolina and Virginia are known for abundant phytoplankton sustained by nutrients drained into the region from river flow, tides, and currents, and carried to the surface by upwelling during seasonal turnover (Boicourt et al. 1987). Phytoplankton are essential food for zooplankton (e.g., copepods and larval forms of crustaceans, bivalves, and other invertebrates) and ichthyoplankton, which in turn serve as food for foraging anchovies, kingfish, mackerel, and jacks (Reiss and McConaugha 1999).

Benthic infauna (e.g., some polychaetes, amphipods, and bivalves) are generally buried in softbottom; their respiratory and feeding appendages extend into the water column as they feed on plankton and nutrient-rich detritus in the overlying water. Epifauna include both attached and mobile invertebrates on the seafloor (e.g., hermit crabs, moon snails, sea stars, sand dollars, and sponges). Epifaunal organisms may filter food from the water column or forage on other organisms on the seafloor.

W.2.4 Other NOAA Trust Resources

The ASMFC manages more than two dozen fish and invertebrate species separately from the MSA. In the review area, the ASMFC manages these species in cooperation with VMRC (Table W-4). Many of these species are also identified as NOAA Trust Resources.

Table W-4 NOAA Trust Resources in the Review Area Managed by ASMFC and VMRC

Common Name	Scientific Name
Amberjack a/	*Seriola dumerili*
American eel c/	*Seriola dumerili*
American lobster	*Homarus americanus*
American shad c/	*Anguilla rostrata*
Atlantic croaker c/	*Micropogonias undulatus*
Atlantic menhaden c/	*Brevoortia tyrannus*
Atlantic sturgeon c/	*Acipenser oxyrinchus*
Billfish a/	Istiophoriformes
Black drum c/	*Pogonias cromis*
Blue crab a/	*Callinectes sapidus*
Channeled whelk a/	*Busycotypus canaliculatus*
Cobia c/	*Rachycentron canadum*
Groupers a/	Epinephelidae
Horseshoe crab c/	*Limulus polyphemus*
Jonah crab c/	*Cancer borealis*
Red drum c/	*Sciaenops ocellatus*
River herring c/	*Clupeidae*
Sheepshead a/	*Archosargus probatocephalus*
Spadefish a/	*Chaetodipterus faber*
Spot c/	*Leiostomus xanthurus*
Spotted seatrout c/	*Cynoscion nebulosus*
Striped bass c/	*Morone saxatilis*
Tautog	*Tautoga onitis*

Common Name	Scientific Name
Tilefish b/	Malacanthidae
Weakfish c/	*Cynoscion regalis*
Notes: a/ Managed by VMRC only b/ managed by MAFMC/NOAA Fisheries and VMRC c/ May be affected by the Project	

The catadromous American eel spends most of its life in freshwater or estuarine environments in major river systems from Canada through Brazil. The species is a panmictic, meaning it migrates to offshore spawning grounds in the Sargasso Sea to reproduce as a single stock. The ASMFC management unit for American eel includes the portion of the population occurring from inland waters to the U.S. Exclusive Economic Zone (EEZ) along the Atlantic Coast from Maine to Florida (ASMFC 2017a). The historically supported commercial, recreational, and subsistence fisheries have been in decline since the 1980s due to overfishing, habitat loss, food web alterations, predation, environmental changes, toxins and contaminants, and disease. The 2017 stock assessment update indicates the stock is currently depleted (ASMFC 2017a).

The anadromous American shad spends most of its life in marine environments and migrates to freshwater spawning grounds in major river systems from Canada through Florida. The species once supported the largest commercial and recreational fisheries on the U.S. Atlantic Coast; fisheries stocks have declined due to impoundments in spawning rivers, habitat degradation, and overfishing (ASMFC 2020a). The ASMFC manages the species at the river system level; in Virginia, stocks are managed in the Potomac, Rappahannock, York, and James Rivers. The 2020 benchmark stock assessment indicates that American shad has continued to decline and stocks are currently at all-time lows (ASMFC 2020a). In Virginia, the James River stock status is unknown, the Rappahannock and York River stocks are experiencing sustainable mortalities, and the Potomac River stock is depleted and experiencing unsustainable mortality (ASMFC 2020a).

The Atlantic croaker is a demersal sciaenid common to estuarine and nearshore waters from the Gulf of Maine to Argentina. The ASMFC management unit for Atlantic croaker includes the portion of the population occurring from estuarine waters to the U.S. EEZ along the Atlantic Coast from New Jersey to Florida (ASMFC 2017b). The species supports commercial and recreational fisheries that experience cyclical declines and recoveries. The 2017 benchmark stock assessment did not conclusively determine stock status; however, the report suggested that the Atlantic croaker spawning biomass is increasing, suggesting that the species is being managed sustainably (ASMFC 2017b).

The Atlantic menhaden occurs in estuaries and coastal waters from Nova Scotia to northern Florida. The ASMFC manages Atlantic menhaden in estuarine waters and the U.S. EEZ from Maine to Florida (ASMFC 2020b). The species has historically supported one of the largest U.S. Atlantic Coast commercial fisheries. The fishery is divided into the reduction fishery, which processes Atlantic menhaden to obtain fish oil and fish meal, and the bait fishery, which supplies Atlantic menhaden as bait to other fisheries (e.g., blue crab, lobster). While landings for the bait fishery have increased in recent years, the reduction fishery (the larger component of the commercial fishery) has declined substantially. Despite this decline, the 2020 benchmark stock assessment indicates the species is not overfished or subject to overfishing (ASMFC 2020b).

The anadromous Atlantic striped bass occurs in estuaries from Canada to Florida. It spends most of its life in coastal estuaries or nearshore marine environments, migrating seasonally along the coast and ascending rivers to spawn in the spring. The ASMFC manages the population from Maine to North Carolina from estuarine waters to the U.S. EEZ (ASMFC 2019a). The species is fished both commercially and recreationally and the 2019 benchmark stock assessment indicates that the fishery stock is both overfished and subject to overfishing (ASMFC 2019a).

The anadromous Atlantic sturgeon spends most of its adult life in estuarine and marine waters, migrating to freshwater spawning grounds in major river systems from Canada through Florida. Five Atlantic sturgeon distinct population segments (DPS), or geographically isolated subspecies, are protected under the ESA. The Gulf of Maine DPS is listed as threatened and the remaining DPSs are listed as endangered. Though DPSs represent geographically distinct populations, individuals from all DPSs migrate across the coast and are not easily distinguished from one another. Therefore, any Atlantic sturgeon encountered in the review area is considered endangered for the purpose of this analysis. The species is also listed as endangered in Virginia under 4 Virginia Administrative Code 15-20-130. No critical habitat has been designated for Atlantic sturgeon in the review area (NOAA Fisheries 2021b). The nearest Atlantic sturgeon spawning grounds to the review area are the James and York Rivers, which provide important habitat for the Chesapeake Bay DPS (VIMS 2021). The 2017 benchmark stock assessment reported that all DPSs remain depleted relative to historic distributions (ASMFC 2017c).

The black drum is a demersal species that occurs in nearshore waters along the Atlantic Coast from the Gulf of Maine to Argentina. The species conducts annual north-south migrations and exhibits sporadic recruitment. The ASMFC management unit for black drum includes the portion of the population occurring from nearshore waters to the U.S. EEZ along the Atlantic Coast from the Gulf of Maine to Florida (ASMFC 2015a). The species currently supports growing commercial and recreational fisheries, with most commercial landings in Virginia and North Carolina. The first benchmark stock assessment for black drum in 2015 concluded that the species is not overfished or subject to overfishing (ASMFC 2015a).

The highly migratory pelagic cobia is distributed globally in tropical and warm-temperate waters. It occurs along the Atlantic Coast from Nova Scotia to Argentina in two stocks, one from Georgia north and the other from Florida south to the Gulf of Mexico. The species overwinters in southern offshore waters and migrates to northern nearshore waters during summer months. The ASMFC management unit for Atlantic cobia includes the portion of the population occurring from nearshore waters to the U.S. EEZ along the Atlantic Coast from the Mid-Atlantic Bight to the Georgia-Florida border (ASMFC 2020c). The Atlantic cobia fishery supports a small commercial fishery and an expanding recreational fishery from the Mid-Atlantic to South Atlantic region. The 2020 benchmark stock assessment concluded that the Atlantic cobia is not overfished or experiencing overfishing (ASMFC 2020c).

The horseshoe crab is a marine arthropod that occurs in estuaries and over the continental shelf along the Atlantic Coast from Maine to the Gulf of Mexico. The Delaware Bay supports the largest spawning population of horseshoe crab in the world. The review area spans two of the four ASMFC management units: Delaware Bay (which includes the Virginia landfall area) and Southeast (which includes the Wind Development Area off North Carolina (ASMFC 2019b). Historically, horseshoe crabs have been harvested to provide bait for commercial American eel and conch fisheries and to provide blood to the biomedical industry to produce *Limulus* Amoebocyte Lysate. The 2019 benchmark stock assessment concluded that Delaware Bay stock is in a neutral condition and the southeast stock in good condition; coastwide, the species is not overfished or subject to overfishing (ASMFC 2019b).

The Jonah crab, distributed along the Atlantic Coast from Canada to Florida, has a poorly understood life history. The ASMFC management unit for Jonah crab includes the portion of the population occurring from nearshore waters to the U.S. EEZ along the Atlantic Coast from Maine to Florida. The species has historically been considered bycatch in the lobster fishery but has supported a growing commercial fishery since the 1990s. The Jonah crab is reported from both rocky and softbottom habitats. Large adult Jonah crabs are most frequently caught in rocky offshore habitats (NOAA Fisheries 2018). Some evidence suggests that adult Jonah crabs migrate to shallow nearshore waters in spring/summer and move to offshore in the fall and winter. Some researchers suggest adult Jonah crab are associated with rockier, deeper sites with cover/crevices; however, Wenner et al. (1992) observed mature female Jonah crabs in softer sediments along the continental slope (NOAA Fisheries 2018). There is no stock assessment for the Jonah crab, and the status of the fishery remains unknown (ASMFC 2021a).

The red drum is distributed from estuaries to offshore marine waters along the Atlantic Coast from Massachusetts to Florida. Juveniles remain inshore while adults conduct seasonal north-south or inshore-offshore migrations. The ASMFC management unit for red drum spans the entire species range from estuaries to the U.S. EEZ along the Atlantic Coast from Massachusetts to Florida (ASMFC 2017d). The species supports a robust recreational fishery that targets the southern stock, while the smaller commercial fishery is dominated by North Carolina and targets the northern stock. The 2017 benchmark stock assessment did not conclusively determine stock status but indicates that overfishing may be occurring (ASMFC 2017d). The species is currently undergoing a new stock assessment.

The term river herring collectively refers to the anadromous alewife and blueback herring. Historically, river herring have spawned in virtually every river and tributary along the North American Atlantic Coast; the alewife spawns in lakes and ponds, while the blueback herring spawns in swift-moving rivers. Currently, the alewife is most abundant from the Mid-Atlantic Bight north, while blueback herring is most abundant from Chesapeake Bay south. The ASMFC manages river herring at the state level and the 2017 stock assessment update indicates that both species are overexploited (ASMFC 2017e). The Virginia commercial herring fishery collapsed in the 1970s and in 2012 the VMRC implemented a moratorium on river herring in state waters that is currently upheld (ASMFC 2017e).

The spot is a sciaenid that commonly occurs in estuarine and coastal waters from the Gulf of Maine to Florida. The species migrates seasonally, entering bays and estuaries in spring and migrating offshore to spawn in late summer or fall. The ASMFC management unit for spot spans the entire species range from estuaries to the U.S. EEZ along the Atlantic Coast from the Gulf of Maine to Florida (ASMFC 2017f). Spot support important commercial and recreational fisheries in the South Atlantic, though annual fluctuations in landings are common. The first coastwide benchmark stock assessment for spot, conducted in 2017, did not conclusively determine stock status but did indicate that both Mid-Atlantic and South Atlantic regions were experiencing significant stock declines (ASMFC 2017f).

The spotted seatrout primarily occurs in estuaries from Cape Cod, Massachusetts, to the Florida Keys but migrates to nearshore marine waters during cold periods (ASMFC 2021b). The species is non-migratory and exhibits strong site fidelity to natal estuaries; however, individuals from the Chesapeake Bay are known to migrate seasonally to North Carolina waters. The ASMFC management unit for spotted seatrout spans the entire species range from estuaries to the U.S. EEZ along the Atlantic Coast from Massachusetts to Florida (ASMFC 2021b). North Carolina has primarily driven the historic commercial fishery, though increased regulation has drastically reduced the commercial fishery. The spotted seatrout fishery is now largely recreational. A coastwide stock assessment of spotted seatrout has not been conducted, though populations have declined in recent decades due to coastal development, loss of habitat, and overfishing (ASMFC 2021b).

The tautog is a wrasse distributed in shallow, nearshore waters from Nova Scotia to Georgia. The species spawns inshore in spring, remains in nearshore waters throughout the summer, and conducts short migrations to offshore overwintering grounds in the fall. The ASMFC management unit for tautog includes the portion of the population occurring from inshore waters to the U.S. EEZ along the Atlantic Coast from Massachusetts through Virginia (ASMFC 2017g). Recreational anglers account for about 90 percent of tautog landings, mostly in state waters between Cape Cod and Chesapeake Bay. The 2015 benchmark stock assessment and 2016 stock assessment update determined that all regional tautog stocks are overfished and subject to overfishing (ASMFC 2017g).

The weakfish occurs on the continental shelf from Nova Scotia to southeastern Florida. It conducts seasonal north-south migrations and overwinters in offshore waters between Chesapeake Bay and Cape Lookout, North Carolina. The ASMFC management unit for weakfish includes the portion of the population occurring from inshore waters to the U.S. EEZ along the Atlantic Coast from Massachusetts to southern Florida (ASMFC 2019c). Weakfish has been one of the largest components of a mixed-stock commercial fishery on the Atlantic Coast since the 1800s; landings collapsed in the 1990s and reached an all-time low in 2013. The 2019 stock assessment update indicates the weakfish stock remains depleted due to overfishing and increased natural mortality from predation, disease, and starvation (ASMFC 2019c).

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

The Company is proposing to construct, own, and operate the Project as a private commercial enterprise that will generate energy using renewable wind resources. The purpose and goals of the Project are to:

- Deliver sustainable, safe, and healthy domestic energy generation through the responsible production of electricity using WTGs;
- Efficiently and responsibly construct and operate an offshore wind energy facility that enhances the quality and long-term productivity of a renewable wind resources located on the OCS;
- Deploy technically and economically feasible technologies that maximize the sustainable electrical generation within the Wind Development Area;
- Contribute to the federal goal of delivering 30 gigawatts of offshore wind in the U.S. by 2030; and
- Contribute to the Commonwealth of Virginia enacted Virginia Clean Economy Act mandated to procure 5.2 gigawatts of offshore wind by 2034.

W.3.1 Summary of Maximum Design Scenario

The Company is proposing to develop the Wind Development Area, which comprises approximately 40 percent of the Lease Area in the northwest portion closest to land (approximately 44 km offshore of Corolla, North Carolina). For the purposes of this EFHA, the review area refers to the offshore Project facilities, including WTGs, ESP, and inter-array and offshore export cable corridor. The WTGs, ESP, and inter-array cables will be located in federal waters within the Lease Area. The offshore export cable corridor will traverse both federal and state territorial waters of Virginia.

The Company is assessing impact-producing factors associated with the Project according to the maximum parameters considered for key components (i.e., WTGs, foundations, and installation methodologies). By assessing the realistic maximum design scenario for each component, the review area impact assessment can be robust while allowing for flexibility further on in the development process. This process and set of parameters adopted for a specific project is referred to as a Project Design Envelope (PDE). The primary goal of applying a PDE is to allow for meaningful assessments by the jurisdictional agencies of the proposed project activities, while concurrently providing the Company reasonable flexibility to make prudent development and design decisions prior to construction (BOEM 2018a).

The project design that permanently converts the largest area of softbottom substrate to artificial hardbottom substrate, including WTG and ESP foundations, scour protection, and cable armoring is considered the maximum design scenario for benthic habitats. The design that permanently introduces the greatest surface area of novel structures into the water column is considered the maximum design scenario for pelagic habitat and species. The design with the longest duration of pile driving at the maximum hammer energy is considered the maximum design scenario for acoustic and vibratory impacts to all managed species. The parameters provided in Table W-5 represent the maximum potential effect of full build-out of the Project, as analyzed in the EFHA.

Table W-5 Summary of Maximum Design Scenarios for EFH as Outlined in the PDE

Parameter	Realistic Maximum Design Scenario	Rationale
Construction		
Wind Turbine Generators (WTGs)	*Maximum number of WTGs:* 69	Representative of the maximum number of structures in the review area: 69 WTGs and 1 electrical service platform (ESP).
WTG and ESP Foundations	*Maximum number of monopile foundations:* 67 *Maximum number of suction caisson jacket foundations:* 3 *Monopile footprint without scour protection*: 143 square meters (m^2) *Suction caisson footprint without scour protection:* 963 m^2 *Monopile footprint with scour protection*: 3,188 m^2 *Suction caisson footprint with scour protection*: 3,848 m^2	Representative of the greatest surface area of hardbottom introduced to the review area.
Softbottom habitat loss: WTG and ESP Foundations and scour protection	Based on 69 WTGs and one ESP with maximum scour protection corresponding to the maximum overall footprint in the review area: 225,140 m^2.	Representative of conversion of the maximum area of softbottom to artificial hardbottom habitat by installation of foundations and scour protection
Inter-Array Cables	*Maximum burial depth*: 2.5 m *Maximum installation corridor width*: 100 m *Maximum installation corridor length:* 240 km *Maximum temporary seafloor footprint*: 2,400 hectares (ha) *Maximum permanent seafloor footprint (cable protection*): 5.7 ha	Representative of the maximum seafloor footprint of temporary and permanent impacts.
Offshore Export Cables	*Maximum burial depth:* 2.5 m *Maximum installation corridor width*: 810 m *Maximum installation corridor length:* 80 km *Maximum temporary seafloor footprint*: 6,480 ha *Maximum permanent seafloor footprint (cable protection):* 3.84 ha	Representative of the maximum seafloor footprint of temporary and permanent impacts

Parameter	Realistic Maximum Design Scenario	Rationale
Underwater noise: Pile driving	*Method:* Monopile installation *Maximum penetration:* 55 m *Maximum foundation diameter:* 13.5 m *Soft-start hammer energy:* 650 kilojoules (kJ) *Maximum hammer energy:* 4,400 kJ *Maximum number of hammer blows at maximum energy:* 9,450 *Maximum duration:* 5.25 hours	Representative of the loudest underwater noise for the longest duration.
Underwater noise: Project-related vessels	Based on 69 WTGs, one ESP, and associated inter-array and offshore export cables in the review area. *Maximum number of vessel trips:* 653	Representative of the maximum underwater noise generated by Project-related construction vessels.
Operations		
Underwater noise: Project-related vessels	Based on the maximum number of structures in the review area (69 WTGs, one ESP, and associated inter-array and offshore export cables) and maximum number of associated operations and maintenance vessels.	Representative of the maximum underwater noise generated by Project-related construction vessels.
Electric and magnetic fields (EMF): Inter-Array Cables	Based on the maximum number of offshore structures (69 WTGs and one ESP) to be connected. *Maximum operating voltage*: 66 kilovolts (kV) *Maximum cable diameter*: 154 millimeters (mm) *Maximum total length of cables*: 240 km	Representative of the maximum exposure of marine life to EMF within the Wind Development Area.
EMF: Offshore Export Cables	*Maximum operating voltage*: 275 kV *Maximum cable diameter*: 286 mm *Maximum total length of cables*: 80 km	Representative of the maximum exposure of marine life to EMF within the offshore export cable corridor.

Advancements in decommissioning methods are expected to occur during the estimated 20-year life of the Project. The Company will submit a full decommissioning plan to BOEM for approval prior to undertaking any decommissioning activities. BOEM currently requires that offshore Project facilities be fully removed or severed 4.6 m below the sediment surface. Predictive ecosystem modeling indicates that benthic-pelagic coupling relationships established during the operational life of the Project would be decoupled and regional connectivity would return to pre-construction conditions following decommissioning and full removal of infrastructure (van der Molen et al. 2018).

W.3.2 Avoidance, Minimization, and Mitigation Measures

The Company proposes to implement the following measures to avoid, minimize, and mitigate the potential impact-producing factors to managed species and EFH (Table W-6).

Table W-6 Impact-Producing Factors and Avoidance, Minimization, and Mitigation Measures

Project Stage	Impact-Producing Factor	Avoidance, Minimization, and Mitigation
Construction; Decommissioning	Disturbance of softbottom sandy habitat	• The Company will further micro-site offshore Project facilities within the offshore export cable corridor to avoid complex benthic habitats where feasible to minimize the probability of adverse interactions with sensitive marine resources. • The release of non-toxic drilling mud during horizontal directional drilling (HDD) at the landfall is possible but unlikely. The Company will develop and implement an HDD Inadvertent Release Plan that will incorporate local pollution prevention and spill response procedures covered by the Stormwater Pollution Prevention Plan. • The Company will implement a soft-start procedure to the extent practicable to avoid or minimize impacts to marine resources.
	Disturbance, injury, and/or mortality of benthic and pelagic organisms	
	Increase in turbidity, sediment deposition, suspended sediment, and chemical contamination	
	Entrainment of plankton and ichthyoplankton	
	Increase in Project-related noise and vibrations	
Operations and Maintenance	Conversion of softbottom to artificial hardbottom habitat and introduction of vertical infrastructure in open water habitat	• The Company will develop and implement an Oil Spill Response Plan describing measures to avoid accidental releases. The Company will also require all Project-related vessels to operate in accordance with laws regulating at-sea discharges of vessel-generated waste. • The Company will commit to burying or armoring electric cables to minimize detectable EMF and thermal effects.
	Habitat provision for nonindigenous invasive species	
	Increase in shading and artificial lights	
	Increase in underwater noise and vibration	
	Change in water quality, including oil spills	
	Project-related electric and magnetic fields (EMF) and thermal effects of offshore export and inter-array cables	

To develop an adaptive mitigation approach that provides flexible and protective measures, the Company will continue discussions and engagement with the appropriate regulatory agencies and environmental non-governmental organizations throughout the life of the Project. In addition to these specific measures, the Company will require all Project-related vessels to abide by applicable laws and regulations, including but not limited to reducing marine debris, managing ballast water, preventing spills of fuels and other hazardous materials, and complying with vessel speed restrictions.

W.4 EFFECTS OF THE PROJECT ON EFH

Under the MSA, adverse effects to EFH are defined as any impacts which reduce the quality and/or quantity of EFH. General adverse effects associated with Project construction and O&M may include direct and indirect physical, chemical, and biological habitat alterations and associated injury to or mortality of managed species and their prey. These are not restricted to site-specific effects and may extend beyond the review area (Degraer et al. 2021). Specific impacts associated with Project activities are described for each species and life stage in Attachment W-2. Impact-producing factors associated with Project construction and O&M were identified based on a review of the following resources:

- EFHAs for offshore wind development projects prepared by other proponents;
- EFH consultations and biological opinions prepared by NOAA Fisheries for similar projects;
- EFH source documents, FMPs, and stock assessments prepared by NOAA Fisheries and FMCs; and
- Peer-reviewed literature and presentations by subject matter experts examining site-specific and cumulative effects of offshore wind developments on benthic and pelagic habitats and species in the U.S. and worldwide.

Potential fishing and non-fishing activities that may impact EFH for managed species are identified and described in species FMPs. Commercial fishing pressures may impact managed species through gear interactions with EFH (e.g., bottom trawling) and intense fishing pressures on unmanaged forage species. The results of commercial fishing pressures may alter habitat ranges and feeding habits of managed species (MAFMC 2017; NEFMC 2017; NOAA Fisheries 2017). Non-fishing impacts to EFH include both climactic and anthropogenic stressors. Shifts in community assemblages along the U.S. Atlantic Coast and more locally within the Mid-Atlantic Bight have been linked to regional changes in physiochemical oceanic conditions (e.g., increased sea surface and bottom temperatures, changes in pH, variations in current dynamics). Climactic stressors are described in further detail in Section 5.4, Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat. Anthropogenic activities such as seismic surveys, dredging and dredged material disposal, mining, ocean dumping, cooling water intake and discharge, impounding and diverting of coastal hydrology, and point and non-point source pollution and sedimentation from coastal infrastructure and agriculture may compound impacts of climactic stressors on EFH (MAFMC 2017; NEFMC 2017; NOAA Fisheries 2017).

The EFHA has been prepared in the context of identified impacts. FMPs include offshore renewable energy developments (e.g., wind, wave, solar, underwater current, hydrogen energy) as non-fishing anthropogenic activities that may impact EFH. Construction, O&M, and decommissioning of offshore and coastal energy projects may disturb habitat quality and introduce sound and vibrations into the environment, thereby affecting managed species and their designated EFH (MAFMC 2017; NOAA Fisheries 2017).

The potential impact-producing factors associated with the Project will vary by species, life stage, and designated EFH. The Company assessed potential effects of Project construction and O&M on water column, softbottom, and hardbottom EFH in the review area. The following sections identify groups of managed species based on their relative probability of exposure to impact-producing factors associated with the Project.

W.4.1 Species Least Likely to be Affected by the Project

Pelagic species and life stages with designated water column EFH are least likely to be affected by Project construction and O&M activities. Most impact-producing factors associated with the Project are associated with benthic habitats. Therefore, exposure of pelagic species and life stages to benthic disturbance associated with the project would be limited to physical interactions with construction vessels and equipment, temporary and localized elevations to turbidity, and sediment deposition. Many pelagic species are highly mobile and are expected to avoid exposure to excessive sound by temporarily vacating the ensonified area. Entrainment of planktonic life stages would be similar to baseline (pre-Project) conditions during which other vessels (e.g., commercial fishing and recreational vessels, military vessels, tankers) transit through the area. Construction and O&M activities are not expected to cause substantial changes to the abundance or distribution of the forage base for pelagic species. Species that encrust or attach to underwater structures are expected to colonize foundations and armoring materials. The benthic and vertical substrate introduced by the Project is not expected to notably affect the distribution or abundance of managed species or EFH. Effects on the pelagic life stages of species listed in Table W-7 would be localized, temporary, and reversible. Potential impacts on these species are described in greater detail in Attachment W-2.

Table W-7 Managed Species and Life Stages Least Likely to be Affected by the Project

Species	Pelagic Life Stages in the Review Area
Atlantic butterfish	All
Atlantic cod	Egg, Larva
Atlantic herring	Juveniles, Adults
Atlantic mackerel	Juvenile, Adult
Black sea bass	Larva
Bluefish	All
Longfin inshore squid	Juvenile, Adult
Monkfish	Egg, Larva
Northern shortfin squid	Juvenile
Pollock	Larva
Summer flounder	Egg, Larva
Windowpane flounder	Egg, Larva
Witch flounder	Egg, Larva
Yellowtail flounder	Larva

W.4.2 Species and Life Stages Most Likely to be Affected by the Project

Demersal species and life stages with designated benthic EFH are most likely to be affected by Project construction and O&M activities. Impact-producing factors of the Project will likely include physical interactions with construction equipment, burial by sediment deposition, and exposure to or avoidance of pile driving noise and vibration. The sessile, demersal, or otherwise benthic-dependent life stages of managed species that are expected to experience impacts associated with construction activities or long-term habitat loss associated with O&M activities are identified in Table W-8. Potential impacts to these species and life stages are described in greater detail in Attachment W-2.

Table W-8 Managed Species and Life Stages Most Likely to be Adversely Affected by Construction or O&M

Species	Benthic Life Stages Likely Affected in the Review Area	
	Construction	O&M
Atlantic sea scallop	All	Egg, Adult
Clearnose skate	Juvenile, Adult	Juvenile, Adult
Monkfish	Juvenile, Adult	-
Red hake	Adult	-
Windowpane flounder	Juvenile, Adult	Juvenile, Adult
Winter skate	Juvenile	Juvenile
Atlantic surfclam	Juvenile, Adult	Juvenile, Adult

Species	Benthic Life Stages Likely Affected in the Review Area	
	Construction	O&M
Black sea bass	Juvenile, Adult	-
Longfin inshore squid	Egg	-
Scup	Juvenile, Adult	-
Summer flounder	Juvenile, Adult	Juvenile, Adult
Snapper grouper	Juvenile, Adult	-
Spiny lobster	Juvenile, Adult	-
Note: - none		

Some demersal species and life stages with designated EFH in benthic habitats employ hardbottom substrates and complex structured habitats for settlement, protection from predators and energy-draining currents, and foraging opportunities. The species and life stages that are expected to aggregate around novel structures in the review area are identified in Table W-9.

Table W-9 Managed Species and Life Stages Attracted to Artificial Structures

Species	Life Stages Associated with Structure in the Review Area	
	Attaches to Hard Substrate	Associates with Hardbottom/Structure
All HMS	-	All (vertical structure)
Atlantic sea scallop	Larva, Juvenile	-
Black sea bass	-	Juvenile, Adult
Longfin inshore squid	Egg	-
Monkfish	-	Juvenile, Adult
Red hake	-	Adult
Scup	-	Juvenile, Adult
Snapper grouper	-	Juvenile, Adult
Spiny dogfish	-	Adult, Subadult
Spiny lobster	-	Juvenile, Adult
Notes: HMS Highly Migratory Species - none		

Impact-producing factors associated with the Project and short- and long-term effects of construction and O&M activities are discussed in the following sections, with an emphasis on the species that are most likely to be affected.

W.4.3 Analysis of Potential Construction Impacts

Construction activities in the review area include pre-lay grapnel runs, cable installation and armoring, pile driving, and deployment of scour protection. These impact-producing factors would temporarily disturb softbottom benthic EFH in the review area by altering bedforms (e.g., waves, megaripples, ripples). However, the bedforms are expected to reform within days to weeks following construction under the influence of the same physical conditions that formed them initially. Construction-related impact-producing factors would also alter pelagic EFH in the review area by creating a sediment plume that would increase turbidity and potentially introduce chemical contamination into the water column.

Impact-producing factors were analyzed in the COP and determined not to pose substantial threats to EFH in the review area (Section 5.4, Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat). The COP findings are considered applicable to this EFHA; therefore, the remainder of this section focuses on those impact-producing factors that could cause direct injury to or mortality of managed species or degradation of their softbottom habitat or prey.

W.4.3.1 Direct Disturbance, Injury, and/or Mortality of Benthic and Pelagic Species and Life Stages

The construction activities described above may injure or kill immobile or slow-moving demersal life stages of fish and invertebrates (including eggs and larvae). Such activities would disturb the seafloor directly and subsequently crush or bury Atlantic sea scallop eggs and juveniles, Atlantic surfclam juveniles and adults, longfin inshore squid egg mops, and small fish and invertebrates directly in the construction footprint (Table W-8).

Pre-lay grapnel runs completed throughout the review area prior to cable and foundation installation would have impacts similar to those of commercial trawls (Hiddink et al. 2017). Construction vessel anchors may also injure or kill organisms by direct contact upon placement or when dragged across the seafloor. The impact of anchors on the seafloor would be reduced by placing any necessary anchors within previously cleared and disturbed areas to the maximum extent possible. Construction support vessel anchoring is estimated to disturb approximately 0.70 hectares (ha) of substrate (see Chapter 3, Description of Proposed Activity).

The area and depth of benthic disturbance differs among foundation types. Monopile foundations cover the smallest area but penetrate deepest into the seafloor, while suction caisson jackets cover the largest area but do not penetrate the seafloor as deeply (ICF 2020). Monopiles and suction caisson jackets for the same size WTG would require comparable amounts of scour protection. The maximum design scenario analysis assumes that an area of 3,188 square meters (m^2) of seafloor around each foundation would be armored with rock or other hard material to prevent bottom scour. The Company conservatively estimates that up to 8 percent of the offshore export and inter-array cables (up to 25.6 km) would require some type of hard protection, particularly in areas where sufficient cable burial cannot be achieved. A construction vessel stabilized by dynamic positioning, spuds, or anchors would lower or release armoring material to the seafloor. Mobile fish and invertebrates would likely leave the area to avoid noise and physical impacts, but organisms that consume demersal prey (e.g., flounders, monkfish, red hake, skates) are expected to return after armoring activities to scavenge organisms that were injured or buried by armoring activity (ICF 2020; Vallejo et al. 2017).

Following the pre-lay clearing and grapnel runs, cable-laying equipment would trench or plow the seafloor to bury the cables. Any invertebrates that remained within the cable installation footprint following the clearing activities (e.g., deep burrowing Atlantic surfclam) would be displaced by the jet plow, mechanical plow, or free-lay/post-lay burial tool. Most mobile fish and macroinvertebrates would avoid the slow-moving installation equipment and escape injury; relatively immobile invertebrates and demersal fish life stages within the trenched area would be injured, buried, or killed. Shelled mollusks, such as Atlantic sea scallop and Atlantic surfclam, would fare better than soft-bodied species. The installation equipment would be active in a given area for only several hours, representing a transient impact on fish and invertebrates. Most burrowing bivalves would reposition themselves at suitable depths in the sediment after cable installation was complete. The offshore export cable corridor was sited to avoid known sensitive benthic habitats; further micro-siting within the offshore export cable corridor will avoid complex habitats where feasible.

Avoidance and conservation measures will minimize the probability of adverse interactions with sensitive benthic resources.

W.4.3.2 Burial of Organisms by Sediment Deposition

The Company modeled sediment transport in the Wind Development Area and offshore export cable corridor to characterize the duration of suspended sediment and area of likely deposition associated with construction (see Appendix M). Results of the modeling are summarized below.

Suspended sediments would settle to the seafloor close to the offshore export cable trench following cable installation and armoring; at 150 m from the trench centerline, modeled deposition thicknesses were less than 0.05 cm. The duration and height of the deposited sediment above the bottom would be influenced by particle size and bottom currents (see Appendix M, Sediment Transport Modeling Report).

At the landfall, which is 506 to 724 m offshore of Sandbridge, Virginia in water approximately 8 to 10 m deep, roughly 250 cubic meters of sediment would be dredged for each of up to six horizontal directional drilling (HDD) exit pits. A sediment plume and subsequent sediment deposition would extend a maximum of 800 m from the HDD exit pit during flood tide and 350 m during ebb tide (Appendix M, Sediment Transport Modeling Report). Additional sedimentation would occur immediately surrounding the dredge disposal site. Sediment plumes travel similar distances during beach nourishment projects, although plume concentration and travel distance are dependent on tides, winds, and sediments material. Plumes with turbidity concentrations greater than 100 NTUs have been measured more than 1,000 m away from a project site, although some sites have only measured large plumes within a few hundred meters of a project (Greene 2002; USACE 2001). The amount of resuspended sediment measured during beach nourishment is similar to concentrations measured during storms at those same beaches (USACE 2001).

Some demersal eggs and larvae, such as those of the Atlantic sea scallop, Atlantic surfclam, and longfin inshore squid, could be buried by the deposition of suspended sediments. However, most benthic organisms are able to adjust their positions vertically to accommodate the additional sediment depth as an adaptation to living in a highly dynamic environment. The Atlantic surfclam, for example, is a fast burrower capable of vertical and lateral movement within sediment. Sabatini (2007) observed the surfclam rebury itself to its desired depth within a few minutes of exposure to experimental trawl conditions. Longfin inshore squid egg mops may be dusted with a fine layer of sediment but are not likely to be buried unless located directly within the narrow footprint of foundations or cables. Mobile scavengers, such as flounders, monkfish, red hake, and skates, would likely be attracted to dead and injured invertebrates in the area following construction activities (Kaiser and Hiddink 2007; Vallejo et al. 2017). Any indirect impacts of sediment suspension and deposition on fish and invertebrates would be short-term and minimal.

Estimates of natural recovery time following construction vary by region, species, and type of disturbance (Hiddink et al. 2017). Recovery time depends on the availability of mobile sediment; the softbottom communities typical of the review area recover quickly, particularly when towed plows are used to prepare the bottom for cables (Kraus and Carter 2018). Studies of recovery following sand mining on the U.S. Atlantic Coast and in the Gulf of Mexico indicate that benthic habitat in the review area would fully recover within three months to two-and-a-half years (Kraus and Carter 2018; BOEM 2015b). NOAA Fisheries estimated recovery of the softbottom benthic community at the Block Island Wind Farm would occur within three years; post-construction monitoring has shown that there are no substantial differences in benthic macrofaunal communities or ecological function within wind turbine areas after two years of operation (HDR 2019).

W.4.3.3 Entrainment of Plankton and Ichthyoplankton

Intake pumps of cable installation equipment may entrain planktonic organisms. Pelagic eggs and larvae of Atlantic cod, monkfish, pollock, windowpane flounder, yellowtail flounder, Atlantic butterfish, Atlantic mackerel, black sea bass, bluefish, and summer flounder are expected to occur in the review area (see Attachment W-1; NOAA Fisheries 2021b). Entrainment of the planktonic life stages of these species may cause injury from movement through the pump and high-pressure discharge into the seafloor. No data are available on the probability of survival of entrained organisms in cable installation equipment; therefore, mortality of all entrained individuals is assumed.

Water jetting installation equipment would operate within a narrow centerline of the review area and would disturb a negligible fraction of sediment and water column. Individuals immediately surrounding the intake pumps would be at risk of entrainment as the equipment moves continuously along the offshore export cable corridor and inter-array cable corridors. A small zone of water surrounding the intake would supply the pump and temporarily affect plankton in a given area. Mortality of planktonic organisms is naturally high in the review area; mortality resulting from entrainment would represent a negligible loss and would be undetectable within the background of existing sources of entrainment in the review area (e.g., commercial, recreational, and military vessels).

W.4.3.4 Short-term Increase in Project-related Noise and Vibration

Noise generated by construction activities could directly and indirectly affect fishes and invertebrates. Sudden loud noises have been shown to cause behavioral changes, permanent or temporary threshold shifts, injury, or death (Jones et al. 2020; Andersson et al. 2017; Popper et al. 2014; Popper and Hastings 2009). Brief exposure to extremely loud noise or extended exposure to mid-level noise can cause a permanent threshold shift that may lead to long-term loss of hearing sensitivity, although serious injury is unlikely (Popper et al. 2021). Exposure to less-intense noise may cause a temporary threshold shift that may result in reversible loss of hearing acuity (Oestman et al. 2009).

The type and size of piling and the method of driving determine the level of underwater noise associated with pile driving for monopile foundations. Pile driving using an impact hammer and associated vibration of the seabed would be the greatest source of potentially injurious noise in the review area. The Company modeled the use of an impact hammer with maximum energy of 4,400 kilojoules to install the pilings for monopile foundations (see Appendix P, Underwater Acoustic Assessment). Installation of 13.5-m diameter foundations was evaluated as the maximum potential acoustic impact scenario. The suction caisson jacket foundation type would not require pile driving.

The physiology of the organism, the magnitude of the sound, and the distance of the organism from the sound all influence the potential impact of underwater noise on an individual fish or invertebrate. Fish and invertebrates may be sensitive to construction-induced sound pressure, particle motion (i.e., the oscillation of water molecules set in motion by sound), and vibrations (Popper et al. 2021). Fish with swim bladders connected to the ear are most sensitive to sound pressure (ICF 2020; Hawkins and Popper 2018; Popper and Hawkins 2019; Popper et al. 2014).

In 2014, NOAA Fisheries initiated a Working Group on Effects of Sound on Fish and Turtles, which established interim threshold criteria finalized under the American National Standards Institute (Popper et al. 2014). The Working Group developed general guidelines for predicting acoustic sensitivity from basic morphological traits of fish and invertebrates and established numeric thresholds for mortality, recoverable injury, and temporary threshold shifts, as well as qualitative risks of masking effects and behavioral responses for fish and invertebrates at three relative distances from the sound source (near, intermediate, and far). Because information on early life stages was not available, injury thresholds for eggs and larvae were based on thresholds for fish with swim bladders not linked to hearing (Popper et al. 2014).

Interim thresholds may be updated when more data on the effects of noise on fish and invertebrates become available. Uncertainties in the injury thresholds in Popper et al. (2014) may be attributed to the use of confined test chambers where test fish were exposed to noise for 24 minutes with no choice of leaving (Andersson et al. 2017). Cod and herring may swim more than 1,000 m in this timeframe, thereby reducing exposure to injurious noise by avoidance. NOAA Fisheries concluded in a Biological Opinion that acoustic stressors are unlikely to adversely affect Atlantic sturgeon or their prey; an individual fish would only be injured by noise if it remained in the vicinity of the pile during installation (NOAA Fisheries 2015). Because the ESA requires protection of individual fish, this Biological Opinion on Atlantic sturgeon impacts applies equally to species managed for commercial harvest under the MSA. Fishes and squid in the open waters of the review area may temporarily leave the site at the onset of soft-start pile driving to avoid harmful noise levels. Such behavior has been observed in schools of pelagic fish, which moved in horizontal and vertical directions in response to air gun noise (Carroll et al. 2017).

The Working Group interim criteria for predicting acoustic impacts to fish and invertebrates did not include impacts of particle motion or sediment vibration on marine taxa (Popper et al. 2021, Hawkins and Popper 2018; Roberts et al. 2016). This is in part because the environmental field conditions that determine the probability of detection of and response to particle motion in the field cannot be replicated in a laboratory setting (Hawkins and Popper 2018). Acoustic pathways not typically measured or modeled, such as sound-generated vibrations of sediment, may generate responses in marine invertebrates (Popper and Hawkins 2018). The Atlantic sea scallop, Atlantic surfclam, longfin inshore squid, and northern shortfin squid could be vulnerable to such effects. Juvenile and adult bivalves would likely respond to the impact hammer sounds and vibrations by "flinching," or closing their valves, which prevents feeding, though they would likely resume feeding immediately after the disturbance (Day et al. 2017). The short-term interruption of foraging would not affect the health of individuals or decrease abundance of the local populations of bivalves. In most species of squid, statocysts and lateral lines aid in the detection of particle motion (Mooney et al. 2010; Solé et al. 2013). 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 population-level impacts of acoustic stressors (Jones et al. 2020).

Though more developmentally mature individuals may be capable of directional swimming, ichthyoplankton as a whole have limited ability to flee unfavorable construction conditions (Pineda et al. 2007). In controlled laboratory studies, the sensory cells of newly hatched squid were observed to be susceptible to injury by anthropogenic sound. Squid hatchling statocysts and lateral line cells were damaged when exposed to 50 to 400 hertz sinusoidal wave sweeps for two hours at a measured sound pressure level of 157±5 decibels referenced at one micropascal (Solé et al. 2013). The sensory hair cells of some larval fish can regenerate within a few weeks, but the recovery capabilities of damaged squid sensory cells remain unknown (Solé et al. 2013). In contrast, monkfish and cod egg survival and abundance were unaffected by seismic sounds (Carroll et al. 2017).

The Company's underwater acoustic modeling of maximum Project design elements is presented in Appendix P, Underwater Acoustic Assessment. Based on the results of the assessment, the footprint of noise relative to the extent of habitat and the short duration of pile driving would not cause population-level effects on fish, bivalves, squid, or other invertebrates. These conclusions are consistent with modeling and field measurements for offshore wind foundations elsewhere in the Greater Atlantic region that reported only short-term adverse effects on fish, invertebrates, and EFH exposed to pile driving noise (BOEM 2018b, 2015b). An individual organism would experience harmful cumulative impacts only if it were exposed to the pile driving equipment throughout the review area for weeks or months, which is unlikely. Individual Atlantic sturgeon could be exposed to pile driving noise briefly but are not expected to remain in the vicinity of construction activities for more than a few hours. The Atlantic sturgeon is likely to respond to pile driving noise by avoiding the zone of influence. The Company will implement a soft-start procedure to the extent practicable to avoid or minimize impacts to marine mammals, sea turtles, fishes, and mobile invertebrates. Given the extent of suitable habitat outside the review area, adult fish and squid would likely relocate temporarily during pile driving activities and return to the area once the acoustic stressor diminished. Any injury caused by acoustic pulses during pile driving would not cause significant population-level effects on any species. Impacts to fish and invertebrates at all life stages would be temporary and localized.

W.4.4 Analysis of Potential Operations and Maintenance Impacts

Impact-producing factors associated with O&M in the review area would introduce EMF in the vicinity of inter-array and offshore export cables, introduce artificial lights and underwater noise in the vicinity of WTGs, and potentially cause fuel spills or the spread of non-indigenous species by Project-related vessels. Section 5.4, Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat describes these impact-producing factors in detail and determined that they would not adversely affect managed species or EFH in the review area. The COP findings are considered applicable to this EFHA and these impact-producing factors are not considered further in this section.

The most substantial impact-producing factors associated with Project O&M are those that cause loss of softbottom and the development of artificial reefs on and around novel structures. During the life of the Project, the loss of softbottom habitat and development of artificial reefs on foundations, scour protection, and cable protection is likely to have minimal, moderate, or less than substantial adverse effects on managed species and EFH.

Long-term conversion of softbottom to artificial hardbottom habitat and introduction of vertical infrastructure in pelagic habitat: Encrusting and attaching organisms would recruit from the plankton to colonize underwater portions of foundations and scour protection, creating an array of biogenic reefs (ICF 2020; Degraer et al. 2018). Shortly after installation, algae, amphipods, anemones, barnacles, blue mussels, bryozoans, hydroids, tubeworms, and tunicates would begin recruiting from the plankton (ICF 2020; Causon and Gill 2018; BOEM 2015b; Langhamer 2012; Langhamer et al. 2009; Steimle et al. 2002; Steimle and Zetlin 2000). Initial colonization would create secondary habitat, increase biodiversity, and attract mobile fish and invertebrates for foraging and refuge opportunities (ICF 2020; Causon and Gill 2018). Potential impacts on demersal species would vary by foundation type. Monopile foundations would provide smooth vertical walls for attachment, while suction caisson jacket foundations would provide a larger and more varied surface area for encrusting and attaching organisms and more shelter for forage species, enhancing the reef effect and increasing potential habitat complexity (ICF 2020). Relative to the vertical orientation of monopiles, the jacket foundations provide multiple orientations of hard surfaces, which were shown to support a greater diversity of organisms (Causon and Gill 2018).

Mature epifaunal communities on monopiles have been examined in northern Europe where offshore wind farms have been established for many years. Vertical surfaces of 4.6-m diameter monopiles were colonized by 23 species within a few months of installation and 55 species within four years; the associated scour protection was colonized by 24 species within a few months and 35 species within four years (Bouma and Lengkeek 2012). Similar results were observed in the southern Baltic Sea on 3-m diameter monopile foundations (Andersson and Öhman 2010). After seven years of succession, epifaunal assemblages included red and green algae, hydroids, and sessile bivalves such as blue mussels, representing similar assemblages as those on a nearby lighthouse. These same taxa have been observed on jacket foundations (e.g., red and green algae, anemones, barnacles, mussels, sea stars and urchins) (Causon and Gill 2018). The diverse orientations and greater shading and sheltering of jacket surfaces offer more habitat complexity to support greater diversity and abundance than monopiles (Causon and Gill 2018).

Both surface area and timing of installation influence colonization of new hard substrate. Planktonic larval assemblages vary throughout the year and partially determine the availability of colonizers immediately following installation. Therefore, the pattern of colonization and succession would vary throughout the review area during early years (Krone et al. 2013, 2017). The Gulf Stream carries plankton into review area waters from the south, while the Labrador Current carries plankton from the north. The quasi-decadal shift in the latitude of the Gulf Stream is reported to cause a corresponding northward shift in some species in response to increases in bottom temperature (Davis et al. 2017). The presence of WTGs would not interfere with these oceanic currents or disrupt the typical dispersion of eggs and larvae in the region but would likely increase recruitment in the built area. However, thermal stratification could be disrupted by the cumulative effect of numerous offshore wind developments in the U.S. Atlantic (Carpenter et al. 2021). The thin vertical foundations provide relatively small surface areas for planktonic settlement within the review area. Temperature, prey availability, and chemical odor of conspecifics all provide environmental signals to initiate or delay larval settlement; the developmental stage of individuals that encounter the foundations also influences the probability of recruitment (McManus et al. 2016; Pineda et al. 2007). In the North Sea, foundations predicted to serve as attachment sites for squid and herring eggs have not exhibited the expected extent of recruitment, likely due to the existing conditions of these environmental signals (Degraer et al. 2016). Settlement of macroinvertebrates and fish on the foundations is expected to be more variable than algae and protists among foundations and other hard structures.

Epifaunal communities on monopiles and jacket foundations typically exhibit vertical zonation, with more species near the seafloor than the sea surface, possibly because reef-building species rely on suspended sediments to construct tubes (Bouma and Lengkeek 2012). Epifaunal communities near the sea surface on all foundation types are dominated by red and green algae and barnacles, while deeper areas of the foundations tend to be made up of sessile reef-forming invertebrates (e.g., blue mussels) (Causon and Gill 2018; Andersson and Öhman 2010). Mobile demersal megafauna have been reported to be most abundant at the bases of monopile foundation s, possibly because bottom anchorage offers shade, shelter, and access to surrounding soft-bottom forage areas (Causon and Gill 2018; Krone et al. 2013; Bouma and Lengkeek 2012). Mobile invertebrates have been reported at all jacket foundation depths. Adult *Cancer* crabs dominated the lower-level communities of steel jacket foundations, while larval edible crab dominated the upper levels of steel jacket and monopile foundations (Krone et al. 2013, 2017).

A rain of enriched organic matter and empty invertebrate shells, known as littoral fall or foundation effect, typically accumulates on the sea floor around each foundation (ICF 2020; Causon and Gill 2018; Coates et al. 2014; Goddard and Love 2010). Empty shells provide essential habitat for juvenile life stages of many species, including bivalves, crabs, scup, and other demersal fish. Discarded bivalve shells have been shown to provide valuable habitat for species of hake, skate, black sea bass, and other species known to frequent the review area, and to support more species per unit area than flat, soft-bottom habitat (Coen and Grizzle 2007). Squid mops may also be attached to empty mollusk shells. Organic detritus provides nutrients and physical shelter for benthic organisms; however, excessive organic matter may create areas of anoxia beneath foundations (ICF 2020). Such enrichment associated with littoral fall around well-established oil and gas platforms has been detectable only within 1 to 5 m of the foundation (Bergstrom et al. 2014; Wilhelmsson et al. 2006). Bottom currents in the review area are expected to maintain adequate oxygen to support marine life even in the presence of littoral fall (see Section 4.2, Water Quality).

Grain size, total organic carbon, and benthic species assemblages vary along transects extending out from monopile bases (Coates et al. 2014; Bouma and Lengkeek 2012; Andersson and Öhman 2010), possibly caused by accelerated water movement around the new structures, which results in turbulence and reduced current strength (ICF 2020). Organic carbon enrichment has been shown to be highest near monopile foundation bases and decrease with distance from the structures. Mean grain size is typically smallest near the monopile foundations, possibly due to construction activities and low-flow pockets formed immediately down-current from the bases. Such pockets may also provide a sheltered area where larval recruits and organic matter accumulate and enrich the seafloor (ICF 2020; Coates et al. 2014; Bouma and Lengkeek 2012). Introduced organic matter, larval recruits, and adult forage species seeking refuge from currents may subsequently attract predators to the turbulent areas (ICF 2020). In contrast, the speed and direction of bottom currents have been shown to be unaffected by jacket foundations, likely because the water moves through rather than around the foundations (Degraer et al. 2016; Coates et al. 2014).

The distribution and abundance of predatory fish and invertebrates would be influenced by the increased diversity and productivity around foundations (Degraer et al. 2016; Rein et al. 2013). In the North and Baltic Seas, benthic fish collected within and in the vicinity of wind farm foundations constructed on softbottom substrate had stomachs full of hardbottom prey associated with the foundations (Degraer et al. 2016; Andersson and Öhman 2010). The sandy substrates of the Wind Development Area provide little habitat for structure-associated species (Guida et al. 2017). Of the demersal species with EFH in the review area, EFH source documents indicate that black sea bass, monkfish, red hake, scup, and spiny dogfish benefit from the complex habitat offered by structured hardbottom. These species are known to associate with artificial structures (Attachment W-1).

Black sea bass aggregate around artificial reefs along the eastern seaboard from Massachusetts to Florida and exhibit particularly strong site fidelity to specific reefs (Powers et al. 2003; Rousseau 2008; Barber et al. 2009; Harrison and Rousseau 2020). Structure-associated managed species have been observed aggregating around artificial reefs in New York (NYSDEC 2020), New Jersey (Figley et al. 2000), Delaware (Steimle et al. 2002), Maryland (Loftus and Stone 2007; Cullen and Stevens 2017), North Carolina (Bangley and Rulifson 2014; Lemoine et al. 2019), South Carolina (Kolmos 2007), and elsewhere throughout the Mid-Atlantic Bight (Steimle and Zetlin 2000; Ross and Rhode 2016). Atlantic cod, bluefish, pollock, and other softbottom-dependent species (e.g., summer and winter flounder) also frequent artificial reefs. Benefits of complex habitat provided by introduced WTGs may or may not extend to meso- and epipelagic species. While increased vertical mixing and subsequent transport of nutrients to the sea surface have been observed at WTGs in the North Sea, changes to primary production did not notably alter the distribution of resident pelagic fishes (Floeter et al. 2017). Likewise, a study of stomach contents of benthic and pelagic fishes in the North Sea concluded that benthic but not pelagic species were directly feeding on the artificial reefs (Mavraki et al. 2021). Colonization would follow a characteristic pattern of succession on a linear horizontal scale on cable armoring materials, increasing habitat heterogeneity and attracting mobile fishes and invertebrates seeking forage and refuge (Glarou et al. 2020; Taormina et al. 2018; Langhamer 2012). Investigations have shown no significant differences in benthic communities between cable armoring and surrounding hardbottom control areas (Taormina et al. 2018). However, cable armoring can generate a stronger reef effect when the surrounding substrate is softbottom. For example, sea anemones became significantly more abundant on the ATOC/Pioneer Seamount cable in Half Moon Bay, California, than on the surrounding softbottom in the eight years following cable installation; the secondary habitat provided by the anemones subsequently attracted higher abundances of reef-associated fish species (Kogan et al. 2006).

The Company is considering various materials for use as foundation scour protection and cable armoring, including rock armor, gabion rock bags, grout bags, concrete mattresses, and protective half-shells. Because of the well-documented positive correlation between structural complexity, biodiversity, and abundance, materials offering greater structural complexity are expected to generate stronger reef effects. Rough surface texture increases surface area and enhances early benthic settlement. Diverse surface orientations supports a greater diversity of organisms with differing settlement preferences (Glarou et al. 2020). Materials offering crevices of various shapes and sizes support more fish species and life stages (Glarou et al. 2020; Langhamer 2012). Rock armor and gabion rock bags offer greater habitat heterogeneity and are expected to generate a stronger reef effect by increasing early colonization by macromolecular films, bacteria, and microalgae; offering various surface orientations for bivalves, hydroids, and barnacles with differing settlement preferences; and providing an extensive spectrum of microhabitats for greater fish diversity and abundance (Glarou et al. 2020; Taormina et al. 2018; Langhamer 2012). In contrast, prefabricated concrete mattresses, grout bags, and half-shells typically offer smooth, uniform surfaces that support fewer colonizing species.

Well-established offshore wind farms throughout Europe have been shown to have positive effects on distributions of fish and macroinvertebrates. In the Belgian part of the North Sea, increased foraging opportunities near foundations were linked to increases in Atlantic cod and pout abundance and output (Reubens et al. 2014). Demersal fish abundances were higher near wind turbine foundations than on surrounding softbottom sediments (Bergstrom et al. 2013, 2014; Wilhelmsson et al. 2006). In the Netherlands, sand eels were attracted to the hardbottom scour protection around wind turbine foundations (Rein et al. 2013). In the North Sea, benthic epifauna growing on foundations provided increased feeding opportunities for fish species and nursery habitat for crab species(Krone et al. 2017; Stenberg et al. 2015). On the U.S. Atlantic Coast, NOAA Fisheries concluded that any individual Atlantic sturgeon passing through an operational wind farm area would likely benefit from increased prey associated with the hard armoring around the turbine foundations and offshore export cables (NOAA Fisheries 2015).

A recent meta-analysis of the effect of wind farms on fish abundance found that more fish occur within wind farms than at nearby reference locations (Methratta and Dardick 2019). Whether artificially introduced hard substrates increase or simply redistribute existing biomass is still debated (Friedland et al. 2021; Methratta 2021; Smith et al. 2015; Brickhill et al. 2005; Powers et al. 2003). In some cases, observed increases in structure-associated fish within a wind farm may not be clearly attributable to site-specific productivity or immigration from surrounding areas (Rein et al. 2013). Furthermore, differences in the abundances of fish, squid, and ichthyoplankton may not always be observed, as was reported in the North and Baltic Seas (Langhamer et al. 2018; Degraer et al. 2016). Demersal fish and American lobster have not responded as expected to the increase in hard structure at the Block Island Wind Farm; no declines in the distribution, abundance, or condition of fish or invertebrates were attributed to the wind farm (Wilber et al. 2018; Carey et al. 2020; Guarinello and Carey 2020).

Offshore structures attract most highly migratory fishes. Tunas, including yellowfin and bigeye, and sharks (e.g., dusky, whitetip, shortfin Mako, common thresher) may be drawn to the abundant schooling forage fish associated with structure or use the structures as navigational landmarks (Taormina et al. 2018). Effects of the foundations on fish and invertebrate populations may be adverse, beneficial, or mixed depending on the species and location (van der Stap et al. 2016; NOAA Fisheries 2015).

The relatively uniform sandy substrate type in the review area supports the same or similar benthic species typical throughout the area. Foundations, scour protection, and cable armoring would introduce a small area of hardbottom in the review area. Under the maximum design scenario, a total of 225,140 m^2 of softbottom substrate would be covered by foundations and associated scour protection and an additional 95,400 m^2 would be covered by cable armoring, representing approximately 0.001 percent of the review area.

In summary, monopile and suction caisson jacket foundation types would offer similar but not identical habitat values. The complex structure of a jacket foundation would support a more complex species assemblage than a smooth vertical monopile (Wilhelmsson and Langhamer 2014). Jacket foundations would also allow water to flow through the structure, whereas the wider monopile foundation bases would deflect bottom currents and create low-flow pockets. Similarly, various scour protection and cable armoring materials would offer similar but not identical habitat values. Concrete mattresses, grout bags, and half-shells would offer smooth, uniform surfaces for colonization, whereas rock armor and gabion rock bags would offer greater structural complexity and likely generate augmented reef effects.

Predicted effects of introduced structure to most benthic and pelagic habitat would either be neutral or beneficial (Hooper et al. 2017). No population-level species effects are expected, as foundations, scour protection, and cable armoring would influence only local distributions of demersal fish and invertebrates on a small spatial scale. Structure-associated species, such as black sea bass and scup, may benefit from the introduction of project-related infrastructure. Effects of the new infrastructure on softbottom-associated species, such as surfclam, ocean quahog, and some flatfish, would be neutral. The species assemblage that would colonize each foundation type or armoring material cannot be predicted in advance. Across all foundation types and armoring materials, population-level effects on fish and invertebrate species would not be measurable given the highly localized extent of the introduced hard substrate.

W.5 SUMMARY OF EFFECTS ON EFH AND MANAGED SPECIES

Impact-producing factors that may affect managed species with designated EFH in the review area are detailed in Attachment W-2 and summarized in Table W-10. Effects on other NOAA Trust Resources would parallel those for managed species with similar habitat and forage requirements.

Table W-10 Summary of Impacts by Species and Life Stage (see Attachment W-2 for details)

Managed Species	Wind Development Area				Offshore Export Cable Corridor							
					Federal Waters				State Waters			
	Life Stage											
	E	L	J	A	E	L	J	A	E	L	J	A
Atlantic butterfish	X	X	X	X	X	X	X	X	-	-	X	X
Atlantic cod	-	X	-	-	X	X	-	-	X	-	-	-
Atlantic herring	-	-	X	X	-	-	X	X	-	-	-	X
Atlantic mackerel	-	-	X	X	-	-	X	X	-	-	-	X
Atlantic sea scallop	X	X	X	X	X	X	X	X	-	-	-	-
Atlantic surfclam	-	-	X	X	-	-	X	-	-	-	-	-
Black sea bass	-	X	X	X	-	X	X	X	-	-	X	X
Bluefish	X	X	X	X	X	X	X	X	-	-	X	X
Clearnose skate	-	n/a	X	X	-	n/a	X	X	-	n/a	X	X
Longfin inshore squid	-	-	X	X	X	-	X	X	X	-	-	-
Monkfish	X	X	X	-	X	X	-	X	X	X	-	X
Northern shortfin squid	-	-	X	-	-	-	-	-	-	-	-	-
Pollock	-	-	-	-	-	X	-	-	-	-	-	-
Red hake	-	-	-	X	-	-	-	X	-	-	-	-
Scup	-	-	X	X	-	-	X	X	-	-	X	X
Snapper grouper unit	X	X	X	X	X	X	X	X	-	-	-	-
Spiny dogfish	n/a	-	-	X	n/a	-	-	X	n/a	-	-	X
Spiny lobster unit	X	X	X	X	X	X	X	X	-	-	-	-
Summer flounder	X	X	X	X	X	X	X	X	-	-	X	X
Windowpane flounder	X	-	X	X	X	X	X	X	X	-	X	-
Winter skate	-	n/a	-	-	-	n/a	X	-	-	n/a	-	-
Witch flounder	-	X	-	-	X	X	-	-	X	-	-	-
Yellowtail flounder	-	X	-	-	-	X	-	-	-	-	-	-

Managed Species	Wind Development Area				Offshore Export Cable Corridor							
					Federal Waters				State Waters			
	Life Stage											
	E	L	J	A	E	L	J	A	E	L	J	A

Notes:
X This life stage is not expected to be adversely affected in the given portion of the Offshore Project Area.
X This life stage may be adversely affected in the given portion of the Offshore Project Area.
\- No EFH for this life stage is designated in the given portion of the Offshore Project Area; thus, no effect is expected.
n/a No EFH is designated for this life stage.
A Adult
E Egg
L Larva (or neonate shark)
J Juvenile

Construction and decommissioning activities associated with the Project would have a temporarily, localized effect on pelagic life stages and water column EFH in the review area. Impact-producing factors associated with these activities would include localized increases in turbidity (sediment plumes), inadvertent fuel releases from Project vessels and equipment, ichthyoplankton entrainment by cable installation equipment, and introduction of noise and vibration from impact pile driving. O&M activities would not generate measurable effects on water column EFH or pelagic life stages

A maximum of 23 ha of softbottom benthic habitat in the review area would be converted to hardbottom by WTG and ESP foundations and associated scour protection. Impact-producing factors associated with construction and decommissioning activities would include direct disturbance by construction equipment and potential injury to or mortality of managed species. However, monitoring of the Block Island Wind Farm indicates that softbottom macrofaunal communities directly adjacent to WTGs have not notably changed during operations, implying that long-term changes to softbottom EFH would be restricted to areas directly covered by the Project (Hutchison et al. 2020). Softbottom habitat is not an ecologically limiting factor in the review area. Bedforms would be temporarily disturbed but would reform within days to weeks under the influence of the same physical conditions that formed them initially. Long-term impact-producing factors associated with O&M would include the introduction of EMF in the benthic environment and the conversion of softbottom to hardbottom habitat.

Up to 23 ha of hardbottom substrate would be introduced in the review area for the operational life of the Project. Certain resident and highly migratory managed species may benefit from the introduction of complex habitat and associated increased productivity in the review area. While foundations would introduce some habitat variability to the relatively uniform softbottom substrates of the Wind Development Area, only a small fraction of the review area would be subject to reef effects; no population-level impacts are expected.

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Attachment W-1
Profiles of Managed Species in the Review Area

Construction and Operations Plan
Kitty Hawk North Wind Project
Lease Area OCS-A 0508

Attachment W-1
Profiles of Managed Species in the Review Area

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°N, °S	degrees north and degrees south, latitude
°W	degrees west, longitude
Company	Kitty Hawk Wind, LLC
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
°F	Degrees Fahrenheit
FMP	Fishery Management Plan
Ft	feet
HMS	Highly Migratory Species
Lease Area	Renewable Energy Lease Area OCS-A 0508
m	meter
MAFMC	Mid-Atlantic Fishery Management Council
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEFMC	New England Fishery Management Council
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Marine Fisheries Service
Review Area	Project components in Wind Development Area and offshore export cable corridor
ppt	parts per thousand
Project	Kitty Hawk North Wind Project
SAFMC	South Atlantic Fishery Management Council
U.S.	United States
YOY	young-of-year

W-1.1 MANAGED SPECIES IN THE REVIEW AREA

Kitty Hawk Wind, LLC (the Company), a wholly owned subsidiary of Avangrid Renewables, LLC, proposes to construct, own, and operate the Kitty Hawk North Wind Project (the Project). The Project will be located in the designated Renewable Energy Lease Area OCS-A 0508 (Lease Area). At this time, the Company proposes to develop approximately 40 percent of the Lease Area in the northwest corner closest to shore (19,441 hectares; the Wind Development Area). The offshore components of the Project, including the wind turbine generators, ESP, and inter-array cables, will be located in federal waters within the Wind Development Area, while the offshore export cable corridors will traverse both federal and state territorial waters of Virginia.

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), federal agencies must consult with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries) regarding any actions authorized, funded, undertaken, or proposed to be authorized, funded, or undertaken under their jurisdiction. The present Essential Fish Habitat (EFH) Assessment (EFHA) was prepared in accordance with 50 Code of Federal Regulations (CFR) § 600.920(e)(1) to support BOEM in consultation with NOAA Fisheries under the MSA. Potential impacts of construction, operations and maintenance (O&M), and decommissioning of the Project on managed species with designated EFH in the review area are discussed. For the purposes of this EFHA, the review area includes the offshore components of the Project in the Wind Development Area and offshore export cable corridor (Figure W-1-1).

Species with EFH in the review area were identified using the NOAA Fisheries EFH Mapper (2021a), New England Fishery Management Council (NEFMC) Omnibus Amendment 2 (2017), Mid-Atlantic Fishery Management Council (MAFMC) Fisheries Management Plans, South Atlantic Fishery Management Council (SAFMC) Final Comprehensive Amendment (1998), NOAA Fisheries Highly Migratory Species (HMS) Amendment 10 (2017), and NOAA Fisheries EFH source documents. Managed species with designated EFH intersecting the review are listed in Table W-1-1.

Table W-1-1. Managed Species with Designated EFH in the Review Area

Common Name	Scientific Name	Essential Fish Habitat (EFH) Designations Intersecting the Review Area
New England Fishery Management Council (NEFMC)		
Atlantic cod	*Gadus morhua*	Egg, Larva
Atlantic herring b/	*Clupea harengus*	Juvenile, Adult
Atlantic sea scallop	*Placopecten magellanicus*	All
Clearnose skate	*Raja eglanteria*	Juvenile, Adult
Monkfish a/	*Lophius americanus*	All
Pollock	*Pollachius virens*	Larva
Red hake	*Urophycis chuss*	Adult
Windowpane Flounder	*Scophthalmus aquosus*	All
Winter skate	*Leucoraja ocellata*	Juvenile
Witch flounder	*Glyptocephalus cynoglossus*	Egg, Larva
Yellowtail flounder	*Limanda ferruginea*	Larva

Common Name	Scientific Name	Essential Fish Habitat (EFH) Designations Intersecting the Review Area
Mid-Atlantic Fishery Management Council (MAFMC)		
Atlantic butterfish	*Peprilus triacanthus*	All
Atlantic mackerel	*Scomber scombrus*	Juvenile, Adult
Atlantic surfclam	*Spisula solidissima*	Juvenile, Adult
Black sea bass b/	*Centropristis striata*	Larva, Juvenile, Adult
Bluefish b/	*Pomatomus saltatrix*	All
Longfin inshore squid	*Doryteuthis (Amerigo) pealeii*	Egg, Juvenile, Adult
Northern shortfin squid	*Illex illecebrosus*	Juvenile
Scup b/	*Stenotomus chrysops*	Juvenile, Adult
Spiny dogfish b/	*Squalus acanthias*	Sub-female, Adult Female/Male
Summer flounder b/	*Paralichthys dentatus*	All
South Atlantic and Gulf of Mexico Fishery Management Councils (SAFMC & GMFMC)		
Snapper grouper	Epinephelidae; Lutjanidae	All
Spiny lobster	Palinuridae	All
NOAA Fisheries Highly Migratory Species (HMS) Division		
Albacore tuna	*Thunnus alalonga*	Juvenile
Atlantic angel shark	*Squatina dumeril*	All
Atlantic bluefin tuna	*Thunnus thynnus*	All
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	Juvenile, Adult
Atlantic skipjack tuna	*Katsuwonus pelamis*	Juvenile, Adult
Atlantic yellowfin tuna	*Thunnus albacares*	Juvenile
Blacktip shark	*Carcharhinus limbatus*	Juvenile, Adult
Common thresher shark	*Alopias vulpinus*	All
Dusky shark	*Carcharhinus obscurus*	All
Sand tiger shark	*Carcharhinus taurus*	All
Sandbar shark	*Carcharhinus plumbeus*	All
Scalloped hammerhead shark	*Sphyrna lewini*	Juvenile, Adult
Smoothhound shark complex / smooth dogfish	*Mustelus canis*	All
Tiger shark	*Galeocerdo cuvier*	All
a/ Joint management by NEFMC and MAFMC b/ Joint management with Atlantic States Marine Fisheries Commission		

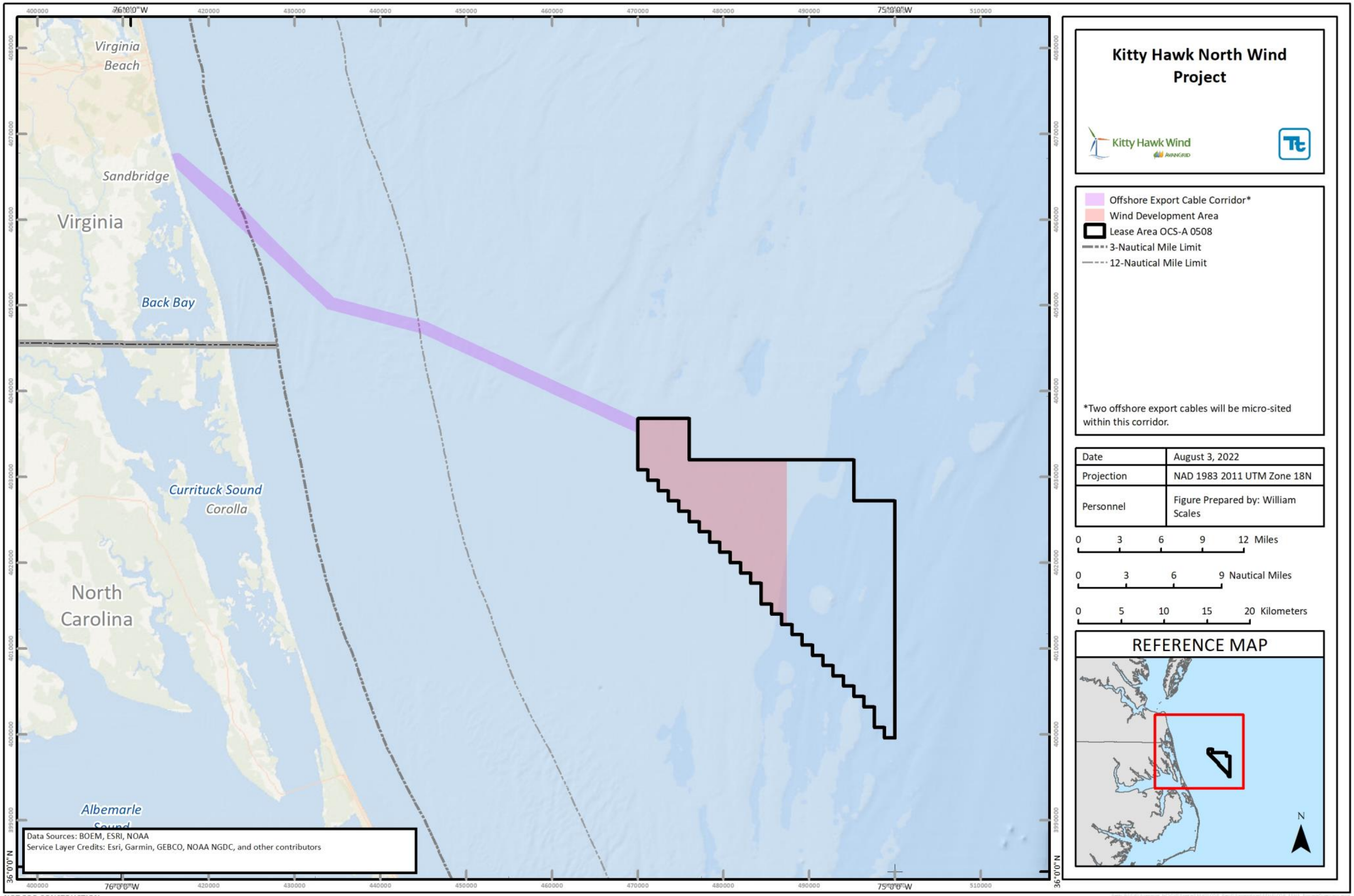


Figure W-1-1. Kitty Hawk Review Area Overview

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

The following sections describe managed species with designated EFH intersecting the review area. EFH acreages, percentage of the review area intersected by the EFH, and percentage of total EFH intersected by the review area are presented in tables. The species-specific acreages of EFH within the review area were calculated using geographic information system tools that measure the intersection of EFH and review area shapefiles. All EFH returned by the EFH Mapper shapefile downloads (NOAA Fisheries 2021a) was assumed to be present, regardless of the geographic boundaries presented in EFH source documents. The acreages presented in the following sections therefore represent conservative estimates of functional EFH in the review area.

W-1.2.1 Atlantic Cod (*Gadus morhua*)

EFH for Atlantic cod eggs is designated in federal and state waters of the offshore export cable corridor (Table W-1-2; Figure W-1-2). Atlantic cod egg EFH is designated during the fall and spring spawning season in the upper 230 feet (ft; 70 meters [m]) of the water column, where salinities are within 32 to 33 parts per thousand (ppt) and temperatures do not exceed 54 degrees Fahrenheit (°F; 12 degrees Celsius [°C]) (Fahay et al. 1999a; Lough 2004). In the Mid-Atlantic Bight, eggs occur in pelagic marine habitats and in the high salinity zones of regional bays and estuaries (NEFMC 2017). They primarily occur in surface waters to depths of 33 ft (10 m) but may sink to lower depths in areas where spring rainfalls have reduced salinities in the water column (Fahay et al. 1999a; Lough 2004).

EFH for Atlantic cod larvae is designated in the Wind Development Area and federal waters of the offshore export cable corridor (Table W-1-2; Figure W-1-2). Atlantic cod larval EFH is designated in temperatures of 39 to 46°F (4 to 8°C) in winter and spring and 45 to 54°F (7 to 12°C) in summer and fall, where salinities are within 32 to 33 ppt (Fahay et al. 1999a; Lough 2004). In the Mid-Atlantic Bight, larvae occur in pelagic marine habitats and in the high salinity zones of regional bays and estuaries (NEFMC 2017). Young larvae are found in the upper 246 ft (75 m) of the water column and descend to depths of 689 ft (210 m) as they age. They exhibit diel vertical migrations in response to light and in pursuit of planktonic prey (Fahay et al. 1999a; Lough 2004).

Table W-1-2. Atlantic Cod (*Gadus morhua*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg	0	679	4,975
Larva	34,562	0	0
Percent of Review Area Covered by EFH by Life Stage			
Egg	0.000%	0.000%	0.005%
Larva	0.006%	0.000%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Egg	0.0%	3.4%	99.7%
Larva	71.9%	0.0%	0.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Lough 2004; Fahay et al. 1999a			

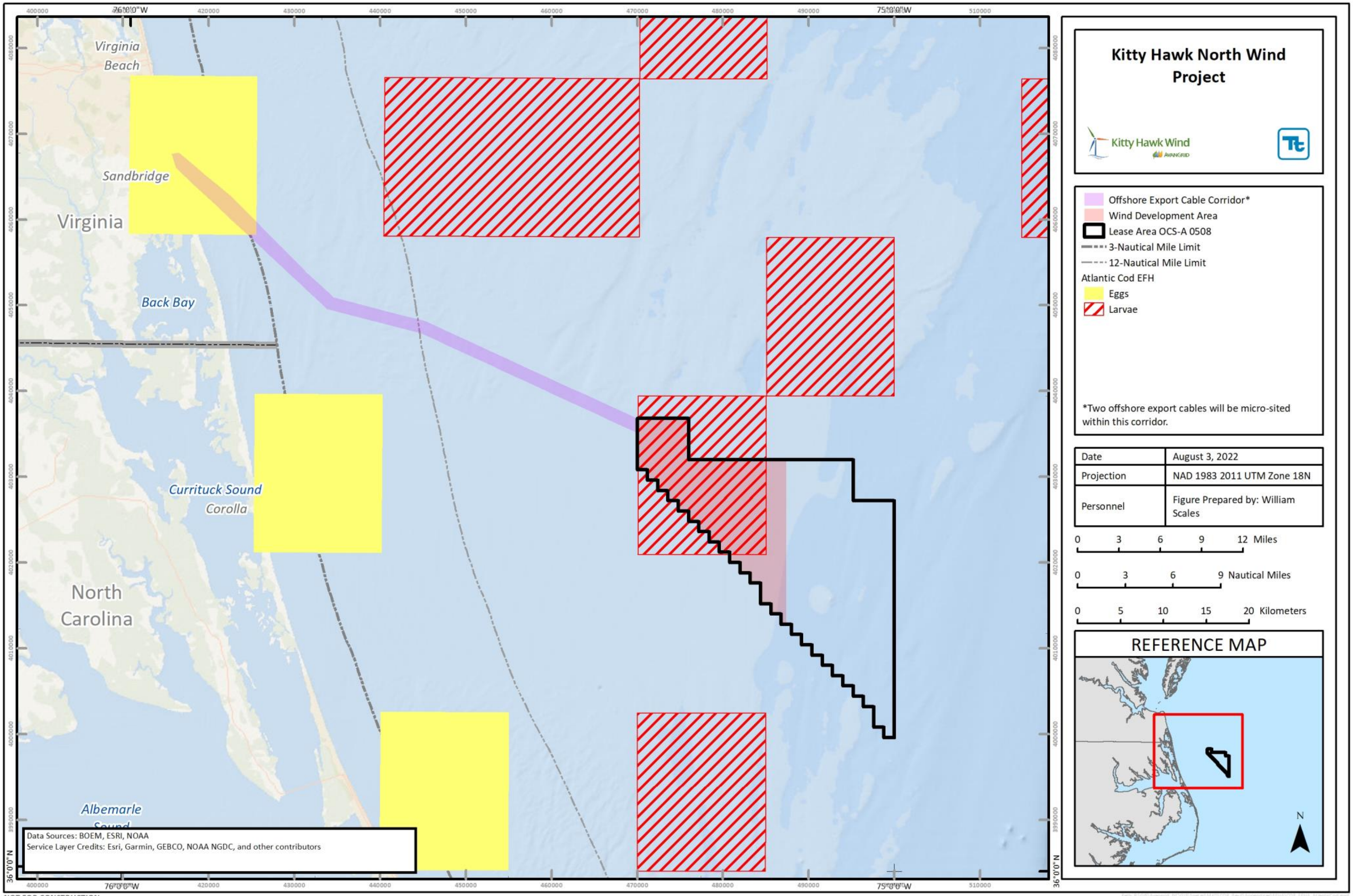


Figure W-1-2. Atlantic Cod (*Gadus morhua*) Designated EFH in the Review Area

No EFH for Atlantic cod juveniles or adults is designated in the review area.

The NEFMC Northeast Multispecies FMP manages Atlantic cod as two stocks: the Gulf of Maine stock and the Georges Bank stock. Both fishery stocks are currently overfished and subject to continued overfishing (NOAA Fisheries 2021b).

W-1.2.2 Atlantic Herring (*Clupea harengus*)

No EFH for Atlantic herring eggs or larvae is designated in the review area.

EFH for Atlantic herring juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-3; Figure W-1-3). Atlantic herring juvenile EFH is designated in the upper 984 ft (300 m) of the water column, where salinities are within 28 to 32 ppt and temperatures range from 37 to 72°F (3 to 22°C) (Reid et al. 1999; Stevenson and Scott 2005; NEFMC 2017). In the Mid-Atlantic Bight, juveniles occur in intertidal and subtidal pelagic marine habitats and in the high salinity zones of regional bays and estuaries (NEFMC 2017). Young-of-year (YOY) tolerate a wide range of salinities but exhibit increasing preference for high salinities as they age. One- and two-year-old juveniles exhibit diel vertical migrations in response to light and form large schools to undertake limited seasonal inshore-offshore migrations (NEFMC 2017). Juveniles feed on a variety of zooplankton, including barnacle larvae, cladocerans, copepod larvae, decapod larvae, and molluscan larvae (Stevenson and Scott 2005).

Table W-1-3. Atlantic Herring (*Clupea harengus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	4,248	19,106	0
Adult	10,669	19,785	4,975
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.001%	0.002%	0.000%
Adult	0.002%	0.001%	0.009%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	8.8%	96.1%	0.0%
Adult	22.2%	99.5%	99.7%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Stevenson and Scott 2005; Reid et al. 1999			

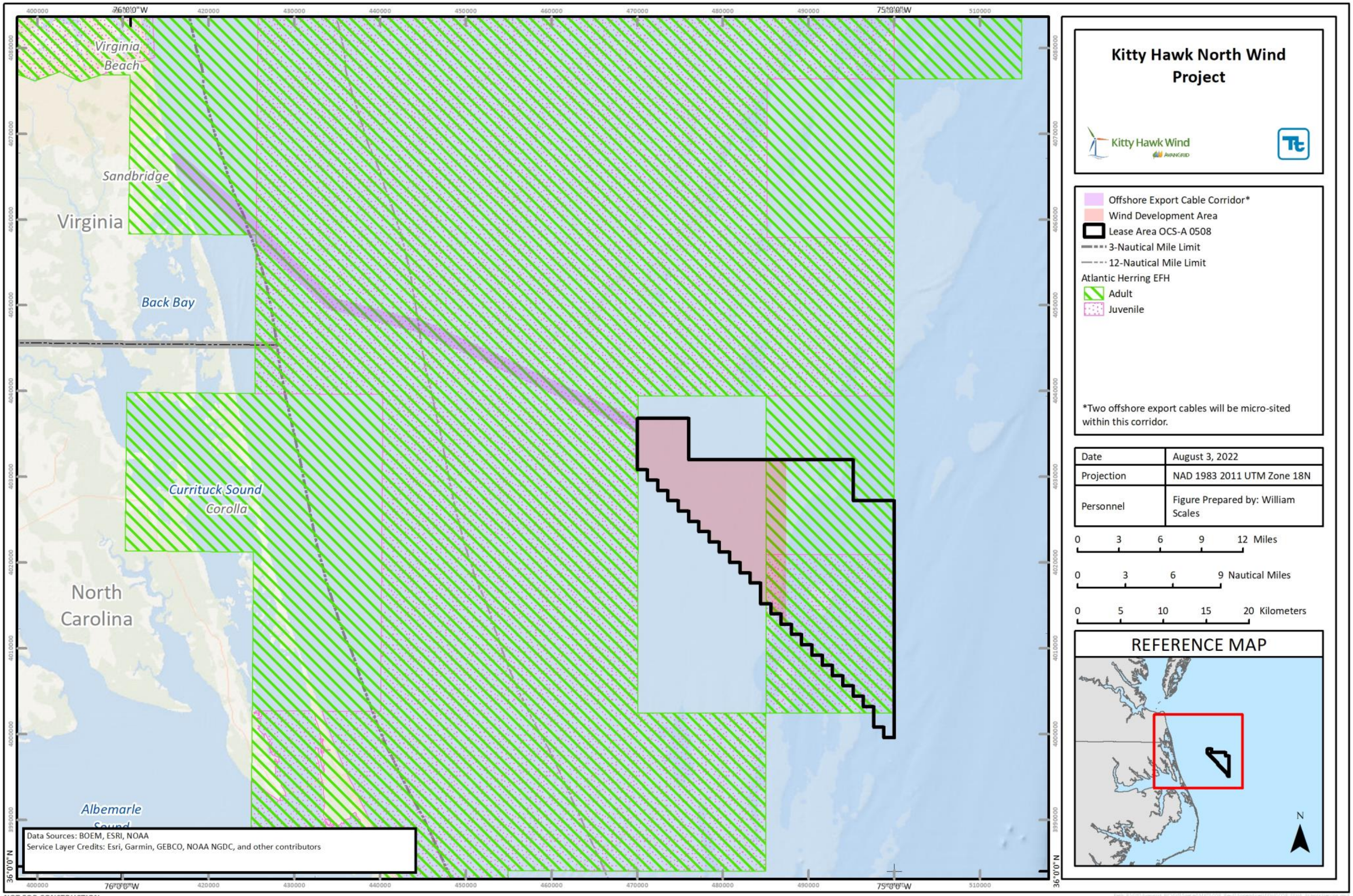


Figure W-1-3. Atlantic Herring (*Clupea harengus*) Designated EFH in the Review Area

EFH for Atlantic herring adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-3; Figure W-1-3). Atlantic herring adult EFH is designated in the upper 984 ft (200 m) of the water column, where salinities are within 27 to 35 ppt and temperatures range from 39 to 45°F (4 to 7°C) in spring and 41 to 57°F (5 to 14°C) in summer and fall (Reid et al. 1999; Stevenson and Scott 2005). In the Mid-Atlantic Bight, adults occur in subtidal pelagic marine habitats and in the high salinity zones of regional bays and estuaries (NEFMC 2017). Adults prefer well-mixed waters and the transition zones between stratified and unstratified waters. Like juveniles, they exhibit diel vertical migrations in response to light and undertake extensive seasonal migrations between southern overwintering habitats and northern spawning habitats. Spawning occurs on the seafloor in depths ranging from 16 to 295 ft (5 to 90 m) over a variety of substrates (NEFMC 2017). Adults feed on chaetognaths, copepods, and euphausiids (Stevenson and Scott 2005).

The NEFMC Atlantic Herring FMP manages Atlantic herring as a single stock: the Northwestern Atlantic Coast stock. The fishery stock is currently overfished but is not subject to overfishing (NOAA Fisheries 2021a).

W-1.2.3 Atlantic Sea Scallop (*Placopecten magellanicus*)

EFH for all life stages of the Atlantic sea scallop is designated in the Wind Development Area and federal waters of the offshore export cable corridor (Table W-1-4; Figure W-1-4). The Atlantic sea scallop is a suspension and filter feeder that consumes diatoms, detritus, microscopic animals, and phytoplankton (Packer et al. 1999a). Feeding habits do not vary substantially across life stages.

Atlantic sea scallop egg EFH is designated on the seafloor in temperatures ranging from 55 to 63°F (13 to 17°C) (Packer et al. 1999a). In the Mid-Atlantic Bight, eggs occur in inshore benthic marine habitats and on the continental shelf in the vicinity of adults (NEFMC 2017). Eggs remain on the seafloor for four to five weeks and subsequently develop into a free-swimming larval stage.

Atlantic sea scallop larval EFH is designated in the upper 33 ft (10 m) of the water column for planktonic stages and on the seafloor for spat, where salinities are within 16.9 to 30 ppt and temperatures range from 54 to 64°F (12 to 18°C) (Packer et al. 1999a). In the Mid-Atlantic Bight, larvae occur in inshore and offshore benthic and pelagic marine habitats (NEFMC 2017). During their two planktonic stages (trochophore and veliger stages), larvae exhibit diel vertical migrations and are dispersed by currents for more than a month before settling as spat on hard surfaces (e.g., gravel, macroalgae, pebbles, shells) (NEFMC 2017). Spat settled on hardbottom substrates exhibit higher survival rates than spat settled on mobile softbottom sediments.

Table W-1-4. Atlantic Sea Scallop (*Placopecten magellanicus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
All	13,285	2,910	0
Percent of Review Area Covered by EFH by Life Stage			
All	0.002%	0.004%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
All	27.7%	14.6%	0.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Packer et al. 1999a			

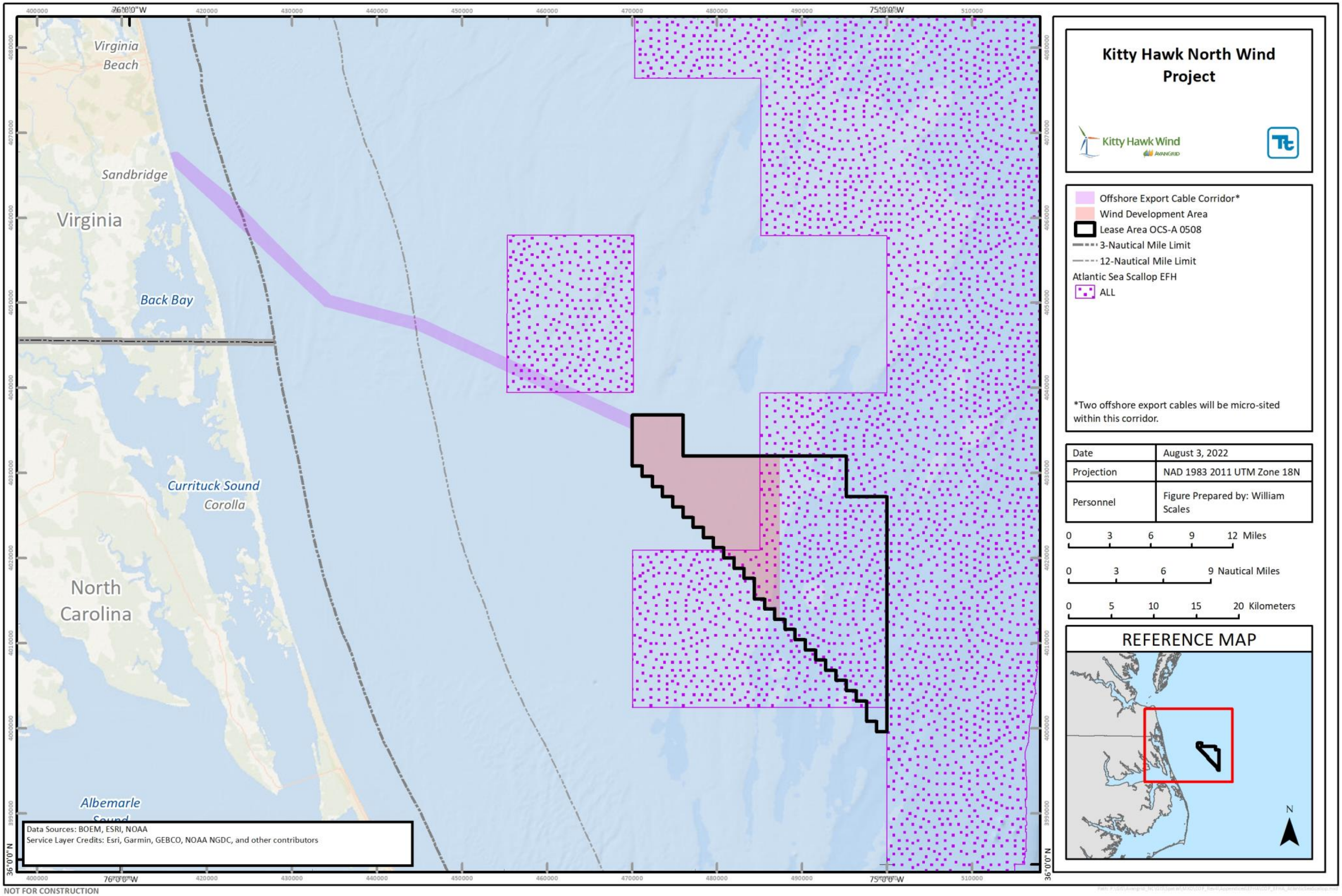


Figure W-1-4. Atlantic Sea Scallop (*Placopecten magellanicus*) Designated EFH in the Review Area

Atlantic sea scallop juvenile EFH is designated in depths of 59 to 361 ft (18 to 110 m), where salinities exceed 25 ppt and temperatures range from 34 to 59°F (1.2 to 15°C). In the Mid-Atlantic Bight, juveniles occur in benthic marine habitats attached by byssal threads to gravel, pebbles, cobble, and shells (NEFMC 2017). Juveniles lose their byssal attachments as they age and become demersal swimmers. They exhibit preferences for habitats with high concentrations of suspended organic material for feeding purposes (Packer et al. 1999a; NEFMC 2017).

Atlantic sea scallop adult EFH is designated in depths of 59 to 361 ft (18 to 110 m), where salinities are within 32 to 33 ppt and temperatures range from 50 to 59°F (10 to 15°C). In the Mid-Atlantic Bight, adults occur in benthic marine habitats over coarse sand and gravel substrates containing shell fragments. Adults often aggregate in beds whose size and duration are dictated by local larval retention or dispersion by currents (NEFMC 2017). They exhibit preferences for habitats with high concentrations of suspended organic material for feeding purposes (Packer et al. 1999a; NEFMC 2017).

The NEFMC Atlantic Sea Scallop FMP manages the Atlantic sea scallop as a single stock: the Northwestern Atlantic Coast stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

W-1.2.4 Clearnose Skate (*Raja eglanteria*)

No EFH for clearnose skate eggs or larvae is designated in the review area.

EFH for clearnose skate juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-5; Figure W-1-5). Clearnose skate juvenile EFH is designated in benthic habitats from the shoreline to depths of 984 ft (300 m) during spring and 262 ft (80 m) during fall, where salinities are within 26 to 36 ppt and temperatures range from 39 to 70°F (4 to 21°C) in spring and 45 to 81°F (7 to 27°C) in fall (Packer et al. 2003a). In the Mid-Atlantic Bight, juveniles occur in subtidal benthic marine habitats in coastal and inner continental shelf waters and in the high salinity zones of regional bays and estuaries (NEFMC 2017). They can be found on gravel and hardbottom substrates but prefer mud and sand. Juveniles feed on amphipods, mantis and mysid shrimps, polychaetes, and a variety of small crabs, squids, and fishes (e.g., sole, weakfish, butterfish, scup) (Packer et al. 2003a).

Table W-1-5. Clearnose Skate (*Raja eglanteria*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	45,041	13,797	4,991
Adult	47,848	16,709	4,991
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.005%	0.002%	0.005%
Adult	0.006%	0.003%	0.006%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	93.8%	69.4%	99.7%
Adult	99.6%	84.0%	100.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Packer et al. 2003a			

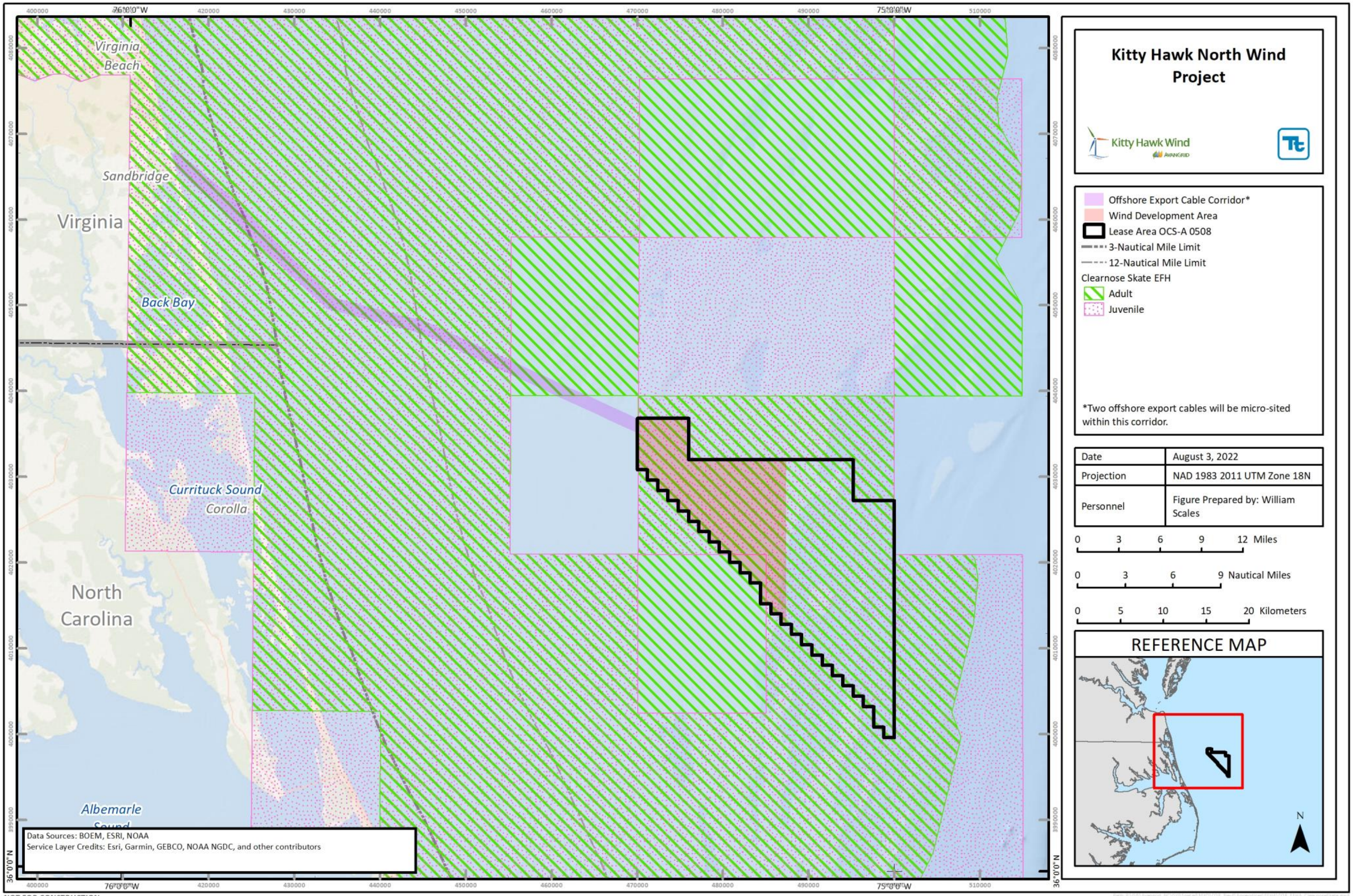


Figure W-1-5. Clearnose Skate (*Raja eglanteria*) Designated EFH in the Review Area

EFH for clearnose skate adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-5; Figure W-1-5). Clearnose skate adult EFH is designated in benthic habitats from shoreline to depths of 984 ft (300 m) during spring and 164 ft (50 m) during fall, where salinities are within 26 to 36 ppt and temperatures range from 39 to 72°F (4 to 22°C) in spring and 50 to 77°F (10 to 25°C) in fall (Packer et al. 2003a). In the Mid-Atlantic Bight, adults occur in subtidal benthic marine habitats in coastal and inner continental shelf waters and in the high salinity zones of regional bays and estuaries (NEFMC 2017). They can be found on gravel and hardbottom substrates but prefer mud and sand and consume the same prey as juveniles.

The NEFMC Northeast Skate Complex FMP manages the clearnose skate as a single stock: the Southern New England/Mid-Atlantic stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

W-1.2.5 Monkfish (*Lophius americanus*)

EFH for monkfish eggs is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-6; Figure W-1-6). Monkfish egg EFH is designated from March to September from the surface to depths of 3,280 ft (1,000 m), where temperatures range from 39 to 64°F (4 to 18°C) (Steimle et al. 1999a; MAFMC 2017; NEFMC 2017). In the Mid-Atlantic Bight, eggs float in buoyant mucoidal egg veils on or near the surface in coastal pelagic marine habitats and on the continental shelf and slope (NEFMC 2017).

Table W-1-6. Monkfish (*Lophius americanus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg/Larva	43,980	16,873	4,975
Juvenile	6,422	0	0
Adult	0	679	4,975
Percent of Review Area Covered by EFH by Life Stage			
Egg/Larva	0.002%	0.001%	0.005%
Juvenile	0.001%	0.000%	0.000%
Adult	0.000%	0.001%	0.007%
Percent of Total Species EFH Area Covered by Review Area			
Egg/Larva	91.6%	84.9%	99.7%
Juvenile	13.4%	0.0%	0.0%
Adult	0.0%	3.4%	99.7%
Sources: NOAA Fisheries 2021a; MAFMC 2017; NEFMC 2017; Steimle et al. 1999a			

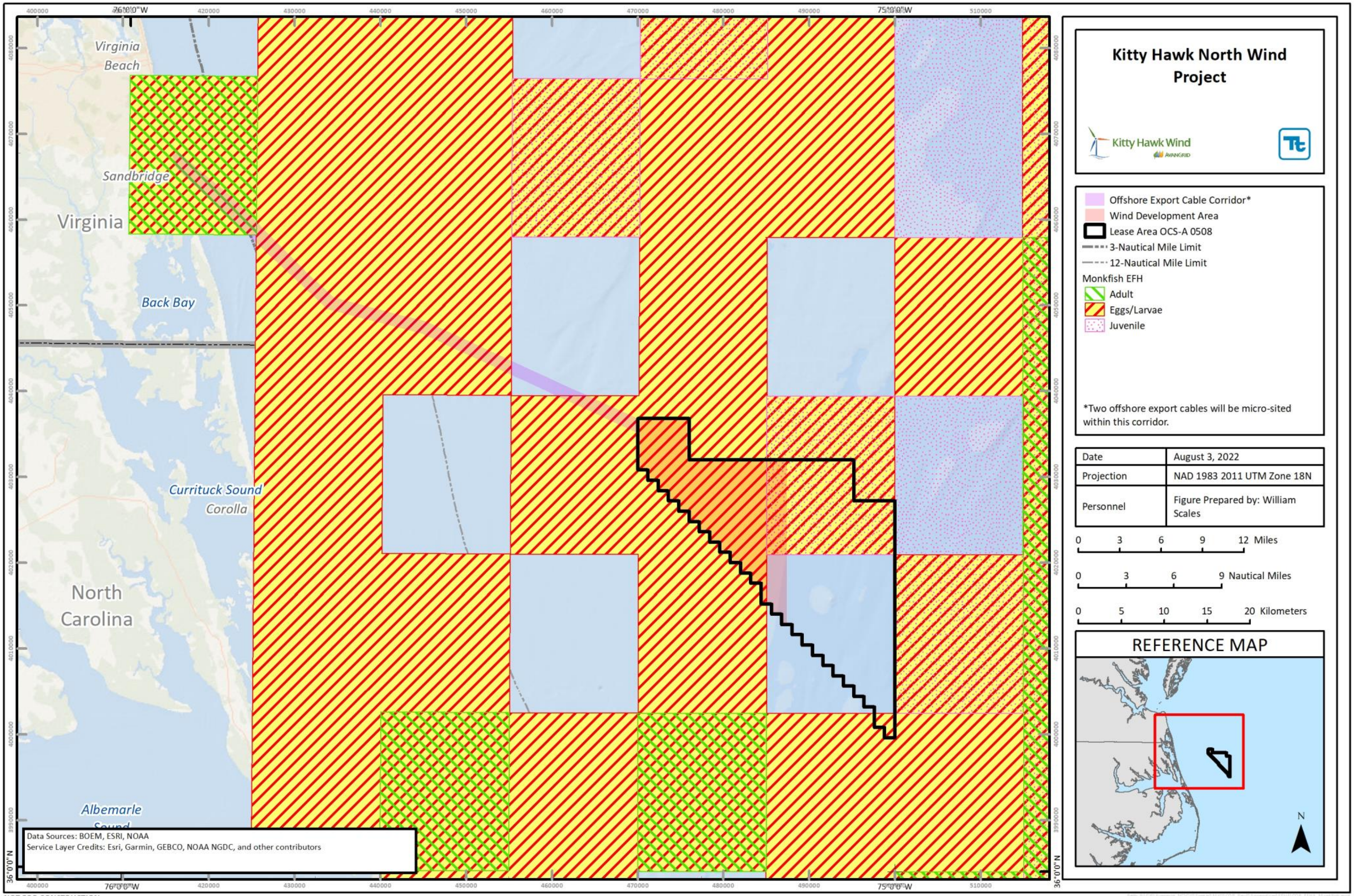


Figure W-1-6. Monkfish (*Lophius americanus*) Designated EFH in the Review Area

EFH for monkfish larvae is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-6;Figure W-1-6). Monkfish larval EFH is designated from March to September from the surface to depths of 3,280 ft (1,000 m), where temperatures range from 43 to 68°F (6 to 20°C) (Steimle et al. 1999a; MAFMC 2017; NEFMC 2017). In the Mid-Atlantic Bight, larvae occur in coastal pelagic marine habitats and on the continental shelf and slope (NEFMC 2017). They feed on a variety of zooplankton, including chaetognaths, copepods, and crustacean larvae (Steimle et al. 1999a).

EFH for monkfish juveniles is designated in the Wind Development Area (Table W-1-6; Figure W-1-6). Monkfish juvenile EFH is designated in benthic habitats in depths of 66 to 1,312 ft (20 to 400 m), where salinities are within 30 to 36 ppt and temperatures range from 36 to 75°F (2 to 24°C). In the Mid-Atlantic Bight, juveniles occur in subtidal benthic marine habitats over soft mud, sand, gravel, pebbles, shell fragments, and structurally complex rock outcroppings with attached macroalgae (NEFMC 2017). They exhibit seasonal inshore-offshore migrations but most commonly reside on the outer continental shelf (Steimle et al. 1999a; NEFMC 2017). Juveniles feed on small fishes (e.g., sand lance), red shrimp, and squid (Steimle et al. 1999a).

EFH for monkfish adults is designated in federal and state waters of the offshore export cable corridor (Table W-1-6; Figure W-1-6). Monkfish adult EFH is designated in benthic habitats from the shoreline to depths of 2,625 ft (800 m), where salinities are within 30 to 36 ppt and temperatures range from 32 to 75°F (0 to 24°C). In the Mid-Atlantic Bight, adults occur in subtidal benthic marine habitats over soft mud, sand, gravel, pebbles, and shell fragments (NEFMC 2017). They prefer softbottom, forage at the edges of structurally complex rock outcroppings, and most commonly reside on the outer continental shelf (NEFMC 2017). Adults are opportunistic feeders and consume benthic and pelagic crustaceans, fishes, and squid (Steimle et al. 1999a).

The NEFMC and MAFMC co-manage monkfish under the Monkfish FMP as two separate stocks: the Gulf of Maine/Northern Georges Bank stock and the Southern Georges Bank/Mid-Atlantic stock. Neither stock is currently overfished or subject to overfishing (NOAA Fisheries 2021b).

W-1.2.6 Pollock (*Pollachius virens*)

No pollock egg, juvenile, or adult EFH is designated in the review area.

EFH for pollock larvae is designated in federal waters of the offshore export cable corridor (Table W-1-7; Figure W-1-7). Pollock larval EFH is designated in depths of 33 to 4,101 ft (10 to 1,250 m), where temperatures range from 36 to 63°F (2 to 17°C) (Cargnelli et al. 1999a). In the Mid-Atlantic Bight, larvae occur in pelagic inshore and offshore marine habitats and in the high salinity zones of regional bays and estuaries (NEFMC 2017). They are dispersed from spawning grounds by currents during their three- to four-month larval stage. Young larvae feed on larval copepods and shift their diets to adult copepods as they age (Cargnelli et al. 1999a). Following passive dispersal, larvae metamorphose into harbor pollock and migrate inshore to rocky subtidal and intertidal zones (Cargnelli et al. 1999a).

The NEFMC Northeast Multispecies FMP manages pollock as a single stock: the Gulf of Maine/Georges Bank stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

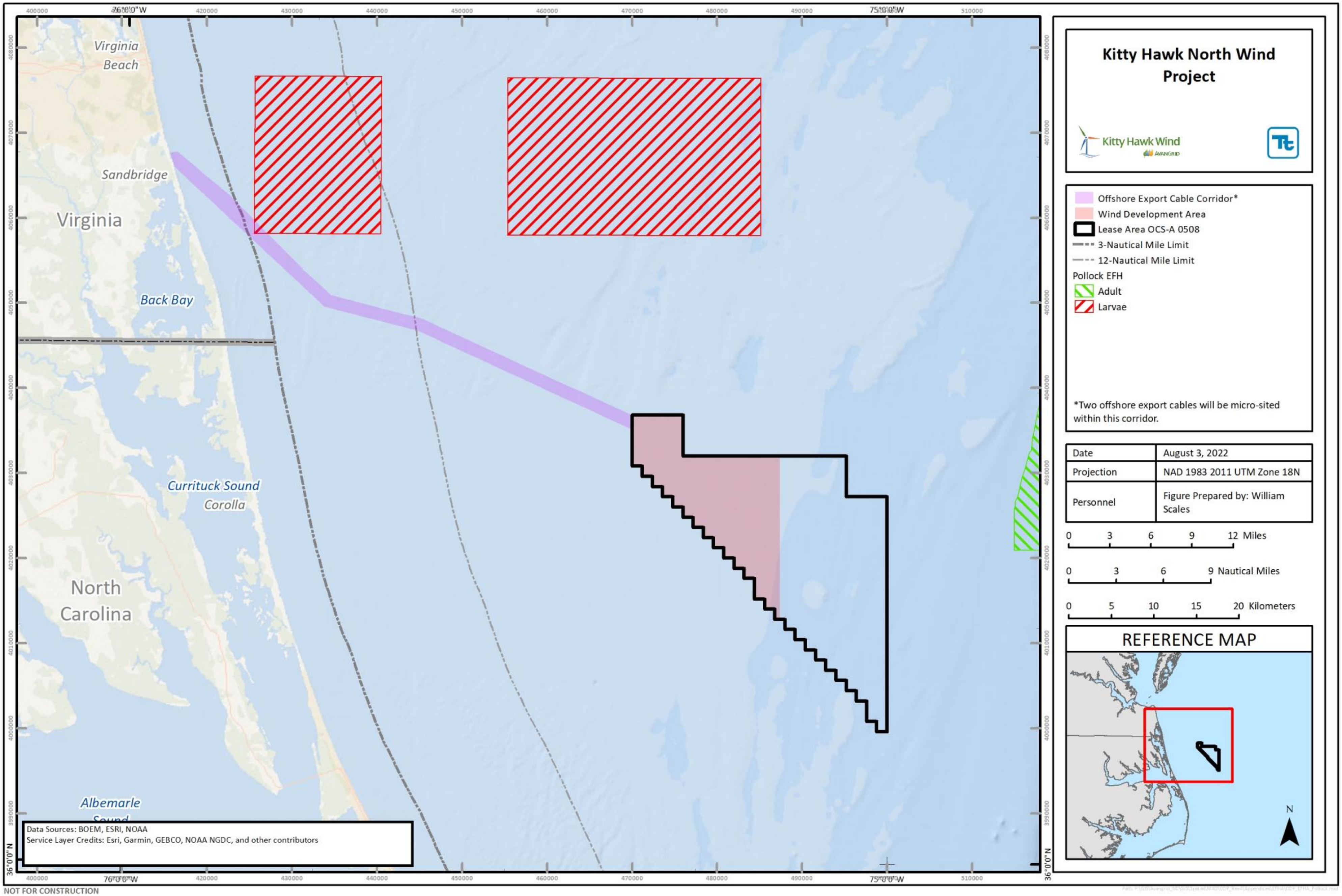


Figure W-1-7. Pollock (*Pollachius virens*) Designated EFH in the Review Area

Table W-1-7. Pollock (*Pollachius virens*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Larva	0	298	0
Percent of Review Area Covered by EFH by Life Stage			
Larva	0.000%	0.000%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Larva	0.0%	1.5%	0.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Cargnelli et al. 1999a			

W-1.2.7 Red Hake (*Urophycis chuss*)

No red hake egg, larval, or juvenile EFH is designated in the review area.

EFH for red hake adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-8; Figure W-1-8). Red hake adult EFH is designated in benthic habitats in depths of 16 to 2,461 ft (5 to 750 m), where salinities exceed 20 ppt and temperatures range from 36 to 72°F (2 to 22°C). In the Mid-Atlantic Bight, adults occur in benthic marine habitats on the outer continental shelf and slope and in the high salinity zones of regional bays and estuaries (NEFMC 2017). Adults exhibit seasonal migrations from inshore waters in spring and fall to offshore waters in summer and winter. They reside in depressions of soft mud and sand, shell beds, and complex reef structures and feed on crustaceans, fishes, and squids (Steimle et al. 1999b; NEFMC 2017).

The NEFMC Northeast Multispecies FMP manages red hake as a single stock: the Southern Georges Bank/Mid-Atlantic stock. The fishery stock is currently overfished and subject to continued overfishing (NOAA Fisheries 2021b).

Table W-1-8. Red Hake (*Urophycis chuss*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Adult	41,133	9,942	0
Percent of Review Area Covered by EFH by Life Stage			
Adult	0.004%	0.001%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Adult	85.6%	50.0%	0.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Steimle et al. 1999b			

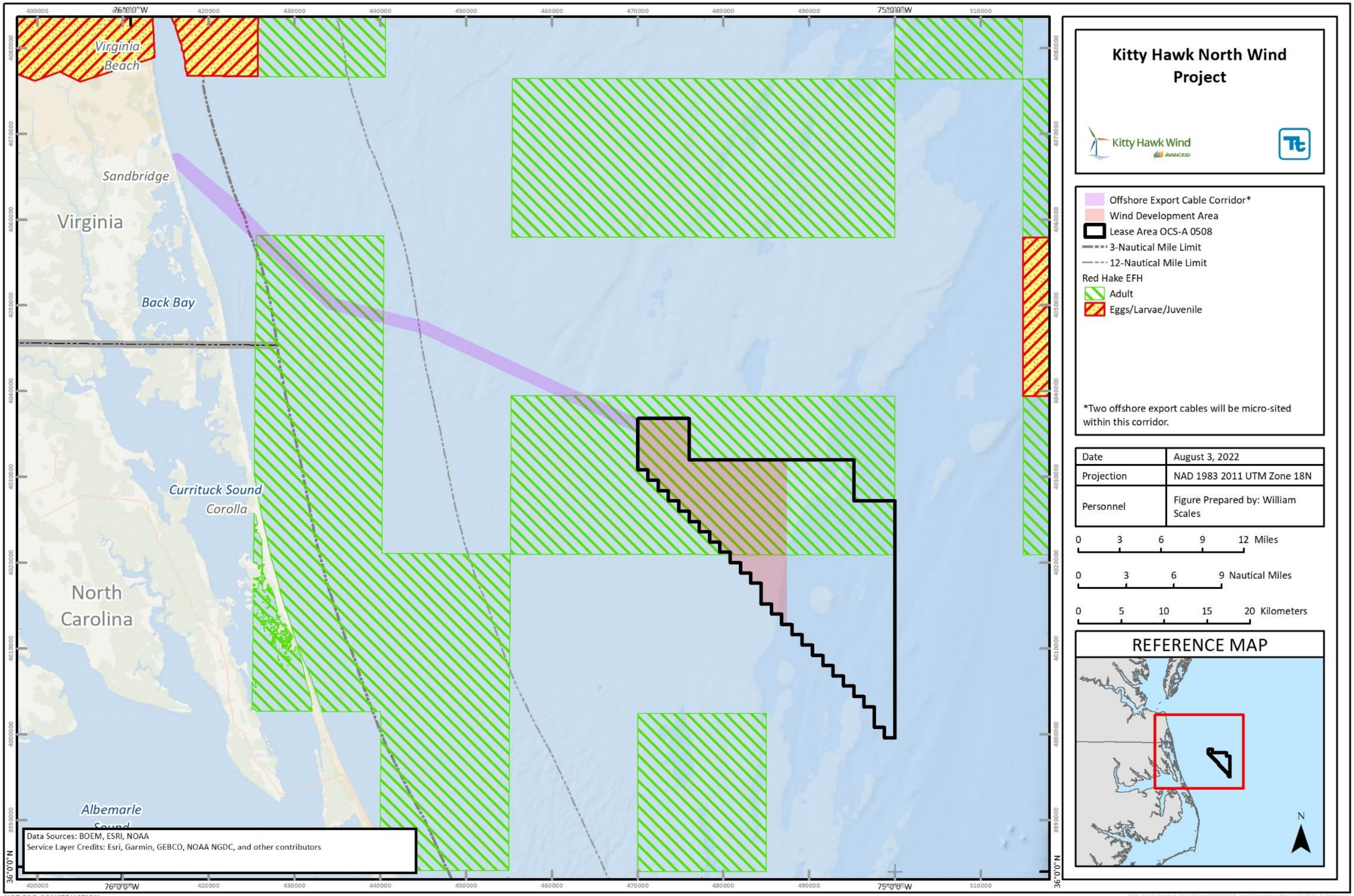


Figure W-1-8. Red Hake (*Urophycis chuss*) Designated EFH in the Review Area

W-1.2.8 Windowpane Flounder (*Scophthalmus aquosus*)

EFH for windowpane flounder eggs is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-9; Figure W-1-9). Windowpane flounder egg EFH is designated in the upper 230 ft (70 m) of the water column, where temperatures range from 43 to 57°F (6 to 14°C) in spring, 50 to 61°F (10 to 16°C) in summer, and 57 to 68°F (14 to 20°C) in fall (Chang et al. 1999). In the Mid-Atlantic Bight, eggs occur in pelagic marine habitats and in the mixed and high salinity zones of regional bays and estuaries (NEFMC 2017).

EFH for windowpane flounder larvae is designated in federal and state waters of the offshore export cable corridor (Table W-1-9; Figure W-1-9). Windowpane flounder larval EFH is designated in the upper 230 ft (70 m) of the water column, where temperatures range from 37 to 57°F (3 to 14°C) in spring, 50 to 63°F (10 to 17°C) in summer, and 55 to 66°F (13 to 19°C) in fall (Chang et al. 1999). In the Mid-Atlantic Bight, larvae occur in pelagic marine habitats and in the mixed and high salinity zones of regional bays and estuaries, where they consume planktonic prey. Once they grow to approximately 0.4 inches (10 millimeters) in length, they descend to the seafloor; spring-spawned larvae settle in estuaries and on the shelf, while autumn-spawned larvae primarily settle on the shelf (Chang et al. 1999).

Table W-1-9. Windowpane Flounder (*Scophthalmus aquosus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg	37,369	13,698	4,975
Larva	0	13,019	0
Juvenile	37,367	16,709	4,991
Adult	44,595	19,106	0
Percent of Review Area Covered by EFH by Life Stage			
Egg	0.006%	0.002%	0.006%
Larva	0.000%	0.007%	0.000%
Juvenile	0.006%	0.001%	0.003%
Adult	0.003%	0.002%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Egg	77.8%	68.9%	99.7%
Larva	0.0%	65.5%	0.0%
Juvenile	77.8%	84.0%	100.0%
Adult	92.8%	96.1%	0.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Chang et al. 1999			

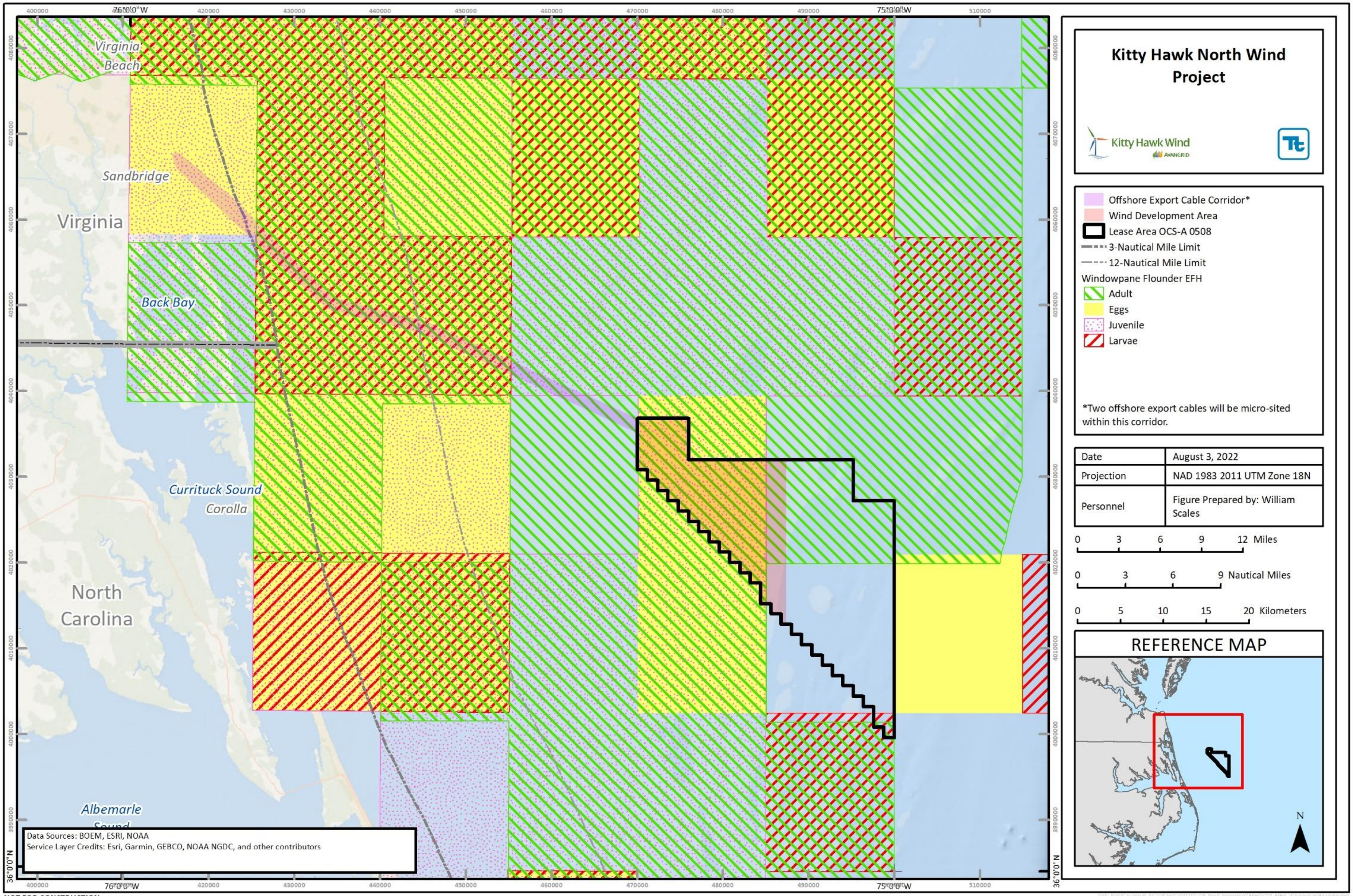


Figure W-1-9. Windowpane flounder (*Scophthalmus aquosus*) Designated EFH in the Review Area

EFH for windowpane flounder juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-9; Figure W-1-9). Windowpane flounder juvenile EFH is designated in benthic habitats of nearshore bays and estuaries from the shoreline to depths of 246 ft (75 m), where salinities are within 15 to 33 ppt and temperatures range from 32 to 75°F (0 to 24°C) (Chang et al. 1999). In the Mid-Atlantic Bight, juveniles occur in intertidal and subtidal benthic habitats in estuarine, coastal marine, and continental shelf waters, including mixed and high salinity zones in regional bays and estuaries (NEFMC 2017). YOY prefer sand substrates and shift to both mud and sand substrates as they age (NEFMC 2017). They feed on small crustaceans (e.g., mysid and decapod shrimps) and fish larvae (e.g., hakes, cod, and other windowpane flounder) (Chang et al. 1999).

EFH for windowpane flounder adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-9; Figure W-1-9). Windowpane flounder adult EFH is designated in benthic habitats in nearshore bays and estuaries from the shoreline to depths of 246 ft (75 m), where salinities are within 15 to 33 ppt and temperatures range from 32 to 75°F (0 to 24°C) (Chang et al. 1999). In the Mid-Atlantic Bight, adults occur in intertidal and subtidal benthic habitats in estuarine, coastal marine, and continental shelf waters, including mixed and high salinity zones in regional bays and estuaries (NEFMC 2017). Adults prefer mud and sand substrates and consume the same prey as juveniles.

The NEFMC Northeast Multispecies FMP manages windowpane flounder as two separate stocks: the Gulf of Maine/Georges Bank stock and the Southern New England/Mid-Atlantic stock. The Southern New England/Mid-Atlantic stock is not overfished but the Gulf of Maine/Georges Bank stock is currently overfished; neither stock is subject to overfishing (NOAA Fisheries 2021b).

W-1.2.9 Winter Skate (*Leucoraja ocellata*)

No winter skate egg or adult EFH is designated in the review area and there is no larval life stage for skates.

EFH for winter skate juveniles is designated in federal waters of the offshore export cable corridor (Table W-1-10; Figure W-1-10). Winter skate juvenile EFH is designated in benthic habitats from the shoreline to 1,217 ft (371 m), where salinities are within 28 to 35 ppt and temperatures range from 30 to 66°F (-1.2 to 19°C) (Packer et al. 2003b). In the Mid-Atlantic Bight, juveniles occur in subtidal benthic marine habitats on the continental shelf and in the high salinity zones of regional bays and estuaries (NEFMC 2017). Juveniles reside in sand and gravel sediment depressions during the day and are more active at night (Packer et al. 2003b; NEFMC 2017). They feed on amphipods, bivalves, decapods, isopods, fishes, and polychaetes (Packer et al. 2003b).

Table W-1-10. Winter Skate (*Leucoraja ocellata*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	0	2,914	0
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.000%	0.001%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	0.0%	14.7%	0.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Packer et al. 2003b			

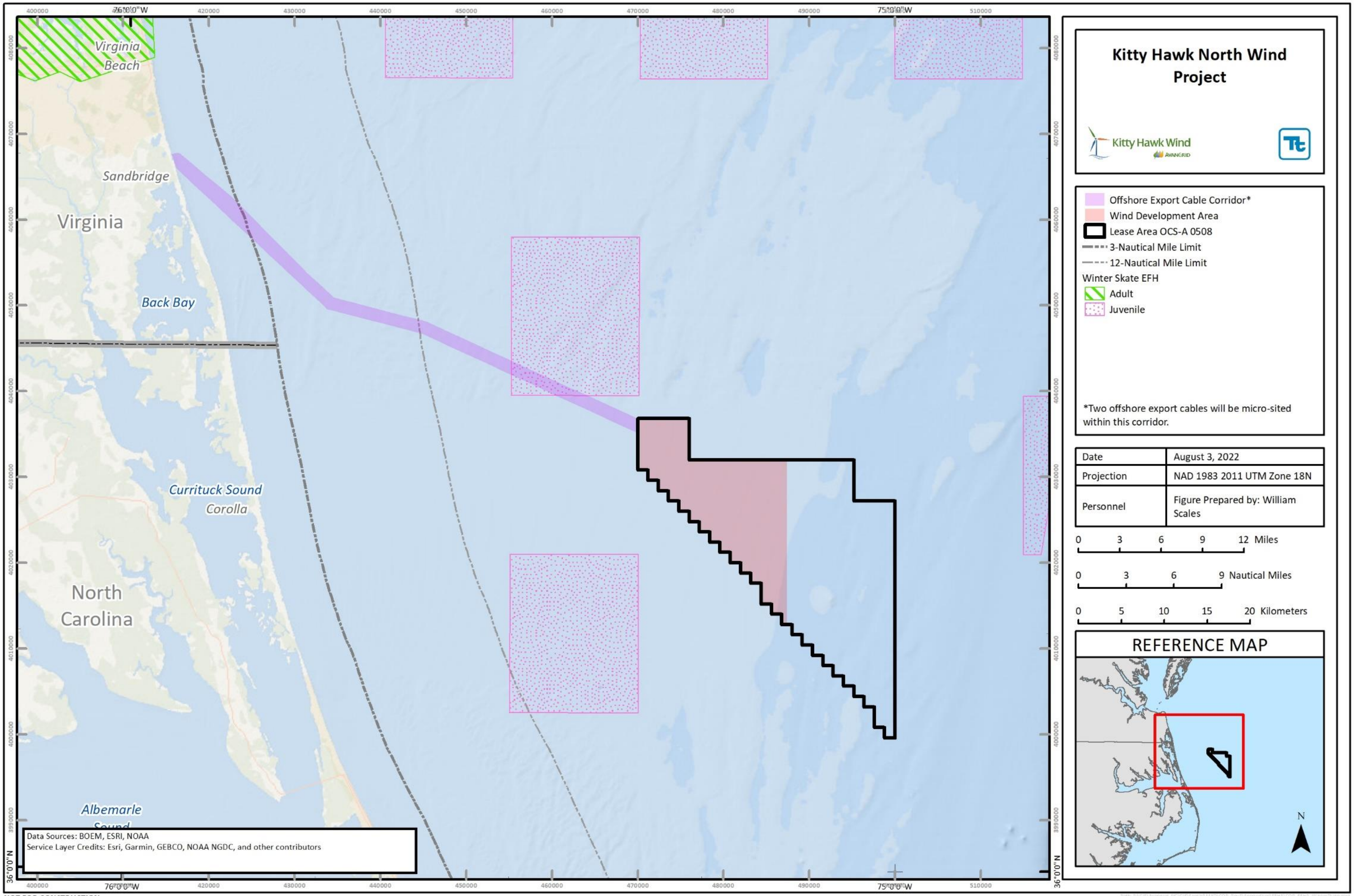


Figure W-1-10. Winter Skate (Leucoraja ocellata) Designated EFH in the Review Area

The NEFMC Northeast Skate Complex manages winter skate as a single stock: the Georges Bank/Southern New England stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

W-1.2.10 Witch Flounder (*Glyptocephalus cynoglossus*)

EFH for witch flounder eggs is designated in federal and state waters of the offshore export cable corridor (Table W-1-11; Figure W-1-11). Witch flounder egg EFH is designated from March to October in depths of 33 to 558 ft (10 to 170 m), where salinities are high and temperatures range from 39 to 63°F (4 to 17°C) (Cargnelli et al. 1999b). In the Mid-Atlantic Bight, eggs occur in pelagic marine habitats on the continental shelf. They are primarily found near the surface above deep waters but have been found at depths of 16,404 ft (5,000 m) (NEFMC 2017).

EFH for witch flounder larvae is designated in the Wind Development Area and in federal and state waters of the offshore export cable corridor (Table W-1-11; Figure W-1-11). Witch flounder larval EFH is designated in the upper 820 ft (250 m) of the water column, where salinities are high and temperatures range from 39 to 61°F (4 to 16°C) (Cargnelli et al. 1999b). In the Mid-Atlantic Bight, larvae occur in pelagic marine habitats on the continental shelf, where they feed on planktonic prey (NEFMC 2017). Larvae undergo extended planktonic stages from four months to up to one year, during which time young larvae are found near the surface and gradually sink to lower depths as they age (Cargnelli et al. 1999b)

No witch flounder juvenile or adult EFH is designated in the review area.

The NEFMC Northeast Multispecies FMP manages witch flounder as a single stock: the Northwestern Atlantic Coast stock. The fishery stock is currently overfished and it is unknown whether the stock is subject to continued overfishing (NOAA Fisheries 2021b).

Table W-1-11. Witch Flounder (*Glyptocephalus cynoglossus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg	0	6,941	4,975
Larva	34,561	6,756	0
Percent of Review Area Covered by EFH by Life Stage			
Egg	0.000%	0.005%	0.012%
Larva	0.014%	0.002%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Egg	0.0%	34.9%	99.7%
Larva	71.9%	34.0%	0.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Cargnelli et al. 1999b			

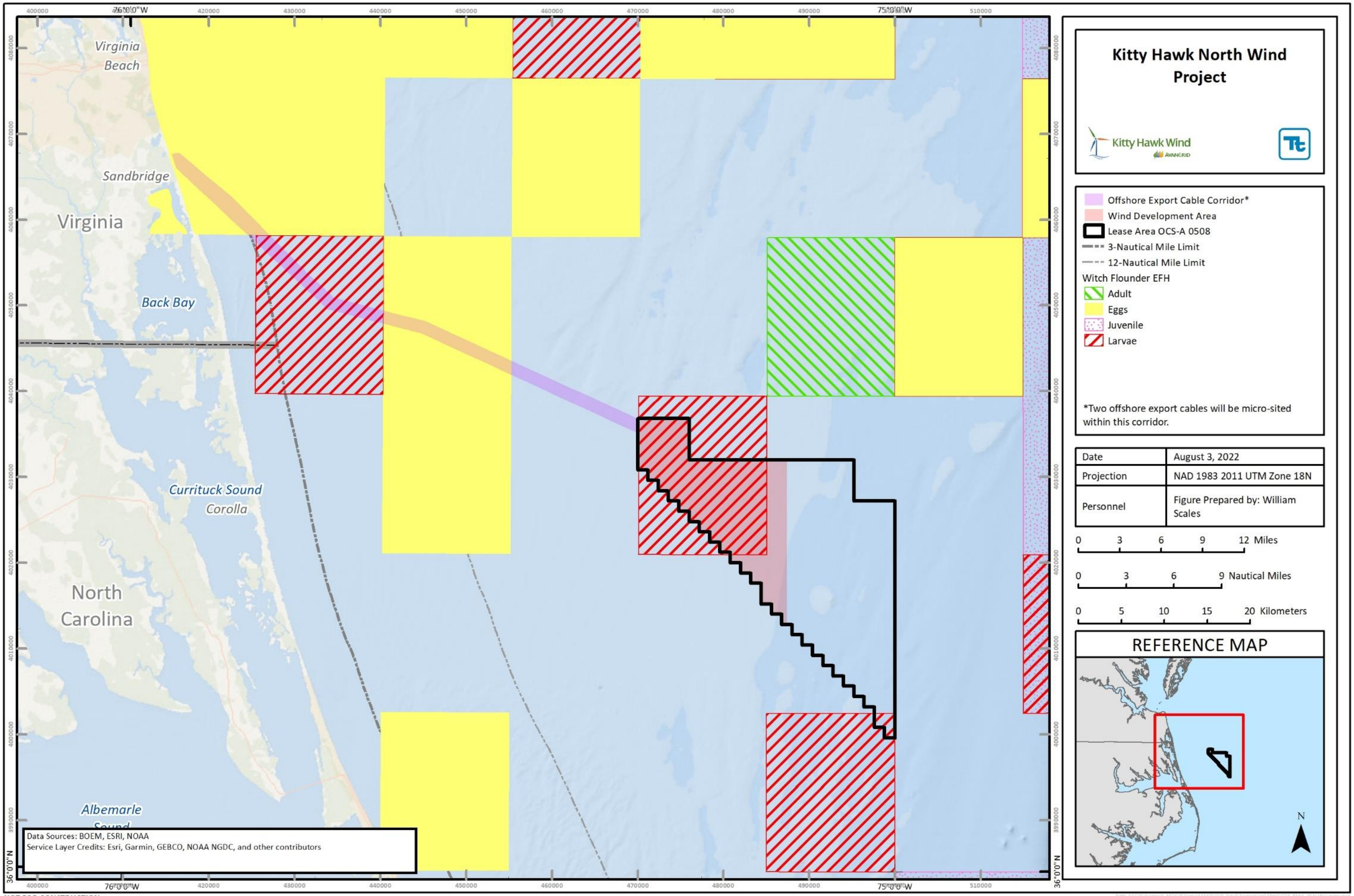


Figure W-1-11. Witch Flounder (*Glyptocephalus cynoglossus*) Designated EFH in the Review Area

W-1.2.11 Yellowtail Flounder (*Limanda ferruginea*)

No yellowtail flounder egg, juvenile, or adult EFH is designated in the review area.

EFH for yellowtail flounder larval EFH is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-12; Figure W-1-12). Yellowtail flounder larval EFH is designated in depths of 33 to 2,460 ft (10 to 1,250 m), where salinities are within 32 to 34 ppt and temperatures range from 41 to 63°F (5 to 17°C) (Johnson et al. 1999). In the Mid-Atlantic Bight, larvae are found in coastal and continental shelf pelagic marine habitats and in the high salinity zones of regional bays and estuaries, where they feed on planktonic prey (NEFMC 2017). Larvae undergo diel migrations with vertical abundance peaks at approximately 33 ft (10 m) at night and 66 ft (20 m) during the day (Johnson et al. 1999). They are planktonic until they grow to approximately 0.5 to 0.7 inches (12 to 16 millimeters) in length, at which point they descend to the seafloor and metamorphose into juveniles (Johnson et al. 1999).

The NEFMC Northeast Multispecies FMP manages yellowtail flounder as two separate stocks: the Cape Cod/Gulf of Maine stock and the Southern New England/Mid-Atlantic stock. The Southern New England/Mid-Atlantic stock is overfished and the Cape Cod/Gulf of Maine stock is rebuilding; neither stock is subject to overfishing (NOAA Fisheries 2021b).

Table W-1-12. Yellowtail Flounder (*Limanda ferruginea*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Larva	34,561	6,756	0
Percent of Review Area Covered by EFH by Life Stage			
Larva	0.012%	0.002%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Larva	71.9%	34.0%	0.0%
Sources: NOAA Fisheries 2021a; NEFMC 2017; Johnson et al. 1999			

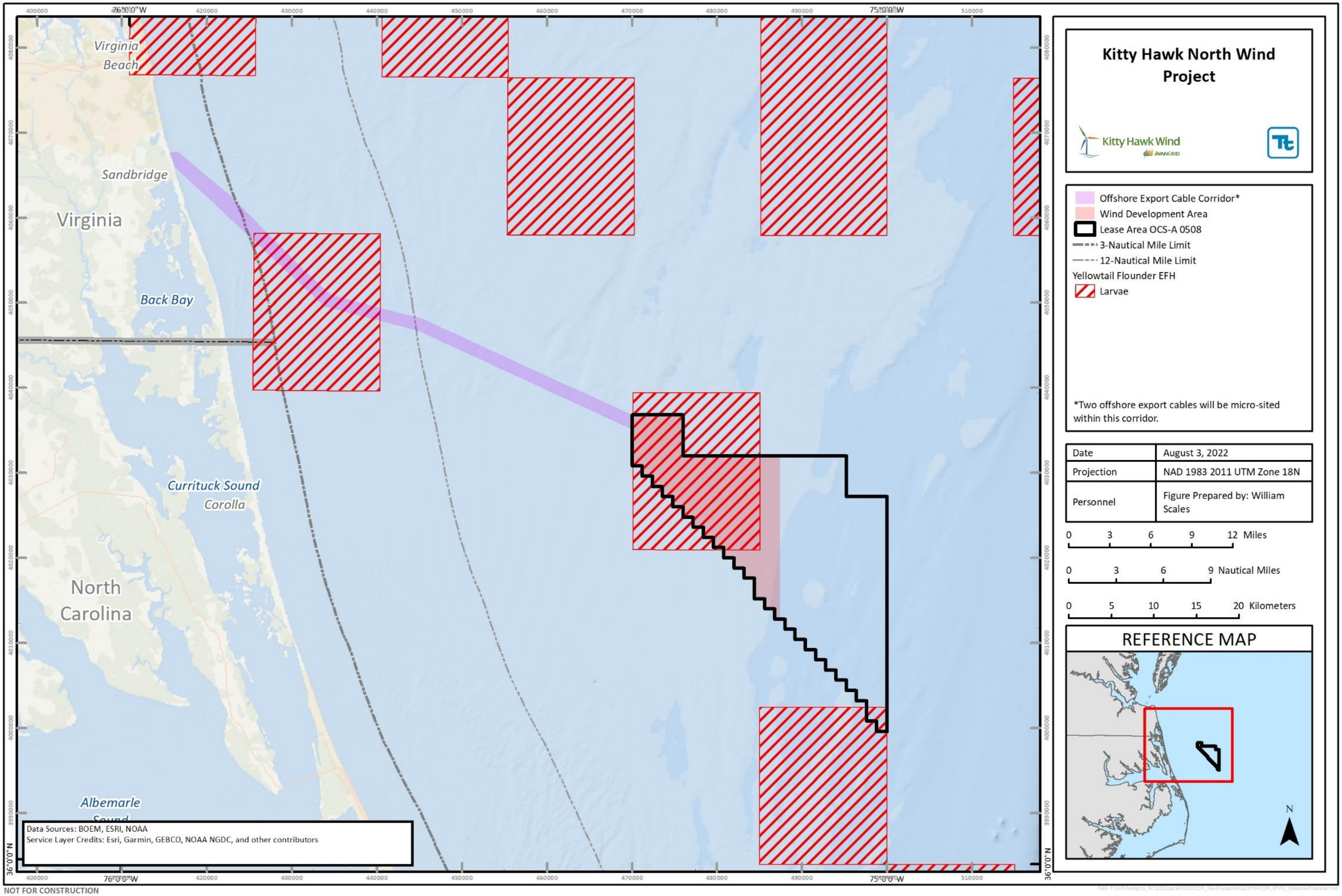


Figure W-1-12. Yellowtail Flounder (*Limanda ferruginea*) Designated EFH in the Review Area

W-1.2.12 Atlantic Butterfish (*Peprilus triacanthus*)

EFH for Atlantic butterfish eggs is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-13; Figure W-1-13). Atlantic butterfish egg EFH is designated in the upper 656 ft (200 m) of the water column over maximum depths of 4,921 ft (1,500 m), where salinities are within 25 to 33 ppt and temperatures range from 43 to 79°F (6 to 26°C) (Cross et al. 1999; MAFMC 2011). In the Mid-Atlantic Bight, eggs occur in pelagic marine habitats on the continental shelf and slope and in the high salinity zones of regional bays and estuaries (MAFMC 2011).

EFH for Atlantic butterfish larvae is designated in the Wind Development Area and federal waters of the offshore export cable corridor (Table W-1-13; Figure W-1-13). Atlantic butterfish larval EFH is designated in the upper 656 ft (200 m) of the water column over maximum depths of 5,741 ft (1,750 m), where salinities are within 6 to 38 ppt and temperatures range from 45 to 79°F (7 to 26°C) (Cross et al. 1999; MAFMC 2011). In the Mid-Atlantic Bight, larvae occur in pelagic marine habitats on the continental shelf and in the high salinity zones of regional bays and estuaries (MAFMC 2011). Larvae undergo diel vertical migrations in response to light and in pursuit of planktonic prey (MAFMC 2011).

Table W-1-13. Atlantic Butterfish (*Peprilus triacanthus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg	4,058	15,632	0
Larva	38,618	2,910	0
Juvenile	48,039	19,884	4,896
Adult	10,670	11,008	4,986
Percent of Review Area Covered by EFH by Life Stage			
Egg	0.007%	0.006%	0.000%
Larva	0.028%	0.004%	0.000%
Juvenile	0.006%	0.001%	0.002%
Adult	0.002%	0.001%	0.002%
Percent of Total Species EFH Area Covered by Review Area			
Egg	8.4%	78.6%	0.0%
Larva	80.4%	14.6%	0.0%
Juvenile	100.0%	100.0%	99.9%
Adult	22.2%	55.4%	99.9%
Sources: NOAA Fisheries 2021; MAFMC 2011; Cross et al. 1999			

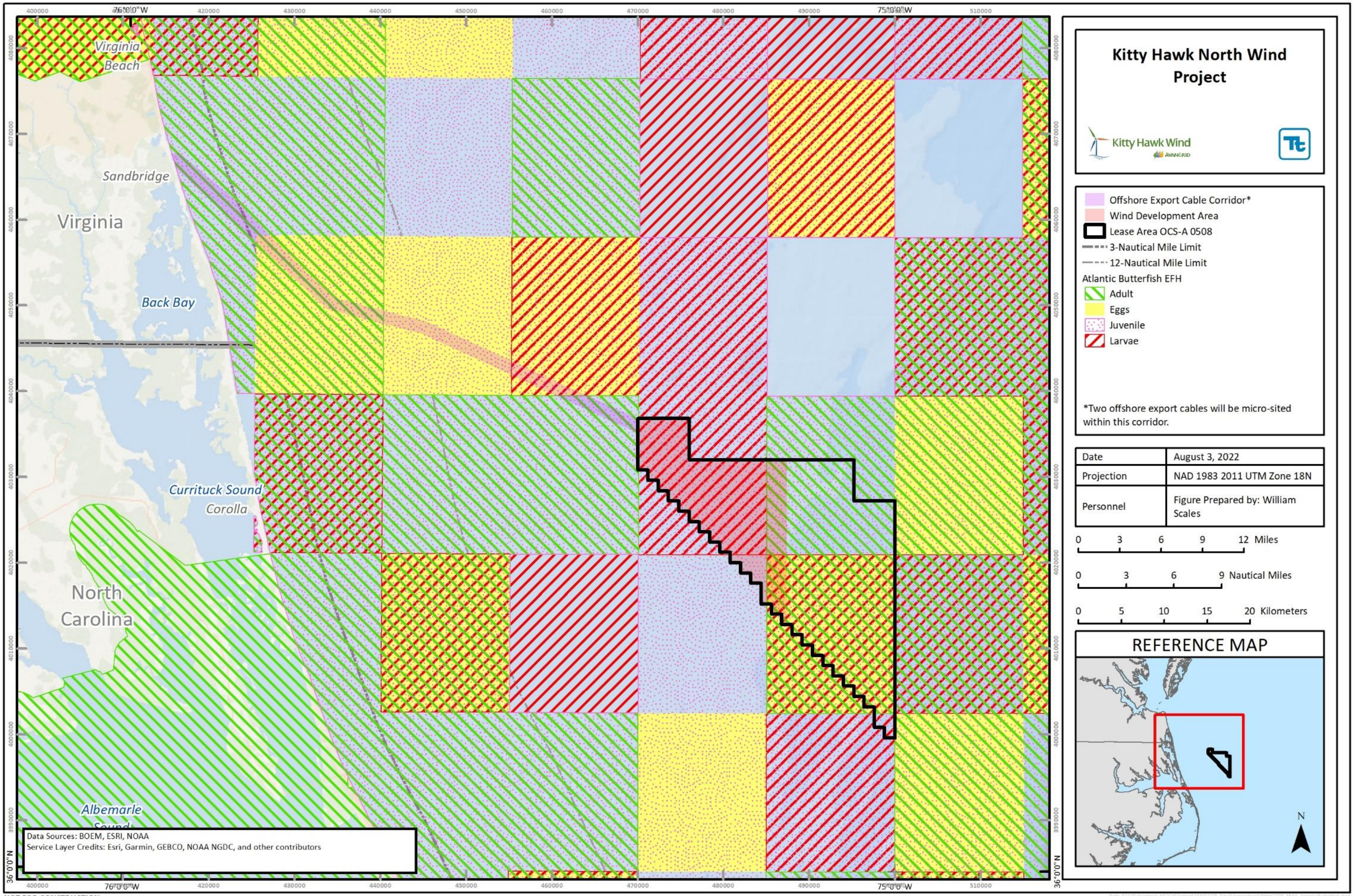


Figure W-1-13. Atlantic Butterfish (*Peprilus triacanthus*) Designated EFH in the Review Area

EFH for Atlantic butterfish juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-13; Figure W-1-13). Atlantic butterfish juvenile EFH is designated in depths of 33 to 1,083 ft (10 to 330 m), where salinities are within 3 to 37 ppt and temperatures range from 45 to 86°F (7 to 30°C) (Cross et al. 1999; MAFMC 2011). In the Mid-Atlantic Bight, they occur in pelagic marine habitats in the inner and outer continental shelf over mud and sand substrates and in the high salinity zones of regional bays and estuaries (MAFMC 2011). They tolerate a wide range of temperatures and salinities, and can be found in inshore areas, including the surf zone. Juveniles feed on small fishes, coelenterates, crustaceans, ctenophores, mollusks, and polychaetes (Cross et al. 1999).

EFH for Atlantic butterfish adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-13; Figure W-1-13). Atlantic butterfish adult EFH is designated from surface waters to depths of 1,378 ft (420 m), where salinities are within 4 to 33 ppt and temperatures range from 41 to 82°F (5 to 28°C) (Cross et al. 1999; MAFMC 2011). In the Mid-Atlantic Bight, adults occur in pelagic marine habitats on the inner and outer continental shelf and in the high salinity zones of regional bays and estuaries (MAFMC 2011). Adults are eurythermal and euryhaline and consume the same prey as juveniles.

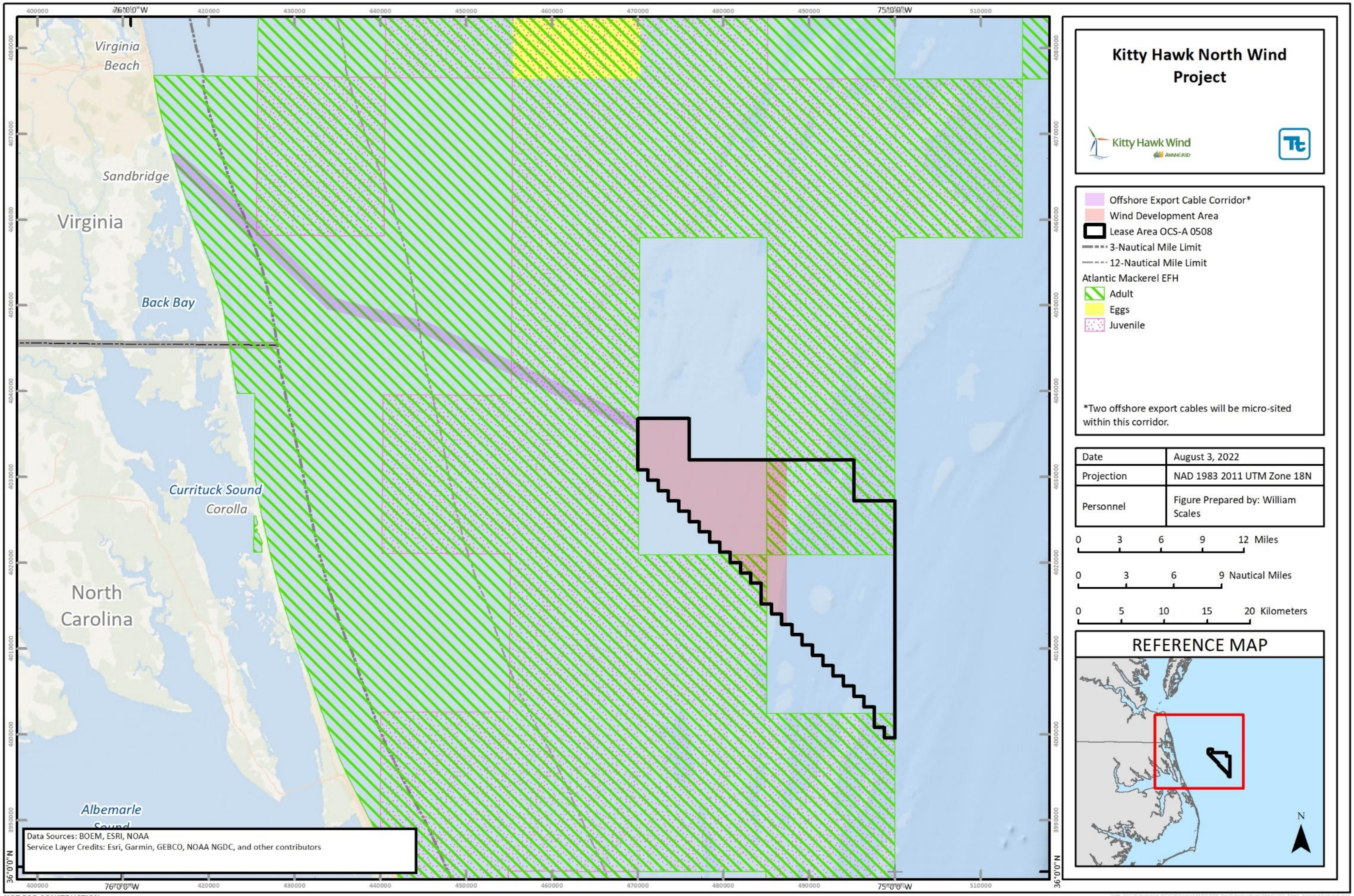
The MAFMC Atlantic Mackerel, Squid, and Butterfish FMP manages Atlantic butterfish as a single stock: the Gulf of Maine/Cape Hatteras stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

W-1.2.13 Atlantic Mackerel (*Scomber scombrus*)

No Atlantic mackerel egg or larval EFH is designated in the review area. EFH for Atlantic mackerel juveniles is designated in the Wind Development area and federal waters of the offshore export cable corridor (Table W-1-14; Figure W-1-14). Atlantic mackerel juvenile EFH is designated from surface waters to depths of 1,050 ft (320 m), where salinities exceed 225 ppt and temperatures range from 39 to 72°F (4 to 22°C) (Studholme et al. 1999). In the Mid-Atlantic Bight, juveniles occur in pelagic marine habitats on the continental shelf and in the high salinity zones of regional estuaries and bays (MAFMC 2011). They exhibit seasonal variations in depth, occurring in depths of 66 to 131 ft (20 to 40 m) in fall, 164 to 230 ft (50 to 70 m) in winter, 98 to 295 ft (30 to 90 m) in spring, and 66 to 164 ft (20 to 50 m) in summer (Studholme et al. 1999). Juveniles are opportunistic feeders that consume amphipods, copepods, decapod larvae, and mysid shrimp.

Table W-1-14. Atlantic Mackerel (*Scomber scombrus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	9,421	6,384	0
Adult	9,421	19,884	4,986
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.002%	0.003%	0.000%
Adult	0.002%	0.002%	0.002%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	19.6%	32.1%	0.0%
Adult	19.6%	100.0%	99.9%
Sources: NOAA Fisheries 2021a; MAFMC 2011; Studholme et al. 1999			



NOT FOR CONSTRUCTION

Figure W-1-14. Atlantic Mackerel (*Scomber scombrus*) Designated EFH in the Review Area

EFH for Atlantic mackerel adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-14; Figure W-1-14). Atlantic mackerel adult EFH is designated from surface waters to depths of 1,247 ft (380 m), where salinities exceed 25 ppt and temperatures range from 41 to 61°F (5 to 16°C) (Studholme et al. 1999). In the Mid-Atlantic Bight, adults occur in pelagic marine habitats on the continental shelf and in the high salinity zones of regional bays and estuaries (MAFMC 2011). Adults exhibit seasonal variations in depth, occurring in depths of 197 to 262 ft (60 to 80 m) in fall, 66 to 98 ft (20 to 30 m) in winter, 197 to 558 ft (60 to 170 m) in spring, and 164 to 230 ft (50 to 70 m) in winter (Studholme et al. 1999). Larger adults are found at greater depths than smaller adults; distributions may be correlated with prey availability, downwelling events, and onshore advection of warm surface water (Studholme et al. 1999). Adults consume the same general prey as juveniles but consume a wider assortment of organisms and larger prey items.

The MAFMC Atlantic Mackerel, Squid, and Butterfish FMP manages Atlantic mackerel as a single stock: the Gulf of Maine/Cape Hatteras stock. The fishery stock is currently overfished and subject to continued overfishing (NOAA Fisheries 2021b).

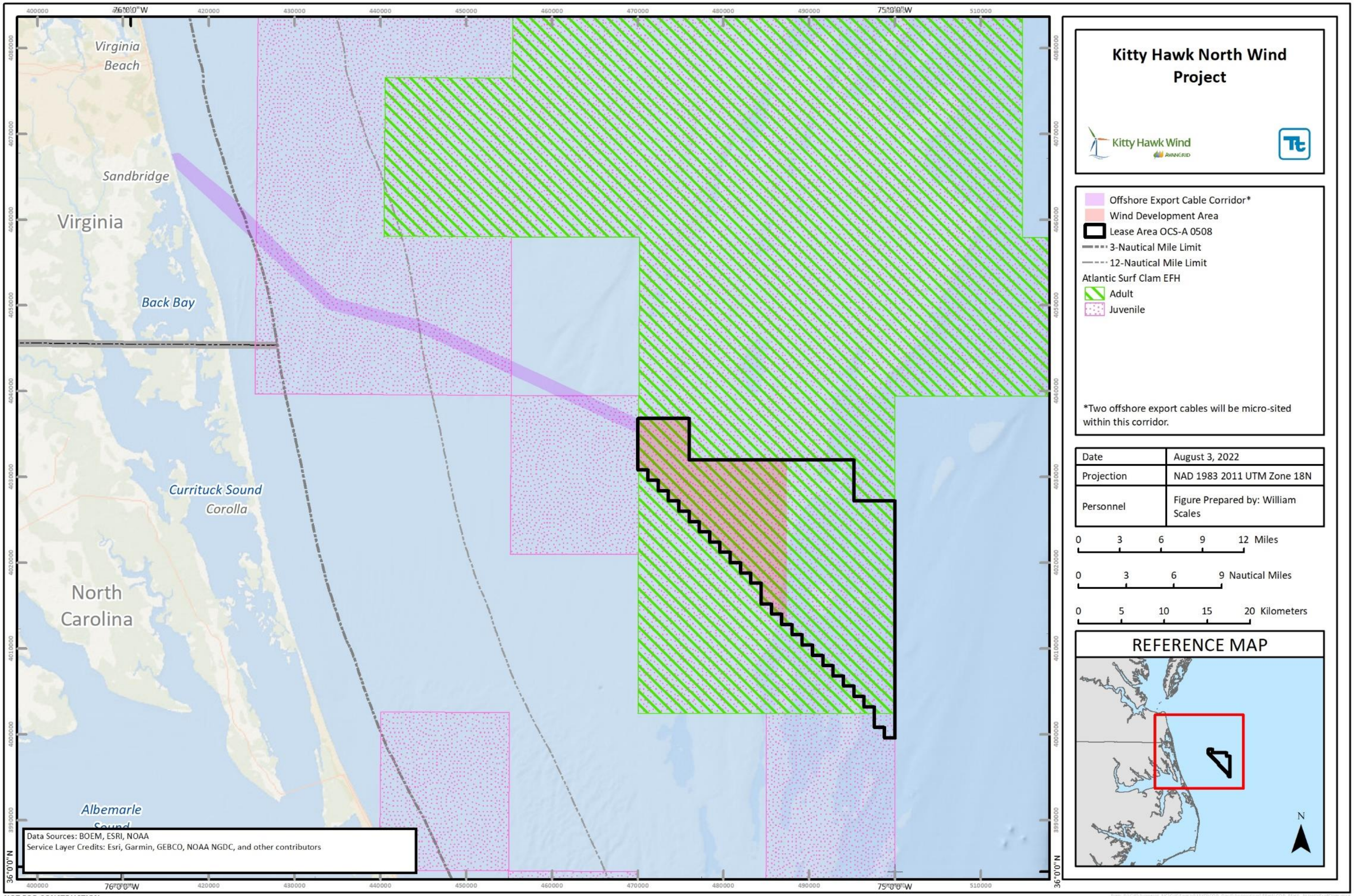
W-1.2.14 Atlantic Surfclam (*Spisula solidissima*)

No Atlantic surfclam egg or larval EFH is designated in the review area.

EFH for Atlantic surfclam juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-15; Figure W-1-15). Atlantic surfclam juvenile EFH is designated in benthic habitats in depths of 26 to 217 ft (8 to 66 m), where salinities exceed 14 ppt and temperatures range from 36 to 86°F (2 to 30°C) (Cargnelli et al. 1999c). In the Mid-Atlantic Bight, juveniles occur in benthic marine habitats within unconsolidated substrates to depths of approximately 3 ft (1 m) below the sediment/water interface (MAFMC 2017). Juveniles are siphon feeders that feed on planktivorous ciliates and diatoms (Cargnelli et al. 1999c).

Table W-1-15. Atlantic Surfclam (*Spisula solidissima*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	48,039	16,195	0
Adult	47,848	0	0
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.014%	0.006%	0.000%
Adult	0.020%	0.000%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	100.0%	81.4%	0.0%
Adult	99.6%	0.0%	0.0%
Sources: NOAA Fisheries 2021a; MAFMC 2017; Cargnelli et al. 1999c			



NOT FOR CONSTRUCTION

Figure W-1-15. Atlantic Surfclam (*Spisula solidissima*) Designated EFH in the Review Area

EFH for Atlantic surfclam adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-15; Figure W-1-15). Atlantic surfclam adult EFH is designated in benthic habitats in depths of 26 to 217 ft (8 to 66 m), where salinities exceed 14 ppt and temperatures range from 36 to 86°F (2 to 30°C) (Cargnelli et al. 1999c). In the Mid-Atlantic Bight, adults occur in benthic marine habitats within unconsolidated substrates to depths of approximately 3 ft (1 m) below the sediment/water interface (MAFMC 2017). Adults are siphon feeders and consume the same prey as juveniles.

The MAFMC Atlantic Surfclam and Ocean Quahog FMP manages Atlantic surfclam as a single stock: the Mid-Atlantic Coast stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

W-1.2.15 Black Sea Bass (*Centropristis striata*)

No black sea bass egg EFH is designated in the review area.

EFH for black sea bass larvae is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-16; Figure W-1-16). Black sea bass larval EFH is designated in the upper 328 ft (100 m) of the water column over maximum depths of 6,562 ft (2,000 m), where salinities are within 30 to 35 ppt and temperatures range from 52 to 79°F (11 to 26°C) (Steimle et al. 1999c; Drohan et al. 2007; MAFMC 2017). In the Mid-Atlantic Bight, larvae occur in pelagic marine habitat over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998a). Larvae primarily feed on decapods and migrate to nearshore habitats as they age to metamorphose into juveniles (Drohan et al. 2007).

Table W-1-16. Black Sea Bass (*Centropristis striata*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Larva	41,427	15,929	0
Juvenile	48,039	19,884	4,991
Adult	48,039	19,785	4,975
Percent of Review Area Covered by EFH by Life Stage			
Larva	0.040%	0.014%	0.000%
Juvenile	0.008%	0.002%	0.002%
Adult	0.009%	0.003%	0.009%
Percent of Total Species EFH Area Covered by Review Area			
Larva	86.2%	80.1%	0.0%
Juvenile	100.0%	100.0%	100.0%
Adult	100.0%	99.5%	99.7%
Sources: NOAA Fisheries 2021a; MAFMC 2017; Drohan et al. 2007; Steimle et al. 1999c; MAFMC 1998a			

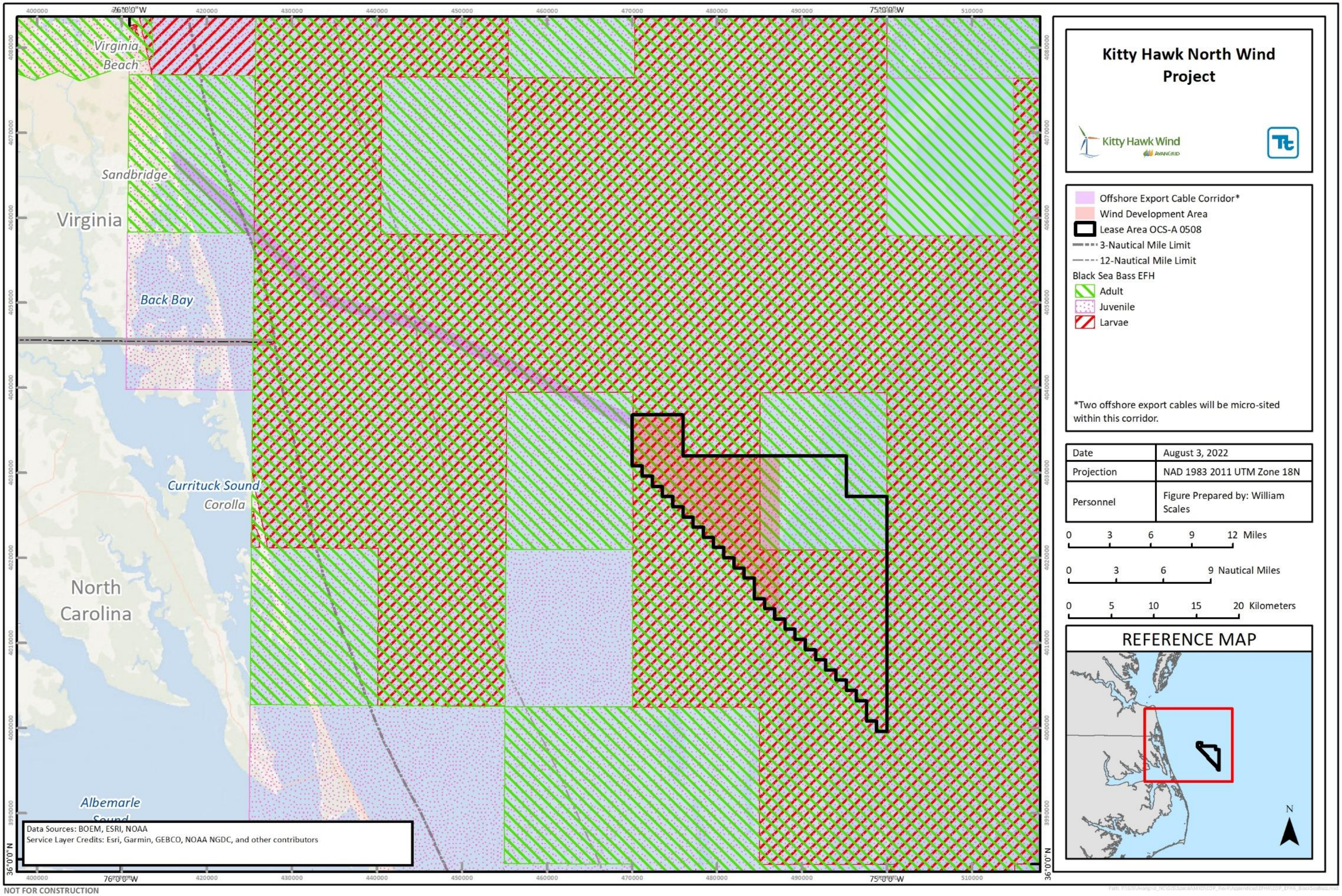


Figure W-1-16. Black Sea Bass (*Centropristis striata*) Designated EFH in the Review Area

EFH for black sea bass juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-16; Figure W-1-16). Black sea bass juvenile EFH is designated from the shoreline to depths of 1,312 ft (400 m), where salinities are within 18 to 36 ppt and temperatures range from 43 to 79°F (6 to 26°C) (MAFMC 1998a; Steimle et al. 1999c; Drohan et al. 2007; MAFMC 2017). In the Mid-Atlantic Bight, juveniles occur in benthic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998a). Juveniles summer in estuaries, spring and overwinter in deeper waters offshore, and exhibit high site fidelity for structural landmarks. They are found over structurally complex substrates, sandy substrates with shell hash, shellfish and eelgrass beds, offshore clam beds, and artificial reefs, where they feed on amphipods, copepods, isopods, sand and mysid shrimps, small crabs, and other benthic crustaceans (MAFMC 1998a; Drohan et al. 2007; MAFMC 2017).

EFH for black sea bass adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-16; Figure W-1-16). Black sea bass adult EFH is designated in depths of 66 to 1,312 ft (20 to 400 m), where salinities are within 30 to 36 ppt and temperatures range from 43 to 81°F (6 to 27°C) (MAFMC 1998a; Drohan et al. 2007; MAFMC 2017). In the Mid-Atlantic Bight, adults occur in benthic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998a). Adults summer in estuaries and coastal waters, overwinter in deeper waters offshore, and exhibit high site fidelity for structural landmarks. They are found over structurally complex substrates, sandy substrates with shell hash, and artificial reefs, where they feed on infaunal and epibenthic crustaceans, small fishes, and squid (Drohan et al. 2007).

The MAFMC Summer Flounder, Scup, and Black Sea Bass FMP manages black sea bass as a single stock: the Mid-Atlantic Coast stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

W-1.2.16 Bluefish (*Pomatomus saltatrix*)

EFH for bluefish eggs is designated in the Wind Development Area and federal waters of the offshore export cable corridor (Table W-1-17; Figure W-1-17). Bluefish egg EFH is designated from spring through fall in depths of 98 to 230 ft (30 to 70 m), where salinities exceed 26 ppt and temperatures range from 64 to 72°F (18 to 22°C) (Fahay et al. 1999b; Shepherd and Packer 2006). In the Mid-Atlantic Bight, eggs occur in pelagic marine habitats over the continental shelf (MAFMC 1998b). At least three separate cohorts of spawning bluefish contribute to the prolonged bluefish spawning season; eggs are dispersed south and offshore from spawning areas by surface currents (Shephard and Packer 2006).

EFH for bluefish larvae is designated in the Wind Development Area and federal waters of the offshore export cable corridor (Table W-1-17; Figure W-1-17). Bluefish larval EFH is designated from May to September in depths of 98 to 230 ft (30 to 70 m), where salinities are within 30 to 35 ppt and temperatures range from 64 to 79°F (18 to 26°C) (Fahay et al. 1999b; Shepherd and Packer 2006). In the Mid-Atlantic Bight, larvae occur in pelagic marine habitats over the continental shelf, where they primarily consume copepods (MAFMC 1998b; Shepherd and Packer 2006). Individuals from the spring cohort associate strongly with surface waters, while those from the summer cohort exhibit diel vertical migrations from surface waters to depths of 13 ft (4 m) in response to light and in pursuit of planktonic prey.

EFH for juvenile bluefish is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-17; Figure W-1-17). Bluefish juvenile EFH is designated from surface waters to mid-shelf depths, where salinities are within 23 to 36 ppt and temperatures range from 59 to 86°F (15 to 30°C) (Fahay et al. 1999b; Shepherd and Packer 2006; MAFMC 2017). In the Mid-Atlantic Bight, juveniles occur in pelagic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998b). They move inshore as they age and enter estuarine nurseries; individuals from the summer cohort exhibit diel horizontal distributions from the shoreline during the day to open bay or channel waters at night (Fahay et al. 1999b; Shepherd and Packer 2006). Juveniles are opportunistic feeders that consume locally abundant taxa, including crustaceans, fishes, and polychaetes (Shepherd and Packer 2006).

EFH for adult bluefish is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-17; Figure W-1-17). Bluefish adult EFH is designated from surface waters to mid-shelf depths, where salinities are within 32 to 33 ppt and temperatures range from 57 to 86°F (14 to 30°C) (Fahay et al. 1999b; Shepherd and Packer 2006; MAFMC 2017). In the Mid-Atlantic Bight, adults occur in pelagic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998b). Adults migrate in schools and their distributions vary seasonally and according to the sizes of the individuals comprising the schools (Shepherd and Packer 2006). They are opportunistic feeders that consume locally abundant taxa, including crustaceans, fishes, and polychaetes (Shepherd and Packer 2006).

Table W-1-17. Bluefish (*Pomatomus saltatrix*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg	34,560	5,965	0
Larva	38,618	5,965	0
Juvenile	41,172	16,874	4,975
Adult	193	16,974	4,991
Percent of Review Area Covered by EFH by Life Stage			
Egg	0.019%	0.004%	0.000%
Larva	0.006%	0.001%	0.000%
Juvenile	0.004%	0.001%	0.002%
Adult	0.000%	0.000%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Egg	71.9%	30.0%	0.0%
Larva	80.4%	30.0%	0.0%
Juvenile	85.7%	84.9%	99.7%
Adult	0.4%	85.4%	100.0%
Sources: NOAA Fisheries 2021a; MAFMC 2017; Shepherd and Packer 2006; Fahay et al. 1999b; MAFMC 1998b			

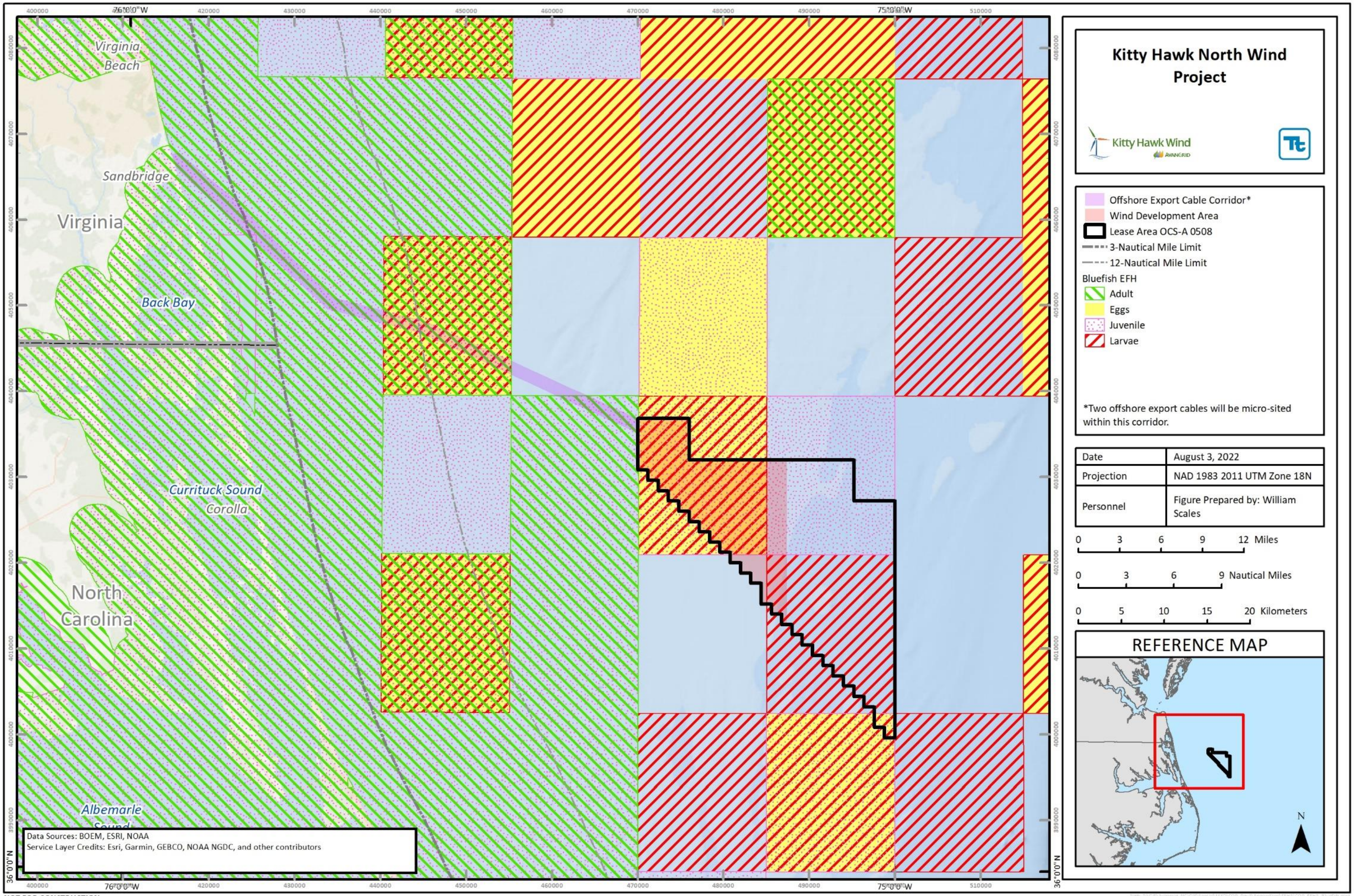


Figure W-1-17. Bluefish (*Pomatomus saltatrix*) Designated EFH in the Review Area

The MAFMC Bluefish FMP manages bluefish as a single stock: the Atlantic Coast stock. The fishery stock is currently overfished but is not subject to overfishing (NOAA Fisheries 2021b).

W-1.2.17 Longfin Inshore Squid (*Doryteuthis [Amerigo] pealeii*)

EFH for longfin inshore squid eggs is designated in federal and state waters of the offshore export cable corridor (Table W-1-18; Figure W-1-18). Longfin inshore squid egg EFH is designated in benthic habitats from the shoreline to depths of 164 ft (50 m), where salinities are within 30 to 32 ppt and temperatures range from 50 to 73°F (10 to 23°C) (Cargnelli et al. 1999d; Jacobson 2005). In the Mid-Atlantic Bight, eggs occur in inshore and offshore benthic marine habitats, where egg masses, or "mops", are anchored to hard substrates, including shells, rocks, boulders, submerged aquatic vegetation, sand, and mud (MAFMC 2011).

No longfin inshore squid larval EFH is designated in the review area.

EFH for longfin inshore squid juveniles is designated in the Wind Development Area and federal waters of the offshore export cable corridor (Table W-1-18; Figure W-1-18). Longfin inshore squid juvenile EFH is designated in the upper 33 ft (10 m) of the water column over maximum depths of 328 ft (100 m), where salinities are within 28 to 37 ppt and temperatures range from 50 to 79°F (10 to 26°C) (Cargnelli et al. 1999d; Jacobson 2005; MAFMC 2011). In the Mid-Atlantic Bight, juveniles and sub-adults (pre-recruits) occur in pelagic marine habitats in coastal inshore waters from spring through fall and offshore continental shelf waters in winter (Cargnelli et al. 1999d; Jacobson 2005). Juveniles undergo diel vertical migrations in response to light (Cargnelli et al. 1999d; Jacobson 2005). Small juveniles feed on arrow worms and euphausiids and shift their diets as they age to small crabs, polychaetes, and shrimp (Jacobson 2005).

Table W-1-18. Longfin Inshore Squid (*Doryteuthis [Amerigo] pealeii*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg	0	977	4,969
Juvenile	48,039	6,087	0
Adult	48,039	3,177	0
Percent of Review Area Covered by EFH by Life Stage			
Egg	0.000%	0.001%	0.013%
Juvenile	0.008%	0.004%	0.000%
Adult	0.007%	0.002%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Egg	0.0%	4.9%	99.6%
Juvenile	100.0%	30.6%	0.0%
Adult	100.0%	16.0%	0.0%
Sources: NOAA Fisheries 2021a; MAFMC 2011; Jacobson 2005; Cargnelli et al. 1999d			

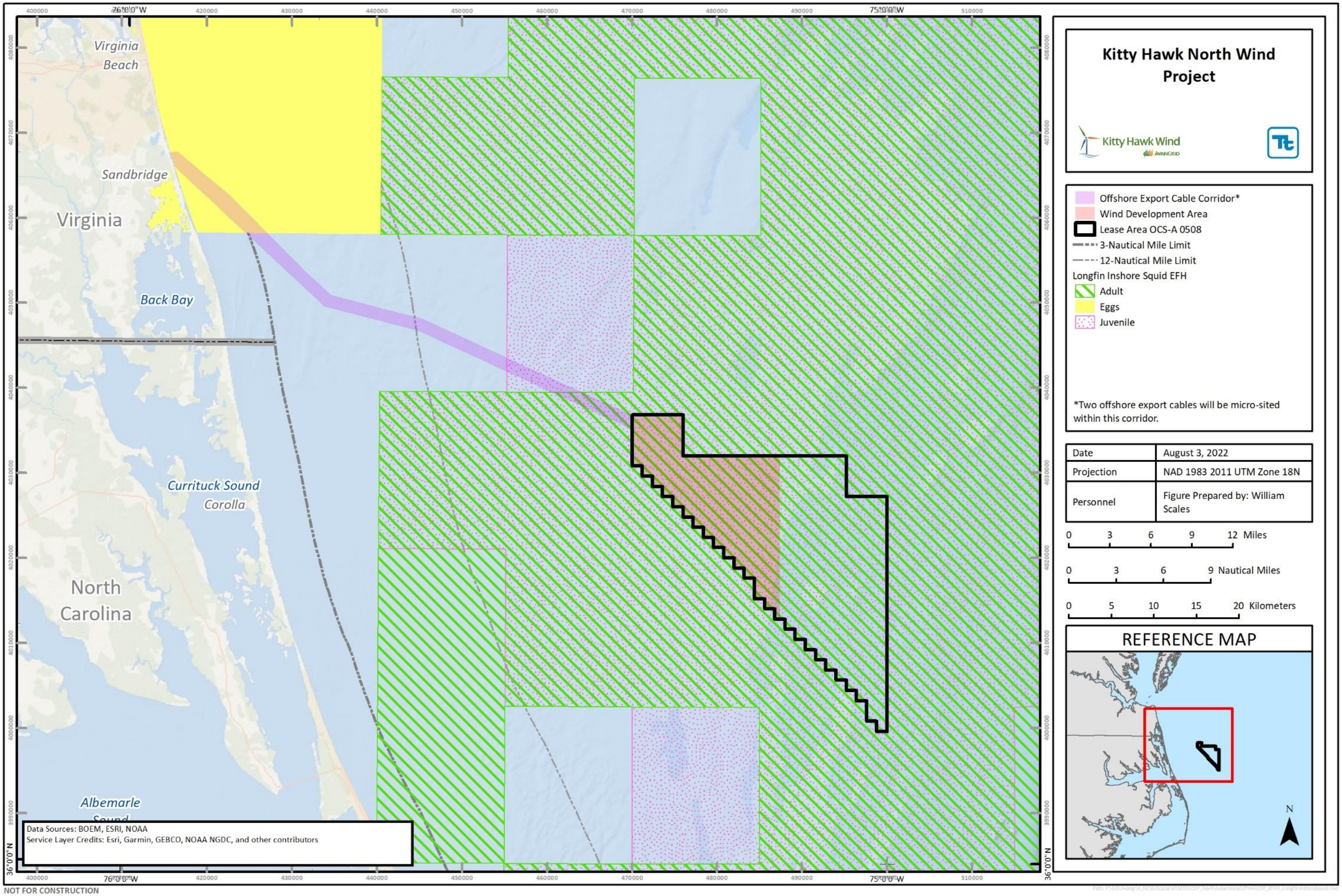


Figure W-1-18. Longfin Inshore Squid (*Doryteuthis [Amerigo] pealeii*) Designated EFH in the Review Area

EFH for longfin inshore squid adults (recruits) is designated in the Wind Development Area and federal waters of the offshore export cable corridor (Table W-1-18; Figure W-1-18). Longfin inshore squid EFH is designated in surface waters to depths of 591 ft (180 m) during spring and summer and depths of 1,312 ft (400 m) during fall and winter, where salinities are within 24 to 37 ppt and temperatures range from 46 to 61°F (8 to 16°C) (Cargnelli et al. 1999d; Jacobson 2005; MAFMC 2011). In the Mid-Atlantic Bight, adults occur in pelagic marine habitats in inshore and offshore continental shelf waters and in the high salinity zones of regional bays (MAFMC 2011). They exhibit diel vertical migrations in response to light and migrate offshore in the fall to overwinter in warmer waters along the edge of the continental shelf (MAFMC 2011). Small adults feed on larval and juvenile fishes and squid and shift their diets as they age to adult fishes (e.g., anchovies, hakes, herring, menhaden, mackerel, weakfish) and squid (Jacobson 2005).

The MAFMC Atlantic Mackerel, Squid, and Butterfish FMP manages longfin inshore squid as a single stock: the Georges Bank/Cape Hatteras stock. The fishery stock is not currently overfished but it is unknown whether the stock is subject to overfishing (NOAA Fisheries 2021b).

W-1.2.18 Northern Shortfin Squid *(Illex illecebrosus)*

No northern shortfin squid egg, larval, or adult EFH is designated in the review area.

EFH for northern shortfin squid juveniles is designated in the Wind Development Area (Table W-1-19; Figure W-1-19). Northern shortfin squid EFH is designated in depths of 135 to 1,312 ft (40 to 400 m), where salinities are within 34 to 37 ppt and temperatures range from 49 to 62°F (9 to 17°C) (Cargnelli et al. 1999e; Hendrickson and Holmes 2004; MAFMC 2011). In the Mid-Atlantic Bight, juveniles occur over the continental shelf from spring through summer, migrate offshore in fall, and overwinter over the continental slope (MAFMC 2011). They exhibit diel vertical migrations in response to light and in pursuit of euphausiid prey (Cargnelli et al. 1999e; Hendrickson and Holmes 2004; MAFMC 2011).

The MAFMC Atlantic Mackerel, Squid, and Butterfish FMP manages northern shortfin squid as a single stock: the Northwestern Atlantic Coast stock. The fishery stock is not subject to overfishing, but the stock status is currently unknown (NOAA Fisheries 2021b).

Table W-1-19. Northern Shortfin Squid *(Illex illecebrosus)* Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	6,418	0	0
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.033%	0.000%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	13.4%	0.0%	0.0%
Sources: NOAA Fisheries 2021a; MAFMC 2011; Hendrickson and Holmes 2004; Cargnelli et al. 1999e			

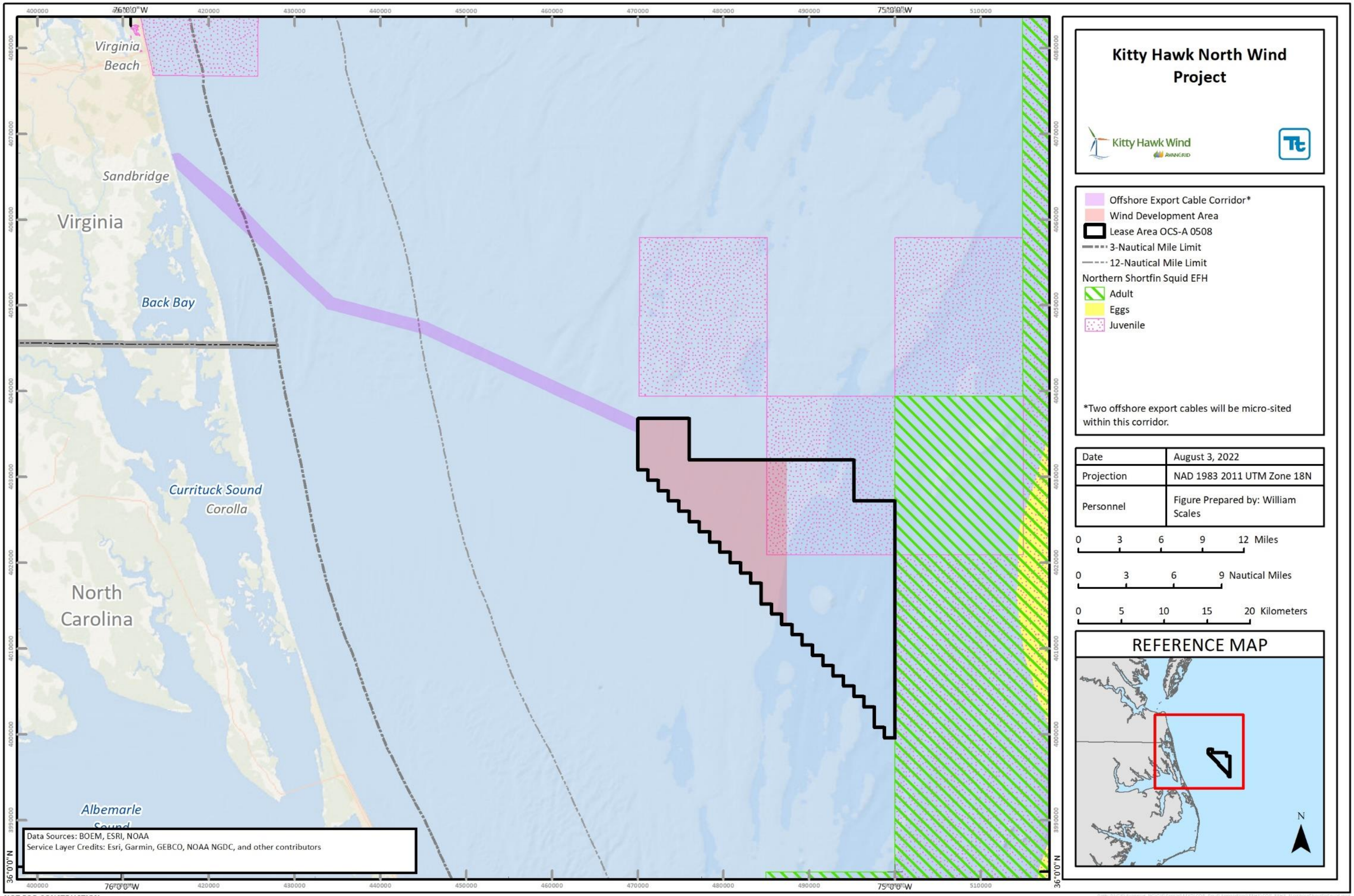


Figure W-1-19. Northern Shortfin Squid *(Illex illecebrosus)* Designated EFH in the Review Area

W-1.2.19 Scup (*Stenotomus chrysops*)

No scup egg or larval EFH is designated in the review area.

EFH for scup juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-20; Figure W-1-20). Scup juvenile EFH is designated from the shoreline to depths of 125 ft (38 m), where salinities exceed 15 ppt and temperatures range from 45 to 81°F (7 to 27°C) (MAFMC 1998a; Steimle et al. 1999d). In the Mid-Atlantic Bight, juveniles occur in intertidal and subtidal benthic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998a). They undergo seasonal migrations from inshore waters in summer and nearshore waters in fall to offshore waters in winter and spring (Steimle et al. 1999d). In inshore waters, juveniles occur over mud, sand, mussel beds, and eelgrass beds; in offshore waters, juveniles occur over sand substrates of varying grain sizes (Steimle et al. 1999d). They feed on amphipods, polychaetes, mollusks, and fish eggs and larvae.

EFH for scup adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-20; Figure W-1-20). Scup adult EFH is designated in depths of 7 to 125 ft (2 to 38 m) during summer and 125 to 607 ft (38 to 185 m) during winter, where salinities are within 20 to 31 ppt and temperatures span 45 to 77°F (7 to 25°C) (Steimle et al. 1999d). In the Mid-Atlantic Bight, adults occur in intertidal and subtidal benthic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998a). Like juveniles, adults undergo seasonal migrations between inshore summer habitats and offshore overwintering grounds. They occur over silty sand, mud, mussel beds, rocks, and artificial reefs (Steimle et al. 1999d). Adults feed on detritus, small fish, hydroids, insect larvae, mollusks, polychaetes, and sand dollars.

The MAFMC Summer Flounder, Scup, and Black Sea Bass FMP manages scup as a single stock: the Atlantic Coast stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

Table W-1-20. Scup (*Stenotomus chrysops*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	43,980	19,884	4,991
Adult	43,980	13,028	4,975
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.009%	0.002%	0.002%
Adult	0.008%	0.002%	0.007%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	91.5%	100.0%	100.0%
Adult	91.5%	65.5%	99.7%
Sources: NOAA Fisheries 2021a; Steimle et al. 1999d; MAFMC 1998a			

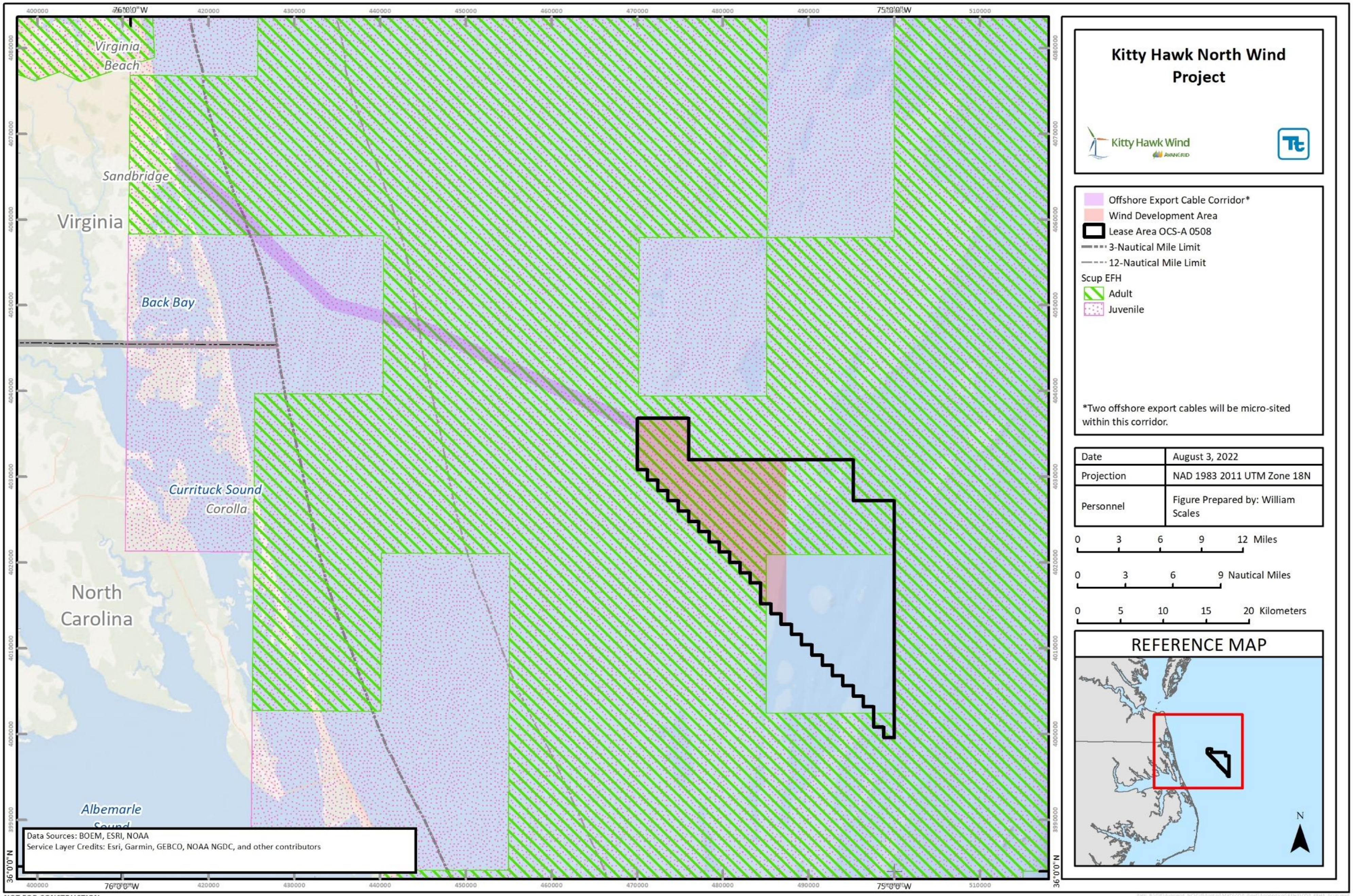


Figure W-1-20. Scup (*Stenotomus chrysops*) Designated EFH in the Review Area

W-1.2.20 Spiny Dogfish (*Squalus acanthias*)

No spiny dogfish neonate, juvenile, or sub-male EFH is designated in the review area.

EFH for spiny dogfish sub-females is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-21; Figure W-1-21). Spiny dogfish sub-female EFH is designated in variety of depths, where salinities are within 32 to 35 ppt and temperatures range from 45 to 59°F (7 to 15°C) (MAFMC 2014). In the Mid-Atlantic Bight, sub-females occur in epibenthic and pelagic marine habitats on the continental shelf; sub-females are often more widely distributed than sub-males (MAFMC 2014). They feed on a variety of ctenophores, fishes, and squid (Stehlik 2007).

EFH for spiny dogfish adult males and females is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-21; Figure W-1-21). Spiny dogfish adult EFH is designated in depths of 82 to 1,194 ft (25 to 364 m), where salinities are within 30 to 35 ppt and temperatures range from 45 to 59°F (7 to 15°C) (McMillan and Morse 1999; Stehlik 2007; MAFMC 2014). In the Mid-Atlantic Bight, adults occur in benthic and pelagic marine habitats on the continental shelf; females are often more widely distributed than males (MAFMC 2014). They occur throughout the continental shelf in winter and spring but few remain in the region in summer and fall when temperatures exceed 59°F (15°C) (MAFMC 2014). Like sub-adults, male and female adults consume a variety of ctenophores, fishes, and squid (Stehlik 2007).

The NEFMC and MAFMC co-manage spiny dogfish under the Spiny Dogfish FMP as a single stock: the Atlantic Coast stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

Table W-1-21. Spiny Dogfish (*Squalus acanthias*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Sub-Female	48,039	19,785	4,975
Adult Female	48,039	19,205	16
Adult Male	47,848	10,647	4,975
Percent of Review Area Covered by EFH by Life Stage			
Sub-Female	0.006%	0.001%	0.002%
Adult Female	0.007%	0.002%	0.000%
Adult Male	0.007%	0.001%	0.002%
Percent of Total Species EFH Area Covered by Review Area			
Sub-Female	100.0%	99.5%	99.7%
Adult Female	100.0%	96.6%	0.3%
Adult Male	99.6%	53.5%	99.7%
Sources: NOAA Fisheries 2021a; MAFMC 2014; Stehlik 2007; McMillan and Morse 1999			

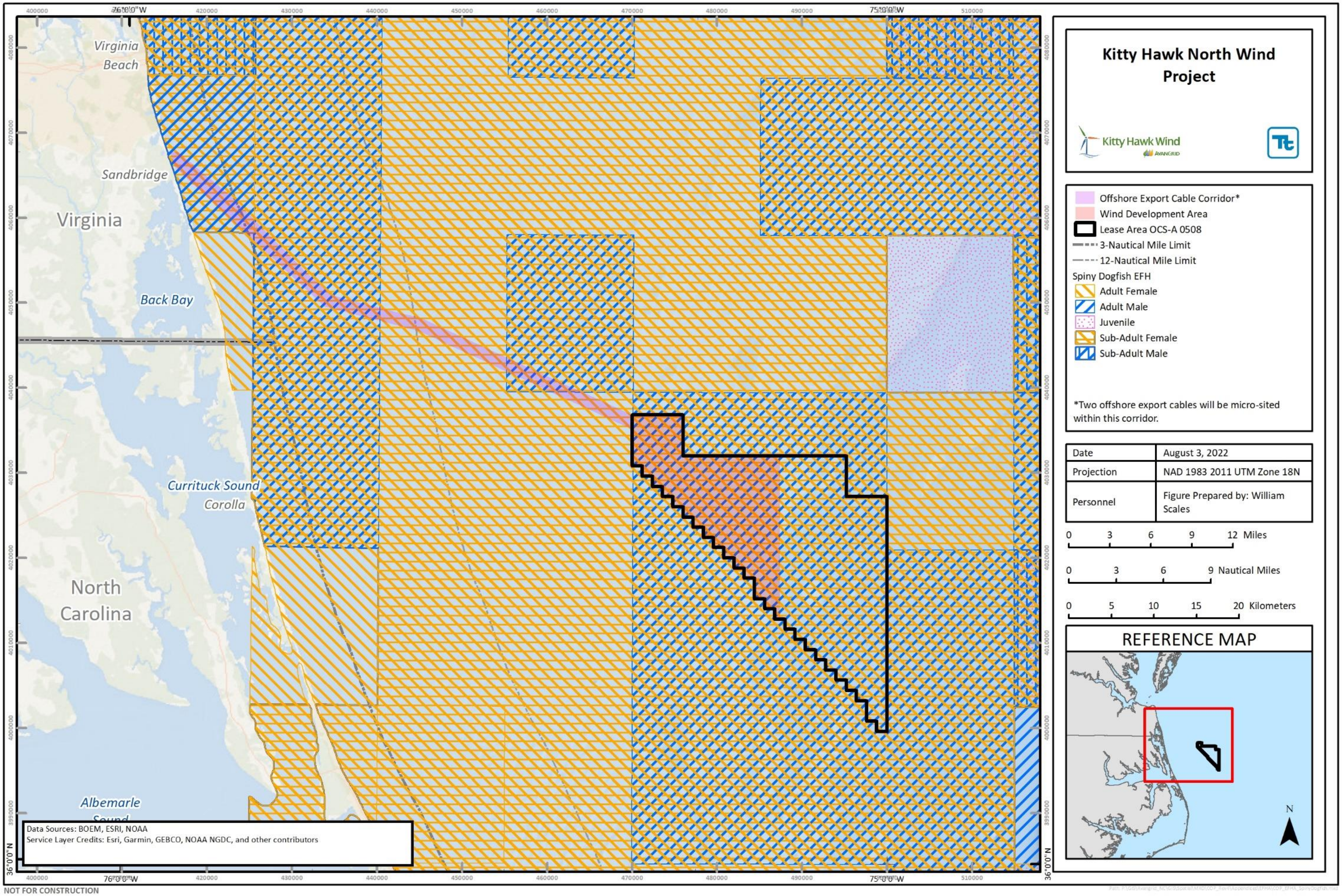


Figure W-1-21. Spiny Dogfish (*Squalus acanthias*) Designated EFH in the Review Area

W-1.2.21 Summer Flounder (*Paralichthys dentatus*)

EFH for summer flounder eggs is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-22; Figure W-1-22). Summer flounder egg EFH is designated in depths of 30 to 360 ft (9 to 110 m), where salinities are within 22 to 33 ppt and temperatures range from 48 to 73°F (9 to 23°C) (Packer et al. 1999b). In the Mid-Atlantic Bight, eggs occur in pelagic marine habitats over the continental shelf (MAFMC 1998a).

EFH for summer flounder larvae is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-22; Figure W-1-22). Summer flounder larval EFH is designated in depths of 30 to 230 ft (9 to 70 m), where salinities are within 10 to 30 ppt and temperatures range from 32 to 73°F (0 to 23°C) (Packer et al. 1999b). In the Mid-Atlantic Bight, larvae occur in pelagic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries, where they feed on copepods (MAFMC 1998a; Packer et al. 1999b). They exhibit seasonal migrations from the northern Mid-Atlantic Bight from September through February to the southern Mid-Atlantic Bight from November to May (MAFMC 1998a).

Table W-1-22. Summer Flounder (*Paralichthys dentatus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg	34,560	6,756	0
Larva	37,366	6,756	0
Juvenile	48,039	19,785	4,795
Adult	48,039	19,884	4,991
Percent of Review Area Covered by EFH by Life Stage			
Egg	0.068%	0.027%	0.000%
Larva	0.016%	0.003%	0.000%
Juvenile	0.004%	0.001%	0.002%
Adult	0.003%	0.001%	0.001%
Percent of Total Species EFH Area Covered by Review Area			
Egg	71.9%	34.0%	0.0%
Larva	77.8%	34.0%	0.0%
Juvenile	100.0%	99.5%	99.7%
Adult	100.0%	100.0%	100.0%
Sources: NOAA Fisheries 2021a; Packer et al. 1999b; MAFMC 1998a			

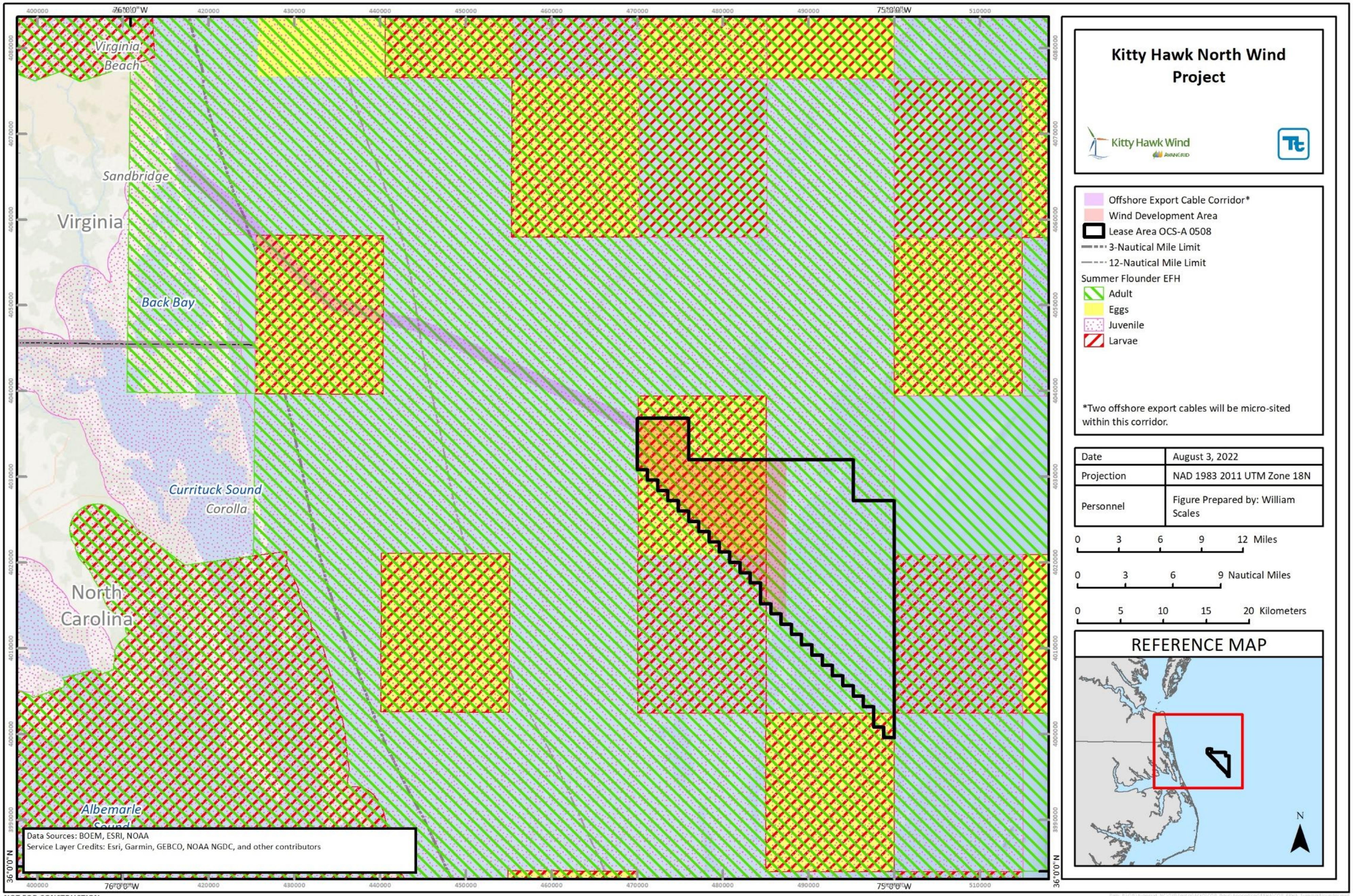


Figure W-1-22. Summer Flounder (*Paralichthys dentatus*) Designated EFH in the Review Area

EFH for summer flounder juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-22; Figure W-1-22). Summer flounder juvenile EFH is designated in benthic habitats from the shoreline to depths of 500 ft (152 m), where salinities are within 18 to 35 ppt and temperatures range from 37 to 81°F (3 to 27°C) (Packer et al. 1999b). In the Mid-Atlantic Bight, juveniles occur in benthic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998a). Estuarine habitats, including salt marsh creeks, seagrass beds, mudflats, and sands of open bays, serve as nurseries for juveniles. They feed opportunistically on bivalve siphons, small fishes, infaunal invertebrates, and polychaetes (Packer et al. 1999b).

EFH for summer flounder adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-22; Figure W-1-22). Summer flounder adult EFH is designated in benthic habitats from the shoreline to 500 ft (152 m), where temperatures range from 36 to 81°F (2 to 27°C) (Packer et al. 1999b). In the Mid-Atlantic Bight, adults occur in benthic marine habitats over the continental shelf and in the mixed and high salinity zones of regional estuaries (MAFMC 1998a). They inhabit shallow coastal and estuarine waters in summer and move offshore to overwinter on outer continental shelf substrates (MAFMC 1998a). Like juveniles, they feed opportunistically on a variety of fishes (e.g., anchovies, bluefish, flounders, hakes, scup, weakfish) and invertebrates (e.g., bivalves, crabs, gastropods, sand dollars, shrimps, squids) (Packer et al. 1999b).

The MAFMC Summer Flounder, Scup, and Black Sea Bass FMP manages summer flounder as a single stock: the Mid-Atlantic Coast stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

W-1.2.22 Snapper Grouper (Epinephelidae; Lutjanidae)

EFH for the 51 species and all life stages in the Snapper Grouper Management Unit is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-23; Figure W-1-23). Snapper Grouper EFH is designated in estuarine, nearshore, and continental shelf benthic habitats from the shoreline to depths of at least 600 ft (183 m) (and to at least 2,000 ft [610 m] for wreckfish) over coral reefs, hardbottom, live bottom, submerged aquatic vegetation, and artificial reefs, where water temperatures are sufficiently warm to maintain adult populations (SAFMC 1998). EFH includes pelagic spawning habitat above listed benthic habitats, including floating *Sargassum* mats (required for larval survival and growth) and the Gulf Stream (required for larval dispersal) (SAFMC 1998).

Table W-1-23. Snapper Grouper (Epinephelidae; Lutjanidae) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
All	48,039	18,122	0
Percent of Review Area Covered by EFH by Life Stage			
All	0.030%	0.011%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
All	100.0%	91.1%	0.0%
Sources: NOAA Fisheries 2021a; SAFMC 1998			

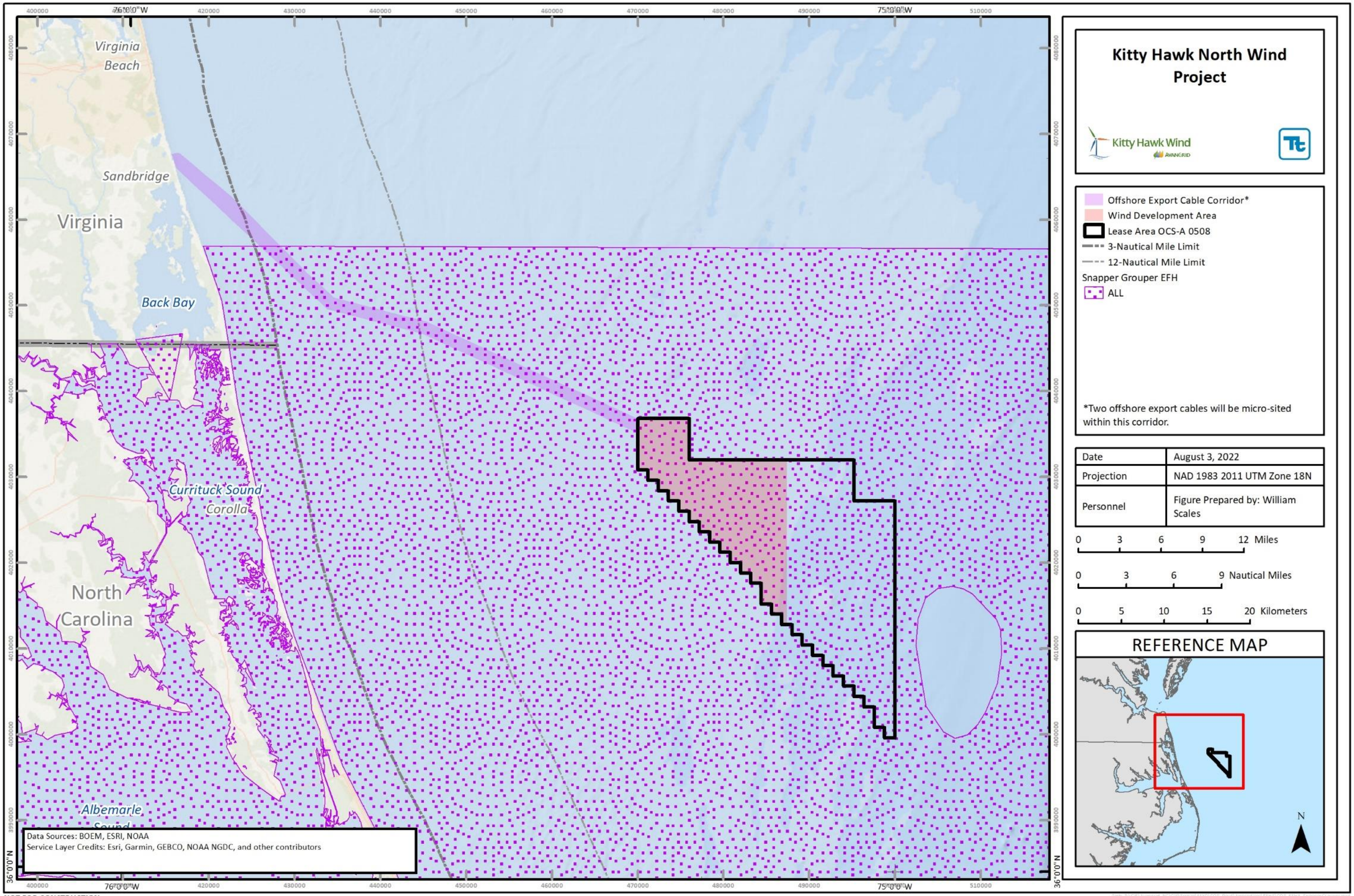


Figure W-1-23. Snapper Grouper (Epinephelidae; Lutjanidae) Designated EFH in the Review Area

W-1.2.23 Spiny Lobster (Palinuridae)

EFH for all species and life stages in the Spiny Lobster Management Unit is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-24; Figure W-1-24). Spiny Lobster EFH is designated in shallow subtidal and continental shelf benthic habitats over unconsolidated softbottom, coral, hardbottom, live bottom, sponges, algal communities, and mangrove habitats (SAFMC 1998). EFH includes the Gulf Stream for the purposes for larval dispersal (SAFMC 1998).

The SAFMC and Gulf of Mexico Fishery Management Council (GMFMC) Spiny Lobster in the Gulf of Mexico and South Atlantic FMP manages the spiny lobster as a single stock: the Southern Atlantic Coast/Gulf of Mexico stock. The fishery stock is not subject to overfishing, but the stock status is currently unknown (NOAA Fisheries 2021b).

Table W-1-24. Spiny Lobster (Palinuridae) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
All	48,039	18,122	0
Percent of Review Area Covered by EFH by Life Stage			
All	0.031%	0.012%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
All	100.0%	91.1%	0.0%
Sources: NOAA Fisheries 2021a; SAFMC 1998)			

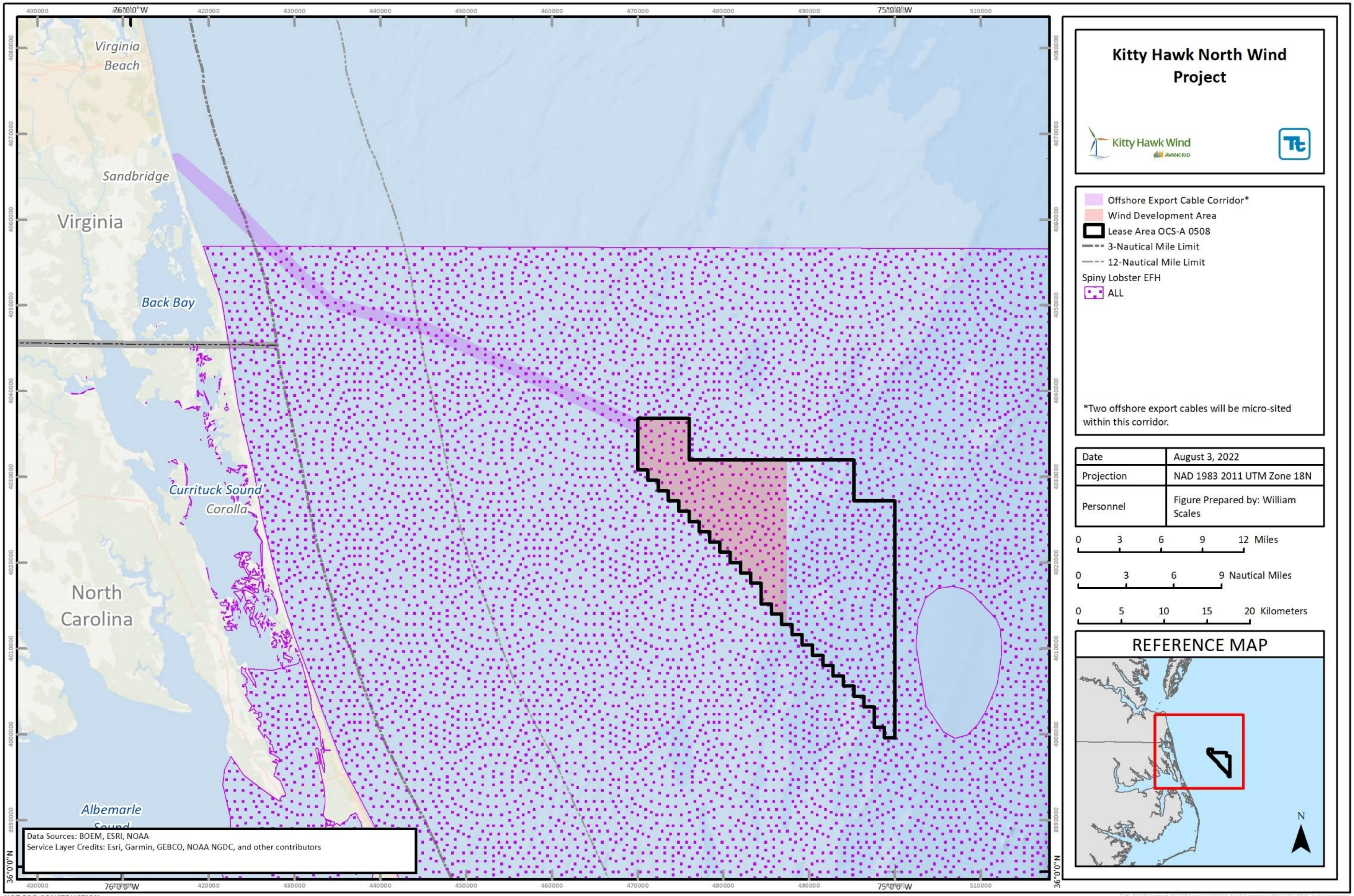


Figure W-1-24. Spiny Lobster (Palinuridae) Designated EFH in the Review Area

W-1.2.24 Albacore Tuna (*Thunnus alalonga*)

No albacore tuna egg, larval, or adult EFH is designated in the review area. EFH for albacore tuna juveniles is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-25; Figure W-1-25).

Albacore tuna juvenile EFH is designated in offshore, pelagic habitats of the Atlantic Ocean from the outer edge of the United States (U.S.) Exclusive Economic Zone through Georges Bank and south to Cape Hatteras, North Carolina, where surface water temperatures range from 61 to 66°F (16 to 19°C) (NOAA Fisheries 2017). The albacore tuna is a highly migratory, temperate, epipelagic species with a poorly known life history. In the Atlantic Ocean, the species is distributed between 40°N to 40°S (NOAA Fisheries 2017). Juveniles (up to five years old) conduct feeding migrations throughout the central Atlantic Ocean in winter and in the northeastern Atlantic Ocean in summer and fall (NOAA Fisheries 2017). Individuals aggregate in migratory schools that often contain multiple species of tuna and are segregated by the sizes of the individuals. Those comprised of the largest individuals undertake the longest feeding migrations. Juveniles forage opportunistically in epipelagic and upper mesopelagic waters on mid-sized fishes and cephalopods (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the albacore tuna as a single stock on the Atlantic Coast of the U.S.: the North Atlantic stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

Table W-1-25. Albacore Tuna (*Thunnus alalonga*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	48,039	19,884	4,991
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.006%	0.001%	0.001%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	100.0%	100.0%	100.0%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

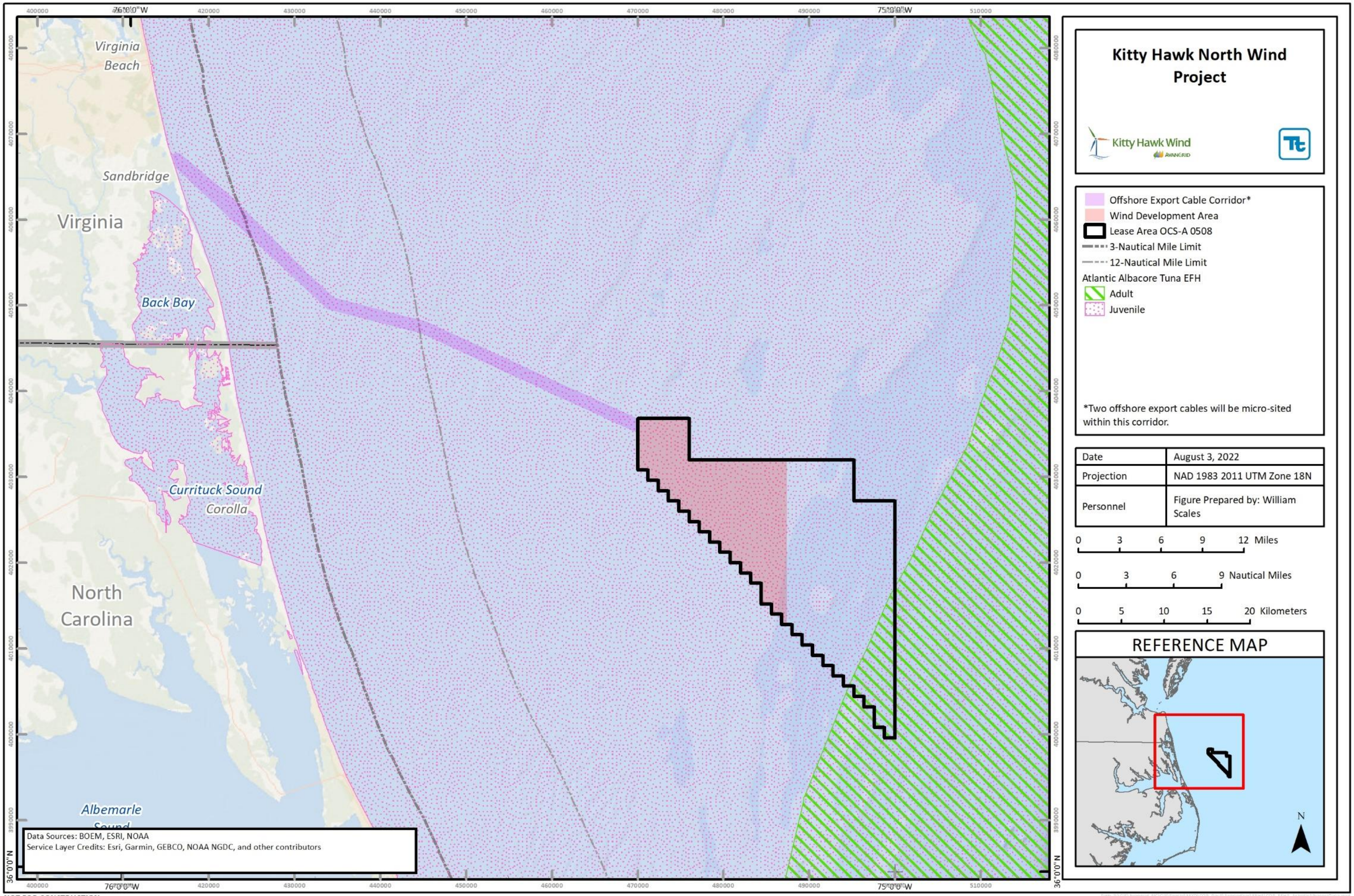


Figure W-1-25. Albacore Tuna (*Thunnus alalonga*) Designated EFH in the Review Area

W-1.2.25 Atlantic Angel Shark *(Squatina dumeril)*

EFH for all life stages of the Atlantic angel shark is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-26; Figure W-1-26).

Atlantic angel shark EFH is designated in benthic habitats of the Atlantic Ocean on the continental shelf from Cape May, New Jersey, to Cape Lookout, North Carolina (NOAA Fisheries 2017). The Atlantic angel shark is a highly migratory species that occurs in benthic marine habitats in coastal waters of the U.S. from Massachusetts to the Florida Keys, Gulf of Mexico, and Caribbean (NOAA Fisheries 2017). Individuals undertake seasonal migrations from shallow to deep waters and feed on cephalopods, crustaceans, fishes, and portunid crabs (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the Atlantic angel shark on the Atlantic Coast of the U.S. Fishing for the Atlantic angel shark is prohibited in U.S. waters (NOAA Fisheries 2017).

Table W-1-26. Atlantic Angel Shark (*Squatina dumeril*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
All	48,039	19,884	4,991
Percent of Review Area Covered by EFH by Life Stage			
All	0.017%	0.003%	0.002%
Percent of Total Species EFH Area Covered by Review Area			
All	100.0%	100.0%	100.0%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

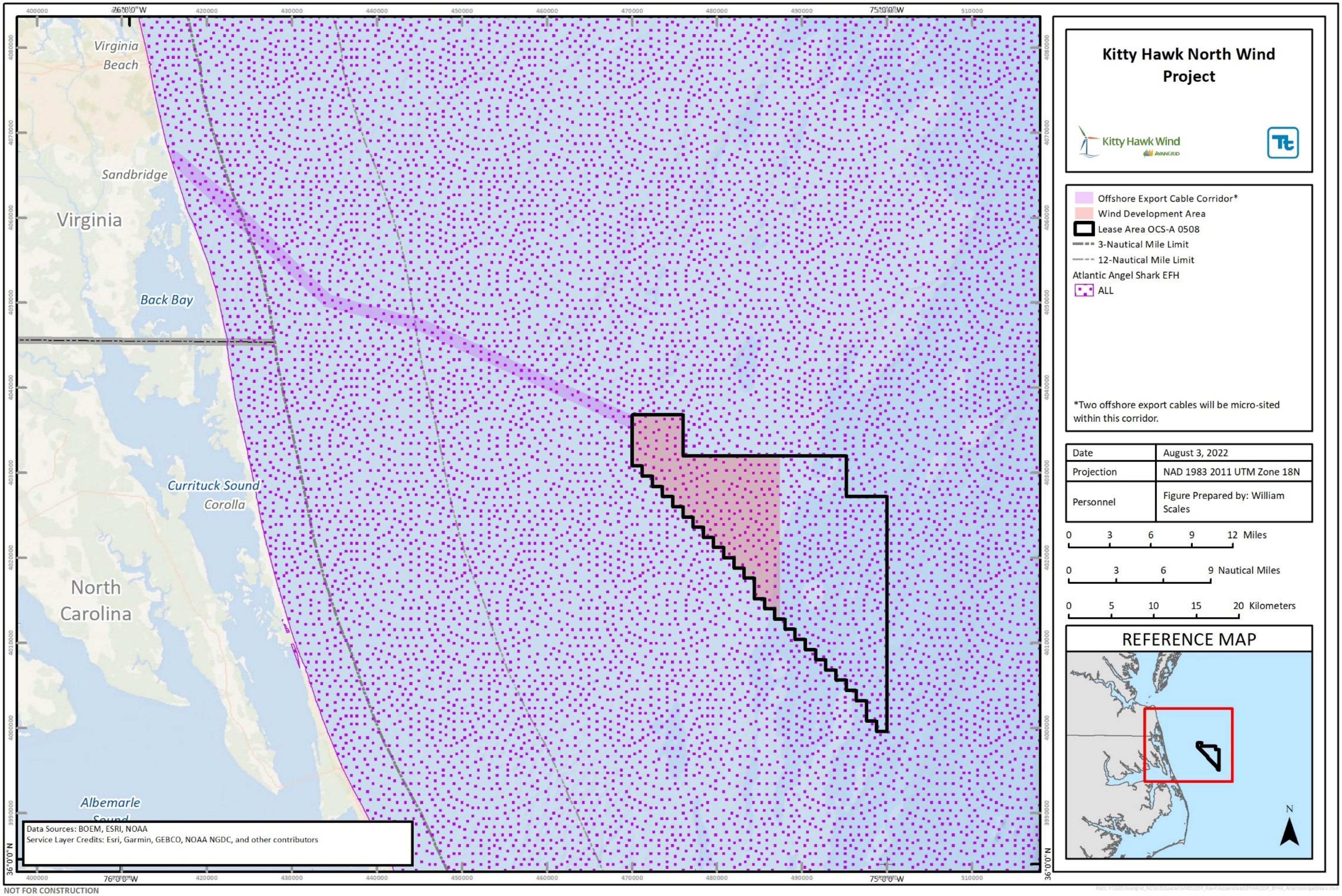


Figure W-1-26. Atlantic Angel Shark (*Squatina dumeril*) Designated EFH in the Review Area

W-1.2.26 Atlantic Bluefin Tuna *(Thunnus thynnus)*

EFH for Atlantic bluefin tuna eggs and larvae is designated in the Wind Development Area and federal waters of the offshore export cable corridor. EFH for Atlantic bluefin tuna juveniles and adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-27; Figure W-1-27).

Egg and larval EFH is designated in pelagic habitats of the Slope Sea from Georges Bank to North Carolina; eggs and larvae occur from the shoreline between the North Carolina/Virginia line and Oregon Inlet to seaward of the outer continental shelf, where salinities are approximately 36 ppt and temperatures range from 74 to 82°F (23 to 28°C). Juvenile EFH is designated in coastal and pelagic habitats from the shoreline to the continental shelf break in depths of 66 to 328 ft (20 to 100 m), where temperatures range from 39 to 79°F (4 to 26°C). Adult EFH is designated in coastal and offshore pelagic habitat from southern New England to Onslow Bay, North Carolina (NOAA Fisheries 2017). The Atlantic bluefin tuna is a highly migratory species that occurs in the Western Atlantic Ocean from the equator to 60°N. Females spawn from April to June in the Gulf of Mexico, Bahamas, and Florida Straits. YOY migrate in June to juvenile habitats over the continental shelf near 34°N and 41°W and shift with age to nursery areas between Cape Hatteras, North Carolina, and Cape Cod, Massachusetts. Individuals conduct seasonal migrations in pursuit of forage species off the eastern U.S. and Canadian coasts from June through March (NOAA Fisheries 2017). Though the species is generally epipelagic in the open ocean, some individuals migrate inshore during the summer in pursuit of prey (e.g., herring, mackerel, and squid). Juveniles feed primarily on zooplanktivorous fishes and crustaceans, while adults opportunistically prey on schooling fish, cephalopods, and benthic invertebrates (NOAA Fisheries 2017).

Table W-1-27. Atlantic Bluefin Tuna (*Thunnus thynnus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Egg/Larva	48,039	8,828	0
Juvenile	48,039	19,884	4,991
Adult	45,826	12,455	4,991
Percent of Review Area Covered by EFH by Life Stage			
Egg/Larva	0.005%	0.001%	0.000%
Juvenile	0.023%	0.003%	0.002%
Adult	0.006%	0.001%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Egg/Larva	100.0%	44.4%	0.0%
Juvenile	100.0%	100.0%	100.0%
Adult	95.4%	62.6%	100.0%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

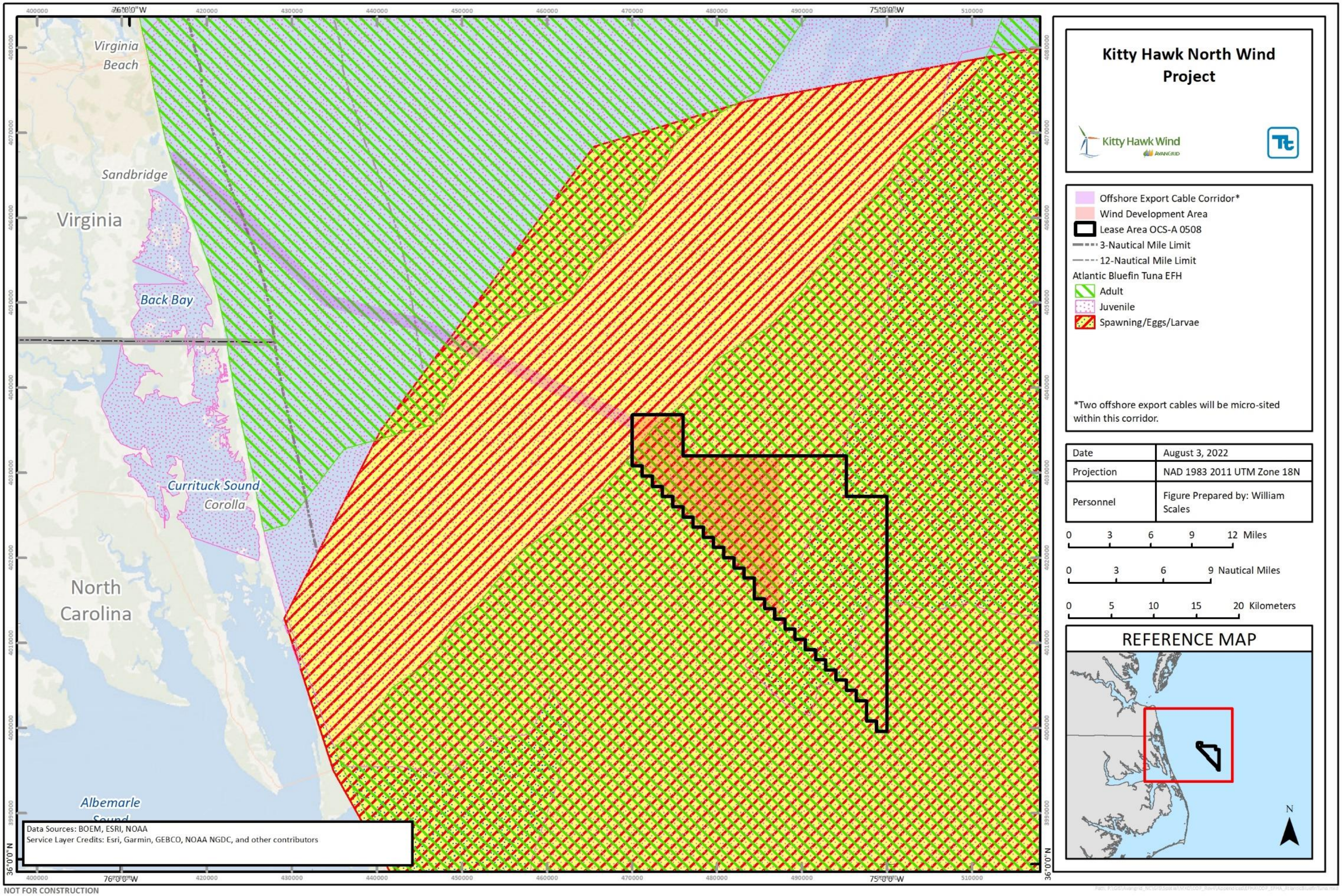


Figure W-1-27. Atlantic Bluefin Tuna (*Thunnus thynnus*) Designated EFH in the Review Area

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the Atlantic bluefin tuna as a single stock on the Atlantic Coast of the U.S.: the Western Atlantic stock. The fishery stock is not subject to overfishing, but the status of the stock is currently unknown (NOAA Fisheries 2021b).

W-1.2.27 Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*)

No Atlantic sharpnose shark neonate EFH is designated in the review area. EFH for Atlantic sharpnose shark juveniles is designated in the federal and state waters of the offshore export cable corridor. EFH for Atlantic sharpnose shark adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-28; Figure W-1-28).

Juvenile and adult EFH is designated in estuarine, inshore, and nearshore waters in pelagic marine habitats from the shoreline to depths of 591 ft (180 m), where salinities are within 21 to 37 ppt and temperatures range from 63 to 91°F (17 to 33°C) (NOAA Fisheries 2017). The Atlantic sharpnose shark is an abundant summer migrant off coastal Virginia and Chesapeake Bay. Both juveniles and adults exhibit seasonal summer distributions in the northern portion of the species' Atlantic stock range and adults often occur farther offshore than juveniles (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the albacore tuna as a single stock on the Atlantic Coast of the U.S.: the Atlantic stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

Table W-1-28. Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	0	6,582	4,944
Adult	48,039	19,884	4,991
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.000%	0.004%	0.004%
Adult	0.025%	0.004%	0.002%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	0.0%	33.1%	99.1%
Adult	100.0%	100.0%	100.0%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

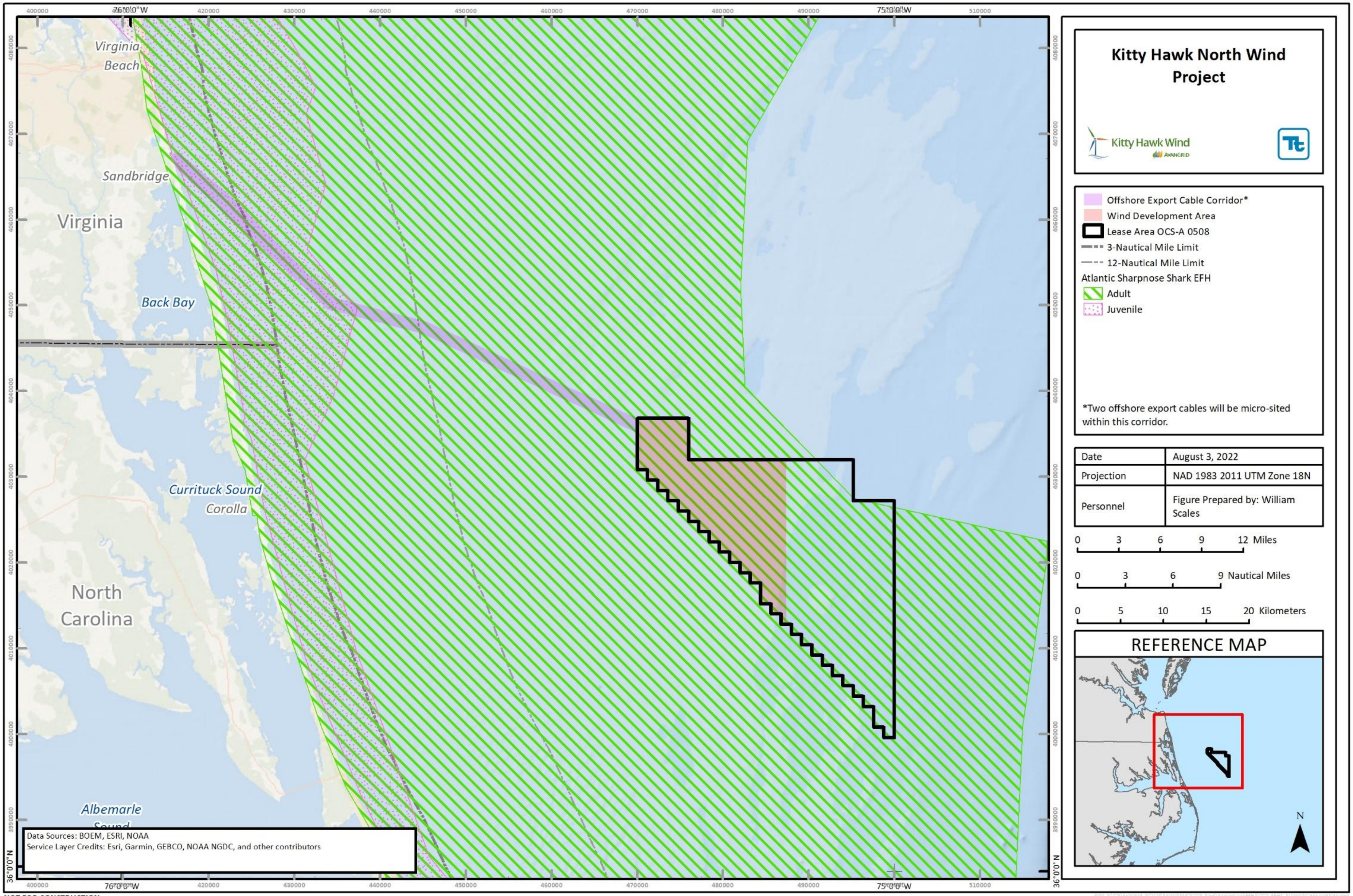


Figure W-1-28. Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*) Designated EFH in the Review Area

W-1.2.28 Atlantic Skipjack Tuna *(Katsuwonus pelamis)*

No Atlantic skipjack tuna egg or larval EFH is designated in the review area. EFH for Atlantic skipjack tuna juveniles is designated in the Wind Development Area and federal waters of the offshore export cable corridor. EFH for Atlantic skipjack tuna adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-29; Figure W-1-29).

Juvenile EFH is designated in coastal pelagic habitats from Massachusetts to South Carolina and in offshore pelagic habitats seaward of the continental shelf break in depths greater than 66 ft (20 m), where temperatures range from 68 to 88°F (20 to 13°C) (NOAA Fisheries 2017). Adult EFH is designated in coastal and offshore pelagic habitats from Massachusetts to Cape Lookout, North Carolina, where temperatures range from 68 to 88°F (20 to 13°C) (NOAA Fisheries 2017). The Atlantic skipjack tuna is a highly migratory, epipelagic species that occurs in tropical and warm-temperate waters from Newfoundland to Brazil. Individuals inhabit surface waters but may dive to depths of 853 ft (260 m) during the day. Schools of Atlantic skipjack tuna are associated with convergences, hydrographic discontinuities, birds, shifting objects, whales, sharks, and other tuna species (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the Atlantic skipjack tuna as a single stock on the Atlantic Coast of the U.S.: the Western Atlantic stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

Table W-1-29. Atlantic Skipjack Tuna (*Katsuwonus pelamis*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	48,039	16,319	0
Adult	48,039	15,390	1,128
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.004%	0.001%	0.000%
Adult	0.005%	0.001%	0.001%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	100.0%	82.1%	0.0%
Adult	100.0%	77.4%	22.6%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

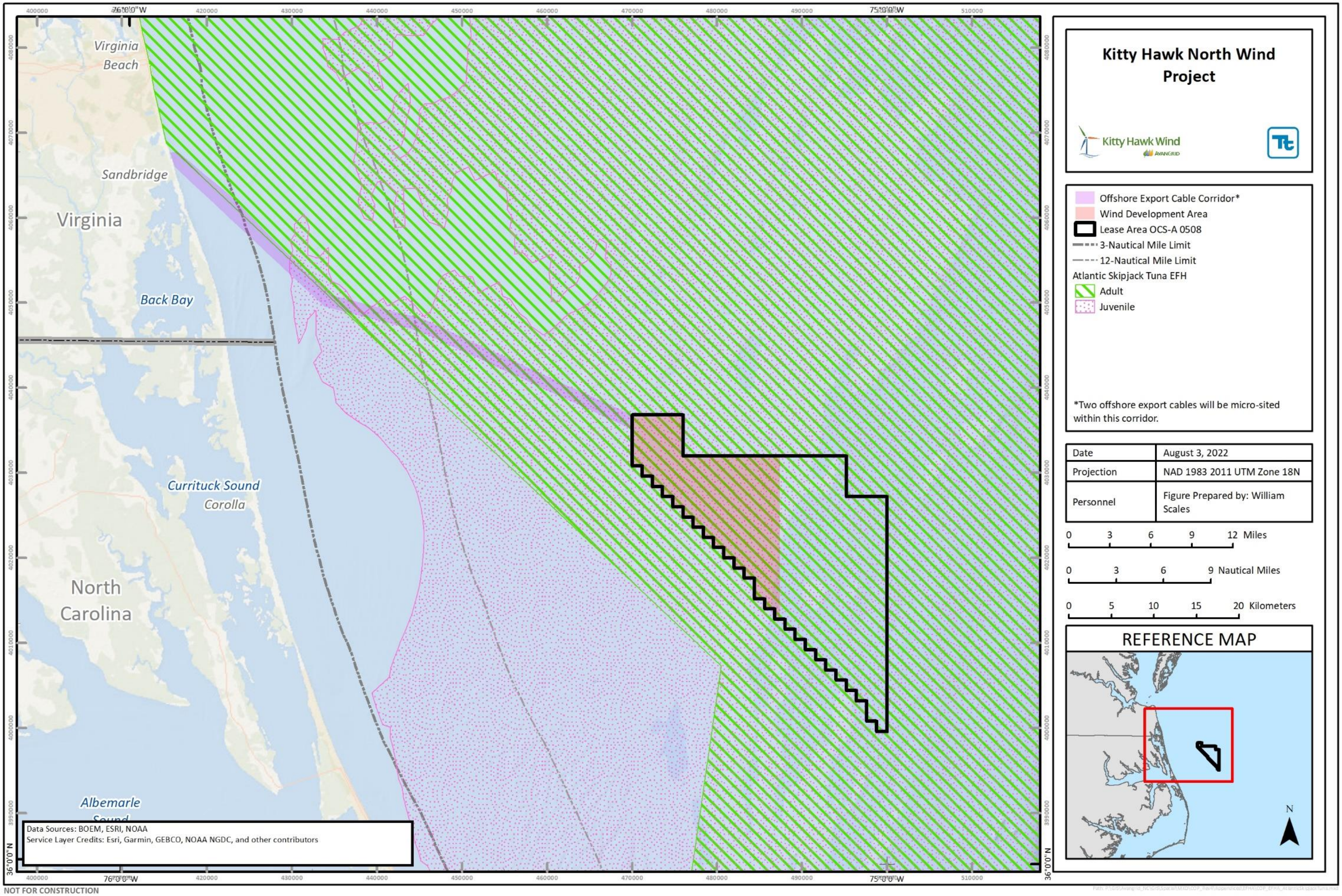


Figure W-1-29. Atlantic Skipjack Tuna (*Katsuwonus pelamis*) Designated EFH in the Review Area

W-1.2.29 Atlantic Yellowfin Tuna *(Thunnus albacares)*

No Atlantic yellowfin tuna egg, larval, or adult EFH is designated in the review area. EFH for Atlantic yellowfin tuna adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-30; Figure W-1-30).

Juvenile EFH is designated in coastal and offshore pelagic marine habitats from Cape Cod, Massachusetts, to Florida and seaward of the continental shelf break (NOAA Fisheries 2017). The Atlantic yellowfin tuna is a highly migratory, epipelagic species that occurs in tropical and temperate waters 45°N and 40°S (NOAA Fisheries 2017). Juveniles reside in surface waters and aggregate in mixed schools of skipjack and bigeye tuna. Vertical distributions of juveniles may be associated with thermocline depth. They opportunistically feed on fishes, cephalopods, and crustaceans and their prey often include *Sargassum*-associated species (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the Atlantic yellowfin tuna as a single stock on the Atlantic Coast of the U.S.: the Western Atlantic stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

Table W-1-30. Atlantic Yellowfin Tuna (*Thunnus albacares*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile	48,039	17,524	4,991
Percent of Review Area Covered by EFH by Life Stage			
Juvenile	0.004%	0.001%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile	100.0%	88.1%	100.0%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

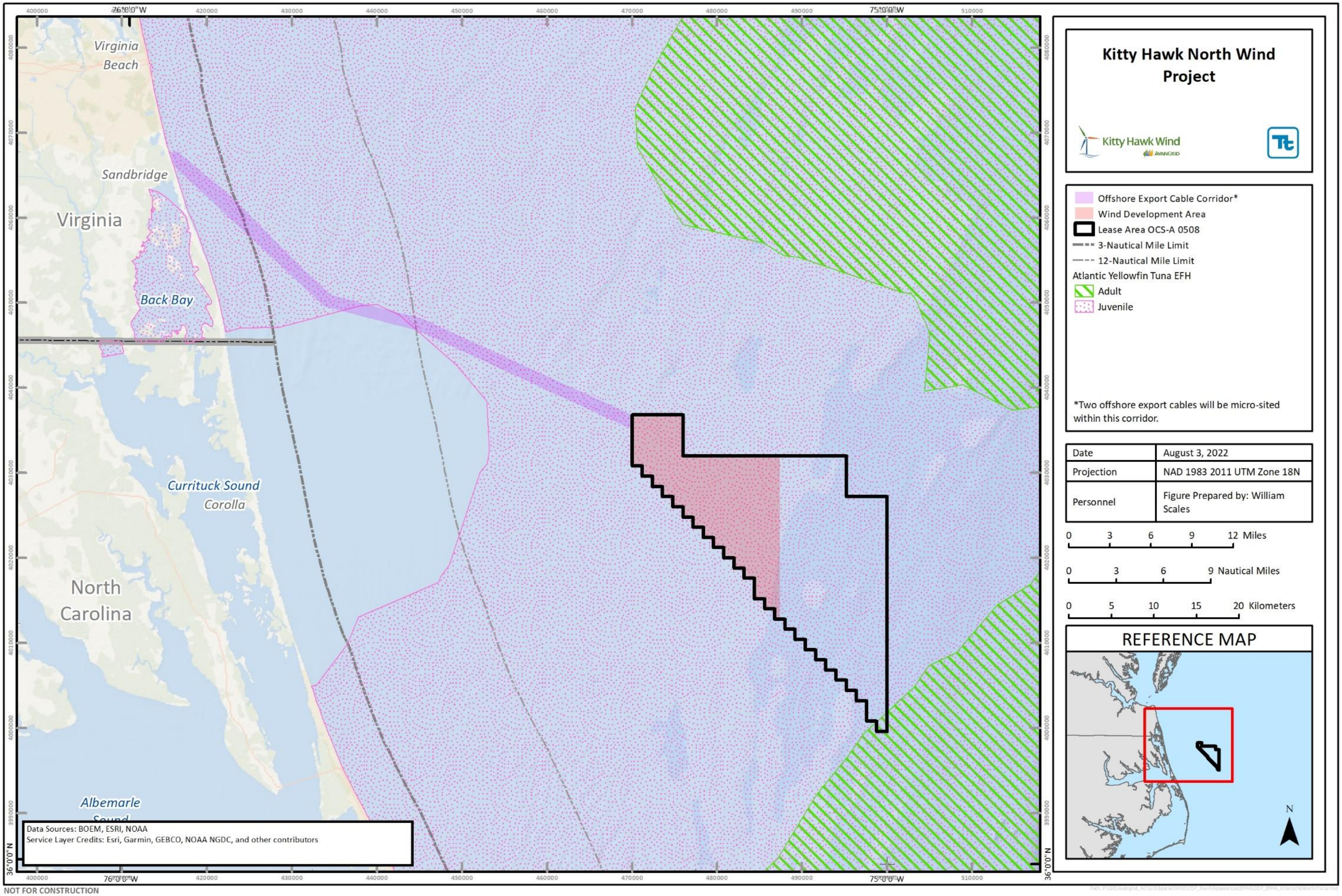


Figure W-1-30. Atlantic Yellowfin Tuna (*Thunnus albacares*) Designated EFH in the Review Area

W-1.2.30 Blacktip Shark (*Carcharhinus limbatus*)

No blacktip shark neonate EFH is designated in the review area. EFH for blacktip shark juveniles and adults is designated in federal and state waters of the offshore export cable corridor (Table W-1-31; Figure W-1-31).

Juvenile and adult EFH is designated in estuarine and coastal areas from Virginia to Florida in depths of 3 to 30 ft (1 to 9 m), where salinities are within 22 to 35 ppt (though juveniles are known to occur in salinities as low as 7 ppt) and temperatures range from 66 to 91°F (20 to 32°C) (NOAA Fisheries 2017). The blacktip shark is a highly migratory, circumtropical species present in shallow coastal waters and offshore surface waters of the continental shelf. Individuals occur over a variety of substrates, including silt, sand, mud, shell hash, seagrass beds, and rocky habitats. They feed on fishes, cephalopods, and crustaceans (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the blacktip shark as a single stock on the Atlantic Coast of the U.S.: the Atlantic stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

Table W-1-31. Blacktip Shark (*Carcharhinus limbatus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile/Adult	0	10,924	4,986
Percent of Review Area Covered by EFH by Life Stage			
Juvenile/Adult	0.000%	0.006%	0.006%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile/Adult	0.0%	54.9%	99.9%
Sources: NOAA Fisheries 2012a; NOAA Fisheries 2017			

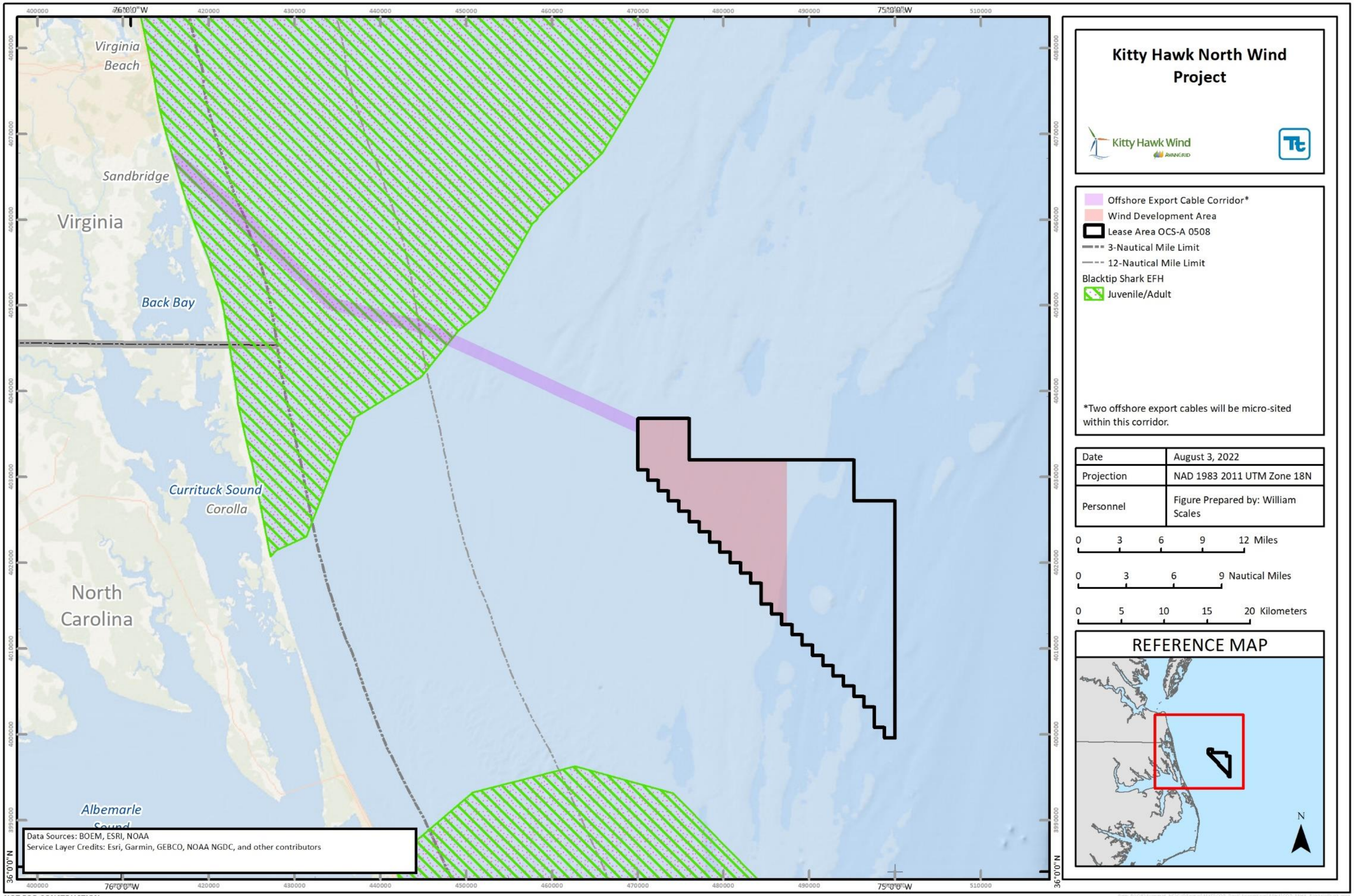


Figure W-1-31. Blacktip Shark (*Carcharhinus limbatus*) Designated EFH in the Review Area

W-1.2.31 Common Thresher Shark *(Alopias vulpinus)*

EFH for all life stages of the common thresher shark is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-32; Figure W-1-32).

Common thresher shark EFH is designated in the Atlantic Ocean from Georges Bank to Cape Lookout, North Carolina, in depths of 16 to 43 ft (5 to 13 m), where temperatures range from 64 to 70°F (18 to 21°C) (NOAA Fisheries 2017). The common thresher shark is a highly migratory species that occurs in warm and temperate coastal and offshore pelagic marine habitats. It is more abundant in nearshore habitats and undertakes north-south seasonal migrations. The species feeds on invertebrates (e.g., squid and pelagic crabs) and small fishes (e.g., anchovies, sardines, hakes, mackerels) (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the common thresher shark as a single stock on the Atlantic Coast of the U.S.: the Atlantic and Gulf of Mexico stock. The status of the stock is currently unknown and it is unknown if the stock is subject to overfishing (NOAA Fisheries 2021b).

Table W-1-32. Common Thresher Shark (*Alopias vulpinus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
All	48,039	19,884	4,986
Percent of Review Area Covered by EFH by Life Stage			
All	0.017%	0.002%	0.002%
Percent of Total Species EFH Area Covered by Review Area			
All	100.0%	100.0%	99.9%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

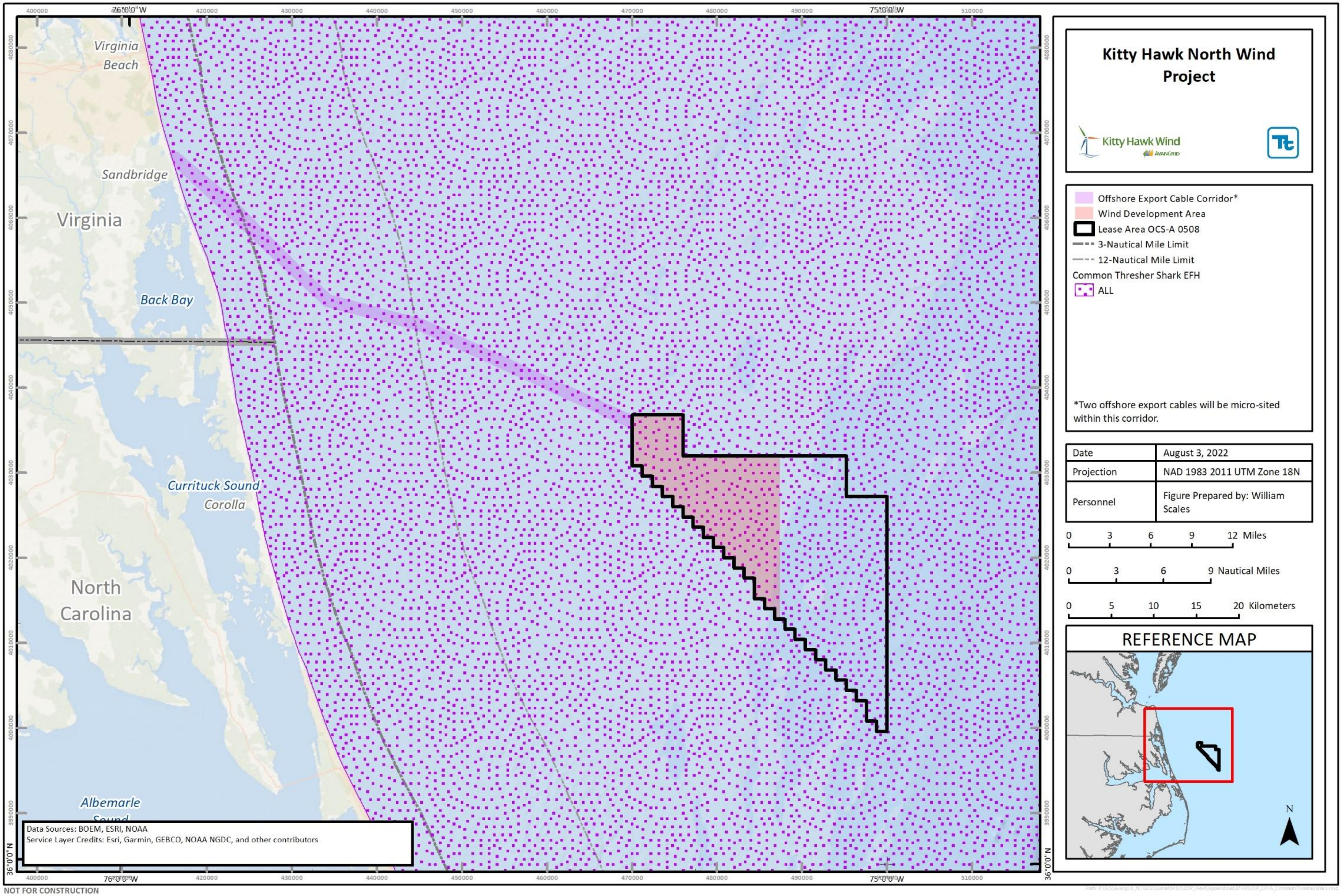


Figure W-1-32. Common Thresher Shark (*Alopias vulpinus*) Designated EFH in the Review Area

W-1.2.32 Dusky Shark (*Carcharhinus obscurus*)

EFH for dusky shark neonates is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor. EFH for dusky shark juveniles and adults is designated in the Wind Development Area and federal waters of the offshore export cable corridor (Table W-1-33; Figure W-1-33).

Neonate and YOY EFH is designated in offshore pelagic habitats from New England to Cape Lookout, North Carolina, in depths of 13 to 197 ft (4 to 60 m), where salinities are within 25 to 35 ppt and temperatures range from 64 to 72°F (18 to 22°C). Juvenile and adult EFH is designated in pelagic habitats along the coast and inshore of the continental shelf break in depths of 66 to 656 ft (20 to 200 m), where temperatures range from 68 to 75°F (20 to 24°C) (NOAA Fisheries 2017). The dusky shark is a highly migratory species that occurs in warm and temperate continental shelf waters from the shoreline to the outer continental shelf. It undertakes seasonal north-south migrations and adults are generally found in deeper waters than juveniles, in maximum depths of 6,562 ft (2,000 m). Juveniles and adults feed on demersal fishes (e.g., flounders, skates), pelagic fishes (e.g., sardines, tunas), and cephalopods (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the dusky shark as a single stock on the Atlantic Coast of the U.S.: the Atlantic and Gulf of Mexico stock. The fishery stock is currently overfished and subject to continued overfishing (NOAA Fisheries 2021b).

Table W-1-33. Dusky Shark (*Carcharhinus obscurus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Neonate	48,039	19,884	4,980
Juvenile/Adult	48,039	16,319	0
Percent of Review Area Covered by EFH by Life Stage			
Neonate	0.043%	0.006%	0.009%
Juvenile/Adult	0.008%	0.001%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Neonate	100.0%	100.0%	99.4%
Juvenile/Adult	100.0%	82.1%	0.0%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

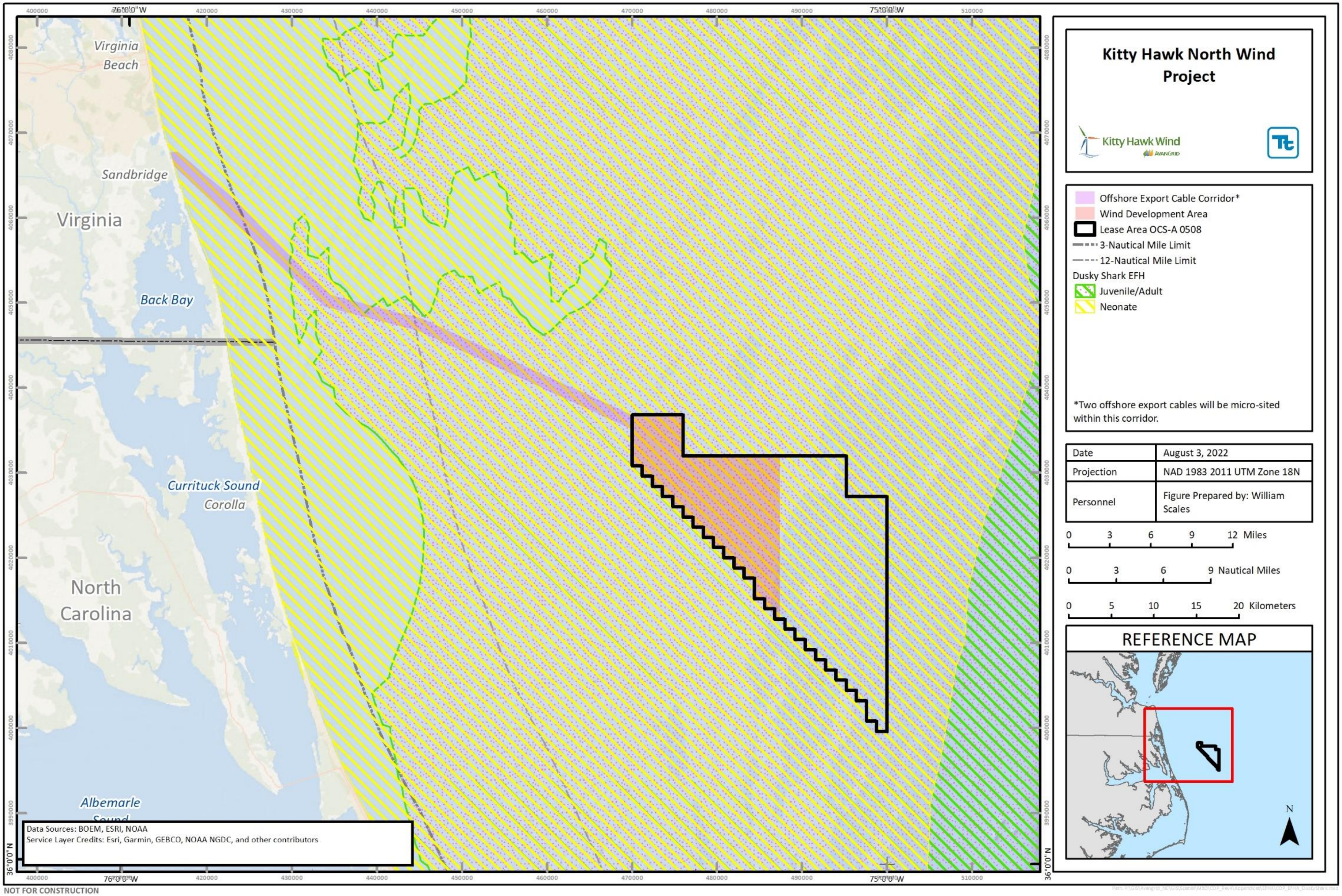


Figure W-1-33. Dusky Shark (*Carcharhinus obscurus*) Designated EFH in the Review Area

W-1.2.33 Sand Tiger Shark (*Carcharhinus taurus*)

EFH for all life stages of the sand tiger shark is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-34; Figure W-1-34).

Neonate, YOY, and juvenile EFH is designated from Massachusetts to Florida in nearshore and coastal sound habitats over mud, rocky substrates, and complex natural or artificial reefs in depths of 26 to 46 ft (8 to 14 m), where salinities are within 30 to 31 ppt and temperatures range from 66 to 81°F (19 to 27°C) (NOAA Fisheries 2017). Adult EFH is designated in shallow coastal waters from Delaware Bay to Florida in average depths of 13 ft (4 m), where temperatures range from 63 to 73°F (17 and 23°C) (NOAA Fisheries 2017). The sand tiger shark is a highly migratory species that occurs in tropical and warm temperate coastal waters. Individuals undertake seasonal migrations from northern summer habitats to southern overwintering habitats; male and female distributions are segregated, with males exhibiting stricter north-south migrations and females exhibiting greater inshore-offshore migrations. In North America, females typically give birth to two pups in March and April. Neonates are born in the southern part of the sand tiger shark range and migrate northward to Mid-Atlantic Bight estuarine and coastal sound nursery habitat (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the sand tiger shark on the Atlantic Coast of the U.S. Fishing for the Atlantic angel shark is prohibited in U.S. waters (NOAA Fisheries 2017).

Table W-1-34. Sand Tiger Shark (*Carcharhinus taurus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Neonate/Juvenile	27,782	19,884	4,991
Adult	48,039	19,884	4,991
Percent of Review Area Covered by EFH by Life Stage			
Neonate/Juvenile	0.021%	0.004%	0.002%
Adult	0.028%	0.004%	0.003%
Percent of Total Species EFH Area Covered by Review Area			
Neonate/Juvenile	57.8%	100.0%	100.0%
Adult	100.0%	100.0%	100.0%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

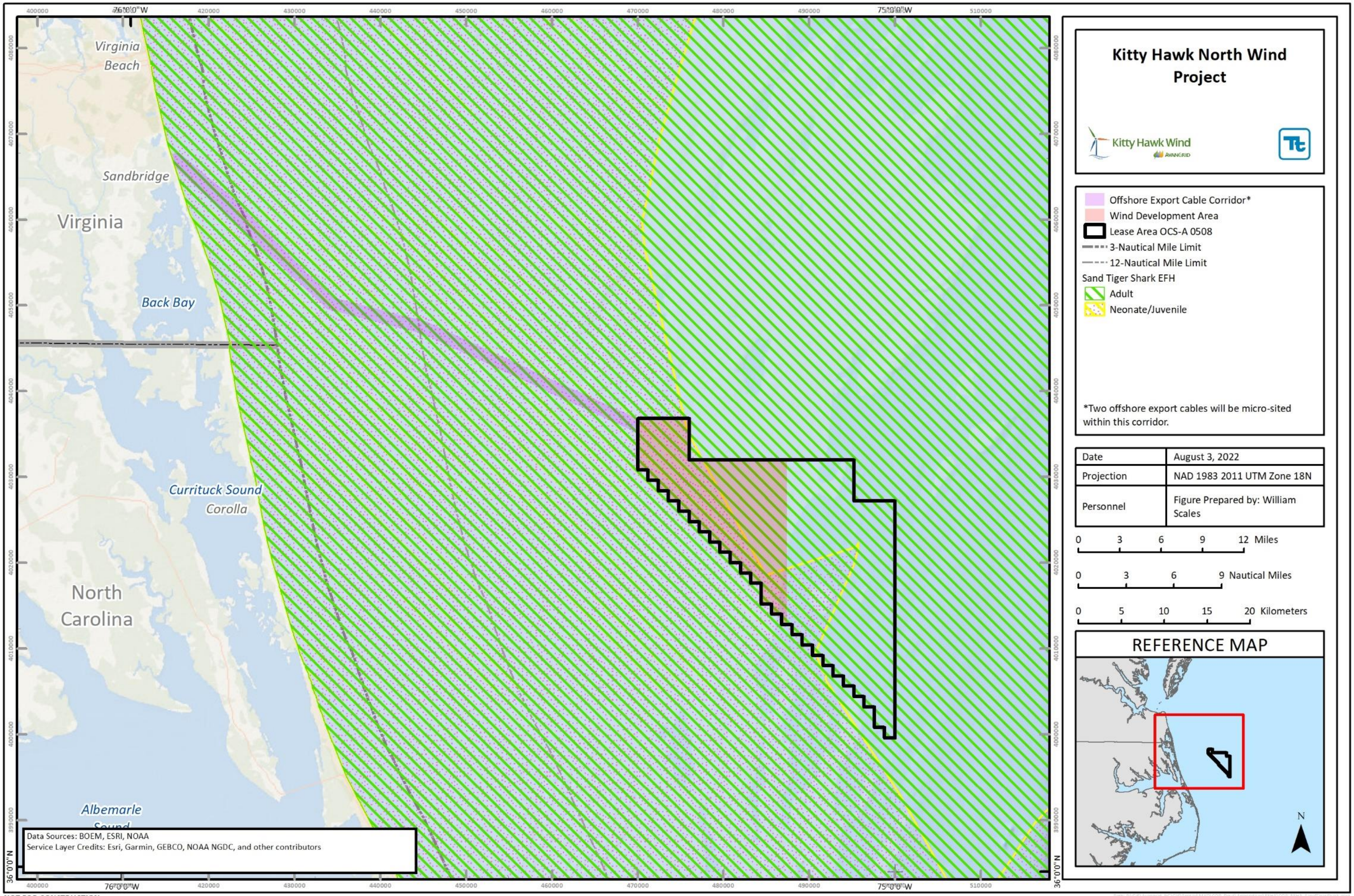


Figure W-1-34. Sand Tiger Shark (*Carcharhinus taurus*) Designated EFH in the Review Area

W-1.2.34 Sandbar Shark (*Carcharhinus plumbeus*)

EFH for sandbar shark neonates is designated in federal and state waters of the offshore export cable corridor. EFH for sandbar shark juveniles and adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-35; Figure W-1-35).

Neonate and YOY EFH is designated in coastal benthic habitats from Long Island, New York, to Cape Lookout, North Carolina, including estuarine nursery habitat in Chesapeake Bay; they occur over sand, mud, shell hash, and rocky substrates in depths of 3 to 75 ft (1 to 23 m), where salinities are within 15 to 35 ppt and temperatures range from 59 to 86°F (15 to 30°C) (NOAA Fisheries 2017). Juvenile EFH is designated in coastal habitats from New England to Georgia, including estuarine habitat in Chesapeake Bay; they occur over sand, mud, shell hash, and rocky substrates in depths of 6 to 20 ft (2 to 236 m), where salinities are within 15 to 35 ppt and temperatures range from 59 to 86°F (15 to 30°C) (NOAA Fisheries 2017). Adult EFH is designated in coastal habitats from New England to the Florida Keys, from estuarine habitats to the continental shelf break in depths of 66 to 646 ft (20 to 200 m) (NOAA Fisheries 2017). The sandbar shark is a highly migratory species that occurs in subtropical and warm temperate benthic habitats. It is common to coastal areas from Cape Cod to the Gulf of Mexico and undertakes seasonal migrations segregated by sex. Individuals feed opportunistically on a variety of fishes, smaller sharks, cephalopods, gastropods, crabs, and shrimp (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the sandbar shark as a single stock on the Atlantic Coast of the U.S.: the Atlantic and Gulf of Mexico stock. The fishery stock is currently overfished but is not subject to overfishing (NOAA Fisheries 2021b).

Table W-1-35. Sandbar Shark (*Carcharhinus plumbeus*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Neonate	0	13,222	4,991
Juvenile	48,039	19,884	4,991
Adult	48,039	19,884	4,986
Percent of Review Area Covered by EFH by Life Stage			
Neonate	0.000%	0.006%	0.004%
Juvenile	0.021%	0.003%	0.002%
Adult	0.007%	0.001%	0.001%
Percent of Total Species EFH Area Covered by Review Area			
Neonate	0.0%	66.5%	100.0%
Juvenile	100.0%	100.0%	100.0%
Adult	100.0%	100.0%	99.9%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

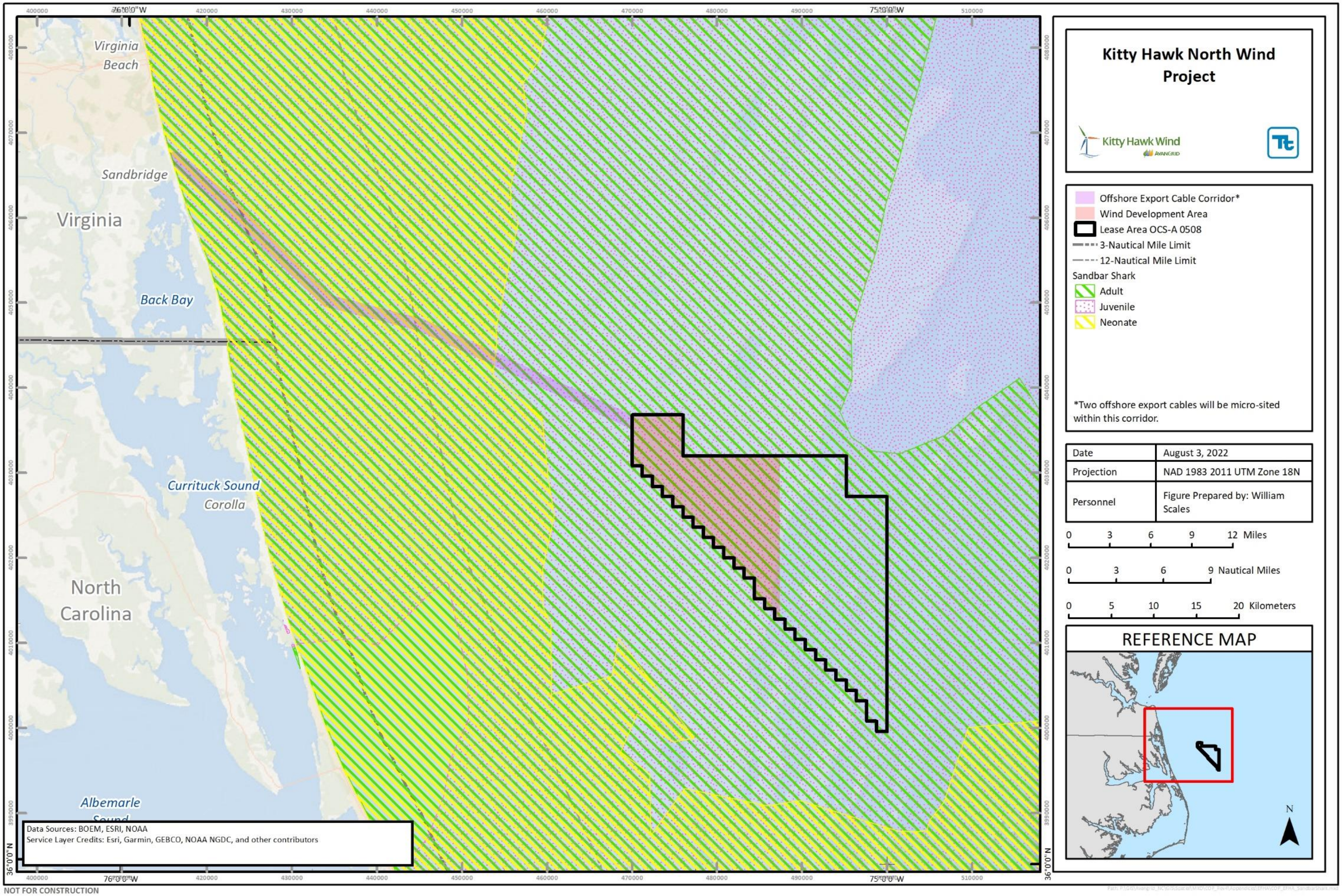


Figure W-1-35. Sandbar Shark (*Carcharhinus plumbeus*) Designated EFH in the Review Area

W-1.2.35 Scalloped Hammerhead Shark *(Sphyrna lewini)*

No EFH for scalloped hammerhead shark neonates is designated in the review area. EFH for scalloped hammerhead shark juveniles and adults is designated in the Wind Development Area and federal waters of the offshore export cable corridor (NOAA Fisheries 2017) (Table W-1-36; Figure W-1-36).

Juvenile and adult EFH is designated in surface waters of coastal habitats from North Carolina to the Florida Keys, including Florida Bay and the Dry Tortugas (NOAA Fisheries 2017). The scalloped hammerhead shark is a large, schooling species that undertakes seasonal north-south migrations. Juveniles reside within nursery habitats for extended periods of time before beginning migrations; while hammerhead sharks use offshore oceanic habitat, they do not regularly roam beyond the continental shelf (NOAA Fisheries 2017). Individuals feed on small schooling fishes (e.g., sardines, conger eels), cephalopods, crustaceans, and smaller sharks.

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the scalloped hammerhead shark as a single stock on the Atlantic Coast of the U.S.: the Atlantic and Gulf of Mexico stock. The fishery stock is currently overfished and subject to continued overfishing (NOAA Fisheries 2021b).

Table W-1-36. Scalloped Hammerhead Shark *(Sphyrna lewini)* Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Juvenile/Adult	48,039	10,583	0
Percent of Review Area Covered by EFH by Life Stage			
Juvenile/Adult	0.009%	0.002%	0.000%
Percent of Total Species EFH Area Covered by Review Area			
Juvenile/Adult	100.0%	53.2%	0.0%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

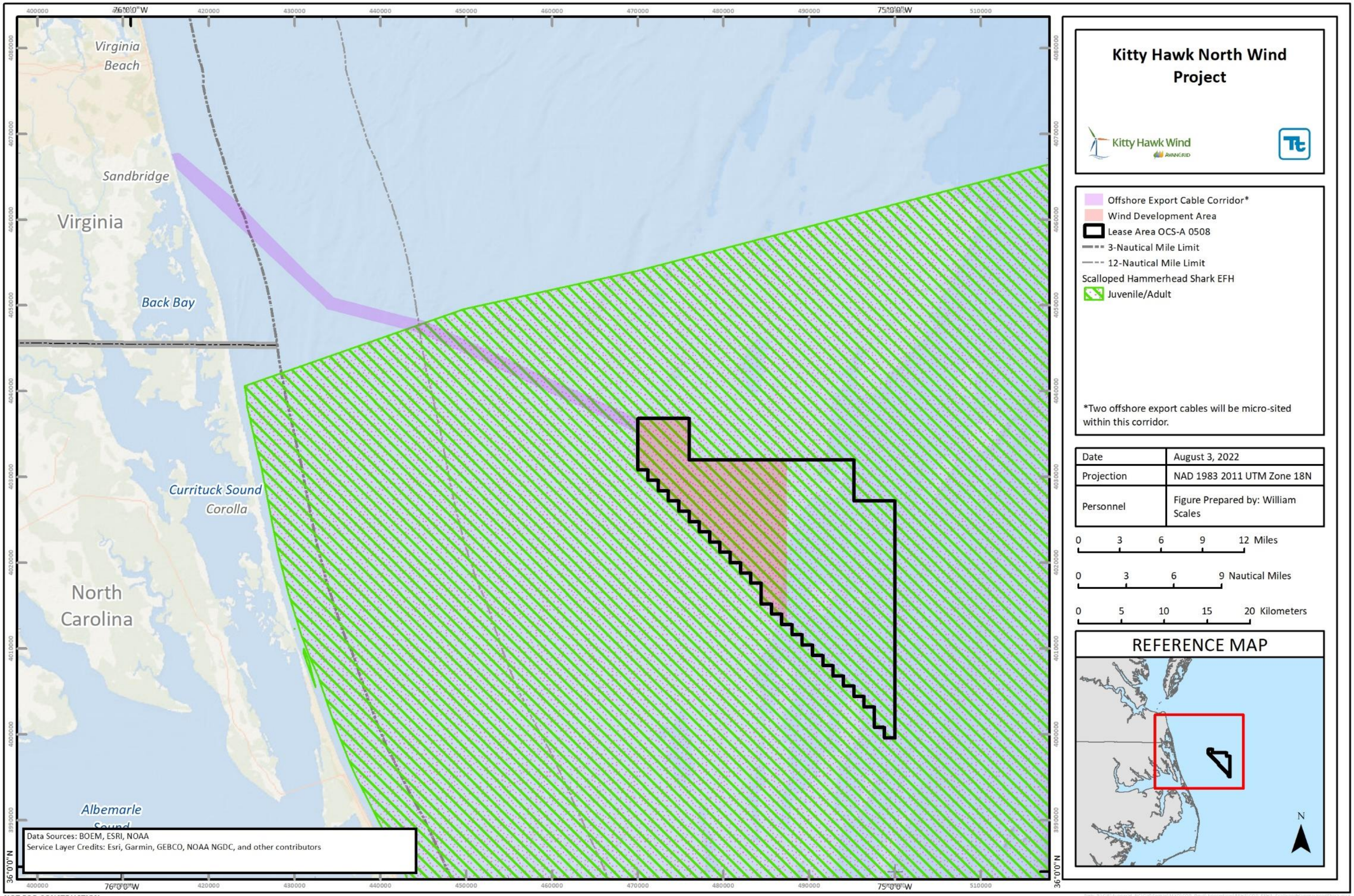


Figure W-1-36. Scalloped Hammerhead Shark *(Sphyrna lewini)* Designated EFH in the Review Area

W-1.2.36 Smoothhound Shark Complex / Smooth Dogfish *(Mustelus canis)*

EFH for all life stages of the smooth dogfish is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-37; Figure W-1-37).

Smooth dogfish EFH is designated in coastal and offshore benthic marine habitats and inshore bays and estuaries from the shoreline to depths of 656 ft (200 m), where temperatures range from 43 to 81°F (6 to 27°C) (NOAA Fisheries 2017). The smooth dogfish is a migratory coastal shark species found in the Atlantic Ocean from Massachusetts to northern Argentina. The species is commonly found in benthic habitats on the continental shelf from offshore North Carolina/Chesapeake Bay overwintering grounds to inshore coastal habitats in spring when bottom temperatures exceed 43°F (6°C) (NOAA Fisheries 2017). Mating occurs from May through September, neonates rear in estuaries and inshore marsh creeks during June and July, and YOY migrate to offshore waters in October. Individuals feed on large crustaceans and small fishes (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the smooth dogfish as a single stock on the Atlantic Coast of the U.S.: the Atlantic stock. The fishery stock is not currently overfished or subject to overfishing (NOAA Fisheries 2021b).

Table W-1-37. Smoothhound Shark / Smooth Dogfish (*Mustelus canis*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
All	48,039	19,884	4,986
Percent of Review Area Covered by EFH by Life Stage			
All	0.029%	0.004%	0.004%
Percent of Total Species EFH Area Covered by Review Area			
All	100.0%	100.0%	99.9%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

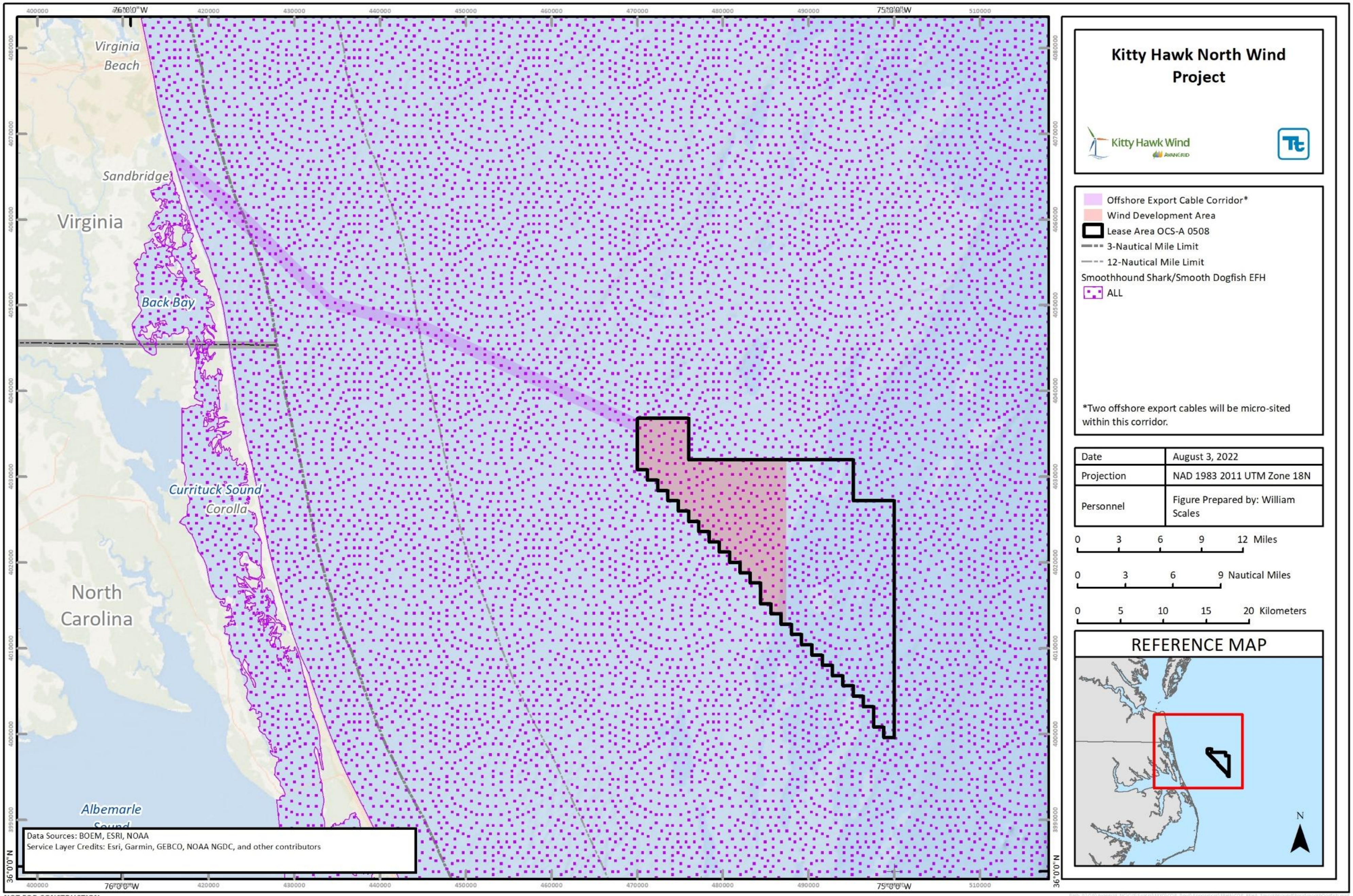


Figure W-1-37. Smoothhound Shark / Smooth Dogfish (*Mustelus canis*) Designated EFH in the Review Area

W-1.2.37 Tiger Shark (*Galeocerdo cuvier*)

EFH for tiger shark neonates is designated in the Wind Development Area. EFH for tiger shark juveniles and adults is designated in the Wind Development Area and federal and state waters of the offshore export cable corridor (Table W-1-38; Figure W-1-38).

Neonate and YOY EFH is designated in coastal areas from the North Carolina/Virginia line to the Florida Keys. Juvenile and adult EFH is designated in offshore pelagic habitats at the continental shelf break; individuals reside in the upper 164 ft (50 m) of the water column but are known to dive to depths greater than 656 ft (200 m) (NOAA Fisheries). The tiger shark is a highly migratory species that occurs in warm waters in shallow coastal and deep pelagic habitats. In the western North Atlantic Ocean, it occurs in coastal and offshore waters from 40°N to the equator and undertakes long distance migrations in pursuit of forage species. Juveniles and adults consume a wide variety of fishes, other sharks, crustaceans, cephalopods, and marine mammals (NOAA Fisheries 2017).

The NOAA Fisheries Consolidated Atlantic HMS FMP manages the tiger shark as a single stock on the Atlantic Coast of the U.S.: the Atlantic and Gulf of Mexico stock. The status of the stock is currently unknown and it is unknown if the stock is subject to overfishing (NOAA Fisheries 2021b).

Table W-1-38. Tiger Shark (*Galeocerdo cuvier*) Designated EFH in the Review Area

Life Stage	Wind Development Area	Offshore Export Cable Corridor	
		Federal Waters	State Waters
Total Acreage	48,039	19,884	4,991
EFH Acreage in Review Area by Life Stage			
Neonate	5,793	0	0
Juvenile/Adult	48,039	19,884	4,986
Percent of Review Area Covered by EFH by Life Stage			
Neonate	0.005%	0.000%	0.000%
Juvenile/Adult	0.006%	0.001%	0.001%
Percent of Total Species EFH Area Covered by Review Area			
Neonate	12.1%	0.0%	0.0%
Juvenile/Adult	100.0%	100.0%	99.9%
Sources: NOAA Fisheries 2021a; NOAA Fisheries 2017			

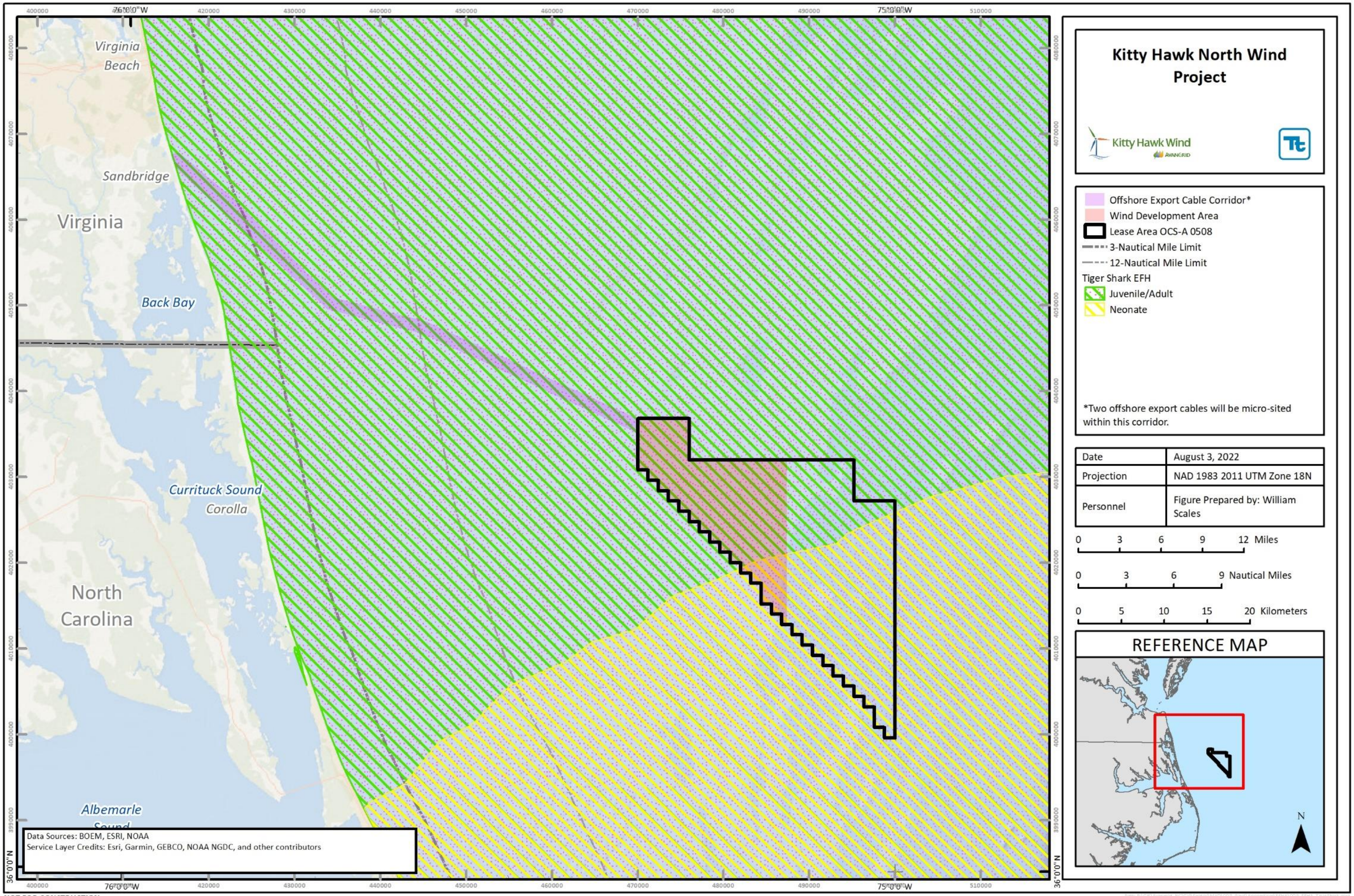


Figure W-1-38. Tiger Shark (*Galeocerdo cuvier*) Designated EFH in the Review Area

W-1.3 REFERENCES

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Attachment W-2
Oversized Tables

Construction and Operations Plan
Kitty Hawk North Wind Project
Lease Area OCS-A 0508

Attachment W-2
Oversized Tables

Prepared for:

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TABLES

Table W-2-1. Summary of Designated EFH for Managed Species and Life Stages in the Review Area W-2-1
Table W-2-2. Summary of Potential Impacts to Managed Species and Life Stages in the Review Area W-2-7

Table W-2-1. Summary of Designated EFH for Managed Species and Life Stages in the Review Area

Species	Stock Status a/	Life Stage	Depth (meters) b/	Habitat Type and Description b/	Typical Prey b/
Atlantic cod	1,2	Egg	0-70	Epipelagic; bays, estuaries, and upper 10m of continental shelf water column	n/a
		Larva	0-75	Epipelagic; bays, estuaries, and upper 75m of continental shelf water column	Plankon
Atlantic herring	1	Juveniles	0-300	Epipelagic; bays, estuaries, and intertidal and subtidal pelagic habitats	Zooplankton including copepods, decapod larvae, barnacle larvae, cladocerans, and mollusk larvae
		Adults			Euphausiides, chaetognaths, and copepods
Atlantic sea scallop	3	Eggs	18-110	Benthic; inshore and continental shelf habitats in the vicinity of adult scallops	n/a
		Larvae	Upper 10m of water column	Pelagic; inshore and offshore habitat until settling as spat on gravel, pebbles, shells, macroalgae, and other seafloor surfaces	Phytoplankton and microzooplankton
		Juveniles	18-110	Benthic; attached to gravel, pebble, cobbles, and shells until losing their byssal threads and becoming active swimmers	
		Adults	18-110	Benthic; seafloor habitats with sand and gravel substrates	
Clearnose skate	3	Juveniles	0-300	Benthic; bays, estuaries, and subtidal benthic habitats on coastal and inner continental shelf	Polychaetes, amphipods, mantis and mysid shrimps, crabs, squid, and fishes
		Adults			
Monkfish	3	Eggs	0-1,000	Pelagic in mucoidal egg veils	n/a
		Larvae	0-1,000	Pelagic; inshore areas and on continental shelf and slope	Zooplankton, including copepods, crustacean larvae, and chaetognaths
		Juveniles	20-400	Benthic; subtidal benthic habitats over soft mud, sand, gravel, pebbles, shell fragments, and rock outcroppings with attached algae	Small fishes, red shrimp, and squid

Species	Stock Status a/	Life Stage	Depth (meters) b/	Habitat Type and Description b/	Typical Prey b/
		Adults	0-800	Benthic; subtidal bethic habitats over soft mud, sand, gravel, pebbles, and shell fragments	Benthic and pelagic crustaceans, squid, and fishes
Pollock	3	Larva	30-1,250	Pelagic; bays, estuaries, inshore and offshore habitats	Copepods
Red hake	1,2	Adults	5-750	Benthic; bays, estuaries, outer continental shelf on depressions in soft mud and sand	Crustaceans, demersal and pelagic fish, squid
Windowpane flounder	3	Eggs	0-70	Pelagic; bays, estuaries, pelagic habitat	n/a
		Larvae			Plankton
		Juveniles	0-75	Benthic; intertidal and sub-tidal benthic habitats in estuaries, bays, and continental shelf over mud and sand substrates	Small crustaceans and fish larvae
		Adults			
Winter skate	3	Juveniles	0-371	Benthic; estuaries, bays, and subtidal benthic habitats on continental shelf	Polychaetes, amphipods, decapods, isopods, bivalves, and fishes
Witch flounder	1	Egg	10-170	Epipelagic; surface waters over continental shelf	n/a
		Larvae	0-250	Pelagic; continental shelf	Pelagic prey
Yellowtail flounder	3	Larvae	10-1,250	Pelagic; estuaries, bays, and upper 20m of coastal and continental shelf habitats	Plankton
Atlantic butterfish	3	Eggs	0-1500	Epipelagic; estuaries, bays, and upper 200m of water column over continental shelf and slope	n/a
		Larvae	0-1,750		Plankton
		Juveniles	10-330	Pelagic; estuaries, bays, and inner and outer continental shelf	Thaliaceans, mollusks, crustaceans, coelenterates, polychaetes, small fishes, and ctenophores
		Adults	0-420		
Atlantic mackerel	1, 2	Juveniles	0-320	Pelagic; estuaries, bays, and continental shelf	Copepods, amphipods, mysid shrimp, decapods
		Adults	0-380		
	3	Juveniles	8-66		Plankton

Species	Stock Status a/	Life Stage	Depth (meters) b/	Habitat Type and Description b/	Typical Prey b/
Atlantic surfclam		Adults		Benthic; softbottom substrates to depths of 1m below sediment/water interface	
Black sea bass	3	Larvae	0-2,000	Epipelagic; estuaries and in the upper 100m of water column over continental shelf	Decapods
		Juveniles	0-400	Benthic; estuaries and continental shelf	Benthic and epibenthic crustaceans and small fishes
		Adults	20-400		Epibenthic invertebrates, small fishes, and squid
Bluefish	1	Eggs	30-70	Pelagic; continental shelf	n/a
		Larvae			Copepods
		Juveniles	5-20	Pelagic; estuaries and continental shelf	Fishes, crustaceans, and polychaetes
		Adults	Varies		
Longfin inshore squid	4	Eggs	0-50	Benthic; anchored to hardbottom on shells, rocks, boulders, vegetation, sand and mud	n/a
		Juveniles	50-100	Pelagic; coastal inshore waters and offshore continental shelf waters	Euphausiids, arrow worms, small crabs, polychaetes, and shrimp
		Adults	6-200	Pelagic; regional embayments, costal inshore and offshore continental shelf waters	Larval and juvenile fish and squid, adult fishes and squid
Northern shortfin squid	3	Juveniles	40-400	Pelagic; continental shelf and slope	Euphausiids
Scup	3	Juveniles	0-38	Benthic; estuaries, intertidal and subtidal habitats over continental shelf	Polychaetes, epibenthic amphipods, other crustaceans, mollusks, and fish eggs and larvae
		Adults	2-38	Benthic; estuaries, intertidal and subtidal habitats over continental shelf	Polychaetes, mollusks, small squid, detritus, insect larvae, hydroids, sand dollars, and small fishes
Spiny dogfish	3	Sub-adult females; Adult males and females	25-364	Epibenthic and pelagic; outer continental shelf	Fishes, squid, and ctenophores

Species	Stock Status a/	Life Stage	Depth (meters) b/	Habitat Type and Description b/	Typical Prey b/
Summer flounder	3	Eggs	9-110	Pelagic	n/a
		Larvae	9-70	Pelagic	Plankton, copepods
		Juveniles	0-152	Benthic; estuaries, salt marshes, seagrasses, mudflats, bays	Polychaetes, infaunal invertebrates, bivalve siphons, small fish
		Adults	0-152	Benthic; shallow coastal and estuarine waters to offshore outer continental shelf	Fishes and invertebrates
Snapper grouper management unit	Varied	All	0-610	Bethic; estuarine, nearshore, continental shelf habitats over coral reefs, hardbottom, live bottom, submerged aquatic vegetation, and artificial reefs	Varies by species
Spiny lobster	3	All	Varies	Benthic; shallow subtidal and continental shelf benthic habitats over softbottom, coral, hardbottom, live bottom, sponges, algal communities, and mangroves	Varies by species
Atlantic albacore tuna	3	Juveniles	Varied	Epipelagic; offshore seaward of the continental shelf	Fishes and cephalopods
Atlantic angel shark	4	All	Varied	Benthic; continental shelf	Bony fishes, cephalopods, crustaceans, and portunid crabs
Atlantic bluefin tuna	4	Eggs; Larvae	20-100	Epipelagic; continental shelf	Plankton
		Juveniles	20-100	Epipelagic; coastal and pelagic habitats to the continental shelf break	Zooplanktivorous fishes and crustaceans
		Adults			Fishes, cephalopods, benthic invertebrates
Atlantic sharpnose shark	3	Juveniles	0-180m	Estuarine, inshore, and nearshore waters	Bony fishes
		Adults			
	4	Juveniles	>20		Fishes, cephalopods, and crustaceans

Species	Stock Status a/	Life Stage	Depth (meters) b/	Habitat Type and Description b/	Typical Prey b/
Atlantic skipjack tuna		Adults		Epipelagic; coastal and offshore habitats	
Atlantic yellowfin tuna	3	Juveniles	Upper 100m of water column	Epipelagic; coastal and offshore pelagic habitats seaward of the continental shelf break	Fishes, cephalopods, and crustaceans
Blacktip shark	3	Juveniles; Adults	1-9	Epipelagic; offshore surface waters and shallow coastal waters over silt, sand, mud, and seagrass habitats	Fishes, cephalopods, and crustaceans
Common thresher shark	4	All	5-13	Pelagic; nearshore	Invertebrates and small fishes
Dusky shark	1, 2	Neonates	4-60	Pelagic; offshore	Demersal and pelagic fishes and cephalopods
		Juveniles; Adults	20-200	Pelagic; coastal, inshore of the continental shelf break	
Sand tiger shark	4	Neonates; Juveniles	8-14	Bays and coastal sounds over mud, rocky substrates, and complex habitat	Fishes, crabs, and cephalopods
		Adults	1-4	Shallow coastal waters	
Sandbar shark	1	Neonates	1-23	Benthic; coastal and estuarine habitats over sand, mud, shell, and rocky substrates	Fishes, smaller sharks, cephalopods, gastropods, crabs, and shrimp
		Juveniles	1-236	Pelagic; coastal and estuarine habitats over sand, mud, shell, and rocky substrates	
		Adults	20-200	Benthic; coastal, estuarine, and shelf break habitats	
Scalloped hammerhead shark	1,2	Juveniles; Adults	Surface waters	Epipelagic; coastal marine habitats	Small schooling fishes, cephalopods, crustaceans, and smaller sharks
Smoothhound shark / smooth dogfish	3	All	0-200	Benthic; coastal and continental shelf, inshore bays and estuaries	Large crustaceans and small fishes

Species	Stock Status a/	Life Stage	Depth (meters) b/	Habitat Type and Description b/	Typical Prey b/
Tiger Shark	4	Neonates	0-50	Epipelagic; coastal and offshore pelagic habitats at the contientnal shelf break	Fishes, crustaceans, cephalopods, and marine mammals
		Juveniles; Adults	0-200	Epipelagic; shallow coastal and deep pelagic habitats at the continental shelf break	Fishes, other sharks, crustaceans, cephalopods, and marine mammals

a/ NOAA Fisheries Stock Status Update as of Q2 2021; 1=overfished; 2=overfishing; 3=recovered; 4=not mentioned
b/ See EFH Source documents listed in Attachment W-1.

Table W-2-2. Summary of Potential Impacts to Managed Species and Life Stages in the Review Area

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Atlantic Cod (*Gadus morhua*)	--	X	--	--	X	X	--	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Eggs and larvae are pelagic and have a minimal chance of entrainment.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									Eggs and larvae are pelagic.
Atlantic Herring (*Clupea harengus*)	--	--	X	X	--	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Juveniles and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									The Project would not affect pelagic prey or habitat.
Atlantic Sea Scallop (*Placopecten magellanicus*)	X	X	X	X	X	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration	✓	✓	✓	✓	✓	✓	✓	✓	Demersal eggs, settled spat, sessile juveniles, and adults with limited mobility could be disturbed, injured, or crushed by direct contact with construction equipment. Sessile life stages could also be buried by sediment deposition. All life stages could be adversely affected by impact pile driving.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat	✓	+	+	✓	✓	+	+	✓	Eggs settled on hard structure may be less viable than those settled on unconsolidated natural substrate, while spat and juveniles may benefit from increased hardbottom available for settlement. Adults would be displaced laterally to adjacent softbottom. No changes are expected to pelagic prey.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Clearnose Skate (*Raja eglanteria*)	--	n/a	X	X	--	n/a	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration			✓	✓			✓	✓	Juveniles and adults could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because these life stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			✓	✓			✓	✓	Juveniles, adults, and demersal prey would be displaced by novel structure laterally to adjacent softbottom.
Monkfish (*Lophius americaus*)	X	X	X	--	X	X	--	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration			✓					✓	Eggs and larvae are pelagic and have a minimal chance of entrainment. Juveniles in the Wind Development Area and adults in the Offshore Export Cable Corridor could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because these life stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+					+	Juveniles and adults are known to forage on the edge of complex reef habitat and may benefit from the introduction of novel structure.
Pollock (*Pollachius virens*)	--	--	--	--	--	X	--	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Larvae are pelagic and have a minimal chance of entrainment.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									Larvae are pelagic.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Red Hake (*Urophycis chuss*)	--	--	--	X	--	--	--	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration				✓				✓	Adults could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because adults are mobile and EFH for this life stage only intersects with the southern edge of the Wind Development Area.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat				+				+	Adults are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.
Windowpane Flounder (*Scophthalmus aquosus*)	X	--	X	X	X	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration			✓	✓			✓	✓	Eggs and larvae are pelagic and have a minimal chance of entrainment. Juveniles and adults could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because these life stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			✓	✓			✓	✓	Juveniles, adults, and demersal prey would be displaced by novel structure laterally to adjacent softbottom.
Winter Skate (*Leucoraja ocellata*)	--	n/a	--	--	--	n/a	X	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration							✓		Juveniles could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because juveniles stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat							✓		Juveniles and demersal prey would be displaced by novel structure laterally to adjacent softbottom.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Witch Flounder (*Glyptocephalus cynoglossus*)	--	X	--	--	X	X	--	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Eggs and larvae are pelagic and have a minimal chance of entrainment.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									Eggs and larvae are pelagic.
Yellowtail Flounder (*Limanda ferruginea*)	--	X	--	--	--	X	--	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Larvae are pelagic and have a minimal chance of entrainment.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									Larvae are pelagic.
Atlantic Butterfish (*Peprilus triacanthus*)	X	X	X	X	X	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Eggs and larvae are pelagic and have a minimal chance of entrainment. Juveniles and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									The Project would not affect pelagic prey or habitat.
Atlantic Mackerel (*Scomber scombrus*)	--	--	X	X	--	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Juveniles and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									The Project would not affect pelagic prey or habitat.
Atlantic Surfclam (*Spisula solidissima*)	--	--	X	X	--	--	X	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration			✓	✓			✓	✓	Juveniles and adults buried in unconsolidated sediments could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			✓	✓			✓	✓	Juveniles and adults would be displaced by novel structure laterally to adjacent softbottom.
Black Sea Bass (*Centropristis striata*)	--	X	X	X	--	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment deposition; entrainment; noise and vibration			✓	✓			✓	✓	Larvae are pelagic and have minimal chance of etrainment. Juveniles and adults could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because these life stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+	+			+	+	Juveniles and adults are heavily structure-associated and exhibit strong site fidelity. They may benefit from the introduction of novel structure.
Bluefish (*Pomatomus saltatrix*)	X	X	X	X	X	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Eggs and larvae are pelagic and have a minimal chance of entrainment. Juveniles and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									The Project would not affect pelagic prey or habitat.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Longfin Inshore Squid (*Doryteuthis [Amerigo] pealeii*)	--	--	X	X	X	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration					✓				Benthic eggs could be disturbed, injured, or crushed by direct contact with construction equipment. They could also be buried by sediment deposition. Juveniles and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat					+				Eggs are attached to hard substrates and may benefit from increased hardbottom available for attachment.
Northern Shortfin Squid (*Illex illecebrosus*)	--	--	X	--	--	--	--	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Larvae are pelagic and have minimal chance of entrainment.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat									The Project would not affect pelagic habitat.
Scup (*Stenotomus chrysops*)	--	--	X	X	--	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration			✓	✓			✓	✓	Juveniles and adults could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because these life stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+	+			+	+	Juveniles and adults are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Spiny Dogfish (*Squalus acanthias*)	n/a	--	--	X	n/a	--	--	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Sub- females and adult males and females are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat				+				+	Sub-females and adult males and females are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.
Summer Flounder (*Paralichthys dentatus*)	X	X	X	X	X	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration			✓	✓			✓	✓	Eggs and larvae are pelagic and have a minimal chance of entrainment. Juveniles and adults could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because these life stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			✓	✓			✓	✓	Juveniles, adults, and demersal prey would be displaced by novel structure laterally to adjacent softbottom.
Snapper Grouper (Epinephelidae; Lutjanidae)	X	X	X	X	X	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration			✓	✓			✓	✓	Eggs and larvae are pelagic and have a minimal chance of entrainment. Juveniles and adults could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because these life stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+	+			+	+	Juveniles and adults are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.
Spiny Lobster (Palinuridae)	X	X	X	X	X	X	X	X	

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration			✓	✓			✓	✓	Eggs and larvae are pelagic and have a minimal chance of entrainment. Juveniles and adults could be disturbed, injured, or crushed by direct contact with construction equipment or indirect contact with noise and vibration. Impacts would be minimal because these life stages are mobile and can avoid injury. Demersal prey may also be injured or temporarily displaced.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+	+			+	+	Juveniles and adults are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.
Albacore Tuna (*Thunnus alalonga*)	--	--	X	--	--	--	X	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Juveniles are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+				+		Juveniles are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.
Atlantic Angel Shark (*Squatina dumeril*)	n/a	X	X	X	n/a	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									All life stages are highly mobile and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat		+	+	+		+	+	+	All life stages are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Atlantic Bluefin Tuna (*Thunnus thynnus*)	X	X	X	X	X	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Eggs and larvae are pelagic and have a minimal chance of entrainment. Juveniles, and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+	+			+	+	The Project would not affect egg or larval pelagic habitat. Juveniles and adults are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.
Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*)	n/a	--	--	X	n/a	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Juveniles and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat				+			+	+	Juveniles and adults are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.
Atlantic Skipjack Tuna (*Katsuwonus pelamis*)	--	--	X	X	--	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Juveniles and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+	+			+	+	Juveniles and adults are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Atlantic Yellowfin Tuna (*Thunnus albacares*)	--	--	X	--	--	--	X	--	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Juveniles are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+				+		Juveniles are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.
Blacktip Shark (*Carcharhinus limbatus*)	--	--	--	--	--	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									Juveniles and adults are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat							+	+	Juveniles and adults are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.
Common Thresher Shark (*Alopias vulpinus*)	n/a	X	X	X	n/a	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									All life stages are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat		+	+	+		+	+	+	All life stages are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.
Dusky Shark (*Carcharhinus obscurus*)	n/a	X	X	X	n/a	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									All life stages are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Operations: Loss of softbottom habitat; introduction of hardbottom habitat		+	+	+		+	+	+	All life stages are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.
Sand Tiger Shark (*Carcharhinus taursu*)	n/a	X	X	X	n/a	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									All life stages are highly mobile and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat		+	+	+		+	+	+	All life stages are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.
Sandbar Shark (*Carcharhinus plumbeus*)	n/a	--	X	X	n/a	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									All life stages are highly mobile and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+	+		+	+	+	All life stages are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.
Scalloped Hammerhead Shark (*Sphyrna lewinil*)	n/a	--	X	X	n/a	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									All life stages are highly mobile and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat			+	+			+	+	All life stages are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.

Managed Species	Wind Development Area				Offshore Export Cable Corridor				Supporting Information
	Life Stage								
	E	L	J	A	E	L	J	A	
Smooth Dogfish (*Mustelus canis*)	n/a	X	X	X	n/a	X	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									All life stages are highly mobile and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat		+	+	+		+	+	+	All life stages are known to aggregate around complex reef habitat and may benefit from the introduction of novel structure.
Tiger Shark (*Galeocerda cuvier*)	n/a	X	X	X	n/a	--	X	X	
Construction: Direct disturbance, injury, or mortality of life stage; sediment suspension and deposition; entrainment; noise and vibration									All life stages are pelagic, highly mobile, and can avoid injury due to physical interactions or noise and vibration.
Operations: Loss of softbottom habitat; introduction of hardbottom habitat		+	+	+			+	+	All life stages are known to aggregate around structure in the water column and may benefit from the introduction of novel structure.

Legend:
X: EFH for this life stage is designated in the portion of the Project Area indicated
--: No EFH for this life stage is designated in the portion of the Project Area indicated
n/a: Life stage does not exist
E: Egg
L: Larva (and neonate sharks)
J: Juvenile
A: Adults (and sub-adult female spiny dogfish)
✓: Likely adverse impact
+: Likely beneficial effect
Green: Negligible or no adverse impact