Kitty Hawk Wind

AVANGRID

Construction and Operations Plan

Chapter 7 - Socioeconomic Resources

September 30, 2022

Submitted by
Kitty Hawk Wind, LLC
1125 NW Couch Street, Suite 600
Portland, Oregon 97209

Submitted to
Bureau of Ocean Energy Management
45600 Woodland Road
Sterling, Virginia 20166

Prepared by
Tetra Tech, Inc.
10 Post Office Square, 11th Floor
Boston, Massachusetts 02109

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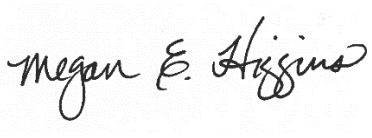
TETRA TECH **September 30, 2022**	 **September 30, 2022**	 **September 30, 2022**

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Description of Revisions			
Rev	**Page**	**Section**	**Description**
01	All	All	Submitted to BOEM
02	All	All	Updated based on BOEM comments and Project updates
03	All	All	Updated based on BOEM comments and Project updates
04	Various	7.6	Updated Aviation and Radar section
05	Various	7.3	Updated Marine Transportation and Navigation section
06	Many	Various	Updated based on BOEM comments and Project updates
07	Many	Various	Updated based on BOEM comments and Project name

Table of Contents

Table of Figures

Table of Tables

Abbreviations & Definitions

Acronym	Definition
ACPARS	Atlantic Coast Port Access Route Study Final Report
AIS	automatic identification system
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
COLREGs	International Regulations for Preventing Collisions at Sea 1972
COP	Construction and Operations Plan
CVOW	Coastal Virginia Offshore Wind
DoD	Department of Defense
EEZ	Exclusive Economic Zone
EMF	electric and magnetic fields
EPA	U.S. Environmental Protection Agency
ESP	electrical service platform
FAA	Federal Aviation Administration
FLO	Fisheries Liaison Officer
FMC	Fishery Management Council
FR	Fisheries Representative
ft	foot
FTE	full-time equivalent
GARFO	Greater Atlantic Regional Fisheries Office
HMS	Highly Migratory Species
kg	kilogram
km	kilometer
km^2	square kilometers
knot	nautical mile per hour
lbs	pounds
Lease Area	designated Renewable Energy Lease Area OCS-A 0508
LNM	Local Notice to Mariners
m	meter
MSA	metropolitan statistical area
NAS	Naval Air Station
NCDMF	North Carolina Division of Marine Fisheries
NEAMAP	Northeast Area Monitoring and Assessment Program

Acronym	Definition
NEFOP	Northeast Fishery Observer Program
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
NVIC	Navigation and Vessel Inspection Circular
O&M	Operations and Maintenance
OCS	Outer Continental Shelf
OPAREA	Operating Area
PDE	Project Design Envelope
Project	the Kitty Hawk North Wind Project
ROW	right-of-way
SAFMC	South Atlantic Fishery Management Council
SAR	search and rescue
the Company	Kitty Hawk Wind, LLC
TSS	Traffic Separation Scheme
U.S.	United States
U.S.C.	United States Code
UK	United Kingdom
USACE	U.S. Army Corps of Engineers
USCG	United States Coast Guard
VACAPES	Offshore Virginia Capes
VFR	Visual Flight Rules
VIMS	Virginia Institute of Marine Science
VMRC	Virginia Marine Resources Commission
VMS	Vessel Monitoring System
VTR	Vessel Trip Report
WEA	Wind Energy Area
Wind Development Area	approximately 40 percent of the Lease Area in the northwest corner closest to shore (19,441 hectares)
WTG	wind turbine generator

7 Socioeconomic Resources

7.1 Recreation and Tourism

This section describes recreation and tourism within and surrounding the Project Area, which includes approximately 40 percent of the designated Renewable Energy Lease Area OCS-A 0508 (Lease Area) in the northwest corner closest to shore (19,441 hectares; the Wind Development Area), export cable corridors, onshore substation, and switching station. Potential impacts to recreation and tourism resulting from construction, operations, and decommissioning of the Kitty Hawk North Wind Project (Project) are discussed. Avoidance and minimization measures proposed by Kitty Hawk Wind, LLC (the Company) are also described in this section.

Other assessments detailed within this Construction and Operations Plan (COP) that are related to recreation and tourism include:

- Visual Resources (Section 6.4);
- Commercial and Recreational Fishing (Section 7.2);
- Other Coastal and Marine Uses (Section 7.7);
- Population, Economy, Employment, and Housing (Section 7.8); and
- Land Transportation and Traffic (Section 7.11).

For the purposes of this section, the review area includes the independent City of Virginia Beach, Virginia, where onshore Project components will be located, and Currituck County and Dare County, North Carolina, from which the wind turbine generators (WTGs) may be partially visible. Uses of ports for construction, staging, and operations and maintenance (O&M) will be consistent with current uses and are not expected to have an impact on recreation and tourism in those locations, except for a potential small increase in Project personnel engaging in recreation activities; therefore, ports are not discussed further in this section. Travel expenditures as described in this section include spending by domestic travelers on goods and services during their trips, such as lodging, transportation, meals, entertainment, and retail shopping (U.S. Travel Association 2015).

This section was prepared in accordance with the Bureau of Ocean Energy Management's (BOEM) *Information Guidelines for a Renewable Energy Construction and Operations Plan* (2020). Data required to complete the socioeconomic effects analysis has been sourced from recreation and tourism data compiled by the states of Virginia and North Carolina.

7.1.1 Affected Environment

Recreation and tourism play a major contributing role in the economy of Virginia Beach, Virginia, as well as the larger coastal regions of southeast Virginia and northeast North Carolina. These regions are known for their beaches, wildlife, and historical attractions, and are most commonly visited during the summer months (City of Virginia Beach 2020; Outer Banks Visitors Bureau 2020). Popular marine recreational activities include surfing, boating, wildlife cruises, and recreational fishing, as well as diving among numerous shipwrecks (see Chapter 5 Biological Resources and 7.2 Commercial and Recreational Fishing for a more detailed discussion of wildlife and recreational fishing, respectively). Onshore activities include beachgoing, golfing, historic tours, horseback riding, and scenic viewing (City of Virginia Beach 2020; Outer Banks Visitors Bureau 2020).

7.1.1.1 Virginia

In 2018, domestic travelers spent more than $25.8 billion on transportation, lodging, food, amusement, recreation, and retail shopping in Virginia. This represents a 4.4 percent increase from 2017 (U.S. Travel

Association 2019a). Virginia's travel and tourism industry is the sixth largest employer among all non-farm industry sectors in Virginia as of 2018. Travelers to Virginia directly supported 234,500 jobs, mostly in food service, lodging, and entertainment and recreation, including full-time and seasonal/part-time positions. Payroll income supported by tourism reached nearly $6.1 billion in 2018, and the industry generated federal, state, and local tax revenue of $3.5 billion (U.S. Travel Association 2019a).

7.1.1.1.1 Virginia Beach

The independent city (i.e., county-equivalent) of Virginia Beach received $1.6 billion from domestic travelers, which accounts for 6.3 percent of the state total. Travel expenditures provided Virginia Beach residents with $301.6 million in payroll income and 14,000 full-time and part-time jobs (U.S. Travel Association 2019a), employing approximately 4 percent of the civilian labor force (ACS 2020).

Virginia Beach is known for its oceanfront, which includes a three-mile boardwalk extending from 2nd to 40th Street (Virginia Beach CVB 2020). It also has a separate bike path that is regularly used for running, rollerblading, and biking. The Virginia Beach Boardwalk features a variety of shopping and dining options. During the summer months, multiple entertainment events are held nightly, and live music is performed at several oceanfront stages (City of Virginia Beach 2020). The area typically receives 19 million domestic visitors annually, as well as 408,000 international visitors (Virginia Beach Economic Development 2018).

Virginia Beach is also home to the Back Bay National Wildlife Refuge, a 3,690 hectare freshwater refuge, which also receives approximately 115,000 visitors annually (USFWS 2010).

Sandbridge is Virginia Beach's southernmost coastal district, located east of the Back Bay National Wildlife Refuge. It is a narrow, beachfront district, separated from the Boardwalk and Town Center districts. In addition to its beaches, Sandbridge is known for quieter attractions such as camping, hiking, and kayaking in Back Bay. It is a popular spot for vacation rentals and condos (City of Virginia Beach 2020).

Parks located within 0.4 kilometer (km) of the onshore export cable corridors include Lago Mar at Back Bay Park, Red Mill Farms North Park, Ocean Lakes East Park, Ocean Lakes North Park, Princess Anne Recreation Center, Strawbridge East Park, Malbon Acres Park, and Dunwoody Park. A homeowner's association park is also located 0.3 km from the Sandbridge route. None of these recreation areas are crossed by the Sandbridge route or western route option export cable installation corridors, which are located entirely within existing rights-of-way (ROWs) for city roads once they reach Nimmo Parkway. Three parks (Red Mill Farms North Park, Ocean Lakes East Park, and Ocean Lakes North Park) border the Sandbridge route along Upton Drive (City of Virginia Beach, n.d.).

Two city parks (Dunwoody Park and Strawbridge East Park) are located within 0.4 km of the onshore substation site, and both have areas of dense trees located between the park and onshore substation site.

7.1.1.2 North Carolina

The State of North Carolina received $25.3 billion in domestic travel expenditures in 2018. Statewide, the travel and tourism industry contributed $3.9 billion to federal, state, and local tax revenue. Tourism spending also led to $6.5 billion in payroll income and 230,600 jobs (U.S. Travel Association 2019b).

7.1.1.2.1 Currituck County

The northernmost county located along North Carolina's coast, Currituck County, includes the northern portion of North Carolina's Outer Banks region. The Outer Banks are a chain of barrier islands off the coast of North Carolina which separate the Atlantic Ocean from the mainland. The region is known for its beaches, marine activities, and intercoastal waterways. It is a popular tourism destination, especially during the summer months (Outer Banks Visitors Bureau 2020). In 2018, domestic travelers spent $243.8 million in Currituck County, which contributed to $45.1 million in payroll and over 2,130 jobs (U.S. Travel Association 2019b) accounting for nearly 8 percent of the employment for the county's more than 27,000 residents (ACS 2020).

7.1.1.2.2 Dare County

Dare County is located just south of Currituck County on the North Carolina coast. It contains the majority of the Outer Banks region, historical attractions including the Roanoke Colony and the Wright Brothers' first flight, as well as historic lighthouses (historic properties are discussed further in Section 6.3 Aboveground Historic Resources). It is the fifth-highest county for tourism expenditures in North Carolina, bringing in $1.19 billion in 2018. These expenditures led to $263.4 million in payroll and 13,550 jobs (U.S. Travel Association 2019b). Tourism employs approximately one-third of Dare County residents (ACS 2020).

7.1.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the Project Design Envelope (PDE, see Chapter 3 Description of Proposed Activity). For this impact analysis, the maximum design scenario is the full build out of the onshore and offshore Project components. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.1.2.1 Construction

During construction, the potential impacts to recreation and tourism may include:

- Short-term impacts to land transportation due to the presence of construction traffic and installation of the onshore export cables;
- Short-term increase in the demand for rental housing due to the presence of temporary workers;
- Short-term displacement of recreation and tourism users due to the construction of the onshore and offshore components;
- Short-term increase in vessel traffic offshore due to the presence of construction vessels; and
- Short-term increase in construction workers recreating during their time off.

Short-term impacts to land transportation due to the presence of construction traffic and installation of the onshore export cables. Construction and support vehicles, as well as vehicles transporting the crews, will travel along local roads in Virginia to reach construction areas associated with the export cable landfall, onshore export cable installation, onshore substation, and switching station. Additionally, installation of the onshore export cables may result in temporary closure of sections of roads or individual lanes within Virginia Beach. Construction activities associated with the export cable landfall will require temporary closure of a parking lot adjacent to Sandbridge Beach. Impacts to local land transportation are expected to be short-term and localized (see Section 7.11 Land Transportation and Traffic for further discussion of these impacts and the Company's proposed mitigation measures). To avoid and minimize impacts to recreation and tourism, onshore construction activities associated with the export cable landfall will be scheduled during the off-peak tourism season, to the extent practicable. The Company will develop a Traffic Management Plan in coordination with local authorities.

Short-term increase in the demand for rental housing due to the presence of temporary workers. A small number of workers are expected to temporarily move to Virginia Beach during the construction of the onshore and offshore Project components (see Section 7.8 Population, Economy, Employment, and Housing). This increased population of workers has the potential to impact the available supply of rental housing. However, as onshore construction activities associated with export cable landfall will be scheduled during the off-peak tourism season, to the extent practicable, Project-related demand for rental housing is unlikely to compete with the majority of tourist rentals. The anticipated increase in workers is therefore unlikely to be greater than the available number of temporary housing units in the area and is not expected to create a shortage of rental housing. On the contrary, increased demand for rental housing during the off-season is expected to have a positive effect on the local tourism economy. Due to the remote distance from shore and the temporary nature of nearshore and onshore construction activities, temporary visibility of

offshore and onshore construction activities is not anticipated to impact the demand for rental housing (see Section 6.4 Visual Resources and Appendix AA Visual Impact Assessment).

Short-term displacement of recreation and tourism users due to the construction of the onshore and offshore components. Safety zones will be implemented around active construction sites, which may displace users of the onshore and offshore areas while Project construction is occurring. The public will be prevented from entering onshore construction zones for safety (see Section 7.12 Health and Safety and Low Probability Events). These safety zones will be temporary, localized, and will be scheduled during the off-peak tourism season, to the extent practicable. Use of horizontal directional drilling to install the export cables at the landfall will also avoid impacts to the coastal environment of Sandbridge Beach. Access to Hell's Point Golf Club, located 0.3 km from the western route option onshore cable corridor (at its nearest point) will not be restricted, as it is also separated by a dense forested area.

Offshore, safety zones will be established, as applicable,[1] surrounding the construction areas of Project components such as foundations, WTGs, the electrical service platform (ESP), and the offshore export and inter-array cables. Where feasible, a minimum advisory safe passing distance for cable laying vessels will be implemented, as per the International Regulations for Preventing Collisions at Sea 1972 (COLREGs). Where United States Coast Guard (USCG) Safety Zone authorities are not applicable, the Company will use safety vessels to promote awareness of these activities and the safety of the construction equipment and personnel. The majority of construction will occur in the Wind Development Area, approximately 44 km offshore. As most offshore recreational activities occur closer to shore, construction in the Wind Development Area is not expected to result in significant impacts to recreational users. Installation of the offshore export cables will be linear, and vessels will not remain in one place for long; therefore, impacts from safety zones and/or minimum advisory safe passing distances will be short-term and localized. The locations of offshore safety zones will be made available in USCG-issued Local Notices to Mariners (LNMs) and posted on the Project website.[2]

Short-term increase in vessel traffic offshore due to the presence of construction vessels. Construction and support vessels will transit to and from the Wind Development Area and offshore export cable corridor, resulting in an increase in vessel traffic. Project-related vessels will originate from existing ports and will follow existing transit lanes as much as practicable. Vessel traffic will therefore be generally consistent with existing uses. With the exception of temporary safety zones that would preclude recreational activity in a given area, there is not anticipated to be impacts to recreation and tourism users (see Section 7.2 Commercial and Recreational Fishing, Section 7.3 Marine Transportation and Navigation, and Appendix BB Navigation Safety Risk Assessment).

Short-term increase in construction workers recreating during their time off. Development of the Project is expected to create 470 jobs in Virginia and North Carolina, with over 300 jobs in the Hampton Roads Region (Appendix EE Economic Impact of Kitty Hawk Offshore Wind). While a portion of the newly created jobs will likely be filled with the local workforce, it is anticipated that there will also be a slight influx of workers relocating to the review area (see Section 7.8 Population, Economy, Employment, and Housing). These workers are expected to engage in recreational activities during their time off, contributing to the local tourism sector.

[1] The William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 authorizes a two-year pilot program under which the USCG may establish safety zones to address special activities in the exclusive economic zone, including offshore energy development activities on or near a fixed platform. Project construction is not anticipated to begin within two years of the passage of the Act; however, the authority may be extended or made permanent. The Company will continue to monitor the results of this pilot program and any implementing regulations to determine where safety zones may be applicable during Project construction. Where applicable, safety zones will extend up to 500 m around construction sites, per 33 CFR § 147.15. All areas will be lit and marked in accordance with USCG requirements and monitored by a safety vessel that will be available to assist local mariners.

[2] https://www.kittyhawkoffshore.com.

7.1.2.2 Operations and Maintenance

During operations, the potential impacts to recreation and tourism may include:

- Modification of existing uses due to the presence of new fixed structures offshore;
- Increase in tourism, including recreational fishing, due to presence of WTGs;
- Long-term change in demand for rental properties; and
- Long-term presence of operations personnel contributing to the tourism industry.

The onshore export cables are sited within existing ROWs to the extent practicable and will be located either underground or mounted on utility poles. The onshore substation and switching station are sited within a business park in a light industrial zone (see Section 7.10 Land Use and Zoning) that is not typically used for recreation and tourism. Therefore, no long-term impacts to recreation and tourism are expected from the presence of onshore Project components.

Modification of existing uses due to the presence of new fixed structures offshore. The long-term presence of WTGs and the ESP may impact navigation within the Wind Development Area. As most offshore recreation occurs much closer to shore, the presence of these structures is not expected to result in significant impacts to recreational users (see Appendix BB Navigation Safety Risk Assessment). In fact, scour protection placements within the Wind Development Area will create new hardbottom habitat that may attract new species of marine life. This has the potential to increase recreational fishing opportunities in the area. Recreational users will not be excluded from using the area and existing recreational uses will be able to continue within the area. See Section 7.2 Commercial and Recreational Fishing.

Increase in tourism, including recreational fishing, due to the presence of WTGs. The presence of new fixed structures within the Wind Development Area also has the potential to attract new marine users visiting the area as a tourist attraction. For example, this has been observed at the Block Island Wind Farm, an operation of just five WTGs. As a result of the WTGs offshore of Block Island, tourism to the island increased, boat charters and rentals increased, and new businesses have emerged to support new tourist demand (Brookins 2017). This increase in recreation and tourism has brought economic benefits to Block Island, as tourists pay for boat tours to see the offshore wind farm (Lilley et al. 2010). Similarly, a study of projected offshore wind facilities in New Jersey predicted that a wind facility located 32 km offshore would increase tourism sales by up to $65 million statewide (Global Insight 2008). See Section 7.2 Commercial and Recreational Fishing.

Long-term change in demand for rental properties. The WTGs will be partially visible from certain vantage points within North Carolina but will not dominate the visual landscape given the distance of 44 km of the Wind Development Area from shore. Even at beach locations, the WTGs will be at the limit of casual visibility and are likely to remain unnoticed by the casual observer (see Section 6.4 Visual Resources and Appendix AA Visual Impact Assessment). The WTGs, and the ESP as applicable, will be lit and marked in accordance with USCG and Federal Aviation Administration (FAA) standards for aviation and navigation obstruction lighting, and may be visible along the coastline.

With regard to property values, a 2017 study found that offshore wind farms had a minimal effect on vacation rental values when located more than eight miles offshore (Lutzeyer et al. 2017). Another study predicted that property values would remain constant or increase slightly with the installation of a wind facility 32 km offshore (Global Insight 2008). Negative impacts on rental property values are not anticipated during the operations phase, and it is estimated that the Project may have positive impacts on rental property values (see also Section 7.8 Population, Economy, Employment, and Housing).

Long-term presence of operations personnel contributing to the tourism industry. The Project is expected to lead to the creation of 409 jobs annually across Virginia and North Carolina (85 full-time direct jobs, plus 324 indirect jobs) to support O&M of both the offshore and onshore components. Of these, 366 jobs will be located in the Hampton Roads region (Appendix EE Economic Impact of Kitty Hawk Offshore

Wind).Many of these workers are expected to engage in recreational activities during their time off, providing benefits to the local economy.

7.1.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.2 Commercial and Recreational Fishing

This section describes the commercial and recreational fishing conducted and the commercial and recreational fishing resources present within and surrounding the offshore Project Area, which includes the Wind Development Area and offshore export cable corridor. Potential impacts to commercial and recreational fishing resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP that are related to commercial and recreational fishing activity include:

- Physical and Oceanographic Conditions (Section 4.1);
- Water Quality (Section 4.2);
- Underwater Acoustic Environment (Section 4.5);
- Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat (Section 5.4);
- Recreation and Tourism (Section 7.1);
- Marine Transportation and Navigation (Section 7.3);
- Essential Fish Habitat Assessment (Appendix W); and
- Navigation Safety Risk Assessment (Appendix BB).

For the purposes of this section, the review area includes the offshore areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project. Additionally, the review area is intended to capture the fisheries that also have the potential to be impacted by the Project.

Following an extensive literature review, oral history collection, and data analysis, the Company can confirm that the Project is exceptionally well sited from a fisheries perspective. The Wind Development Area is inshore of the most intensive trawl fisheries and offshore and north of other relatively intensive commercial fisheries. It is also outside of the route most heavily transited by the Highly Migratory Species (HMS) charter, private, and commercial fleets based in Oregon Inlet, North Carolina.

The Lease Area was sited by a joint state/federal taskforce, which took input from the North Carolina Division of Marine Fisheries (NCDMF) regarding fisheries. The Lease Area is significantly smaller than the Call Area identified by BOEM (BOEM 2015). The size of the Lease Area was reduced by this state/federal taskforce due to stakeholder concerns over viewshed resources, shipping industry concerns, and reflecting input from fisheries. After the Lease was acquired, the Company also sought input from fisheries stakeholders to receive information on fisheries uses, resources, concerns, and issues within the Lease Area. Most potential impacts between both commercial and recreational fishing and offshore wind development are avoided in the Project due to its strategic location. The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) is responsible for managing both marine and anadromous fisheries resources within the United States (U.S.) Exclusive Economic Zone (EEZ). The EEZ is a marine area that generally extends from 3 to 200 nautical miles (nm, 5.6 to 370.4 km) off the coast of the U.S. Individual state agencies are responsible for fisheries management from their coastline out to 3 nm (5.6 km). NOAA Fisheries works with other federal, regional, state, and territorial agencies to promote the sustainable management of U.S. fisheries within the EEZ.

In federal waters, most fisheries resources are managed under the Magnuson-Stevens Fisheries Conservation and Management Act (16 United States Code [U.S.C.] §§ 1801 *et seq*.) through eight Regional Fishery Management Councils (FMCs). The FMCs then develop species-specific or multispecies Fisheries Management Plans. These Fisheries Management Plans establish fishing quotas, seasons, and closure areas, as well as protect critical habitat such as Essential Fish Habitat. The Regional FMCs work in conjunction with NOAA Fisheries to assess and predict the status of fish stocks, set catch limits, promote compliance with fisheries regulations, and reduce bycatch. The South Atlantic Fishery Management Council

(SAFMC) holds regulations for species present in the review area and monitors Fisheries Management Plans for habitat and ecosystem-based management in the vicinity of the Wind Development Area and offshore export cable corridor. Dolphin/wahoo (*Acanthocybium solandri*), shrimp (*Caridea*), snapper (*Lutjanidae*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), and grouper (*Epinephenlinae*) are all managed by the SAFMC.

Summer flounder (*Parelichthys dentatus*), bluefish (*Pomatomus saltatrix*) and black sea bass (*Centropristis striata*) are jointly managed between the Mid-Atlantic Fishery Management Council and the Atlantic States Marine Fisheries Commission. Spiny dogfish (*Squalus acanthias*) and monkfish (*Lophius americanus*) are jointly managed by the New England Fishery Management Council and the Mid-Atlantic Fishery Management Council. The Mid-Atlantic Fishery Management Council also manages Atlantic mackerel (*Scomber scombrus*), squid, and butterfish (*Peprilus triacanthus*).

The NOAA Fisheries Office of Sustainable Fisheries, Atlantic Highly Migratory Species Management Division is responsible for tunas (*Thunnini)*, sharks (*Selachimorpha*), swordfish (*Xiphias gladius*), billfish (*Istiophoridae*), and other migratory, pelagic species that travel long distances across domestic and international boundaries in the Atlantic Ocean, Gulf of Mexico, and Caribbean waters (NOAA Fisheries 2017). The Highly Migratory Species Division also liaises with international agencies such as the International Commission for the Conservation of Atlantic Tunas, which is responsible for the conservation of tunas and other highly migratory, pan-Atlantic species (such as billfish) in the Atlantic Ocean and adjacent seas. The FMC management areas are depicted in Figure 7.2-1. As shown in Figure 7.2-1, the review area sits over two summer flounder sea turtle protection areas. A complete list of managed species with Essential Fish Habitat in the review area is provided in Appendix W Essential Fish Habitat Assessment.

In addition, the Atlantic States Marine Fisheries Commission contributes to the management of striped bass, Atlantic croaker (*Micropogonias undulatus*), red drum (*Sciaenops ocellatus*), and several other commercial and recreational fisheries of economic importance to Atlantic coastal states. Congress amended the Magnuson-Stevens Fisheries Conservation and Management Act by enacting the Modernizing Recreational Fisheries Management Act of 2018 (S. 1520, “Modern Fish Act”) to expand recreational fishing opportunities through enhanced marine fishery conservation and management. The Modern Fish Act recognizes differences between recreational and commercial fishing and directs management agencies to adopt management approaches suitable to each sector.

Saltwater commercial and recreational fisheries in the state waters of Virginia are managed by the Virginia Marine Resources Commission (VMRC). The VMRC manages Virginia fisheries in order to maintain sustainable fisheries, benefitting both anglers and the ecosystem (VMRC 2020a). The VMRC’s jurisdiction extends to 3 nm (5.6 km) offshore.

The NCDMF manages both marine and estuarine fisheries and habitats. The NCDMF’s jurisdiction extends to 3 nm (5.6 km) offshore. Its policies are established by the Marine Fisheries Commission and the Secretary of the Department of Environmental Quality (NCDMF, n.d.).

The NCDMF and VMRC serve an important role within the federal/interstate fisheries management process in the implementation and administration of the federal Fisheries Management Plans. For example, summer flounder is managed with state-by-state quotas. NCDMF and VMRC establish trip limits, seasons, and other technical measures for those commercial fisheries at the state level. While the Lease Area is seaward of their respective jurisdictions, both the NCDMF and VMRC still serve an important role in the management of some of the fisheries that operate within the area.

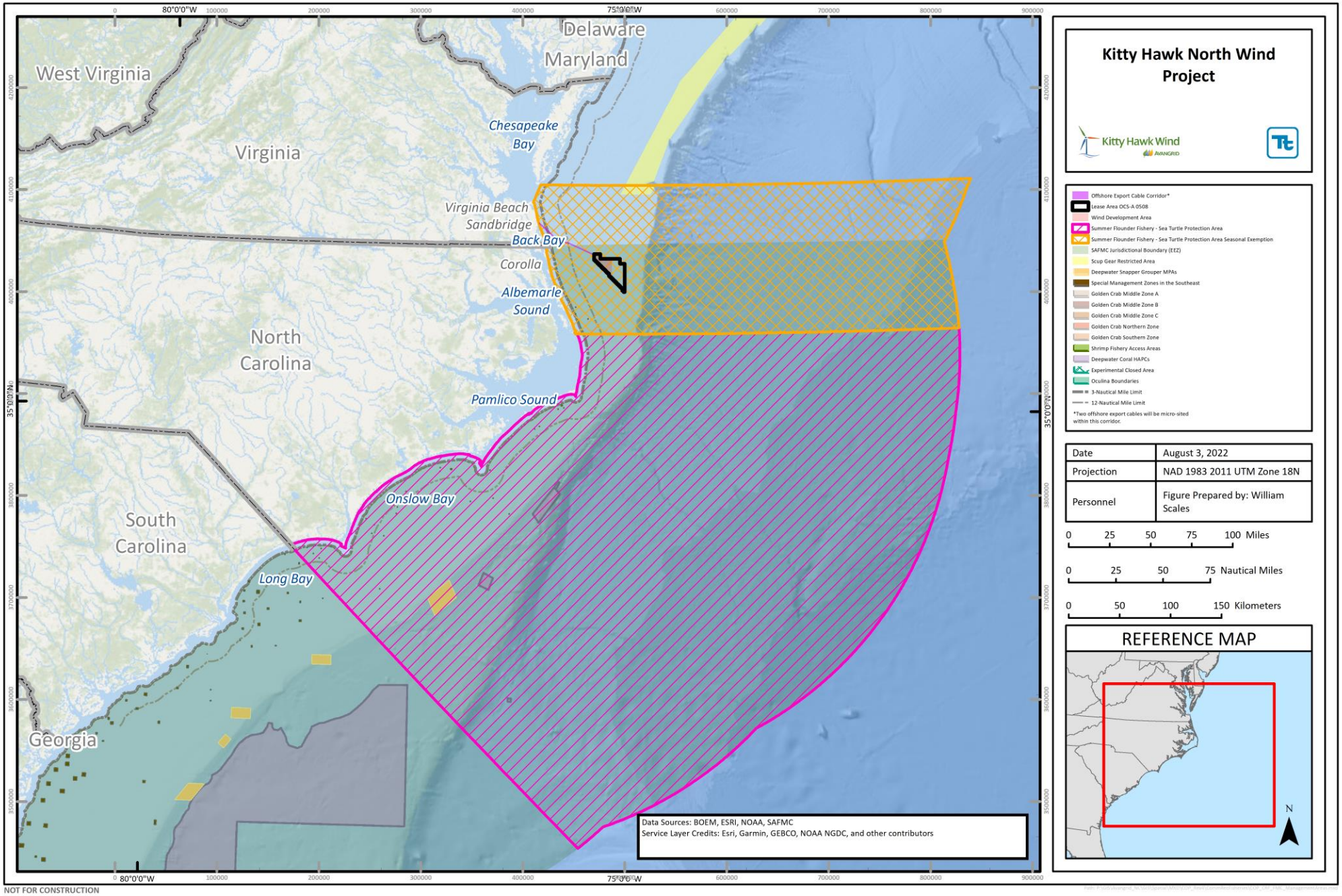


Figure 7.2-1 FMC Management Areas

This section was prepared in accordance with BOEM's *Recommended Practices for Outreach to Commercial and Recreational Fisheries* (BOEM 2020a), which includes the following guidance:

- Early communication with BOEM and stakeholders;
- Review of information sources; and
- Development and implementation of a Fisheries Communications Plan.

Data required to complete this analysis was obtained from the following sources:

- NOAA Fisheries Marine Recreational Information Program Data and economic data (NOAA Fisheries 2019b);
- NOAA Fisheries Vessel Trip Report (VTR) data;
- Fishing Vessel Monitoring Systems (VMS);
- Fisheries Liaison Officer (FLO) fisheries outreach, and interviews;
- Fisheries Representative (FR) local fisheries experience and outreach;
- HMS Pelagic logbooks;
- Northeast Area Monitoring and Assessment Program (NEAMAP) Survey;[3]
- Virginia Institute of Marine Science (VIMS) Longline Shark Survey;
- Northeast Fishery Observer Program (NEFOP);
- Southeast Gillnet Observer Program;
- Northeast Fisheries Science Center Fall Bottom Trawl Survey;
- HMS Observer data;
- NOAA Fisheries Large Pelagics Intercept Survey (NOAA Fisheries 2020a); and
- Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic (Kirkpatrick et al. 2017).

The Company has participated in engagement and coordination with stakeholders specific to commercial and recreational fisheries since May of 2019, and agency outreach and engagement is further detailed in Appendix B Summary of Agency and Stakeholder Engagement. A summary of stakeholder engagement specific to commercial and recreational fisheries is provided in Table 7.2-1 below. These interactions include engagement with federal, regional, and state entities and data requests from several fishery survey programs. Additionally, the Company contracted a local FLO with extensive regional knowledge and direct experience in the area's commercial and recreational fisheries. The FLO developed several of the commercial fisheries in the review area from 1992 to present, is active in the HMS recreational fishery, and is homeported in Rudee Inlet, Virginia. The Company also contracted a local FR, homeported in Wanchese, North Carolina, who has been active in the longline, drop-net, and hook-and-line troll fisheries from Hatteras to New York. The FLO and FR have communicated and collaborated frequently and extensively since May of 2019, and have worked together to develop a comprehensive understanding of the history of commercial and recreational fisheries within the Wind Development Area and the potential impacts to these fisheries. The local knowledge gained through their proactive outreach to the local fishing industry has resulted in recommendations to the Project team to avoid and minimize impacts to local fisheries.

[3] Data acquired from VIMS.

1 **Table 7.2-1 Fisheries Outreach Conducted Through October 2020**

Contact	Federal	Regional	North Carolina	Virginia	Fishery Survey Program
Atlantic States Marine Fisheries Commission		X			
Billfish tournament directors and participants			X	X	
Commercial fishers oral history interviews			X	X	
Offshore export cable corridor commercial fishers				X	
Corridor fish dealer/packer				X	
Greater Atlantic Regional Fisheries Office (GARFO)	X				
Individual recreational HMS captains			X	X	
Lease Area commercial fishers		X	X	X	
Lease Area dealers/packers			X	X	
Marinas: HMS private/charter fleet			X	X	
Marinas: local and regional		X	X	X	
Miami Laboratory, NOAA Fisheries					X
Mid-Atlantic Fishery Management Council		X			
National recreational fishing associations	X				
NCDMF			X		
Northeast Fisheries Science Center					X
New England Fishery Management Council		X			
NOAA Fisheries	X	X			
Panama City Laboratory, NOAA Fisheries					X
Recreational fishing writers/social media authors	X	X			
SAFMC		X			
Regional fish packers/processors		X			
Southeast Fisheries Science Center		X			X
Tackle shops			X	X	
VIMS					X
VMRC				X	

7.2.1 Affected Environment

The affected environment defined for this section of the document consists of the coastal and offshore areas, where commercial and recreational fishing activities may occur and have the potential to be impacted by the Project. The Project is located within the Mid-Atlantic Bight, offshore of North Carolina and southern Virginia. Commercial and recreational fishers from both North Carolina and Virginia are known to utilize portions of the review area.

Additional publicly available data sources relied upon for the development of this section are described below.

7.2.1.1 *Catch Reporting Systems*

NOAA Fisheries requires VTRs for all commercial and for-hire fishing vessels operating with fisheries permits issued by the Greater Atlantic Regional Fisheries Office (GARFO). VTR is a catch reporting system that reports what, how much, where, and how target species were caught. Commercial fishing vessels operating under Southeast Regional Office Permits are required to complete Southeast Logbooks. Although the review area straddles the Mid-Atlantic and Southeast management zones, most commercial fishing vessels in the Wind Development Area will have NOAA Fisheries GARFO permits if they are fishing for summer flounder or bluefish, participating in the squid fisheries seaward of the Wind Development Area, or are transiting to/from scallop access grounds in the Northeast. The VTR system is the primary data collection system to monitor the catch and fishing effort of federal commercial fisheries in the review area.

VTR is self-reported and documented at each change in fishing area and/or gear type. Data from these reports are provided to NOAA Fisheries to allow regulatory agencies access to as much relevant data as possible for making fishery-specific decisions. All positional data provided by the VTR is self-reported and is subject to different types of uncertainty or error compared to VMS systems. Both BOEM and NOAA Fisheries have pointed out the spatial imprecision of VTR locations and the need for potential error acknowledgement within the data analysis (GARFO 2018). Therefore, VMS data augmented with observer records are considered to be the best available fisheries-dependent catch data for the offshore Project Area. The Company has integrated the available VTR, VMS, and observer records with oral history interviews to augment fisheries dependent data with local knowledge, providing more context on historical regional fishing usage (see Section 7.2.1.2).

7.2.1.1.1 Fishing Vessel Monitoring Systems

Regulators utilize several other methods for monitoring vessels, including VMS and automatic identification systems (AIS), detailed in Table 7.2-2 below. VTR is a self-reporting mechanism whereas VMS and AIS use satellite and radio signals, respectively, to transmit accurate location data. VMS is a fisheries data collection system used throughout the U.S. Atlantic Coast to accurately collect positional data on fishing vessels, and is the primary vessel monitoring source used by the Company to characterize commercial and recreational fishing in the offshore Project Area.

Table 7.2-2 Vessel Monitoring Systems Overview

Monitoring System	Requirements
VTR	• Required in GARFO- and SERO-permitted vessels (apart from vessels with a commercial lobster permit). • Required in NOAA Fisheries Southeast Regional Office-permitted vessels. • Self-reported location coordinates. • Must be submitted once per trip with required interval for new reports, except when entering a new chart area or changing gear being used.

Monitoring System	Requirements

VMS	• Location data transmitted via satellite transponders.
	• Required under the following federal permits within the Southeast region, defined by NOAA Fisheries (NOAA Fisheries, n.d.):
	  • Highly Migratory Species. Vessels that have:
	  ○ Pelagic longline gear onboard.
	  ○ Bottom longline gear onboard, operating off the coasts of South Carolina, North Carolina, and Virginia between 33° 00' N and 36° 30' N from 01 Jan through 31 Jul.
	  ○ Been issued a directed shark limited access permit with gillnet gear onboard operating in the vicinity of the Southeast U.S. Monitoring Area from 01 Dec to 31 Mar, pursuant to the requirements of the Atlantic large whale take reduction plan.
	  ○ Purse seine gear onboard.
	  • South Atlantic Rock Shrimp.
	  • Gulf Reef Fish:
	  ○ An owner or operator of a vessel that has been issued a commercial vessel permit for Gulf reef fish, including a charter vessel/head boat, must ensure that such vessel has an operational and approved VMS unit on board at all times whether or not the vessel is underway.
	  ○ Hourly reporting requirement: An owner or operator of a vessel subject to the requirements of such permit must ensure that the required VMS unit transmits a signal indicating the vessel's accurate position at least once an hour, 24 hours a day, every day.
	  ○ Declaration of fishing trip and gear: Prior to departure for each trip, a vessel owner or operator must report to NOAA Fisheries any fishery the vessel will participate in on that trip and the specific type(s) of fishing gear, using NOAA Fisheries-defined gear codes, that will be on board the vessel.
	• Individual Fishing Quota species landing requirements: Vessels landing Individual Fishing Quota species are responsible for ensuring that NOAA Fisheries is contacted at least 3 hours, but no more than 24 hours, in advance of landing to report the time and location of landing, estimated species landings in pounds gutted weight, vessel identification number (USCG registration number or state registration number), and the name and address of the Individual Fishing Quota dealer(s) where the Individual Fishing Quota species are to be received.
	• Required under the following federal permits within the Northeast region defined by NOAA Fisheries (NOAA Fisheries, n.d.):
	  • Full or part-time limited access scallop permit.
	  • Occasional limited access scallop permit when fishing under the scallop area access program.
	  • Limited access monkfish, occasional scallop, or combination permit electing to provide VMS notifications.
	  • Limited access multispecies permit when fishing on a Category A or B day at sea, or catches regulated species or ocean pout while on a sector trip; or a limited access multispecies small vessel category or Handgear A vessel that fishes in multiple stock areas.
	  • Surfclam or ocean quahog open access permit.
	  • Maine mahogany quahog limited access permit.
	  • Limited access monkfish vessel electing to fish in the Offshore Fishery Program.
	  • Limited access herring permit, or an Areas 2/3 open access herring permit, or a vessel declaring a herring carrier trip via VMS.
	  • Limited access mackerel permit.
	  • Longfin squid/butterfish moratorium permit.
	  • Illex squid moratorium permit.

AIS	• Required for all vessels over 300 gross tonnage engaged in international voyages. • Required for all cargo vessels over 500 gross tonnage. • Required for all passenger vessels regardless of size. • Class B AIS required for all fishing vessels 19.8 meters (65 feet) or greater.
Source: NOAA Fisheries, n.d.	

7.2.1.1.2 Vessel Trip Report

A VTR is required for every fishing trip, regardless of location or species, conducted by NOAA Fisheries GARFO-permitted vessel operators. Information generally provided in a VTR include the type of commercial trip conducted (head boat, charter boat, commercial operation), coordinates for where fishing catch occurred per chart area, and information providing details about the owner and operator of the vessel used. Additional reports are required for each new chart area location, or for each change in gear type, mesh size, or ring size being used (NOAA Fisheries 2018a). It should be noted that while VTR is considered to be the most prevalent source of fisheries dependent data in this area, the reports do not provide continuous location data and, therefore, cannot provide vessel trackline locations. While there are no required intervals between identified locations, coordinates must be reported at each change in statistical area or with each change in fishing gear type.

7.2.1.1.3 Vessel Monitoring System

The VMS is a satellite surveillance tracking system used in the EEZ to track commercial fishing vessel locations and movements. Certain categories of commercial fishing vessels are required to carry onboard transceiver units that broadcast vessel identification, location, date, and time information to satellites (NOAA Fisheries n.d.). VMS data is typically transmitted once per hour by commercial fishing vessels, making tracking less precise than data collected by the AIS. VMS datasets are publicly available as heat maps based on data from 2006 to 2018, and provide commercial fishing vessel activity in the Northeast and Mid-Atlantic U.S. regions. VMS data provides spatial and temporal data and indications of the volume of fishing activity in a region. VMS can demonstrate fishing activity in an area by gear type or species, and activity by species group in the review area is shown in Figure 7.2-2 through Figure 7.2-8. The VMS data is filtered by speeds to highlight likely active fishing efforts (4 or 5 nautical miles per hour [knots] and slower) and exclude transit activity.

Although it is a widespread and comprehensive data system, VMS data may require additional interpretation and contextualization. For example, some “pings” may occur in areas for vessels fishing for other species not in their designated permit, or vessels may fall below the speed threshold and appear to be actively fishing, when actually they may be experiencing mechanical or other complications. In addition, VMS activity from vessels may be for species other than their permit. For instance, VMS data from scallop-permitted vessels likely represents fishing activity for other fisheries, primarily shrimp fishing close to shore (Figure 7.2-6). Therefore, some of the fishing activity shown in Figure 7.2-2 through Figure 7.2-8 may require additional interpretation, which is why the Company relies on multiple data sources to characterize fishing in the review area.

7.2.1.1.4 Automatic Identification System

The AIS is widely used throughout maritime activities. AIS is an automated tracking system that provides an exchange of navigational information between vessels equipped with AIS transmitters. The International Maritime Organization requires all passenger and commercial vessels over 300 gross tons that travel internationally to carry a Class A AIS transponder, with smaller vessels having the option to carry a Class B AIS transponder. Many U.S. commercial and recreational fishing boats carry a Class B AIS transponder. Vessels over 20 meters (m) are required to carry an AIS transponder and transmit location data within 12 nm (22.2 km) of the coast. AIS signals are sent in a much shorter interval than VMS, with signals being transmitted within seconds or minutes of the previous signal. AIS signals are transmitted as Very High Frequency radio signals and are publicly available to be received via antennas on other vessels, and/or on shore by coastal receivers. AIS data from 2011 to 2019 (Figure 7.2-9 through Figure 7.2-15) show the distribution of fishing vessel traffic and location over recent years. Between 2011 and 2019, AIS vessel usage increased and transponder technology improved, resulting in a larger number of AIS-equipped vessels transiting the area. The appearance of increased vessel transits in the Wind Development Area over time (in Figure 7.2-9 through Figure 7.2-15) reflects the regulatory changes in AIS requirements and expanded adoption of AIS throughout the timeseries.

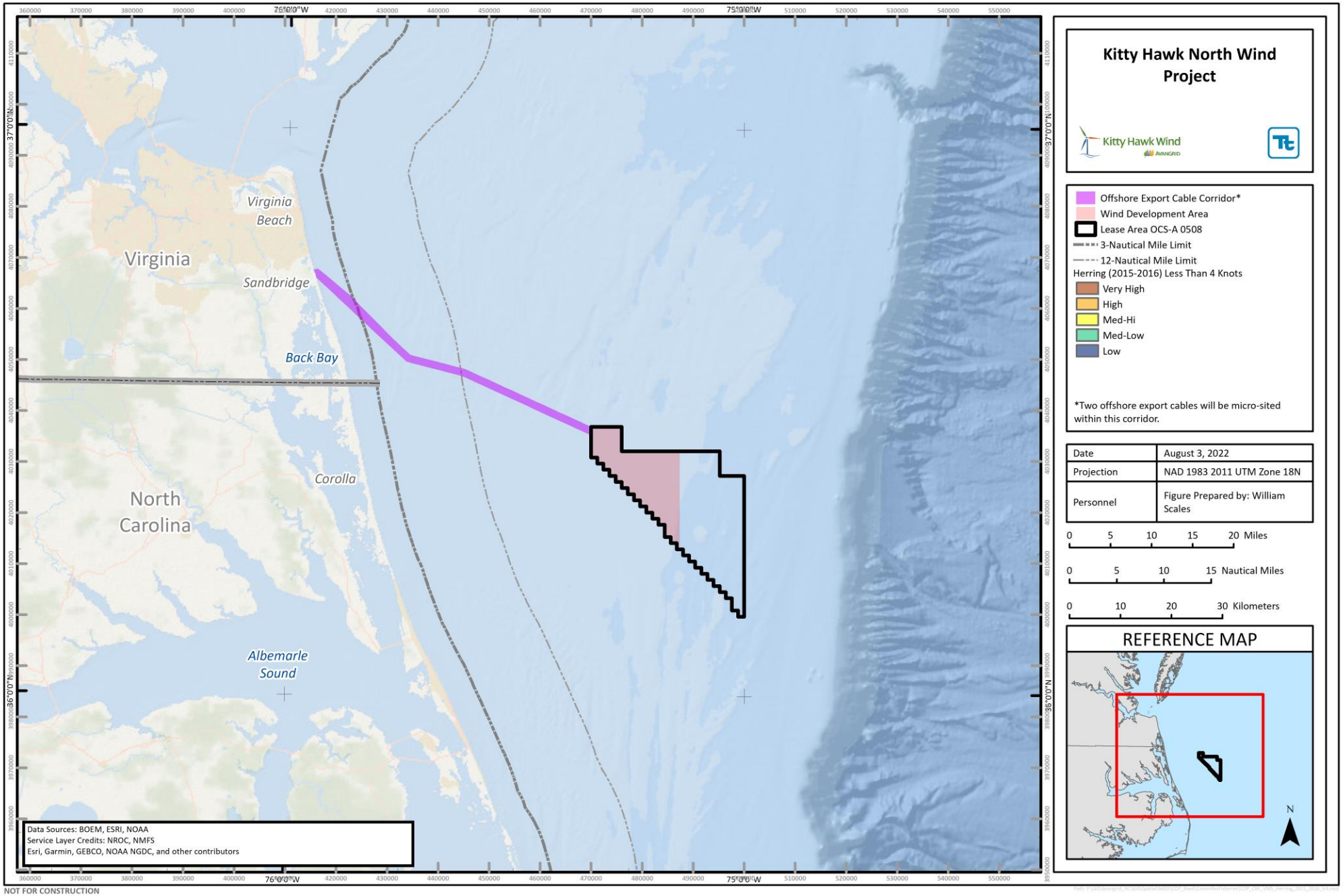


Figure 7.2-2 VMS Data of Herring (*Clupea harengus*) Fishing Intensity (<4 knots) 2015-2016

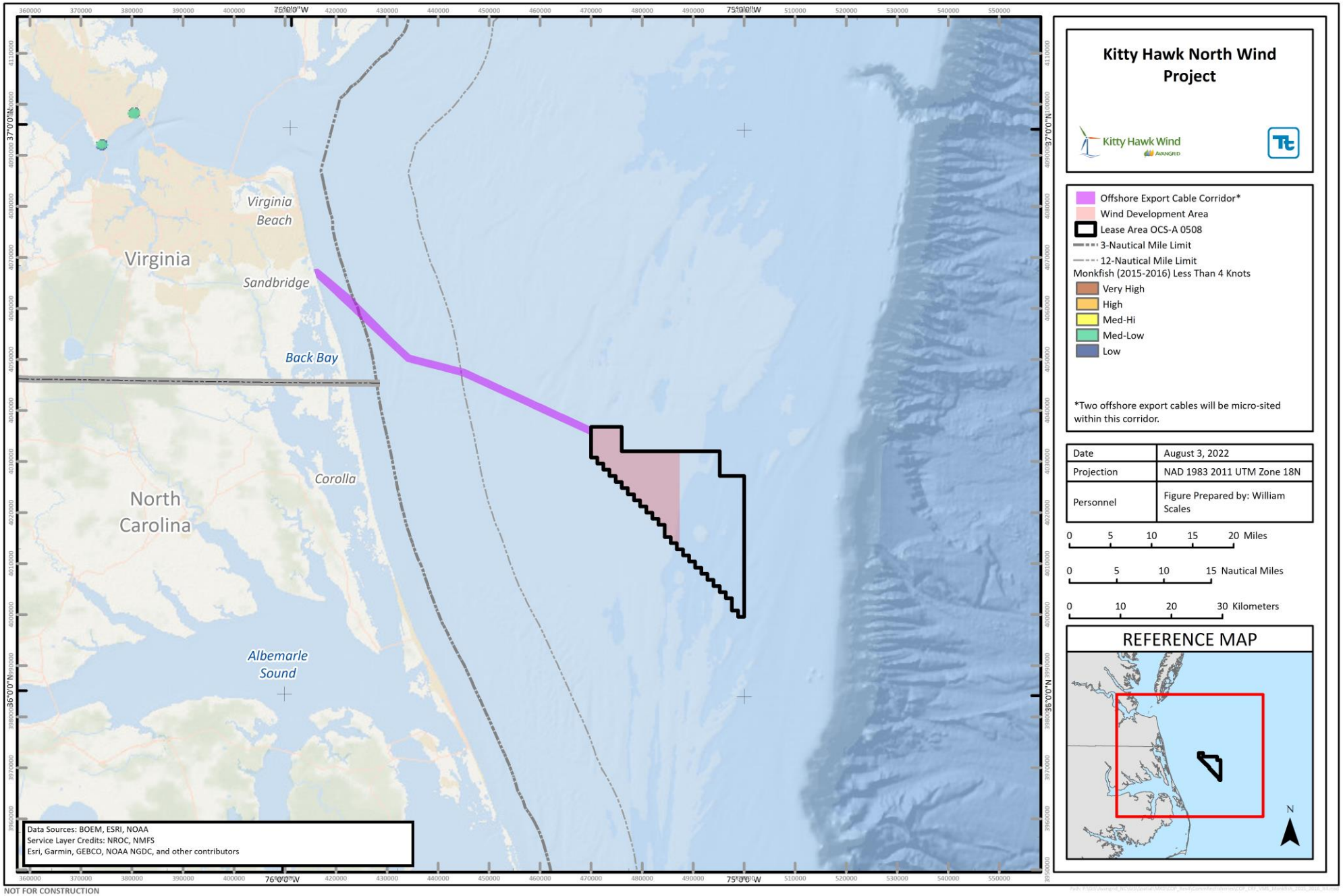


Figure 7.2-3 VMS of Monkfish (*Lophius americanus*) Fishing Intensity (<4 knots) 2015-2016

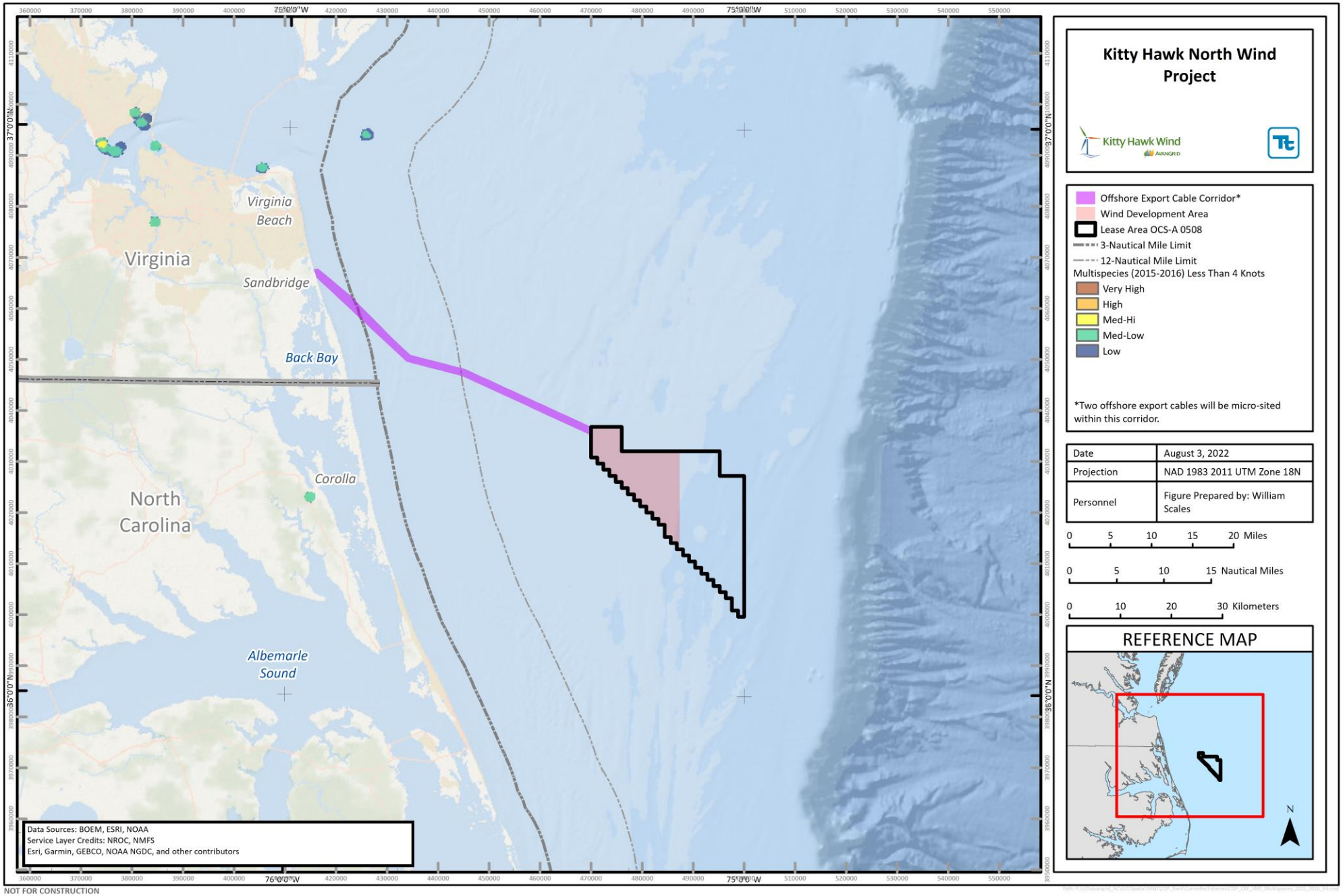


Figure 7.2-4 VMS of Vessels with Multispecies Permits Fishing Intensity (< 4 knots) 2015-2016

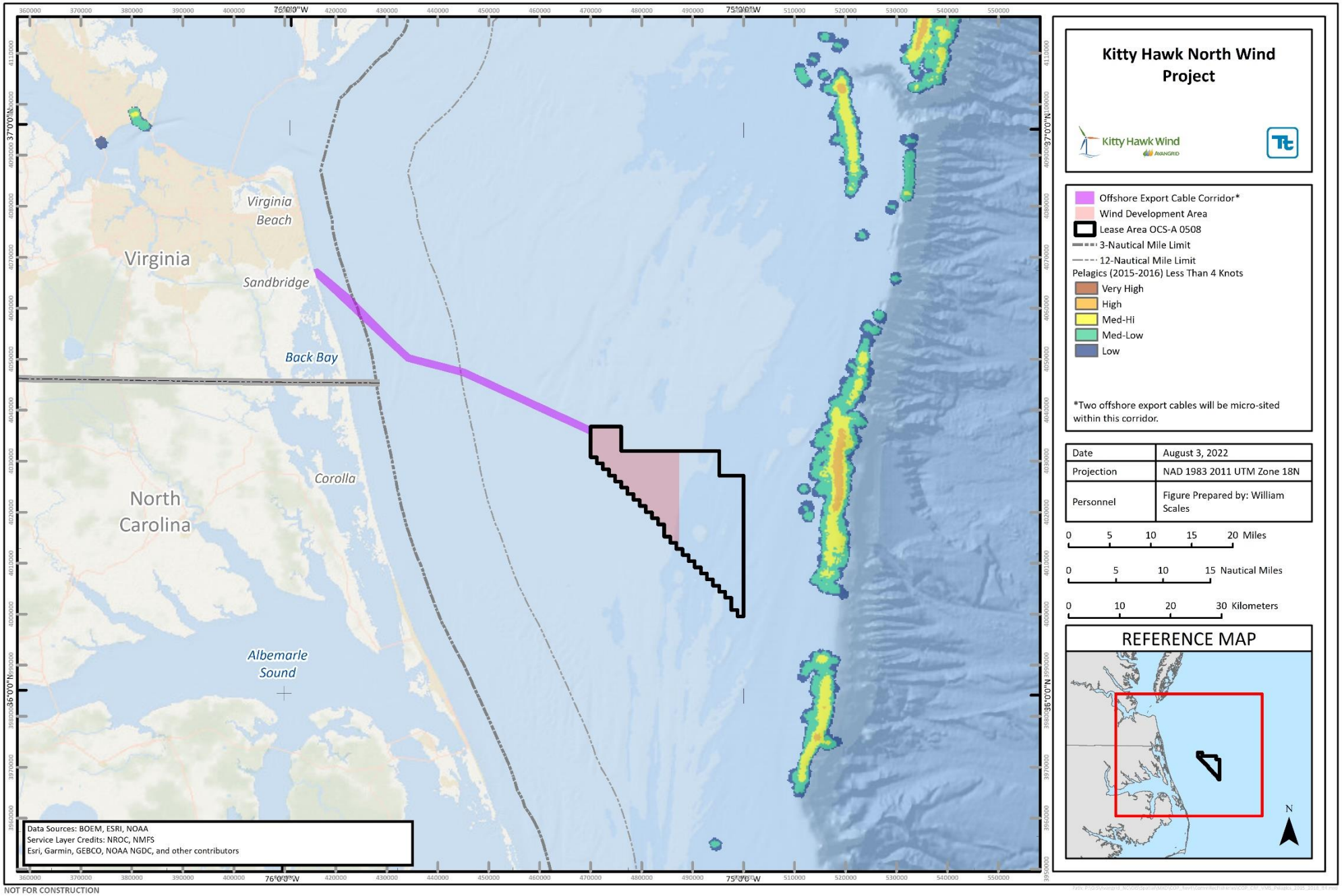


Figure 7.2-5 VMS of Vessels with Pelagic Permits Fishing Intensity (< 4 knots) 2015-2016

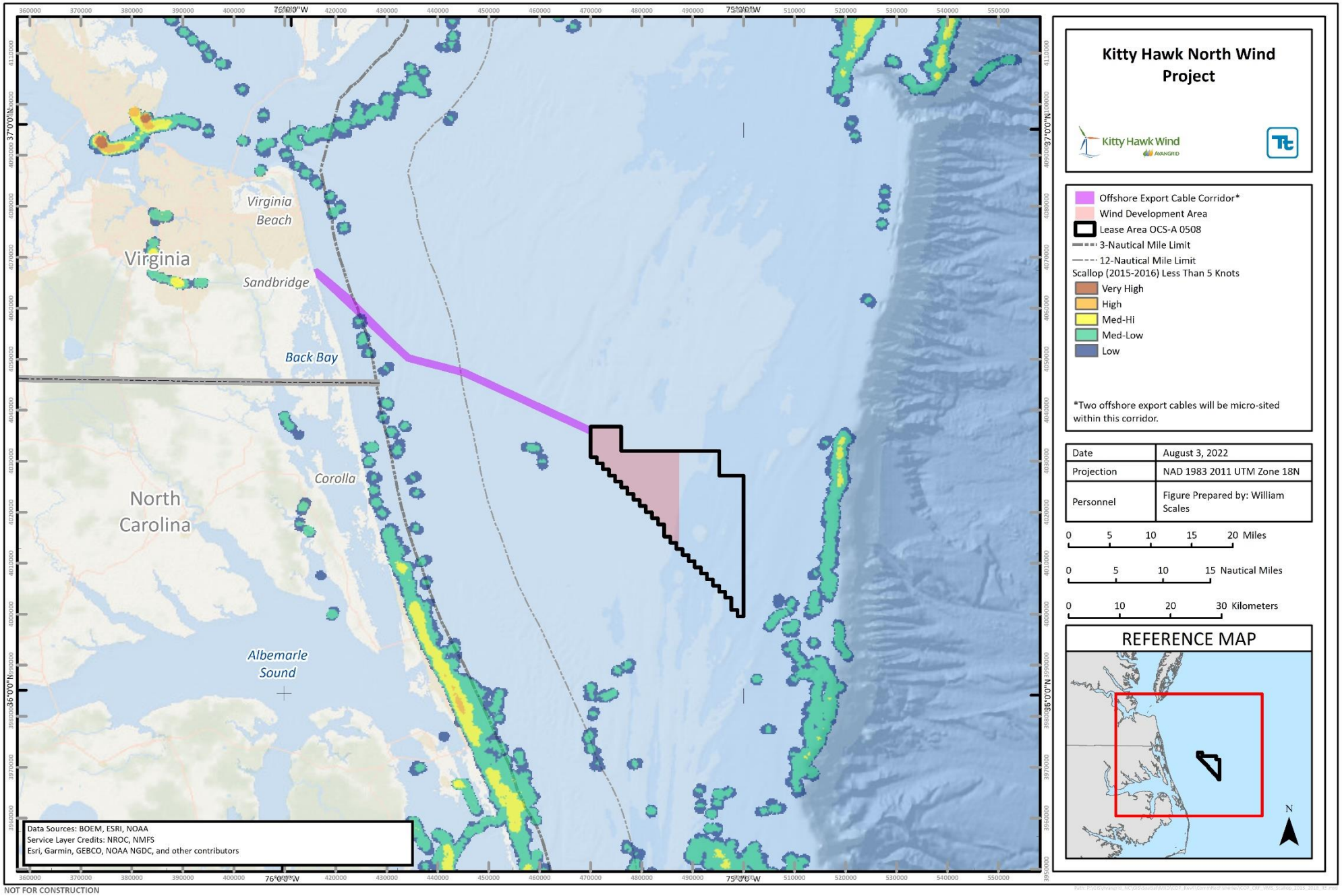


Figure 7.2-6 VMS of Scallop (*Pectinidae*) Permit-holding vessels (< 5 knots) 2015-2016

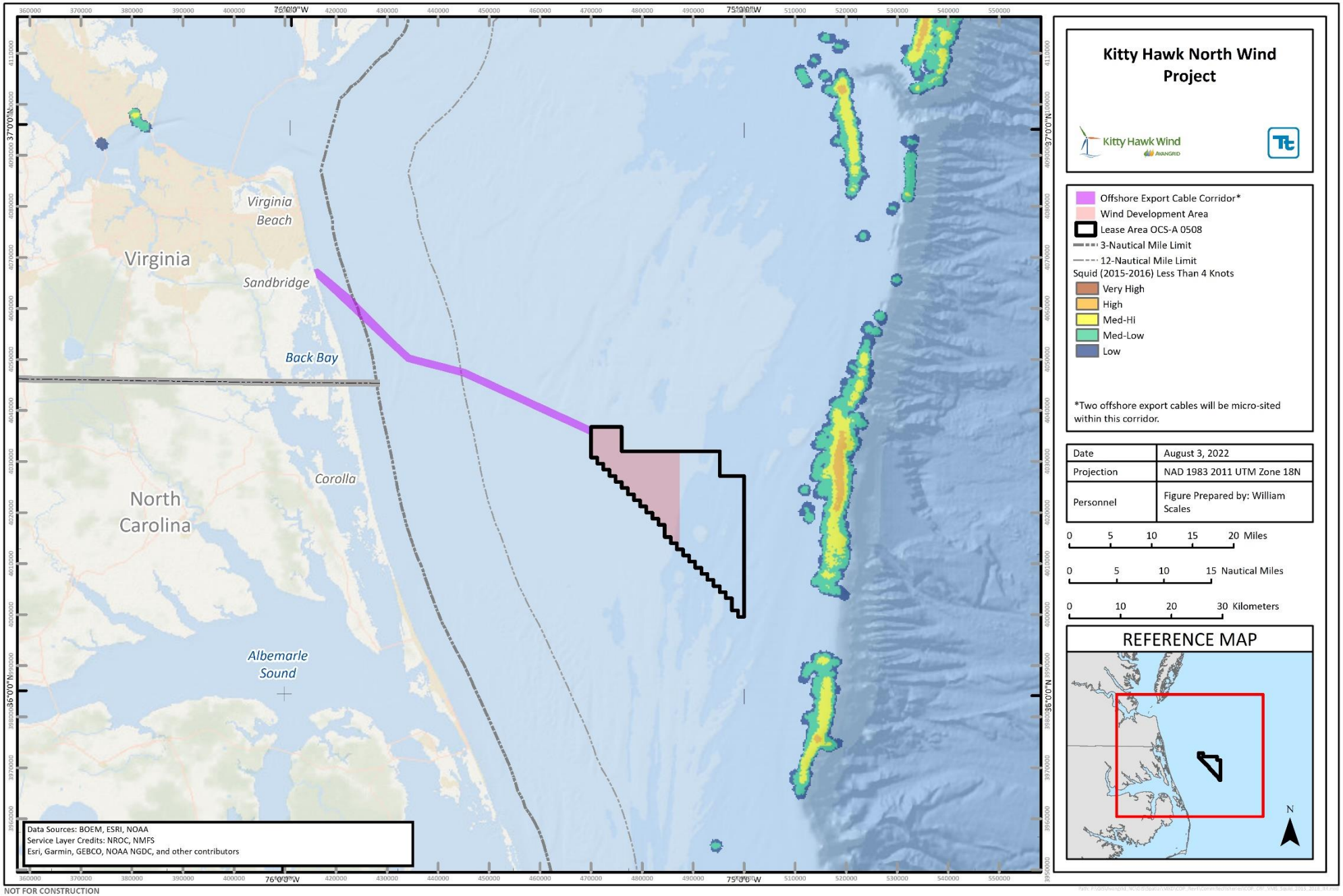


Figure 7.2-7 VMS of Squid (*Doryteuthis* and *Illex*) Fishing Intensity (< 4 knots) 2015-2016

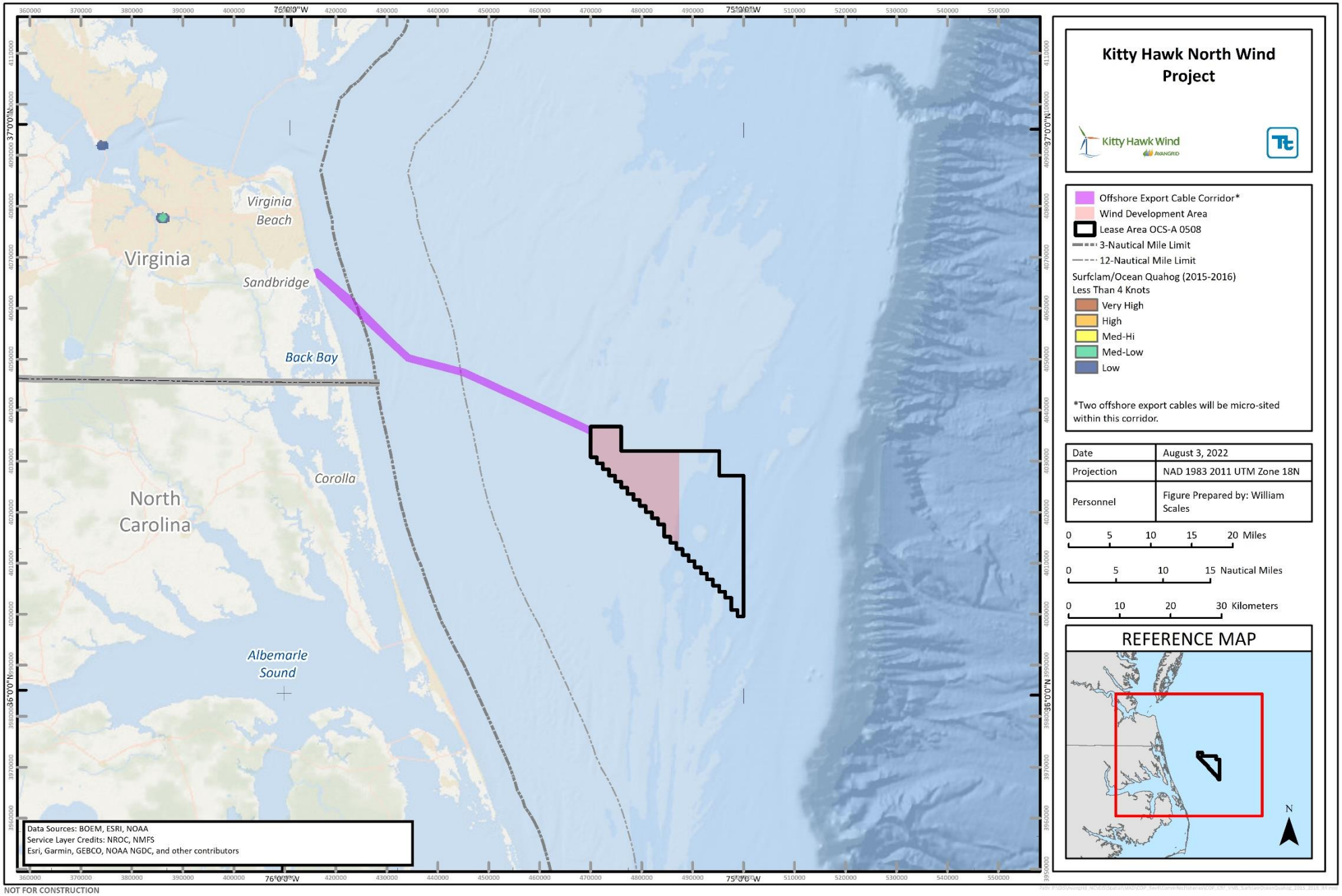


Figure 7.2-8 VMS of Ocean Quahog (*Arctica islandica*) and Surfclam (*Spisula solidissima*) Fishing Intensity (< 4 knots) 2015-2016

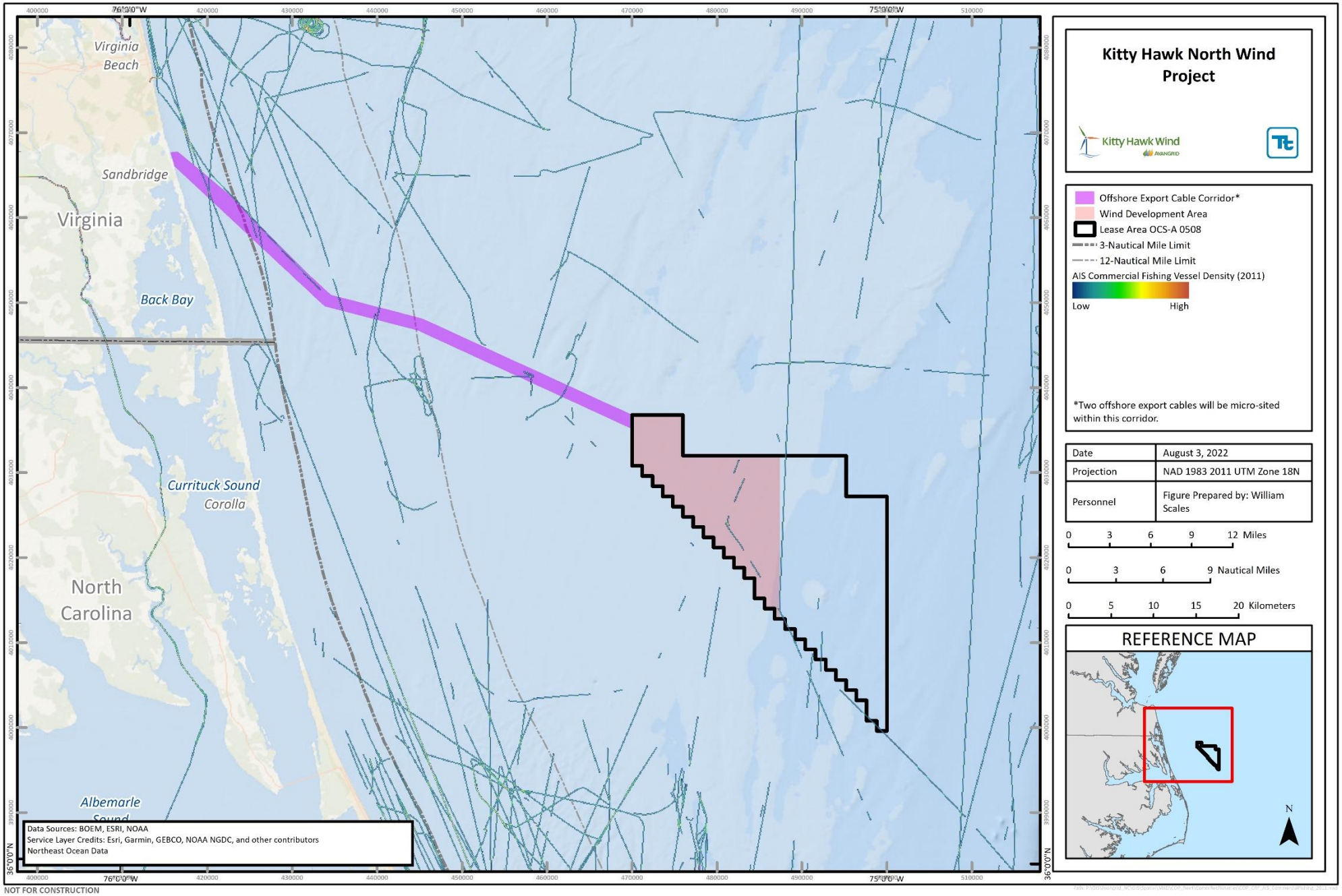


Figure 7.2-9 AIS Data of Fishing Vessel Transit Counts from 2011

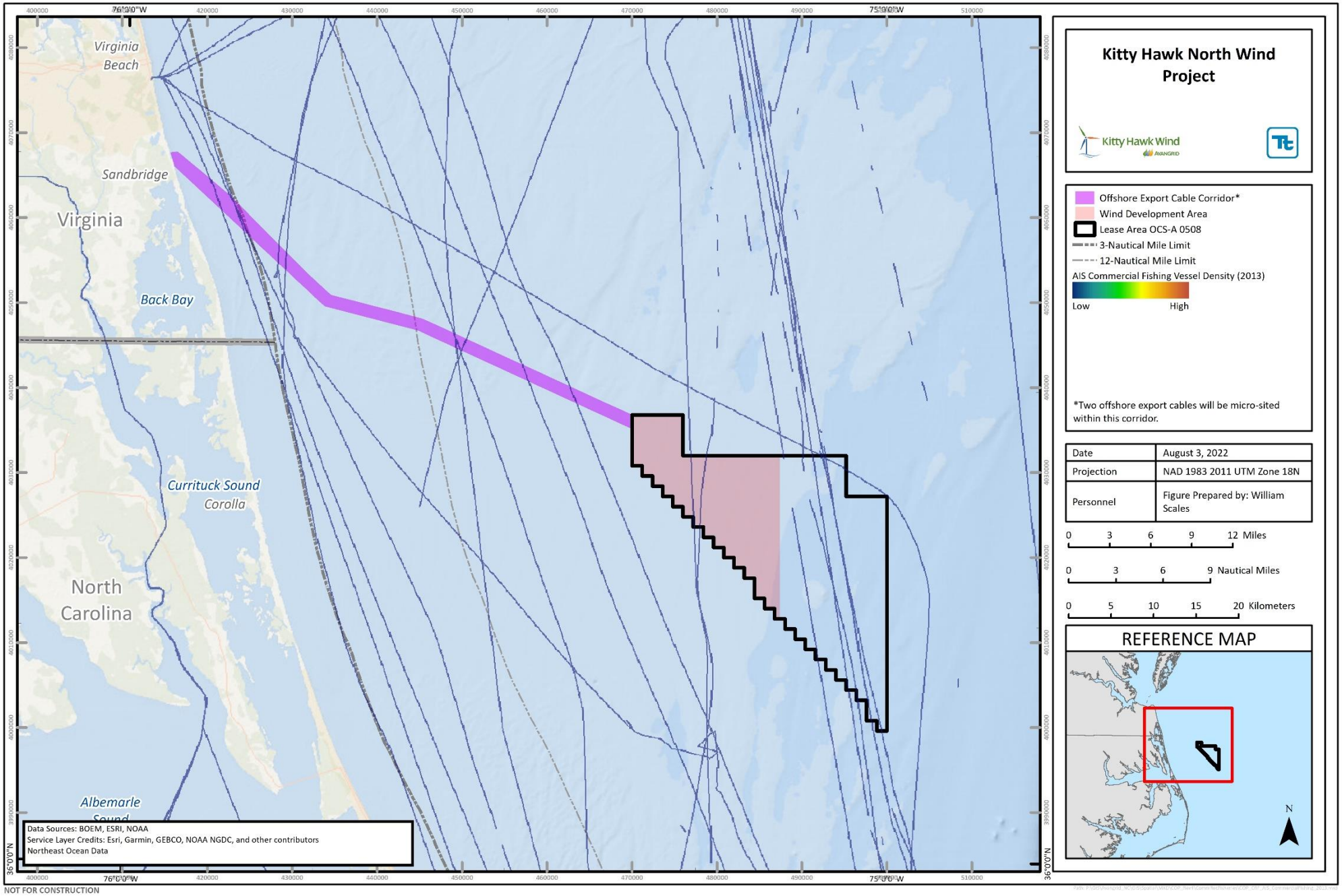


Figure 7.2-10 AIS Data of Fishing Vessel Transit Counts from 2013

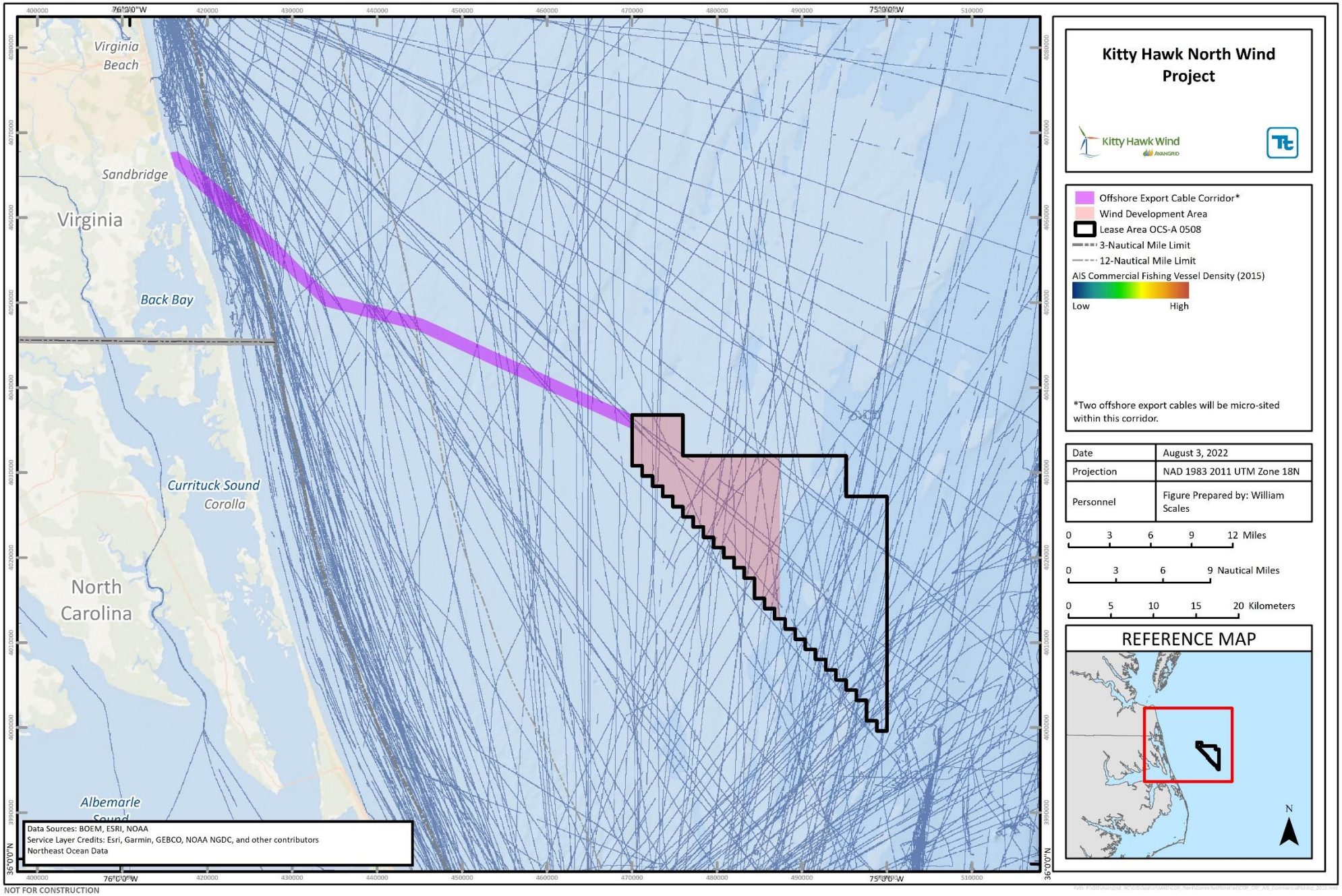


Figure 7.2-11 AIS Data of Fishing Vessel Transit Counts from 2015

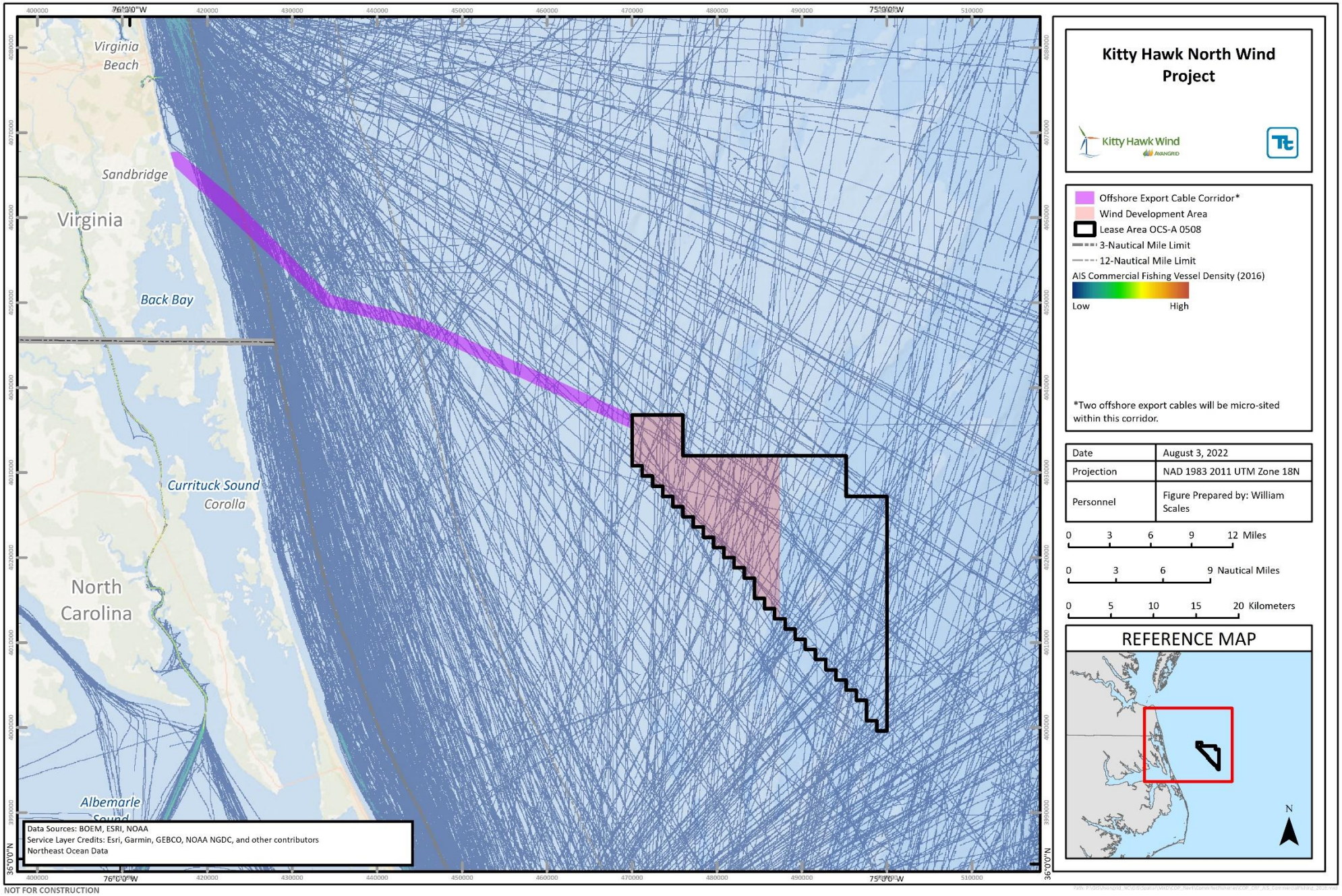


Figure 7.2-12 AIS Data of Fishing Vessel Transit Counts from 2016

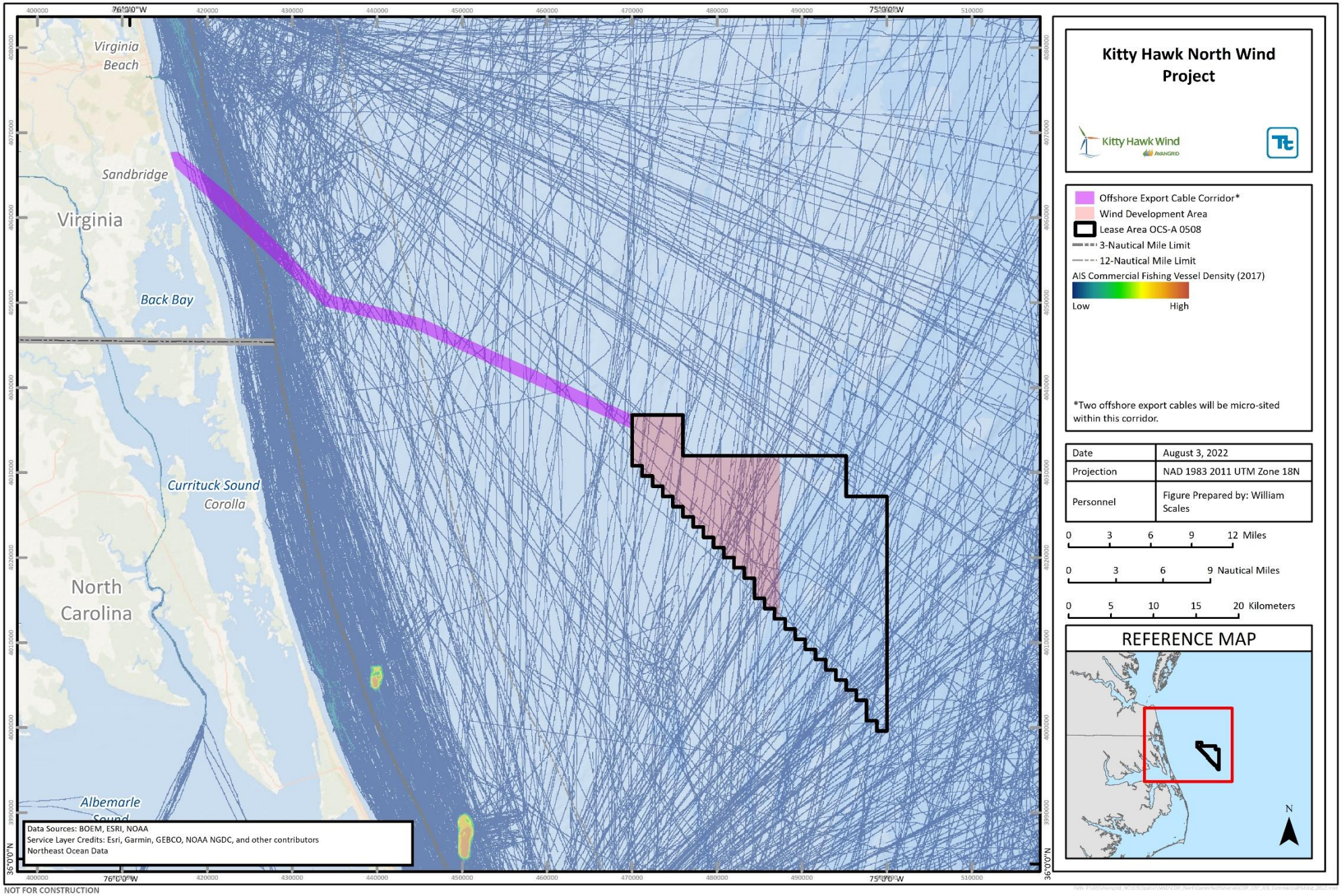


Figure 7.2-13 AIS Data of Fishing Vessel Transit Counts from 2017

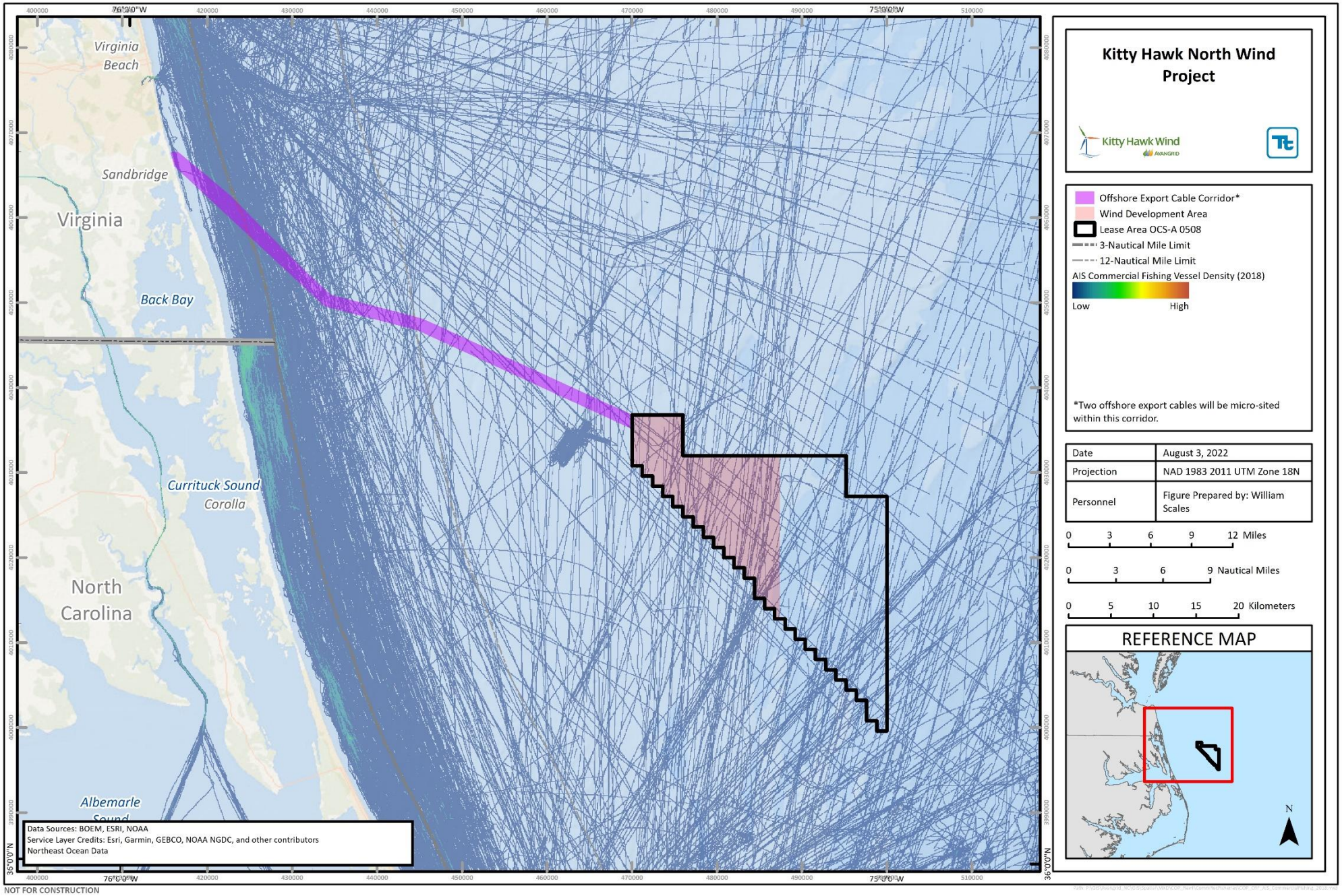


Figure 7.2-14 AIS Data of Fishing Vessel Transit Counts from 2018

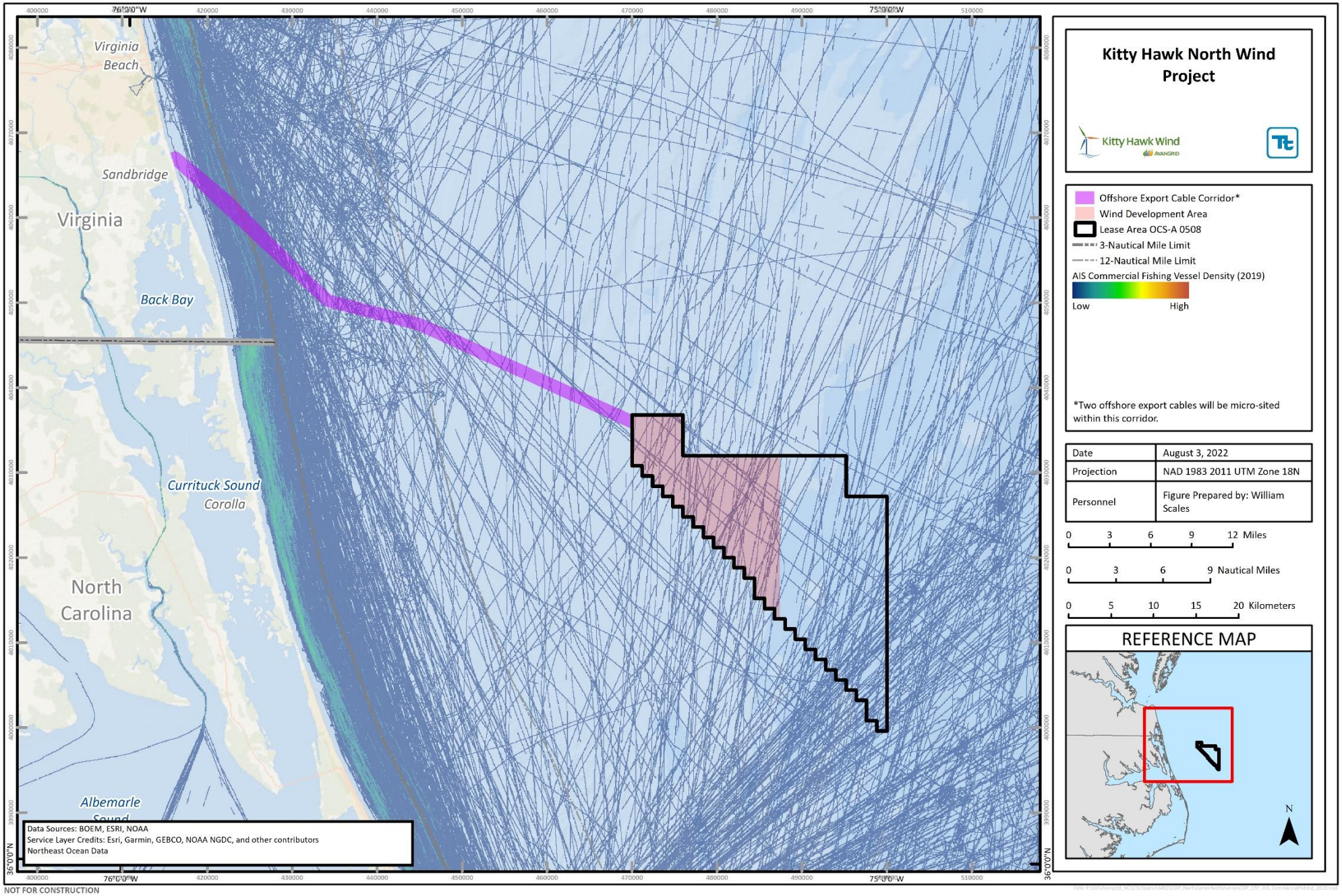


Figure 7.2-15 AIS Data of Fishing Vessel Transit Counts from 2019

7.2.1.2 *Fishing Activity Engagement and Interviews*

As previously mentioned, the Company partnered with an experienced FLO and FR, and through engagement with local commercial and recreational fishers was able to integrate local knowledge into the baseline characterization of the resource. While the data sources discussed in this COP section represent the best available data, errors and data gaps have also been identified by stakeholders. The local knowledge, gained through detailed oral history interviews with local fishers with an average of over 40 years of fishing experience in the area, has identified active commercial and recreational fisheries and described the changes within those fisheries over the years. This work is further described in Section 7.2.1.5.4.

7.2.1.3 *Fish Surveys and Monitoring Programs*

In addition to the characterization below, marine survey work (geophysical, geotechnical, and benthic) was conducted in order to understand existing habitats and bedforms within the review area, and to assess the potential impacts resulting from construction and operations of the Project on fisheries resources (see Appendix K Marine Site Investigation Report and Appendix V Benthic Resource Characterization Reports).

7.2.1.3.1 Northeast Bottom Trawl Survey

The Northeast Bottom Trawl Survey is conducted by NOAA Fisheries twice a year to record catch data along the north Atlantic Coast. The spring survey is typically conducted in March and April and the autumn survey is conducted from September through November. This data is used to monitor the distribution and abundance of fish species and is the longest running survey of its kind (NOAA Fisheries 2019a). The fall 2019 bottom-trawl survey covered 347 stations from 03 Sep 2019 to 14 Nov 2019 (NOAA Fisheries 2019a). Since 1963, thirty-seven trawl survey stations sampled from have occurred within 1.1 nm (2 km) of the Lease Area and offshore export cable corridor: eighteen along the offshore export cable corridor and nineteen within the Lease Area (Figure 7.2-16). A total of 1,055 trawl survey stations have been sampled in the broader review area analyzed from Cape Henry, Virginia to Oregon Inlet, North Carolina.

This nearly sixty-year-long dataset clearly presents trends in species abundance within this area. The total number of stations in the Northeast Bottom Trawl Survey has remained nearly constant at the present level since 1970 (Figure 7.2-17).

Survey catch heatmaps (in kilograms) and decadal sums of specimen counts (Cape Henry to Oregon Inlet) were generated for the following species of interest in response to feedback provided by commercial fishers through oral histories, as well as insight from the FLO: Atlantic croaker, summer flounder, Atlantic cutlassfish, bluefish, smooth dogfish, spiny dogfish, northern kingfish, spot, Spanish mackerel, cobia, and red drum. Each of these species either had historical commercial fishing importance to the region or is presently commonly fished in the review area.

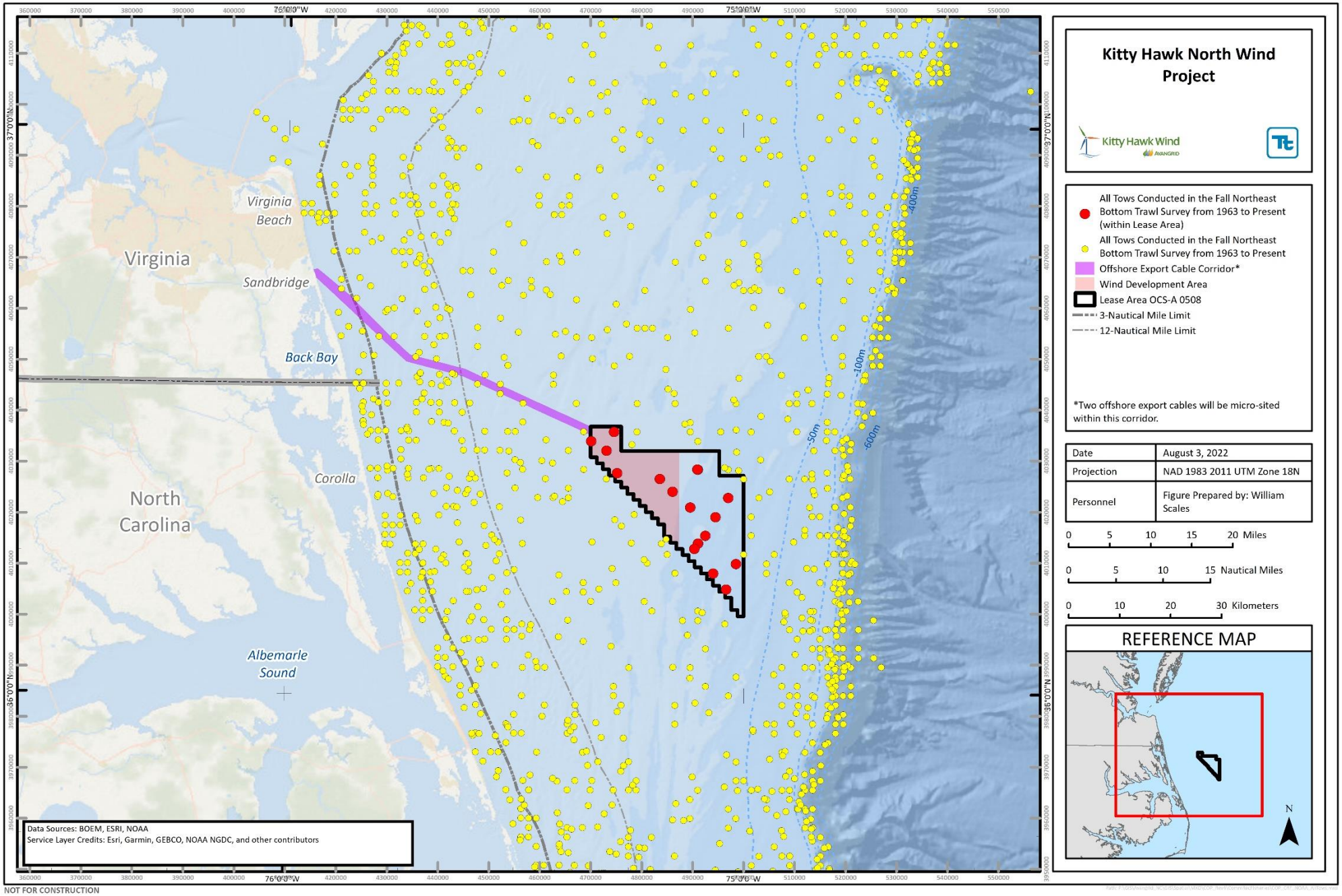


Figure 7.2-16 All Tows Conducted in the Fall Northeast Bottom Trawl Survey from 1963 to 2019 Within the Review Area

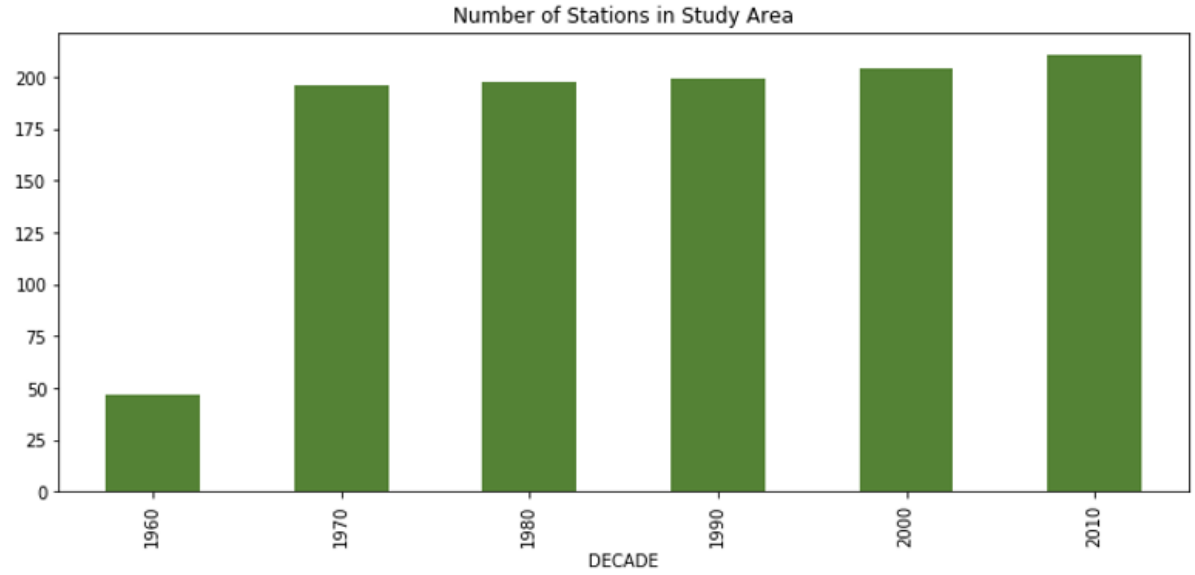


Figure 7.2-17 Trawl Stations in the Review Area

Figure 7.2-18 indicates survey catches of Atlantic croaker in the review area since 1980. However, most of the Atlantic croaker catches are recorded close to shore and not in the Wind Development Area (Figure 7.2-19).

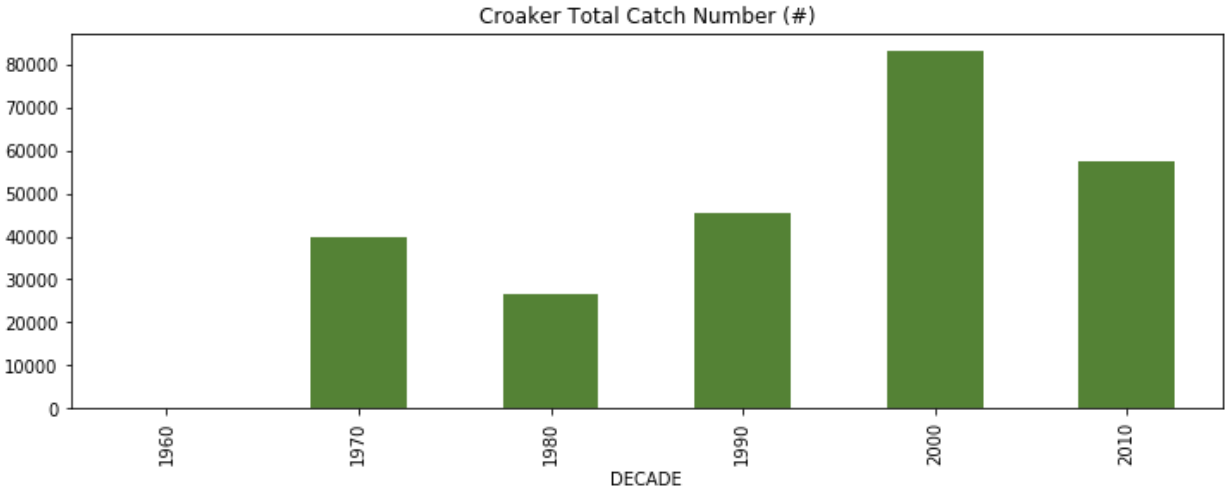


Figure 7.2-18 Decadal Sums of Atlantic Croaker Caught by Trawl Survey in the Review Area

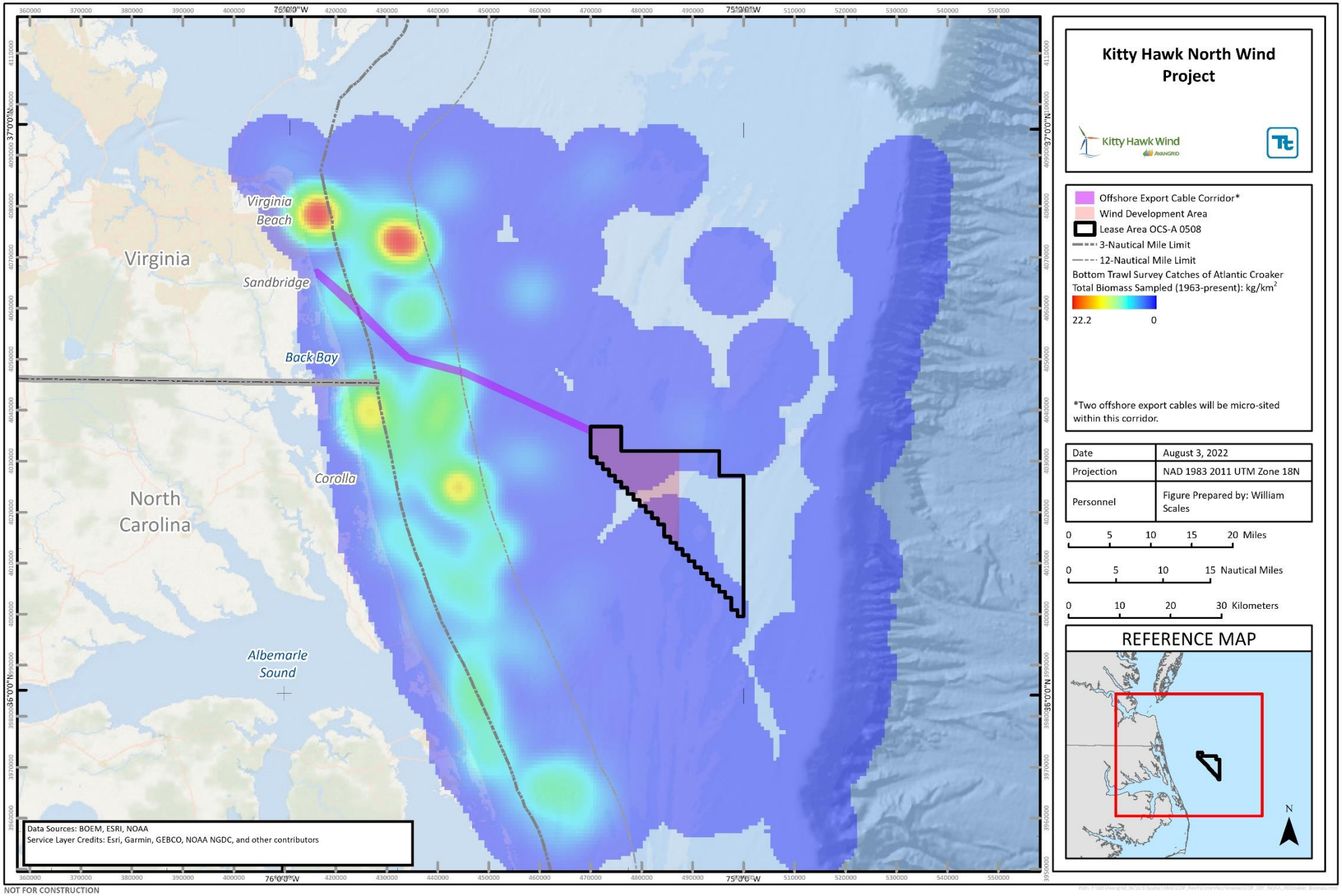


Figure 7.2-19 Bottom Trawl Survey Catches of Atlantic Croaker (1963–2019)

Catches of summer flounder in the Bottom Trawl Survey stations sampled between Cape Henry and Oregon Inlet peaked in the 1970s and decreased by almost 50 percent by 2010-2020 (Figure 7.2-20). Most summer flounder were caught at survey stations inshore of the Wind Development Area (Figure 7.2-22).

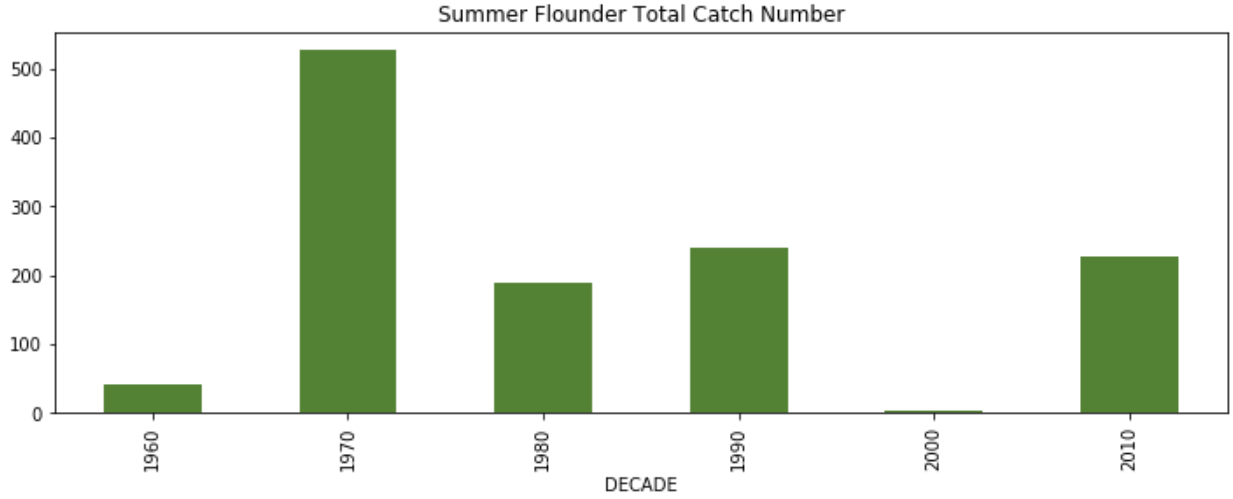


Figure 7.2-20 Decadal Sums of Summer Flounder Caught by Trawl Survey in the Review Area

Bottom Trawl Survey catches of cutlassfish (often called ribbonfish) have steadily increased throughout the life of the survey (besides 2000-2010), peaking between 2010 and 2020 (Figure 7.2-21). There were minimal cutlassfish caught in the Wind Development Area, but a higher amount were caught southwest of the Wind Development Area (Figure 7.2-23).

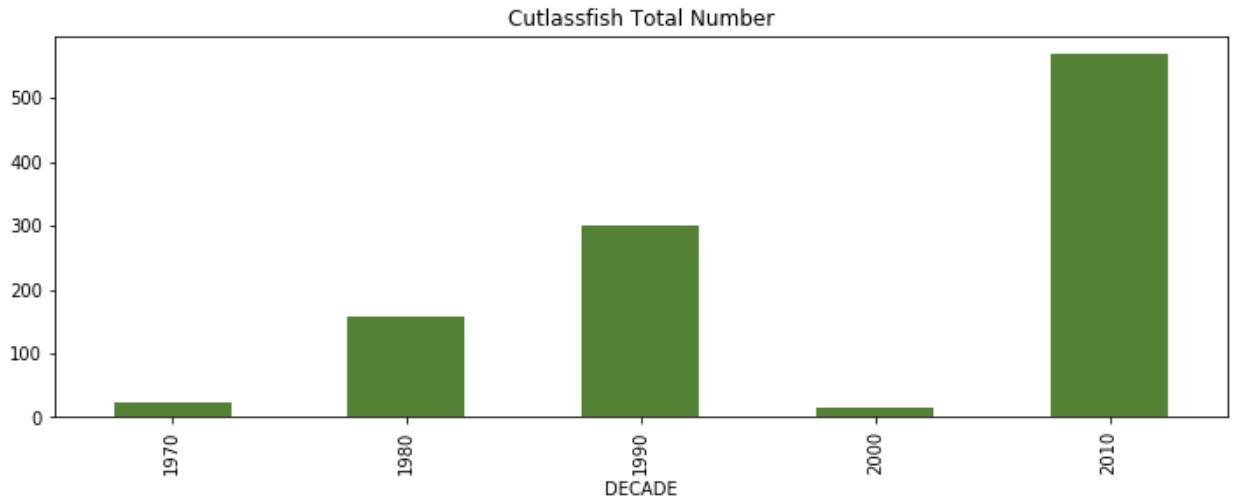


Figure 7.2-21 Decadal Sums of Cutlassfish Caught by Trawl Survey in the Review Area

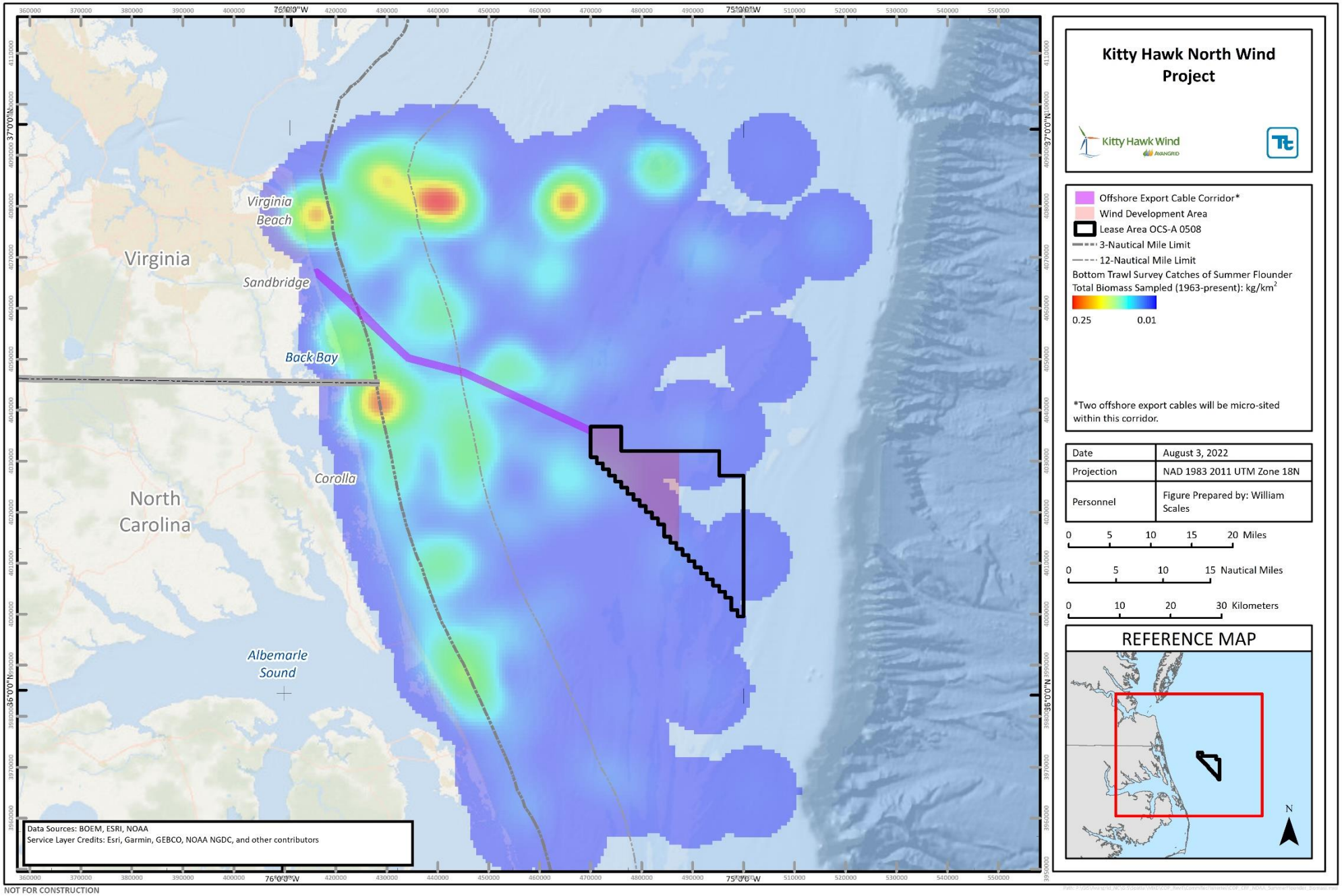


Figure 7.2-22 Bottom Trawl Survey Catches of Summer Flounder (1963–2019)

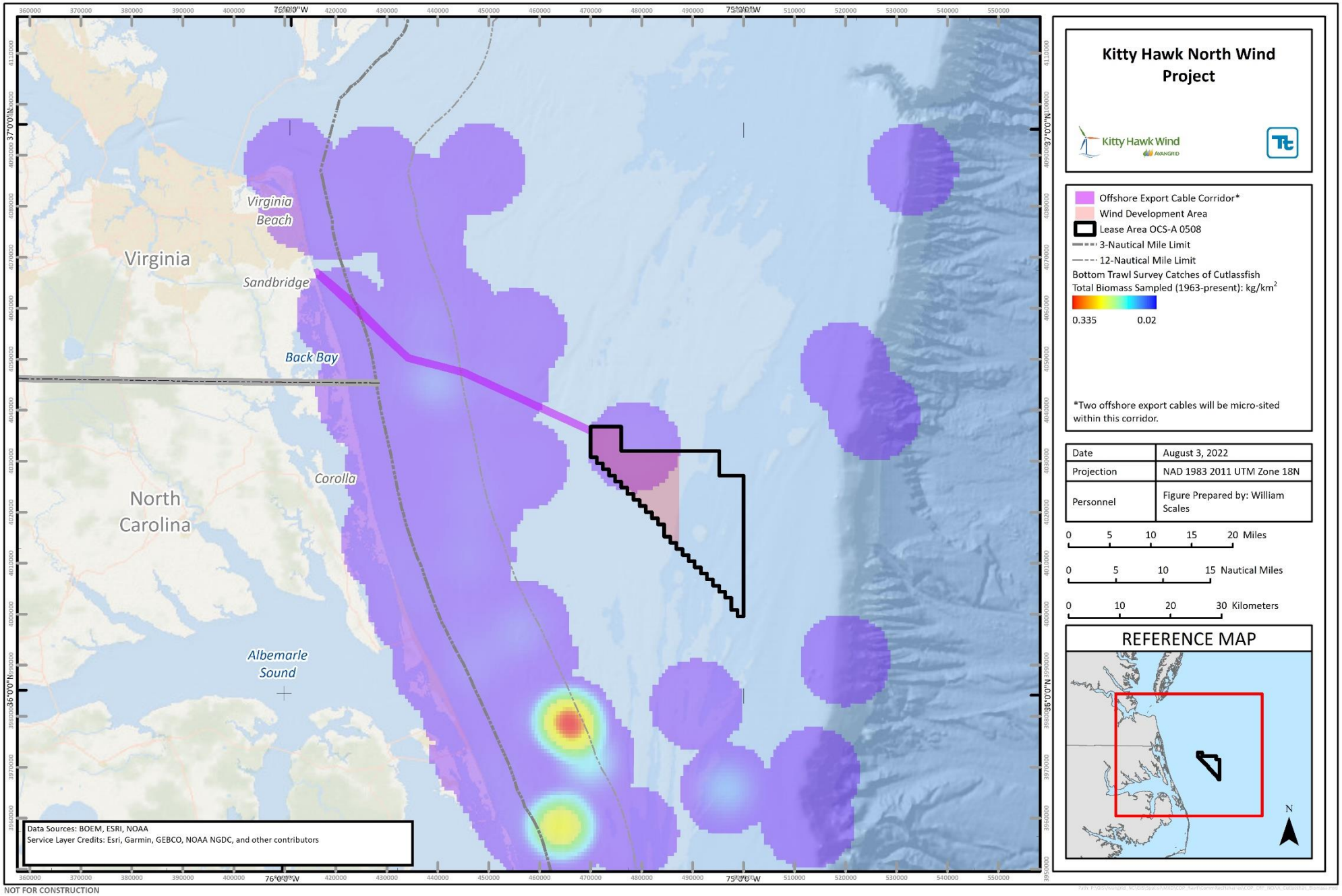


Figure 7.2-23 Bottom Trawl Survey Catches of Cutlassfish (1963–2019)

Bottom Trawl Survey catches of bluefish were highly variable between 1960 and 2020. (Figure 7.2-24). Most of the bluefish landed in this survey were caught relatively close to shore, along the Outer Banks and the offshore export cable corridor (Figure 7.2-26).

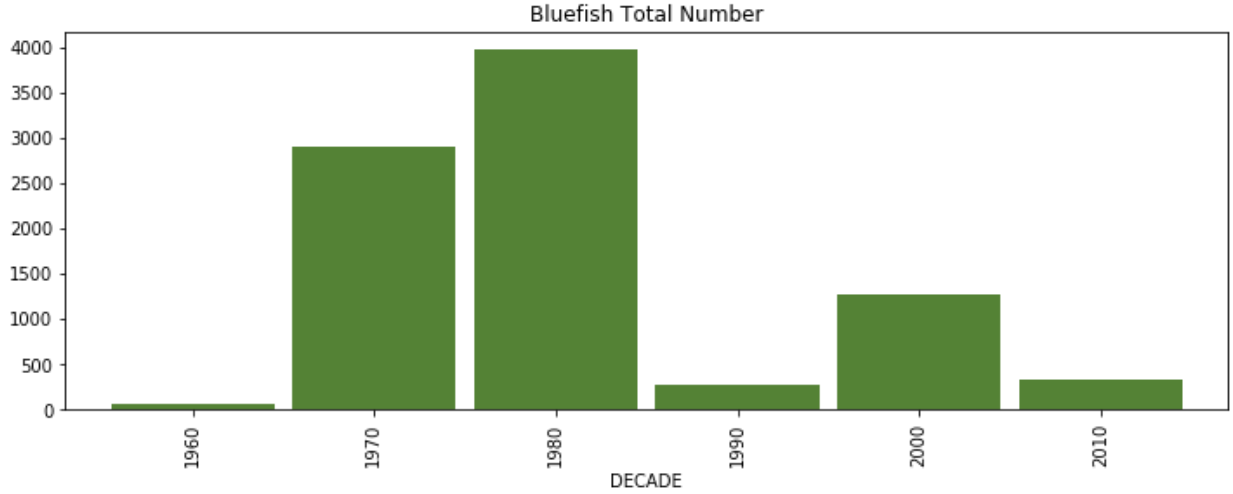


Figure 7.2-24 Decadal Sums of Bluefish Caught by Trawl Survey in the Review Area

Smooth dogfish catches in this survey peaked in the 1970s and has been relatively low in the past decade (Figure 7.2-25). Their abundance, as documented in the survey, was very low throughout both the Wind Development Area and the offshore export cable corridor when the surveys were conducted (Figure 7.2-27). The species migrates northward through the offshore export cable corridor area in April and May and the timing of their migration may not be synchronous with the trawl survey.

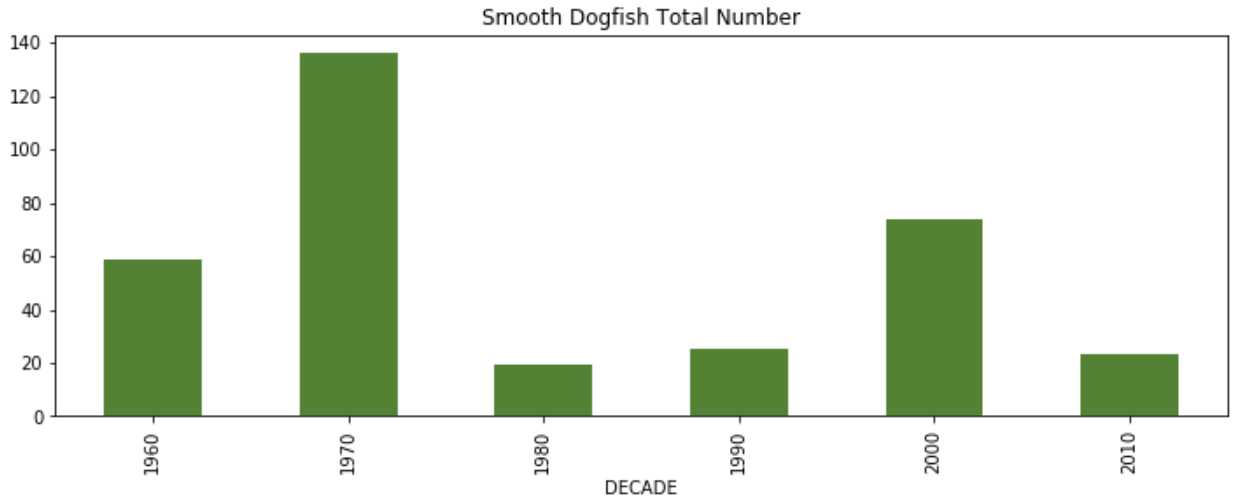


Figure 7.2-25 Decadal Sums of Smooth Dogfish Caught by Trawl Survey in the Review Area

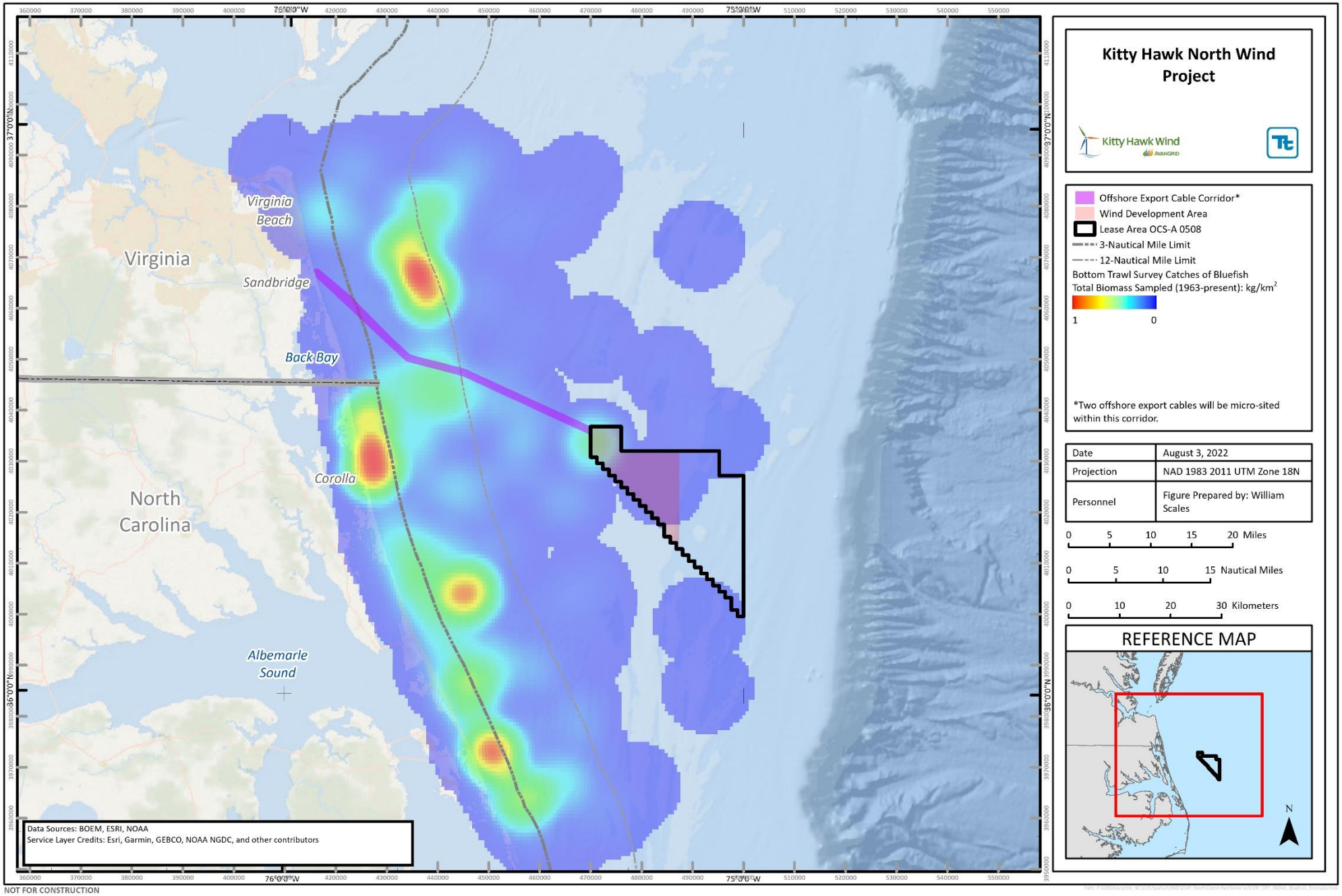


Figure 7.2-26 Bottom Trawl Survey Catches of Bluefish (1963–2019)

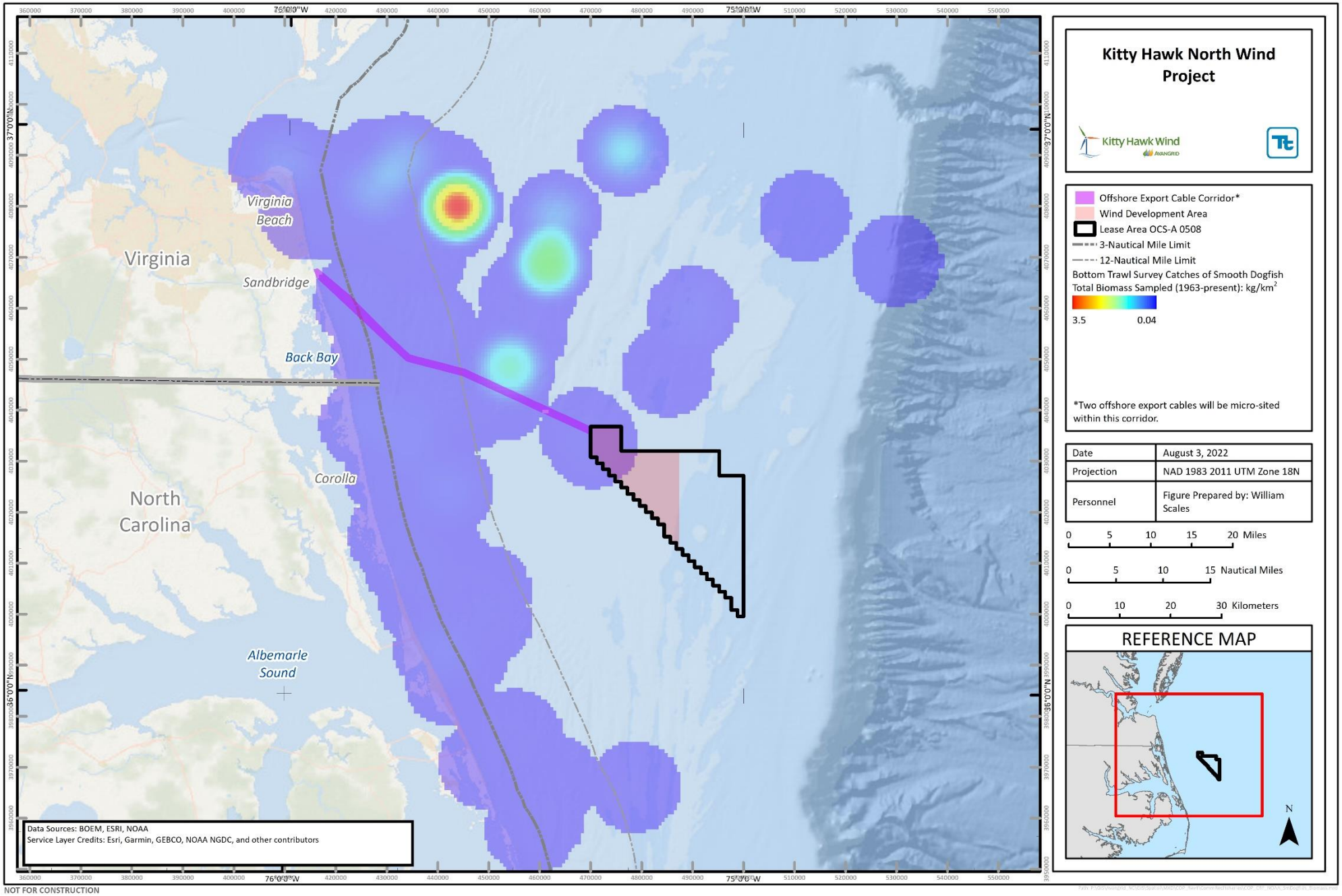


Figure 7.2-27 Bottom Trawl Survey Catches of Smooth Dogfish (1963–2019)

Spiny dogfish presence in the survey peaked in the 1960s (Figure 7.2-28). However, most of the survey catches of spiny dogfish were caught offshore, east of the offshore Project Area (Figure 7.2-30).

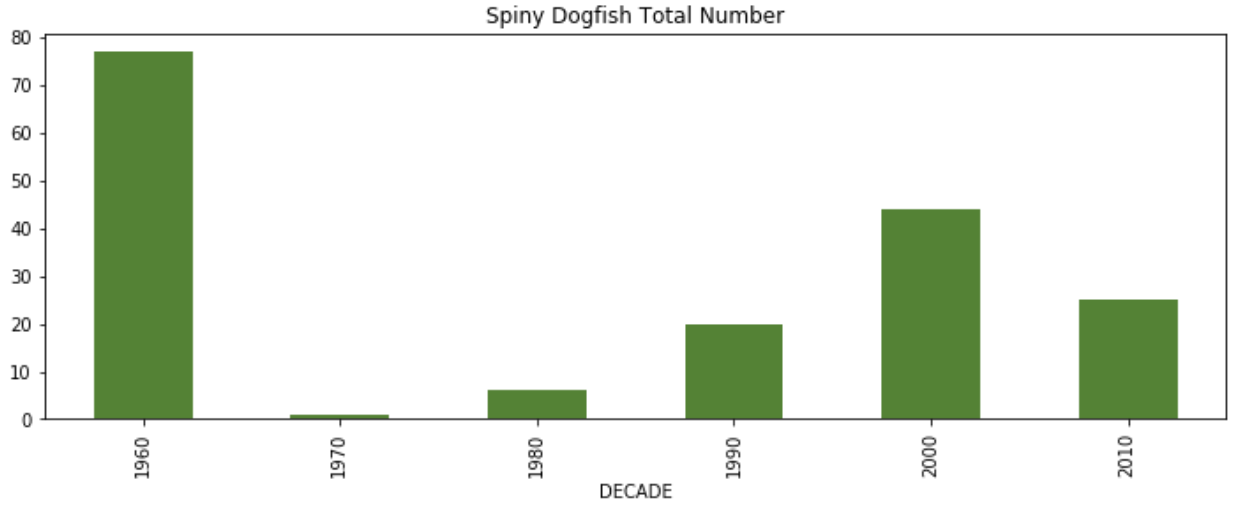


Figure 7.2-28 Decadal Sums of Spiny Dogfish Caught by Trawl Survey in the Review Area

Northern kingfish, known locally as roundhead, catch in the survey peaked between 1990-2000 and slightly decreased between 2000 and 2020 (Figure 7.2-29). However, most of the northern kingfish were caught close to shore and in the western portion of the offshore export cable corridor. There were no northern kingfish caught in the Wind Development Area during the life of the survey (Figure 7.2-31).

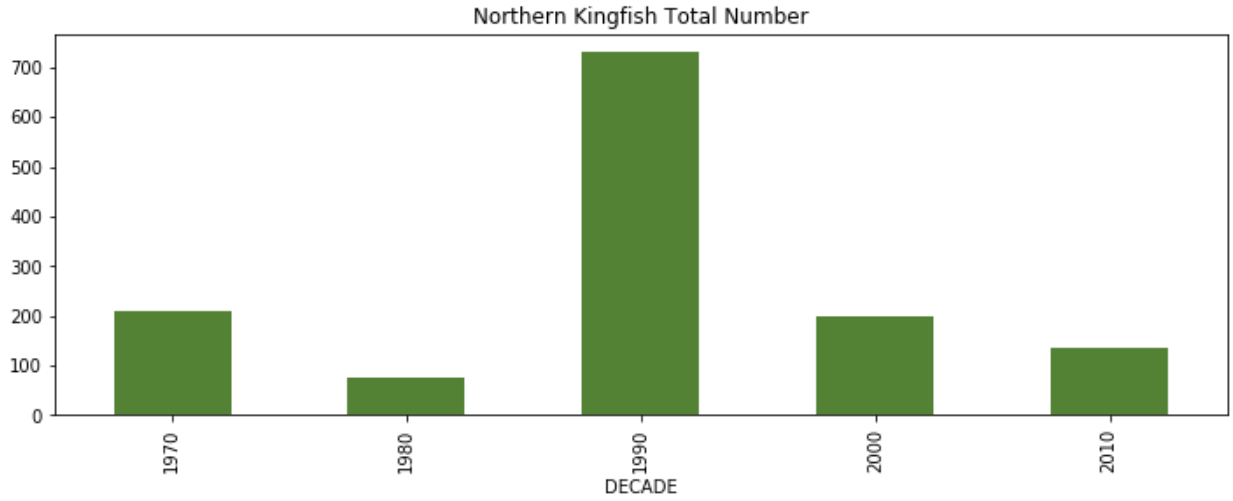


Figure 7.2-29 Decadal Sums of Northern Kingfish Caught by Trawl Survey in the Review Area

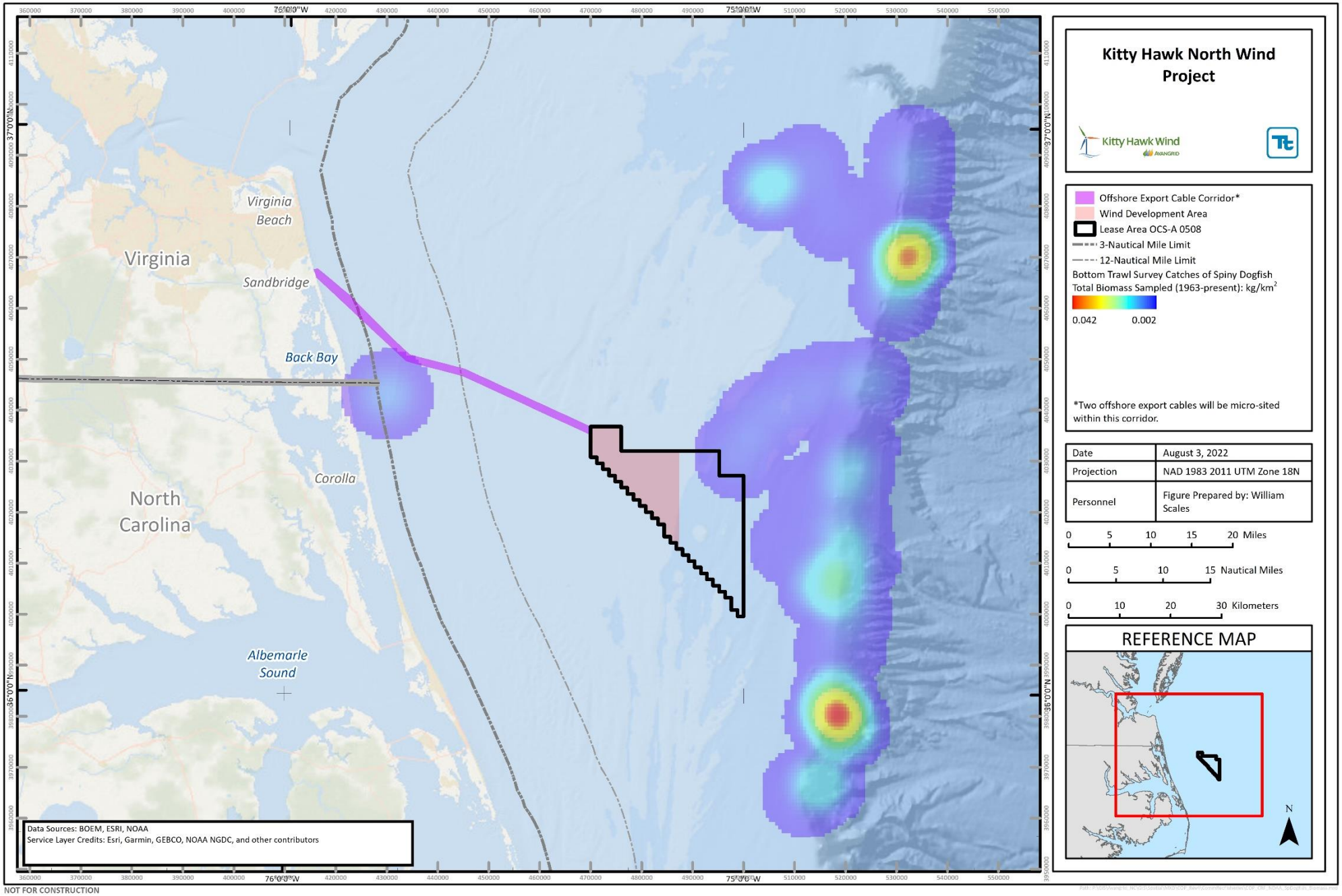


Figure 7.2-30 Bottom Trawl Survey Catches of Spiny Dogfish (1963–2019)

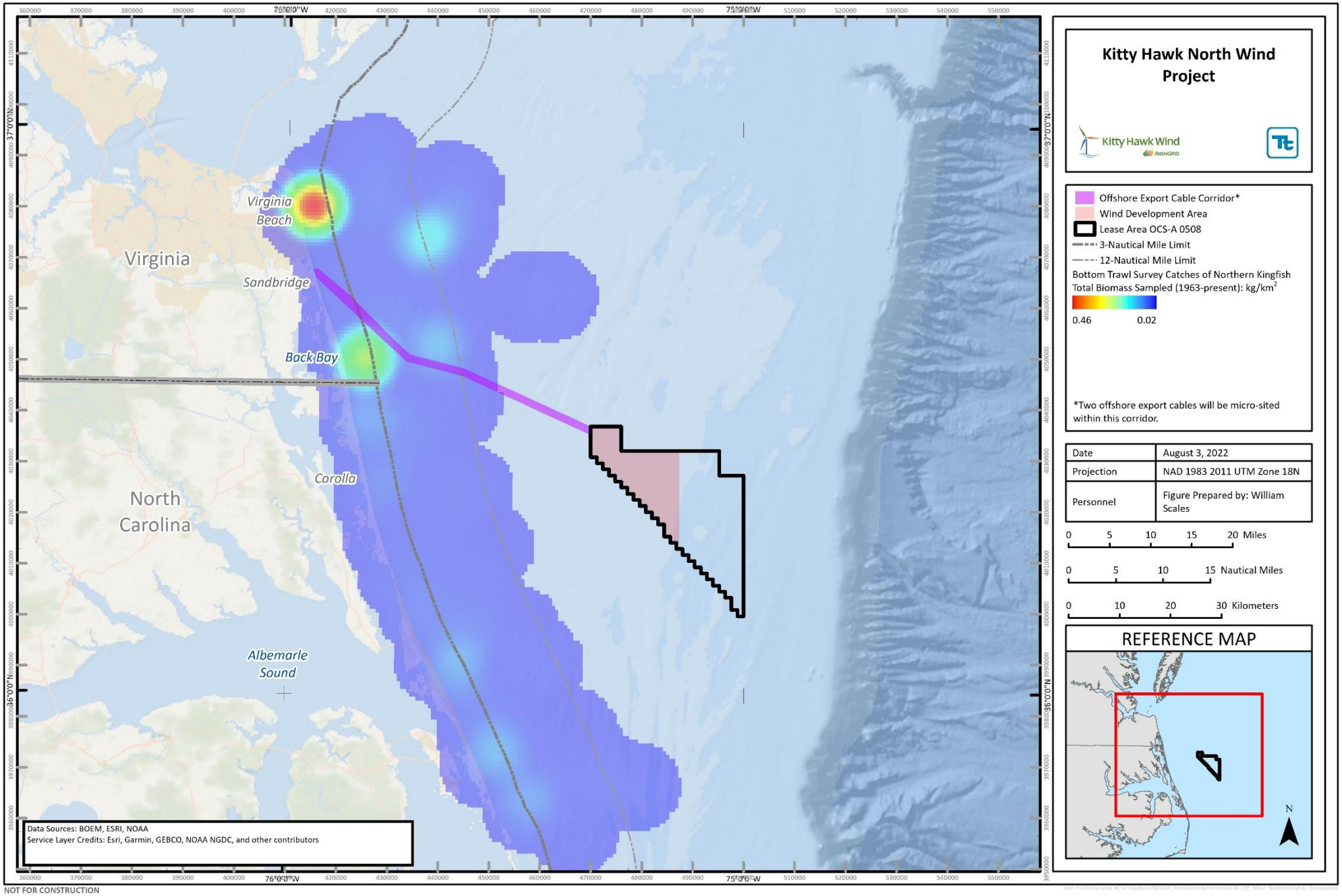


Figure 7.2-31 Bottom Trawl Survey Catches of Northern Kingfish (1963–2019)

Bottom Trawl Survey catches of spot have remained fairly steady in the review area throughout the life of the survey but peaked between 2000 and 2010 (Figure 7.2-32). The majority of the spot were caught very close to shore and along the offshore export cable corridor with very low survey catches in the Wind Development Area (Figure 7.2-34).

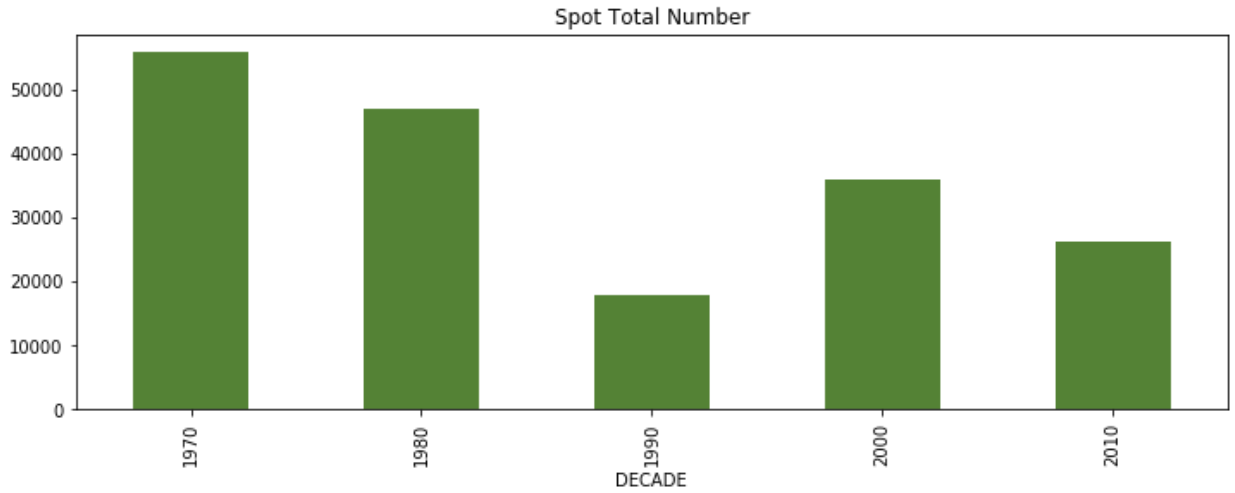


Figure 7.2-32 Decadal Sums of Spot Caught by Trawl Survey in the Review Area

Survey catches of Spanish mackerel between Cape Henry to Oregon Inlet peaked between 1990 and 2000 and has steadily decreased ever since (Figure 7.2-33). Spanish mackerel catches were fairly widespread inshore of the Lease Area with minimal survey catches occurring within the Wind Development Area (Figure 7.2-35).

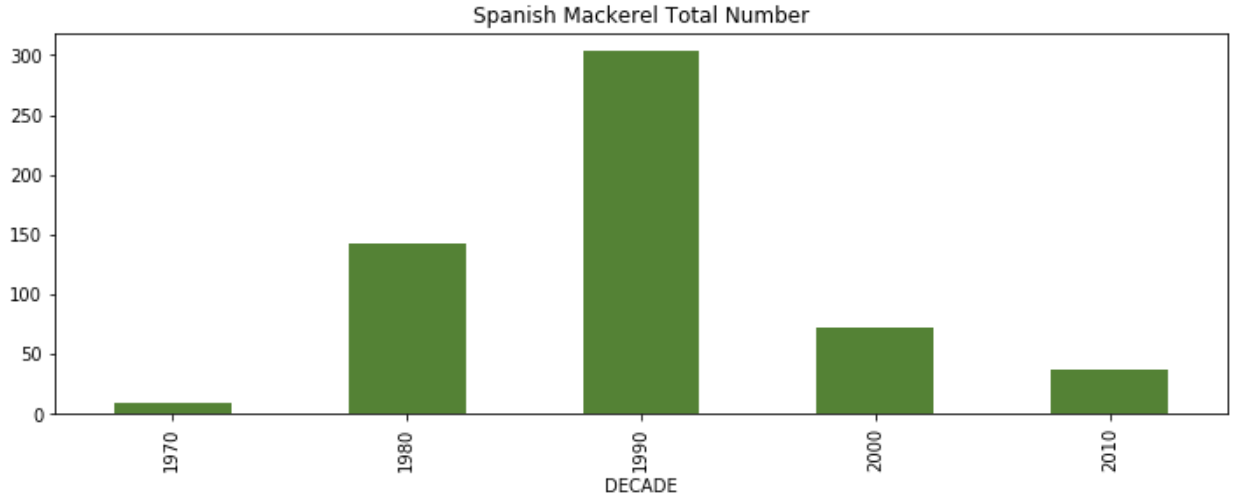


Figure 7.2-33 Decadal Sums of Spanish Mackerel Caught by Trawl Survey in the Review Area

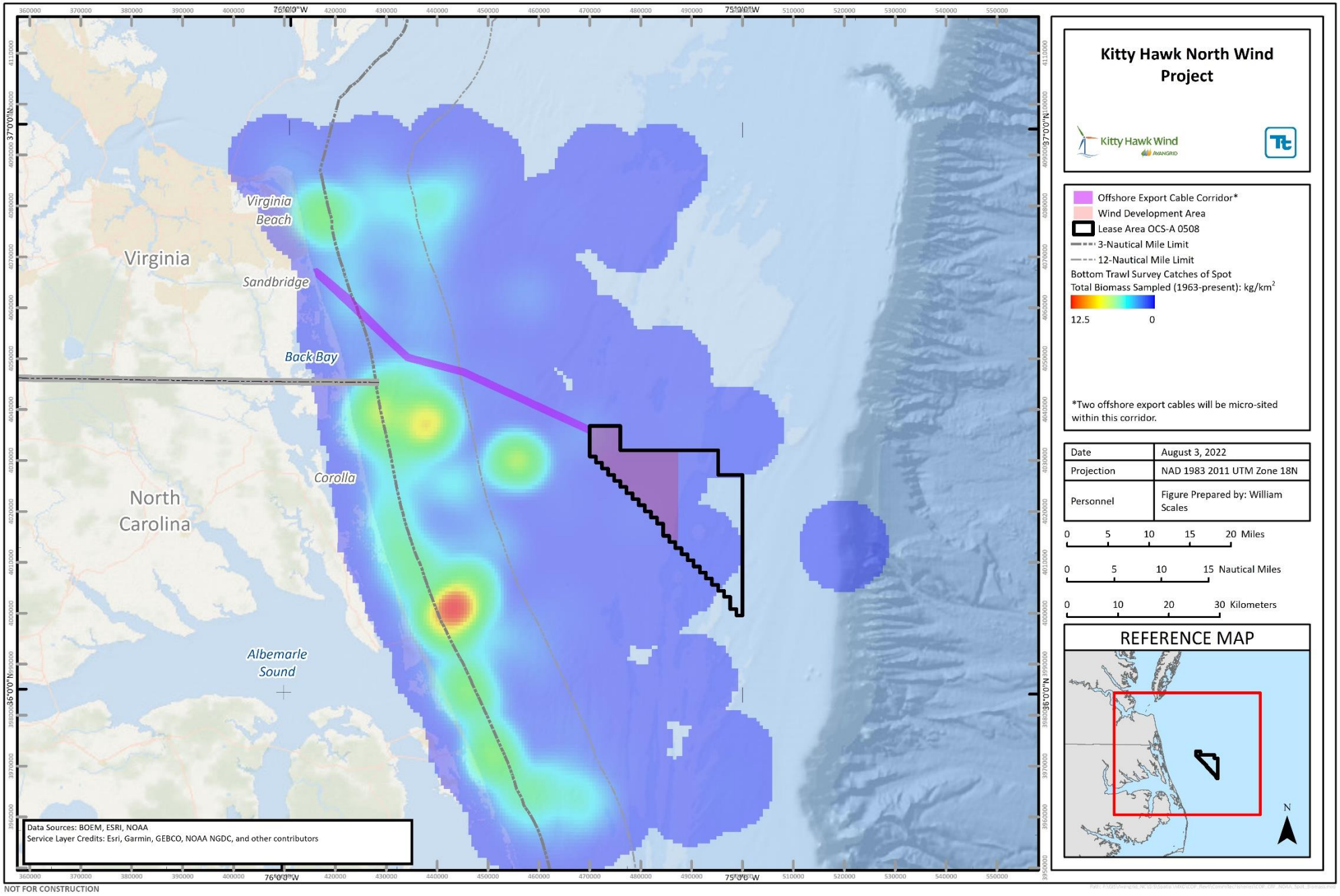


Figure 7.2-34 Bottom Trawl Survey Catches of Spot (1963–2019)

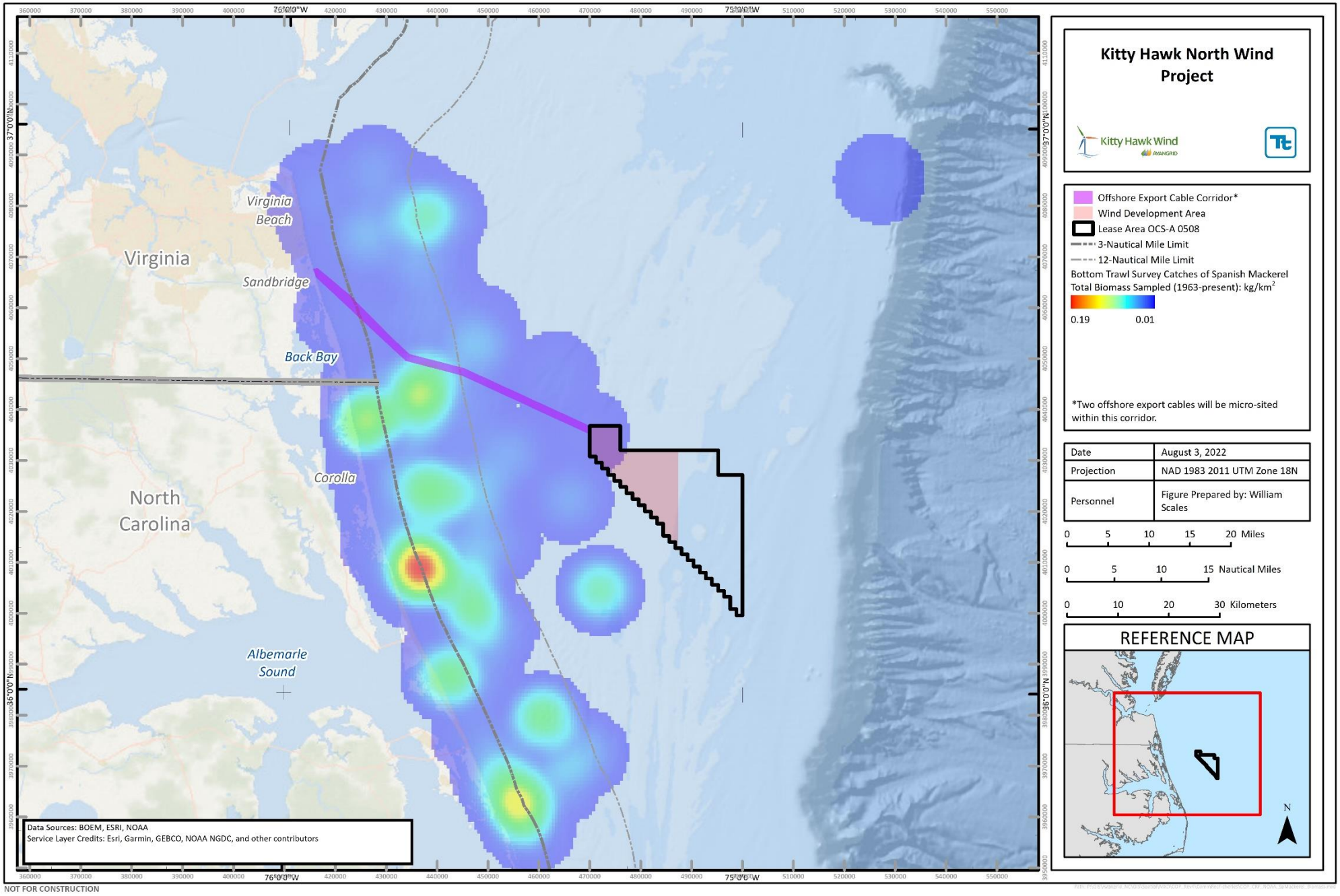


Figure 7.2-35 Bottom Trawl Survey Catches of Spanish Mackerel (1963–2019)

Survey catches of cobia peaked between 1990 and 2000 and has steadily decreased since (Figure 7.2-36). Catch locations between Cape Henry and Oregon Inlet have been distributed inshore of the Lease Area along their migratory path into the Chesapeake Bay (Figure 7.2-38).

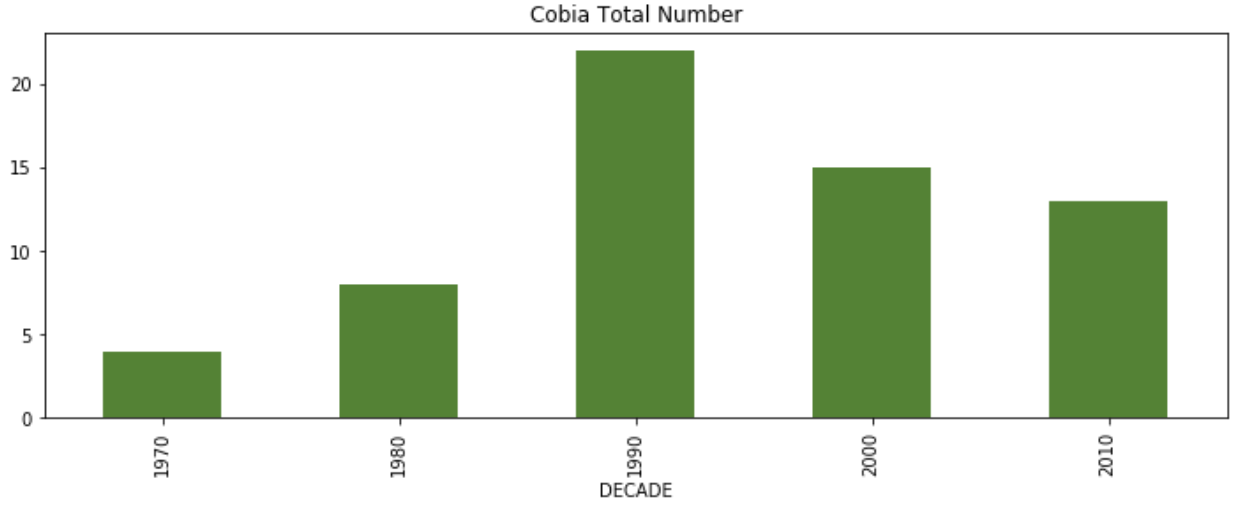


Figure 7.2-36 Decadal Sums of Cobia Caught by Trawl Survey in the Review Area

Red drum were only caught in three of the five decades of the survey and peaked between 2000 and 2010 (Figure 7.2-37). Overall survey catches of red drum between Cape Henry and Oregon Inlet are low (Figure 7.2-39). However, red drum frequently form schools near the surface as they migrate in and out of the Chesapeake Bay, which may make them unavailable to the trawl survey gear.

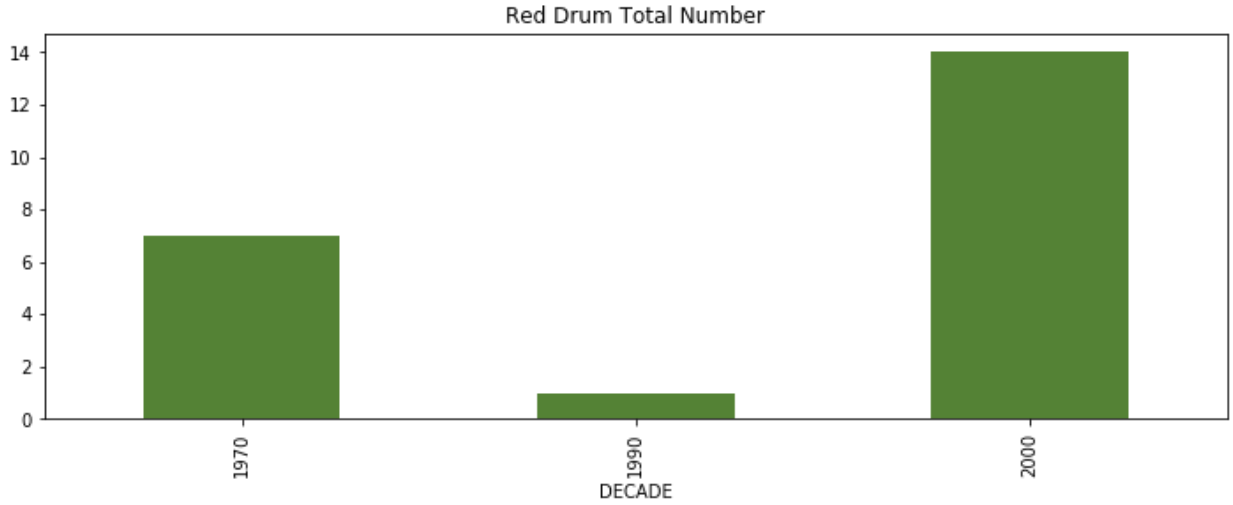


Figure 7.2-37 Decadal Sums of Red Drum Caught by Trawl Survey in the Review Area

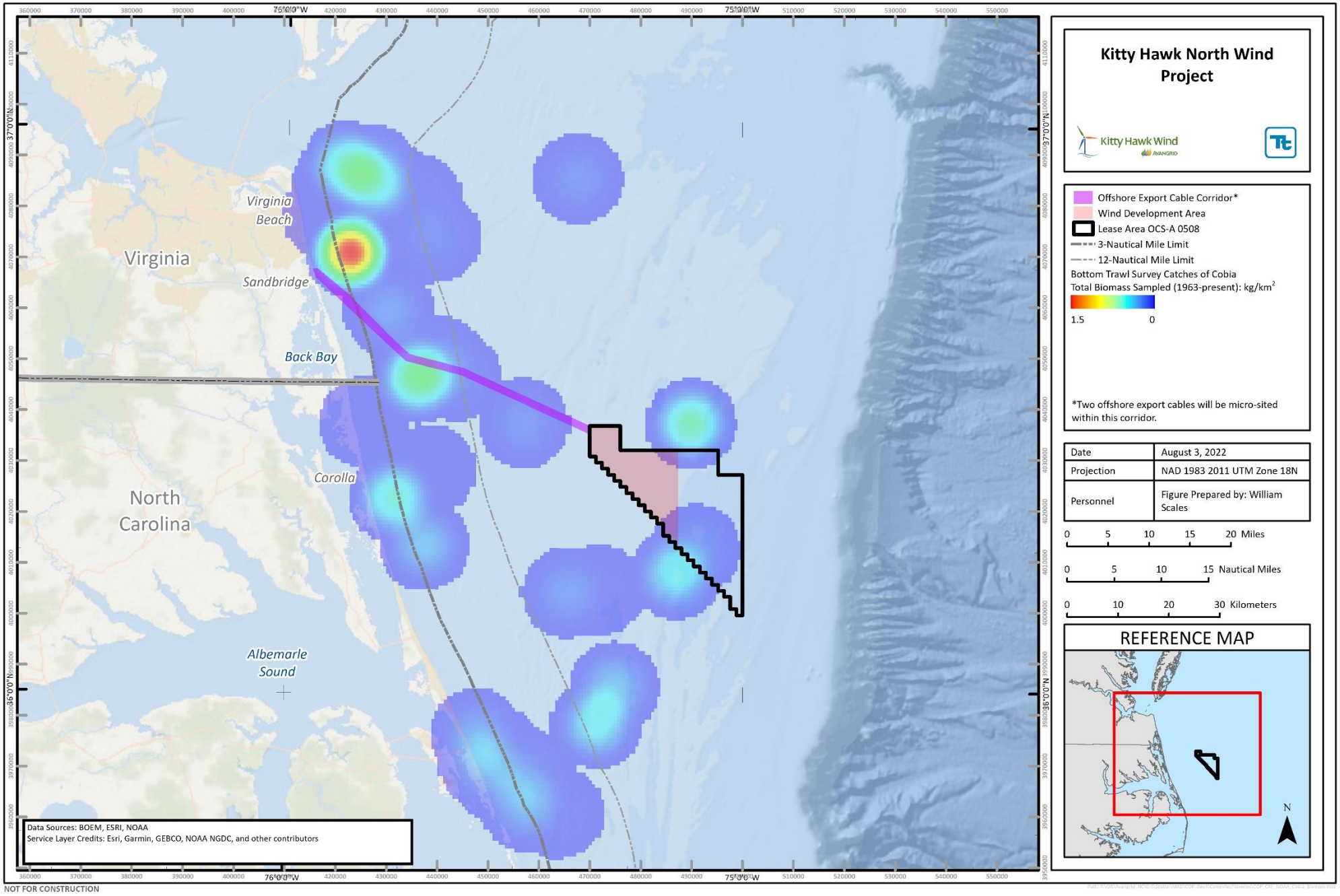


Figure 7.2-38 Bottom Trawl Survey Catches of Cobia (1963–2019)

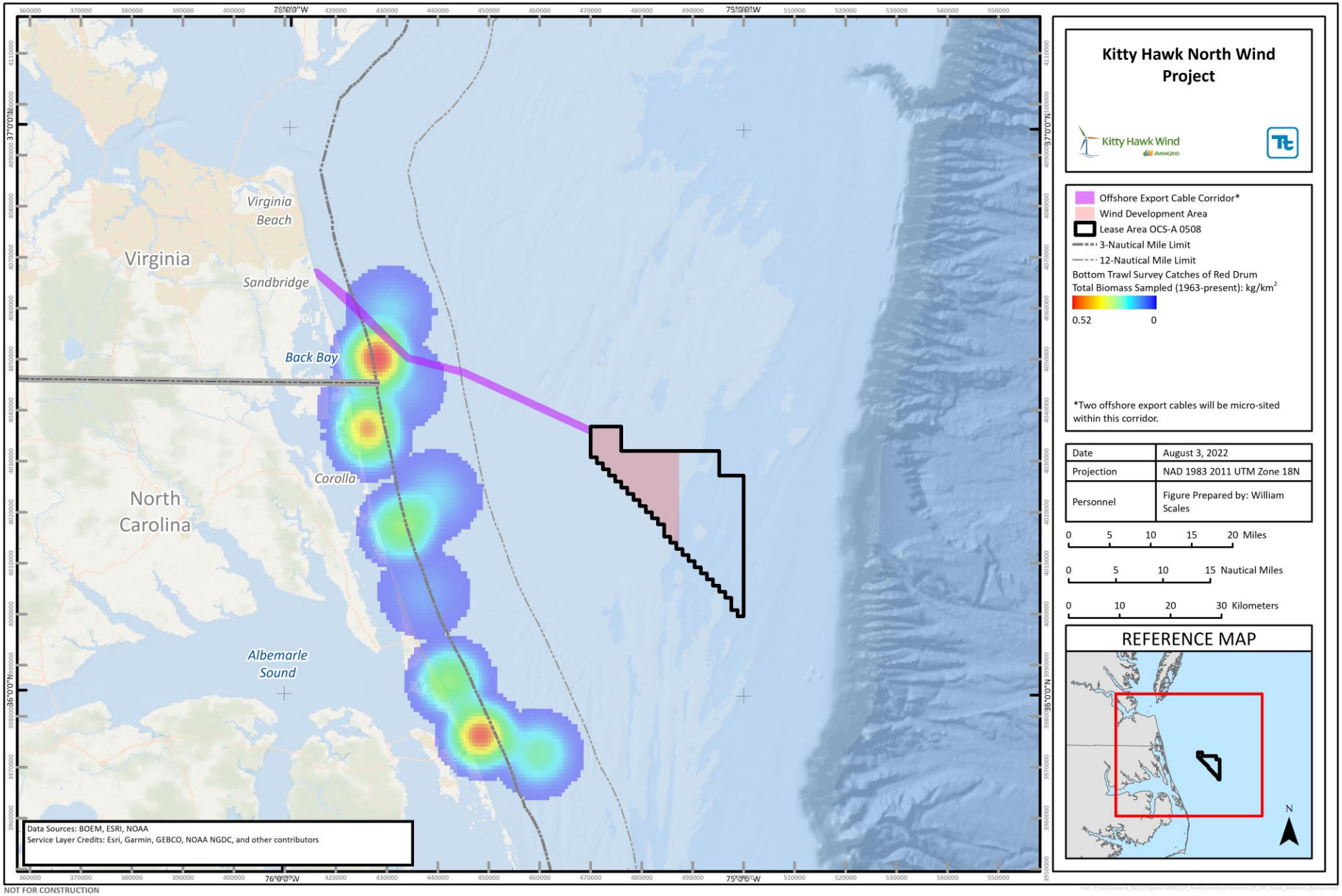


Figure 7.2-39 Bottom Trawl Survey Catches of Red Drum (1963–2019)

7.2.1.3.2 VIMS Shark Longline Survey

The Virginia Institute of Marine Science's Shark Longline Survey provides information on shark, skate, and ray presence around monitoring locations outside of the Chesapeake Bay (VIMS 2020a). The survey was established in 1973 to monitor the distribution, abundance, and biology of adult sharks, which use these waters during seasonal migrations along the U.S. eastern seaboard. The stations in or near the offshore export cable corridor of the Project are identified as VO, VI, D, and FC (Figure 7.2-40). VO station is located offshore of Virginia Beach. VI is inshore of Virginia Beach. D is by the 4A buoy drydock. FC is False Cape. Twenty-eight different species, consisting of 3,870 individuals, were recorded near the offshore export cable corridor since 1973 (Table 7.2-3).

Table 7.2-3 Species Identified in the Offshore Export Cable Corridor from 1974 to 2019

Species	Scientific Name	Count
Clearnose skate	*Raja eglanteria*	988
Sandbar shark	*Carcharhinus plumbeus*	868
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	851
Sand tiger shark	*Carcharias taurus*	241
Blacktip shark	*Carcharhinus limbatus*	223
Spinner shark	*Carcharhinus brevipinna*	167
Dusky shark	*Carcharhinus obscurus*	160
Red drum	*Sciaenops ocellatus*	126
Smooth dogfish	*Mustelus canis*	69
Roughtail stingray	*Bathytoshia centroura*	39
Scalloped hammerhead	*Sphyrna lewini*	25
Cobia	*Rachycentron canadum*	20
Blacknose shark	*Carcharhinus acronotus*	14
Bluntnose stingray	*Dasyatis say*	13
Cownose ray	*Rhinoptera bonasus*	13
Southern stingray	*Hypanus americanus*	13
Tiger shark	*Galeocerdo cuvier*	12
Bull shark	*Carcharhinus leucas*	8
Great white shark	*Carcharodon carcharias*	3
Smooth hammerhead	*Carcharodon carcharias*	3
Spiny butterfly ray	*Gymnura altavela*	3
Thresher shark	*Alopias*	3
Bullnose ray	*Myliobatis freminvillii*	2
Horseshoe crab	*Limulidae*	2
American eel	*Anguilla rostrata*	1
Bluefish	*Pomatomus saltatrix*	1

Species	Scientific Name	Count
Bonnethead	*Sphyrna tiburo*	1
Mahi-mahi	*Coryphaena hippurus*	1
	Total	**3,870**
Source: Jim Gartland, VIMS, Data request by the FLO, 24 Aug 2020		

The three most abundant species caught in the longline survey in the offshore export cable corridor from 1974 onward are clearnose skates, sandbar sharks, and Atlantic sharpnose sharks. From 2015 to 2019, twenty-one different species were recorded in the offshore export cable corridor, consisting of 1,040 different individuals. They consisted of eleven shark species, six ray species, one skate species, two fish species, and horseshoe crab. The top three most abundant species caught over the past five years are the same species most abundant in the lifetime of the survey, but with a higher proportion of Atlantic sharpnose sharks. More information about recreational fishing activities on species found in the offshore export cable corridor can be found in Section 7.2.1.4.

7.2.1.3.3 NEAMAP Surveys

NEAMAP is the inshore complement to the annual fall/spring bottom-trawl survey. The inshore portion of the export cable corridor overlaps with Regions 13 and 14 of the NEAMAP survey. This survey is conducted within these regions inshore of the 60-foot (18-m) depth contour.

The VIMS NEAMAP facilitates fisheries management and stock monitoring by collecting data from Cape Cod, Massachusetts south to Cape Hatteras, North Carolina (VIMS 2020b). NEAMAP conducts a mixture of nearshore trawl surveys that compliment trawls in federal waters conducted by NOAA Fisheries and Northeast Fisheries Science Center (NEAMAP, n.d.). The tow target speed is 1.5 meters per second (3 knots). The NEAMAP trawls occur in the fall and spring, typically from late September to late October and from the end of April to the middle of May. The top fifteen most abundant species in the trawl survey included fish, cephalopods, and one crustacean (Table 7.2-4).

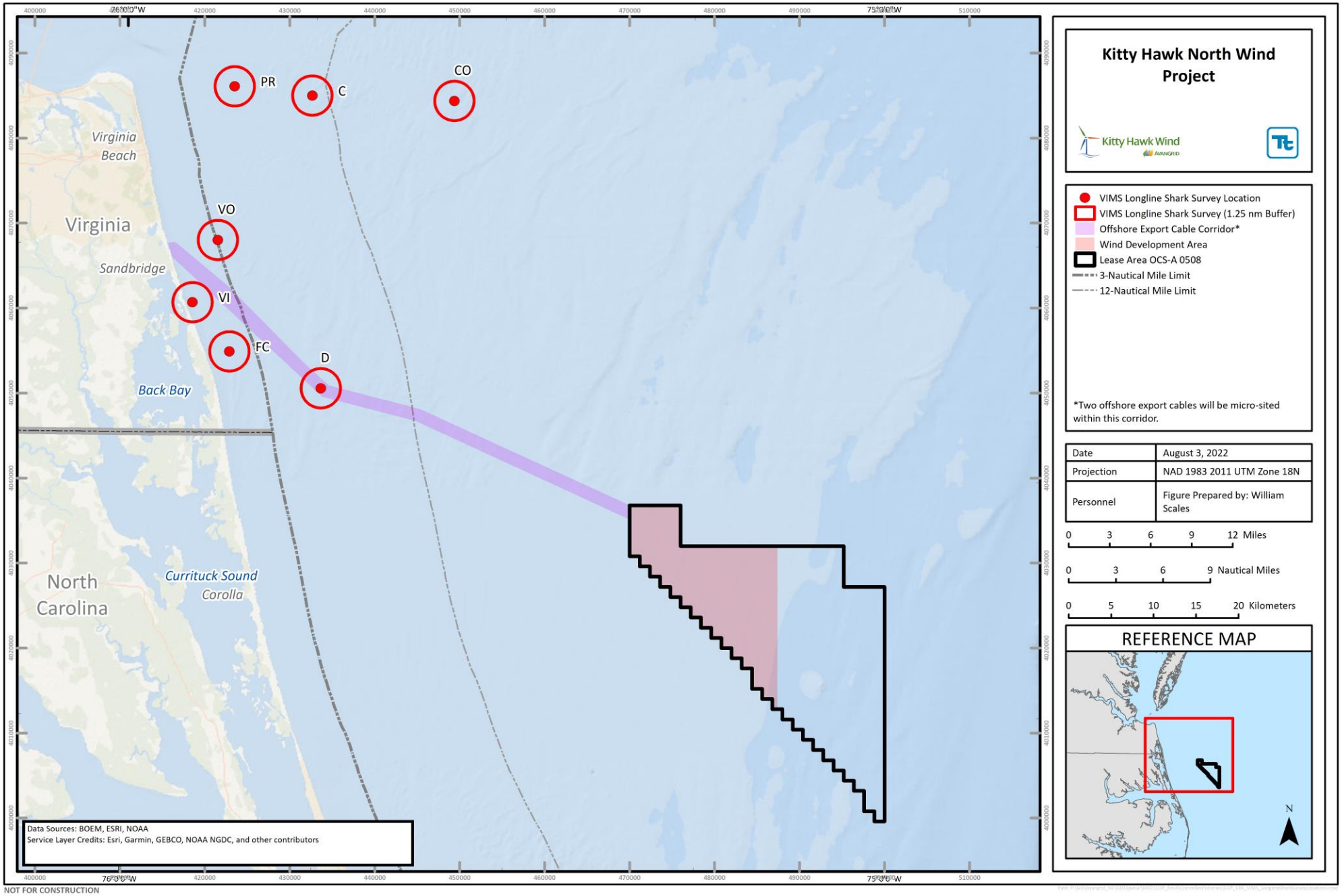


Figure 7.2-40 VIMS Shark Survey Stations Overlay

Table 7.2-4 Top 15 Species Caught in Regions 13 and 14 by the NEAMAP Survey

Species	Scientific Name	Count	Biomass (lbs)	Biomass (kg)
Atlantic croaker	*Micropogonias undulatus*	476,233	75,138	34,082
Spot	*Leiostomus xanthurus Lacepede*	434,872	49,031	22,240
Clearnose skate	*Raja eglanteria*	13,232	42,368	19,218
Weakfish	*Cynoscion regalis*	337,052	40,724	18,472
Kingfish/Sea mullet	*Menticirrhus americanus*	83,920	21,314	9,668
Striped anchovy	*Anchoa hepsetus*	531,440	14,932	6,773
Butterfish	*Peprilus triacanthus*	119,799	9,601	4,355
Scup	*Stenotomus chrysops*	111,216	7,604	3,449
Silver perch	*Bairdiella chrysoura*	56,453	4,039	1,832
Longfin inshore squid	*Doryteuthis pealeii*	32,462	3,082	1,389
White shrimp	*Litopenaeus setiferus*	53,743	2,994	1,358
Atlantic menhaden	*Brevoortia tyrannus*	36,797	2,950	1,338
Spotted hake	*Urophycis regia*	26,661	1,636	742
Atlantic cutlassfish	*Trichiurus lepturus*	15,191	472	214
Bay anchovy	*Anchoa mitchilli*	66,596	379	172
Source: Jim Gartland, VIMS, Data request by the FLO, 24 Aug 2020				

The three most abundant species caught in the NEAMAP survey during the time series are Atlantic croaker, spot, and clearnose skate (Table 7.2-4; Jim Gartland, VIMS, Data request by the FLO, 27 Aug 2020). From 2007 to 2019, 165 species were collected in the NEAMAP trawl survey in Regions 13 and 14 (Figure 7.2-41). From 2015 to 2019, 125 species were caught in the region by the NEAMAP survey. Regions 13 and 14 are located on the coast of Virginia and the northern coast of North Carolina respectively.

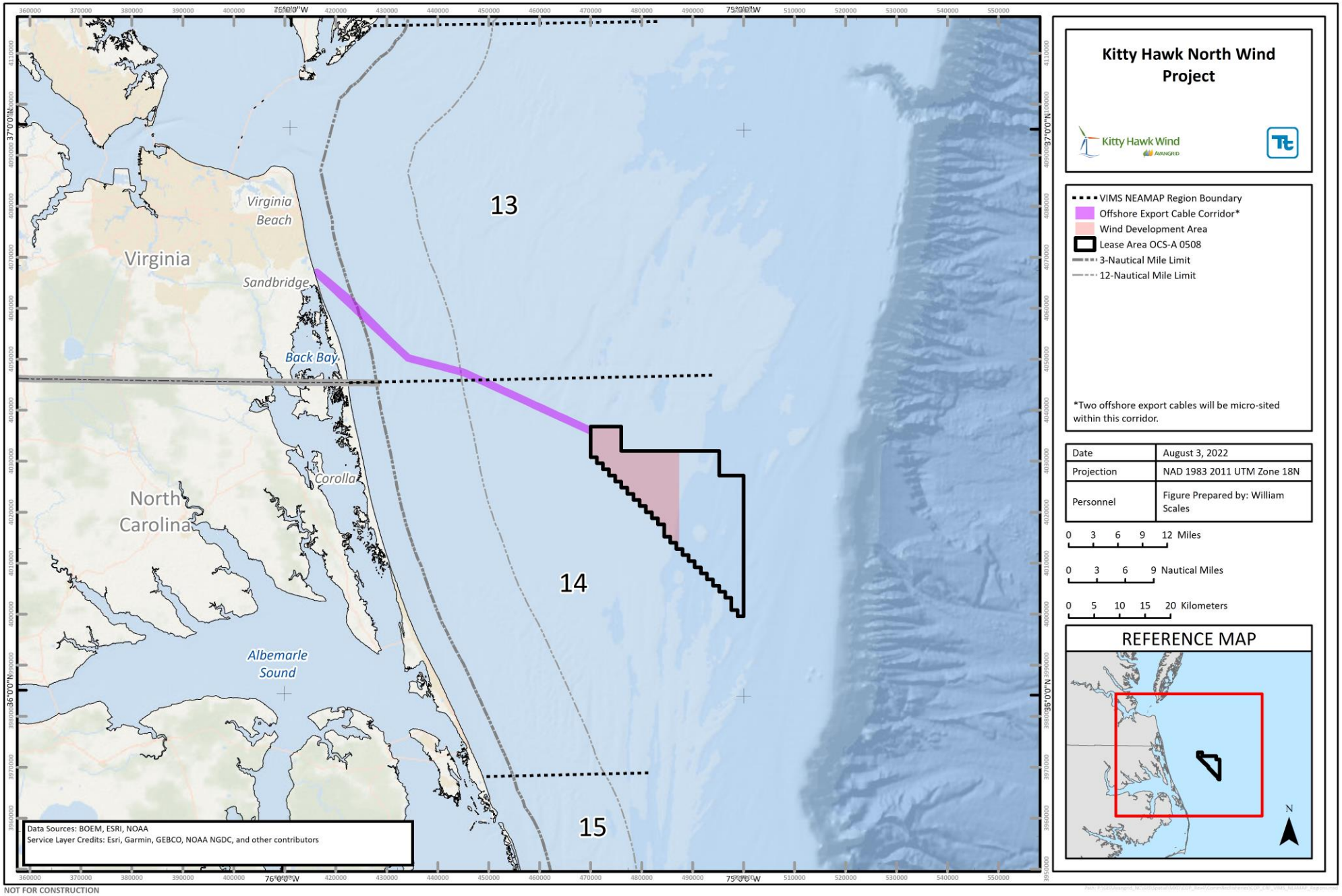


Figure 7.2-41 NEAMAP Regions Adjacent to the Offshore Project Area

7.2.1.4 *Recreational Fishing*

Recreational fishers from Virginia and North Carolina, as well as many who travel to these states from elsewhere, may utilize the waters in and around the review area for recreational fishing. Recreational fishing within the review area occurs by saltwater anglers on privately owned vessels as well as on chartered vessels and head boats. Recreational vessels hail from various ports, but due to the contiguous nature of the beaches along this portion of the coastline from Rudee Inlet near Virginia Beach, Virginia, to Oregon Inlet near Nags Head, North Carolina (a distance of 67 nm [124 km]), the ports utilized by recreational vessels are limited. Both locations attract recreational fishing tourists and typically host numerous fishing tournaments.

While most of the recreational fishing in the area does not occur within the Wind Development Area, recreational fishers traverse through the review area in transit to fishing grounds where targeted species are more commonly found. Recreational fishing also occurs in and near the offshore export cable corridor as discussed below. A BOEM study indicated that approximately 24 percent of the for-hire recreational boating trips that left from North Carolina ports were estimated to be exposed to Wind Development Areas from 2007 to 2012 (Kirkpatrick et al. 2017). In the same study period, it is estimated that 7.3 percent of all angler trips out of North Carolina were estimated to be exposed to offshore wind energy development for all North Carolina Call Areas. However, the Wind Development Area only accounts for 5.6 percent of the total BOEM Kitty Hawk Call Area. Most recreational vessels transiting through the Wind Development Area are transiting to offshore fishing grounds targeting tunas, billfish, swordfish, dolphin, wahoo, as well as bottom fish such as tilefish (Malacanthidae), grouper, and rosefish (*Sebastes norvegicus*). These fisheries occur east or seaward of the Lease Area, and most recreational fishing vessels transiting through the Lease Area originate from Rudee Inlet, Virginia, and Oregon Inlet, North Carolina. Occasionally, vessels transit from as far away as the Chesapeake Bay.

The highest potential for vessel traffic through the review area will occur during HMS tournaments, predominantly targeting billfish, which can include up to 100 or more vessels over a period of one to four days. Most vessels participating in recreational fishing tournaments in the general vicinity of the review area consist of vessels ranging from 43 to 75 feet (ft, 13 to 23 m) in length and can maintain a cruising speed at or above 12.8 meters per second (25 knots). Over 100 fishing tournaments were scheduled in North Carolina in 2020 (Fisherman's Post 2020). Recreational fishing tournaments east of the review area are focused on HMS species and generally occur annually from June to September, with peak events in August. Fishing tournaments that may include transits through the Wind Development Area currently include eight annual tournaments: five originating from Rudee Inlet, Virginia and three from Oregon Inlet, North Carolina. Fishing tournaments that may transit the Wind Development Area are summarized in Table 7.2-5 below.

The most common types of recreational fishing near the offshore export cable corridor is trolling for Spanish mackerel and other migratory species and sight-casting for cobia and red drum as they migrate in and out of the Chesapeake Bay. Trolling activities occur typically parallel to the beach (north/south) in 4 to 8 fathom (7 to 14 m) water depths. Historically, trolling for striped bass has also been a relatively intensive recreational fishery during the winter months within 3 nm (5.6 km) of the beach in the vicinity of the offshore export cable corridor. However, the stock has stayed further offshore in recent winters within the EEZ where their harvest is prohibited by regulation. This fishery has been subject to major regulatory changes in recent years and is now highly dynamic from year to year. In recent years, cutlassfish have emerged as a recreationally targeted species, with the fishery focused in the vicinity of the dump site buoys and Chesapeake Bay buoy line, north of the offshore export cable corridor.

A study conducted by BOEM, the Virginia Department of Mines, Minerals and Energy, and the Virginia Coastal Zone Management Program on the Virginia fisheries, with a focus on offshore wind development, indicated that there has been a significant decrease in recreational fishing activity out of Virginia Beach, Virginia, compared with activity in the Coastal Virginia Offshore Wind (CVOW; Leases OCS-A 0497 and 0483) review area from 1996 to 2014 (BOEM 2016).

Table 7.2-5 Summary of Recreational Fishing Tournaments Occurring in the Wind Development Area

Tournament	Occurrence	Size	2019 Fishing Dates	Port	Website
Virginia Beach Tuna Tournament	Annual	80-100 boats	6/19-6/22	Rudee Inlet	https://www.vbtuna.com
Virginia Beach Invitational Billfish Tournament	Annual	25-35 boats	7/25-7/27	Rudee Inlet	https://www.facebook.com/VirginiaBeachInvitationalMarlinTournament/
NC Boatbuilders Tournament	Annual	30-35	7/25-7/27	Oregon Inlet	http://dcbbf.org/carolina-boat-builders-fishing-tournament/
Pirates Cove Alice Kelly Ladies Tournament	Annual	100/+ boats	8/11	Oregon Inlet	http://www.pcbgt.com/alice-kelly/
Pirates Cove Big Game Tournament	Annual	80-100 boats	8/13-8/16	Oregon Inlet	http://www.pcbgt.com/
Wine, Women, and Fishing Tournament	Annual	20-30	8/18	Rudee Inlet	http://cbwc.org/wine-women-fishing-gallery/
Virginia Beach Billfish Tournament	Annual	80-90 boats	8/22-8/24	Rudee Inlet	https://vbbt.com/
F. Wayne McLeskey, Jr. Memorial Marlin Tournament	Annual	20-30	8/30-9/1	Rudee Inlet	https://fwmmo.com/

7.2.1.4.1 Economic Overview

Recreational fisheries provide economic value through local revenue driven by anglers' expenditures. The Commonwealth of Virginia recorded 1,367,933 saltwater recreational fishing trips (inclusive of charter boat, party boat, private/rental boat trips, and shore fishing) in 2019, and North Carolina (inclusive of charter boat, private/rental boat trips, and shore fishing) recorded 10,024,223 in 2019 (NOAA Fisheries 2019b). Most of the recreational fishing in both states, however, is shore-based fishing rather than vessel-based (Table 7.2-6). An overview of the socioeconomic impacts to recreational fishing from the North Carolina Call Areas is provided in Table 7.2-7.

Data provided by the American Sportfish Association also demonstrate that marine recreational fishing occurs at a larger scale in North Carolina than in Virginia. Compared to Virginia, in North Carolina the number of anglers fishing is double and recreational fishing activities generate a billion dollars more to the domestic total economic output (American Sportfish Association 2019).

Between 2007 and 2012, expenditures on recreational angler trips within the multiple North Carolina Call Areas (areas of potential wind energy development under consideration by BOEM in federal waters) were estimated to be valued at $14.1 million dollars (Kirkpatrick et al. 2017). The port groups of Manteo, Nags Head, Other Dare, Swansboro, and Wanchese, North Carolina are most exposed to development of the North Carolina Call Areas in the study timeframe. The same study revealed that only 1.5 percent of total angler trips in Virginia are exposed to the North Carolina Call Areas, resulting in a total recreational angler expenditure value of approximately $1.8 million dollars. However, "exposure" in terms of this study include transits within the North Carolina Call Areas, and only a portion of these would potentially be impacted during the construction phase of the Project as the Project represents only a portion of the North Carolina Call Areas that were assessed by BOEM for this study. More information on potential impacts to recreational fishing may be found in Section 7.2.2.

Fishing tournaments provide economic value to both the Commonwealth of Virginia and the state of North Carolina. Each year, recreational fishers compete in over one hundred sport fishing tournaments across North Carolina (Fishermen's Post 2020). In 2018 the average net return (in local angler expenditures) of each tournament was $16,045 with $3.5 million in returns for the sum of all tournaments throughout the entire year (Hutt and Silva 2019).

Table 7.2-6 Recreational Saltwater Fishing Trips in North Carolina and Virginia (2010-2019)

Year	North Carolina			Virginia			
	Charter Boat	Private/ Rental Boat	Shore	Charter Boat	Private/ Rental Boat	Party Boat	Shore
2010	111,736	1,326,748	12,752,139	5,911	158,076	3,669	917,492
2011	107,064	1,288,971	11,653,897	2,142	256,920	3,630	596,221
2012	129,576	974,813	10,651,880	4,946	83,073	4,255	855,211
2013	86,508	1,028,777	10,853,199	3,668	352,774	8,123	1,293,682
2014	73,685	1,239,378	11,686,258	8,379	79,611	13,290	780,565
2015	94,716	1,498,910	12,450,117	6,807	161,584	4,455	749,628
2016	105,107	1,428,490	13,033,417	6,351	121,684	6,103	627,631
2017	107,417	1,244,085	13,381,956	5,249	125,044	3,505	794,628
2018	112,308	1,090,400	9,628,320	4,003	165,583	5,257	820,266
2019	110,450	988,965	8,924,809	6,597	216,102	2,497	1,142,198

Source: NOAA Fisheries 2019b
Data is not available for party boats from North Carolina.

Table 7.2-7 Socioeconomic Impacts to Recreational Fishing in North Carolina Offshore Wind Call Areas (2007-2012)

State	Total Expenditures (private boats and for-hire)	Expenditures exposed to North Carolina Call Areas	Percent of total expenditures exposed to North Carolina Call Areas
North Carolina	$167,031,917	$14,100,000	8.4%
Virginia	$121,549,221	$1,800,000	1.5%

Source: Kirkpatrick et al. 2017

7.2.1.4.2 Recreational Target Species

The North Carolina Department of Environmental Quality data on recreational fishing effort indicated that in 2018, recreational fishers caught 3,304,587 bluefish, 2,068,865 spot, and 1,731,340 kingfish (sea mullet, NCDEQ 2019). The most frequently recreationally fished species in the waters offshore of North Carolina, seaward of the Wind Development Area, include yellowfin tuna, dolphin, wahoo, billfish, swordfish, tilefish and bluefin tuna.

A more comprehensive data set on recreational fishing from Maine to Virginia during 2015 to 2019 is the Large Pelagics Intercept Survey. The survey includes catch and effort data (e.g., total observations, species kept, species released) for tuna, sharks, billfishes, swordfish, and other offshore recreational species (NOAA Fisheries 2020a). Table 7.2-8 represents trends in recreational fishing observations in Virginia from 2015 to 2019 on both private and charter vessels.

Table 7.2-8 Large Pelagics Intercept Survey Data of Total Catch (kept, released, and dead) from 2015-2019 in Virginia

Vessel type	2015		2016		2017		2018		2019		Total
	Private	Charter	Private	Charter	Private	Charter	Private	Charter	Private	Charter	
Dolphin (Coryphaena hippurus)	9,104	3,103	9,405	1,878	4,700	4,763	7,449	3,438	7,680	1,712	**53,232**
Yellowfin tuna (Thunnus albacares)	554	223	5,500	877	2,719	776	1,668	238	4,307	869	**17,731**
White marlin (Kajikia albida)	2,125	736	2,334	429	1,330	1,257	1,528	535	1,218	208	**11,700**
Little tunny (Euthynnus alletteratus)	201	197	262	190	265	288	298	91	283	69	**2,144**
Blue marlin (Makaira nigricans)	309	79	218	16	167	93	153	54	342	65	**1,496**
Wahoo (Acanthocybium solandri)	154	14	237	37	92	43	52	10	524	84	**1,247**
Skipjack tuna (Katsuwonus pelamis)	5	28	59	51	188	91	199	103	222	53	**999**
Amberjack (Seriola dumerili)	91	29	410	59	7	16	0	168	7	1	**788**
Bluefin tuna (Thunnus thynnus)	86	48	45	12	197	94	68	44	7	0	**601**
Atlantic bonito (Thunnus albacares)	151	11	80	13	69	7	37	22	21	1	**412**
Shortfin mako (Carcharhinus plumbeus)	43	2	60	3	44	4	39	0	127	16	**338**
Dusky shark (Carcharhinus obscurus)	43	12	61	1	81	7	0	3	5	4	**217**
Albacore tuna (Thunnus alalonga)	1	0	9	9	103	4	11	2	60	1	**200**
Bigeye tuna (Thunnus obesus)	66	15	0	9	29	1	41	7	11	15	**194**
Swordfish (Xiphias gladius)	1	0	28	0	0	0	12	0	45	19	**105**
Common thresher shark (Alopias vulpinus)	0	0	0	0	9	0	0	0	0	3	**12**
Blue shark (Euthynnus alletteratus)	0	0	0	3	0	2	0	0	0	0	**5**
Sandbar shark (Carcharhinus plumbeus)	0	1	0	0	0	0	0	0	0	0	**1**
Porbeagle shark (Lamna nasus)	0	0	0	0	0	0	0	0	0	0	**0**

Source: NOAA Fisheries 2019b

An overview of all species fished in the review area and their relevance to the review area, is provided in Table 7.2-9. The information presented in Table 7.2-9 is provided by oral histories from commercial and recreational fishers, NEAMAP trawl survey data, VIMS Shark Longline Survey data, Large Pelagics Intercept Survey data, and the North Carolina Department of Environmental Quality data on recreational fishing.

Table 7.2-9 Species Fished Recreationally in Review Area

Species	Vessel Location		
	Wind Development Area	Offshore Export Cable Corridor	Offshore, Transit Only
Amberjack a/			X
Atlantic croaker		X	
Billfish			X
Black sea bass	X		
Bluefin tuna			X
Bluefish		X	
Cobia		X	
King mackerel		X	
Mahi-mahi	X		X
Red Drum		X	
Seatrout		X	
Spanish mackerel		X	
Spot		X	
Swordfish			X
Tilefish			X
Wahoo			X
Yellowfin tuna			X

Note:
a/ Recreationally caught at the 38 Tower (Navy A-tower) just inshore of the Lease Area.

Yellowfin Tuna

The HMS permit is required for recreational yellowfin tuna fishing in federal waters and within North Carolina state waters (NOAA Fisheries 2020b). Interviews with local fishers indicate an area known as The Point (located at 35° 33' N, 74° 49' W) may attract up to 100 private and charter recreational boats on fair weather days during the peak of the yellowfin tuna fishery. The yellowfin tuna fishery season peaks from April to mid-June, and may support some fishing activity throughout the year, depending on conditions. In 2019, over 44,800 yellowfin tuna were estimated to have been recreationally harvested and 2,333 were released in North Carolina (NOAA Fisheries 2019b). Yellowfin tuna are caught offshore of the Wind Development Area and recreational fishers may transit through the review area to get to their fishing grounds.

Dolphin Fish (Mahi-mahi)

Dolphin (mahi-mahi) fishing in waters offshore of North Carolina occurs from May through December; however, the season peaks during the summer months (Currin and Ross 1999). Dolphin fish are managed by the SAFMC and are subject to possession limits (SAFMC 2020a). Dolphin fish are a prized offshore species due to their beauty, their aggressive nature and willingness to bite, acrobatic fights with anglers, and their value as table fare. In 2019, over 450,000 dolphin fish were estimated recreationally harvested and 35,286 were estimated released by boats landing in North Carolina (NOAA Fisheries 2019b). However, neither the VIMS Shark Longline Survey nor the NEAMAP survey caught dolphin in the past five years by the offshore export cable corridor. Recreational anglers have reported catching dolphin around the metocean equipment (one WindSentinel™ Buoy and one trawl-resistant bottom mount platform) in the Wind Development Area since it was deployed in 2020.

Wahoo

Wahoo can be caught throughout the year in waters offshore of North Carolina; however, the most common season for targeting wahoo occurs from April to October. In 2019, over 17,000 wahoo were estimated to have been recreationally harvested and 23 were estimated released in waters outside of North Carolina (NOAA Fisheries 2019b). Wahoo are managed by the SAFMC and are subject to a two per-person per/day bag limit (SAFMC 2020b).

Billfish

Billfish in the South Atlantic region include blue marlin, white marlin, sailfish, swordfish, longbill spearfish and roundscale spearfish. The overwhelming majority of recreationally caught billfish are released. In 2019, it is estimated that 655 billfish were recreational harvested in North Carolina with the majority being swordfish (483) and blue marlin (94, NOAA Fisheries 2019b). However, 117 swordfish, 1,229 blue marlin, 674 white marlin, and 1,793 sailfish were estimated caught and released. No data on roundscale spearfish or longbill spearfish was provided by the Marine Recreational Information Program query.

Billfish have been caught during every month of the year in the waters offshore of North Carolina; however, it is most common for fishers to participate in billfish fishing from May to September. Typically, billfish are released after being caught. The blue marlin season peaks from June to August, and white marlin and roundscale spearfish peak in August and September. Over the past few decades, sailfish and spearfish have been caught with greater frequency within the waters offshore of North Carolina.

Bluefin Tuna

Bluefin tuna fishing in the waters offshore of Virginia and North Carolina has changed substantially in recent decades. School bluefin historically appeared over the inshore lumps east-southeast of Rudee Inlet in late May and early June. These fish ranged from 30 to 100 pounds (lbs; 14 to 45 kilograms [kg]) and were a staple fishery for the Rudee Inlet charter fleet from the 1970s through 1990s. Interviews with Rudee Inlet captains indicated that the school bluefin fishery disappeared over 10 years ago after the sand eels reportedly declined in the area.

In approximately 1990, giant bluefin began showing up on the wrecks off of Hatteras during the winter months, resulting in a highly productive winter fishery for the charter fleet. A few years later, giant bluefins began appearing in November and December offshore of Morehead. By the mid to late 1990s, large school bluefins were showing up on the surface over the 15- to 25-fathom (27-m to 46-m) contours off of Virginia and east of Oregon Inlet in November and December. By the mid-2000s, giant bluefins began concentrating around a popular fishing location, known as The Point (35° 33’ N, 74° 49’ W), during the winter and spring months, typically concentrating on or over the 100-fathom (183-m) contour. These fish typically range in size from 200 to 600 lbs (90 to 270 kg). The giant bluefin typically appear at the Point area by mid-January and peak around the end of February. Their departure date from the area ranges from the end of March through early May, depending on water temperatures. In 2019, 395 bluefin tuna were estimated landed recreationally in North Carolina and 2,365 were estimated released (NOAA Fisheries 2019b).

Other Species

In addition to the primary species discussed above, other notable recreational fisheries known to occur in proximity to the review area include black sea bass, bigeye tuna, blackfin tuna, skipjack tuna, bonito, false albacore, and sharks (Currin and Ross 1999). There is limited trolling within the Wind Development Area; most activity occurs on the offshore periphery of the Lease Area and most of the previously listed target species habituate further offshore. One of the charter boat captains from Wanchese, North Carolina, who also commercially fishes in the Lease Area, described recreational trolling and bottom fishing in the Lease Area as rare events. He indicated that there is occasional bottom fishing for black sea bass by recreational or charter boats in the Lease Area at very low levels. The fish are known to occur in waters offshore of North Carolina year-round, but late fall and early winter are typically optimal for black sea bass fishing in the area because the fish migrate south for the winter. Black sea bass are typically found at depths from 40 to 100 fathoms (73 to 180 m) during the winter and are most commonly fished at a depth of 50 fathoms (90 m).

Amberjack are known to congregate near seabed structures and debris and are subject to restrictions starting in April due to their annual spawning activities. Amberjacks are commonly fished during the summer months at the Navy A-tower, known locally as the 38 Tower, located close to the offshore Project Area.

Two recreational fisheries have emerged seaward of the offshore Project Area over the past 20 years. Beginning in the mid-2000s, private and charter fishing boats began "deep dropping" for a group of deep-water species, including blueline tilefish, golden tilefish, blackbelly rosefish, and snowy grouper (SAFMC 2020c). These fisheries have gained popularity throughout the region, and most of the deep-water species have been added to federal fishery management plans within the South Atlantic and Mid-Atlantic regions (SAFMC 2020c). Within the broader area, blueline tilefish are typically targeted from 45 to 60 fathoms (82 m to 110 m), snowy groupers from 70 to 110 fathoms (128 m to 201 m), and golden tilefish from 100 to 150 fathoms (183 m to 274 m). More recently, within the past 5 years, a directed daytime "deep drop" recreational fishery for swordfish has emerged and has become popular with the fleets operating out of Rudee Inlet and Oregon Inlet. The fishery is concentrated on contour features from 180 to 220 fathoms (329 m to 402 m), and the fishery operates seaward of the Lease Area. Figure 7.2-42 demonstrates the low concentration of party and charter boat presence within the Wind Development Area.

7.2.1.4.3 Nearshore Recreational Species

Recreational fishing is known to occur along the offshore export cable corridor. Primary target species known to occur within the offshore export cable corridor include Spanish mackerel, king mackerel, bluefish, and cobia. The South Atlantic stock of Spanish mackerel migrate north from Florida to North Carolina in early April and are recreationally caught in nearshore waters (NOAA Fisheries 2020c).

From Memorial Day through Labor Day, Spanish mackerel are the top target species of the Rudee Inlet nearshore charter fleet and numerous private boats, targeting them by trolling with small artificial spoons between the 6- and 12-m contours along the beach. Small "tailor" bluefish are also caught incidentally by these same boats while trolling for Spanish mackerel.

King mackerel are found in warm waters following forage species that include squid, shrimp, and other migratory fish, and are a popular recreational fishing species in the Mid-Atlantic and Southeastern U.S. Kings are caught incidentally by boats trolling for Spanish mackerel and are also targeted seasonally in late August into September off Sandbridge, near the Chesapeake Bay line, the dumpsite buoys, and the Chesapeake Light Tower.

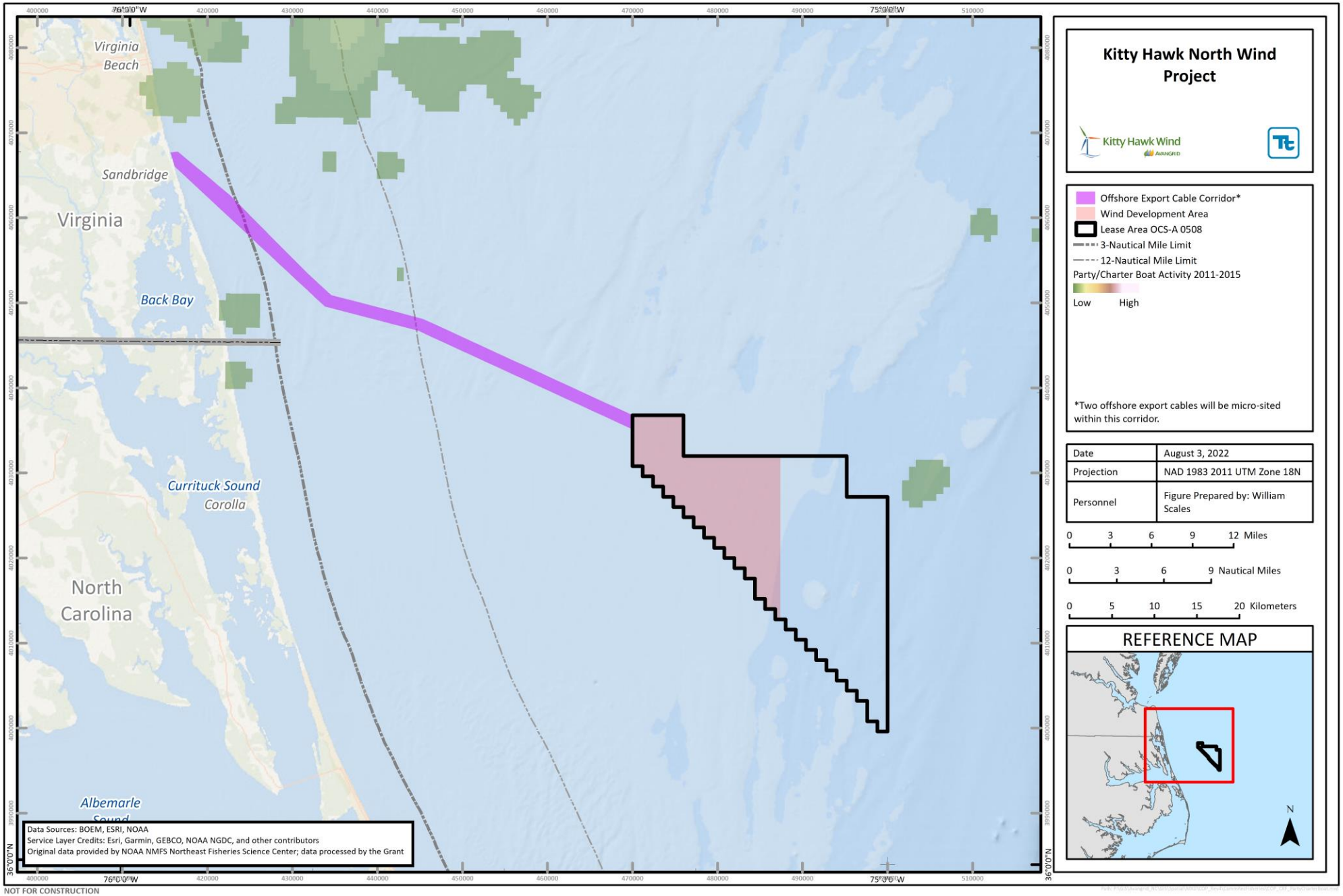


Figure 7.2-42 Fishing VTR Data for Recreational Party and Charter Boats 2011-2015

Cobia is a pelagic fish species typically found in warm and tropical waters. Cobia generally remain in the waters offshore of North Carolina from the spring through the first week of October, depending on water temperature and forage species. Cobia are a frequent target of sight-casting boats that cruise along the fishing grounds and sight-cast to cobias cruising just below the surface. Cobia are targeted seasonally as they migrate in and out of the Chesapeake Bay. They have strong habitat associations and tend to concentrate around the buoys and towers in the area.

NEAMAP trawl data provided by Jim Gartland, VIMS, in a data request by the FLO on 24 Aug 2020 also indicates high levels of Atlantic croaker (58,843), kingfish (30,825), bluefish (3,966), and spot (99,490) in the nearshore portion of the export cable corridor.

7.2.1.4.4 Recreational Fishing Techniques

Recreational fishing within the waters offshore of North Carolina and Virginia consists of rod and reel fishing, either from a boat, beach, jetty, pier, or other access point along the shore. Recreational fishing within the review area is conducted almost entirely from boats. The following is a list of the typical recreational hook and line techniques used:

- Trolling – boats in the area typically troll four to ten lines, using outriggers to maintain a spread across the surface of trolled baits. Naked or skirted ballyhoo are the most common trolling bait in the regional fishery, and boats may also troll artificial lures, depending on the target species. Trolling speed is based on target species and sea conditions.
- Sight casting – boats cruise through the fishing grounds at reduced speeds looking for schools of gamefish, schools of baitfish, or individual gamefish. Live baits or lures are then cast in front of the gamefish. Cobia and red drum are frequently targeted with this technique.
- Bottom fishing – this traditional technique typically uses cut, natural bait presented on a weighted rig with one or more hooks for presentation to demersal fish. Black sea bass, tautog, and summer flounder are all targeted with this technique. Artificial jigs may be used in a similar manner to catch fish near the seafloor or suspended on structure.
- Fly fishing – fly fishing is used effectively for pelagic saltwater gamefish and is popular with some regional anglers targeting Atlantic bonito.
- Spearfishing – spearfishing includes the use of a spear, harpoon, or other sharp object to catch fish.
- Surf fishing – surf casters use natural or artificial baits to catch fish in the surf. Atlantic croaker, bluefish, kingfish (sand mullet), spot, summer flounder, and red drum are among the species caught by surf casters at Sandbridge.

7.2.1.5 *Commercial Fishing*

Commercial fishing in and around the review area primarily occurs from vessels homeported in Virginia and North Carolina, with the potential for commercial fishing vessels from states up and down the eastern seaboard (Figure 7.2-2 through Figure 7.2-8). Regional ports from Cape May, New Jersey to St. Augustine, Florida were assessed to account for the potential of commercial fishers seeking species specific to the waters offshore of North Carolina. The ports are summarized by commercial fishing intake in pounds and in dollars in Table 7.2-10, below. Table 7.2-13 analyzes the top commercially fished species in North Carolina and in Virginia to allow for a more specific analysis of the species being fished in the review area.

In addition to the fisheries known to occur within the offshore Project Area that are discussed below, fisheries that transit through the Wind Development Area to reach optimal fishing grounds, including sea scallop, squid, HMS (tuna and swordfish), and summer flounder, have also been considered. These fisheries are expected to occur with variable frequencies, and primarily by vessels hailing from ports in Wanchese, Stumpy Point, Beaufort, and Engelhard, in North Carolina and Hampton, Newport News, and Virginia Beach in Virginia. VMS data indicate low levels of VMS-permitted fishery transits through the offshore Lease Area.

A study conducted by BOEM, Virginia Department of Mines, Minerals and Energy, and the Virginia Coastal Zone Management Program on the Virginia fisheries regarding offshore wind development indicated a significant decrease in commercial fishing out of Virginia Beach to an adjacent study area from 1996 to 2014 (BOEM 2016). A study conducted by the Company in 2019 identified a decline in the participation in fishing within communities in North Carolina over recent years, and attributed this decline to environmental, market, and regulatory patterns as well as external economic pressures.

Information on historical fishing usage within and in proximity to the Wind Development Area was collected by conducting interviews with ten commercial fishers with over four hundred combined years of experience from Virginia and North Carolina. The FLO worked in consultation with the FR and local seafood dealers to identify the fishers with the most significant fishing history, across fisheries and across gear types, in the Wind Development Area and offshore export cable corridor. The FLO conducted extensive oral history interviews with fishers active in the drop-pot, drop-net, anchored gillnet, trawl, conch pot, conch dredge, shrimp dredge, longline, and hook and line fisheries in the offshore Project Area. The average commercial fisher interviewed has been active in the offshore Project Area since the mid-1970's. Each fisher provided data on what has been historically fished, when it has been fished around the offshore Project Area, and insight into historical and emerging trends. Their knowledge is incorporated into the baseline characterization of the resource presented herein.

7.2.1.5.1 Economic Overview

The top nine regional ports for commercial fishing activity, ranked by weight and value landed, are provided in Table 7.2-10. However, the majority of these landings are not from the Wind Development Area, as indicated by the activity heat maps provided in Figure 7.2-2 through Figure 7.2-8.

Table 7.2-10 Top Regional Ports for Commercial Fishing in 2018

Top Regional Ports by Weight				Top Regional Ports by Value		
U.S. Rank	Port	lbs (MM)	kg (MM)	U.S. Rank	Port	$ (MM)
5	Reedville, VA	352.5	148.0	10	Cape May-Wildwood NJ	66.3
14	Cape May-Wildwood, NJ	101.2	45.9	19	Hampton Roads Area, VA	54.7
47	Wanchese-Stumpy Point, NC	16.3	7.4	28	Reedville, VA	36.2
51	Hampton Roads, VA	14.8	6.7	53	Wanchese-Stumpy Point, NC	19.5
57	Beaufort-Morehead City, NC	9.9	4.5	61	Beaufort-Morehead City, NC	16.6
62	Englehard-Swanquarter, NC	8.4	3.8	77	Mayport, FL	11
76	Mayport, FL	4.7	2.1	78	Englehard-Swanguarter, NC	10.8
90	Oriental-Vandemere, NC	3.7	1.7	85	Darien-Bellville, GA	8.8
100	Darien-Bellville, GA	3.3	1.5	92	Oriental-Vandemere, NC	8.1
Source: NOAA Fisheries 2018b						

NOAA Fisheries fulfilled a request from the FLO for VTR commercial fisheries data from within the Lease Area and offshore export cable corridor shapefiles. The dataset includes matched VTR and dealer records from 2007 through 2019 for the Lease Area and from 2008 through 2019 for the export cable corridor. The VTR data are the most specific data available for commercial landings from the offshore Project Area. Due to the confidentiality requirements of the Magnuson-Stevens Fishery Conservation and Management Act, combined with the low number of records from the Lease Area, it is not possible to see the species-specific landings from year-to-year. Rather, the data must be aggregated across the time series to see the species

composition for the entire time series. Year-to-year trends in total catch can also be seen in the dataset by combining all species.

Overall fishing intensity within the Lease Area is relatively low and declining over time, with landings totaling 252,793 lbs (114,666 kg) with an exvessel value of $561,252 over the 13-year VTR time series. Commercial catches reported from the Lease Area have averaged less than 20,000 lbs (9,072 kg) per year during the period. Summer flounder dominated the documented commercial catches within the Lease Area in the period, totaling 146,834 lbs (66,603 kg) with an exvessel value of $284,951, representing 51 percent of the total landed revenue from the area over the time series (Table 7.2-11). Summer flounder were followed by "all others" (i.e., species masked due to confidentiality requirements), Atlantic croaker, southern flounder, monk livers, and black sea bass. The trawl captains who have fished the area for decades indicated that southern flounder do not occur in or near the offshore Project Area, and the species is most likely misidentified in the records.

Table 7.2-11 Lease Area VTR Landings (by weight) 2007-2019

Species	Number of Years Landed	Total Landings (pounds)	Total Value (dollars)
Summer Flounder	6	146,834	
All Others		54,839	$ 174,824
Atlantic Croaker	4	19,382	$ 10,122
Southern Flounder	3	10,038	$ 27,607
Monk Livers	6	6,971	$ 13,911
Black Sea Bass	9	6,891	$ 33,897
Blueline Tilefish	3	4,148	$ 12,263
Bluefish	8	2,050	$ 881
Loligo Squid	3	673	$ 861
Kingfish	3	503	$ 476
Snowy Grouper	3	226	$ 1,154
Weakfish	4	162	$ 137
Triggerfish	3	76	$ 168
Total		**252,793**	**$ 561,252**

Commercial catches reported from the offshore export cable corridor between 2008 and 2019 have been moderately higher, by weight, than the Lease Area, totaling 878,436 lbs (398,456 kg) with an exvessel value of $395,909 (Table 7.2-12 and Figure 7.2-43) Spiny dogfish are the predominant targeted fishery in the offshore export cable corridor, accounting for over 58 percent of the landed weight during the time series. Due to their higher value per pound, the landed value of Atlantic croaker ($158,194), and channeled whelk ($113,728), eclipse spiny dogfish as the top species by revenue.

Table 7.2-12 Offshore Export Cable Corridor VTR Landings

Species	Number of Years Landed	Total Landings (pounds)	Total Value (dollars)
Spiny Dogfish	11	512,453	$ 92,684
Atlantic Croaker	10	250,581	$ 158,194
Menhaden	8	57,135	$ 7,862
All Others		22,663	$ 11,620
Channeled Whelk	6	19,420	$ 113,728
Bluefish	6	12,837	$ 6,203
Striped Bass	2	834	$ 1,993
Smooth Dogfish	4	793	$ 339
Atlantic Mackerel	3	567	$ 1,805
Kingfish	7	435	$ 434
Hickory Shad	4	294	$ 115
Summer Flounder	4	191	$ 616
Weakfish	7	159	$ 263
Butterfish	2	74	$ 53
Total		**878,436**	**$ 395,909**

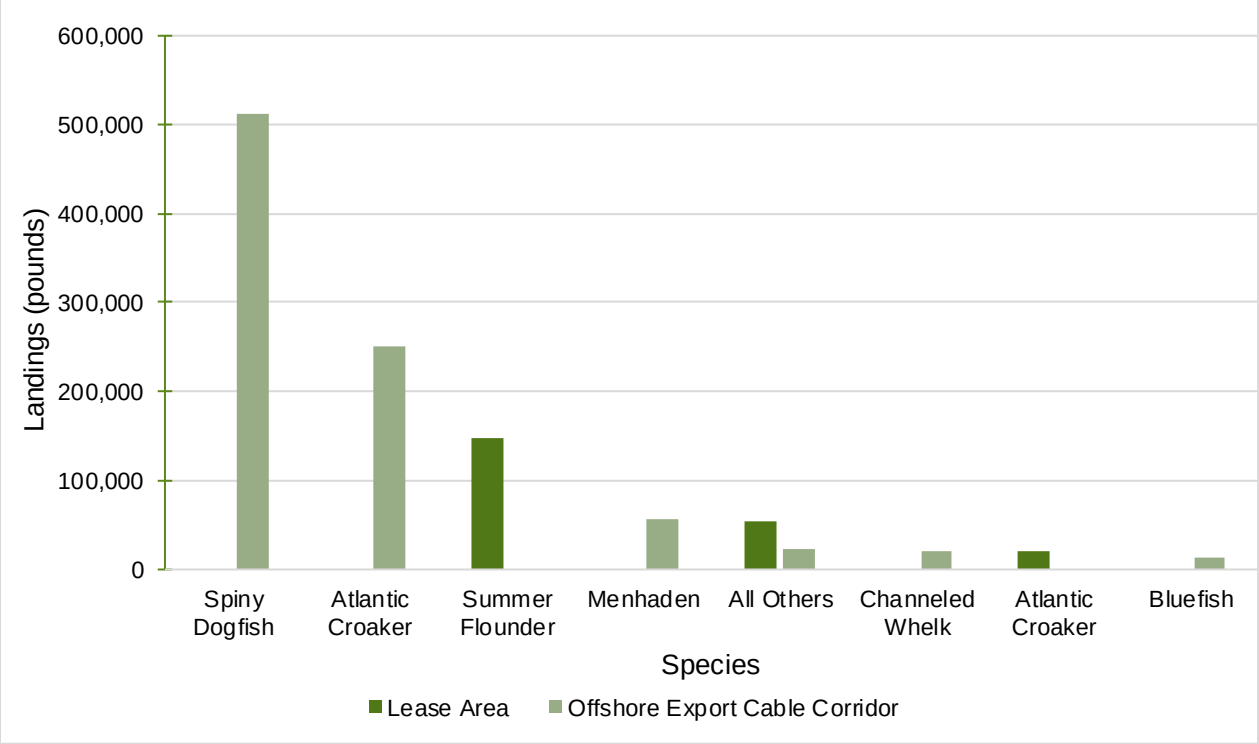


Figure 7.2-43 VTR landings, by species, from Kitty Hawk Lease Area and Offshore Export Cable Corridor

The NOAA Fisheries GARFO provided a modeled assessment of commercial fisheries landings from the Lease Area and offshore export cable corridor (Benjamin Galuardi, NOAA Fisheries GARFO, Data request by the FLO, 25 Sep 2020). This modeled assessment accounts for spatial uncertainty in the agency's VTR records. This has the effect of including fisheries that operate outside of the Lease Area and offshore export cable corridor. For example, interviews with local and regional squid fishers indicate that the illex squid fishery operates seaward of 50 fathoms (91 m) in this area. The agency's available VMS records similarly indicate that the squid fishery operates seaward of the Lease Area. Illex squid do not appear in commercially viable quantities in any of the NEFOP observer records from the Lease Area or offshore export cable corridor. However, the modeled assessment indicates that illex is the top commercial fishery in the Lease Area, which appears to be an artifact of the spatial modeling methodology. Trends in landings over time in the Lease Area and offshore export cable corridor are presented in Figure 7.2-44.

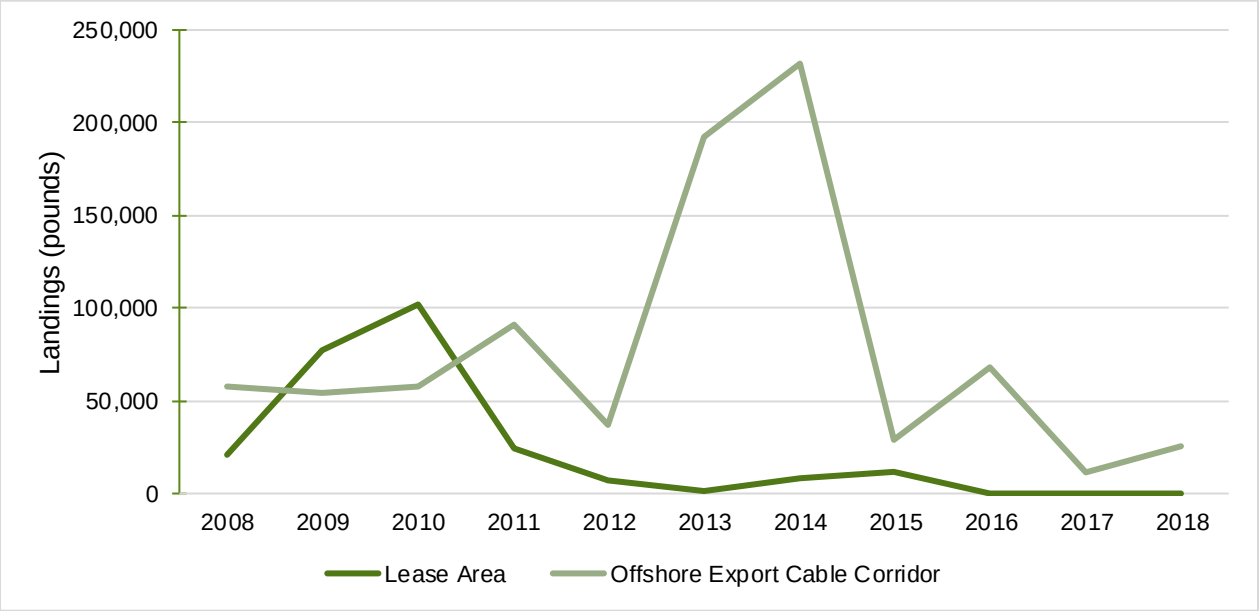


Figure 7.2-44 Total VTR landings from Kitty Hawk Lease Area and Export Cable Corridor

Figure 7.2-45 and Figure 7.2-46 show value in dollars and pounds of modeled landings from the Lease Area and the cable corridor by state from 2008-2018. The NOAA Fisheries GARFO model states that the state with the highest landings from both the Lease Area and offshore export cable corridor is Virginia ($137,764; 547,309 lbs; 248,255 kg) followed by North Carolina ($26,358; 30,082 lbs; 13,645 kg).

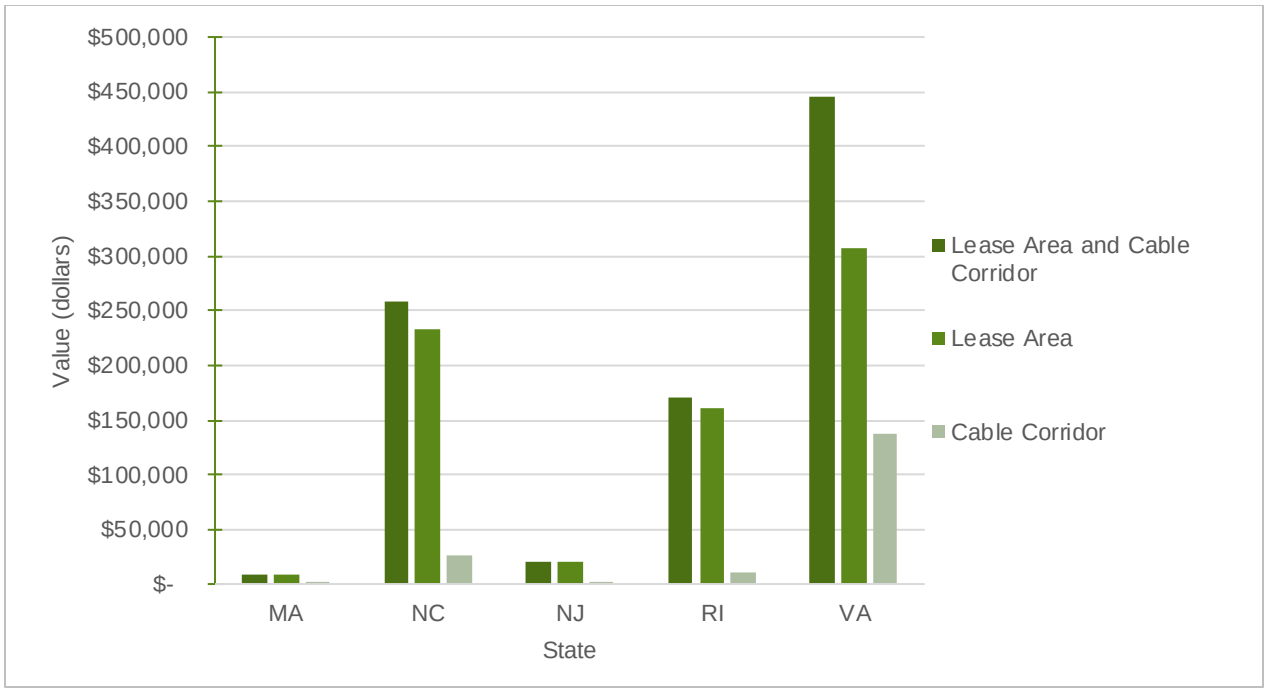


Figure 7.2-45 Modeled Value (dollars) of landings in the Wind Development Area and Offshore Export Cable Corridor from 2008-2018

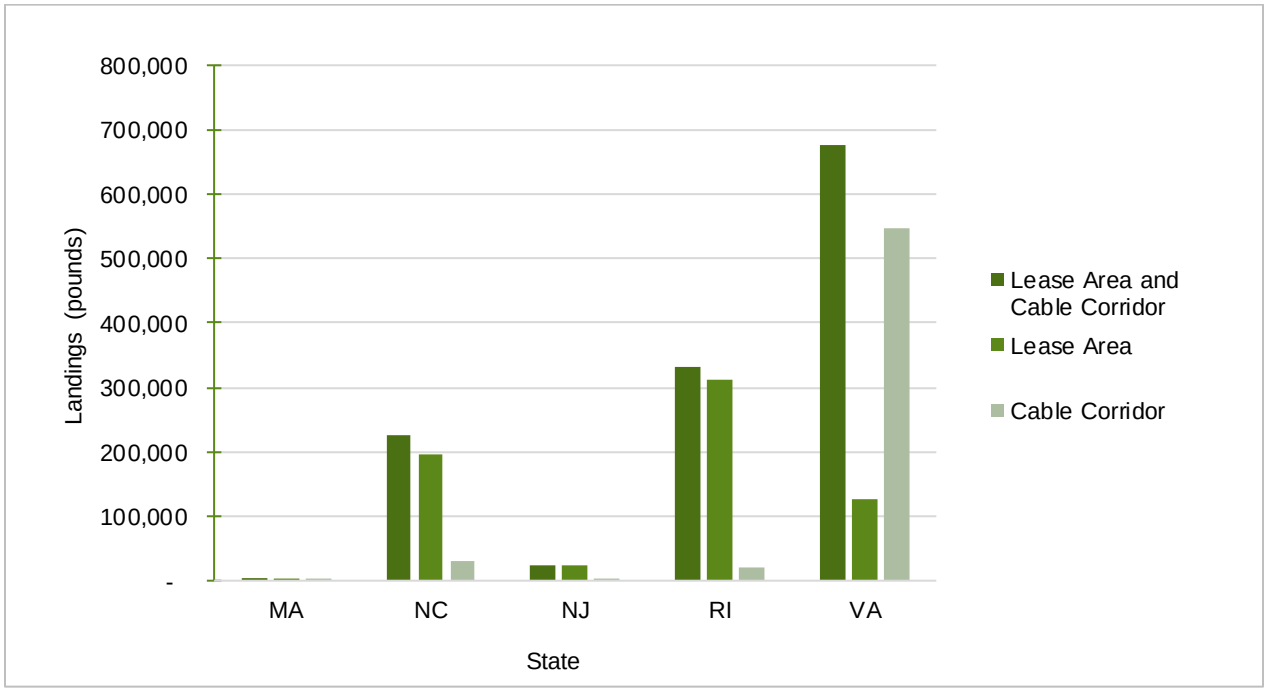


Figure 7.2-46 Modeled Landings (lbs) in the Wind Development Area and Offshore Export Cable Corridor from 2008-2018

The NOAA Fisheries GARFO model states that the ports of Hampton, Newport News, and Virginia Beach, Virginia and Beaufort and Wanchese, North Carolina have relatively higher amounts of landings from the Lease Area and offshore export cable corridor compared to other ports in the U.S. The port that is most

reliant on landings from the Lease Area and offshore export cable corridor (in terms of dollar value and weight landed from the offshore Project Area divided by total landings for the port) was Virginia Beach, Virginia (0.013 percent and 0.025 percent, respectively) followed by Beaufort, North Carolina (0.005 percent and 0.006 percent, respectively, Figure 7.2-47).

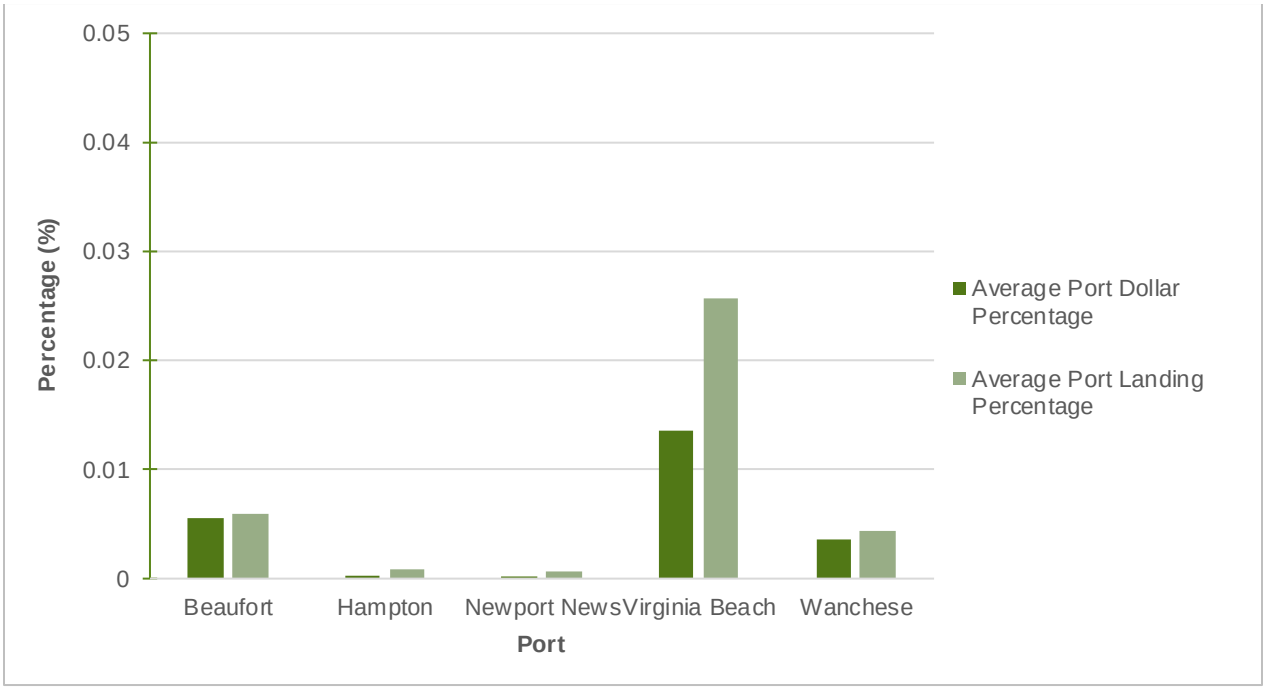


Figure 7.2-47 Average Percentage of Total Port Dollars/Landings caught in the Offshore Project Area 2008-2018

7.2.1.5.2 Commercial Target Species

The top commercial fishing species landings across the broader area, in North Carolina and Virginia, ranked by weight and value, are provided in Table 7.2-13; however, as noted above and depicted in activity heat maps in Figure 7.2-2 through Figure 7.2-8, these species are largely targeted outside of the Wind Development Area. In Virginia, only five of the top ten landed species by weight (Table 7.2-15) are caught in either the Lease Area or the offshore export cable corridor. In addition, the volumes of the species that are caught in the Lease Area or offshore export cable corridor are very small compared to the total landings for the entire state.

NOAA Fisheries provided reported VTR data from the Offshore Project Area for the period 2007 through 2019. Reported commercial landings from the offshore export cable corridor totaled 878,436 lbs ($395,909; 396,188 kg) from 2008 through 2019. Atlantic croaker, spiny dogfish, and menhaden were the top species reported landed, by weight, from the export cable corridor (Table 7.2-14) Reported commercial landings from the Lease Area were lower, totaling 252,793 lbs ($561,252; 114,666 kg) from 2007 through 2019. Summer flounder, "All Others," and Atlantic croaker were the top species reported landed from the Lease Area during the period.

Modeled landings provided by NOAA Fisheries GARFO presents information on landings from the Wind Development Area and the offshore export cable corridor. The agency model states that between 2008 and 2018, commercial fishers landed just under 600,000 lbs ($334,523; 272,000 kg) in the offshore export cable corridor and 816,801 lbs ($704,451; 370,495 kg) in the Lease Area. The top species the model estimated were caught in the offshore export cable corridor were Atlantic croaker, spiny dogfish, and illex squid. The same caveats that were addressed in the discussion of model results for the Lease Area are relevant here

in the model results for the offshore export cable corridor: illex squid are fished seaward of the offshore Project components.

Table 7.2-13 Top Commercial Fishing Species in North Carolina and Virginia in 2019, Ranked by Weight and Value

Top Regional Species by Weight			Top Regional Species by Value	
Species	**Pounds (MM)**	**Kilograms (MM)**	**Species**	**$ (MM)**
Virginia				
Menhadens	332.5	150.8	Eastern oyster	35.6
Blue crab	26.0	11.8	Sea scallop	35.0
Spiny dogfish	6.0	2.7	Blue crab	31.9
Sea scallop	3.9	1.8	Menhadens	27.0
Northern quahog clam	3.5	1.6	Northern quahog clam	24.0
Eastern oyster	3.2	1.4	Summer flounder	5.0
Blue catfish	2.9	1.3	Striped bass	4.4
Summer flounder	1.9	0.9	Spot	2.0
Striped bass	1.3	0.6	Black sea bass	2.0
Spot	1.0	0.5	Blue catfish	1.5
North Carolina				
Blue crab	23	10.4	Blue crab	24.7
Northern white shrimp	8.0	3.6	Northern white shrimp	18.9
Whelks	7.2	3.3	Paralichthys flounder	10.4
Paralichthys flounder	2.8	1.3	Eastern oyster	4.9
Northern brown shrimp	1.5	0.7	Northern brown shrimp	3.0
Striped mullet	1.4	0.6	King mackerel	1.6
Atlantic croaker	1.3	0.6	Atlantic croaker	1.6
Forktail catfish	1.1	0.5	Sea scallop	1.5
Spiny dogfish	1.1	0.5	Bluefin tuna	1.4
Bluefish	1.1	0.5	Vermilion snapper	1.4

Source: NOAA Fisheries 2019c

Table 7.2-14 Top Ten Reported Landed Species in the Offshore Export Cable Corridor and Lease Area from 2007-2019 NOAA Fisheries VTR Data

Offshore Export Cable Corridor			Lease Area		
Species	Total Landings (MM lbs)	Total Landings (MM kg)	Species	Total Landings (MM lbs)	Total Landings (MM kg)
Spiny Dogfish	0.512	0.232	Summer Flounder	0.147	0.067
Atlantic Croaker	0.251	0.114	All Others	0.055	0.025
Menhaden	0.057	0.026	Atlantic Croaker	0.019	0.009
All Others	0.023	0.010	Southern Flounder	0.010	0.005
Channeled/ bushel Whelk	0.019	0.009	Monk Libers	0.007	0.003
Bluefish	0.013	0.006	Black Sea Bass	0.007	0.003
Striped Bass	0.001	0.000	Blueline Tilefish	0.004	0.002
Smooth Dogfish	0.001	0.000	Bluefish	0.002	0.001
Atlantic Mackerel	0.001	0.000	Loligo Squid	0.001	0.000
Kingfish	0.000	0.000	Kingfish	0.001	0.000

Table 7.2-15 Top Ten Landed Species in the Offshore Export Cable Corridor and Lease Area from 2008-2018 Provided by NOAA Fisheries GARFO Modeled Landings

Offshore Export Cable Corridor			Lease Area		
Species	Total Landings (MM lbs)	Total Landings (MM kg)	Species	Total Landings (MM lbs)	Total Landings (MM kg)
Atlantic croaker	0.147	0.067	Squid (Illex)	0.408	0.185
Spiny dogfish	0.101	0.046	Summer flounder	0.099	0.045
Squid (Illex)	0.021	0.009	Squid (Loligo)	0.077	0.035
Channeled whelk	0.021	0.009	Atlantic croaker	0.053	0.024
Menhaden	0.008	0.005	Bluefish	0.022	0.010
Summer flounder	0.007	0.003	Scallops (bushel)	0.01	0.005
Bluefish	0.006	0.003	Menhaden	0.008	0.004
Squid (Loligo)	0.004	0.002	Butterfish	0.008	0.004
Striped bass	0.002	0.001	Southern flounder	0.008	0.004
Shrimp (Pandalid)	0.001	0.000	Black sea bass	0.007	0.003

NOAA Fisheries VTR reported landings indicate that catches in the Lease Area peaked most recently in 2010 at 101,976 lbs (46,256 kg) and declined thereafter, with no reported landings from the Lease Area between 2016 and 2019 (Table 7.2-16). The same dataset indicates that catches peaked in the offshore export cable corridor in 2014 at 231,868 lbs (105,175 kg.)

Table 7.2-16 Reported Offshore Project Area VTR Landings 2007-2019

Year	Lease Area (lbs)	Lease Area (kg)	Offshore Export Cable Corridor (lbs)	Offshore Export Cable Corridor (kg)	Total (lbs)	Total (kg)
2007	371	168			**371**	**168**
2008	20,438	9,271	57,746	26,193	**78,184**	**35,464**
2009	77,250	35,040	54,501	24,721	**131,751**	**59,762**
2010	101,976	46,256	58,074	26,342	**160,050**	**72,598**
2011	24,596	11,157	90,972	41,265	**115,568**	**52,421**
2012	7,477	3,392	37,408	16,968	**44,885**	**20,360**
2013	1,155	524	192,136	87,152	**193,291**	**87,676**
2014	7,720	3,502	231,868	105,175	**239,588**	**108,676**
2015	11,810	5,357	28,578	12,963	**40,388**	**18,320**
2016	0	0	67,965	30,829	**67,965**	**30,829**
2017	0	0	11,412	5,176	**11,412**	**5,176**
2018	0	0	25,546	11,588	**25,546**	**11,588**
2019	0	0	23,807	10,799	**23,807**	**10,799**

NOAA Fisheries GARFO-modeled landings also demonstrate a steady downward trend within the offshore Project Area over time (Table 7.2-17). The peak year for modeled landings within the offshore Project Area was in 2014 with 219,286 lbs (99,466 kg) and decreased to below 45,000 lbs (20,400 kg) in the last two years of the study period (2017 and 2018).

Table 7.2-17 Modeled Offshore Project Area Landings 2008-2018

Year	Lease Area (lbs)	Lease Area (kg)	Value (dollars)	Offshore Export Cable Corridor (lbs)	Offshore Export Cable Corridor (kg)	Value (dollars)	Total (lbs)	Total (kg)
2008	86,175	39,088	$85,966	60,867	27,609	$43,060	**147,042**	**66,697**
2009	120,734	54,764	$166,203	48,042	21,791	$29,302	**168,776**	**76,555**
2010	123,828	56,167	$112,235	45,407	20,596	$20,938	**169,235**	**76,764**
2011	103,184	46,803	$68,865	84,086	38,141	$62,260	**187,270**	**84,944**
2012	104,979	47,618	$76,737	40,734	18,477	$46,955	**145,713**	**66,094**
2013	68,666	31,146	$59,986	79,477	36,050	$64,365	**148,143**	**67,197**
2014	105,733	47,960	$46,681	113,453	51,461	$31,642	**219,186**	**99,421**

Year	Lease Area (lbs)	Lease Area (kg)	Value (dollars)	Offshore Export Cable Corridor (lbs)	Offshore Export Cable Corridor (kg)	Value (dollars)	Total (lbs)	Total (kg)
2015	44,841	20,340	$32,073	33,568	16,133	$8,303	**78,409**	**35,566**
2016	33,984	15,415	$33,650	38,419	17,427	$10,568	**72,403**	**32,841**
2017	15,311	6,945	$24,073	20,514	9,305	$10,496	**35,825**	**16,250**
2018	9,366	4,248	$8,072	35,381	16,049	$6,634	**44,747**	**20,297**

Northeast Fisheries Observer Program

The NEFOP employs professionally trained scientists to collect catch data dockside and onboard fishing vessels (NOAA Fisheries 2020d). NEFOP data limited to observations within the review area were provided by NOAA Fisheries GARFO (note that this data was provided for the entire Lease Area, not just the Wind Development Area). NEFOP observers record tow or gear set locations by latitude and longitude. This data spans trips from 1992 to 2020. NEFOP data is subject to certain confidentiality restraints. The two categories of vessels recorded in this survey were trawl, otter, and bottom fishing vessels and fixed or anchored gillnet/other.

Between 1994 and 2007, there were thirty-six unique observed trips in the offshore export cable corridor targeting ten different species: summer flounder, striped bass, kingfish, spiny dogfish, Atlantic croaker, weakfish, smooth dogfish, Atlantic menhaden, and one unknown species. Twenty-nine of the vessels were gillnetters and seven were trawlers. From 1992 to 2019, 125,040 lbs (56,717 kg) of fish were caught on observed trips in the corridor and 113,648 lbs (51,550 kg) were kept for market (Figure 7.2-48).

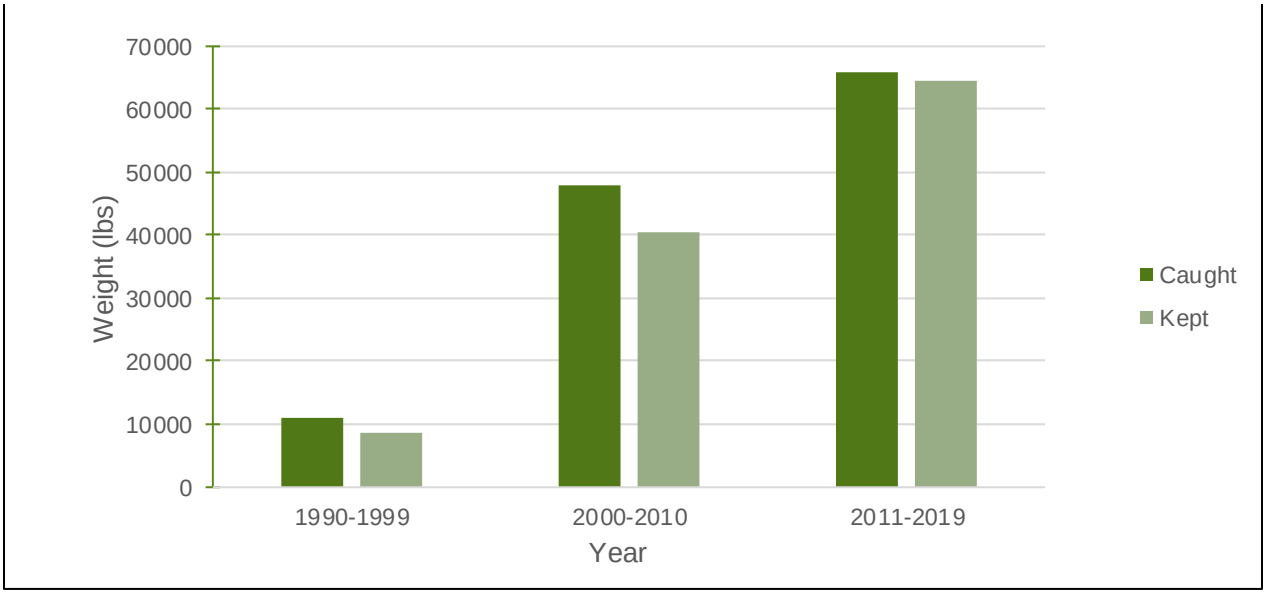


Figure 7.2-48 Total Observed 10-year Sum of Catch in the Offshore Export Cable Corridor

The top species kept by weight in the offshore export cable corridor on observed trips were spiny dogfish (74,245 lbs [33,677 kg]), Atlantic croaker (19,426 lbs [8,811 kg]), and striped bass (8,729 lbs [3,959 kg], Table 7.2-18). The top discarded species (by weight) in the offshore export cable corridor were clearnose skates (4,084 lbs [1,852 kg]), spiny dogfish (1,875 lbs [850 kg]), and Atlantic menhaden (1,290 lbs [585 kg]).

Table 7.2-18 Most Common Observed Catch in the Offshore Export Cable Corridor 1992-2020

Species	Weight Landed (lbs)	Weight Landed (kg)
Spiny dogfish	74,245	33,677
Atlantic croaker	19,426	8,811
Striped bass	8,730	3,960
Summer flounder	3,990	1,810
Smooth dogfish	2,929	1,329
Bluefish	1,251	567
Atlantic mackerel	264	120
Menhaden	264	120
Spanish mackerel	212	96

Between 1992 and 2020, twenty-three unique vessels fished in the Lease Area on observed trips. Twenty of these vessels were trawl boats and three were gillnet boats. The vessels were targeting four different species: summer flounder, Atlantic croaker, bluefish, and unknown fish species. Between 1990 and 2020, 210,626 lbs (95,538 kg) of fish were caught on observed trips within the Lease Area with 52,459 lbs (23,795 kg) kept for market (Figure 7.2-49).

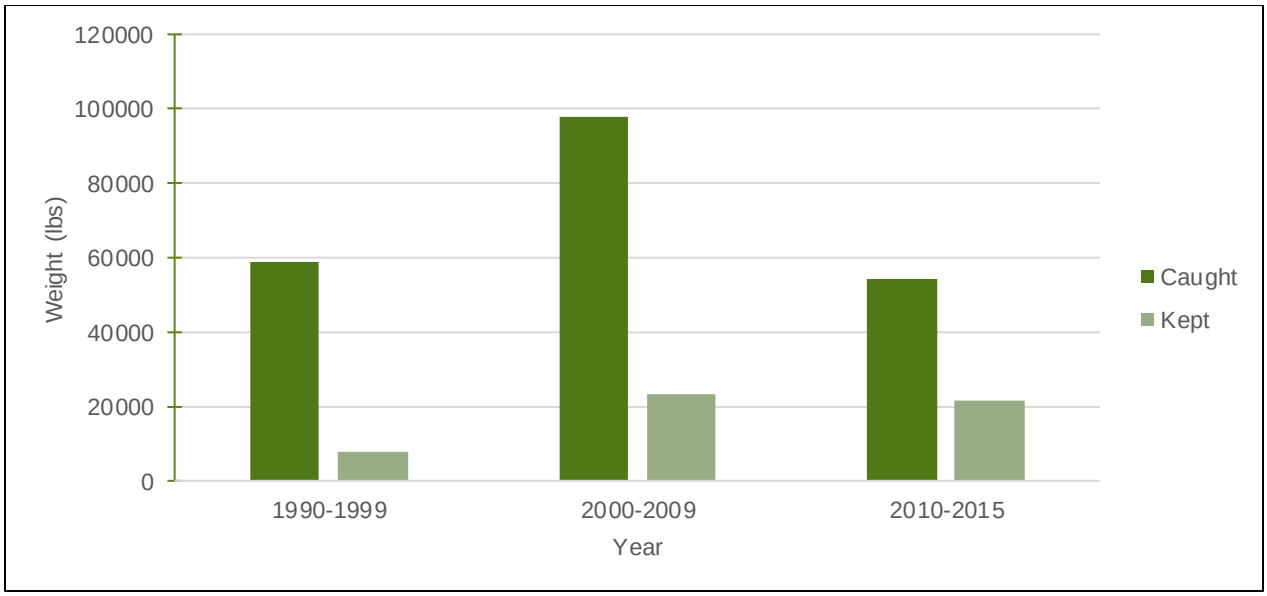


Figure 7.2-49 Total Observed Catch in the Lease Area

The top species kept on observed trips from the Lease Area (by weight), during the period 1992 through 2020, were summer flounder (46,150 lbs [20,933 kg]), bluefish (3,620 lbs [1,642 kg]), and monkfish (1,717 lbs [779 kg], Table 7.2-19). The top discarded species on observed trips (by weight) in the Lease Area were summer flounder (156,065 lbs [70,790 kg]), Atlantic croaker (1,429 lbs [648 kg]), and unidentified species (666 lbs [302 kg]). The last observed trawl trip in the Lease Area occurred in 2012.

Table 7.2-19 Most Common Observed Catch in the Lease Area 1992-2020

Species	Weight Landed (lbs)	Weight Landed (kg)
Summer flounder	46,150	20,933
Bluefish	3,620	1,642
Monkfish	1,717	779
Atlantic croaker	500	227
Black sea bass	177	80
Whelk (conch)	101	46
Weakfish	59	27
Squid (longfin)	58	26
Knobbed whelk	20	9

Southeast Gillnet Observer Program

The Southeast Fisheries Observer Program records data from all gillnet fishing vessels from North Carolina to Florida and in the Gulf of Mexico (NOAA Fisheries 2019d). The FLO requested data from this program for observed trips by gillnetters in the review area. Due to confidentiality restraints, the observer program was unable to provide data on observed trips specifically within the offshore Project Area. Within a much broader, 60-minute area, bounded by 37 degrees N, 36° S, 75° W and 76° W, the program indicated a total of between 23 and 33 observed gillnet trips throughout the history of the program. However, the confidentiality threshold for this program is fewer than three active fishing vessels. The low number of observer records from the review area is generally consistent with the low level of fishing in the area.

Southeast Shark Bottom Longline Observer Program

The Southeast Shark Bottom Longline Observer Program records data from vessels participating in the shark bottom longline fishery in the Southeast Region. The FLO requested data from the program for observed trips within the offshore Project Area. Within a much broader, 60-minute area, bounded by 37° N, 36° S, 75° W and 76° W, the program indicated a total of between 1 and 10 observed shark bottom longline sets throughout the history of the program. Due to confidentiality restraints, the observer program was unable to provide any data on observed trips specifically within the review area. The program's latest report from 2017 does not indicate any shark bottom longline sets within the broader area (Southeast Regional Office, NOAA, Data request by the FLO, September 2020).

Highly Migratory Species Observer Data

Atlantic Highly Migratory Species include tunas, swordfish, sharks, and billfishes located within the U.S. Atlantic, the Gulf of Mexico, and the Caribbean. NOAA Fisheries requires mandatory reporting of recreationally landed HMS species by phone or online (NOAA Fisheries 2012). North Carolina's HMS catch card programs are funded and benefit from technical support from NOAA Fisheries. The FLO requested the HMS Observer Data within the offshore Project Area, but the program indicated there were no observer records within the area. This is consistent with the fact that the HMS fisheries typically operate seaward of the offshore Project Area.

Figure 7.2-2 through Figure 7.2-8 show VMS fishing intensity of different fisheries around the Wind Development Area. Of the seven fisheries provided (herring, monkfish, multispecies, pelagics, scallop, squid, and surfclam/ocean quahog), there are no overlaps in fishing effort in VMS fisheries and the Wind Development Area in the designated timeframes. Additionally, several maps (Figure 7.2-2, Figure 7.2-3, Figure 7.2-4, Figure 7.2-7, and Figure 7.2-8) do not indicate any fishing activity in the offshore Project Area..

7.2.1.5.3 Project Area Commercial Fisheries and Techniques

Fishing techniques utilized by commercial fisheries in the offshore Project Area vary significantly based on the target fish types, season, regulatory restrictions, weather, vessel used, and market demand. Additionally, fishing demand varies by location as fish species follow seasonal migration patterns.

Commercial fishing within the offshore Project Area and surrounding waters typically consists of mobile or fixed-gear fishing. Mobile commercial fishing gear includes otter trawls, mid-water trawls, dredges, and rod-and-reel trolling. Typical commercial fixed fishing gear includes pots and gillnets.

A study on Virginia fisheries regarding offshore wind development conducted by BOEM, Virginia Department of Mines, Minerals and Energy, and the Virginia Coastal Zone Management Program indicated that most gillnet fishing (a popular method in the region) occurs inshore of the Wind Development Area. Similarly, the primary fishing locations for pot and trap fishing also occur nearer to the shore than the Wind Development Area, with some exceptions of pot and trap fishing occurring further seaward (BOEM 2016).

Virginia Shrimp Fishery

A shrimp trawl fishery has operated under experimental fishery permits issued by VMRC since 2018. The Virginia Experimental Shrimp Trawl fishery targets white shrimp and is permitted in two discrete areas. One of the areas is within the offshore export cable corridor, south of Rudee Inlet, and is limited to an area bound on the north by Dam Neck Road, extending south to the Virginia/North Carolina border, seaward to the EEZ. Currently, the experimental fishery is permitted to operate during the fourth quarter of the calendar year. However, shrimp are also present in the area in commercially viable quantities during the first and second quarters of the year, indicating the potential for an expansion of the fishery's permitted season. Fishing for shrimp overlaps with the offshore export cable corridor in Virginia state waters (out to 3 nm [5.6 km]). The collection area will be limited to the Virginia Territorial Sea, south of Rudee Inlet, Virginia Beach, Virginia, specifically described as Area Number 3 of the conch dredge areas in Chapter 4VAC20-150-10 *et seq.*, but south of Dam Neck Annex (Dam Neck Road) and north of the Virginia/North Carolina border, out to 3 nm (5.6 km). In 2020, VMRC has issued eight experimental shrimp fishery permits for the Virginia Beach area fishery.

The permitted gear of the Virginia Experimental Shrimp Trawl fishery includes a beam trawl, or modified conch dredge, with a maximum width of 16 ft (4.9 m, Figure 7.2-50). The gear comprises a rigid frame with two bottom-tending metal skis. A mesh net and cod end are fitted to the frame and equipped with two fisheye type excluders to reduce nontarget finfish catch. Shrimp trawling in the waters offshore of North Carolina and Virginia typically occurs in the north/south direction, either against or with the tide. VMRC indicated that 57,648 lbs (26,149 kg) of white shrimp were caught in the experimental shrimp fishery and landed in Virginia from 2017 through 2019. Virginia's experimental shrimp fishery began with one permit in 2017, two permits in 2018, six in 2019, and eight permits in the Virginia Beach zone of the experimental fishery in 2020 (VMRC 2021). In 2020, the expanded experimental fleet landed 418,616 lbs (189,883 kg) of white shrimp.

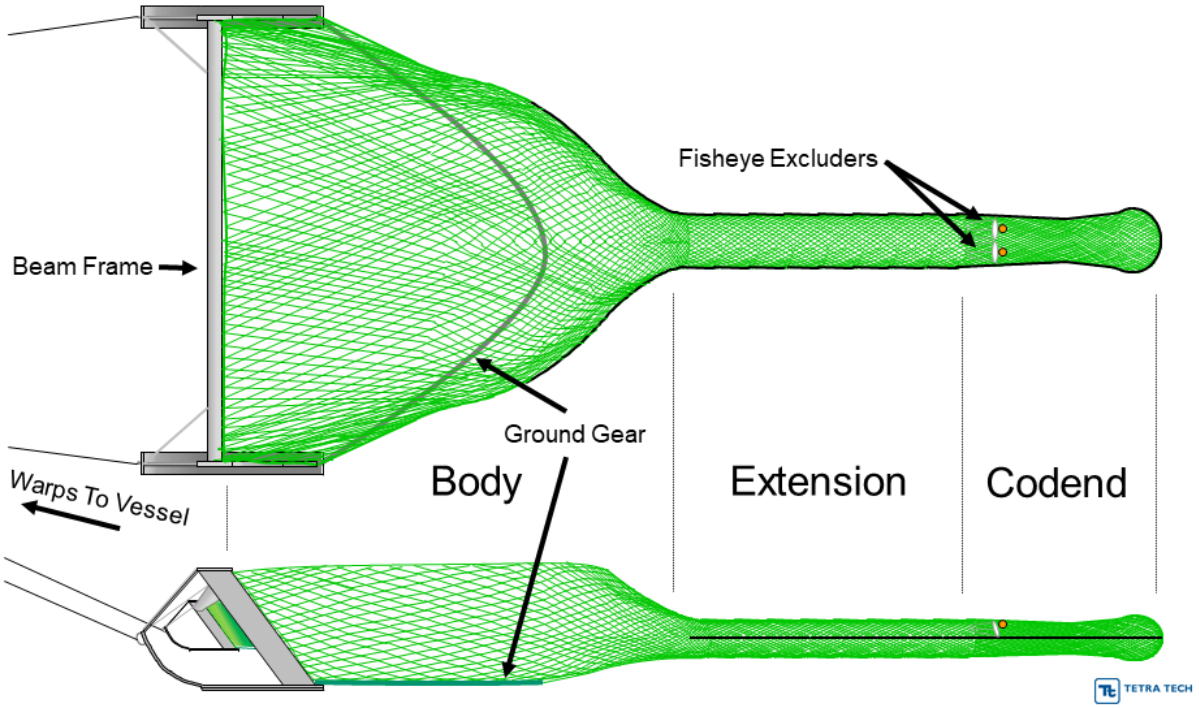


Figure 7.2-50 Example of Shrimp Beam Trawl Net

Spiny Dogfish Fishery

The modern directed gillnet fishery for spiny dogfish in the review area has operated since approximately 1992 from the mouth of the Chesapeake Bay south to False Cape, Virginia. Approximately 17 boats participate in the spiny dogfish fishery in the area off Virginia Beach. Most of the fleet is based in Rudee Inlet, with the several boats based in Lynnhaven Inlet. These boats typically target spiny dogfish from 2 to 14 nm (3.7 to 25.9 km) offshore from Cape Henry to south of False Cape, Virginia. The directed fishery for spiny dogfish typically occurs from November until April or until Virginia's annual quota is caught, whichever comes first. Stakeholder interviews indicated that there is some overlap of the fishery with the offshore export cable corridor, typically occurring 2 to 12 nm (3.7 to 22.2 km) off Virginia Beach. Spiny dogfish are also landed in Wanchese and Hatteras, North Carolina. Although the Wanchese fleet typically targets them closer to the inlet, the agency model estimates 25,000 lbs (11,340 kg) of spiny dogfish were harvested in the Lease Area in 2015. The Virginia Beach dogfish fleet targets spiny dogfish inshore of the Lease Area.

The modern fishery for spiny dogfish evolved rapidly in the early 1990s, predominantly as a directed gillnet fishery. The fishery was subsequently determined to be overfished and a stock rebuilding plan was implemented in 2000. This had the effect of essentially closing the fishery in Virginia and North Carolina in the early 2000s until the quota gradually increased. The stock was declared rebuilt in 2010 and quotas began to increase. Quota increases, combined with quota transfers between states, have enabled Virginia to increase landings of spiny dogfish in recent years, with most of these landings occurring in Virginia Beach (Figure 7.2-51).

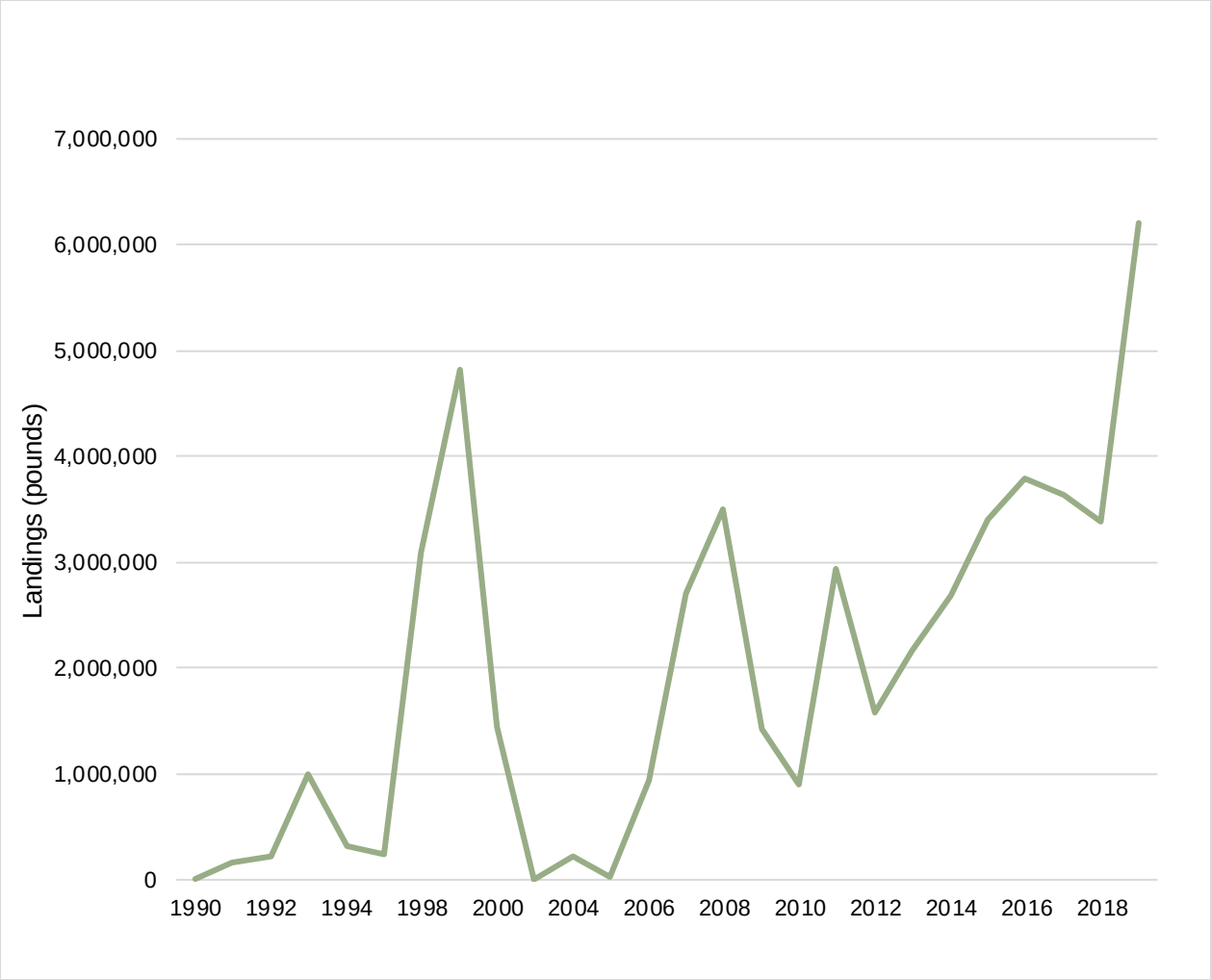


Figure 7.2-51 Commercial Spiny Dogfish Landings in Virginia

The gillnets used for the spiny dogfish fishery by the Virginia Beach fleet are typically anchored at each end of the net with 11-kg Danforth-style anchors and left overnight (Figure 7.2-52). They are marked at the northern end with an upright flag and on the southern end with a high visibility poly ball. Each anchored gillnet rig typically comprises three sections or "bundles" of net, totaling approximately 1,200 ft (366 m) in length. The predominant direction for anchored gillnet deployment in the offshore export cable corridor is north/south.

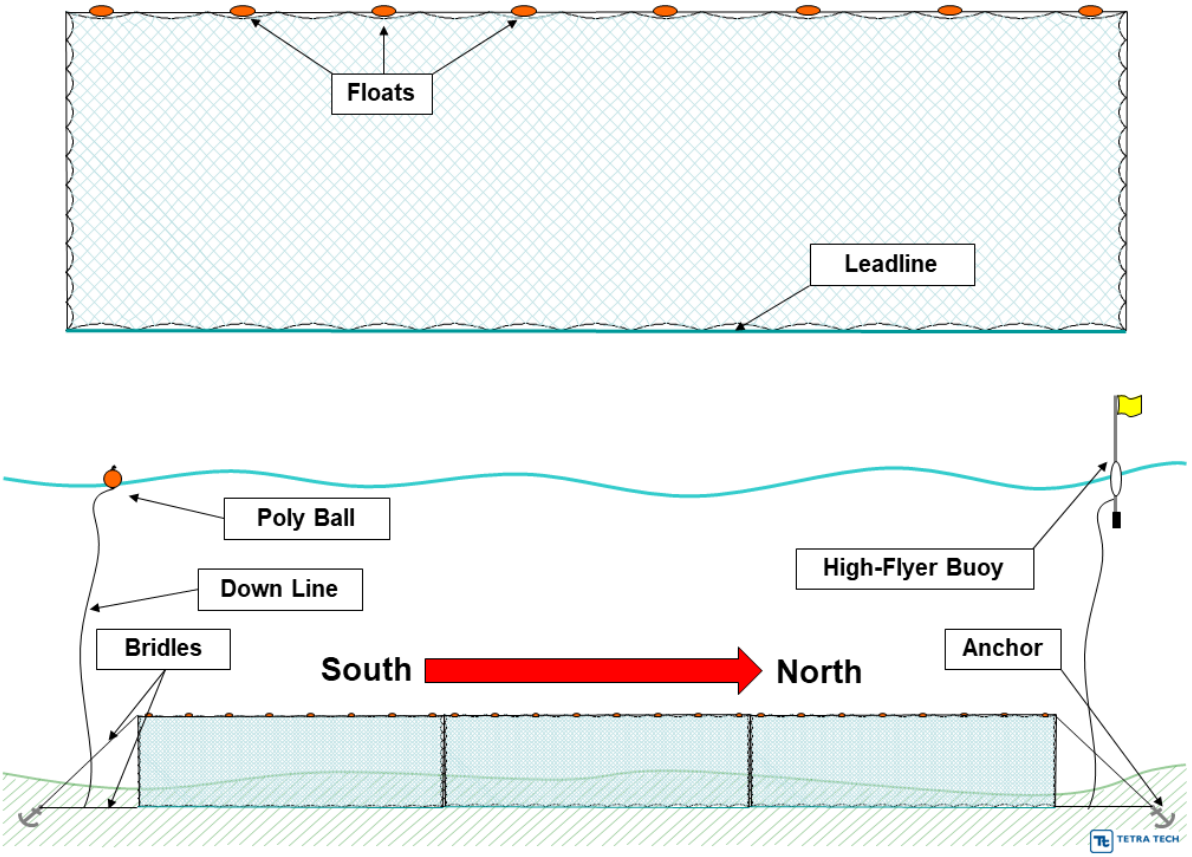


Figure 7.2-52 Example of Spiny Dogfish Anchored Gillnet

Conch Dredge Fishery

The conch dredge fishery utilizes dredges that have steel frames and a toothbar on the leading edge of the gear fitted with short steel teeth (Figure 7.2-53). The predominant direction for tows in the conch dredge fishery along the offshore export cable corridor is north/south.

A directed conch dredge fishery has historically operated around the entrance of the Chesapeake Bay, around Cape Henry, and south of Rudee Inlet. Effort in the fishery peaked in the 1980's and 1990's, abated for 20 years, then experienced a resurgence in effort around 2015. The fishery targets knobbed whelk, *Busycon carica,* referred to locally as knobby "conch." The fishery is managed by VMRC and the gear comprises two 2.4-m dredges per vessel. The Virginia conch dredge fishery operates in several areas with specific seasonal and spatial regulations (VMRC 2020b). Area 3 is defined by regulation as the area bounded on the north at 36° 45' N latitude, extending south to the Virginia/North Carolina line and extending seaward to the EEZ. This area overlaps with the offshore export cable corridor within Virginia state waters. The fishery was comprised of five vessels in 2019, operating from Rudee Inlet and Lynnhaven Inlet, Virginia. The spring conch dredge season in 2020 was foreclosed by market impacts associated with the COVID-19 pandemic.

Interviews with commercial fishers indicate that conch dredging overlaps the offshore export cable corridor and is conducted from the Sandbridge buoy to the southernmost end of the Chesapeake Bay buoy line from April to June. They also shared that conch dredging is typically oriented north/south with or against

the tide in the area of the offshore export cable corridor. Most conch dredging occurs north of the offshore export cable corridor.

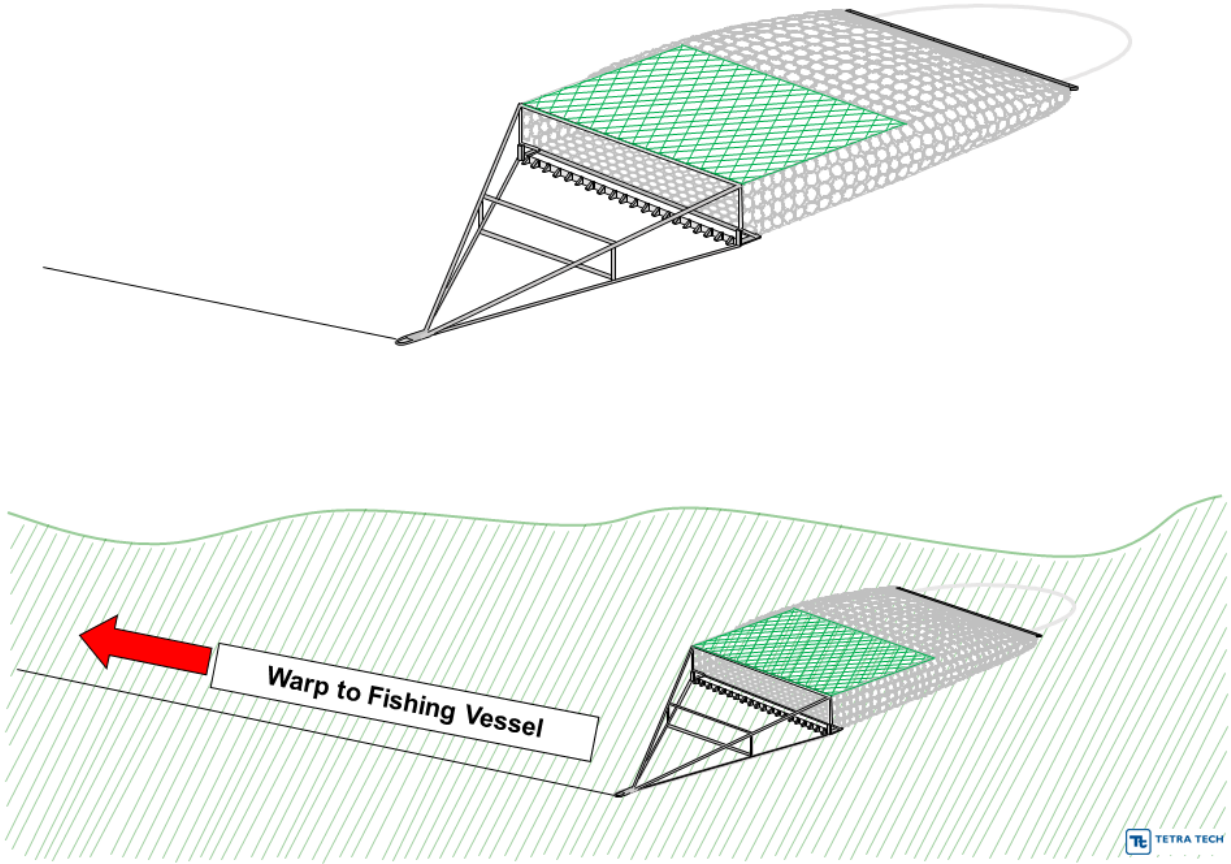


Figure 7.2-53 Example of a Conch Dredge

Conch Pot Fishery

A directed pot fishery for channeled whelk, *Busycotypus canaliculatus,* known locally as smooth "conch", has operated offshore of Virginia Beach since approximately 1994. The conch pot fishery is not federally managed and not subject to regulations in North Carolina, but landings in Virginia are subject to regulation by VMRC. The conch pot fishery extends through coastal waters from approximately Oregon Inlet through Massachusetts. Conch pots may be distributed broadly through the general area, although the area from the Chesapeake Light Tower to the Triangle Wrecks, through the Horseshoe seamount, located north-northwest of the northwest corner of the Wind Development Area, have historically been fished intensively. The fishery is known to be active in and around the offshore export cable corridor, and in the area of the 4A buoy southeast of Sandbridge. Conch fishing may also occur in the Wind Development Area, on a limited basis, typically during the winter months. Conch captains interviewed by the FLO indicated that the conch effort off of North Carolina is directed inshore of the Wind Development Area, and they noted that conch densities drop off to low levels east of the 38 Tower (Navy A-tower), in the vicinity of the Project. Most of the effort in the offshore conch fishery in the waters offshore of North Carolina is conducted by boats operating from Rudee Inlet, with some vessels operating out of Wanchese, North Carolina. The fishery is open year-round by VMRC regulation. Conch potting along the offshore export cable corridor typically begins in late November or December and extends through the end of the season, typically ending in both the offshore export cable corridor and Lease Area when sea surface temperatures drop to approximately 5.5°C, or following sustained cold fronts and snow events. The fishery has ended as early

as early January in relatively cold winters and has extended through March in the general area of the offshore export cable corridor through March in mild winters. The fishery was also active in the spring and early summer historically, but the summer fishery has not been active at any substantial levels in recent years. VMRC indicated that 83,139 lbs (37,712 kg) of conchs were landed in Virginia from the Atlantic Ocean water bodies in the conch pot fishery between 2015 and 2018, with catches occurring from December through March.

The conch pot fishery uses wooden or wire open-top pots that are heavily weighted with patio bricks and individually buoyed (Figure 7.2-54). Individual boats may deploy up to 250 pots in Virginia state waters. Most offshore conch potters operating out of Virginia Beach deploy 500 to 1,000 or more pots in federal waters. The predominant direction for gear sets in the conch pot fishery in the waters offshore of North Carolina is north/south and are individually buoyed. The pots are 61 x 61 centimeters in diameter, and are 23 centimeters tall.

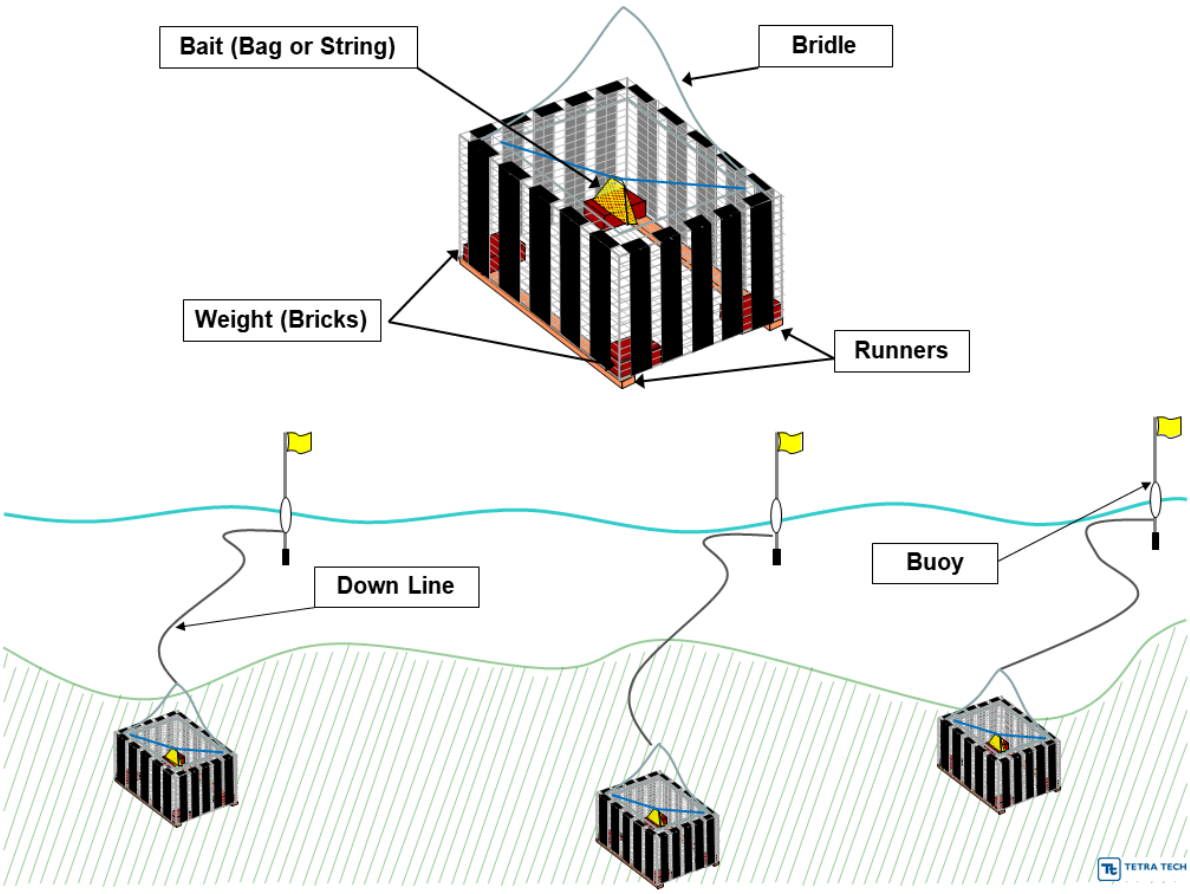


Figure 7.2-54 Example of Conch Pot Gear

Black Sea Bass Fishery

A directed "drop-pot" fishery for black sea bass has historically operated, and remains currently active on a very limited basis, in the review area, particularly in the general area of the Wind Development Area. Research and interviews with local fishers identified one remaining drop-potter active in or near the Wind Development Area. The active drop-potter provided the FLO with a detailed description of commercial black sea bass fishing in the broader area. Late fall and early winter are typically optimal for black sea bass fishing in the area because the fish migrate south for the winter, but the fish are available within the Wind

Development Area year-round on the structured habitat within the waters offshore of North Carolina. Black sea bass are typically found at depths from 40 to 100 fathoms (70 to 180 m) during the winter and are most fished at a depth of 50 fathoms (90 m). Black sea bass are targeted by the drop-pot fishery throughout the year in specific habitat types within the Wind Development Area.

Interviews with regional commercial fishers indicated that black sea bass can be caught seasonally in the Wind Development Area after Christmas and move back inshore around April. Although the resident stock is still within the Wind Development Area, the population dynamics within the regional stock to the northeast have changed. There are several shipwrecks seaward of the Wind Development Area (CHENANGO and SNOOPY for example) with higher black sea bass fishing by rod and reel fishing activity. Local fishers also indicate that most of the wintertime black sea bass potting occurs offshore of the Wind Development Area.

Drop-potters deploy short strings of multiple (roughly six) baited pots, connected on a common groundline, or "trawl", and buoyed at one end (Figure 7.2-55). They deploy the gear and tend it, or remain in the general area with the gear, and retrieve it onboard the vessel before returning to port. The directionality of drop-potting is variable, and the strings of pots are deployed specific to the mark or structure that the potter is trying to fish. The target fishing area is typically a relatively small piece of hard bottom or structured habitat, so the gear is deployed accordingly.

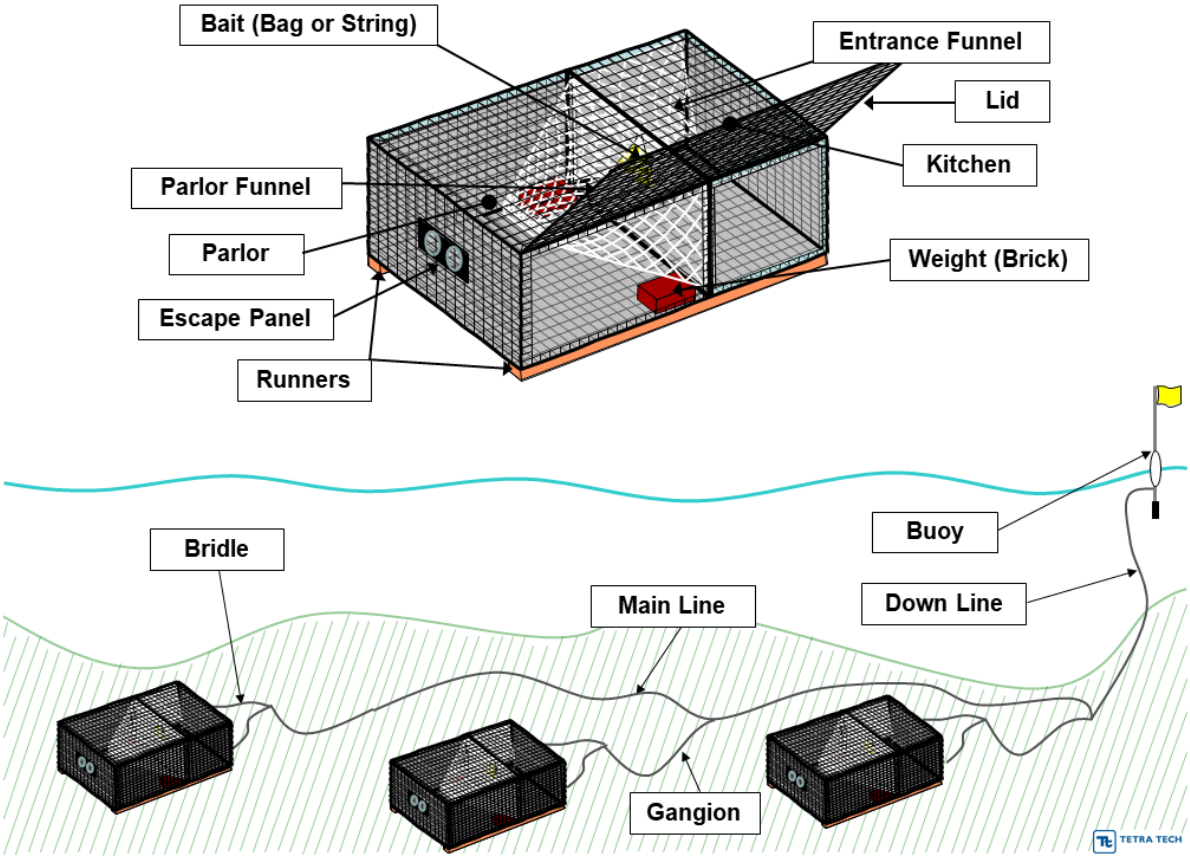


Figure 7.2-55 Example of Black Sea Bass Pot

Drop Netting Fisheries (Bluefish, Cutlassfish, Atlantic Croakers)

A fleet of dayboats homeported in Wanchese, Stumpy Point, and Engelhard, North Carolina fish with "drop nets" in and seaward of the Wind Development Area. The drop netting fishery in the review area includes bluefish, cutlassfish, and Atlantic croaker. Most drop netting effort in the immediate vicinity of the offshore Project Area is just seaward of the Lease Area. Within the Wind Development Area, the eastern portion, approaching the 20-fathom (37-m) contour, is fished more with drop nets than the western portion. The 60-fathom (110-m) contour is typically the eastern boundary of the drop netting operations, although float nets may be deployed over deeper contours. Drop netting in the Wind Development Area is spread over the winter and spring seasons, as fish migrate through and seaward of the area, and is not typically contiguous. The fleet may fish for bluefish in the general area from December through April.

Most of the drop-net fishing for Croakers in the Wind Development Area occurs in late winter and early spring as the fish overwinter and begin to migrate inshore and up the beach, heading into Chesapeake Bay. They were very abundant in the late 1990s to early 2000s and were caught from the fall to December as they overwintered in the Oregon Inlet area, below the Wind Development Area. Commercial landings of Atlantic croaker last peaked in 2003 at over 14 million lbs (6.4 million kg, Figure 7.2-56).

Gillnet and trawl captains indicated Atlantic croaker fishing effort in the offshore Project Area has declined over the past decade, consistent with the sharp declines in commercial landings of Atlantic croaker in Virginia and North Carolina over the same time frame (Table 7.2-20). Gillnetters indicated that they expected gillnetting to be viable within the offshore Project Area in the absence of any area restrictions. The Project's layout incorporates the predominant local trawl tow directionality to avoid and minimize impacts to current and historical fisheries in the area.

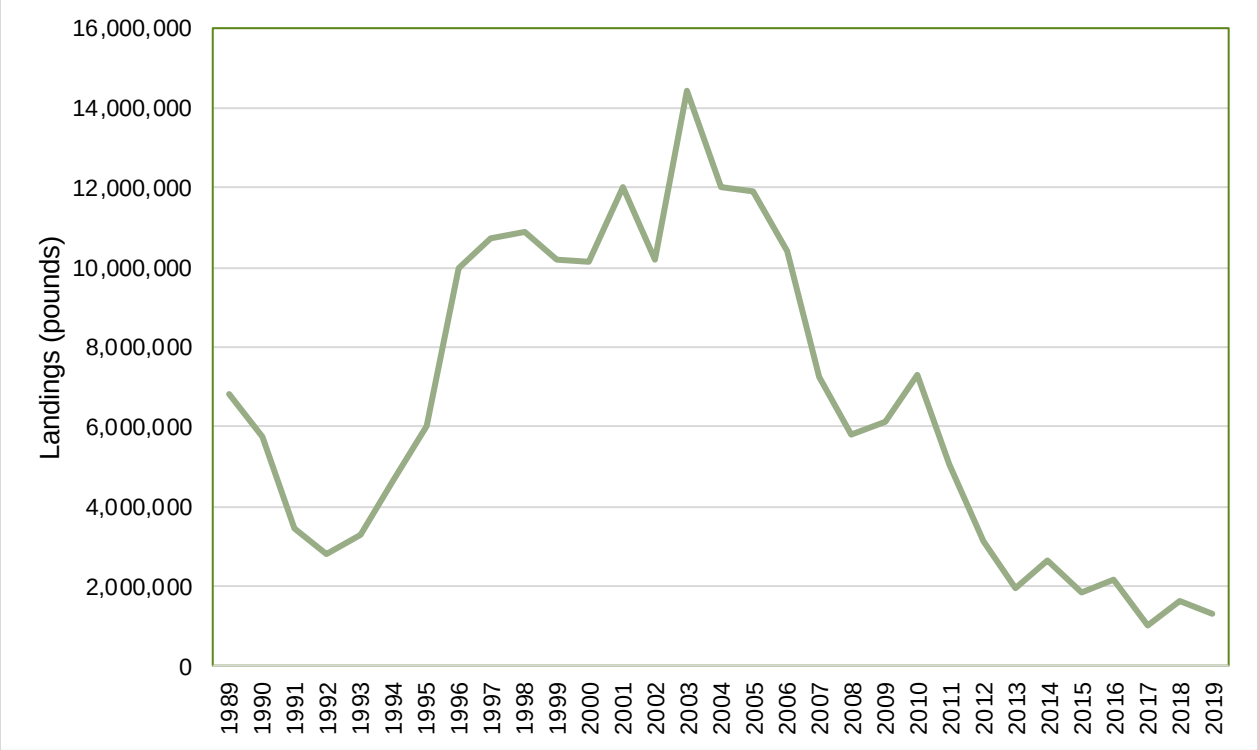


Figure 7.2-56 North Carolina Commercial Landings of Atlantic Croaker

Table 7.2-20 Atlantic Croaker Decade Landings in North Carolina and Virginia

	North Carolina			Virginia		
Year	Pounds	Kilograms	Value (dollars)	Pounds	Kilograms	Value (dollars)
2009	6,135,437	2,782,985	2,988,024	8,575,478	3,889,768	6,940,220
2010	7,312,159	3,316,737	3,409,433	7,872,754	3,571,018	6,025,067
2011	5,054,186	2,292,538	3,160,085	5,569,394	2,526,233	4,570,793
2012	3,106,616	1,409,136	2,131,894	6,940,080	3,147,965	7,534,338
2013	1,927,938	874,497	1,726,953	6,324,542	2,868,762	6,246,911
2014	2,629,908	1,192,905	1,864,628	4,814,406	2,183,776	4,186,314
2015	1,819,067	825,114	1,651,334	4,506,124	2,043,942	4,058,800
2016	2,164,015	981,580	2,290,271	3,934,484	1,784,650	3,071,074
2017	1,007,963	457,204	1,134,605	2,892,468	1,312,000	2,704,674
2018	1,643,634	745,539	1,653,218	2,440,431	1,106,960	2,892,818
2019	1,277,829	579,613	1,569,081	909,364	412,480	861,143
Source: NOAA Fisheries 2019c						

Bluefish have been historically important for the North Carolina drop-net fleet. Landings last peaked in 1990 at over 4.5 million lbs (2 million kg), and have since declined to just over 1.1 million lbs (.5 million kg) in 2019 (Figure 7.2-57). The drop netting fleet usually drop net on the bottom for bluefish deeper than 20 fathoms (37 m), with the modal depth being 35 to 50 fathoms (64 to 91 m). Sampling data provided by NCDMF provides additional insight into reported catch depths, and changes in the overall intensity in the fishery in the waterbodies east and northeast of Oregon Inlet (Figure 7.2-58) Fishermen have indicated that the inshore late fall (November and December) run of large “chopper” bluefish has declined in recent years, and this trend is also evident in the sampling data. Effort, and catches, in the fishery have also decreased significantly since the mid-2000s.

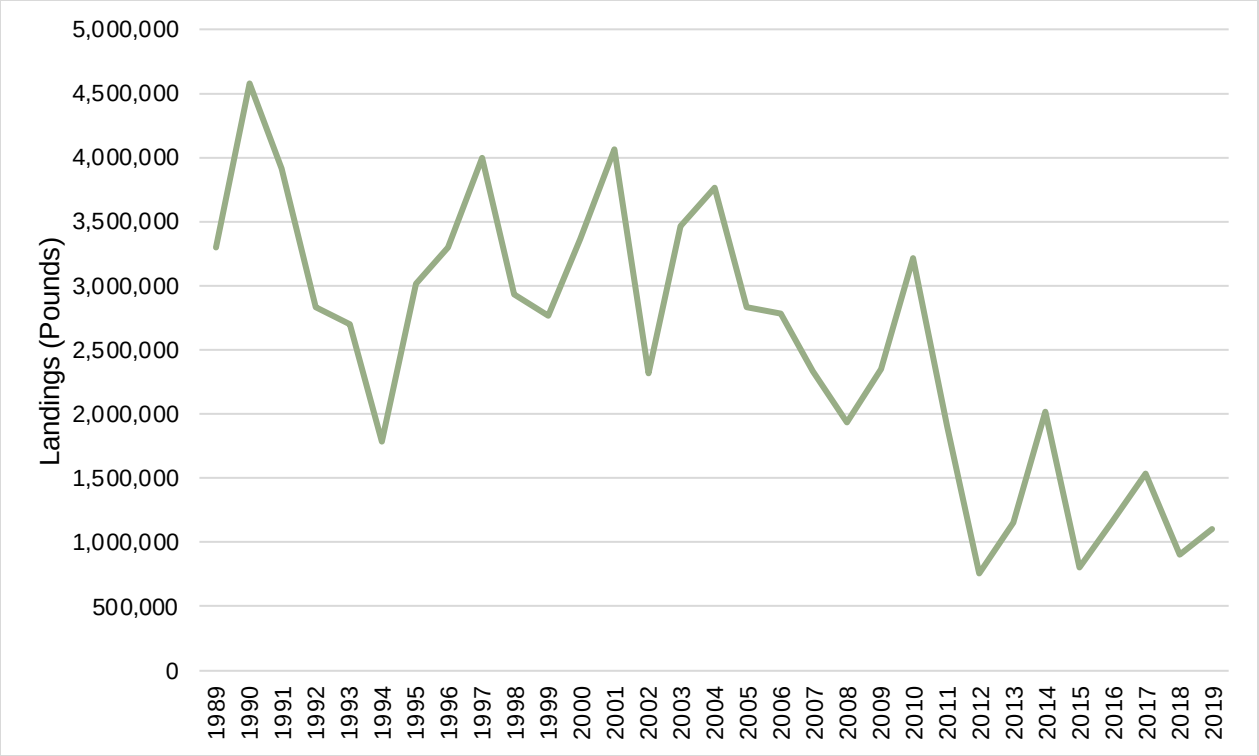


Figure 7.2-57 North Carolina Commercial Landings of Bluefish

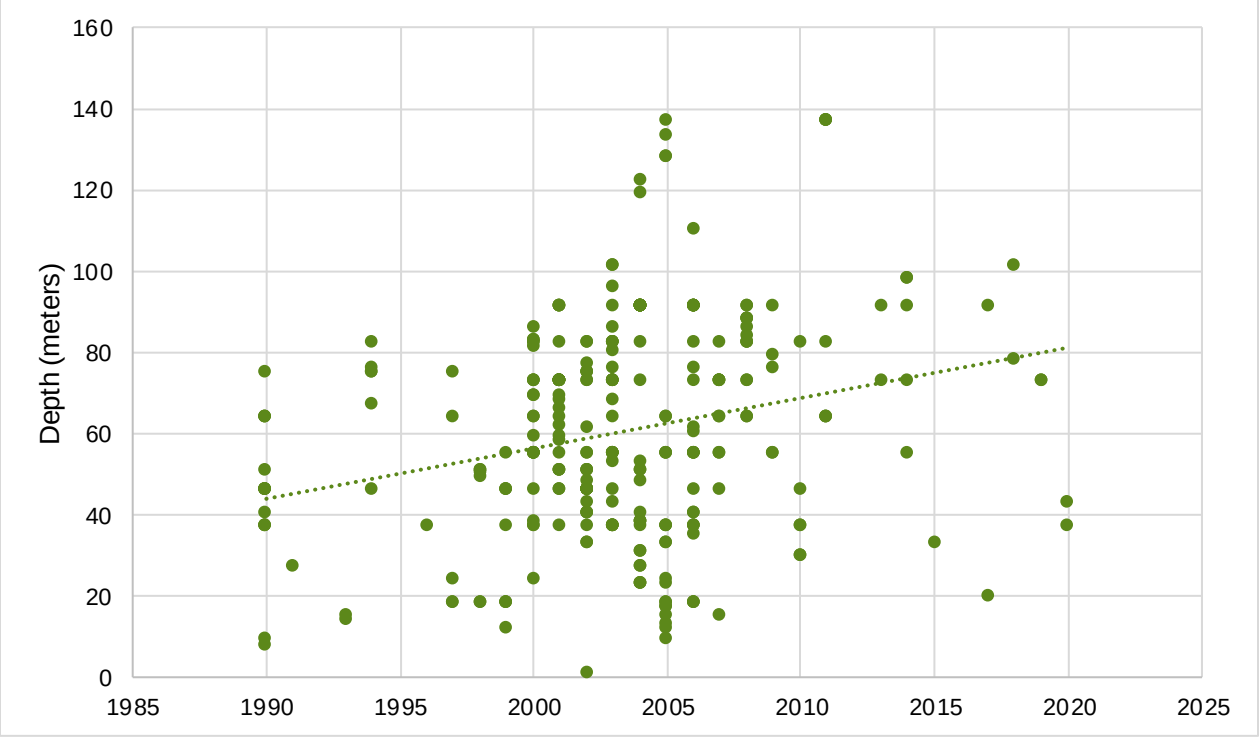


Figure 7.2-58 Reported Catch Depths for Sampled North Carolina Bluefish Trips (>100 lbs) for Water Bodies East and Northeast of Oregon Inlet

Atlantic cutlassfish, known locally as "ribbonfish," have emerged in the last decade as a directed, seasonal fishery for the North Carolina drop net fleet in late winter and early spring **(**Figure 7.2-59) The drop netting fleet bottom drop net for cutlassfish the same way, mostly from 30 to 70 m, with a modal depth of 25 fathoms (46 m). The local fishers have indicated that the fishing effort for the species is centered within approximately 10 nm (18.5 km) of the 102 tower, located southeast of Oregon Inlet. However, the fishery typically operates seaward of the Wind Development Area and the offshore export cable corridor, and this fishery is not anticipated to be disrupted by Project activities.

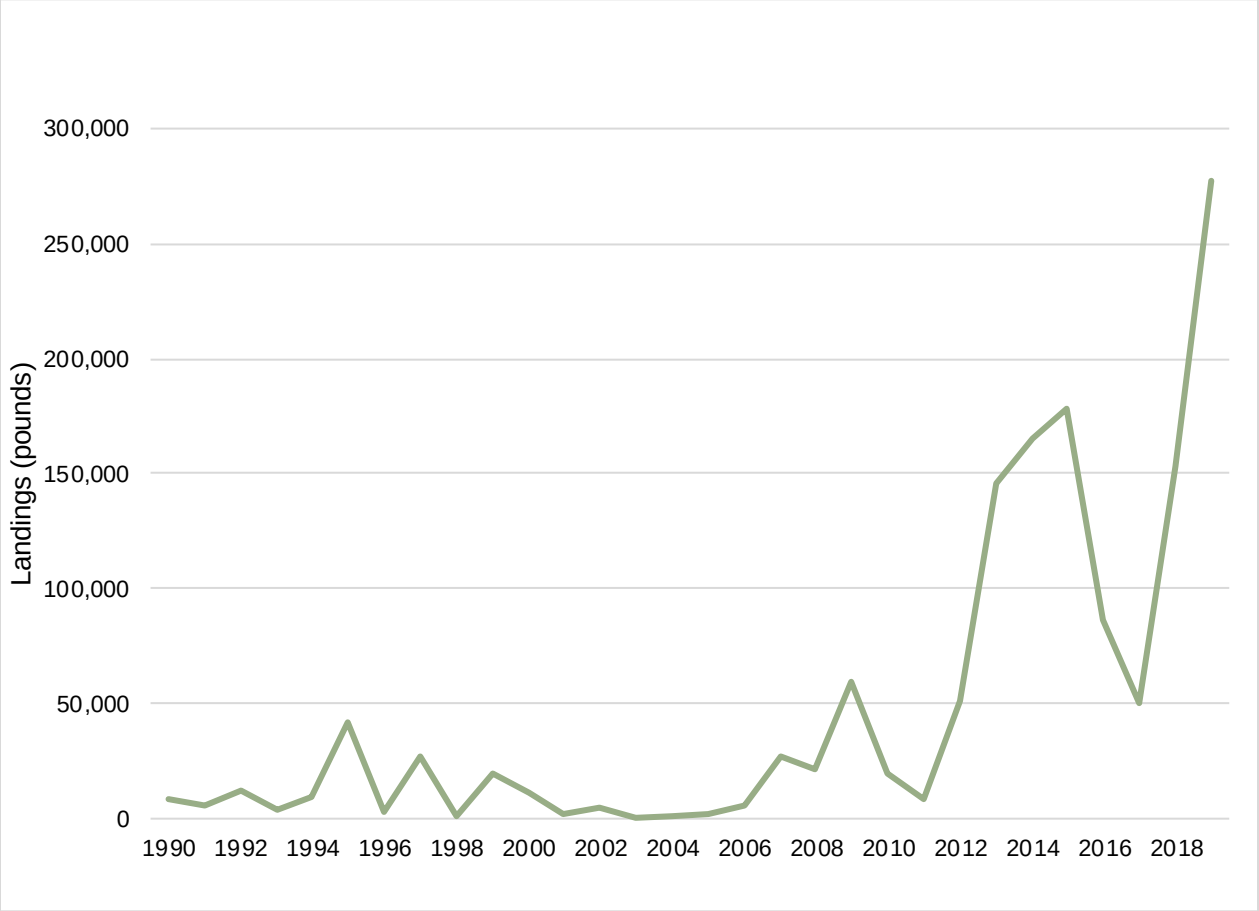


Figure 7.2-59 North Carolina Commercial Landings of Atlantic Cutlassfish

The drop netting fleet also float net for bluefish around the end of March or early April in the same area. Atlantic croakers may be targeted in the Wind Development Area in the late fall, early winter, and spring, as the fish migrate through the area.

Drop-netting comprises bottom gillnets that are deployed without anchors (Figure 7.2-60 and Figure 7.2-61). They are typically deployed on "marks" (i.e., concentration or school of fish seen on the bottom machine), and the boat remains near the gear until it is hauled back. They also deploy unanchored float nets on a seasonal basis when targeting bluefish in the area, typically in the spring (late March through early April.) They use 8-centimeter mesh bottom drop nets for Atlantic croaker, and approximately 13-centimeter mesh nets (bottom or float nets) for bluefish. When they set (bottom) drop nets, they may set several rigs and fish them after 30 minutes to an hour, depending on what is in the nets and how long it takes to work a rig. A rig is typically three bundles of gillnet, each bundle comprising approximately 360 ft (110 m) in length. Float net rigs are also typically three bundles, although some fish longer float nets. Float nets are typically left attached to the vessel's net reel and are then retrieved when the rig is fished. Drop

netting sets are variable in their directional orientation. They may be in a straight line or curved, depending on the shape, extent, and movement of the "mark". According to local fishers, the nets are usually orientated north/south or east/west depending on the mark.

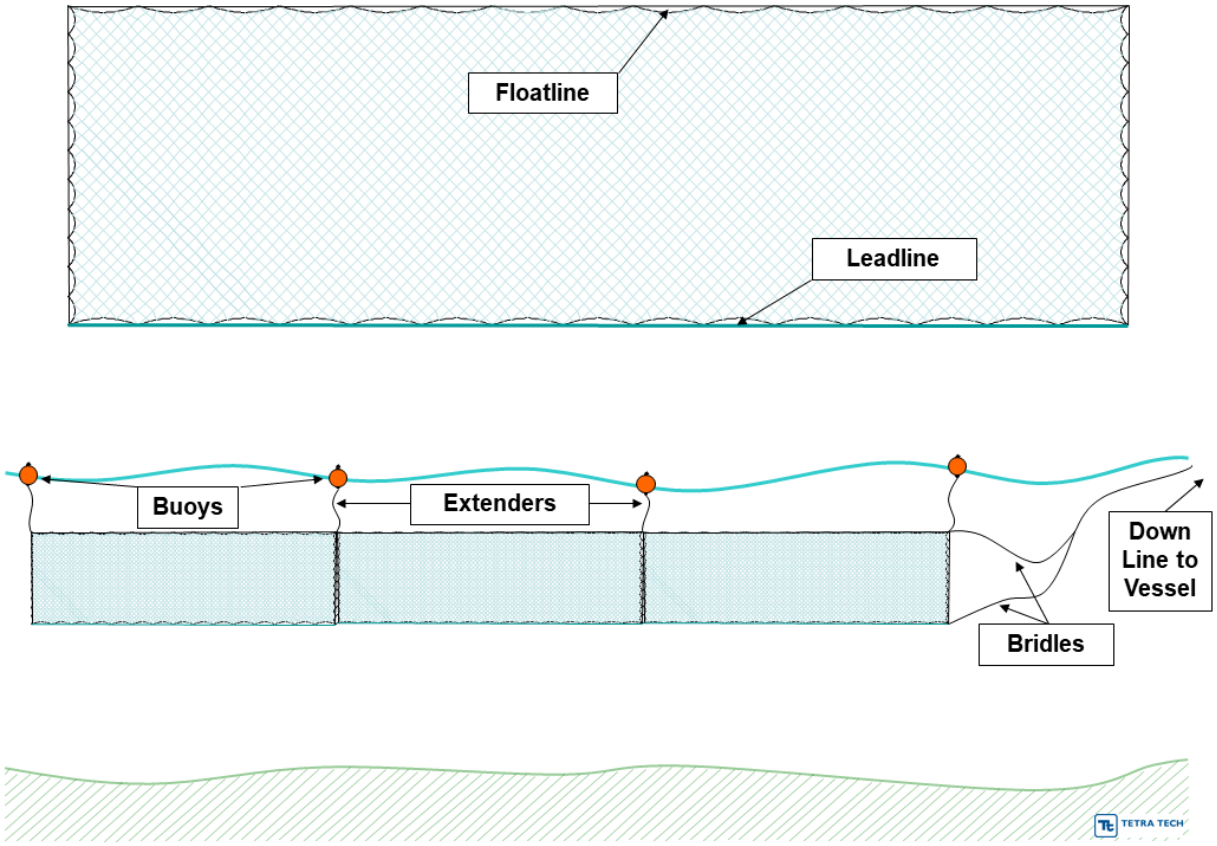


Figure 7.2-60 Example of Floating Drop Gillnet

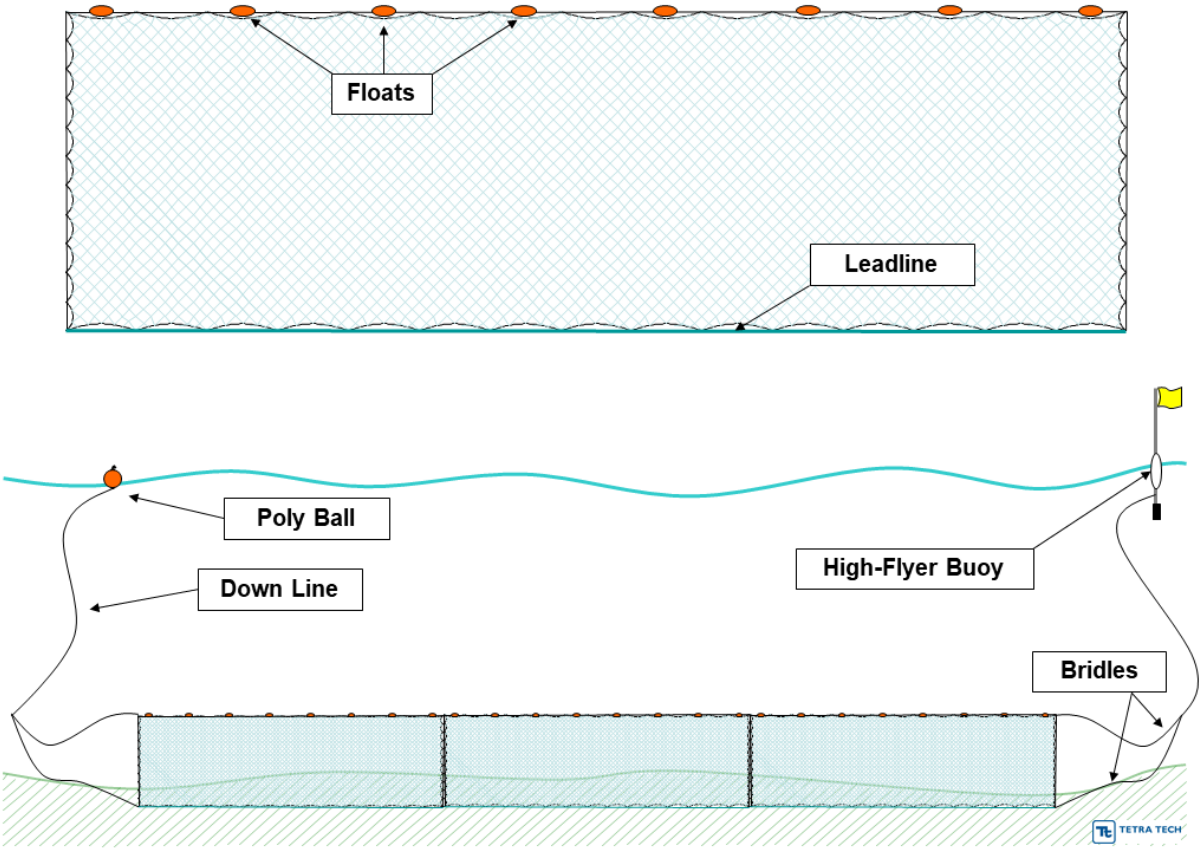


Figure 7.2-61 Example of Bottom Drop Gillnet

Otter Trawl Fisheries (Atlantic Croaker, Summer Flounder, Bluefish, Herring, Scup, and Atlantic Mackerel)

Mobile otter trawl fisheries have been prosecuted historically within the Wind Development Area. Directed fisheries have included Atlantic croaker, summer flounder, bluefish, herring, scup, and Atlantic mackerel. The species targeted with bottom trawls within the Wind Development Area are usually caught in the sloughs and troughs in the area, and along the contour edges. The eastern portion of the area, approaching the 20-fathom (37-m) contour, has also been described as relatively important to the historic trawl fisheries in the area. Trawl fisheries have operated historically in the Wind Development Area from late fall through spring, depending on the target species.

Commercial fishers indicate that most trawls in the area tow north-northeast/south-southwest with the bathymetric contour. Summer flounder were historically caught in the eastern region of the Wind Development Area going seaward but are now caught closer to the Hudson Canyon due to changes in stock distribution. Summer flounder fishing within the Lease Area has changed substantially over time. NCDMF samples trawl catches in their dockside sampling program. Although the data do not represent a full census of catch, they do provide important data, resolved at waterbody levels specific to areas east and northeast of Oregon Inlet, which provides an important contextual layer to help understand trends in the summer flounder fishery off the coast of North Carolina. The data show a steady decline in summer flounder catches from those waterbodies from 1990 through 2010, and no sampled catches over 1,000 lbs (454 kg) from those waterbodies since 2010 (Figure 7.2-62).

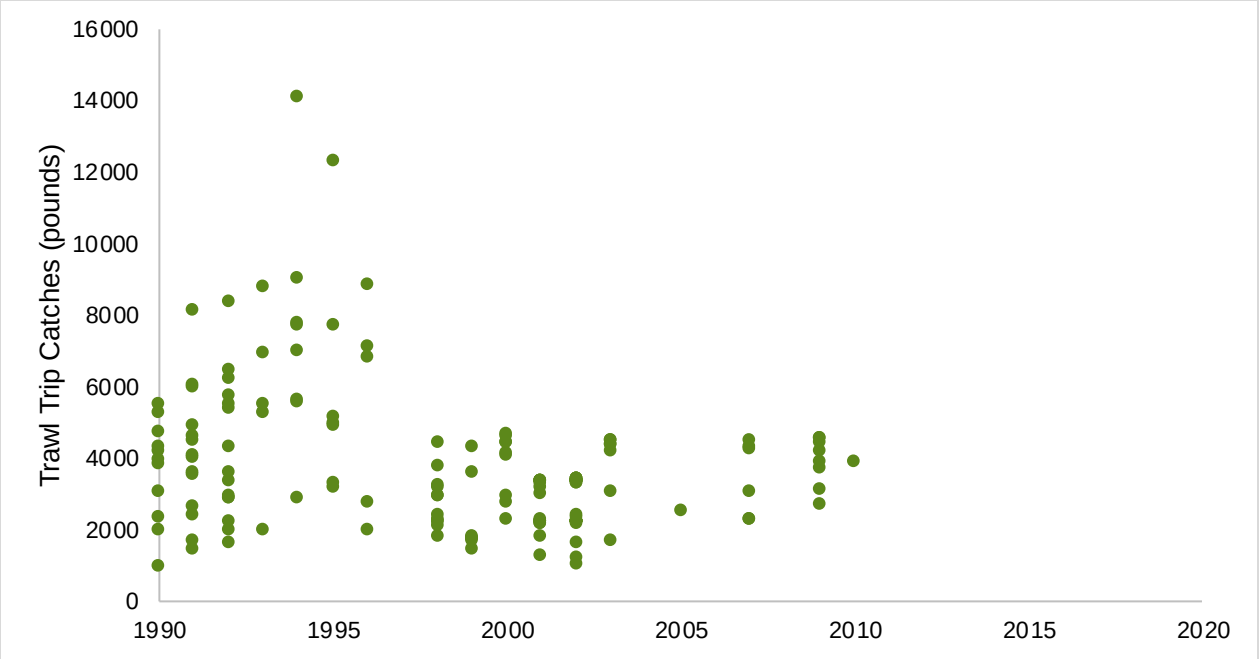


Figure 7.2-62 Sampled Summer Flounder Catches >1,000 lbs from Water Bodies East or Northeast of Oregon Inlet

Most Atlantic croaker trawling in the Wind Development Area occurs in late fall as they migrate to the Point and end up inshore of the Wind Development Area by spring right off the beach in North Carolina up to the Virginia state line.

These fisheries have typically been conducted with bottom-tending trawls (Figure 7.2-63). The nets are deployed astern of trawl boats operating in the area with approximately 590 ft (180 m) of scope on the trawl warps and are towed at speeds of 1.5 to 1.8 meters per second (3 to 3.5 knots). Based on interviews with trawl captains who have fished in the Wind Development Area historically, most tows in the Wind Development Area are oriented approximately north-northeast/south-southwest.

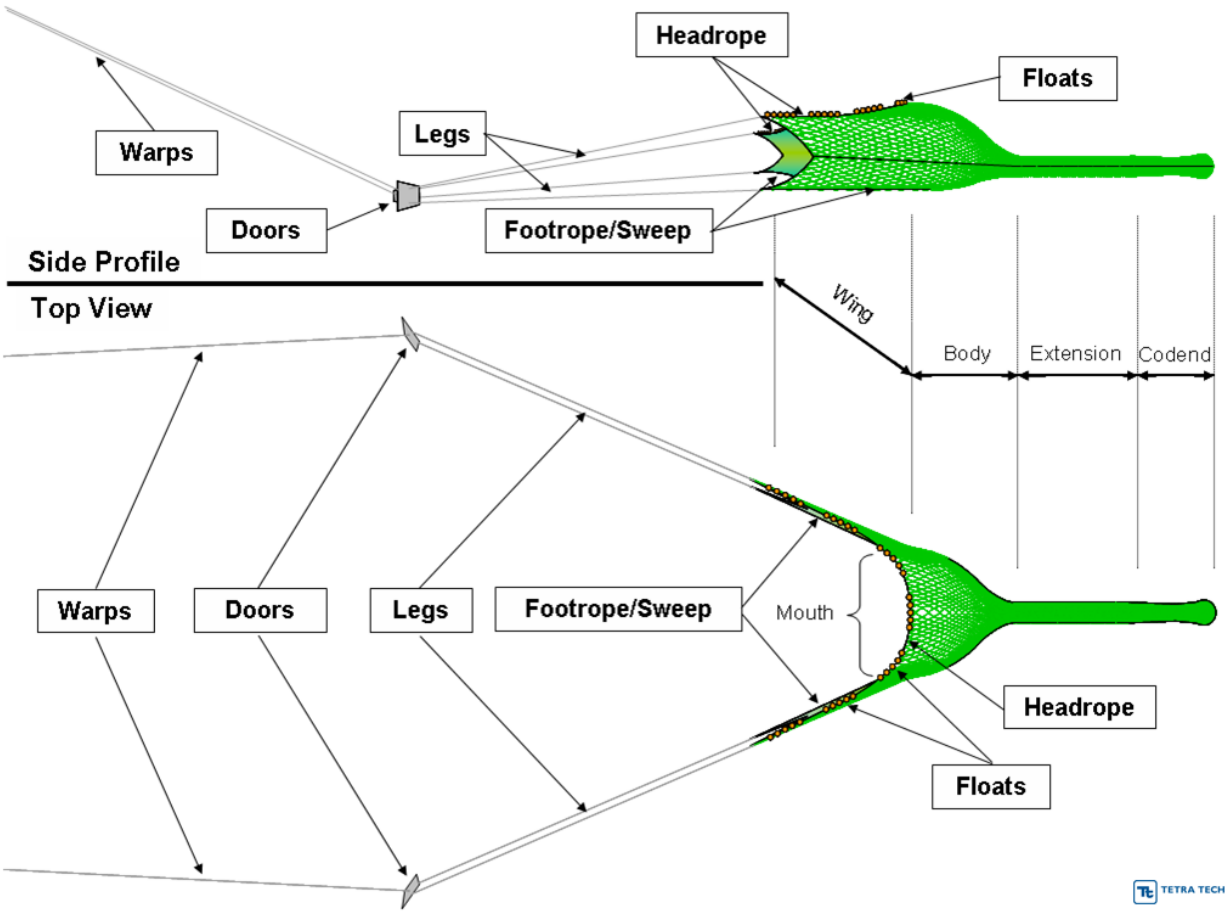


Figure 7.2-63 Example of Typical Otter Trawl Net Diagram

Monkfish Fishery

The historical commercial monkfish industry was present in waters inland and around the Wind Development Area. An oral history with a commercial fisher in the area indicates that there was a directed gillnet fishery for monkfish that ended in around 2005 due to various regulatory impacts. Like other gillnet fisheries, the monkfish industry suffered impacts from the implementation of the Harbor Porpoise rules that implemented time and area restrictions on large mesh gillnets. The directed gillnet fishery for monkfish began in 1994 when a cohort of New England-based gillnetters came to Wanchese for the winter spiny dogfish fishery. They then transitioned to monkfish in the spring. They were subsequently joined in the fishery by some of the local boats operating out of Oregon Inlet. Landings in the fishery peaked at over 700,000 lbs (317,518 kg) in 2000, and declined sharply thereafter, with landings in recent years below 70,000 lbs (31,752 kg, Figure 7.2-64)

Figure 7.2-64 North Carolina Commercial Monkfish Landings

When the directed gillnet fishery for monkfish was active in the area, there were eight gillnetting vessels out of Wanchese, North Carolina targeting monkfish, and two were specifically targeting monkfish within the Wind Development Area. They would target the monkfish as they migrated inshore, typically for a short period in March as they followed a warm water edge during their migration. Most of the effort for the Wanchese-based monkfish gillnet fleet was inshore of the Wind Development Area southeast of Oregon Inlet, closer to the beach.

Other Historical Fisheries in the Offshore Export Cable Corridor

Several fisheries that were historically significant along the offshore export cable corridor have been eliminated by regulations or substantially reduced by other factors. There was a directed float gillnet fishery for American shad that intercepted the fish as they migrated into the Chesapeake Bay and its tributaries each spring. The fishery was important to the Virginia Beach gillnet fleet but was eliminated by regulation in 1994 in response to stock depletion (VIMS 2010). Gray trout (weakfish) also supported directed historical commercial gillnet fisheries for the local commercial gillnet fleets in Virginia Beach, Virginia and Wanchese and Hatteras, North Carolina. The states of Virginia and North Carolina implemented regulations limiting weakfish catches to incidental levels, effectively prevented directed gillnet fishing for the species, consistent with the requirements of the Atlantic States Marine Fisheries Commission fishery management plan. A directed gillnet fishery for smooth dogfish developed in Virginia Beach in 1993. The fish were caught seasonally from April through early June. The fleet intercepted the fish around False Cape and followed their migration up to Chincoteague. Market factors combined with shark fin regulations have adversely impacted the economics for the fishery, resulting in lower levels of effort and landings in the fishery in the review area.

7.2.1.5.4 Input from the Commercial Fishing Industry

The Company contracted with FathomEdge Limited for fisheries liaison services to collect information on historic fishing usage in the review area and to provide data on industry concerns and comments. These oral histories were collected from ten commercial fishers out of Lynnhaven Inlet, Rudee Inlet, Norfolk, and Chincoteague, Virginia and Hatteras Inlet, Oregon Inlet, and Wanchese, North Carolina with approximately 400 collective years of experience in the region's offshore commercial fisheries. Their experiences cover the full suite of commercial gear used in the review area; including drop (sink) gillnet, drop (float) gillnet, anchored gillnet, bottom trawl, beam trawl, flynet, longline, hook-and-line, conch pot, drop (sea bass) pot, and beach haul seine. The captains interviewed provided detailed information regarding seasonal patterns in local and regional fisheries, historical evolution of the local fisheries, locations of specific habitat, and tow or set directionality. Gear and species-specific data learned through the interviews are integrated in Section 7.2.1.5.3, and are taken into consideration throughout the design process of the Project. The predominant trawl tow directionality is incorporated in the Project's layout based on input from the trawl captains who have worked in the Wind Development Area. Common themes among responses regarding fishing activity in the Wind Development Area emerged from the interviews, including that the Wind Development Area is relatively well sited from a fisheries perspective, and mobile gear fishing effort in the Wind Development Area has decreased significantly over time. Anchored gillnetting effort has also decreased over time for the Rudee Inlet fleet in the offshore export cable corridor for most species, with the exception of spiny dogfish. Most of the fishers interviewed have fished in the area since the 1970s. The fishers indicated that the fish and fisheries in the offshore Project Area have changed significantly over time. A declining trend in fish abundance and fishing effort in the area was a prevailing theme in the interviews. Some captains also noted that some species that have shifted northward could return to the area in the future, while some new opportunities have emerged in the local fisheries: Virginia has started an experimental shrimp fishery in state waters south of Dam Neck, and some directed drop-netting for Atlantic cutlassfish has emerged for the Oregon Inlet drop-netters.

Some of the most experienced trawl captains indicated that they did not anticipate fishing in the Wind Development Area in the future and described it as having relatively low current fisheries productivity. Commercial drop-netters indicated that they fish in the area on a seasonal basis as croakers and bluefish pass through the area, and they would expect to continue to fish in the area. Commercial conch potters, conch dredgers, anchored gillnetters, and experimental shrimp beam trawlers have fished in the offshore export cable corridor and expect to remain active in the corridor.

Some questions and concerns from the commercial fishing industry representatives interviewed included:

- If access would be restricted through exclusion or buffer zones;
- How effectively cables would be buried;
- If cables would ever be "rocked over," creating risk of gear entanglement;
- The effect of electric and magnetic fields (EMF) on fisheries; and
- WTG spacing.

The questions identified by commercial fishers in the interview process regarding access are addressed through the Frequently Asked Questions page on the Project website: https://www.kittyhawkoffshore.com/. Cable burial is addressed in the Preliminary Cable Burial Risk Assessment (Appendix J).

7.2.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For commercial and recreational fishing, the maximum design is represented by the largest number of structures in the Wind Development Area. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.2.2.1 *Construction*

During construction, the potential impacts to commercial and recreational fishing may include the following:

- Short-term loss of access to fishing grounds due to implementation of safety zones;
- Short-term, localized impacts on commercial and recreational target species due to installation of the offshore components;
- Short-term presence of partially installed structures presenting collision and snagging risk; and
- Short-term increase of Project-related vessel traffic resulting in increased collision risk.

Short-term loss of access to fishing grounds due to implementation of safety zones. Safety zones of up to 500 m radius will be established around construction activities as applicable,[4] and, where feasible, a minimum advisory safe passing distance for cable laying vessels will be implemented, as per the COLREGs. Where USCG Safety Zone authorities are not applicable, the Company will use safety vessels to promote awareness of these activities and the safety of the construction equipment and personnel. The presence of these safety zones may temporarily impact fishers by limiting access to fishing grounds within portions of the Wind Development Area and offshore export cable corridor. Safety zones will be temporary and localized around active construction activities and partially installed structures. The specific commercial fisheries with demonstrated potential overlap of the Wind Development Area that may experience short-term loss of access include Virginia shrimp beam trawl, spiny dogfish, conch dredge and pot, black sea bass, Atlantic croaker gillnet, bluefish gillnet and trawl, summer flounder, scallop, blueline tilefish, and Atlantic menhaden. Participants in these fisheries may have to remove or re-locate fixed gear or avoid mobile gear fishing in areas where safety zones are in effect. This may result in reductions in earnings due to loss of ability to fish in usual locations or increased vessel fuel usage to re-locate fishing activities. Considering the low levels of fishing activity that currently occur within the area, these impacts are not likely to be widespread. Further, the seasonal nature of many of these fisheries may result in no impact, as timing of the construction may not coincide with certain fishing seasons. To mitigate potential short-term loss of access to fishing grounds, should there be any during these seasonal fisheries, the Company will continue to engage with fishers, as described in the Fisheries Communication Plan, prior to and during all construction activities to ensure all required area closures will be communicated to the fishing industry and all other necessary parties.

Short-term, localized impacts to commercial and recreational target species due to installation of the offshore components. The original siting of the Lease Area by BOEM included significant public engagement and, as discussed above, commercial fishing occurs at relatively low levels within the Wind Development Area. As described in Sections 7.2.1.4 and 7.2.1.5, there is some commercial and recreational fishing activity along the offshore export cable corridor. Installation of Project components in both the Wind Development Area and offshore export cable corridor have the potential to impact commercial target species temporarily, but as discussed in Section 5.4 Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat, species are expected to return to their normal habitat soon after construction activities are completed. Commercial fisheries that may experience impacts related to temporary target species disturbance by construction include Virginia shrimp beam trawl, spiny dogfish, conch dredge and pot, black sea bass, Atlantic croaker gillnet and otter trawl, bluefish gillnet and otter trawl, summer flounder, Atlantic scallop, blueline tilefish, and Atlantic menhaden. Target species of these fisheries are known to occur in the Wind Development Area, and dispersion or mortality caused by construction may result in reductions in harvest or displaced fishing effort. As described, these impacts are expected to be discrete and temporary.

Short-term presence of partially installed structures presenting collision and snagging risk. Partially installed structures have the potential to cause a collision and snagging risk to commercial and recreational fisheries. If partially installed structures are outside of the safety zones discussed above, structures will be

[4] Where applicable, safety zones will extend up to 500 m around construction sites, per 33 CFR § 147.15. All areas will be lit and marked in accordance with USCG requirements and monitored by a safety vessel that will be available to assist local mariners.

lit and marked according to USCG and FAA standards, even during the construction phase. The Project has a comprehensive Fisheries Communications Plan and network and will provide the local and regional fishing communities with fisheries notices describing construction operations and locations of all fixed structures within the Wind Development Area, including partially installed structures within the Wind Development Area. For the safety of both mariners and Project technicians, safety zones of up to 500m radius will be established around construction activities as applicable,[2] and, where feasible, a minimum advisory safe passing distance for cable laying vessels will be implemented, as per the COLREGs. Where USCG Safety Zone authorities are not applicable, the Company will use safety vessels to promote awareness of these activities and the safety of the construction equipment and personnel. These may temporarily displace commercial and recreational fisheries, or fisheries transits, within discrete areas. More information regarding navigational safety can be found in Section 7.3 Marine Transportation and Appendix BB Navigation Safety Risk Assessment. Prior to construction, the Company will develop a Gear Loss/Damage Compensation Plan to address gear interactions with partially or fully installed structures. Commercial fisheries that may experience these impacts include Virginia shrimp beam trawl, spiny dogfish, conch dredge and pot, black sea bass, Atlantic croaker gillnet and otter trawl, bluefish gillnet and otter trawl, summer flounder, Atlantic scallop, blueline tilefish, and Atlantic menhaden.

Short-term increase of Project-related vessel traffic resulting in increased collision risk. The increase in Project-related vessel traffic has the potential to cause increased collision risk for fishing vessels operating in or near and/or transiting through the Wind Development Area. While the Company anticipates Project-related vessels requiring regular transits to and from the Wind Development Area for construction activities, in comparison to the volume of vessel traffic occurring within the waters offshore of North Carolina the increase is expected to have negligible impacts. The potential for an increase in collision risk due to Project vessel activities was studied in the Navigation Safety Risk Assessment (see Appendix BB). The Company will schedule and control Project-related vessels to best manage congestion and traffic flow in coordination with the USCG, Department of Defense (DoD), and other national security stakeholders. Where practical, Project vessels will utilize transit lanes, fairways, and predetermined passage plans consistent with existing waterway uses. More information regarding mitigations for vessel collision risk can be found in Section 7.3 Marine Transportation and Navigation and Appendix BB Navigation Safety Risk Assessment.

7.2.2.2 *Operations and Maintenance*

During operations, the potential impacts to commercial and recreational fishing may include the following:

- Long-term presence of new fixed structures may result in loss of access to traditional fishing grounds;
- Long-term modification of habitat;
- Potential long-term positive beneficial increases in species biodiversity and abundance during operations;
- Long-term presence of EMF;
- Increased Project-related vessel traffic;
- Long-term impacts to marine radar/navigation instruments due to the presence of WTGs;
- Potential hazards to navigation due to WTGs; and
- Potential increased presence of fisheries and usage of the Wind Development Area for recreational and commercial fishing.

Long-term presence of new fixed structures may result in loss of access to traditional fishing grounds. The Company has considered the historical, current, and traditional uses of the Wind Development Area regarding commercial and recreational fishing. Specific species that may be targeted by recreational fishermen in the offshore Project Area are presented in Table 7.2-9, and species targeted by commercial fishermen are presented in Table 7.2-14 and Table 7.2-15. A thorough analysis of historical fishing patterns within the region indicates the Wind Development Area is not currently fished intensively

commercially or recreationally. There have not been any commercial VTRs from the Lease Area from 2016 through 2020. The most recent NEFOP observed trawl trip within the Lease Area occurred in 2012 (Figure 7.2-48, Figure 7.2-49). NCDMF's Program 433 dockside sampling data (Figure 7.2-62) and oral history interviews with local captains also indicate that trawl effort in the area has declined sharply over the past decade. Fisheries that have been historically targeted within the Wind Development Area have had reduced catches in recent years, including Atlantic croaker (Figure 7.2-56), bluefish (Figure 7.2-57, summer flounder (Figure 7.2-62), and monkfish (Figure 7.2-64). The analysis of fisheries data confirms that the Lease Area is sited effectively in order to avoid fisheries impacts. The Company has further avoided, minimized, and mitigated impacts to the local, historical trawl fisheries by orienting the Project's layout on a north-northeast/south-southwest axis, consistent with the predominant trawl tow directionality in the area, in order to accommodate historical fishing practices. This strategic and predictable layout also may help minimize potential conflicts with other fishing gears that have historically fished, and may continue to fish during Project operations, in or near the Lease Area.

Drop netting occurs occasionally on a seasonal basis within the Lease Area. There were three NEFOP-observed drop net trips in the Lease Area in the time series. Drop netting is accommodated within the array with turbine spacing that is approximately four to six times the length of a drop net rig. Based on interviews with local captains, some drop potting occurs on the margin of the Lease Area. Drop potting is accommodated within the array with the turbine spacing.

Transiting through the Wind Development Area to reach offshore fishing grounds does occur. The Project has a comprehensive fisheries communications network and Fisheries Communications Plan and will provide the local and regional fishing communities with fisheries notices describing construction operations and locations of all fixed structures within the Wind Development Area.

The Company completed a Preliminary Cable Burial Risk Assessment, calculating a target depth of lowering to minimize the risk to the offshore export cables from external aggression and mitigate conflicts between other users and the new subsea structures (see Appendix J). The Preliminary Cable Burial Risk Assessment assessed unmitigated risks (risks prior to outreach and marine liaison taking action to educate mariners and fisheries to be aware of cables, as well as before any burial or cable protection) to the fishing industry regarding conflict between vessels/gear and the export cable. The risk of commercial fishing to the offshore export cables was ranked as "likely" at water depths of 5 to 9 fathoms (9 to 16 m), "possible risk" to "unlikely risk" at 9 to 11 fathoms (17 to 21 m), and "highly unlikely" risk from 11 fathoms (22 m) and deeper. As a result, the Company determined a recommended depth of lowering as identified as the maximum value needed to mitigate those individual risks. An extensive review of commercial and recreational fishing traffic and activities along the proposed offshore export cable corridor was conducted and factored into the Preliminary Cable Burial Risk Assessment. The offshore export cables will be buried to a target depth of up to 2.5 m below stable seabed to mitigate specific risks as described in Chapter 3 Description of Proposed Activity. In addition, the Project's layout incorporates local trawl tow directionality and avoids specific areas of fisheries habitat.

Long-term modification of habitat. The presence of WTG and ESP foundations and associated scour protection would result in loss and conversion of soft-bottom habitat, potentially displacing species that currently inhabit soft substrates within the Wind Development Area. Impacts of WTG and ESP foundations to fish and benthic species are detailed in Section 5.4.2 Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat. Fisheries that may be impacted by species displacement include conch dredge and pot, Atlantic croaker gillnet and otter trawl, Atlantic cutlassfish, monkfish, summer flounder, scallop, and blueline tilefish. Atlantic croaker, Atlantic cutlassfish, monkfish, summer flounder, and scallop fisheries have had minimal landings over recent years from within the Lease Area where displacement may occur.

Additionally, this habitat conversion would add new structures and new hardbottom habitat, which can present environmental benefits and attract structure-associated species to the area. Depending on the benthic characteristics of the seafloor, WTGs may be installed in areas of previously low productivity or soft

sediments with little hard structure; these foundations considerably attract fish and can enhance food availability for local predator species (Reubens et al. 2011). Well-established offshore wind developments throughout Europe have been shown to have positive effects on distributions of fish and macroinvertebrates, which are attracted to the hard bottom scour protection around wind turbine foundations (Reubens et al. 2014; Wilhelmsson et al. 2006; Bergstrom et al. 2013, 2014; Rein et al. 2013; Krone et al. 2017).

The Company recognizes that discussions are ongoing regarding pre- and post-construction monitoring needs. More information on habitat modification can be found in Section 5.4 Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat. In addition, the Lease Area was sited to avoid areas of high ecological importance (BOEM 2015), thus many impacts of the long-term modification of habitat were minimized early in the planning process.

Potential long-term positive beneficial increases in species biodiversity and abundance during operations. The construction of WTG and ESP foundations may have an aggregating effect on local benthic and pelagic organisms due the nature of increasing structure surface area in offshore waters, which may enhance food availability for local predator species (Reubens et al. 2011). Increase in overall total ecosystem activity has been observed in offshore wind farms, and higher trophic organisms reacted positively to post-construction structures (Raoux et al. 2017). These high trophic organisms include piscivorous fish species, marine mammals, and seabirds (Raoux et al. 2017). More information on ecosystem biodiversity and aggregation can be found in Section 5.4 Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat. The black sea bass and scup fisheries may experience these beneficial impacts. Black sea bass may inhabit new structures, near which fish pots targeting sea bass can be fished. While there is no considerable commercial scup fishery activity in the Lease Area, scup are also a structure-associated species which may support increased commercial harvest during Project operations.

Long-term presence of EMF. Undersea power cables associated with offshore wind energy projects will generate weak EMF at frequencies outside the known range of detection by electrosensitive and magnetosensitive fish (BOEM 2020b). An organism's electro-sensitivity is dependent on the amount of electrical current being carried by the cable, the design of the cable, and the distance of marine organisms from the cable (BOEM 2020b) and may vary by project and location. The presence of the EMF is long-term; however, studies have not identified a trend of adverse impacts to fish species. Research on this phenomenon is ongoing. The potential impact on EMF to fish species is further discussed in Section 5.4 Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat. To mitigate impacts from the presence of EMF, the Company has committed to burying or armoring electric cables to minimize detectable EMF.

Increased Project-related vessel traffic. Fishing vessels that fish in or near and/or transit through the Wind Development Area may experience long-term impacts of increased vessel traffic. While the Company anticipates that Project-related vessels will require regular transits to and from the Wind Development Area for scheduled and unplanned maintenance, in comparison to the volume of vessel traffic occurring within the waters offshore of North Carolina the increase is expected to have negligible impacts. Information on potential risks and associated avoidance measures for increased vessel traffic is provided in Section 7.3 Marine Transportation and Navigation and Appendix BB Navigation Safety Risk Assessment.

Long-term impacts to marine radar/navigation instruments due to the presence of WTGs. The Company completed a Navigation Safety Risk Assessment in compliance with BOEM and USCG requirements and regulatory guidance (Appendix BB). The Navigation Safety Risk Assessment assesses the navigational transit hazard associated with the development and operations of the Project.

The extent to which the presence of WTGs can impact the accuracy and efficacy of marine radar is well understood following years of United Kingdom (UK) vessel operational experience within and near large offshore wind facilities. Experience in UK waters has shown that mariners have become increasingly aware

of any radar effects as more offshore wind facilities become operational. Based on this experience, the mariner can interpret the anticipated effects accurately, noting that effects are the same as those experienced by mariners in other environments, such as in close proximity to other vessels or structures. Effects can be mitigated through careful adjustment of radar controls and compliance with COLREGs.

Several UK studies of radar interference in the vicinity of offshore wind facilities have resulted in published guidance, including MGN 371 (MCA 2008a), MGN 372 (MCA 2008b), and MGN 543 (MCA 2016). This information is useful given that U.S. guidance does not contain specific information relating to radar interference. It is noted however that this published guidance is intended to be used on a case-by-case basis; noting that since these studies were undertaken, turbine size and spacing within offshore wind facilities has increased.

A study conducted in 2009 by the USCG for the Cape Wind Project found that presence of WTGs had an effect on marine radar, but that the impacts were both predictable and manageable with training and technology (MMS 2009). Regarding concerns over EMF from the offshore export cables interfering with vessel magnetic compasses, the offshore export and inter-array cables for the Project will contain alternating current. Studies indicate that alternating current does not emit an EMF significant enough to impact marine magnetic compasses (BOEM 2020b; Appendix BB Navigation Safety Risk Assessment).

Specific commercial fisheries that may experience these impacts include those that may operate in or near and/or transit through the Lease Area to reach fishing grounds. These include conch pot, black sea bass, Atlantic croaker gillnet and otter trawl, Atlantic cutlassfish, bluefish gillnet and otter trawl, monkfish, summer flounder, squid, scallop, blueline tilefish, and pelagic and HMS fisheries. The mitigation measures described above and in Appendix FF are aimed at addressing and minimizing navigation safety risks.

Potential hazards to navigation due to WTGs. WTGs may introduce potential impacts to transiting commercial and recreational fishing vessels, especially in foul weather and times of low visibility. The Company will be taking impact avoidance measures to promote navigational safety, such as following USCG and BOEM's guidelines for lighting and marking. AIS will be used to mark structures within the Wind Development Area, pending additional guidance from USCG. More information on navigational safety can be found in Section 7.3 Marine Transportation and Navigation. As-built plans will be provided to NOAA and appropriate stakeholders to update nautical charts with structure locations, including WTGs and the ESP, along with the location of the offshore export cable corridor. Specific fisheries that may experience these impacts are those that may operate in or near or transit through the Lease Area to reach fishing grounds. These include conch pot, black sea bass, Atlantic croaker gillnet and otter trawl, Atlantic cutlassfish, bluefish gillnet and otter trawl, monkfish, summer flounder, squid, scallop, blueline tilefish, and pelagic and HMS fisheries. Safety measures and the strategic WTG layout design are aimed at minimizing collision and allision risks to fishing vessels working in and transiting through the Lease Area.

Potential increased presence of fisheries and usage of the Wind Development Area for recreational and commercial fishing. The Company acknowledges that the presence of new structures may increase the fishing usage of the Wind Development Area as new species inhabit the area. Foundations may act as fish aggregators and open the opportunity for increased fishing and spearfishing grounds (ten Brink and Dalton 2018). A study conducted by the University of Rhode Island has also determined that anglers believe that it has improved fishing in the areas very close to the turbines by increasing species richness (Prevost and Bidwell 2019). Various commercial and recreational fisheries described in Section 7.2.1 may benefit from these improved fishing conditions. However, higher fishing activity and vessel traffic amongst the fixed offshore structures may increase the risk for fishing gear conflicts, which may result in entanglements and gear loss. Specific commercial fisheries with demonstrated presence in the Lease Area that may be vulnerable to these impacts include conch pot, black sea bass, Atlantic croaker gillnet and otter trawl, bluefish gillnet and otter trawl, summer flounder, scallop, and blueline tilefish. Gear conflicts that may occur with Project-related fixed structures will be addressed by the Gear Loss/Damage Compensation Plan (as described in Appendix FF).

7.2.2.3 *Decommissioning*

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.3 Marine Transportation and Navigation

This section discusses marine transportation and navigation within and surrounding the offshore Project Area, which includes the Wind Development Area and offshore export cable corridor. Potential impacts to marine transportation and navigation resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP that are related to marine transportation and navigation include:

- Recreation and Tourism (Section 7.1);
- Commercial and Recreational Fishing (Section 7.2);
- Department of Defense and Outer Continental Shelf National Security Maritime Uses (Section 7.4);
- Other Coastal and Marine Uses (Section 7.7), and
- Navigation Safety Risk Assessment (Appendix BB).

For the purposes of this section, the review area includes the offshore Project components and the areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project. Note that the Navigation Safety Risk Assessment evaluated a study area (Wind Development Area study area) consisting of a 10 nm (18.5 km) buffer around the Wind Development Area and an approximately 2 nm (3.7 km) buffer around the offshore export cable corridor. The Navigation Safety Risk Assessment study area was defined so that focus is placed upon the vessel traffic relevant to the Wind Development Area and the offshore export cable corridor in order to provide a comprehensive assessment of related vessel routing.

The USCG is responsible for analyzing the suitability of the siting of offshore wind facilities near vessel traffic. The Ports and Waterways Safety Act requires the USCG to conduct studies to provide safe access routes for vessel traffic in federal waters. The USCG must consider all possible uses of the waterways to reconcile the need for safe access routes with the needs of all other uses of the waterways.

As a cooperating agency, the USCG provides guidance in the form of a Navigation and Vessel Inspection Circular (NVIC). The current NVIC on Offshore Renewable Energy Installations is 01-19 (USCG 2019a). This guidance includes the development of a Navigation Safety Risk Assessment which is provided in Appendix BB.

To satisfy the information requirements of 30 Code of Federal Regulations (CFR) § 585.627(a)(8) and USCG guidance, a Navigation Safety Risk Assessment was prepared in support of the COP. The Navigation Safety Risk Assessment includes the development of a shipping and navigation baseline (including a review of 12 months of vessel traffic data collected from AIS receivers) followed by an assessment of risk using both qualification and quantification techniques. Quantification includes an assessment of collision, allision, and grounding risks and qualification covers analysis of potential impacts to communications and positioning systems as well as potential impacts on USCG missions (including search and rescue [SAR]). To conclude, the Navigation Safety Risk Assessment assesses safe navigation within the Wind Development Area. A full description of the methodology, baseline data, and results of the analysis are presented in Appendix BB Navigation Safety Risk Assessment. The Company's approach to the Navigation Safety Risk Assessment was discussed with key stakeholders including BOEM, USCG and major operators and mariners who are active in the offshore Project Area (see Appendix B Summary of Agency and Stakeholder Engagement).

In addition to USCG guidance (2019a) and BOEM's *Information Guidelines for a Renewable Energy Construction and Operations Plan* (2020a), the following guidance documents were considered:

- *Atlantic Coast Port Access Route Study Final Report* (ACPARS; USCG 2015a);
- Commandant Instruction 16003.2B (USCG 2019b);
- MGN 654 (Merchant and Fishing) *Safety of Navigation: Offshore Renewable Energy Installations (OREIs)-Guidance on UK Navigational Practice, Safety and Emergency Responses* (MCA 2021)—which is referenced within both the NVIC and the Commandant Instruction; and
- *Revised Guidelines for Formal Safety Assessment for Use in the Rule-Making Process* (IMO 2018).

Proposed lighting and marking of structures associated with the Project has also been determined in line with guidance provided in:

- COMDTINST M16500.7A (Aids to Navigation Manual, USCG 2015b);
- *International Association of Marine Aids to Navigation and Lighthouse Authorities Recommendation O-139 on The Marking of Man-Made Offshore Wind Structures* (IALA 2013);
- *NC, VA, MD, DE, NJ-Atlantic Ocean-Offshore Structure PATON Marking Guidance* (USCG 2020a); and
- *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development* (BOEM 2021).

Vessel traffic data used to complete the Navigation Safety Risk Assessment and to inform this section includes 12 months of AIS vessel traffic data (see Section 7.3.1), VMS data for fishing vessels (including polar histograms from January 2014 to August 2019), USCG maritime incident data, National Oceanic and Atmospheric Administration (NOAA) nautical charts, and other publicly available data. Additionally, in-situ AIS data used for the Navigation Safety Risk Assessment reconciled data from coastal receivers, satellite receivers, and research vessels operating in the review area. Finally, information provided by the FLO as described in Section 7.2 Commercial and Recreational Fishing was reviewed.

7.3.1 Affected Environment

Maritime navigation and vessel traffic characteristics of the Wind Development Area study area are discussed below, supplemented by the Navigational Safety Risk Assessment, a document completed by Anatec Limited to assess the impact of the major navigational hazards associated with the development of the Project (Appendix BB). Cargo vessels, push/pull vessels, tank or tanker vessels, passenger vessels, military vessels, fishing vessels, and recreational vessels in the Wind Development Area study area are examined. USCG responsibilities for implementing routing measures such as Traffic Separation Schemes (TSS) and safety fairways and responsibilities for SAR are discussed.

AIS has been used to determine what types of vessels are transiting through the Wind Development Area study area and is a primary data source to characterize the affected environment. AIS is an automated, autonomous anti-collision and tracking system which is used extensively by commercial vessels for the exchange of navigational information between AIS-equipped vessels. Static and dynamic vessel information can be electronically exchanged between AIS receiving stations (onboard, ashore, or satellite). Since December 2004, the International Maritime Organization requires all passenger vessels, as well as all commercial vessels over 300 gross tons that travel internationally, to carry a Class A AIS transponder. This requirement has been translated into U.S. Flag state legislation and full carriage requirements are covered within the Navigation Safety Risk Assessment. AIS data was used to establish information on commercial shipping, passenger vessel, and fishing vessel activity in the Wind Development Area study area. In-situ AIS data used for the Navigation Safety Risk Assessment reconciled data from coastal receivers, satellite receivers, and research vessels operating in the Wind Development Area study area and underwent rigorous quality assurance processes. This approach reduced inevitable data gaps when relying only on data from distant coastal AIS receivers.

7.3.1.1 Coastal Infrastructure

Commercial vessel traffic in the Wind Development Area study area makes use of waterways, ports, and other coastal infrastructure to move goods and passengers, and is essential for the Project region's economy and security. The closest large commercial ports to the Wind Development Area and the landfall are Norfolk, Virginia, and Newport News, Virginia. Both ports are located inside of Chesapeake Bay on the western side of the entrance. They are both deepwater ports each with a commercial vessel terminal (New Kent County Economic Development 2020). The United States Army Corps of Engineers (USACE) is responsible for documenting vessel and trip information of major American ports. Cargo vessels, tankers, and push/pull traversed in and out of Norfolk Harbor, Virginia in 2017, and the same kinds of vessels traversed through Newport News Virginia in 2017 (USACE 2018).

Special anchorage areas are described in subpart A of 33 CFR § 110. The closest official anchorages to the Project are within or at the opening of the Chesapeake Bay. Given the distance from the offshore export cable corridor and the Wind Development Area to the closest anchorage area (approximately 80 nm [148 km]), the Project is not anticipated to have an impact on anchorage areas and they are not addressed further in this analysis. See Appendix BB Navigation Safety Risk Assessment for additional detail regarding anchored vessels.

7.3.1.1.1 Aids to Navigation

Aids to navigation consist of lights, sound signals, buoys, and onshore lighthouses. Within the Wind Development Area study area, there are private aids to navigation, federal aids to navigation, and radar transponders. Most are marked on NOAA nautical charts and are intended to serve as a visual reference to support safe maritime navigation. Federal aids to navigation are developed, established, operated, and maintained by the USCG to assist mariners in determining their position, help mariners plan a safe route, and warn mariners of dangers and obstructions. While not developed, established, operated, or maintained by the USCG, private aids to navigation are permitted by the USCG. Private aids to navigation and federal aids to navigation are used to facilitate the safe and economic movement of all vessel traffic. Most of the federal aids to navigation within the region are those marking the Chesapeake Bay International Maritime Organization routing measure. These include lights, sound signals and other forms of electronic marking such as AIS and Radar Beacons. The Wind Development Area is 30 nm (50 km) south of one precautionary area (Figure 7.3-1). Precautionary areas are areas within which ships must use added caution and should follow the recommended direction of traffic flow and include TSS lanes.

The Wind Development Area is located offshore and southeast of the Chesapeake Southern Approach and the Chesapeake Bay Eastern Approach TSSs (Figure 7.3-1). TSSs are internationally recognized through the International Maritime Organization and are designed to reduce the risk of collision in high vessel traffic areas; regulations do not allow for fixed structures to be permitted within these lanes. TSSs are designed to be used by large commercial vessels to provide safe transit in and out of port areas. Transit and maneuvering rules for vessels within a TSS can be found in 33 CFR § 83.10 (COLREGs Rule 10). TSSs consist of an inbound lane, outbound lane, and separation zone located between the two lanes. The presence of an inbound and outbound lane indicates the direction of vessel traffic within the TSS. The Chesapeake Bay Precautionary Area consists of the southern approach, the eastern approach, and space between bounded by a circle 2 nm (3.7 km) in radius. Although these Precautionary Areas and TSSs are not in the offshore Project Area, they have a role in dictating the movement of vessels in the general vicinity of the Project (Figure 7.3-1).

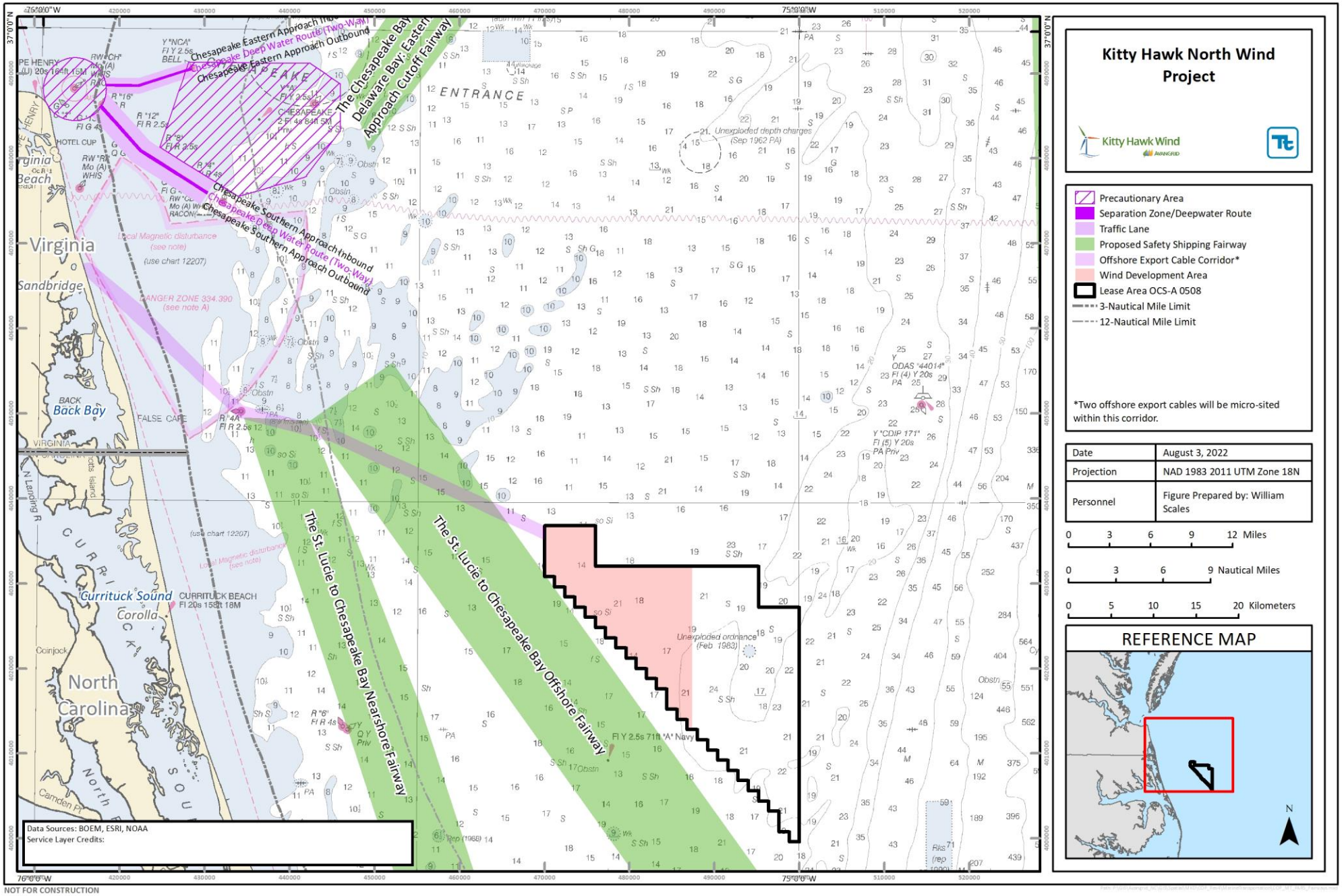


Figure 7.3-1 Existing TSS Lanes and ACPARS Proposed Fairways

The ACPARS, conducted by the USCG, reconciles the need for safe access routes with other reasonable waterway uses, such as renewable energy sites (USCG 2020a). The USCG designated "potential fairways" to ensure traditional navigational routes are kept free from obstructions (Figure 7.3-1). The Wind Development Area is located directly adjacent to the east of the proposed St. Lucie to Chesapeake Bay Offshore Fairway and is approximately 15 nm (28 km) west of the St. Lucie to New York proposed fairway. The proposed St. Lucie to Chesapeake Bay Offshore Fairway is about 1,043 nm (1,931 km) long, approximately 10 nm (18.5 km) wide, and the proposed St. Lucie to Chesapeake Bay Nearshore Fairway is about 1,043 nm (1,931 km) long and approximately 5 nm (9.3 km) wide (USCG 2020b). The proposed rule states: "Under 46 U.S.C. 70003, fairways are designated through federal regulations. Regulations governing fairways in 33 CFR Part 166 provide that fixed offshore structures are not permitted within fairways because these structures would jeopardize safe navigation. The Coast Guard may establish, modify, or relocate existing fairways to improve navigation safety or accommodate offshore activities such as mineral exploitation and exploration" (USCG 2020b). In response to discussions with the USCG regarding the proposed ACPARS fairways in the Wind Development Area study area, the Company committed to moving one WTG location that was previously located in the area of overlap.[5] No above-water Project features are located within the proposed ACPARS fairways and the Company understands that no further mitigation is required.

7.3.1.2 Vessel Traffic

Commercial vessel traffic may include a variety of vessel types ranging from passenger vessels to articulated tug (pull) barges moving liquid petroleum cargos. Each of these vessel types operate differently and may have operational and navigational requirements that present unique needs based on other uses and activities in the Wind Development Area study area. In 2019, an average of 368 vessels were recorded in the vicinity of the Wind Development Area study area (Appendix BB Navigation Safety Risk Assessment). The month of May had the highest recorded transits with 14 unique vessels per day. Descriptions of individual vessel activity by type are included below.

7.3.1.2.1 Cargo Vessels

Cargo ships are merchant ships that carry goods and materials from one port to another and handle most international trade and include both dry bulk and containerized cargo vessels. AIS data demonstrates that there is relatively light cargo vessel traffic through the Wind Development Area. Most of the cargo vessel activity in the Wind Development Area study area and surrounding waters is comprised of transits to and from the Chesapeake Bay and the various ports to the north and south of the Wind Development Area study area. Throughout the survey period, an average of eight unique cargo vessels per day was recorded within the Wind Development Area study area and two per day within the Wind Development Area itself (Figure 7.3-2). The busiest day featured 19 unique cargo vessels, 7 of which passed through the Wind Development Area itself. Of all vessel types, cargo vessels were observed most frequently (Appendix BB Navigation Safety Risk Assessment).

7.3.1.2.2 Push/Pull Vessels

A push/pull or tug/towing vessel is defined in 46 U.S.C. § 2101(50) as "a commercial vessel engaged in or intending to engage in the service of pulling, pushing, or hauling alongside, or any combination of pulling, pushing, or hauling alongside." Throughout the survey period an average of one unique push/pull vessel every one to two days was recorded within the Wind Development Area study area and one in seven to eight days within the Wind Development Area itself. The vessel density of push/pull vessels is very uniform throughout the Wind Development Area study area with higher vessel density closer to shore and outside of the Wind Development Area study area (Figure 7.3-3). The ACPARS proposed a potential push/pull safety fairway located close to land (St. Lucie to Chesapeake Bay Nearshore Fairway, Figure 7.3-1) to assist in safe transit along the North Carolina coast towards the Chesapeake Bay (USCG 2020b).

[5] Portions of BOEM North Carolina Lease OCS–A 0508, in OCS sub-block 6664D are located within protraction NJ18–11. This potential fairway overlaps a portion of this sub-block by 120 m at its widest point.

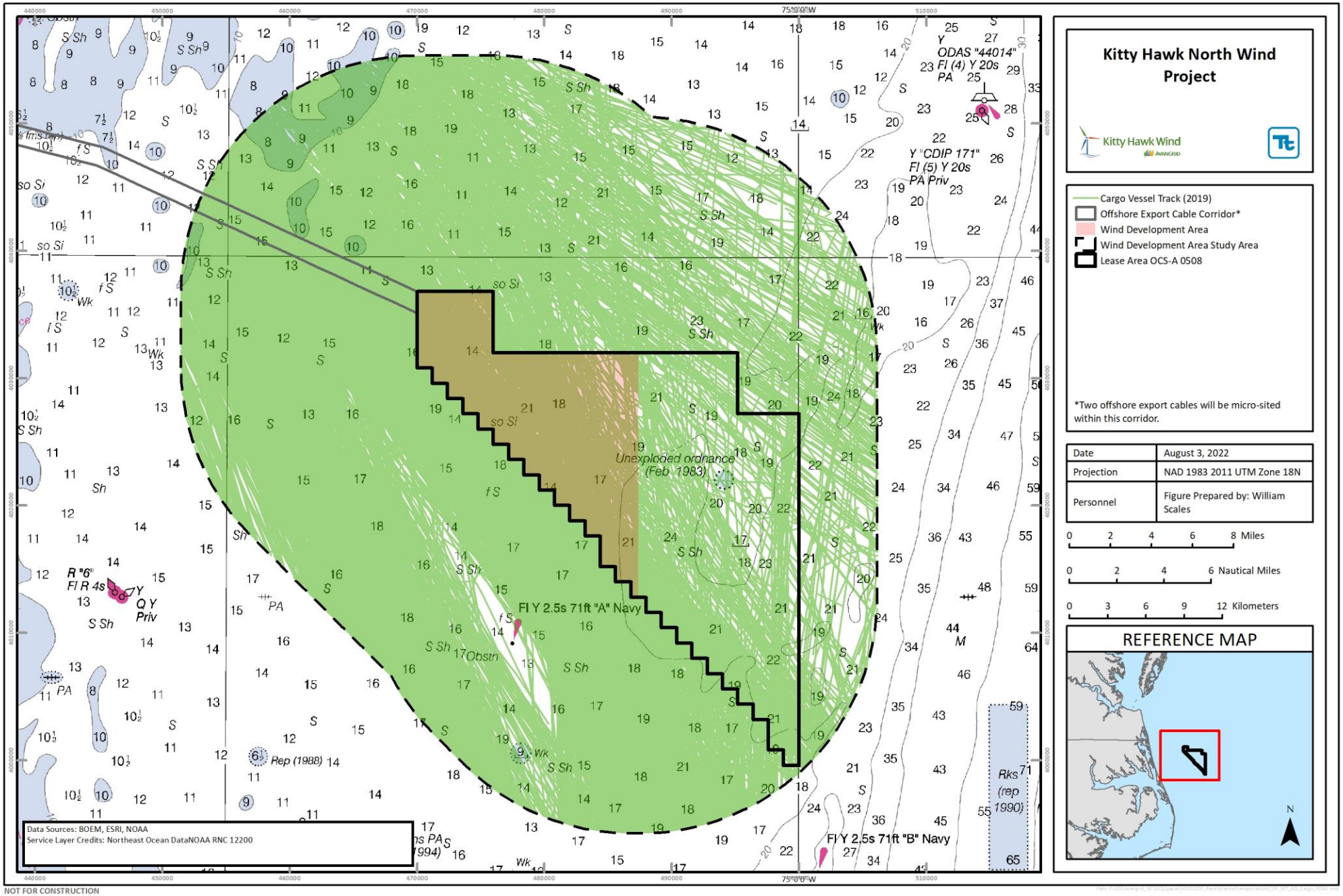


Figure 7.3-2 AIS Cargo Vessel Density 2019

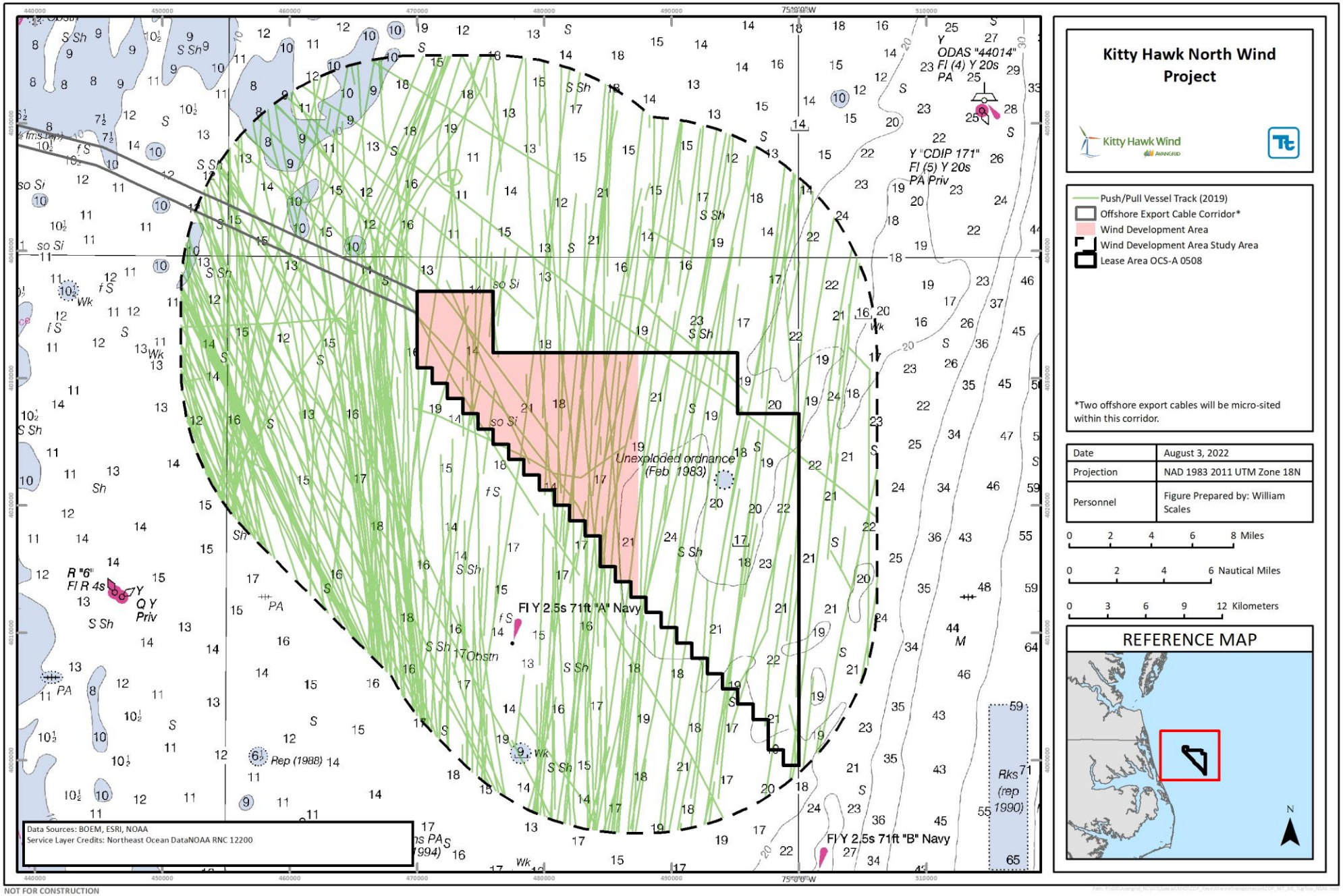


Figure 7.3-3 AIS Push/Pull Density 2019

7.3.1.2.3 Tank or Tanker Vessels

A tanker is defined as "a self-propelled tank vessel constructed or adapted primarily to carry oil or hazardous material in bulk in the cargo spaces" (46 U.S.C. § 2101(48)) and a tank vessel is defined as "a vessel that is constructed or adapted to carry, or that carries, oil or hazardous material in bulk as cargo or cargo residue that (A) is a vessel of the United States; (B) operates on the navigable waters of the United States; or (C) transfers oil or hazardous material in a port or place subject to the jurisdiction of the United States" (46 U.S.C. § 2101(49)). Like cargo ships, tanker vessels transport cargo between ports. Tanker vessels carry liquid goods, typically oil, gas, or chemicals. There is tanker vessel presence in the Wind Development Area study area (one every day within the Wind Development study area of which one every six days passed through the Wind Development Area). AIS data from 2019 demonstrates that tankers transit the space from several different directions (Figure 7.3-4). On the southwest side of the Wind Development Area, there is a clear pattern of tankers transiting to and from Chesapeake Bay. On the east side of the Lease Area, the transit appears to be going in a north/south direction coming from North and South Carolina and heading north to Delaware, New York, and beyond.

7.3.1.2.4 Passenger Vessels

A passenger vessel is defined by 46 U.S.C. § 2101(31) as "a vessel of at least 100 gross tons as measured under section 14502 of this title that; carries more than 12 passengers, including at least one passenger for hire; is chartered and carrying more than 12 passengers; that is a submersible vessel carrying at least one passenger for hire; or is a ferry carrying a passenger" (46 U.S.C. § 2101(31)). Passenger vessel navigation, which includes passenger ferries and cruise ships, was also recorded in proximity to the Wind Development Area study area (Figure 7.3-5). There is a regular but low level of cruise vessel presence out of Norfolk, Virginia. Carnival Cruise Lines, one of the world's largest cruise operators, uses Norfolk as a central hub for many of their Caribbean cruises. There are around a dozen cruises that leave their Norfolk hub a year with two ships primarily making the trips (Carnival Cruise Lines 2020). They are 892 ft (272 m) long and 1004 ft (306 m) long respectively.

The Navigation Safety Risk Assessment (Appendix BB) found that passenger vessels accounted for approximately 2 percent of traffic within the Wind Development Area study area. Throughout the survey period, an average of one unique passenger vessel every one to two days was recorded within the Wind Development Area study area, although the presence of passenger vessels within the Wind Development Area itself was limited as shown in Figure 7.3-5.

7.3.1.2.5 Military Vessels

Figure 7.3-6 presents a plot of the military vessel tracks recorded within the Wind Development Area study area throughout the survey period, including USCG-operated vessels. Throughout the survey period an average of one unique military vessel per day was recorded within the Wind Development Area study area and one every four days within the Wind Development Area itself. Military vessels varied in size, although approximately 58 percent of military vessels were between 152 m and 213 m in length.

Military vessels often disable AIS due to concerns about national security; therefore, military vessel movements shown in this section may not be comprehensive. However, it is assumed to be sufficient for this analysis based on feedback from the DoD.

The survey confirmed that the majority of military vessels were inbound or outbound from Norfolk, Virginia and the Joint Expeditionary Base–Little Creek within Chesapeake Bay. A minority of military vessels were transiting southbound headed for Morehead City, North Carolina and Jacksonville, Florida. A significant proportion of military traffic were undertaking military operations, noting that the Wind Development Area study area is located within the Virginia Capes (VACAPES) Operating Area (OPAREA). USCG-operated vessels were primarily observed landward of the Wind Development Area.

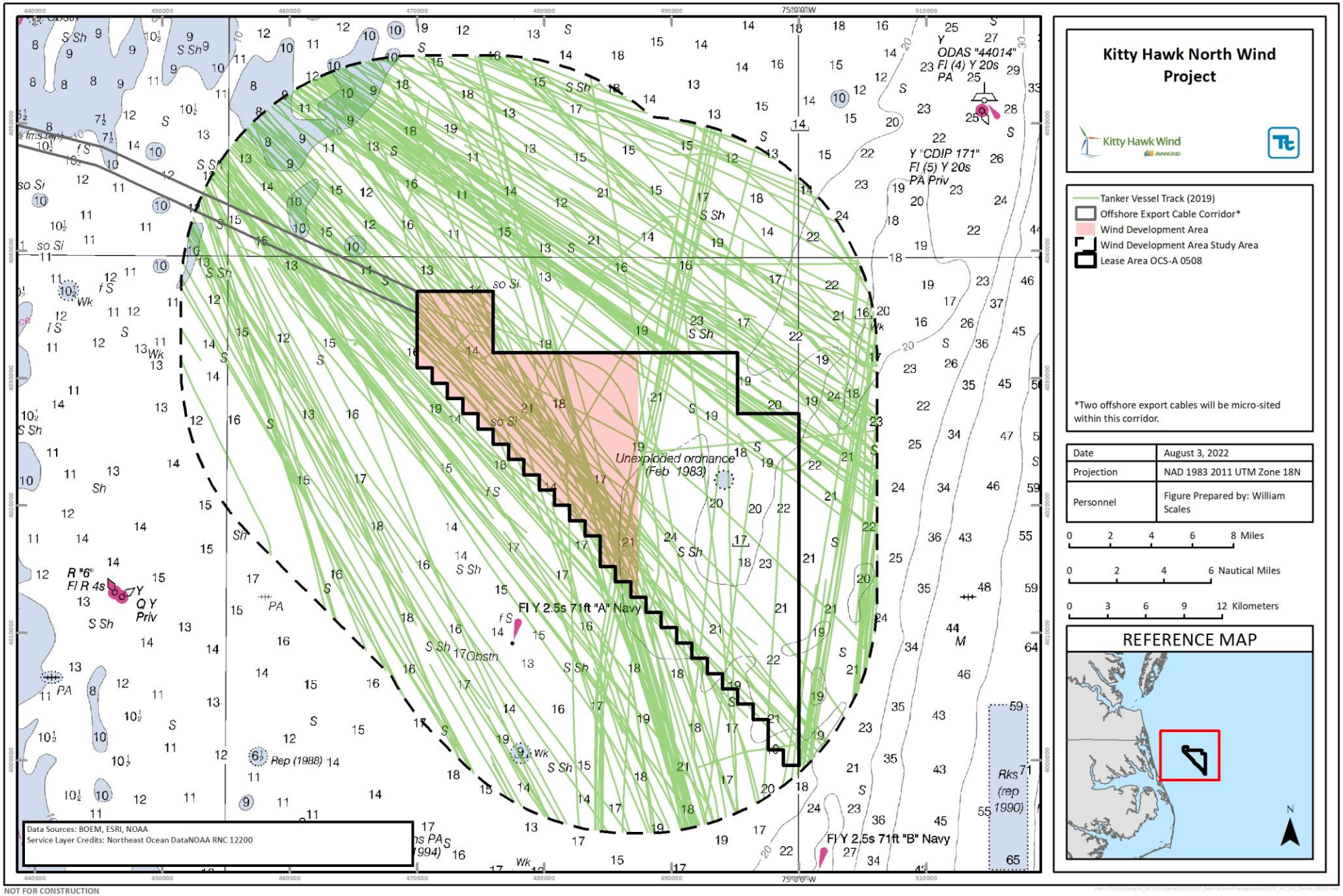


Figure 7.3-4 AIS Tanker Vessel Density 2019

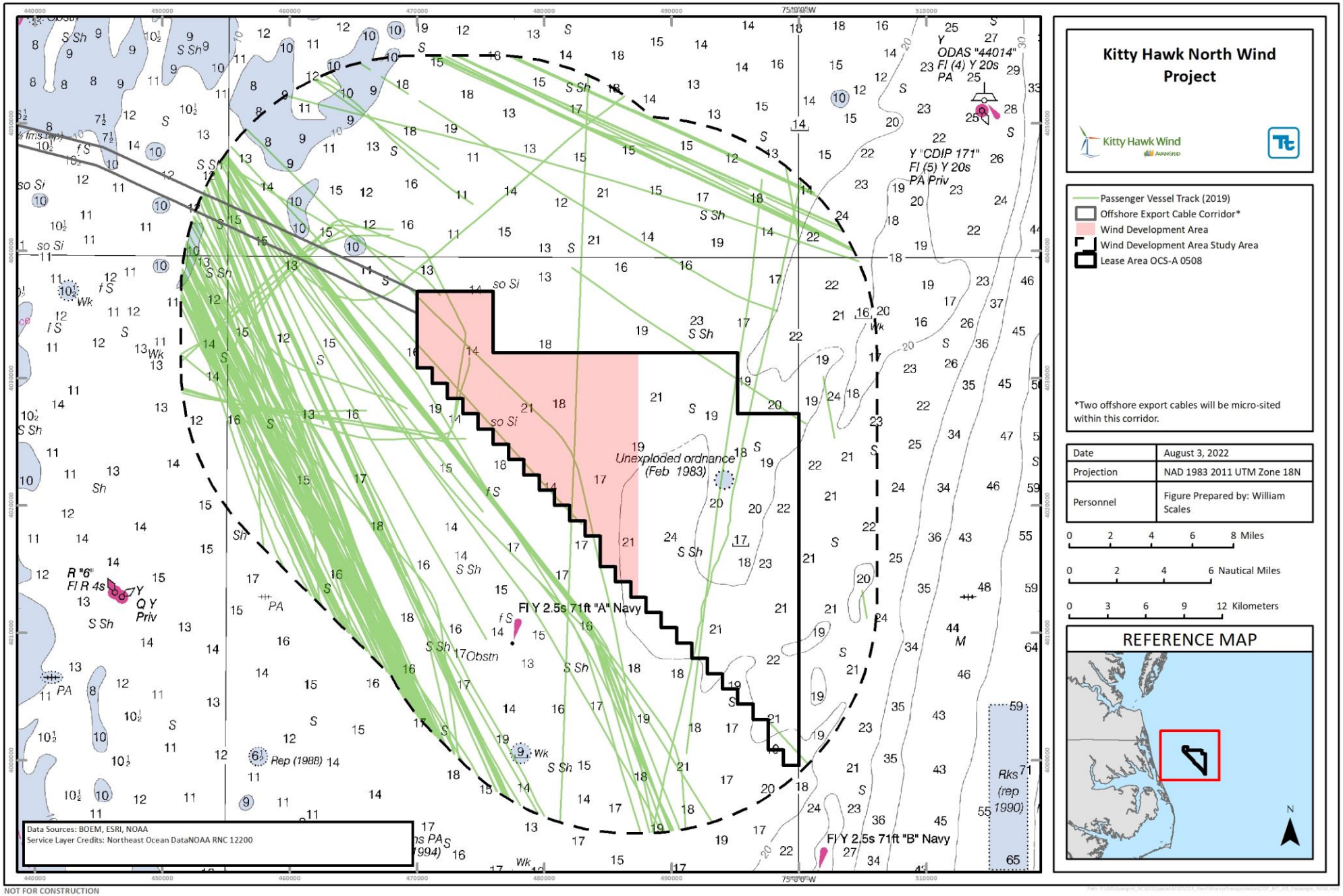


Figure 7.3-5 AIS Passenger Vessel Density in 2019

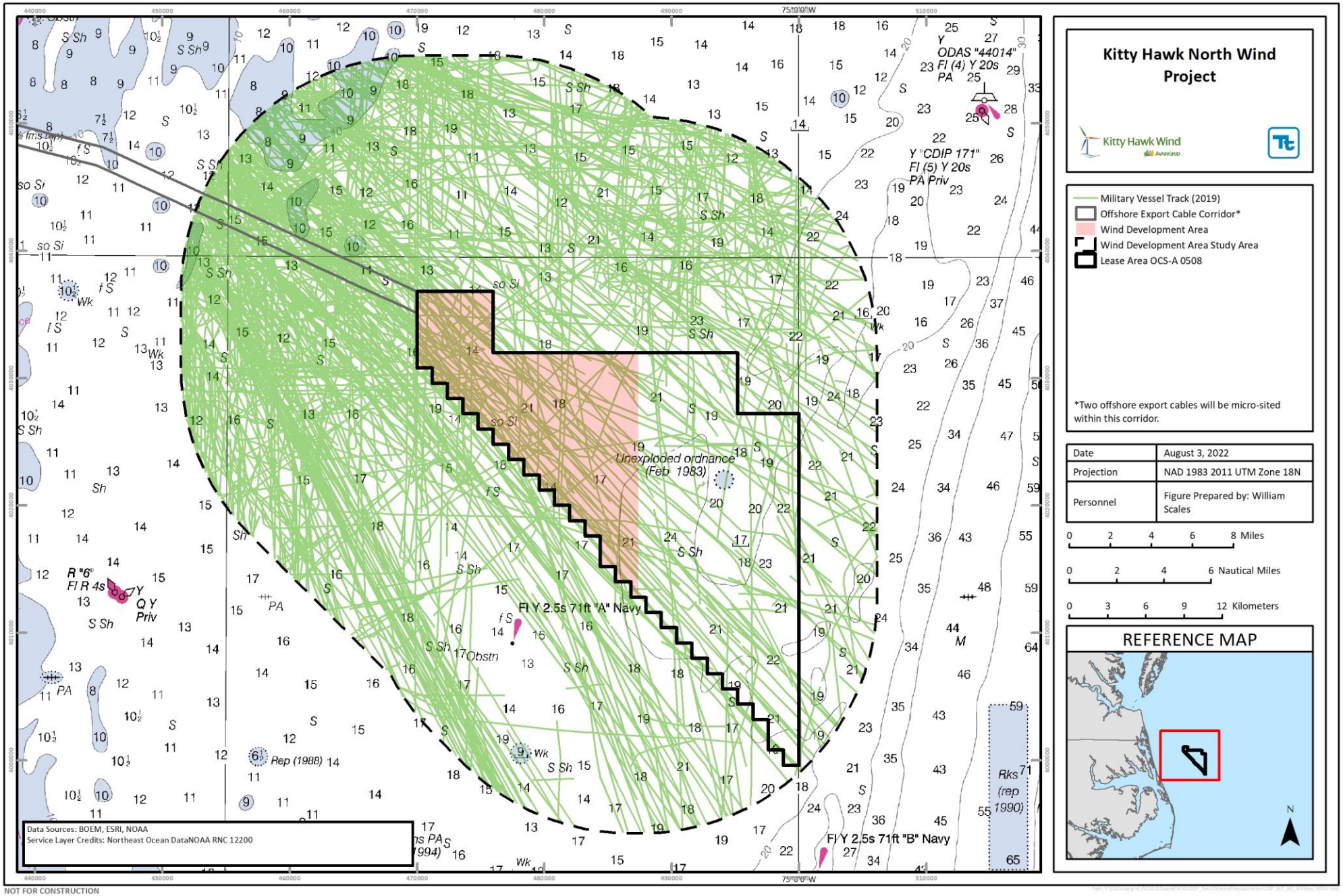


Figure 7.3-6 Military Vessel Tracks within Wind Development Area Study Area (12 months January to December 2019)

7.3.1.2.6 Fishing Vessels

AIS, VMS, and VTR data reveal that there are commercial fishing vessel transits and fishing effort throughout the Wind Development Area study area. A fishing vessel is defined as "a vessel that commercially engages in the catching, taking, or harvesting of fish or an activity that can reasonably be expected to result in the catching, taking, or harvesting of fish" (46 U.S.C. § 2101(12)).

VMS data, AIS data, and information from fishers indicate that most transits through the Wind Development Area use hand gear and trawls (Kirkpatrick et al. 2017) originating from the Chesapeake Bay/Virginia Beach area and/or the Wanchese/Nags Head area. VTR data provided by the Mid-Atlantic Regional Council on the Ocean Data Portal show higher trends of multispecies and squid trawler occurring east of the Wind Development Area with possible transits through the Wind Development Area. Commercial scallop vessels may also transit the Wind Development Area. Throughout the survey period an average of one unique fishing vessel every nine days was recorded within the Wind Development Area study area. During the survey period, only one fishing vessel track intersected the Wind Development Area. More information on commercial and recreational fishing activities can be found in Section 7.2 Commercial and Recreational Fishing.

7.3.1.2.7 Recreational Vessels

A recreational vessel is defined as "a vessel that was manufactured or operated primarily for pleasure; or leased, rented, or chartered to another for the latter's pleasure" 46 U.S.C § 2101(34). The Navigation Safety Risk Assessment (Appendix BB) determined that recreational vessels accounted for approximately 4 percent of traffic within the Wind Development Area study area and pleasure craft and sailing vessel density show very low recreational activity within and directly around the Wind Development Area study area as shown in Figure 7.3-7. An average of one unique recreational vessel every two days was recorded within the Wind Development Area study area and one every 14 days within the Wind Development Area itself. It is not clear how many recreational vessels voluntarily carry AIS transmitters, but it is likely only to be a minority of the total number; therefore, this data only provides an indication of activity in the area.

Most of the recreational fishing activity occurred directly adjacent to shore with density decreasing farther offshore.

More information on recreation and tourism activities within the Wind Development Area study area can be found in Section 7.1 Recreation and Tourism, Section 7.2 Commercial and Recreational Fishing, and Section 7.7 Other Coastal and Marine Uses.

7.3.1.3 U.S. Coast Guard Incident Response

Responses by the USCG to SAR incidents within the Mid-Atlantic Bight fall within the Area of Responsibility of USCG District 5. District 5 has four sectors: Sector Maryland-NCR, Sector Delaware Bay, Sector Virginia, and Sector North Carolina. The Wind Development Area and offshore export cable corridor are in the northern region of Sector North Carolina, in close proximity to the border of Sector Virginia. There are three stations in Sector North Carolina and two stations in Sector Virginia that are in the general vicinity of the Wind Development Area (Figure 7.3-8). There are also 27 boat stations, 8 coastal patrol boats, 5 fast response cutters, 11 aids to navigation teams, 5 buoy tenders, 3 harbor tugs, 3 construction tenders, 14 short and medium range rotary wing aircraft, and 5 long range fixed wing aircraft within District 5 (USCG 2019c). The USCG responds to SAR incidents with both air and sea assets. The closest Air Station in proximity to the Wind Development Area is Air Station Elizabeth City, North Carolina. The closest USCG stations in proximity to the Wind Development Area are Oregon Inlet, North Carolina, Little Creek, Virginia, and Cape Charles, Virginia.

Between 2010 and 2019, the USCG responded to a total of six SAR related incidents in the Wind Development Area study area (Appendix BB Navigation Safety Risk Assessment). However, no incidents occurred in the Wind Development Area or in the offshore export cable corridor during that period.

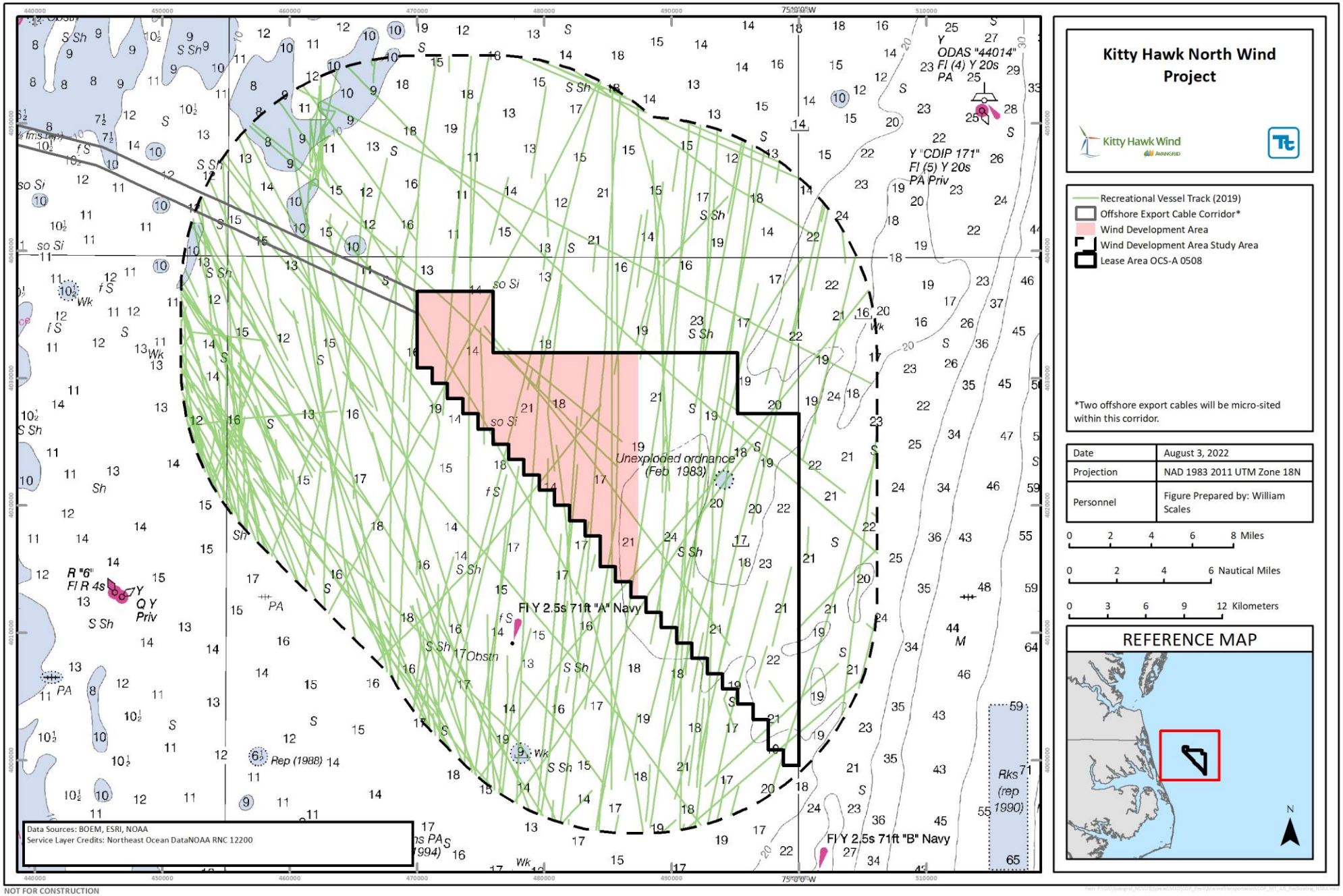


Figure 7.3-7 Recreational Boating in the Review Area

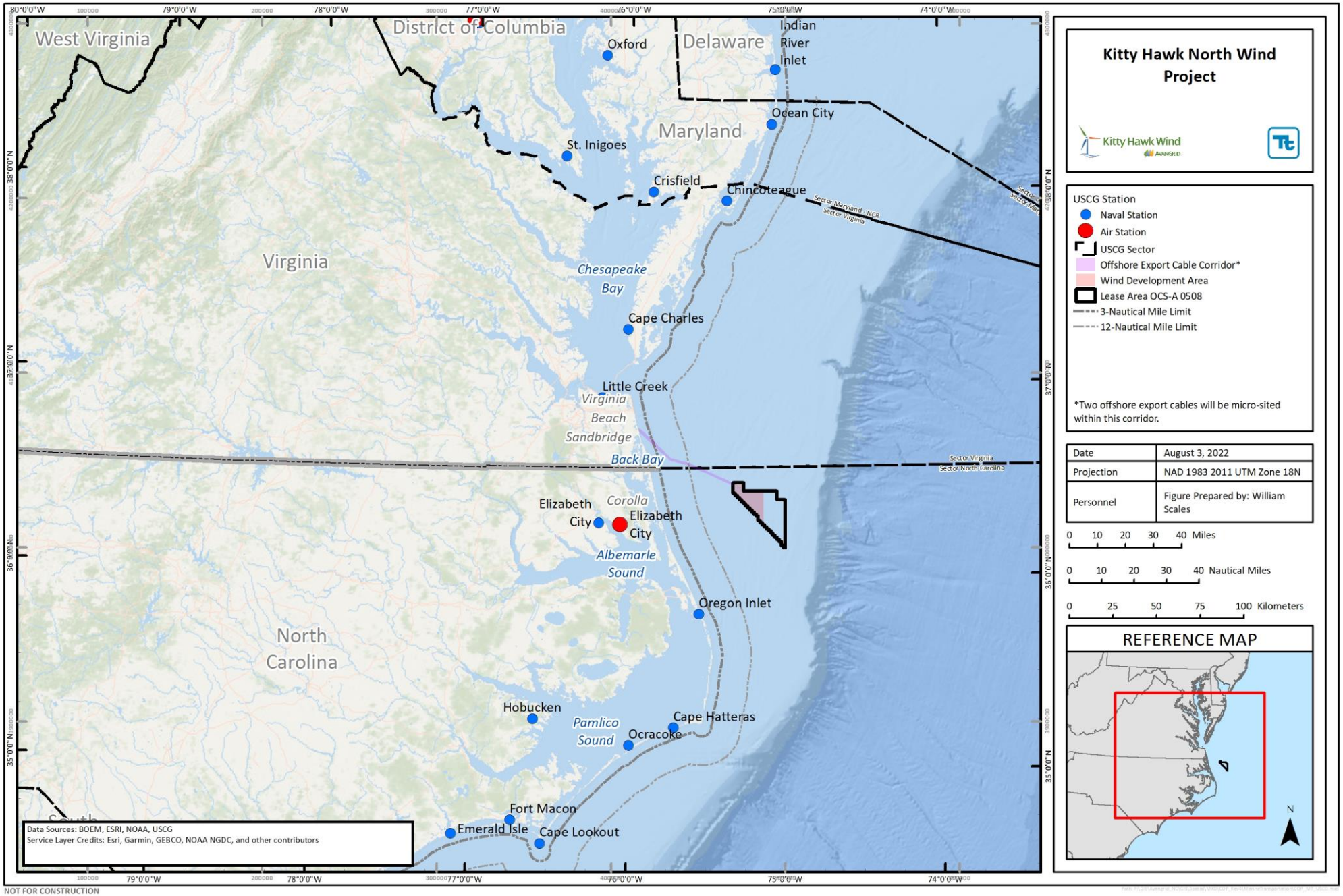


Figure 7.3-8 USCG Stations in the Vicinity of the Review Area

7.3.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For marine transportation and navigation, the maximum design is represented by the greatest number of structures in the Wind Development Area. The maximum design scenario also assumes the use of various ports in the lower Chesapeake Bay area for staging of Project components and construction vessels. Construction and O&M vessels may transit from these locations to the Wind Development Area and the offshore export cable corridor.

As discussed above, the Company prepared a Navigation Safety Risk Assessment to assess risks in line with the requirements of NVIC 01-19 to shipping and navigation and to evaluate whether these risks are as low as reasonably practicable (ALARP). The Navigation Safety Risk Assessment assumes that "embedded mitigation" will be in place and categorizes risks according to the following rankings as agreed with key stakeholders:

- Broadly Acceptable (impacts are acceptable and do not require further mitigations);
- Tolerable or Tolerable with Mitigation (impacts are acceptable, assuming they are as low as reasonably practicable [additional mitigation may therefore be necessary: "tolerable with mitigation"]); and
- Unacceptable (impacts must be mitigated to within "tolerable" levels).

A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.3.2.1 Construction

During construction, the potential impacts to marine transportation and navigation may include the following:

- Short-term increase in Project-related vessel traffic due to the construction of offshore Project components temporarily displacing existing vessel traffic;
- Short-term allision risk with partially installed structures;
- Short-term displacement of vessel traffic activity due to implementation of safety zones; and
- Potential interaction with SAR operations due to presence of partially-installed structures offshore.

Short-term increase in Project-related vessel traffic due to the construction of offshore Project components temporarily displacing existing vessel traffic. There will be a short-term increase in Project-related construction and support vessels during the installation of the offshore Project components. This increase in vessel traffic would occur between the ports and the Wind Development Area as well as along the offshore export cable corridor to the landfall. The potential for an increase in navigational safety risk due to Project vessel activities was studied in the Navigation Safety Risk Assessment (see Appendix BB). Construction vessels will mainly be transiting from various ports in the lower Chesapeake Bay area.

Construction vessels (such as crew transfer or jack-up vessels) are not expected to cause substantial added traffic in the area and risk will be mitigated through marine coordination procedures to ensure Project vessels do not impact third-party activities. The Company will schedule and control Project-related vessels to best manage congestion and traffic flow in coordination with the USCG, DoD, and other national security stakeholders. The Company successfully accomplished this during the Project's 2019 to 2020 survey campaigns. Where practical, Project vessels will utilize transit lanes, fairways, and predetermined passage plans consistent with existing waterway uses. LNMs and Broadcast LNMs will be published by the USCG to inform mariners of Project activities in the area. For each vessel type, the route plan for the vessel operation area will be developed to meet industry guidelines and best practices in accordance with International Chamber of Shipping guidance. The Project will require operational AIS on all vessels

associated with the construction of the Project, pursuant to USCG and AIS carriage requirements. AIS will be required to monitor the number of vessels and traffic patterns for analysis and compliance with vessel speed requirements. All vessels will operate in accordance with applicable rules and regulations for maritime operation within state and federal waters. Additionally, the Project will adhere to vessel speed restrictions, as appropriate, in accordance with NOAA requirements. As applicable, temporary safety zones will be established during the construction and installation phase of the Project to improve safety in the vicinity of localized work areas, and, where feasible, a minimum advisory safe passing distance for cable laying vessels will be implemented, as per the COLREGs. Additionally, the Project website will be updated regularly so that mariners know what work is being done in the various offshore Project locations. The Company will also maintain active communications and updates with the fishing community as described in the Fisheries Communications Plan.

Short-term allision risk with partially installed structures. During the construction phase of the Project, partially installed structures may be present in the Wind Development Area and offshore export cable corridor. These hazards are temporary and will be localized. For the safety of both mariners and Project technicians, temporary safety zones up to 500 m in radius will be in place during the construction phase of the Project as applicable. A safety vessel will also be deployed during construction. Additionally, information on all partially installed structures and other navigational hazards will be announced on the Project website and social media pages and coordinated with the USCG. The Project website will be updated regularly so that mariners and fisheries know what work is being done in the various offshore Project locations. Finally, partially installed structures and other navigational hazards will be appropriately lit and marked in accordance with BOEM, USCG, and FAA guidance, as applicable.

Short-term displacement of vessel activity due to implementation of safety zones. Vessel traffic will be restricted in the temporary and localized safety zones for the benefit of both mariners and Project workers to minimize risks of collision and allision. However, the safety zones will be limited to small portions of the offshore Project Area at a time. The Company will post regular updates on their website and social media pages to give mariners and fisheries information on the location and schedule of Project-related safety zones. The Project website will be updated regularly so that mariners know what work is being done in the various offshore Project locations.

Potential interaction with SAR operations due to presence of partially-installed structures offshore. The presence of construction activities and partially installed structures in the offshore Project Area has the potential to impact SAR missions. There were no SAR incidents between 2010 and 2019 in the Wind Development Area or the offshore export cable corridor. Therefore, the likelihood of an incident requiring an emergency response (SAR) in proximity to the Wind Development Area is considered low for those vessels historically transiting the Wind Development Area. Increased risk to Project vessels and workers during construction will be mitigated by the provisions of the Safety Management System (Appendix F). The Company's Safety Management System will include an Emergency Response Plan, detailing procedures for on-site self-rescue and emergency medical attention. Project vessels and partially installed structures will be lit and marked in accordance with BOEM and USCG requirements. For the safety of both mariners and Project technicians, temporary safety zones up to 500 m in radius will be in place during the construction phase of the Project as applicable. The Project will require operational AIS on all vessels associated with the construction of the Project, pursuant to USCG and AIS carriage requirements. The Company will continue to closely coordinate with the USCG regarding SAR operations and the necessary safety measures. In addition, the Company will create and adhere to operational SAR procedures that will instruct Project personnel on how to engage with the USCG in the event of an emergency and assist emergency responders with their missions (Appendix BB Navigation Safety Risk Assessment).

7.3.2.2 Operations and Maintenance

During operations, the potential impacts to marine transportation and navigation may include the following:

- Long-term displacement of vessels uses due to the presence of new fixed structures within the Wind Development Area;
- Occasional diversion of maritime vessel traffic due to intermittent inspection, repair, or replacement of offshore export and inter-array cables, WTGs, and ESP;
- Marine radar interference;
- Increased risk of vessel to vessel or vessel to offshore wind structure (WTG or ESP) allision; and
- Potential interaction with and support of SAR operations.

In order to evaluate these potential impacts, the Company completed a Navigation Safety Risk Assessment in compliance with USCG guidance (see Appendix BB). The following is a brief summary of the results.

Long-term displacement of vessels due to the presence of new fixed structures within the Wind Development Area. The presence of new fixed structures within the Wind Development Area, including WTGs and ESP, may result in the long-term displacement of vessels. These structures may create obstructions to transiting vessels potentially increasing risk of allision. These structures will result in the long-term diversion of traditional vessel routes while transiting past the Project. All types of vessels, including cargo vessels, push/pull vessels, tank or tanker vessels, passenger vessels, military vessels, commercial fishing vessels, and recreational vessels may need to alter their course to deviate around the array. This may result in increased journey times and distances. It is not anticipated that the Project will result in significant long-term displacement of vessels based on analysis of existing and historic vessel activity in the Wind Development Area study area. The USCG has proposed safety fairways near the Wind Development Area study area, including the St. Lucie to Chesapeake Offshore Fairway and the St. Lucie to New York Fairway. These routing measures, if approved by the International Maritime Organization, will have the effect of displacing traffic to the east and west of the Project, regardless of the presence of structures in the Wind Development Area, with a corresponding increase in collision risk.

Based on analysis from the Navigation Safety Risk Assessment (Appendix BB), it is determined that the volume of recreational vessel traffic within the Wind Development Area study area is very low compared to inshore areas. Besides temporary restrictions during construction and occasional maintenance activities, recreational vessels may transit and utilize the area throughout the operations period. More information on recreational vessels can be found in Section 7.1 Recreation and Tourism, Section 7.2 Commercial and Recreational Fishing, and Section 7.7 Other Coastal and Marine Uses.

Commercial fishing vessel activity within the Wind Development Area is very low based on AIS data, VMS data, stakeholder input, and visual observations from an on-site survey vessel (Appendix BB Navigation Safety Risk Assessment). Much of the commercial fishing transit and activity in the general area occurs much closer to shore, and the Project poses limited risks to the industry (see Section 7.2 Commercial and Recreational Fishing). As with recreational vessels, other than experiencing some temporary restrictions put in place during construction and occasional maintenance activities, commercial vessels may continue to transit and utilize the area throughout the operations period.

AIS data indicates the presence of military vessels in the Wind Development Area study area. For military vessels engaged in exercises, it is noted that only 0.2 percent of the total area covered by the VACAPES OPAREA overlaps the Wind Development Area (Appendix BB Navigation Safety Risk Assessment). Additional information about impacts on military vessels may be found in Section 7.4 Department of Defense and Outer Continental Shelf National Security Maritime Uses.

As-built plans will be provided to NOAA and appropriate stakeholders to update nautical charts with structure locations, including WTGs and the ESP, along with the location of the offshore export cable corridor. Structures will be properly lit and marked in accordance with USCG requirements (USCG 2020a) and BOEM's lighting and marking guidance (BOEM 2021).

Occasional diversion of maritime vessel traffic due to intermittent inspection, repair, or replacement of offshore export and inter-array cables, WTGs, and ESP. The Project may result in the potential infrequent need for a cable-laying vessel to inspect/repair/replace either the inter-array or offshore export cables or for a vessel to inspect/repair WTGs or the ESP during the useful life of the Project. In the event of inspection, repair, or replacement, there may be the need for diversion of vessel traffic due to operations of the repair vessel, which is restricted in ability to maneuver, thus requiring a wide berth. Planned O&M activity includes 232 annual round trips for 9 different vessel types resulting in the average daily addition of less than one round trip per day. Accordingly, the projected increase in vessel traffic within the Wind Development Area is approximately 5 percent. LNMs and Broadcast LNMs will be published by the USCG to inform mariners of Project activities. The Company will communicate with key stakeholders on the timing and location of O&M activities. The Company will follow the USCG establishment of safety zones around O&M activities.

Marine radar interference. The extent to which the presence of WTGs can impact the accuracy and efficacy of marine radar is well understood following years of European vessel operational experience within and near large offshore wind facilities. Experience in European waters has shown that mariners have become increasingly aware of any radar effects as more offshore wind facilities become operational. Based on this experience, the mariner can interpret the anticipated effects accurately, noting that effects are the same as those experienced by mariners in other environments, such as in close proximity to other vessels or structures. Effects can be mitigated through careful adjustment of radar controls and compliance with COLREGs.

Several UK studies of radar interference in the vicinity of offshore wind facilities have resulted in published guidance, including MGN 371 (MCA 2008a), MGN 372 (MCA 2008b), MGN 543 (MCA 2016), and MGN 654 (2021). This information is useful given that U.S. guidance does not contain specific information relating to radar interference. It is noted however that this published guidance is intended to be used on a case-by-case basis; noting that since these studies were undertaken, turbine size and spacing within offshore wind facilities has increased.

A study conducted in 2009 by the USCG for the Cape Wind Project found that presence of WTGs had an effect on marine radar, but that the impacts were both predictable and manageable with training and technology (MMS 2009). Regarding concerns over EMF from the offshore export cables interfering with vessel magnetic compasses, the offshore export and inter-array cables for the Project will contain alternating current. Studies indicate that alternating current does not emit an EMF significant enough to impact marine magnetic compasses (BOEM 2020b; Appendix BB Navigation Safety Risk Assessment).

See Section 7.6 Aviation and Radar for additional detail on high frequency radar.

Increased risk of vessel-to-vessel collisions or vessel-to-offshore wind structure (WTG or ESP) allision. The presence of WTGs may lead to commercial vessels deviating or altering routes due to the array, potentially resulting in an increased number of vessel-to-vessel encounters and consequently an increased vessel to vessel collision risk. A quantitative and qualitative risk assessment was undertaken within the Navigation Safety Risk Assessment. The quantitative assessment of collision risk post wind facility estimated a collision return period for all routing vessels of approximately one in 135 years for base case traffic levels, representing a 59 percent increase in annual collision frequency compared to the pre-wind facility scenario.

Although the quantitative assessment suggests that a collision incident could possibly occur, the quantitative assessment does not take into account the promulgation of information relating to the Project and the presence of infrastructure on relevant nautical charts and electronic charts as well as lighting and marking. This will assist with passage planning, noting that the post wind facility routing considered in this assessment is a worst case, whereas in reality, vessels may choose to pass at a greater distance from the

Project, utilizing the available area all around the Wind Development Area, particularly during the construction and decommissioning phases. This will reduce the likelihood of a collision incident.

A thorough discussion of the rationale that led to the decision to auction the current Lease Area may be found in the ACPARS Final Report, Appendix VI (USCG 2015a). Given the layout of the Project and appropriate measures being taken to allow for safe transit through the Wind Development Area, it is unlikely that an encounter will develop into a collision incident. Due to the siting of the Project and its close proximity to TSS lanes and the proposed ACPARS safety fairways, there are alternate routes for transit around the Project. The Navigation Safety Risk Assessment concludes that with embedded mitigation measures in place, all impacts are considered to be within ALARP parameters and, at most, Tolerable with Mitigation. Additional information is provided in Appendix BB.

Given the minimum spacing between wind facility structures (approximately 0.75 nm [1.4 km] center-to-center), there are not expected to be any issues with wind facility structures blocking or hindering the view of other vessels underway (Appendix BB Navigation Safety Risk Assessment). Furthermore, structures will be properly lit and marked in accordance with USCG requirements (USCG 2020a) and the BOEM lighting and marking guidance (BOEM 2021). These mitigations may also include private aids to navigation to increase mariner awareness of the Project.

Potential interaction with and support of SAR operations. The presence of WTGs in the ocean has the potential to make SAR missions more difficult. There were no SAR incidents between 2010 and 2019 in the Wind Development Area or the offshore export cable corridor. Therefore, the likelihood of an incident requiring an emergency response (SAR) in proximity to the Wind Development Area is considered low for those vessels historically transiting the Wind Development Area. Increased risk to Project vessels and workers during O&M activities will be mitigated by the provisions of the Safety Management System. The Company will develop and implement a Safety Management System that will include an Emergency Response Plan detailing procedures for on-site self-rescue and emergency medical attention. Following USCG guidance NVIC No. 01-19, the Project's layout will allow for safe transit by SAR helicopters operating at a low altitude in bad weather and all other necessary watercraft (USCG 2019a). As assessed in the Navigation Safety Risk Assessment (Appendix BB), in the event of an incident occurring within the Wind Development Area, the minimum spacing between offshore wind structures (approximately 0.75 nm [1.4 km] measured center-to-center) and the two lines of orientation consistent across all internal structures will ensure that access to the sea area occupied by the array for SAR purposes is not compromised significantly. Additionally, the Company will have the capacity for shut-down operations in the event of a SAR mission in the Wind Development Area (Appendix BB Navigation Safety Risk Assessment). All WTGs and the ESP will be lit and marked in accordance with BOEM and USCG requirements, including unique alphanumeric markings determined in coordination with the USCG. This lighting and marking may assist SAR by providing increased visibility and helping mariners determine their exact location. AIS will also be used to mark structures within the Wind Development Area, pending additional guidance from USCG. The Project will require operational AIS on all vessels associated with the construction of the Project, pursuant to USCG and AIS carriage requirements. AIS will be required to monitor the number of vessels and traffic patterns for analysis and compliance with vessel speed requirements. The Company will also monitor Project vessel movements during O&M activities in and near the Wind Development Area via a marine management system.

The regular presence of O&M vessels in the Wind Development Area also has the potential to assist SAR. Further, the Company will work with the USCG to develop an operational protocol that outlines the procedures for braking systems requested on the WTGs to be engaged within a specific time upon request from the USCG during SAR operations and other emergency response situations. The protocol will include formal procedures that will enable efficient, effective processes for communicating and engaging the braking mechanism requests during SAR operations and other emergency response situations. These communication and shut down procedures, as well as the brake systems, will be tested at a frequency agreed upon with the UCSG and BOEM. In the event that a structure is allided by a vessel, the Company

will conduct a structural inspection as quickly as possible and advise the USCG if the structure has become a hazard to navigation.

The Company will maintain an operations center throughout the life of the Project. This center can assist the USCG in the response to distress calls through active control over the WTG braking system. The operations center personnel will have access to charts providing GPS position and identification numbers for each structure. The USCG will also be provided with this chart. The contact telephone number for the operations center will be provided to the USCG and posted in various public notices which are issued.

7.3.2.3 Decommissioning

Impacts resulting from the decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.4 Department of Defense and Outer Continental Shelf National Security Maritime Uses

This section describes national security maritime uses that occur within and surrounding the offshore Project Area, which includes the Wind Development Area and offshore export cable corridor. Potential impacts to or conflicts with national security uses resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP that are related to national security maritime uses include:

- Marine Transportation and Navigation (Section 7.3);
- Aviation and Radar (Section 7.6);
- Preliminary Cable Burial Risk Assessment (Appendix J);
- Navigation Safety Risk Assessment (Appendix BB); and
- Obstruction Evaluation and Airspace Analysis (Appendix CC).

For the purposes of this section, the review area includes the offshore Project components, and the areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project. The Sandbridge route, western route option, and onshore substation site are not located in direct proximity to DoD and Outer Continental Shelf (OCS) national security maritime uses.

This section relied upon information gathered during consultation, outreach, and engagement activities as well as publicly available information as detailed below. As certain information related to national security is not available to the public and many national security activities are covert, the Company has been working with key stakeholders within the DoD and Homeland Security to maintain open communication during Project siting and development (see Appendix B Summary of Agency and Stakeholder Outreach).

Pursuant to 49 U.S.C. § 44718, the DoD is required to study the effects of constructing or altering structures that may obstruct or interfere with air or space navigation facilities and equipment, navigable airspace, or military operations and readiness. In 2011, a Siting Clearinghouse, later renamed the Military Aviation and Installation Assurance Siting Clearinghouse, was established to provide a coordinated DoD review of energy applications and act as a single point of contact for federal agencies (Public Law 111-383; Public Law 115-91). The Company submitted a request for informal review to the Siting Clearinghouse on 25 Mar 2019 and 23 Apr 2020, to which the Clearinghouse responded on 28 May 2019 and 25 Aug 2020, respectively. The Company is engaged in ongoing discussions with the DoD to resolve any potential conflicts between the Project and military operations.

Additionally, the following USCG guidance documents were considered in the preparation of this section:

- Navigation and Vessel Inspection Circular 01-19 Guidance on the Coast Guard's Roles and Responsibilities for Offshore Renewable Energy Installations (OREI) (USCG 2019a);
- Atlantic Coast Port Access Route Study: Port Approaches and International Entry and Departure Transit Areas (USCG 2019b); and
- COMDINST 16003.2B, Marine Planning to Operate and Maintain the Marine Transportation System (MTS) and Implement National Policy (2019c); and
- COLREGs (IMO 1972).

7.4.1 Affected Environment

North Carolina and southern Virginia have a high concentration of military facilities that may be affected by the Project. The U.S. Navy, USCG, U.S. Air Force, and Air National Guard are responsible for various search and rescue missions along the Atlantic Coast, including in the vicinity of the offshore Project Area.

Typically, this may include the use of low flying aircraft and helicopters offshore. The offshore VACAPES Range Complex, and the several VACAPES OPAREAs within the Range Complex, extends from Rehoboth Beach, Delaware, to mid-coast North Carolina. Various military facilities are also located in the vicinity of the Project, as noted in the following sections.

7.4.1.1 VACAPES OPAREA

The VACAPES Range Complex includes 94,875 square kilometers (km^2) of offshore surface and subsurface OPAREA, 98,342 km^2 of special use area warning area, and 62,054 km^2 of deep ocean area greater than 183 m in which submarines may transit and operate. The Department of the Navy published a Final Environmental Impact Statement to assess the potential environmental impacts over a 10-year planning period associated with Navy Atlantic Fleet training, research, development, testing, and evaluation activities, and associated range capabilities enhancements (including infrastructure improvements) for the VACAPES Range Complex. The geographic scope of this Final Environmental Impact Statement includes the airspace, seaspace, and undersea space of the VACAPES Range Complex as well as portions of the lower Chesapeake Bay as shown in Figure 7.4-1.

Operations throughout the VACAPES Range Complex occur intermittently, with durations that range from a few hours up to two weeks and are dispersed off the coasts of Virginia and North Carolina. However, they are largely concentrated within the VACAPES OPAREA (Figure 7.4-1). The U.S. Navy uses the OPAREA for various exercises and training including "Live Fire Training," with areas designated as a "Danger Area," "Danger Zone," and "Restricted Area" on nautical charts. "Danger Areas" are areas where caution should be exercised due to either military firing practice or the potential to encounter unexploded ordnance. "Danger Zones" are defined by 33 CFR § 334.2 as "a defined water area (or areas) used for target practice, bombing, rocket firing or other especially hazardous operations, normally for the armed forces." "Restricted Areas" are those defined areas where public access is prohibited or limited due to general use by the U.S. government. There are three of these designated areas within the vicinity of the Project, but none are located within the Wind Development Area (see Figure 7.4-2).

Training activities occurring in the VACAPES OPAREA include various types of surface warfare exercises involving the use of explosive ordnance, amphibious warfare exercises involving firing from ships to targets onshore, and strike warfare involving firing air-to-surface missiles. Naval training exercises in the VACAPES OPAREA are controlled through the Fleet Area Control and Surveillance Facility in Virginia Beach, otherwise known as "Giant Killer."

The Dam Neck Live Fire Danger Zone (Figure 7.4-2, denoted in red off of Sandbridge) is established in 33 CFR § 334.390. This Live Fire Danger Zone extends seaward 24 km from shore and closely borders the southeast approach traffic lanes. Vessels proceeding through the area are instructed to do so with caution and remain within the area no longer than necessary for purposes of transit. This Live Fire Danger Zone has been in use for more than 40 years. The Wind Development Area is approximately 37 km east of this Danger Zone at the nearest point. The smaller Pendleton Danger Zone (Figure 7.4-2, denoted in orange), mostly located within the Dam Neck Danger Zone, is also used as a naval firing range, and any activities inside the zone are conducted in accordance with applicable regulations (33 CFR § 334.380). The Pendleton Danger Zone is 6.8 km north of the offshore export cable corridor where it makes landfall at Sandbridge Beach.

The mission of the VACAPES Fleet Area Control and Surveillance Facility is to support homeland defense and advance the combat readiness of U.S. Atlantic Fleet and Joint Forces by providing control, surveillance, management, sustainment, and ready access to assigned airspace, operating areas, training ranges, and resources.

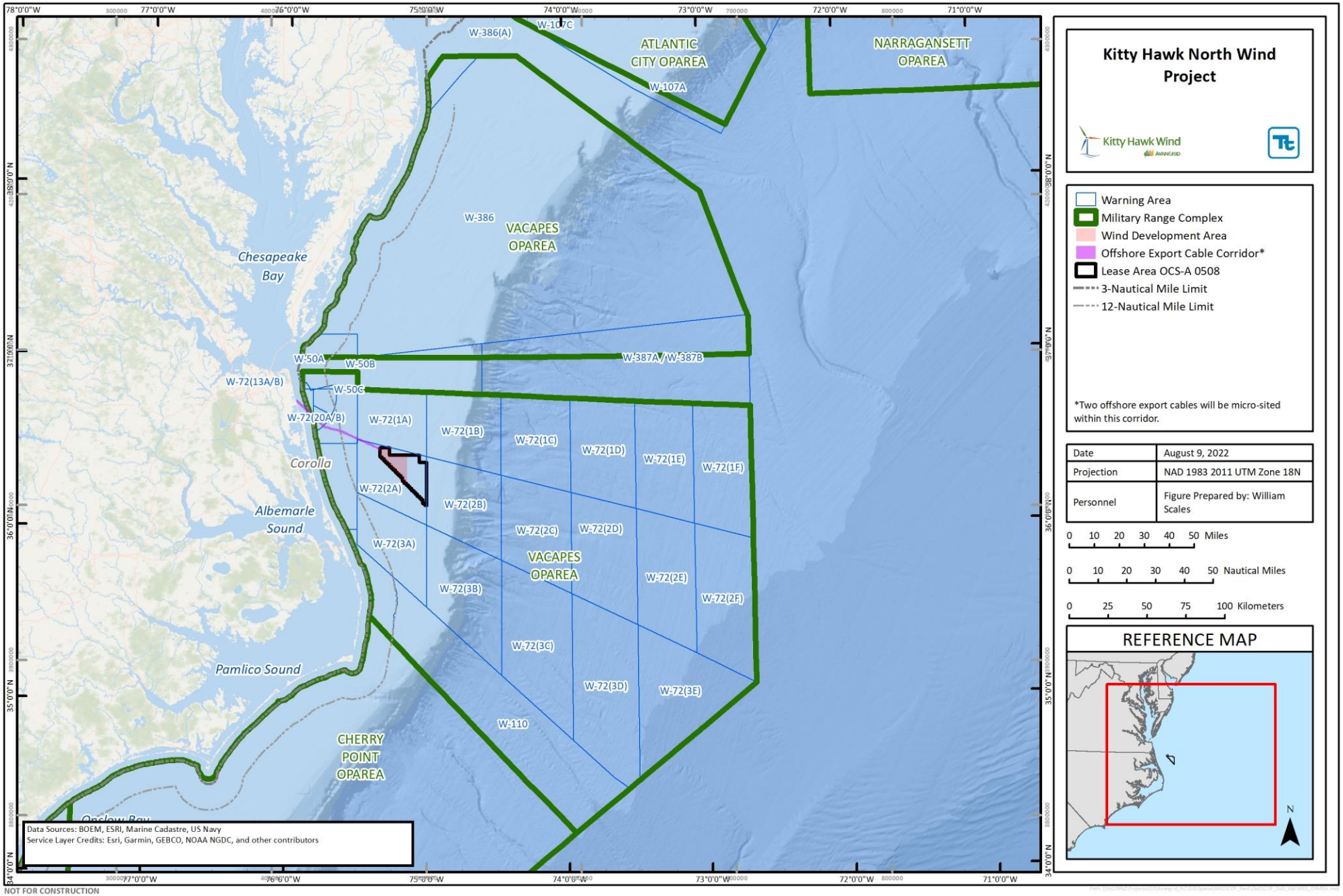


Figure 7.4-1 VACAPES Range Complex Environmental Impact Statement Study Area

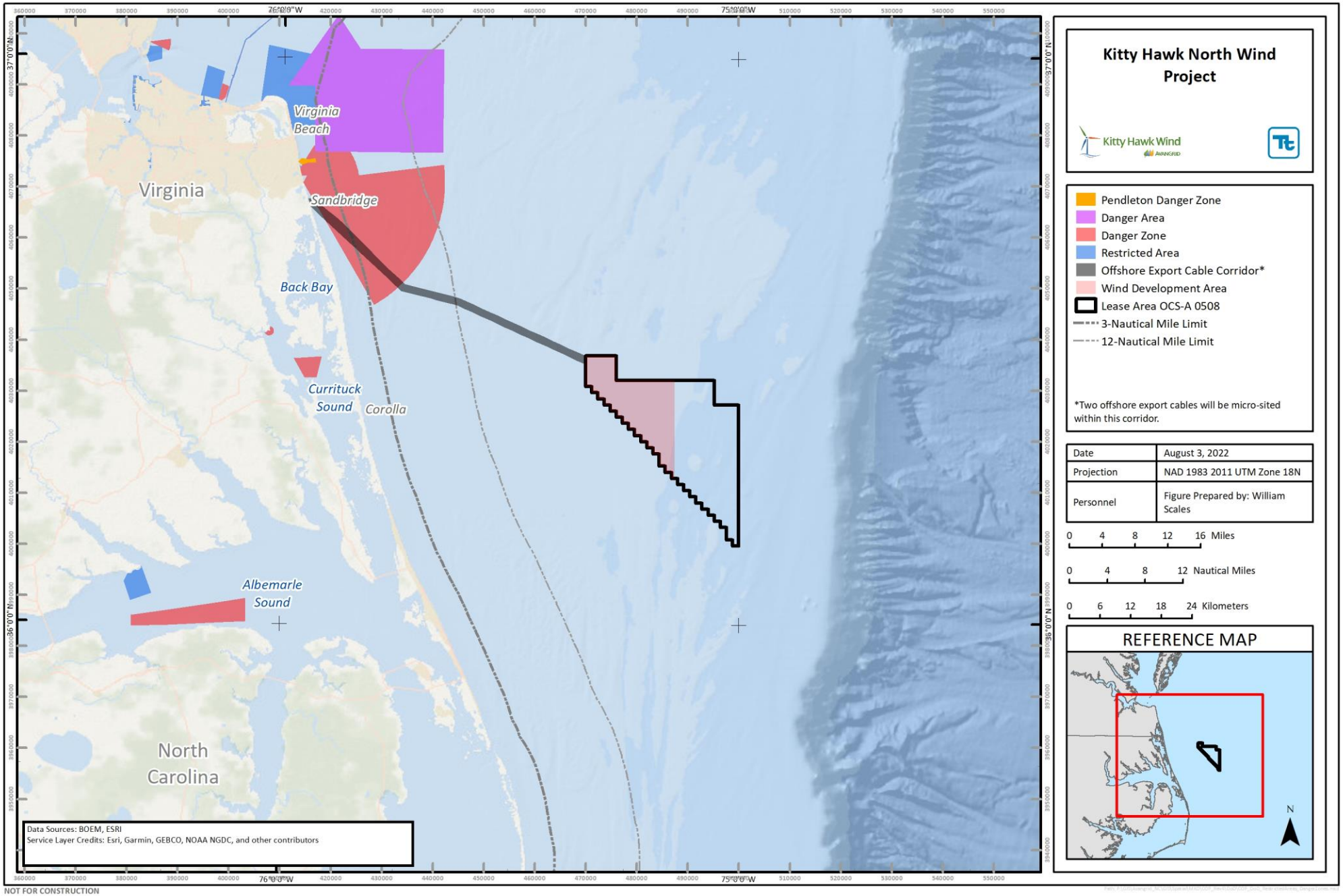


Figure 7.4-2 Danger Zones and Restricted Areas

7.4.1.2 VACAPES Warning Areas

Warning areas within the VACAPES Range Complex include areas designated as W-50, W-386, W-387, W-72, and W-110 as shown in Figure 7.4-1. Restricted airspace within the VACAPES Range Complex is designated R-6606, which extends from the shoreline to approximately 5.6 km as shown in Figure 7.4-3.

7.4.1.3 Naval Air Station Oceana

Naval Air Station (NAS) Oceana, located in Virginia Beach, is the U.S. Navy's East Coast Master Jet Base, home to F/A-18 Super Hornets. Of the 17 aviation squadrons, 15 consist of F/A-18 Super Hornets, which deploy on aircraft carriers. The primary mission of NAS Oceana is as a Shore-Based Readiness Integrator, providing the facilities, equipment, and personnel to support shored-based readiness, total force readiness, and maintain operational access of Oceana-based forces. The base, including Dam Neck Annex and Naval Auxiliary Landing Field Fentress, has approximately 10,500 active U.S. Navy personnel, about 10,000 family members, and 4,500 civilian personnel. NAS Oceana also is the home of an adversary squadron. An adversary squadron or aggressor squadron (in the U.S. Navy and U.S. Marine Corps) is a squadron that is trained to act as an opposing force in military wargames (U.S. Navy, n.d.).

NAS Oceana is located to the northeast of the proposed onshore substation site in Virginia Beach. The onshore substation and switching station will be located 2.1 km from the edge of NAS Oceana at its closest point. The Wind Development Area is approximately 74 km from NAS Oceana.

NAS Oceana Dam Neck Annex, which houses training and support services, is host to 12 tenant commands and over 5,600 instructors, students, and support personnel (Military OneSource 2020a). It is located north of the Sandbridge route and western route option onshore export cable corridors and is 1.7 km from the Sandbridge route onshore export cable corridor at its closest point.

Four U.S. Navy Air Combat Maneuvering Range Towers used for training by NAS Oceana are also located near the Wind Development Area (Figure 7.4-4). The U.S. Navy operates the Tactical Aircrew Combat Training System range to monitor and track fighter pilots engaged in air combat training. Combat aircraft equipped with extensive sensor packages relay real-time tactical information about each plane to several Tactical Aircrew Combat Training System communications platforms. The platforms then relay the flight data to an onshore station for analysis and critiques of the training mission. Towers A, B, C, and G are located 9.2 km, 25.8 km, 36.0 km, and 52.7 km, respectively, from the Wind Development Area.

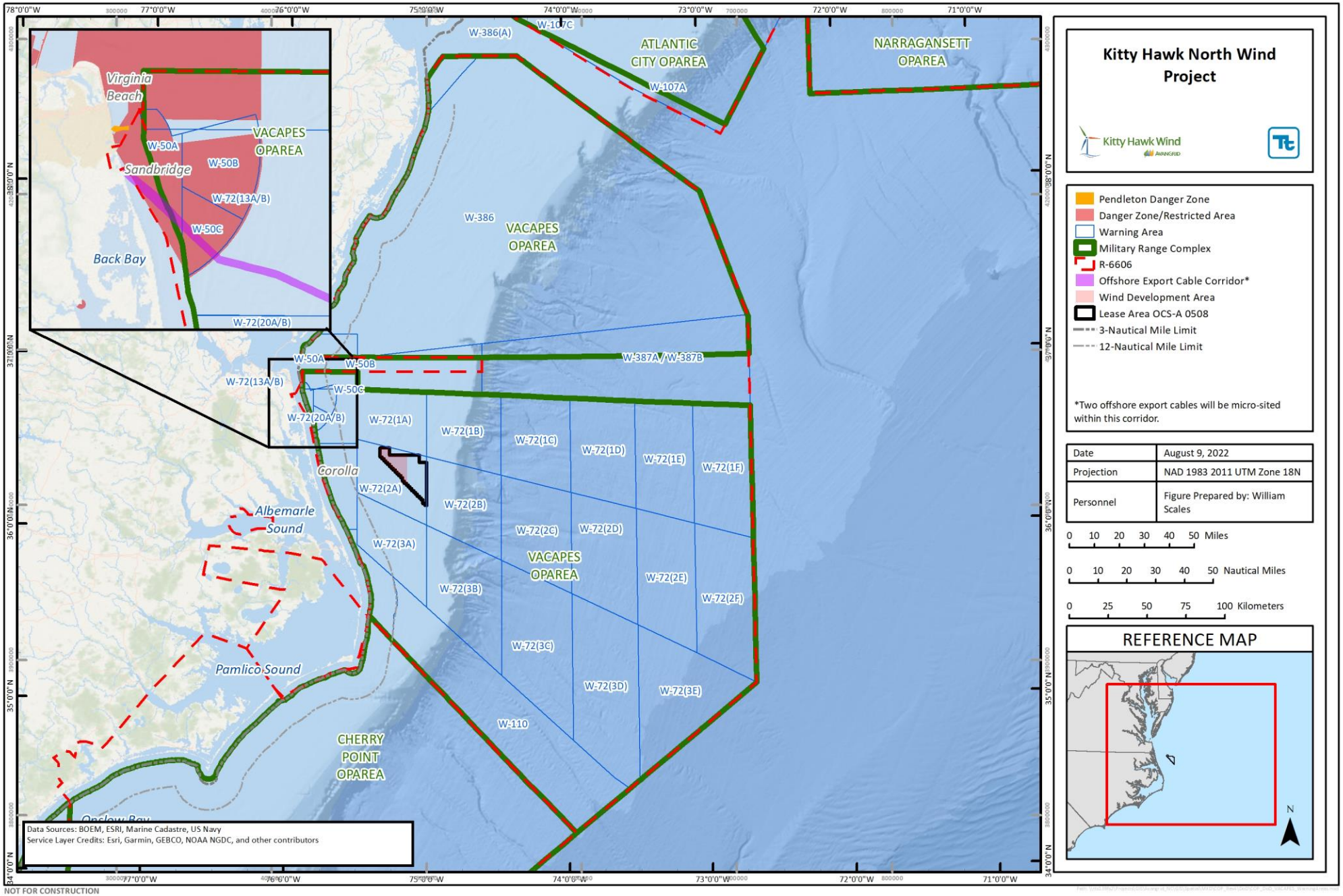


Figure 7.4-3 Special Use Airspace

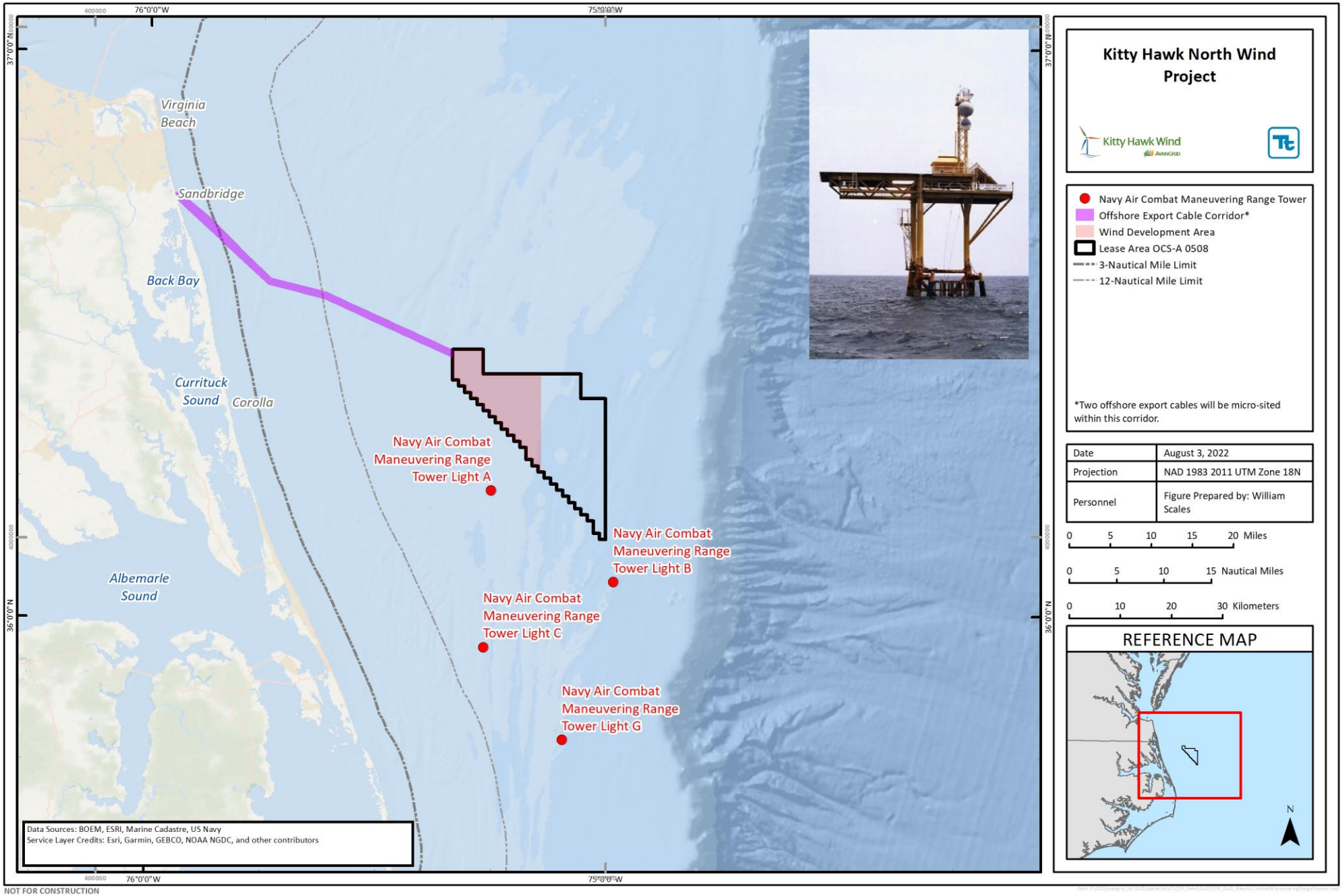


Figure 7.4-4 U.S. Navy Air Combat Maneuvering Range Towers

7.4.1.4 Other Nearby Military Facilities

There are several other military facilities in southern Virginia and North Carolina that should be noted for completeness as detailed in Table 7.4-1.

Table 7.4-1 Other Nearby Military Facilities

Facility	Location	Distance to Wind Development Area	Comments
USCG Communications Command	Chesapeake, Virginia	74 km a/	Communications Command services include watchkeeping for distress and safety calls, and maritime safety information broadcasts with six transmit and receive facilities under remote control. Consultation with the Communications Command indicated that they do not have concerns about the possibility of interference with radio waves due to the operations of the Project.
U.S. Navy's Shipboard Electronic Systems Evaluation Facility	Norfolk, Virginia	74 km	The U.S. Navy's Shipboard Electronic Systems Evaluation Facility's area of operations is limited to the entrance to Chesapeake Bay.
Naval Station Norfolk	Norfolk, Virginia	78 km	Naval Station Norfolk supports 75 ships and 134 aircraft alongside 14 piers and 11 aircraft hangars and houses the largest concentration of U.S. Navy forces (Military.com, n.d.).
USCG Air Station, Elizabeth City	Elizabeth City, North Carolina	78 km	Elizabeth City Air Station is one of most active USCG air stations on the East Coast; its primary missions are Search and Rescue, International Ice Patrol, National Strike Force, and the full range of USCG law enforcement activities (Elizcity.com 2020).
U.S. Marine Corps Air Station, Cherry Point	Havelock, North Carolina	222 km	Marine Corps Air Station Cherry Point is home to the 2nd Marine Aircraft Wing and approximately 7,500 Marines (Military OneSource 2020b).
U.S. Marine Corps, Camp Lejeune	Jacksonville, North Carolina	278 km b/	Camp Lejeune is a U.S. Marine Corps training facility.
Notes: a/ Remote transmitting stations may be closer. b/ Training extends to coastal areas, the nearest being this distance.			

7.4.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). The maximum design scenario is represented by the maximum number of new structures in the Wind Development Area, up to 69 WTGs and one ESP. Within the VACAPES OPAREA, a wide variety of military operations can occur at any given time; therefore, as has been the practice to date, all survey, construction, and operational activities will continue to be coordinated closely with the DoD. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.4.2.1 Construction

During construction, the potential impacts to national security maritime uses may include:

- Short-term increase in Project-related vessel traffic due to the construction of offshore Project components.

Short-term increase in Project-related vessel traffic due to the construction of offshore Project components. An increase in vessel traffic may occur between ports and the Wind Development Area, as well as along the offshore export cable corridor from the Wind Development Area to the landfall. The potential for an increase in navigational safety risk due to Project vessel activities was studied in the Navigation Safety Risk Assessment (see Appendix BB). The Company will schedule and control Project-related vessels to best manage congestion and traffic flow in coordination with the USCG, DoD, and other national security stakeholders. Where practical, Project vessels will utilize transit lanes, fairways, and predetermined passage plans consistent with existing waterway uses. LNMs and Broadcast LNMs will be published by the USCG to inform mariners of Project activities in the area. Additionally, a Project website detailing planned operations will be updated regularly so that mariners know what work is being done in the various offshore Project locations. These measures were successfully implemented during the 2019 and 2020 Project survey campaigns.

7.4.2.2 Operations and Maintenance

During operations, the potential impacts to national security maritime uses may include:

- Long-term displacement of national security maritime uses due to the presence of new fixed structures within the Wind Development Area;
- Occasional disturbance of national security maritime uses due the presence of O&M Project vessels and helicopters within the Wind Development Area;
- Occasional diversion of national security maritime vessel traffic due to intermittent inspection, repair, or replacement of export cables or inter-array cables; and
- Short-term disturbance of military aviation activities due to the presence and transfer of O&M vessels and personnel.

Long-term displacement of national security maritime uses due to the presence of new fixed structures within the Wind Development Area. The presence of WTGs and the ESP may result in the long-term displacement of national security maritime training uses, including training airspace, in this portion of the OCS. In siting the Lease Area, BOEM worked with the DoD to identify areas with military use conflicts, which were then removed from further leasing consideration (BOEM 2015). The Company is engaged in ongoing discussions with the DoD to resolve any potential conflicts between the Project and military operations. Displacement of military uses is therefore expected to be minimal.

These structures may result in the long-term but low consequence diversions of traditional vessel routes while transiting past the Project (see Appendix BB Navigation Safety Risk Assessment). As-built plans will be provided to NOAA Fisheries and appropriate stakeholders to update nautical charts with structure locations, including WTGs and the ESP, along with the offshore export cable corridor. Structures will be properly lit and marked in accordance with USCG guidance (USCG 2020) and BOEM's lighting and marking guidance (BOEM 2021).

Occasional disturbance of national security maritime uses due the presence of O&M Project vessels and helicopters within the Wind Development Area. The Project will result in the presence of O&M vessels and helicopters within the Wind Development Area engaging in operations activities, including regular and unexpected maintenance, and transiting to and from shoreside support locations. This will result in a small increased in number of Project vessel encounters with potential corresponding risk of collisions.

The Company will control Project vessel and helicopter movements to minimize vessel encounters during training operations in and near the Wind Development Area.

Occasional diversion of national security maritime vessel traffic due to intermittent inspection, repair, or replacement of export cables or inter-array cables. The Project may result in the potential infrequent need for a cable-laying vessel to inspect/repair/replace either the inter-array or export cables during the useful life of the Project. In the event of cable inspection, repair, or replacement, there may be the need for diversion of vessel traffic due to operations of the repair vessel, which is restricted in ability to maneuver, thus requiring a wide berth. LNMs and Broadcast LNMs will be published by the USCG to inform mariners of Project activities. The Company will communicate with key national security stakeholders on the timing and location of O&M activities. The Company will follow the USCG establishment of safety zones around O&M activities.

Short-term disturbance of military aviation activities due to the presence and transfer of O&M vessels and personnel. The Project may result in the potential short-term need for military aviation activities to avoid the Wind Development Area during the transfer of O&M personnel and equipment. Military flight operations may conflict with routine O&M flight operations. The Company will publish a regular operations plan on the Project website so that mariners and aircraft pilots are aware of Project activities. The Company will coordinate with the VACAPES Fleet Area Control and Surveillance Facility to deconflict military and O&M flight operations.

7.4.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.5 Offshore Renewable Energy, Mineral Exploration, and Infrastructure

This section describes the existing and potential offshore renewable energy, offshore sand management and ocean disposal, and scientific uses within and surrounding the offshore Project Area, including the Wind Development Area, offshore export cable corridor, and the landfall. These uses include electricity generation and transmission, mineral exploration and development, cable and pipelines, sand borrow areas, dredge disposal sites, and scientific research. Potential impacts to these uses resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP that are related to offshore renewable energy, mineral exploration, and infrastructure include:

- Department of Defense and Outer Continental Shelf National Security Maritime Uses (Section 7.4);
- Other Coastal and Marine Uses (Section 7.7); and
- Navigation Safety Risk Assessment (Appendix BB).

For the purposes of this section, the review area includes the offshore Project components and the areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project.

Data required to complete this analysis comes from NOAA charts, BOEM, USACE, the Mid-Atlantic Regional Council on the Ocean Data Portal, the Northeast Data Portal, and site-specific data collected by the Company.

7.5.1 Affected Environment

7.5.1.1 Offshore Renewable Energy

The Lease Area consists of 495 km^2 off the coast of North Carolina, shown in Figure 7.5-1. There are no other offshore wind leases immediately adjacent to the Lease Area. BOEM has leased two other areas north of the Project Area: the CVOW Pilot Project (Lease OCS-A 0497) and the CVOW Commercial Project (Lease OCS-A 0483).

The CVOW Pilot Project is approximately 9 km^2 in size. This lease area is 46 km northwest of the Wind Development Area and 36 km northeast of the offshore export cable corridor. It is immediately west of Lease OCS-A 0483. In June 2019, BOEM approved the Research Activities Plan revision for construction and operation of a two-turbine project (6-megawatt turbines); the CVOW Pilot Project began operations in September 2020 (BOEM 2020a, b; Offshore 2020).

Lease OCS-A 0483 is 38 km north of the Wind Development Area and 31 km north of the offshore export cable corridor. It is approximately 456 km^2 in area. The commercial lease was issued by BOEM to the Virginia Electric and Power Company (d/b/a Dominion Virginia Power) on 01 Nov 2013 (BOEM 2020a). The estimated construction timeline is 2024 to 2026. The project is anticipated to install 12-megawatt turbines for a generation capacity of approximately 2,640 megawatts (Dominion Energy 2020).

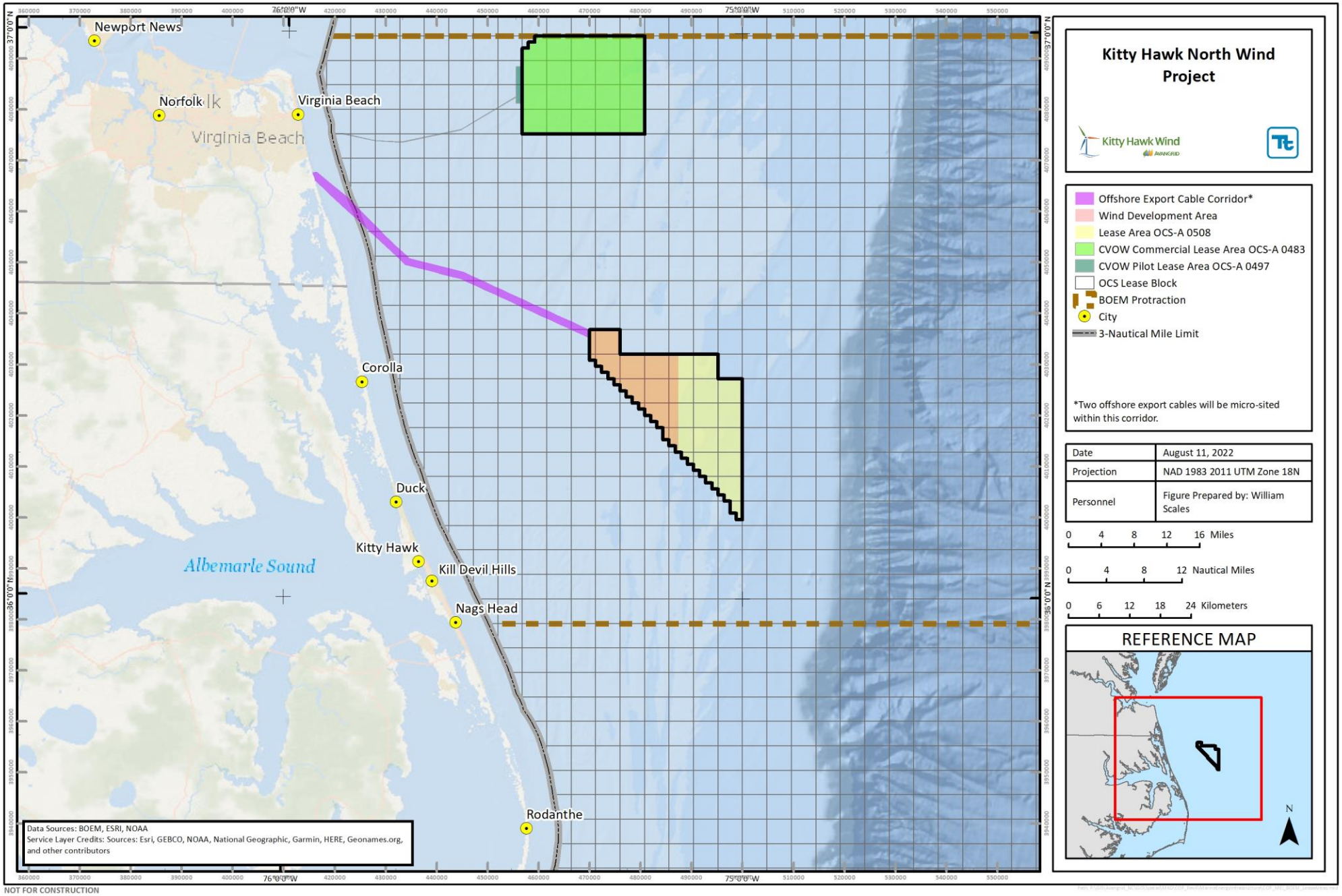


Figure 7.5-1 BOEM Lease Areas

In addition to the Kitty Hawk Wind Energy Area (WEA), BOEM identified two other WEAs offshore North Carolina. These are located off the southern North Carolina coast. These are the Wilmington East WEA (approximately 541 km^2) and Wilmington West WEA (approximately 209 km^2), as shown in Figure 7.5-2. The Wilmington East WEA is 385 km southwest of the Wind Development Area and is 27.8 km from Bald Head Island, North Carolina at its closest point, extending 33.3 km in the southeast direction at its widest point. The Wilmington West WEA is 391 km southwest of the Wind Development Area, beginning 18.5 km from shore and extending 22.6 km in an east-west direction at its widest point. Due to their distance from the Wind Development Area, these two WEAs are not expected to affect the Project (BOEM 2014).

Unleased areas within BOEM's Mid-Atlantic Planning Area, which includes both WEAs, were withdrawn from leasing for ten years, from 2022 to 2032, by Presidential Memorandum on 25 Sep 2020 (U.S. President 2020).

7.5.1.2 U.S. Offshore Oil and Gas Leasing Program

The National OCS Oil and Gas Leasing Program establishes a schedule of oil and gas lease sales proposed for planning areas of the OCS (BOEM 2016). The Program specifies the size, timing, and location of potential leasing activity that the Secretary of the Interior determines will best meet national energy needs. Currently, BOEM is working under the 2017-2022 National OCS Program (BOEM 2016). However, as directed in Executive Order 13795 (28 Apr 2017) and Secretarial Order 3350 (01 May 2017), BOEM is initiating a process to develop the next National OCS Program, the *2019-2024 National Outer Continental Shelf Oil and Gas Leasing Draft Proposed* Program (BOEM 2018).

Figure 7.5-3 shows oil and gas planning and exclusion areas. There are currently no active oil and gas lease areas located in the Mid-Atlantic region under the Outer Continental Shelf Oil and Gas Leasing 5-year program (2017-2022) (BOEM 2016).

For the 2019-2024 Draft Proposal Program Areas, BOEM scheduled lease sales in all the Atlantic region planning areas. BOEM considered a leasing option with a coastal buffer to accommodate military use concerns but did not choose this option for the Draft Proposal Program Areas. BOEM stated that this and other program options may be further analyzed in subsequent versions of the program (BOEM 2018).

There have been almost no geophysical or geotechnical activities for oil and gas exploration in the Mid-Atlantic due to the moratoria on Atlantic leasing activities for the past 30 years. The Presidential Memorandum issued on 25 Sep 2020 prevents consideration of new oil and gas leases in the Mid-Atlantic region from 2022 to 2032 (U.S. President 2020).

The State of North Carolina and Commonwealth of Virginia have stated their opposition to offshore exploration and drilling based on the inherent risks associated with the activities to the environment. On 18 Apr 2019, the North Carolina Coastal Resources Commission passed a resolution to Protect the North Carolina Coast from Harm Caused by Offshore Energy Exploration and Production. Similarly, on 04 Feb 2020, the Virginia legislature passed bill H.B. 706 to block future oil and gas development off the coast of Virginia based on the threat to the Commonwealth's revenue generated from both fishing tourism and recreation.

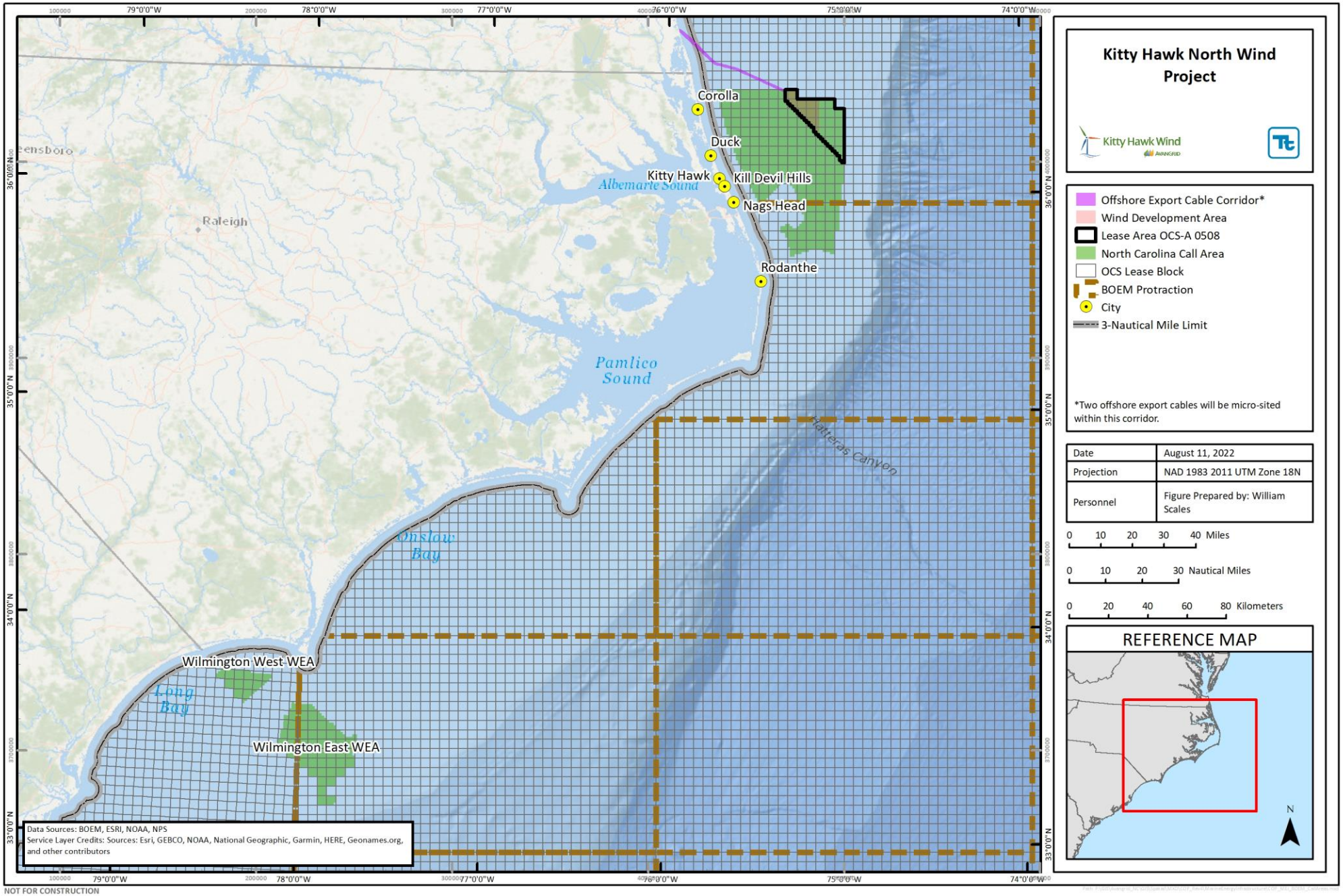


Figure 7.5-2 BOEM Call Areas

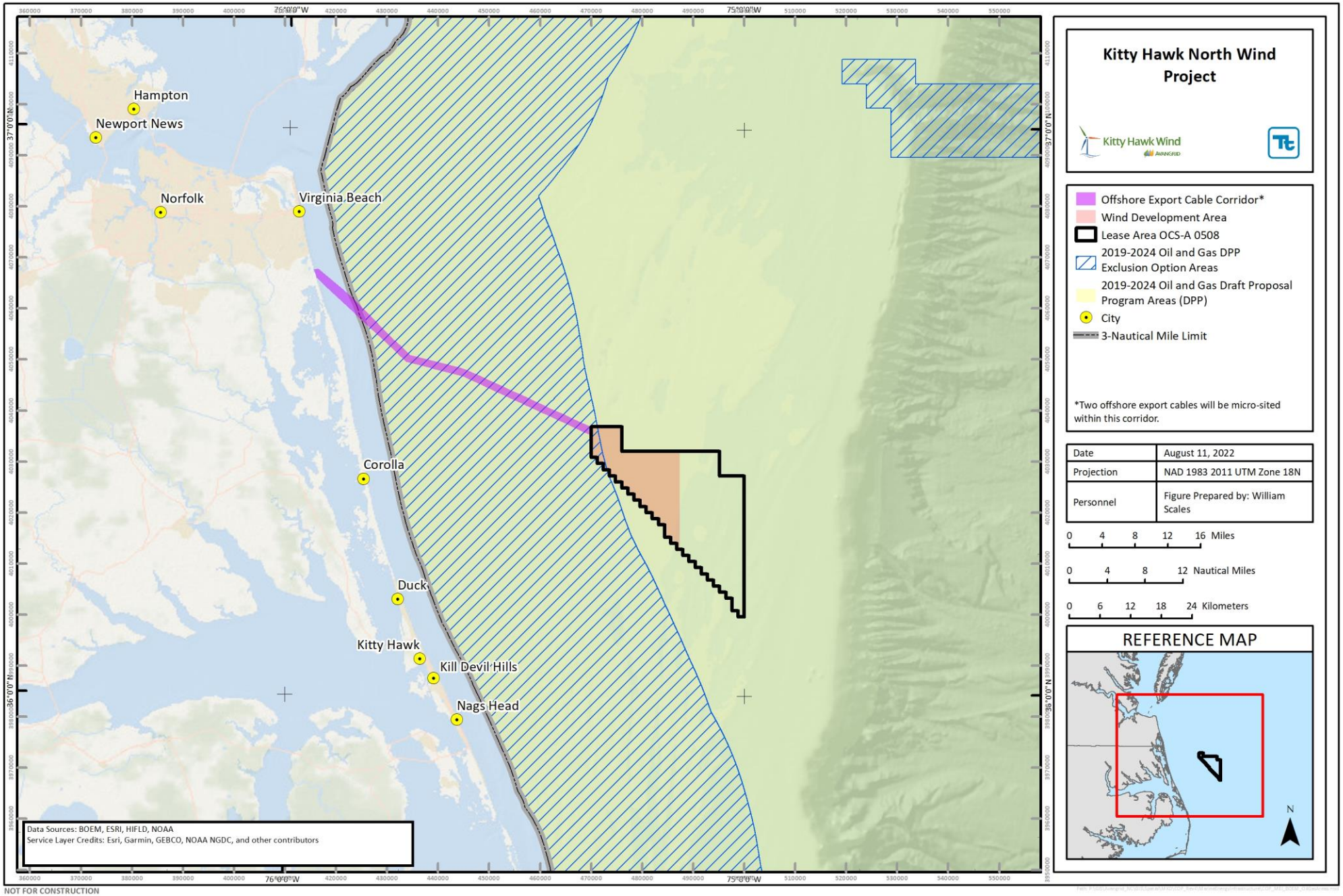


Figure 7.5-3 Oil and Gas Areas

7.5.1.3 Cables and Pipelines

There are no existing NOAA-charted cables or pipelines that cross through the Wind Development Area or the offshore export cable corridor. Additionally, no uncharted cables or pipelines have been identified during reconnaissance geophysical survey activities. The closest cables, the MAREA and BRUSA submarine cables (see Figure 7.5-4) are located north of the Project Area. These are telecommunication cables that make landfall in Virginia Beach, Virginia. The MAREA subsea cable consists of eight fiber pairs that extend approximately 6,437 km from Virginia Beach, Virginia to Bilbao, Spain. The BRUSA subsea cable is approximately 10,944 km long and connects Rio de Janeiro and Fortaleza, Brazil with San Juan, Puerto Rico and Virginia Beach, Virginia (Submarine Cable Networks 2018; NASCA 2015). The BRUSA subsea cable is 34 km north of the northernmost portion of the Wind Development Area and approximately 8 km north of the offshore export cables at its closest point, within Virginia state waters. Additionally, there are cables associated with the CVOW Pilot Project (Lease OCS-A 0497) and, if developed, there will be cables from the CVOW Commercial Project (Lease OCS-A 0483). The CVOW Pilot Project's submarine cables are located 46 km from the northwestern-most corner of the Wind Development Area (BOEM 2020b).

7.5.1.4 Sand Borrow Areas

BOEM's Marine Minerals Program identifies and manages the OCS sand resources and leases for offshore sand borrow areas to replenish eroded shorelines for shore protection, beach nourishment, and wetland restoration to mitigate the effects of erosion and sea level rise from climate change (BOEM 2020c). Sand resource areas represent portions of the OCS where there is likelihood that a viable sand resource exists. However, the existence of these areas does not indicate that there are plans to use these areas in the immediate future. There are currently two active OCS lease areas for marine minerals within the region, including one off the coast of Virginia and one off the coast of North Carolina (Figure 7.5-5).

None of the identified sand borrow areas are located within the Wind Development Area. The closest of these sites is located 56 km northwest of the Wind Development Area. The offshore export cable corridor does not cross through previous or active BOEM Marine Minerals Program sand borrow leases. The nearest active sand lease area to the offshore export cable corridor is approximately 4 km northeast of the corridor at its closet point. However, the offshore export cable corridor does traverse through a potential sand resource area for approximately 3 km. Based on information provided by BOEM's Marine Minerals Program during initial outreach and discussions, portions of the sand resource area represent greater and lesser potential for future sand resources. The offshore export cable corridor alignment reduces impact to these areas of most significant potential by traversing an area where the exploitable sand bodies are thinner.

7.5.1.5 Ocean Disposal Sites

Under the Marine Protection, Research and Sanctuaries Act, the USACE is the federal agency that issues permits authorizing the disposal of dredged materials in the ocean. The USACE relies on the U.S. Environmental Protection Agency's (EPA's) ocean dumping criteria when evaluating permit requests. These criteria include: the need for dumping; the environmental impact of dumping; the effect of the dumping on aesthetic, recreational, or economic values; the adverse effect of dumping on other uses of the ocean; and the appropriate locations and methods of disposal or recycling. There are two USACE dredged material disposal sites near the entrance to the Chesapeake Bay. These are the Dam Neck Dredged Material Disposal Site and the Norfolk Dredged Material Disposal Site (EPA 2019). Both dredged material disposal sites are located north of the offshore export cable corridor and the landfall. The offshore Project components do not cross either site. Both dredged material disposal sites are shown in Figure 7.5-6.

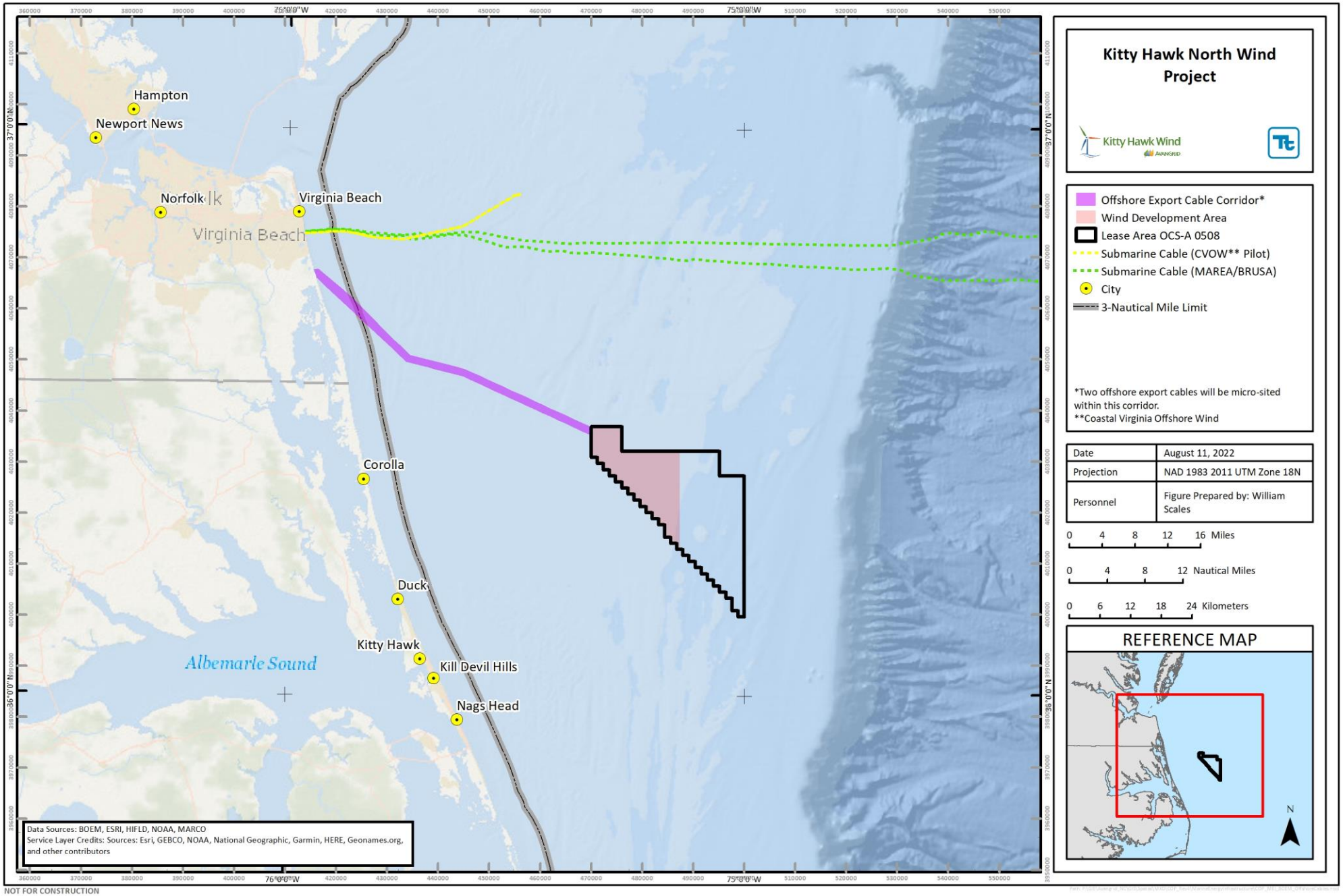


Figure 7.5-4 Offshore Cables

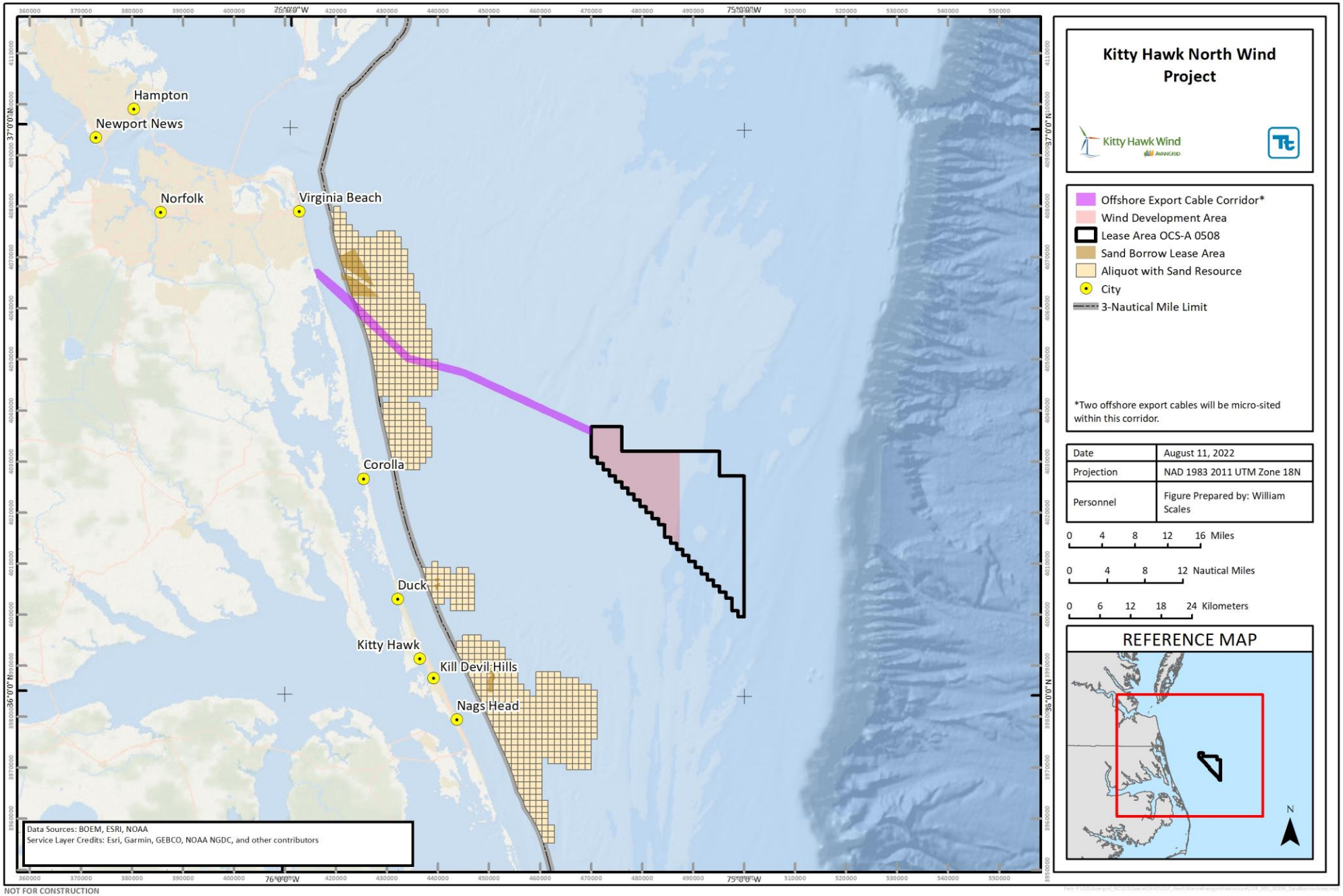


Figure 7.5-5 BOEM Sand Borrow Areas

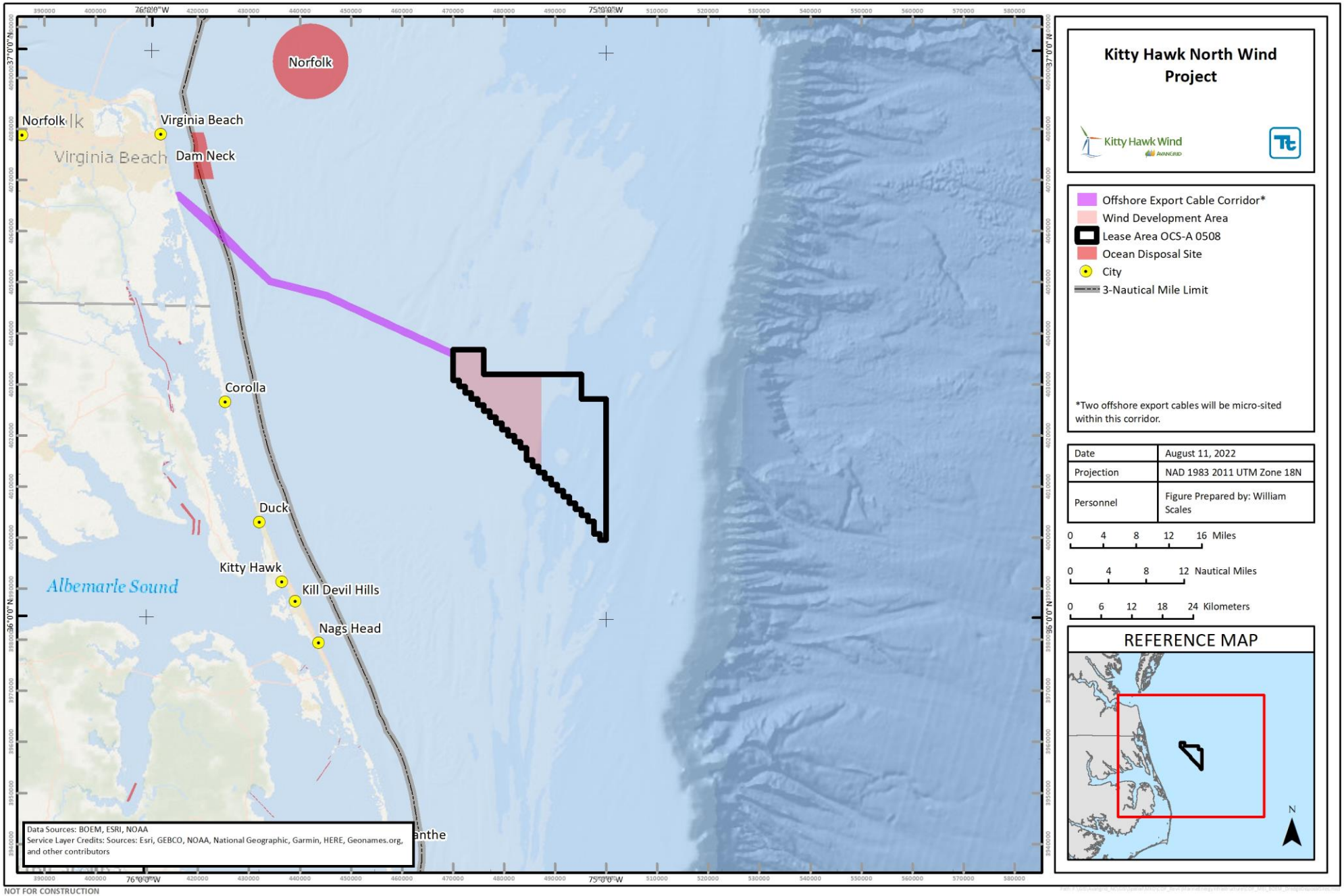


Figure 7.5-6 Ocean Disposal Sites

The Dam Neck Dredged Material Disposal Site is located 4.5 km off the coast of Virginia Beach, Virginia. The Dam Neck Dredged Material Disposal Site was designated by the EPA for the ocean placement of suitable dredged material on 31 Mar 1988 and is still considered active today. It encompasses an area approximately 27 km^2 and is located 57 km to the northwest of the Wind Development Area and 4 km north of the offshore export cable corridor (EPA 2019).

The Norfolk Dredged Material Disposal Site is located 24 km off the coast of Cape Henry, Virginia at the mouth of the Chesapeake Bay. The Norfolk Dredged Material Disposal Site was designated by the EPA for ocean placement of suitable dredged material at this site on 02 Jul 1993 and is still considered active today. It encompasses approximately 172 km^2 and is located 55 km northwest of the Wind Development Area and 29 km north of the offshore export cable corridor (EPA 2019).

The nearest ocean disposal site off the North Carolina coast is the Morehead City Dredged Material Disposal Site. It is located at the mouth of Beaufort Inlet, off the coast of Morehead City, North Carolina. It is more than 370 km southwest of the Wind Development Area and encompasses an area of approximately 27 km^2. It was designated by the EPA on 14 Sep 1987 and is still considered active today (EPA 2019).

An Explosives Dumping Area is located 66 km east of the Wind Development Area. This was used for the dumping of undetonated explosives.

7.5.1.6 Scientific Research

Various federal, state, and educational organizations regularly conduct scientific research, including aerial and ship-based scientific surveys, in the vicinity of the offshore Project Area. This includes multi-decade biological surveys completed by NOAA Fisheries and the U.S. Navy. NOAA's 2020 Hydrographic Survey plans (NOAA 2020) included a survey of Onslow Bay, North Carolina, a project covering an area of approximately 1,242 km^2, seaward of Morehead City and Cape Lookout Shoals, North Carolina. In addition, in 2019, the USACE completed a topo-bathy LiDAR survey along the North Carolina coastline (OCM Partners 2020). The USACE Field Research Facility is located near Duck, North Carolina, 46 km southeast of the Wind Development Area.

7.5.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For this impact analysis, the maximum design scenario is the full build out of the offshore Project components. In general, these impacts include short-term impacts due to implementation of safety zones and increased construction vessel activity. The Project has been sited and designed to reduce impacts to offshore renewable energy, mineral exploration, and infrastructure resulting from construction, operations, and decommissioning activities (Figure 7.5-7). A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.5.2.1 Construction

During construction, the potential impacts to offshore renewable energy and infrastructure may include the following:

- Short-term restricted access to sand resources due to the implementation of safety zones; and
- Short-term increase in vessel traffic during construction.

As the nearest offshore wind lease area is located 38 km away, and the likelihood of new wind, oil, or gas leases nearer to the Project is low, no impacts to other offshore energy production efforts are expected.

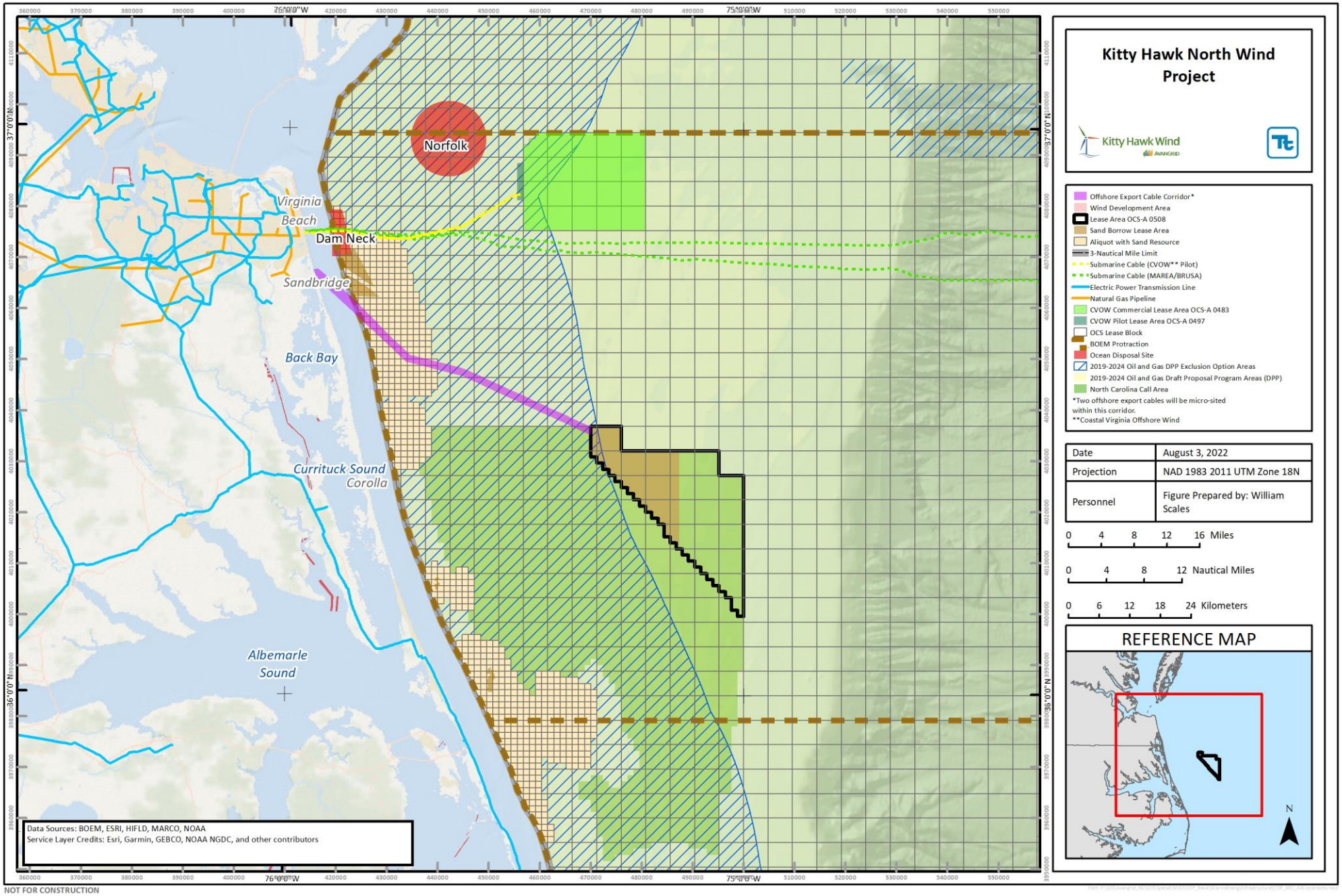


Figure 7.5-7 Offshore Renewable Energy, Mineral Exploration, and Infrastructure Constraints

Short-term restricted access to sand resources due to the implementation of safety zones. As the offshore export cables are being installed, temporary safety zones will be implemented as appropriate,[6] and increased construction vessel traffic may impact vessel traffic associated with sand borrow activity. These activities may temporarily and directly restrict access to the sand borrow areas shown in Figure 7.5-5. The Company will provide advance notice of construction activities through LNMs and Broadcast LNMs as well as on the Project website. Also, the Company will monitor and control Project vessel movements to minimize impacts to sand borrowing activity.

Short-term increase in vessel traffic during construction. There may be a short-term increase in Project-related construction and support vessels due to the installation of the offshore Project components. This increase in vessel traffic would occur between ports and the Wind Development Area as well as along the offshore export cable corridor from the Wind Development Area to the landfall. This may result in potential short-term displacement of vessels associated with sand resource activities, dredge disposal activities, and scientific and research activities within the immediate Project vicinity. The Company will schedule and control Project-related vessels to best manage congestion and traffic flow in coordination with the USCG. Where practical, Project vessels will utilize TSSs, fairways (should they be developed), and predetermined passage plans consistent with existing waterway uses. LNMs and Broadcast LNMs will be published by the USCG to inform mariners of Project activities in the area. Additionally, a Project website will be updated so that mariners know what work is being done in the various offshore Project locations.

7.5.2.2 Operations and Maintenance

During operations, the potential impacts to offshore renewable energy, mineral exploration, and infrastructure may include the following:

- Long-term restricted use of potential sand borrow areas due to the presence of offshore export cables; and
- Occasional diversion of sand borrow, dredge disposal, or scientific research vessel traffic due to intermittent inspection, repair, or replacement of the offshore Project infrastructure.

Due to their location well to the north of the Project Area, the two primary ocean disposal sites are not considered to be impacted by Project infrastructure or O&M activities.

Long-term restricted use of potential sand borrow areas due to the presence of offshore export cables. During operations, the presence of the offshore export cables will directly restrict access to portions of existing potential sand borrow areas for further delineation or future leasing. An adequate avoidance buffer would reduce the risk that use of these potential borrow areas would uncover buried cable, damage cable protection, and/or damage the cables. The Company has sited and designed the offshore export cables to avoid active sand borrow areas, minimize potential impacts to the most significant future sand borrow areas to the extent practicable, and avoid dredge material disposal sites. To prevent future designations of sand borrow areas or dredge disposal sites over installed cables, the Company will provide accurate cable location information on NOAA charts and will make cable location shape files available. The Company will also periodically monitor burial depth as deemed necessary and note and address any concerns.

Occasional diversion of sand borrow, dredge disposal, or scientific research vessel traffic due to intermittent inspection, repair, or replacement of the offshore Project infrastructure. Occasional diversion of scientific research vessel traffic may occur within the Wind Development Area due to intermittent inspection, repair, or replacement of inter-array cables, foundations, WTGs, or the ESP. The Project will have the potential, infrequent need for a cable-laying vessel to inspect, repair, and/or replace the inter-array cables, offshore export cables, WTGs, ESP, and/or foundations during the useful life of the

[6] Where applicable, safety zones will extend up to 500 m around construction sites, per 33 CFR § 147.15. All areas will be lit and marked in accordance with USCG requirements and monitored by a safety vessel that will be available to assist local mariners.

Project. In the event of cable inspection, repair, or replacement, there may be the need to divert vessel traffic due to the operations of the repair vessel, which is restricted in its ability to maneuver, thus requiring a wide berth. LNMs and Broadcast LNMs will be published by the USCG to inform mariners of Project activities. The Company will communicate with key national security stakeholders on the timing and location of O&M activities. The Company will follow the USCG establishment of safety zones around O&M activities.

7.5.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.6 Aviation and Radar

This section describes the airspace and aviation radar within and surrounding the Project Area, which includes the Wind Development Area, export cables, onshore substation, and switching station. Potential impacts to airspace and aviation radar resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Assessments detailed within this COP that are related to aviation and radar include:

- Obstruction Evaluation and Airspace Analysis (Appendix CC);
- Air Traffic Flow Analysis (Appendix DD); and
- Radar and Navigational Aid Screening Study (Appendix Q).

The Project follows the regulatory guidance under 49 U.S.C. § 44718 and 14 CFR Part 77, which provides the FAA with the jurisdiction to assess and ensure that structures located within U.S. territorial waters (defined as 12 nm [22 km] measured from the coastline) and greater than 200 ft (61 m) above ground level do not have adverse effects on the safety or efficient utilization of navigable airspace. Beyond 22 km, BOEM assumes this responsibility. Structures that fall under FAA or BOEM jurisdiction must also be reviewed by the DoD and the U.S. Department of Homeland Security to ensure no interference with operations and/or radar systems.

Any structure with a height greater than 500 ft (152 m) above ground level within the FAA's jurisdictional boundary must be identified as a potential obstruction for assessment. However, the FAA requests that projects file structures within 13 nm (24 km) (12 nm, plus a 1 nm buffer) to ensure that the FAA's defined boundary is being used. When reviewing applications, the FAA will then confirm that the structures are located outside of their jurisdiction. Beyond the FAA jurisdictional boundary, BOEM recommends aviation lighting consistent with FAA regulatory requirements (BOEM 2021). See Chapter 3 Description of Proposed Activity for additional information on lighting and marking measures associated with the Project.

The Project is not located within territorial waters and thus beyond the jurisdiction of the FAA (Figure 7.6-1); therefore, the FAA does not have a mandate to conduct aeronautical studies for WTGs proposed within the defined review area. BOEM may, however, require consultation with the FAA during their review of the COP. Providing an aeronautical study is useful to these consultations.

For the purposes of this section, the review area includes the Wind Development Area and the areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project. Data required to complete this analysis comes from the Air Traffic Flow Analysis and Obstruction Evaluation and Airspace Analysis performed by Capitol Airspace Group.

7.6.1 Affected Environment

An Obstruction Evaluation and Airspace Analysis was conducted by Capitol Airspace Group to characterize and identify obstacle clearance surfaces established by the FAA in the existing airspace surrounding the Project Area (see Appendix CC Obstruction Evaluation and Airspace Analysis). These surfaces could limit the placement of WTGs if certain height thresholds are exceeded. The analysis reviewed the Wind Development Area's proximity to airports (Figure 7.6-2), published instrument procedures, enroute airways, FAA minimum vectoring altitude (MVA) and minimum Instrument Flight Rules altitude charts, as well as military airspace and training routes.

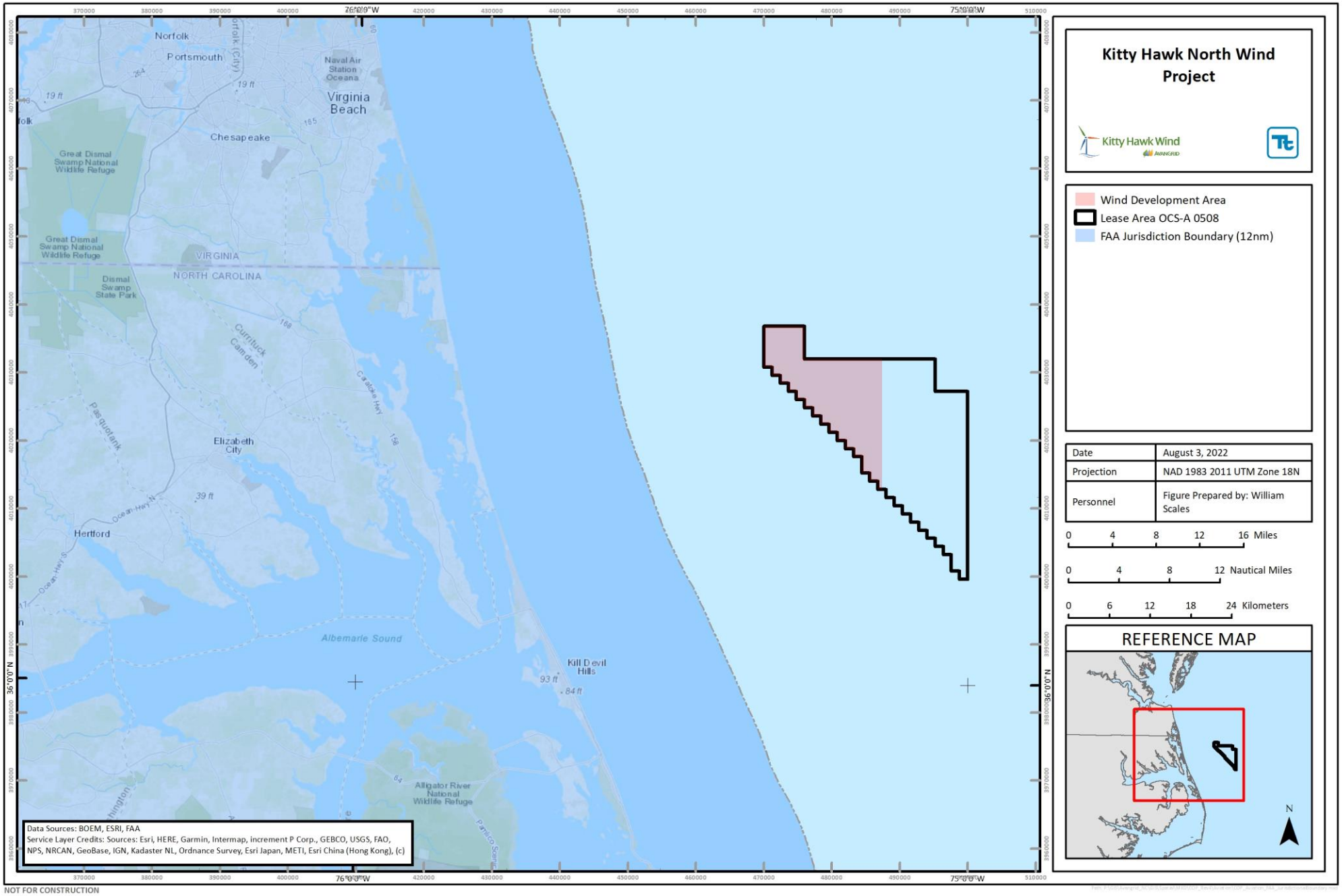


Figure 7.6-1 FAA Jurisdictional Boundary

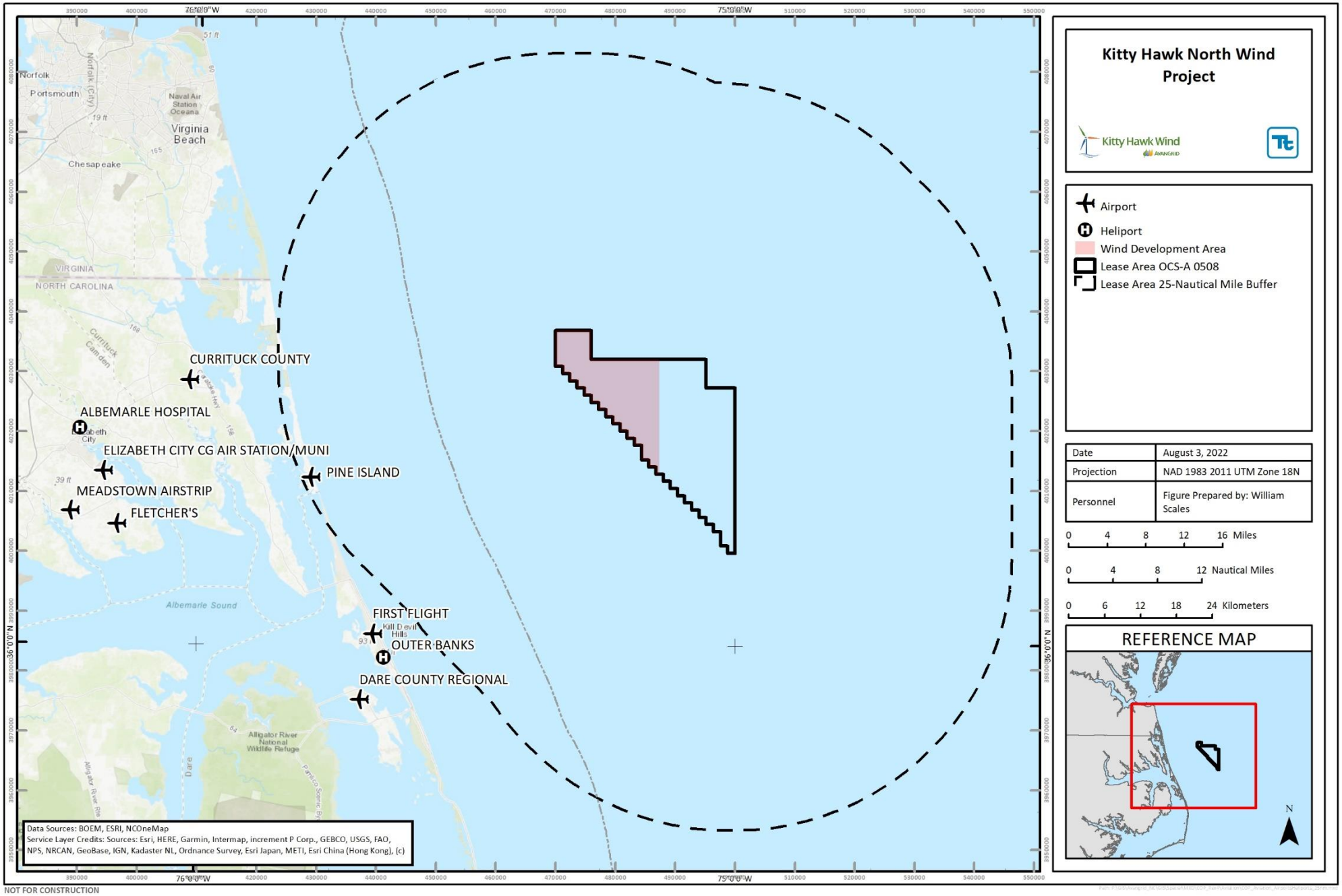


Figure 7.6-2 Airports, Heliports, and Seaplane Bases within 46 km of the Wind Development Area

Based on the result of the Obstruction Evaluation and Airspace Analysis, Capitol Airspace Group completed an Air Traffic Flow Analysis (see Appendix DD Air Traffic Flow Analysis). The purpose was to provide an analysis of the Project's potential to interfere with the utilization of the surrounding airspace. The Air Traffic Flow Analysis evaluated one year (01 Sep 2018 through 31 Aug 2019) of FAA National Offload Program data, comprised of 34,435,429 radar returns associated with 434,273 unique flights receiving air traffic control services from airports surrounding the Project Area. Each flight that had at least one radar return within the affected airspace was analyzed for altitude and direction trends.

Westslope Consulting prepared a Radar and Navigational Aid Screening Study (see Appendix Q) to identify whether WTGs in the Wind Development Area may interfere with DoD, FAA, and NOAA radar sites, and High Frequency Coastal Radar sites.

7.6.1.1 Airports

There are several public-use, private-use, and military airports and heliports just outside of a 25-nm (46-km)-radius review area around the Wind Development Area (Figure 7.6-2); the only airport within the review area is Pine Island. Eight published instrument approach procedures were identified and assessed at Currituck County Regional, First Flight, and Dare County Regional airports (Appendix CC Obstruction Evaluation and Airspace Analysis). Based on the Obstruction Evaluation and Airspace Analysis, there are no anticipated impacts on published instrument departure or approach procedures, and therefore these are not discussed further. An evaluation of 14 CFR § 77.19 imaginary surfaces was also completed. These airport surfaces are used to determine if structures in proximity to airports are considered obstructions, even at heights lower than 152 m above ground level. It was determined that no military or public-use airport imaginary surfaces overlie the Wind Development Area, and therefore these are not discussed further.

It has been determined that instrument departure procedure obstacle clearance surfaces (Figure 7.6-3) do not overlie the offshore Project Area and should not limit the up to maximum representative WTGs within the defined Wind Development Area.

In addition to evaluating the potential for affecting Instrument Flight Rules, an analysis of known Visual Flight Rules (VFR) was completed. This included analyzing local VFR traffic pattern airspace used by pilots entering or leaving the airport environment and the potential for interfering with VFR routes. There are no VFR traffic patterns that overlap with the Wind Development Area (Figure 7.6-4). Further, since there are no landmarks in proximity to the Wind Development Area, it is unlikely that the proposed WTGs would affect regularly used VFR routes. Therefore, these features are not discussed further.

7.6.1.2 Enroute Airways and Minimum Vectoring Altitudes

Enroute airways provide pilots a means of navigation when flying from airport to airport and are defined by radials between very high frequency omni-directional ranges. The FAA publishes minimum altitudes for airways to ensure clearance from obstacles and terrain. The FAA requires that each airway has a minimum of 1,000 ft (305 m) of obstacle clearance in non-mountainous areas and normally 2,000 ft (610 m) in mountainous areas. Proposed structures that exceed enroute airway obstacle clearance surfaces would require an increase to their minimum obstruction clearance altitudes and/or minimum enroute altitudes.

These same limitations apply to the MVA and Instrument Flight Rules altitudes. The altitudes are published by the FAA and define the MVA and minimum Instrument Flight Rules altitude sectors, which provide the lowest altitudes at which air traffic controllers can issue radar vectors to aircraft based on obstacle clearance. Coordination may be required with the FAA if the WTGs are placed in the far northwest section of the Wind Development Area in order to change an MVA sector to account for the 305 m of required obstacle clearance. Since this area is outside of the 22 km territorial airspace, this may require coordination with the FAA but should not be the basis for any hazardous determinations.

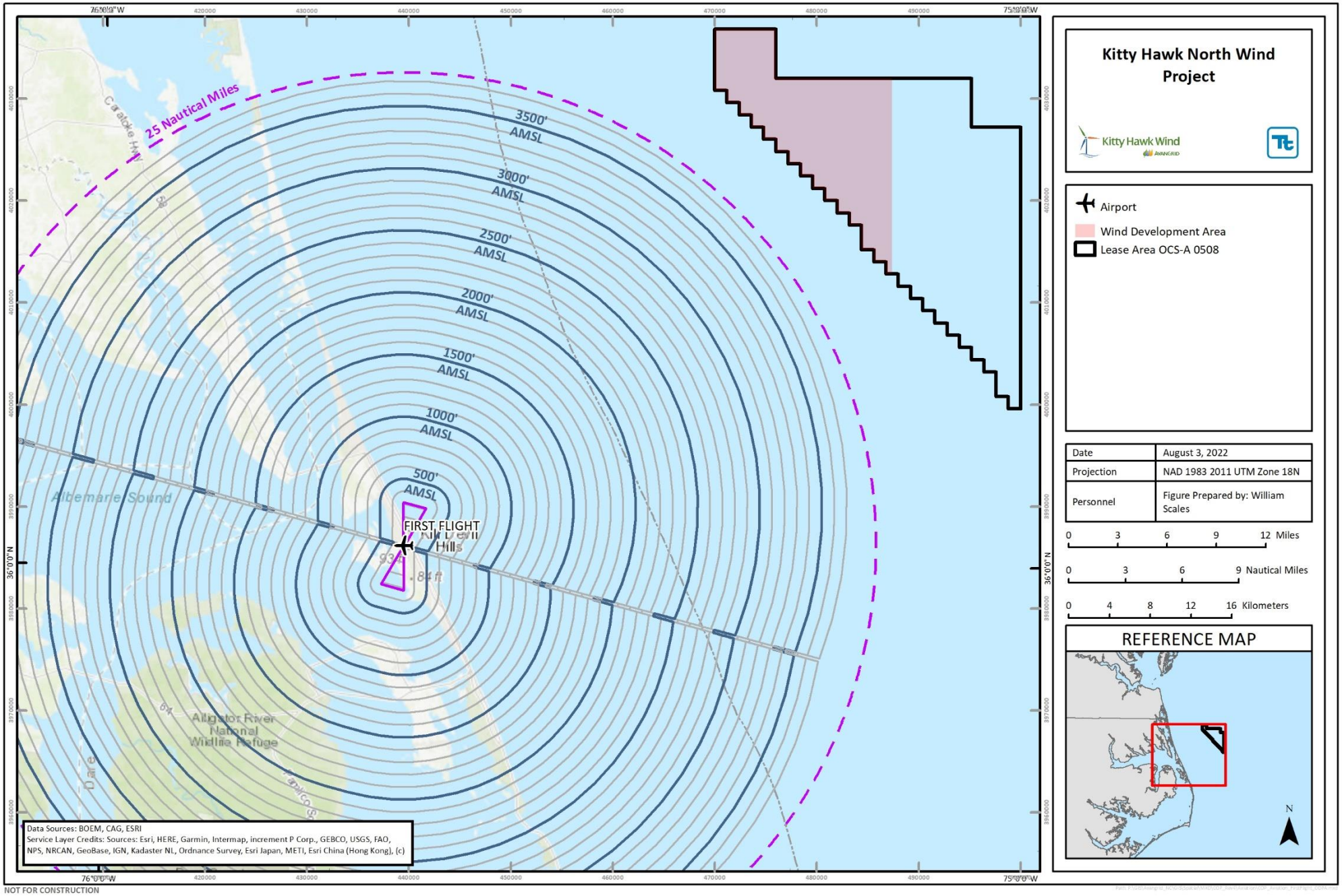


Figure 7.6-3 First Flight (FAA) Obstacle Departure Procedure Assessment

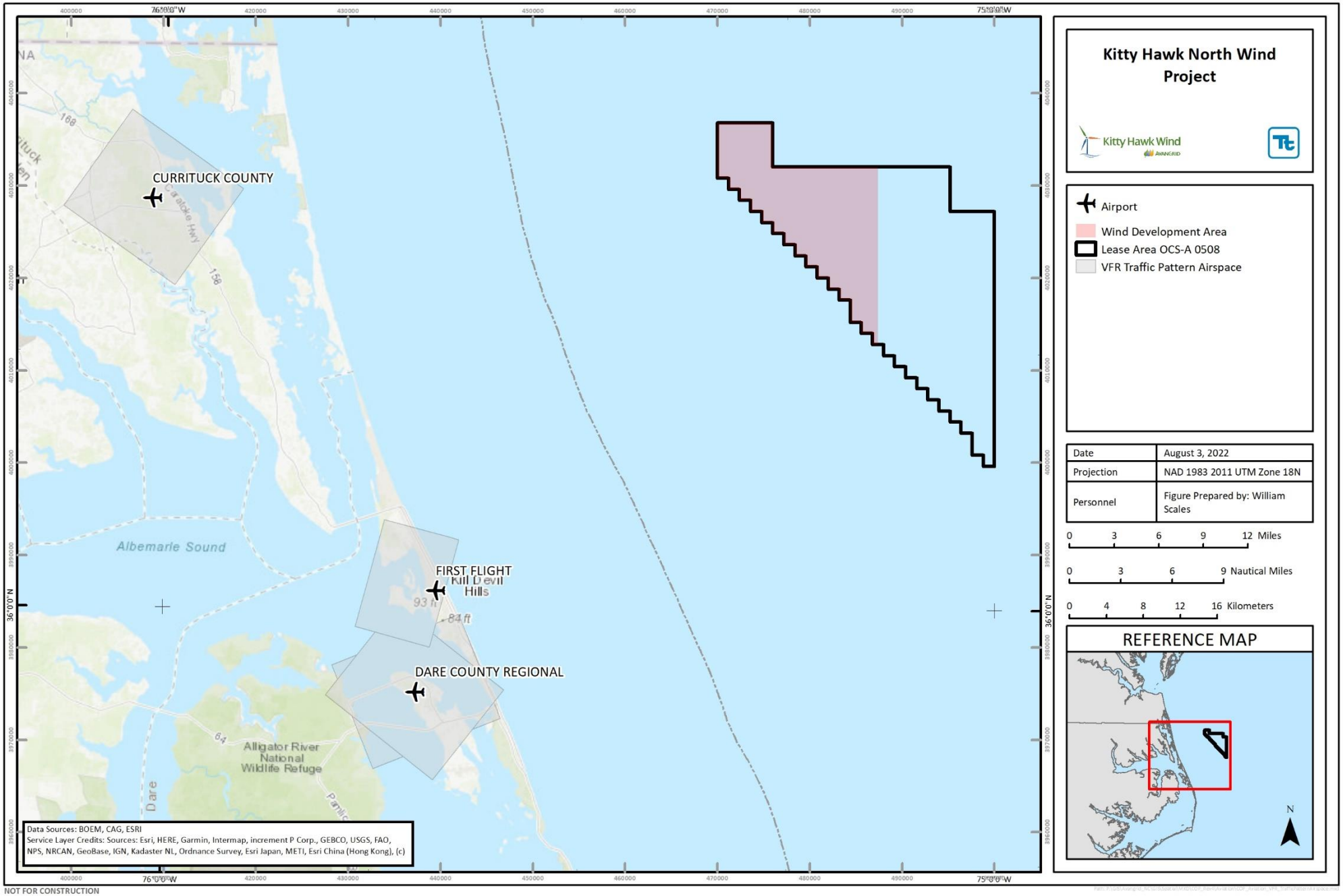


Figure 7.6-4 VFR Traffic Pattern Airspace in Proximity to the Wind Development Area

7.6.1.3 Military Airspace and Training Routes

Although the FAA does not consider impact on military airspace or training routes, they will notify the military of proposed structures located within these segments of airspace (Figure 7.6-5). Warning areas overlying the Project include U.S. Navy, Fleet Area Control and Surveillance Facility, Virginia Capes.[7] The DoD is authorized under 10 U.S.C. § 2684a to enter into agreements to limit encroachments and other constraints on military training, testing, and operations in order to ensure training range sustainability.[8] The Clearinghouse, through consultations with the Company, has provided preliminary feedback as of 25 Aug 2020 in response to a request for informal review of the Project. The Company will continue to engage and coordinate with applicable military contacts to assess potential impacts (see Section 7.4 Department of Defense and Outer Continental Shelf National Security Maritime Uses).

7.6.1.4 Radar

There are several radar systems in the general vicinity of Project, including DoD, FAA, and NOAA radar sites, and High Frequency Coastal Radar sites. In April 2020, an informal review request was submitted to the Siting Clearinghouse to account for the larger WTGs proposed. In a response from the DoD in August 2020, the DoD identified potential impacts to the Advanced Dynamic Aircraft Measurement System at the Naval Air Station Patuxent River and the Relocatable Over the Horizon Radar system in Chesapeake, Virginia. They also identified potential impact to the North American Aerospace Defense Command homeland defense radar. The Company has contracted Westslope Consulting to engage with key stakeholders, including the DoD, to determine potential impacts to radar systems near the Wind Development Area. As the Project matures, the Company will continue to have discussions with the appropriate entities, and the Company is committed to identifying appropriate mitigation measures if necessary.

Westslope Consulting prepared a Radar and Navigational Aid Screening Study (see Appendix Q) to identify whether WTGs in the Wind Development Area may interfere with DoD, FAA, and NOAA radar sites, and High Frequency Coastal Radar sites.

7.6.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For airspace and aviation radar, the maximum design scenario is represented by applying the 69 WTG parameters, as these represent the tallest structures that would be installed in the Wind Development Area. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.6.2.1 Construction

During construction, the potential impacts to aviation and radar may include the following:

- Short-term interference with airspace and aviation radar systems due to the temporary presence of construction equipment onshore and offshore, as well as transportation of Project components to the Wind Development Area.

[7] Route/Airspace Minimum Altitude; W-72A Surface

[8] On 25 Oct 2018, a Record of Decision for the U.S. Navy's National Environmental Policy Act (NEPA) process for the Atlantic Fleet Training and Testing Environmental Impact Statement was published, including the announcement of the decision to conduct training and testing under Alternative I, which will account for the natural fluctuations of training cycles, deployment schedules, and use of synthetic training opportunities. A review of this Environmental Impact Statement did not reveal any substantial changes to policy regarding the development of offshore wind farms.

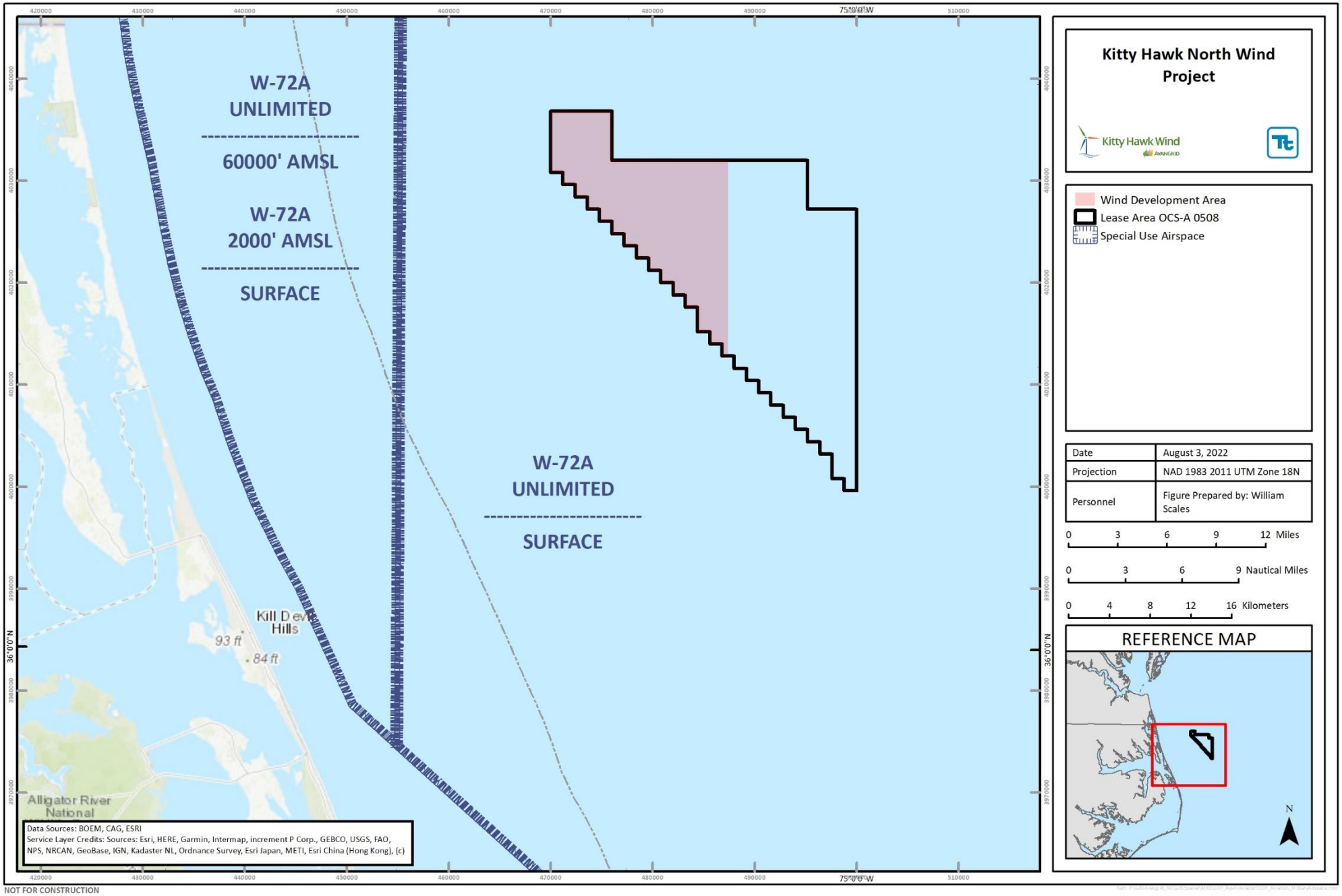


Figure 7.6-5 Military Airspace Near the Offshore Project Area

Short-term interference with airspace and aviation radar systems due to the temporary presence of construction equipment onshore and offshore, as well as transportation of Project components to the Wind Development Area. For short-term construction and/or storage activities in ports and for the onshore substation and switching station, the Project will utilize cranes for assembly and loading/unloading of materials. If the introduction of new crane(s) is required, heights are not anticipated to exceed existing or historical crane heights. It is not anticipated that any short-term direct or indirect impacts would occur. However, if necessary, an additional assessment will be completed to investigate any potential direct airspace or aviation radar system interference that could take place during the transit of Project materials and components. Coordination with local and/or DoD airfields may be required for transit of large materials (e.g., WTG and ESP components) through any affected airspace segments.

The Project has also considered impacts as a result of the presence of large construction equipment (e.g., cranes and barges) offshore. Equipment utilized for offshore construction within the Wind Development Area will not surpass the assessed height of the WTGs. The Company will be in direct communication with applicable agencies and personnel to alert the appropriate parties to planned construction movements and actions. All WTG components and construction equipment will be properly lit and marked in accordance with FAA's Advisory Circular number 70/7460-1L within FAA jurisdiction and beyond, or other methods as deemed required during consultation and as applicable (see Chapter 3 Description of Proposed Activity for additional information on proposed lighting and marking measures).

7.6.2.2 Operations and Maintenance

During operations, the potential impacts to aviation and radar may include the following:

- Long-term interference with regulated airspace due to the presence of fixed structures (WTGs and ESP);
- Long-term interference with regulated aviation radar systems; and
- Long-term interference with DoD, FAA, and NOAA radar site operations.

Long-term interference with regulated airspace due to the presence of fixed structures (WTGs and ESP). Structures within the Wind Development Area will not exceed 317.5 m above mean sea level. As indicated in the Air Traffic Flow Analysis, flight track data indicates that no flights operated within the affected airspace during the one-year study period. This flight total is below the FAA's threshold for a significant volume of operations. Therefore, no long-term direct or indirect impacts are anticipated, and no further mitigation measures are required. The presence of up to 69 WTGs in the Wind Development Area may cause FAA to raise Sector B of the Norfolk Terminal Radar Approach Control Facilities or create an isolation area with a higher segment altitude. In order to mitigate this indirect impact, the Company will coordinate with the FAA to make this required change to the airspace, as necessary. In addition, all WTGs will be properly lit and marked in accordance with FAA's Advisory Circular number 70/7460-1M within FAA jurisdiction and beyond, or other methods as deemed required during consultation and as applicable (see Chapter 3 Description of Proposed Activity for additional information on proposed lighting and marking measures).

Long-term interference with regulated aviation radar systems. WTGs in the Wind Development Area may interfere with the Oceana Air Route Surveillance-4. Since this area is outside of the 22 km territorial airspace, this may require coordination with the FAA but should not be the basis for any hazardous determinations (see Appendix Q Radar and Navigational Aid Screening Study).

Capitol Airspace Group assessed historical FAA radar track data covering the period of one-year (01 Sep 2018 and 31 Aug 2019) to determine the number of operations that could be affected by increasing Norfolk (ORF) Terminal Radar Approach Control Facilities MVAs (Figure 7.6-6). Because the proposed development is up to 317.5 m above mean sea level, it **is anticipated that the proposed** WTGs would not affect a significant volume of Norfolk (ORF) Terminal Radar Approach Control Facilities radar vectoring

operations and there would be no long-term direct or indirect impacts. Therefore, no further mitigation measures are required.

Long-term interference with DoD, FAA, and NOAA radar site operations. In response to a request for informal review, the DoD provided their preliminary feedback in a letter issued on 25 Aug 2020. The letter indicated that the Project may have an impact on military operations in the area, specifically radar operations associated with the Advanced Dynamic Aircraft Measurement System at Naval Air Station Patuxent River and the Re-locatable Over the Horizon Radar system located in Chesapeake, Virginia. There is also a potential impact to the North American Aerospace Defense Command homeland defense radar. Outreach completed to date with the DoD and other key stakeholders is summarized below. The Company will continue to engage and coordinate with applicable military contacts to assess potential impacts (see Section 7.4 Department of Defense and Outer Continental Shelf National Security Maritime Uses).

- *Advanced Dynamic Aircraft Measurement Systems:* The Company and Westslope Consulting had a meeting with the DoD in January 2021, December 2021, and June 2022 to discuss the Advanced Dynamic Aircraft Measurement System and potential interference by WTGs. The DoD plans to study the two operational CVOW Pilot Project (Lease Area OCS-A 0497) WTGs to determine if there is interference and to identify how to update the Advanced Refractive Effects Prediction System model to account for multiple atmospheric data sources across the bay. Potential impacts and mitigation measures, should they be necessary, are still being studied and discussed. The Company will continue working with the DoD.
- *North American Aerospace Defense Command:* The DoD provided informal feedback on the WTG height presented in the PDE. Discussions with North American Aerospace Defense Command surrounding the layout and blade-tip height and potential impacts and mitigation are ongoing. The Company will continue working with the DoD.
- *Virginia Relocatable Over-The-Horizon Radar:* The Company and Westslope Consulting conducted outreach regarding Virginia Relocatable Over-The-Horizon Radar to identify potential impacts and appropriate mitigation, if necessary. In correspondence with DoD, results indicate the Project is acceptable from a Virginia Relocatable Over-The-Horizon Radar perspective. The Company will continue working with the DoD.
- *Oceanographic High-Frequency Radar:* The Company and Westslope Consulting had a meeting with NOAA's Integrated Ocean Observing System in February 2021 and June 2022 to discuss potential oceanographic high-frequency radar concerns. Potential impacts and mitigation measures, should they be necessary, are still being studied and discussed. The Company will continue working with the DoD.
- *Weather Radar:* The National Telecommunications and Information Administration cleared all locations based on the WTG height in a response dated February 2021.

A more detailed discussion of potential impacts associated with the Project is included in Appendix Q, Radar and Navigational Aid Screening Study. The Company is committed to working with the appropriate stakeholders to develop a monitoring and mitigation plan.

7.6.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

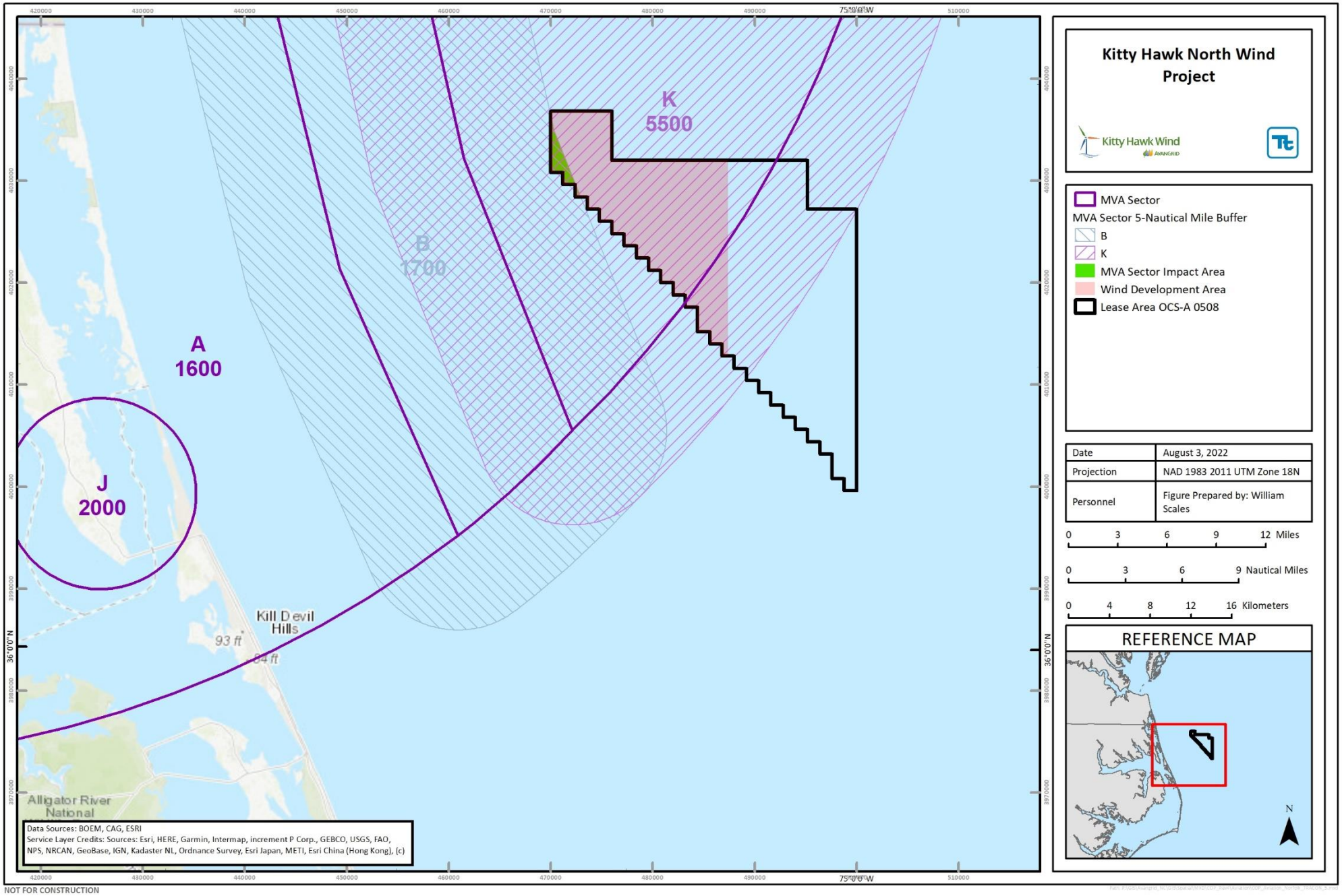


Figure 7.6-6 Norfolk (ORF) Terminal Radar Approach Control Facilities FUSION 5 MVA Sectors

7.7 Other Coastal and Marine Uses

This section describes other coastal and marine uses that may occur within and surrounding the Wind Development Area, including underwater recreational activities (i.e., diving), surface-based marine recreational activities, recreational boating, and offshore wildlife viewing. Potential impacts to these uses resulting from the construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other marine uses discussed in separate sections include:

- Visual Resources (Section 6.4);
- Recreation and Tourism (Section 7.1);
- Commercial and Recreational Fishing (Section 7.2);
- Marine Transportation and Navigation (Section 7.3); and
- Offshore Renewable Energy, Mineral Exploration, and Infrastructure (Section 7.5).

For the purposes of this section, the review area includes the offshore Project components and the areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project.

Data required to complete this analysis comes from the Mid-Atlantic Ocean Data Portal, the Northeast Ocean Data Portal, the Multipurpose Marine Cadastre, Google Earth, and other publicly available data sources.

7.7.1 Affected Environment

7.7.1.1 Marine Recreation

Surface-based marine recreation (e.g. swimming, surfing, kayaking, paddle boarding, windsurfing, kite boarding, recreational boating) takes place along the North Carolina and Virginia coasts. Generally, these activities occur nearshore, in state waters. There are several beach access ramps with associated parking areas located along the North Carolina and Virginia coast, where swimming and other activities mentioned above routinely take place. Recreational activities along the coastline are detailed in Section 7.1 Recreation and Tourism.

These nearshore activities, with the exception of certain recreational boating activities, are not likely to be affected due to Project construction and O&M activities taking place much further offshore. Also, construction and O&M vessel routes are mostly to the north and east of these coastline activities. Common recreational boating routes are shown in Figure 7.7-1 and recreational fishing activities are detailed in Section 7.2 Commercial and Recreational Fishing.

It is anticipated that once construction is completed, recreational vessels may travel to the Wind Development Area to view the WTGs and ESP. However, the distance from the nearest inlet (Oregon Inlet) is more than 60 km west of the Wind Development Area. The second closest inlet is Rudee Inlet at Virginia Beach (located 70 km northwest of the Wind Development Area), followed by the mouth of the Chesapeake Bay (located 84 km northwest of the Wind Development Area). Although there are several smaller inlets along the Eastern Shore Peninsula of Virginia (including Smith Inlet, 88 km, and Little Inlet, 90 km northwest of the Wind Development Area), they are shallow, unmarked, and only recommended to be used with local knowledge (Blue Seas 2020).

Other North Carolina inlets are located much further to the south, beyond Cape Hatteras, with distances to the closest point of the Wind Development Area ranging from 140 to 444 km (Marinas.com 2020).

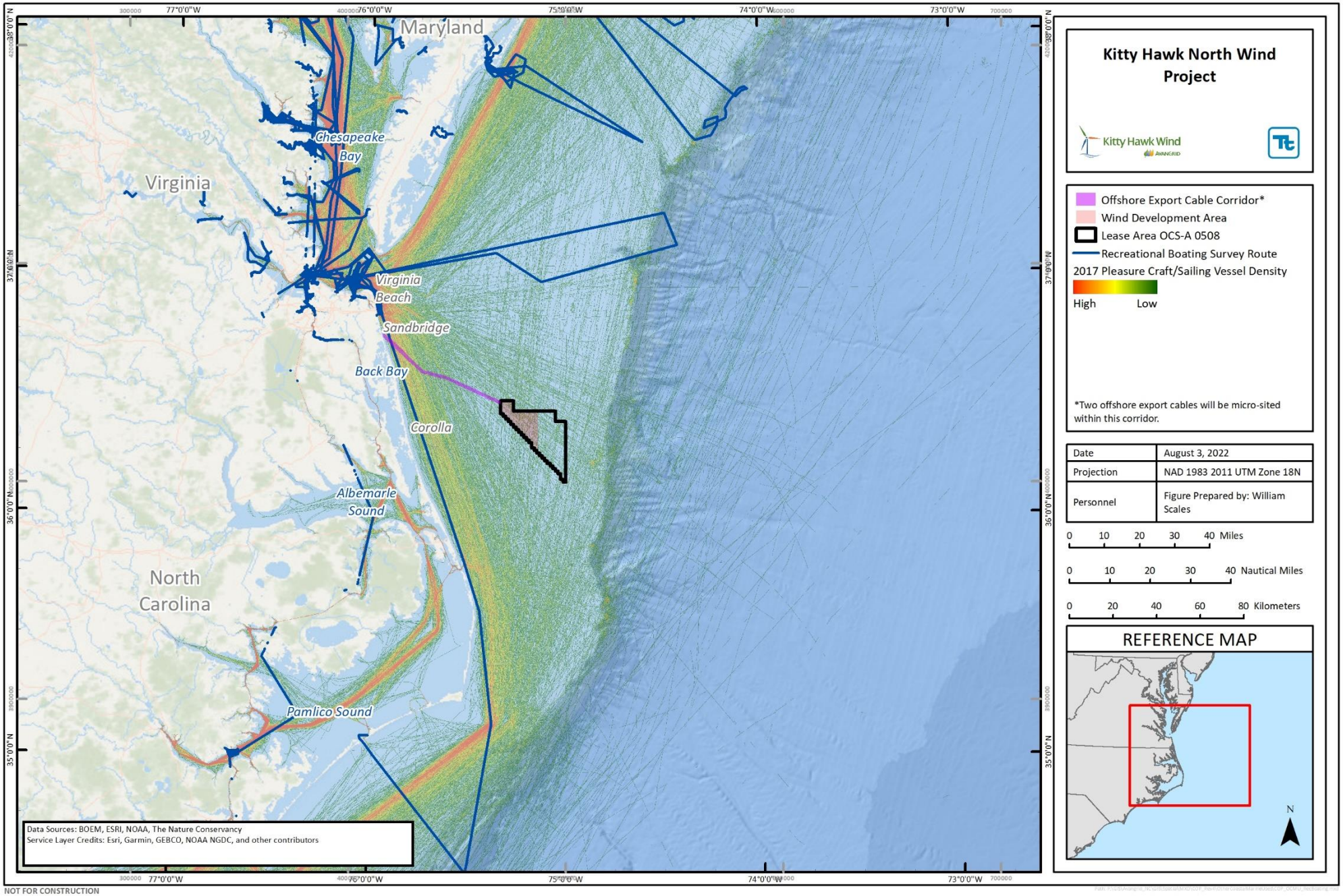


Figure 7.7-1 AIS Pleasure Craft/Sailing Vessel Density - 2017

The Mid-Atlantic Ocean Data Portal reveals that there is substantial recreational boating traffic through the Intracoastal Waterway in North Carolina. This is likely due to fact that the Intracoastal Waterway provides a safer alternative for those vessels in seasonal transit to warmer waters during the winter. It is common for such vessels to avoid open ocean transits off the North and South Carolina coasts during winter months. The Mid-Atlantic Ocean Data Portal also shows recreational vessel traffic is typically concentrated closer to shore (Figure 7.7-1). However, there are some recreational vessels transiting through the Wind Development Area in much smaller numbers, according to available AIS data (see Appendix BB Navigation Safety Risk Assessment).

7.7.1.1.1 Yacht Racing

Long-distance offshore yacht racing events, such as the Annapolis to Newport Race (Annapolis Newport Race 2019), the Newport Bermuda Race (Bermuda Race Organizing Committee 2019), the Marion to Bermuda Race (Marion - Bermuda Cruising Yacht Race Association, Inc. 2020), and the Bermuda One-Two© Race (Bermuda One-Two Yacht Race 2020) run well to the north and to the east of the Wind Development Area. There is no impact to these events expected due to the presence of the WTGs and ESP. Local yacht races are generally conducted within the Chesapeake Bay. An online search of yacht clubs in North Carolina and the Chesapeake Bay area found that there are no North Carolina or Virginia yacht clubs along the northern coast of North Carolina or the Chesapeake Bay area (with offshore yacht racing programs) that could potentially route racing sailboats near the Wind Development Area.

7.7.1.2 Underwater Recreation

In the waters off of Virginia and North Carolina, underwater recreation, including diving and snorkeling, occurs year-round. Recreational diving occurs along the Virginia and North Carolina coasts and is supported by several local dive companies that offer dive charters to popular dive spots near shore. An online search of dive shops found that the dive shops closest to the Wind Development Area are located in Manteo, North Carolina; Wanchese, North Carolina, and Virginia Beach, Virginia. Both Virginia and North Carolina waters offer artificial reefs, shipwrecks, ledges, and underwater wildlife viewing accessible to divers by boat and from shore. Some nearshore dive sites exist with access from local beaches and access points.

Local dive shops indicate that wreck diving is a popular sport for advanced divers with more than 20 well known offshore wrecks located off the North Carolina and Virginia coasts. These wreck locations range from the shoreline to more than 60 km offshore. (Figure 7.7-2) shows shipwreck locations in the vicinity of the Wind Development Area. Several of the most visited shipwrecks along the North Carolina coast are located generally west and south of the Wind Development Area; from Nags Head along the Outer Banks to Beaufort, North Carolina (NC Wreck Diving 2020). None of these popular dive sites are located within the Wind Development Area. However, there is one snorkeling area near where the export cables make landfall (Point 97 et al. 2013). Known dive sites, artificial reefs, and wrecks are shown in relation to the Project in Figure 7.7-2.

Section 6.1 Marine Archaeological and Cultural Resources further discusses the shipwrecks located in and near the Wind Development Area.

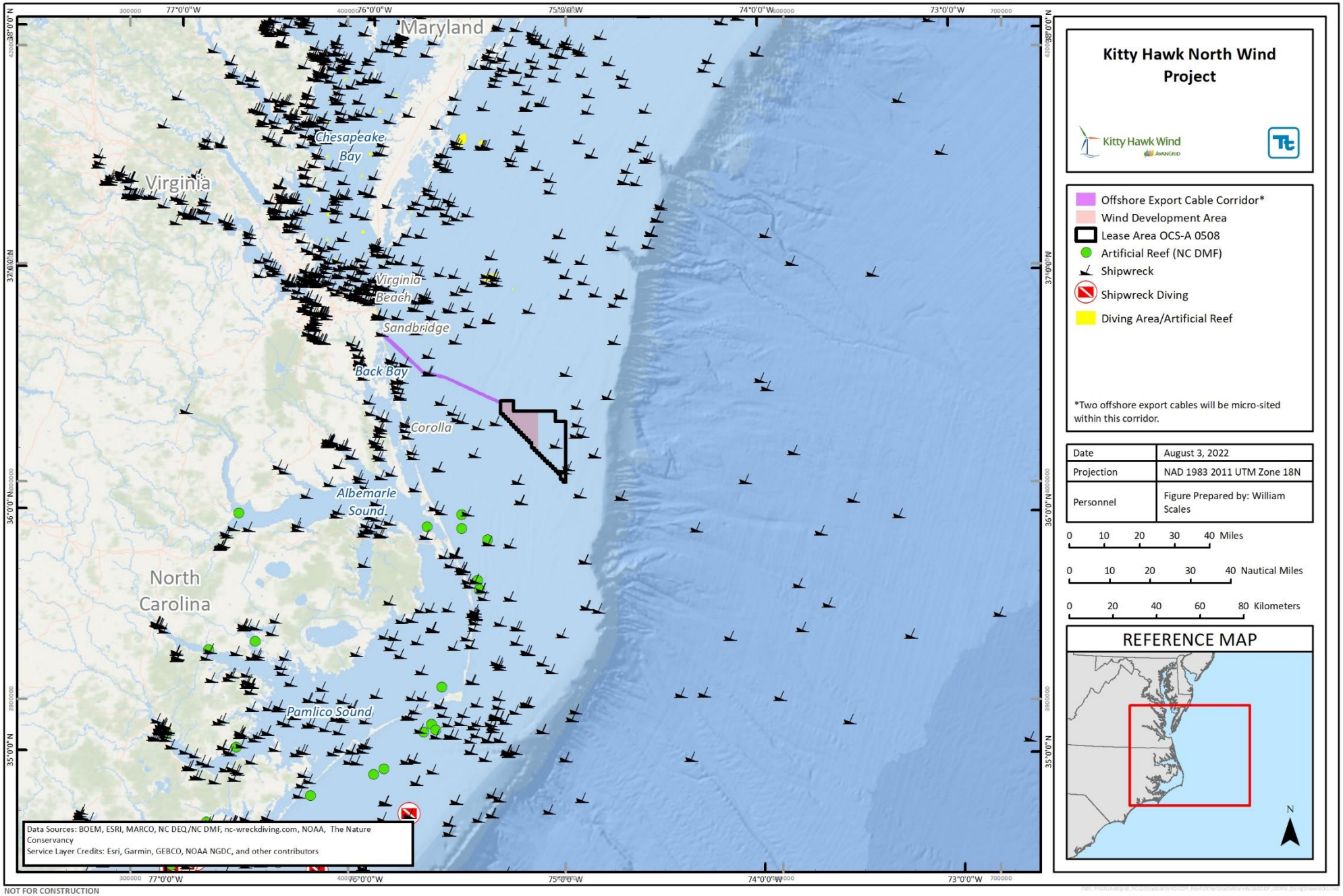


Figure 7.7-2 Dive Sites, Artificial Reefs, and Wrecks

7.7.1.3 Offshore Wildlife Viewing

7.7.1.3.1 Whale Watching

Whale watching tours located closest to the Wind Development Area are available from Norfolk, Virginia and Rudee Inlet, Virginia. Prime viewing opportunities for whales typically occur from November through February and for dolphins from June through September. There are also whale, dolphin, and general sightseeing tours that depart from inlets well to the south of Wind Development Area, including those from Hatteras, Nags Head, and Beaufort. Virginia whale watch operators promote tours that stay close to shore and generally remain within sight of land (Rudee Tours 2020; Virginia Aquarium 2020).

7.7.1.3.2 Other Wildlife Tours

In addition to the many shoreline bird watching opportunities along the North Carolina and Virginia coastlines, seabirding tours are also available to search for pelagic birds offshore. One tour company offers boat tours that depart from Hatteras Landing Marina in Hatteras, North Carolina; Wanchese, North Carolina; and Oregon Inlet, North Carolina. It is unclear how close these tours come to the Wind Development Area as the tour routes follow the migration paths of the birds. Generally, tours travel east towards the edge of the continental shelf and back to shore (Seabirding 2020). See Section 5.3 Bat and Avian Species for further discussion of bird migration routes.

7.7.1.3.3 Sightseeing

There are also several companies offering evening sunset cruises off the coast of Virginia Beach. These tours generally last less than 2 hours and stay close to the shore (Rudee Tours 2020).

7.7.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For this impact analysis, the maximum design scenario is the full build out of the offshore Project features, including offshore export cables, WTGs, and the ESP. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.7.2.1 Construction

During construction, the potential impacts to coastal and marine uses may include the following:

- Short-term increase in Project-related vessel traffic;
- Short-term displacement of marine users due to the implementation of safety zones around Project-related vessels and structures;
- Short-term impacts to nearshore and beach area access;
- Short-term changes in water quality; and
- Short-term disturbance and displacement of local species targeted for wildlife viewing.

Short-term increase in Project-related vessel traffic. Construction and support vessels will transit to and from the Wind Development Area and offshore export cable corridor, resulting in a temporary increase in vessel traffic. Project-related vessels will originate from existing ports and will follow existing transit lanes as much as is practicable. Therefore, vessel traffic will generally remain consistent with existing uses. The change in the number of vessels is not expected to present a significant increase from baseline levels and not anticipated to impact other marine uses, such as recreational and wildlife viewing activities (see Section 7.3 Marine Transportation and Navigation and Appendix BB Navigation Safety Risk Assessment). The Company will schedule and control Project-related vessels to best manage congestion and traffic flow in coordination with the USCG. Where practical, Project vessels will utilize TSS, fairways (should they be developed), and predetermined passage plans consistent with existing waterway uses. LNMs will be published by the USCG to inform mariners of Project activities in the area. This level of coordination has been successfully implemented during the Project survey campaigns. Additionally, the Project website will

be updated regularly so that mariners know what work is being done in the various offshore Project locations.

Short-term displacement of marine users due to the implementation of safety zones around Project-related vessels and structures. During offshore construction, temporary safety zones will be implemented, as appropriate, around foundations and stationary construction vessels,[9] and, where feasible, a minimum advisory safe passing distance for cable laying vessels will be implemented, as per the COLREGs. Where USCG Safety Zone authorities are not applicable, the Company will use safety vessels to promote awareness of these activities and provide safety for the construction equipment and personnel. These activities may temporarily and directly displace recreational coastal and marine users in the immediate vicinity of Project installation activities. However, as the majority of construction will occur in the Wind Development Area, approximately 44 km offshore, and since most offshore recreation occurs much closer to shore, construction in the Wind Development Area is not expected to result in significant impacts to recreational users. Potential impacts to recreational fishing are further discussed in Section 7.2 Commercial and Recreational Fishing.

Installation of the offshore export cables will be linear, and vessels will not remain in one place for long. Impacts from these associated safety zones will be short-term and localized. The locations of offshore equipment and vessels, as well as safety zones, will be posted in LNMs and on the Project website. The Project website will be updated regularly so that mariners know what work is being done in the various offshore Project locations. The Company will also maintain active communications and updates with the fishing community as described in the Fisheries Communications Plan.

Short-term impacts to nearshore and beach area access. During installation of certain components of the export cables, nearshore and beach areas may be temporarily disturbed. Safety zones will be implemented as appropriate around active construction sites, which may displace users of the onshore and nearshore areas near Project construction. The public will be prevented from entering onshore construction zones for safety (See Section 7.12 Health and Safety and Low Probability Events). This disturbance will be temporary and localized. Additionally, onshore construction activities associated with export cable landfall will be scheduled during the off-peak tourism season, to the extent practicable. Use of horizontal directional drilling to complete landfall of the export cables will also minimize impacts to the Sandbridge Beach area.

Short-term changes in water quality. During construction, water quality may be temporarily impacted as a result of seabed disturbances or from potential oil and fuel spills or releases from Project vessels. Seabed disturbance may result in the potential release of contaminants into the water column. Cable laying activities may result in suspended sediment in the water column. However, suspended sediment is anticipated to be temporary and localized, with approximately 75 percent of suspended sediment settling within two minutes and water quality returning to pre-installation levels within four hours. These projections are further detailed in Section 4.2 Water Quality. Project-related vessels will be subject to USCG regulations about wastewater handling and discharges and will operate in compliance with oil spill prevention and response plans that meet USCG requirements.

Temporary impacts to water quality may disturb marine users along the nearshore areas, including those used for recreational swimming, bathing, and recreational watersports. However, safety zones established around installation activities, where applicable, will reduce and minimize impacts to recreational users. To reduce the risk of accidental releases, construction personnel will undergo training prior to the start of activities. Secondary containment measures will be in place on construction sites for oils and greases in accordance with state and federal regulations. Spill response kits will also be present at all construction sites. Additionally, hazardous materials will be transported to and from the construction sites in water-tight

[9] Where applicable, safety zones will extend up to 500 m around construction sites, per 33 CFR § 147.15. All areas will be lit and marked in accordance with USCG requirements and monitored by a safety vessel that will be available to assist local mariners. Vessels will not be permitted to enter the safety zone without express consent from the Company.

containers. Prevention and response measures for accidental releases will be further detailed in Appendix I Oil Spill Response Plan.

Short-term disturbance and displacement of local species targeted for wildlife viewing. Construction and installation activities may temporarily disturb the distribution of local species of interest, including birds, marine mammals, and fish (see Chapter 5 Biological Resources). This may result in impacts to marine users observing or interacting with these species. Species are anticipated to temporarily avoid construction areas and are expected to return to these areas after construction and installation has completed. As the Company anticipates the use of safety zones around construction areas where applicable, impacts to marine users are anticipated to be temporary and localized.

7.7.2.2 Operations and Maintenance

During operations, the potential impacts to coastal and marine uses may include the following:

- Long-term modification of existing uses;
- Long-term increase in vessel traffic;
- Increase in tourism due to the presence of new fixed structures (e.g. WTGs and ESP) in the Wind Development Area; and
- Potential attraction of fishers to foundations due to eventual build-up of biofouling and subsequent attraction of fish.

Long-term modification of existing uses. The long-term presence of WTGs and the ESP may impact navigation within the Wind Development Area. As most offshore recreation occurs much closer to shore, the presence of these structures is not expected to result in significant impacts to recreational users (see Appendix BB Navigation Safety Risk Assessment). Users will not be excluded from using the area and existing uses will be able to continue during Project operations.

Long-term increase in vessel traffic. The Project will result in the long-term presence of O&M vessels within the Wind Development Area and in transit to and from shoreside support locations. This will result in an increased number of Project vessel encounters, with the potential for a corresponding risk of collisions. There may also be an infrequent need for a cable-laying vessel to inspect, repair, and/or replace the inter-array and/or export cables during the useful life of the Project. This could temporarily displace marine users. The Company will monitor Project vessel movements during O&M activities in and near the Wind Development Area via a marine management system. LNMs will be published by the USCG to inform mariners of these and other Project activities.

Increase in tourism due to presence of new fixed structures (e.g. WTGs and ESP) in the Wind Development Area. The presence of new fixed structures within the Wind Development Area has the potential to attract new marine users visiting the area as a tourist attraction. Discussed in Section 7.1 Recreation and Tourism, this has been observed occurring at the Block Island Wind Farm, located off the coast of Rhode Island. As a result of the WTGs offshore of Block Island, tourism to the island increased, boat charters and rentals increased, and new businesses have emerged to support new tourist demand (Brookins 2017). This increase in recreation and tourism has brought economic benefits to Block Island, as tourists pay for boat tours to see the offshore wind farm (Lilley et al. 2010). Similarly, a study of projected offshore wind facilities in New Jersey predicted that a wind facility located 32 km offshore would increase tourism sales by up to $65 million statewide (Global Insight 2008).

Potential attraction of fishers to foundations due to eventual build-up of biofouling and subsequent attraction of fish. The presence of new fixed structures within the Wind Development may result in the aggregation of certain fish species due to the building of biofouling over time. As stationery objects, the structures act as artificial reefs, providing hard surfaces and habitat for algae, fish, and invertebrates to congregate. A similar phenomenon has been observed on most offshore oil rigs and offshore wind structures located in the Gulf of Mexico and the North Sea. This may also result in the aggregation of

commercially and recreationally important species, and thus attract fishers to the Wind Development Area for fishing (van der Strap et al. 2016). Through its fisheries outreach efforts within the coastal community, the Company has become aware of spearfishing and recreational diving activities occurring at the CVOW Pilot Project WTGs, located approximately 46 km northwest of the Wind Development Area. The Company anticipates that spearfishing and recreational diving activities may similarly occur within the Wind Development Area after WTGs are installed. Additionally, scour protection in the Wind Development Area will create new hardbottom habitat and may attract new species, which also has the potential to increase fishing opportunities in the area. See Section 7.2 Commercial and Recreational Fishing for more details.

7.7.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.8 Population, Economy, Employment, and Housing

This section describes the population, economy, employment, and housing and property values within and surrounding the Project Area. Potential impacts to these resources resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP that are related to population, economy, employment, and housing and property values include:

- Recreation and Tourism (Section 7.1);
- Environmental Justice (Section 7.9);
- Land Use and Zoning (Section 7.10);
- Land Transportation and Traffic (Section 7.11);
- Health and Safety and Low Probability Events (Section 7.12); and
- Economic Impact of Kitty Hawk Offshore Wind (Appendix EE).

For the purposes of this section, the review area includes the cities and county in which the onshore Project Area and ports expected to be used for construction and O&M are located. This area consists of the independent cities of Virginia Beach, Norfolk, and Portsmouth, as well as the town of Cape Charles in Northampton County, all located in Virginia.

This section was prepared in accordance with BOEM's *Information Guidelines for a Renewable Energy Construction and Operations Plan* (2020). Information required to complete this analysis comes from the U.S. Census Bureau and studies related to offshore wind development.

7.8.1 Affected Environment

The Commonwealth of Virginia is comprised of 95 counties and 38 independent cities that are considered county-equivalents (VACo 2020). The onshore Project components will be located in Virginia Beach, Virginia. Virginia Beach is a coastal independent city in the southeast corner of the Commonwealth of Virginia, where the Chesapeake Bay meets the Atlantic Ocean.

The Project will utilize various ports in the lower Chesapeake Bay area for staging of Project components and construction vessels. Locations under consideration include Hampton Roads (in the independent city of Norfolk, Virginia); Elizabeth River (in the independent city of Portsmouth, Virginia); Cape Charles (in Northampton County, Virginia); and Cape Henry (in Virginia Beach, Virginia; Figure 7.8-1).

The Company is considering the following locations for O&M facilities: Portsmouth, Virginia; Newport News, Virginia (an independent city in Virginia); Cape Charles, Virginia; and Chesapeake, Virginia (an independent city in Virginia, Figure 7.8-1). A final determination regarding the suitable location of the O&M facility will be made upon conclusion of thorough site assessments and due diligence of all locations under consideration.

Table 7.8-1 summarizes the areas that could be affected by the Project.

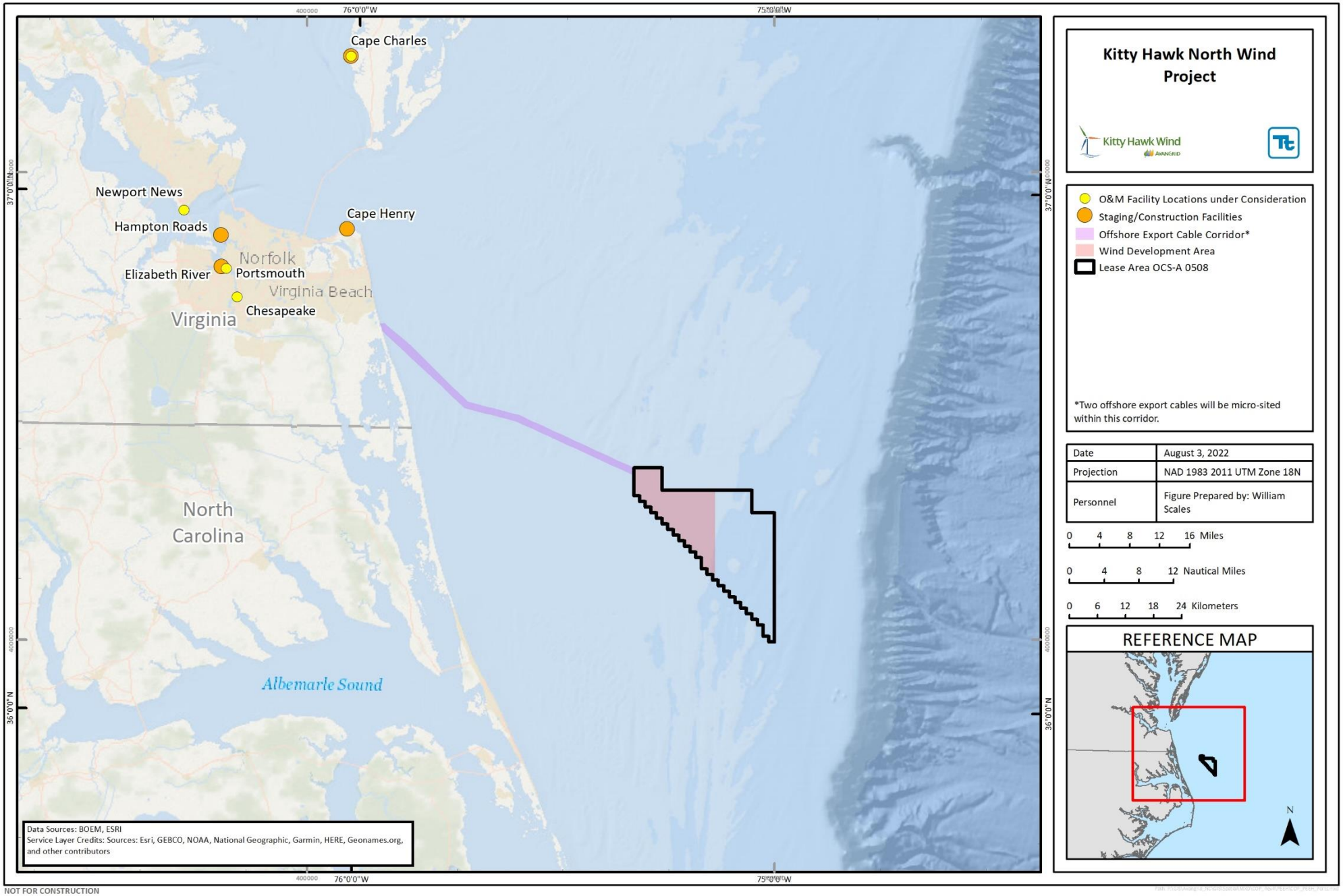


Figure 7.8-1 Potential Project Port Locations

Table 7.8-1 Geographic Areas to be Affected by Project Infrastructure and/or Activities

Location	Onshore Export Cables	Onshore Substation and Switching Station	Staging/ Construction Facilities	O&M Facilities
Virginia	**X**	**X**	**X**	**X**
Northampton County (Cape Charles)			X	X
Virginia Beach a/	X	X	X	
Norfolk (Hampton Roads)			X	
Portsmouth (Elizabeth River)			X	X
Newport News				X
Chesapeake				X

Note:
a/ The onshore Project components will be located in Virginia Beach. In addition, Cape Henry, which is located within the City of Virginia Beach, may be used for staging/construction facilities.

7.8.1.1 Population, Economy, and Employment

Virginia Beach had a total estimated population of 449,974 in 2019, making it the largest independent city and the third largest county/independent city in Virginia in terms of population (Table 7.8-2). Population in the other affected cities/county ranged from 1,145 (Cape Charles, with 11,710 in Northampton County) to 244,835 (Chesapeake). Population densities ranged from just 5.7 persons per square km (Northampton County) to 972.2 persons per square km (Norfolk). Population densities in all five affected independent cities were substantially higher than the state average (U.S. Census Bureau 2018, 2019a).

The affected areas have lower per capita and median household incomes than the corresponding state figures, with the exception of Virginia Beach, which has a slightly higher median household income (104 percent of the state median), Chesapeake, which has a slightly higher mean household income (106 percent of the state median average), and Cape Charles, which has a slightly higher per capita income (112 percent of the state median). Estimated unemployment rates were below the state average in Northampton County and Virginia Beach, while rates in Norfolk, Portsmouth, Chesapeake, and Newport News were higher.

The combined educational services, health care and social assistance sector was identified by the U.S. Census as the top economic sector in Virginia and the affected cities/county based on total employment. Three other economic sectors were identified as highly present as secondary sectors: professional services; retail; and arts, entertainment, recreation, accommodation and food services (Table 7.8-2).

7.8.1.2 Housing and Property Values

Housing resources are summarized by city, county, and state in Table 7.8-3. Data on housing units are annual estimates for 2018 prepared by the U.S. Census Bureau using 5 years of data (2014 through 2018) (U.S. Census Bureau 2019b, 2019c). The U.S. Census Bureau defines a housing unit as a house, apartment, mobile home or trailer, group of rooms, or single room occupied or intended to be occupied as separate living quarters. These data suggest that rental housing is available in Virginia Beach, Norfolk, Portsmouth, Chesapeake, and Newport News with numerous housing units also available for sale. Housing availability is limited in Northampton County, with an estimated rental vacancy rate of 0.4 percent and less than 10 units available for rent. Additional units classified for seasonal, recreational, or occasional use may also be available in the review area (Table 7.8-3).

Table 7.8-2 Existing Economic Conditions in the Review Area

Geographic Area	Total Population (2019 annual estimates)	Population Density (persons per square kilometer) a/	Per Capita Income	Median Household Income	Civilian Labor Force	Unemployment Rate	Top 3 Industries b/
Virginia	**8,535,519**	**199.5**	**$37,763**	**$71,564**	**4,336,393**	**5.0%**	**E, P, R**
Northampton County	11,710	5.7	$26,467	$43,553	5,053	3.1%	E, R, A
Cape Charles	1,145 c/	122.1	$42,337	$57,188	476	5.3%	E, P, A
Virginia Beach	449,974	349.6	$36,268	$74,186	231,348	4.9%	E, P, R
Norfolk	242,742	972.2	$28,508	$49,146	114,289	8.2%	E, A, R
Portsmouth	94,398	780.8	$25,179	$50,224	45,600	9.2%	E, R, M
Newport News	179,225	578.6	$26,993	$51,884	87,670	6.7%	E, M, R
Chesapeake	244,835	269.3	$33,844	$75,790	116,386	5.1%	E, P, R

Notes:

a/ Population density was calculated using the total population amounts and the square km of each location.

b/ E = Educational Services, and health care and social assistance; P = Professional, scientific, and management, and administrative and waste management services; R = Retail trade; A = Arts, entertainment, and recreation, and accommodation and food services; M = Manufacturing

c/ The most recent data was extracted from the 2018 5-year population estimates rather than the 2019 annual population estimates.

Sources: U.S. Census Bureau 2019a, 2019b

Table 7.8-3 Estimated Annual Housing Units and Vacancy Rates

Geographic Area	Total housing units	Homeowner vacancy rate	Rental vacancy rate	For sale	For rent	For seasonal, recreational, or occasional use a/
Virginia	3,491,091	1.6	5.6	33,483	63,404	88,357
Northampton County	7,397	2.0	0.4	70	8	961
Cape Charles	989	9.5	1.1	33	3	267
Virginia Beach	183,906	1.8	4.9	1,973	3,173	3,158
Norfolk	97,257	2.9	6.3	1,150	3,426	438
Portsmouth	40,895	3.4	7.2	697	1,308	56
Newport News	77,664	3.0	9.5	1,066	3,744	142
Chesapeake	89,882	1.4	6.1	879	1,597	236

Note: a/ Housing units for seasonal, recreational, or occasional use are generally considered to be vacation homes. They are not included in the estimated number of housing units available for rent.
Sources: U.S. Census Bureau 2019c, 2019d

Rental housing options may also include other special living situations, such as peer-to-peer housing units (i.e., Airbnb, Vrbo, etc.) and spare bedrooms in homes that residents would be willing to rent to construction workers. These types of potential housing opportunities are not included in the data presented in Table 7.8-3. Temporary housing is also available in the vicinity of the Project Area in the form of hotel and motel rooms, and recreational vehicle and other types of campsites.

Estimated median home values for owner-occupied units are shown in Table 7.8-4. The median home values in Virginia Beach, Cape Charles, and Chesapeake are higher than the state median. Median home values in the other cities and Northampton County are lower, ranging from 62 percent (Northampton County) to 75 percent (Norfolk) of the state median. Median rents for renter-occupied units have a similar distribution. Median rent in Virginia Beach and Chesapeake are higher than the state median; rents in the other cities and county are lower than the state median (Table 7.8-4).

Table 7.8-4 Estimated Annual Housing Value and Rental Rates

Geographic Area	Owner-Occupied Units	Renter-Occupied Units	Median Value of Owner-Occupied Units (Dollars)	Median Rent (Dollars) a/
Virginia	2,070,879	1,057,536	264,900	1,202
Northampton County	3,371	1,780	164,000	736
Cape Charles	298	281	339,800	789
Virginia Beach	108,486	60,804	274,300	1,339
Norfolk	38,029	50,126	199,400	1,031
Portsmouth	19,810	16,661	171,800	1,027
Newport News	34,043	35,281	193,100	1,008
Chesapeake	60,083	24,147	265,600	1,235

Note: a/ Median rent values are for renter-occupied units only.
Source: U.S. Census Bureau 2019c

7.8.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For this impact analysis, the maximum design scenario is the full build out of the onshore and offshore Project components. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.8.2.1 Construction

During construction, the potential impacts to population, economy, employment, and housing and property values may include:

- Short-term increase in spending on construction materials and services and related economic activity in the state and region;
- Short-term increase in construction-related employment and income in the state and region;
- Short-term increase in tax revenues for state and local governments;
- Short-term increase in the demand for housing;
- Short-term increase in the demand for public services; and
- Potential short-term effects to property values.

Short-term increase in spending on construction materials and services and related economic activity in the state and region. An economic impact analysis prepared on behalf of the Company estimates that development of the Project will involve total related spending of $503 million and $338 million in Virginia and the Hampton Roads metropolitan statistical area (MSA), respectively, with $293 million and $224 million of these totals considered net new spending over a six-year period (see Appendix EE Economic Impact of Kitty Hawk Offshore Wind).[10, 11] These totals include estimated in-state and regional expenditures for WTG foundations, the onshore substation, onshore O&M facilities, engineering and surveying, permitting, legal, land, and other components (Appendix EE).

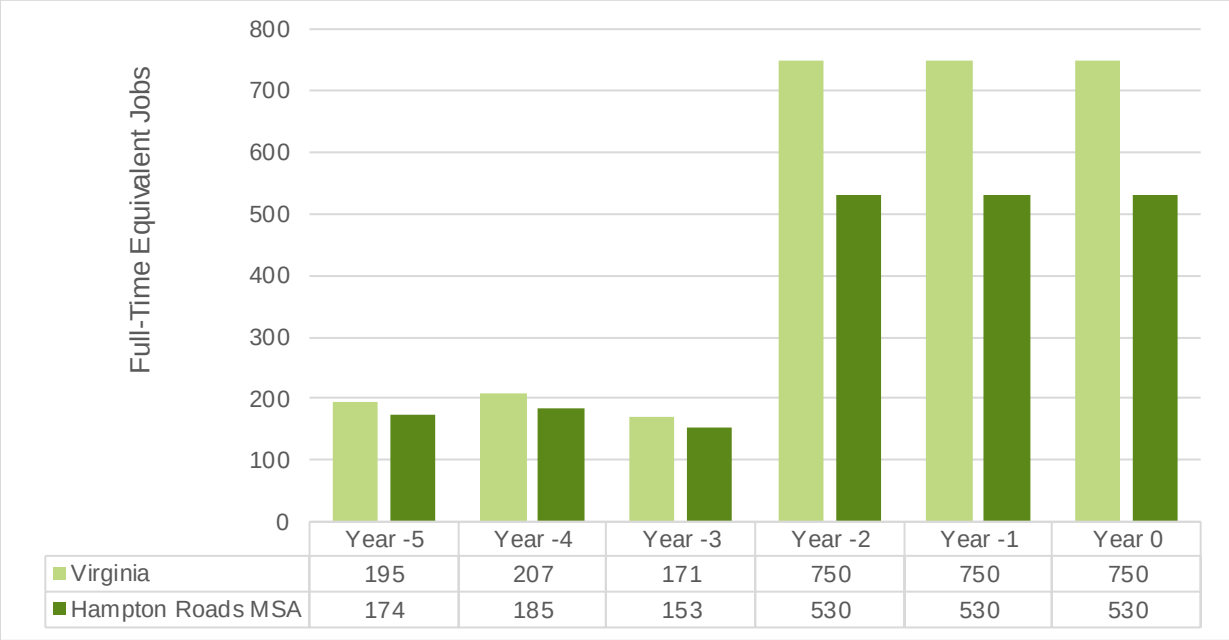
These expenditures will also generate economic activity elsewhere in the state and regional economies through the multiplier effect, as suppliers purchase goods and services to meet the demand, resulting in total (direct and indirect) estimated sales (economic output) of approximately $503 million in Virginia and $338 million in the Hampton Roads MSA during the construction of the Project (Appendix EE).

Short-term increase in construction-related employment and income in the state and region. Construction-related expenditures will also support jobs and income in Virginia and the Hampton Roads MSA. The economic impact analysis prepared on behalf of the Company estimates that expenditures over the construction period will support an estimated total of 2,822 full-time equivalent (FTE) jobs or job-years in Virginia, with 2,102 job-years supported in the Hampton Roads MSA.[12]

Viewed by year, the estimated job-years supported in Virginia will range from 171 (Year -3) to 750 (Years -2 through 0) (Figure 7.8-2). Construction-related expenditures and associated employment are expected to peak in Year -2 through Year 0. Estimated jobs supported in the Hampton Roads MSA follow a similar pattern, ranging from 153 (Year -3) to 530 (Year -2 through 0) job-years (Figure 7.8-2). Construction-related

[10] The area referred as the Hampton Roads MSA in the economic impact analysis is formally known as the Virginia Beach-Norfolk-Newport News VA-NC MSA. This area consists of six counties and 10 independent cities (county-equivalents) in Virginia, as well as three counties in North Carolina (HRPDC 2013). This area includes the independent cities of Portsmouth, Virginia Beach, and Norfolk, but does not include Northampton County.
[11] The economic analysis prepared for the Project adjusted estimated in-state and regional expenditures to account for the effects of substitution. Substitution in this context occurs when Project-related expenditures displace economic activity that would otherwise have occurred.
[12] FTE jobs represent 2,080 hours of employment. Part-time and temporary jobs represent a fraction of a job. For example, if an engineer works just three months on an offshore wind project, that would be considered one-quarter of an FTE job. FTEs are also sometimes referred to as job-years.

expenditures will also result in an estimated total of $132 million in labor income in Virginia and $93 million in the Hampton Roads MSA (Appendix EE Economic Impact of Kitty Hawk Offshore Wind).



	Year -5	Year -4	Year -3	Year -2	Year -1	Year 0
Virginia	195	207	171	750	750	750
Hampton Roads MSA	174	185	153	530	530	530

Figure 7.8-2 Estimated Employment Supported by Construction-Related Expenditures in Virginia and the Hampton Roads MSA

The above estimates are for those jobs that would be directly and indirectly supported by estimated in-state and regional expenditures for WTG foundations, the onshore substation, onshore O&M facilities, engineering and surveying, permitting, legal, land, and other components. The majority of these jobs are expected to be filled by workers normally resident in Virginia and the Hampton Roads MSA, respectively. Some workers, particularly those employed in on-site construction activities, may temporarily relocate to the review area for the duration of their employment. Workers' incomes are expected to be recirculated into the local economy through living expenses, recreation and leisure, and other expenditures.

These job estimates do not include all workers that would be directly employed on the Project. Workers not fully accounted for in these estimates include those who may be employed during installation and commissioning. The installation and commissioning phase includes final assembly of the WTGs onshore; transport of the foundations, towers, WTGs, and cables to the offshore site; installation of all components at the offshore site; and commissioning of the facility. A recent study estimated that approximately 86 percent of installation and commissioning jobs involve construction and marine labor trade workers, with the remaining 14 percent made up by management and support personnel (BVG Associates et al. 2017). Trade workers include electrical and mechanical fitters, crane operators, riggers, vessel skippers and deck hands, marine engineering technicians, and wind turbine technicians. Management and support personnel include workers employed in construction management, health and safety, logistics, and engineering. The same study estimated that the annual installation of 600 megawatts in offshore wind capacity off the coast of New York would support 139 FTE direct jobs, the majority (86 percent) of which would employ trade workers (BVG Associates et al. 2017).

The above estimates developed by BVG Associates et al. suggest that Project installation and commissioning could support approximately 600 FTE direct jobs in addition to those identified in Figure 7.8-2, with the associated investment also supporting additional indirect or secondary jobs in the state and regional economies. The specific tasks associated with installation and commissioning and some

other construction-related tasks (such as WTG and ESP foundation work) are anticipated to be new to Virginia workers, but current workforce skills for trade workers are likely to be transferable in many cases. Trainings undertaken in support of the offshore wind industry would prepare local workers with the skills necessary for work on future offshore wind projects in the area. In other cases, skilled, experienced workers would likely be hired from outside the state and region and would temporarily relocate to the review area for the duration of their employment on the Project.

Short-term increase in tax revenues for state and local governments. Construction and operations of the Project will generate an estimated $32 million in tax revenues for state and local governments, with an estimated $18 million paid to the Commonwealth of Virginia and $14 million paid to the City of Virginia Beach. Estimated state-level tax revenues consist of sales tax and personal income tax. Sales tax is estimated based on construction-related expenditures on materials and in-state spending of household earnings that will be supported by construction and operations, with the development phase expected to generate an estimated $8.1 million in sales tax revenue over a six-year period. New household earnings will also be subject to state income tax and are estimated to generate a total of $9.9 million in income tax revenues during the construction phase (six years) (Appendix EE Economic Impact of Kitty Hawk Offshore Wind).

Estimated local tax revenues consist of property taxes that will be levied by the City of Virginia Beach on the Project components that will be built onshore. Property taxes on these facilities are estimated to generate a total of $14.3 million in revenues during Project construction (six years).

Short-term increase in the demand for housing. The temporary relocation of workers to the review area may result in an increased demand for temporary housing resources. Workers temporarily relocating to the area will likely seek a range of temporary accommodations, including rental housing (houses, apartments, mobile homes), hotel/motel rooms, and recreational vehicle parks/campgrounds, as well as other special living situations such as peer-to-peer housing units (i.e., Airbnb, Vrbo, etc.) and spare bedrooms. Given the number of available units, it is unlikely that the short-term demand from workers temporarily relocating to the area will be greater than the available number of temporary housing units. Almost 3,200 housing units were identified as available for rent in Virginia Beach in 2018, with a further almost 10,100 units available in the other cities and county in the review area (Table 7.8-3). Additionally, as onshore construction activities associated with the export cable landfall will be scheduled during the off-peak tourism season, to the extent practicable, the increase in the demand for rental housing during the off-season is expected to benefit the local tourism economy (see Section 7.1 Recreation and Tourism).

Short-term increase in the demand for public services. The increased workforce and associated construction activities will likely result in a slight increased demand for public services, including police, fire, healthcare, and educational services. The review area contains numerous law enforcement stations, fire departments, hospitals, and public schools, and is thus equipped with sufficient capacity such that the Project will not impact the availability of public services. As a result, this anticipated increase in demand is unlikely to create a shortage of public services available to the general public. The Company will coordinate with local fire, police, and emergency medical departments as needed throughout construction of the Project. Additional information on public health and safety is presented in Section 7.12 Health and Safety and Low Probability Events.

Potential short-term change in property values due to construction activities. The construction of onshore components of the Project will occur within existing city road and utility ROWs and previously developed areas. Onshore construction activities associate with the cable landfall will take place during the off-peak tourism season, to the extent practicable. Thus, due to the temporary nature of the construction activities, property values are not expected to be negatively impacted during the construction stage. Additionally, construction of the offshore Project components is not anticipated to negatively impact property values, as installation of the export cables nearshore will be short-term, and Project-related vessels

transiting to the Wind Development Area will be largely consistent with existing vessel traffic off the coast of Virginia.

7.8.2.2 Operations and Maintenance

During operations, the potential impacts to population, economy, employment, and housing and property values may include the following:

- Long-term increase in direct operations-related employment in the review area;
- Long-term increase in indirect or secondary employment and income in the state and region;
- Long-term increase in tax revenues for state and local governments;
- Long-term increase in demand for housing;
- Long-term increase in the demand for public services; and
- Long-term change in property values due to O&M activities.

Long-term increase in direct operations-related employment in the review area. The Company plans to maintain staff in Virginia Beach to manage the Project. Operations-related employment for the Project is expected to support a total of 85 full-time direct jobs in Virginia and North Carolina. Direct operations-related jobs include WTG technicians, welders, vessel managers, and computer-aided design technicians (Appendix EE Economic Impact of Kitty Hawk Offshore Wind). Local hiring will be conducted to the extent practicable to help benefit the local economy.

Long-term increase in indirect or secondary employment and income in the state and region. Project operations will also support economic activity elsewhere in the state and regional economies. Operations of the Project will support an estimated total of 409 jobs. This total include both direct and indirect jobs. Direct jobs will likely be located in Virginia Beach, as discussed in Section 7.8.2.1; indirect or secondary jobs will be distributed throughout the state. Estimated total (direct and indirect) operations-related impacts are expected be similar in the Hampton Roads MSA,(see Appendix EE). Additionally, workers' incomes are expected to be recirculated into the local economy through living expenses, recreation and leisure, and other expenditures. These annual economic benefits are expected to continue onward for the useful life of the Project.

Long-term increase in tax revenues for state and local governments. Following the completion of construction, operations of the Project will generate an estimated $4.2 million in annual tax revenues, with an estimated $1.8 million in state revenue and $2.4 million in local property tax revenue. Estimated state-level tax revenues include sales tax ($0.5 million) and personal income tax ($1.3 million), primarily resulting from direct and indirect household earnings supported by operations of the Project. Estimated annual revenues for the City of Virginia Beach are property taxes that will be levied on the Project components that will be built onshore (see Appendix EE). These estimated annual operations-related tax revenues will be generated each year the facility is in operation from Year 0 onward.

Long-term increase in demand for housing. Once construction is complete, Project operations are projected to support a total of 409 jobs in Virginia and North Carolina. Workers will either be hired locally or permanently relocate to the area. The permanent relocation of a portion of this workforce is not expected to noticeably affect local housing markets. An estimated total of almost 2,000 housing units were for sale in Virginia Beach in 2018, with approximately 3,200 units available for rent. Additional housing units are also available for sale and rent in the surrounding cities and county (Table 7.8-3).

Long-term increase in the demand for public services. The increase in workforce and operations activities will likely result in a slightly increased demand for public services. The review area contains numerous law enforcement stations, fire departments, hospitals, and public schools, and is thus equipped with sufficient capacity such that the Project will not impact the availability of public services. As a result, this anticipated increase in demand is unlikely to create a shortage of public services available to the

general public. The Company will coordinate with local fire, police, and emergency medical departments as needed throughout operations of the Project. Additional information on potential impacts and mitigation measures to health and public safety are discussed in Section 7.12 Health and Safety and Low Probability Events.

Long-term change in property values due to O&M activities. Changes in property values are not expected during the operations stage, as the onshore components of the Project will be located underground or within previously developed areas. While the offshore components will be partially visible from certain areas in Virginia and North Carolina, a 2017 study found that there is little evidence of a negative impact to property values when an offshore wind farm is located 6.4 km or more from the coast (US Wind 2018); the Wind Development Area is 44 km from the coast. Similar findings occurred during a 2018 study, which demonstrated that there was no impact on property values when the offshore wind farm was located 9 km offshore (Jensen et al. 2018). Additional detail on the visibility of the offshore components of the Project can be found in Section 6.5 Visual Resources and Appendix AA Visual Impact Assessment.

7.8.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are anticipated to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.9 Environmental Justice

This section describes the environmental justice communities surrounding the Project Area and supporting facilities. Potential impacts to environmental justice communities resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP that are related to environmental justice include:

- Visual Resources (Section 6.4);
- Recreation and Tourism (Section 7.1);
- Population, Economy, Employment, and Housing (Section 7.8);
- Land Use and Zoning (Section 7.10);
- Land Transportation and Traffic (Section 7.11);
- Health and Safety and Low Probability Events (Section 7.12); and
- Visual Impact Assessment (Appendix AA).

Environmental justice, as defined by the EPA, is "the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies." Specifically, fair treatment means that "no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies" (EPA 2018). Executive Order 12898 requires federal agencies to enact environmental justice by identifying and addressing, as appropriate, disproportionately high and adverse health or environmental effects of federal actions on minority and low-income populations.

The Council on Environmental Quality developed guidelines to assist federal agencies in implementing this order during the NEPA process (CEQ 1997). The guidance defines minority individuals as members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Island; Black, not of Hispanic origin; or Hispanic. Minority populations are defined where either (a) the minority population of the affected area exceeds 50 percent or (b) the minority population of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. The Council on Environmental Quality guidance also directs low-income populations to be identified based on the annual statistical poverty thresholds from the U.S. Census Bureau. The U.S. Census Bureau defines a poverty area as a census tract or other area where at least 20 percent of residents are below the poverty level (U.S. Census Bureau 2021).

In addition, the Council on Environmental Quality developed six principles for federal agencies to use when conducting environmental justice analyses during the NEPA process (CEQ 1997):

- Consider the composition of the affected area to determine whether low-income, minority or Tribal populations are present and whether there may be disproportionately high and adverse human health or environmental effects on these populations;
- Consider relevant public health and industry data concerning the potential for multiple exposures or cumulative exposure to human health or environmental hazards in the affected population, as well as historical patterns of exposure to environmental hazards;
- Recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed action;
- Develop effective public participation strategies;
- Assure meaningful community representation in the process, beginning at the earliest possible time; and
- Seek Tribal representation in the process.

Data required to complete this analysis comes from the American Community Survey data provided by the U.S. Census Bureau (2018).

7.9.1 Affected Environment

The environmental justice review area for the Project includes the cities and counties where onshore Project components, as well as ports used for construction and O&M, will be located. The onshore substation site, onshore export cables, and export cable landfall will be located in the independent city (i.e., county-equivalent) of Virginia Beach, Virginia. Ports under consideration for construction and staging areas and O&M facilities include the independent cities of Virginia Beach, Norfolk, Portsmouth, Newport News, and Chesapeake, Virginia, as well as the town of Cape Charles in Northampton County, Virginia. Final determinations regarding use of ports and the location of the O&M facilities will be made upon conclusion of thorough site assessments and due diligence of all locations under consideration.

Areas in North Carolina from which offshore components may be visible, including Currituck and Dare Counties, are also included in the review area. However, offshore Project components are not anticipated to produce significant visual impacts to coastal communities or significant impacts to the recreation and tourism economies of these communities (see Section 6.4 Visual Resources and Section 7.1 Recreation and Tourism).

The percentage of state and city populations that would be considered minority or low-income based on the Council on Environmental Quality guidance are listed in Table 7.9-1 (U.S. Census Bureau 2018). As the minority populations in Norfolk and Portsmouth exceed 50 percent, these areas would be considered potential environmental justice communities as defined by the EPA. Low-income populations in Cape Charles, Norfolk, and Portsmouth are higher than the Commonwealth of Virginia as a whole, but all are less than 20 percent and therefore not considered poverty areas under the U.S. Census Bureau definition. None of the potentially affected areas in North Carolina have minority populations greater than 50 percent or low income populations greater than 20 percent; these areas are, therefore, not considered potential environmental justice communities.

Both Virginia and North Carolina follow the same criteria for environmental justice as the EPA; state-defined environmental justice communities are therefore the same as those defined at the federal level.

In 2019, the Commonwealth of Virginia enacted Executive Order 29 which established the Virginia Council on Environmental Justice (Commonwealth of Virginia 2019). The Council provides guidance to the Governor of Virginia to enforce consistent approaches to environmental justice, including:

- Communications and partnerships;
- Public health;
- Local governments;
- Climate change and resilience;
- Transportation systems;
- Clean energy transition; and
- Outdoor access.

In North Carolina, the Department of Environmental Quality Secretary's Environmental Justice and Equity Advisory Board "advise[s] the Secretary on the consistent implementation of fair treatment and meaningful involvement of North Carolina citizens across the Department" (NCDEQ 2018).

Onshore construction activity, and the long-term presence of onshore Project components, will be located in Virginia Beach. The EPA's Environmental Justice Screening and Mapping Tool, EJSCREEN, identified several smaller communities within the City of Virginia Beach with 50 percent low-income population, 50 percent minority population, or both (Figure 7.9-1). While these identified communities are within the City

of Virginia Beach, they are outside of the areas that will be directly impacted by the Project by at least 4 km. The Visual Study Area (see Chapter 6 Cultural Resources) was used to demonstrate areas from which adverse visual impacts from the offshore Project components may occur. No potential environmental justice communities were identified that overlap with this area (Figure 7.9-2).

Table 7.9-1 Income and Minority Population Levels

Location	Total Population a/	Population with Income Below Poverty Level b/	Minority Hispanic or Latino b/	Minority not Hispanic or Latino b/	Total Minority b/
Virginia	**8,535,519**	**10.9%**	**9.2%**	**28.6%**	**37.8%**
Northampton County	11,710	19.1%	8.7%	37.2%	45.9%
Cape Charles	1,145 c/	19.9%	1.5%	29.9%	31.4%
Virginia Beach	449,974	7.6%	8.0%	30.0%	38.0%
Norfolk	242,742	19.7%	7.9%	48.6%	56.5%
Portsmouth	94,398	17.2%	4.3%	57.7%	62.0%
Newport News	179,225	15.5%	8.8%	47.8%	56.6%
Chesapeake	244,835	9.0%	5.9%	36.2%	42.1%
North Carolina	**10,155,624**	**15.4%**	**9.2%**	**27.4%**	**36.7%**
Currituck County d/	25,796	10.0%	3.8%	9.0%	12.8%
Dare County	35,741	8.2%	7.2%	5.3%	12.4%
Duck	581	4.9%	1.4%	1.9%	3.3%
Kill Devil Hills	7,035	12.6%	10.8%	2.7%	13.5%
Southern Shores	2,850	4.9%	1.1%	6.2%	7.3%
Kitty Hawk	3,462	3.9%	0.4%	1.9%	2.3%

Sources:
a/ U.S. Census Bureau 2019. QuickFacts.
b/ American Community Survey 2018. 5-Year Estimates.
c/ The most recent data was extracted from the 2018 5-year population estimates rather than the 2019 annual population estimates.
d/ Includes the unincorporated community of Corolla, for which ACS data is not available.

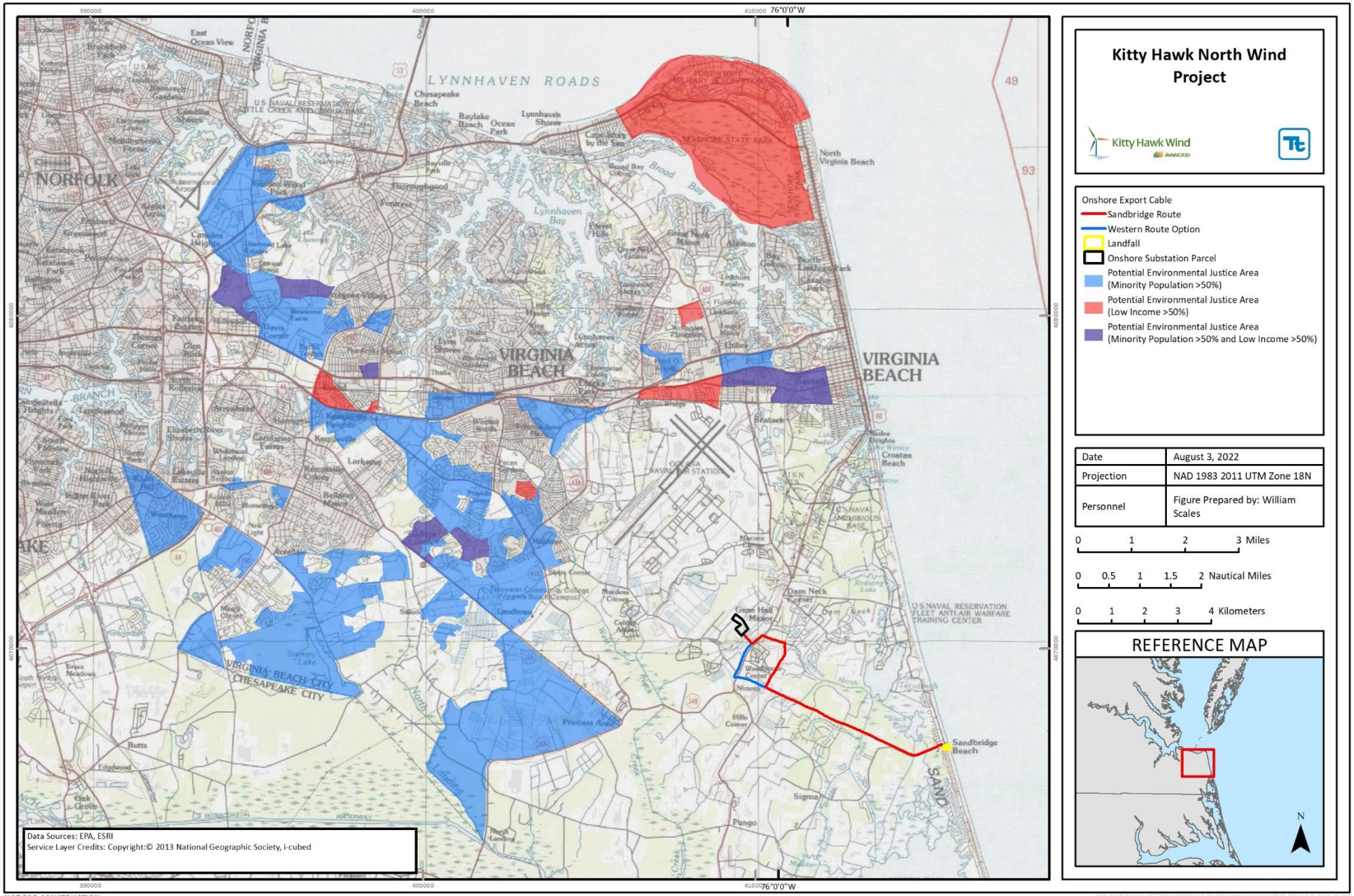


Figure 7.9-1 Potential Environmental Justice Communities Near the Onshore Project Components

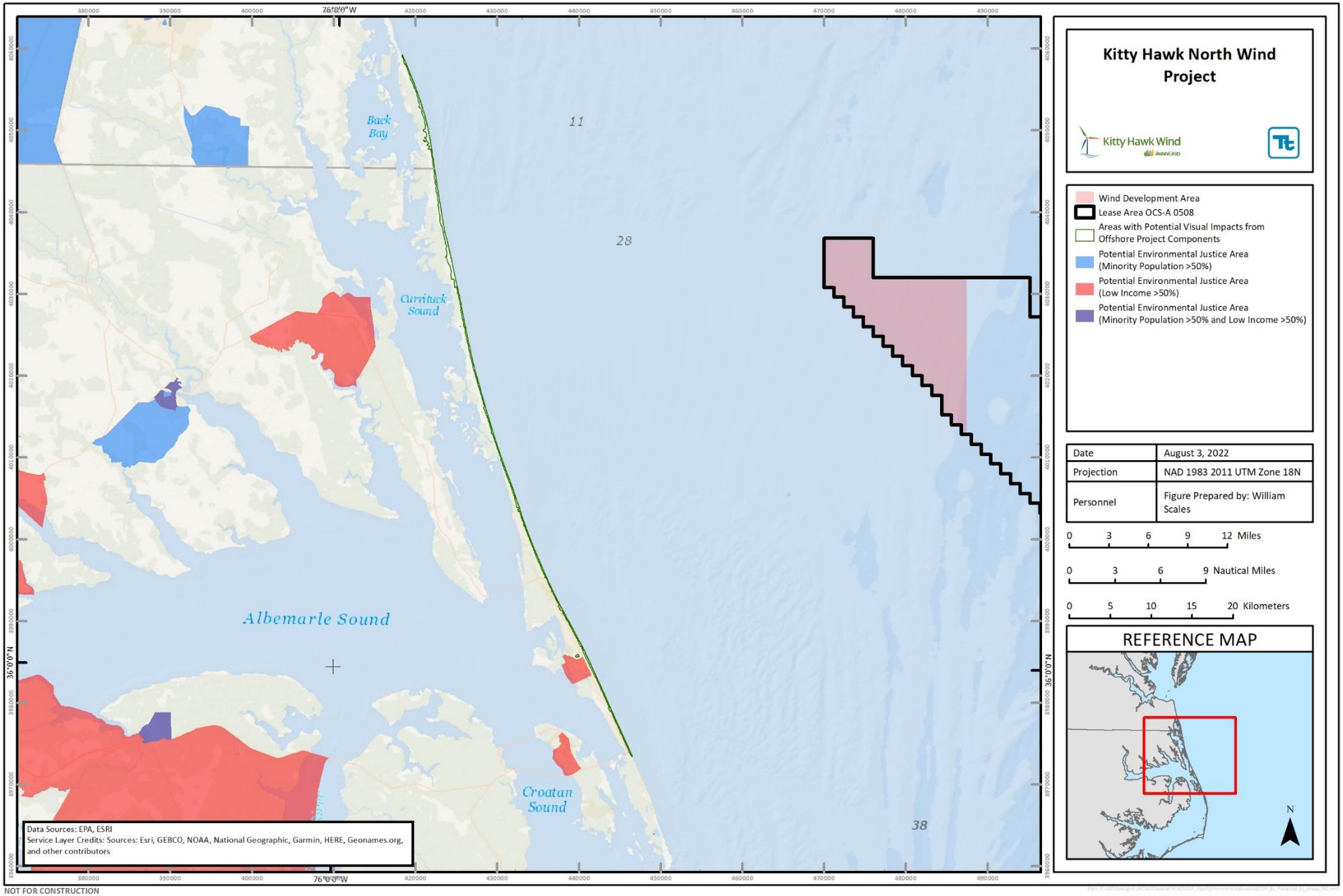


Figure 7.9-2 Potential Environmental Justice Communities with Potential Visibility of the Offshore Project Components

7.9.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). With respect to the EPA's environmental justice policy, impacts are identified as any disproportionately high and adverse health or environmental effects on minority and low-income populations. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.9.2.1 Construction

During construction, the potential impacts to environmental justice communities may include:

- Short-term increase in construction-related employment and income in the region and states;
- Short-term increase in tax revenues for state and local governments;
- Short-term increase in vehicle traffic due to construction of the Project facilities; and
- Short-term increase in demand for affordable housing due to an increase in temporary workforce.

Short-term increase in construction-related employment and income in the region and states. As discussed in Section 7.8, Population, Economy, Employment, and Housing, construction-related expenditures would support direct, indirect, and induced employment and associated labor income. Jobs and income would be supported throughout the local and regional economy, including positions occupied by potential environmental justice populations. Construction-related employment and income impacts are anticipated to have a short-term but beneficial impact to the economy.

Short-term increase in tax revenues for state and local governments. As discussed in Section 7.8, Project construction would generate tax revenues for state and local governments. These impacts are anticipated to be beneficial and temporary.

Short-term increase in vehicle traffic due to construction of the Project facilities. A short-term increase in onshore construction vehicle traffic and activities may occur due to construction of the onshore facilities in Virginia Beach, and, to a lesser extent, the transit of workers to the ports used for Project construction. This increase in vehicle traffic would also increase associated noise and pollution and has the potential to occur in environmental justice communities. Any increase will be temporary and is not expected to disrupt the normal and routine functions of nearby communities. The Company will develop a Traffic Management Plan in coordination with local authorities. In addition, the Company is engaged in extensive outreach with local stakeholders, including those in potential environmental justice areas, to ensure the opportunity for meaningful involvement from these communities. Local hiring will be conducted to the extent practicable to help stimulate the local economy, including creating jobs in potential environmental justice communities; this will have the additional effect of minimizing traffic increases. No construction activities will take place on roads within potential environmental justice communities. It is not expected that an increase in vehicle traffic will cause disproportionate impacts to environmental justice communities.

Short-term increase in demand for affordable housing due to an increase in temporary workforce. A short-term increase in the demand for affordable housing may occur as a result of the increase in temporary workforce for the construction phase of the Project (see Section 7.8 Population, Economy, Employment, and Housing). This increase in demand may disproportionally affect environmental justice communities. However, as onshore construction activities associated with the export cable landfall will be scheduled during the off-peak tourism season, to the extent practicable, Project-related demand for rental housing is unlikely to compete with the majority of temporary rentals. The anticipated increase in workers is therefore not expected to create a shortage of affordable housing. In addition, demand for rental housing during the off-season is expected to be beneficial to the local tourism economy.

7.9.2.2 Operations and Maintenance

During operations, the potential impacts to environmental justice communities may include:

- Long-term increase in construction vehicle traffic and activities;
- Long-term increase in O&M-related employment and income in the region;
- Long-term increase in local and regional government tax revenues;
- Changes to marine uses due to long-term presence of offshore Project facilities; and
- Long-term visual impacts resulting from the presence of WTGs.

Long-term increase in construction vehicle traffic and activities. A small number of O&M vehicles will travel along local roads for inspections or repairs of the onshore components and to transit to ports used for O&M activities. This long-term increase in vehicle traffic is expected to be very low and not likely to cause any noticeable changes to the traffic already existing within the area. Of the more than 900 full-time equivalent jobs that will be created in Virginia for operation of the Project, a portion will be filled with local workers, reducing the long-term increase in traffic (see Section 7.8 Population, Economy, Employment, and Housing).

Long-term increase in O&M-related employment and income in the region. As discussed in Section 7.8, O&M-related expenditures would support direct, indirect, and induced employment and associated labor income. Jobs and income would be supported throughout the local and regional economy, including positions occupied by potential environmental justice populations. O&M-related employment and income impacts are anticipated to be beneficial and long term.

Long-term increase in local and regional government tax revenues. As discussed in Section 7.8, O&M associated with the Project would generate tax revenues for state and local governments. State and local tax revenues fund programs that may aid environmental justice populations. The potential impact of these revenues is anticipated to be long term and beneficial.

Changes to marine uses due to long-term presence of offshore Project facilities. Onshore Project facilities, including the onshore export cables, onshore substation. Interconnection lines, and switching station, will not be located in potential environmental justice communities. The presence of new fixed structures within the Wind Development Area has the potential to attract new marine users visiting the area as a tourist attraction. This was observed with the Block Island Wind Farm; tourism to the island has increased as a result of the offshore wind turbines, vessel charter rentals have increased, and new businesses have emerged to support tourist demand (Brookins 2017). This increase in recreation and tourism has brought economic benefits to Block Island, as tourists pay for boat tours to see the offshore wind farm (Lilley et al. 2010).

Long-term visual impacts resulting from the presence of WTGs. As described in Section 6.4 Visual Resources, views of the offshore Project components (i.e., WTGs) will be limited primarily to certain coastal areas of Virginia and North Carolina. In developed places, such as Kill Devil Hills and Nags Head, North Carolina, the dunes and/or the first row of buildings tend to block views from locations further inland. The nearest identified potential environmental justice community is located in Kill Devil Hills, over 53 km from the Wind Development Area at the closest point, and does not extend to the shoreline. Other identified potential environmental justice communities are located further from the Wind Development Area and further inland. Visual impacts from offshore Project components are therefore not expected to disproportionately impact environmental justice communities. A Visual Impact Assessment has been conducted to identify areas where proposed offshore structures (including WTGs and ESP) could potentially be visible (Appendix AA). The visual presence of WTGs is not expected to have disproportionately high and adverse impacts on any populations, including the potential environmental justice populations identified in this section.

7.9.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.10 Land Use and Zoning

This section describes the land use and zoning within and surrounding the onshore Project Area, which includes the export cable landfall, onshore export cable corridors, and onshore substation site. Potential impacts to land use resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP that are related to land use and zoning include:

- Wetlands and Waterbodies (Section 5.1);
- Recreation and Tourism (Section 7.1);
- Department of Defense and Outer Continental Shelf National Security (Section 7.4); and
- Land Transportation and Traffic (Section 7.11).

For the purposes of this section, the review area includes the onshore components, including landfall in Sandbridge, Virginia Beach, Virginia, the onshore export cable corridors, the onshore substation site, and a 0.4-km buffer around these features.

Data required to complete this analysis includes land use data from the National Land Cover Database (2016) and zoning data from the City of Virginia Beach (2018a).

7.10.1 Affected Environment

7.10.1.1 Land Use

The existing land use in Virginia Beach, Virginia is a mix of developed land, undeveloped land, and open water (Figure 7.10-1). Project components were sited to avoid use of undeveloped land and maximize use of existing paved areas, cleared spaces, and ROWs to the extent practicable.

The export cable landfall is sited in a parking lot just south of the public ROW for Sandbridge Road and Sandbridge Seaside Market near Sandbridge Beach. The area is part of the "Suburban Focus Area 6 – Sandbridge" within the City's 2016 Comprehensive Plan, characterized as a "stable, low-density, single-family community" (City of Virginia Beach 2018b). Installation of a cable landfall is consistent with City of Virginia Beach recommendations for the area, including "[w]here opportunities present themselves, consider placing overhead utilities underground." The parking lot is owned by the City of Virginia Beach. The Company has submitted an easement application for the Sandbridge parcel to the City's Public Works Department and is working with the City of Virginia Beach to secure an easement.

The areas immediately surrounding the onshore export cable corridors are primarily developed land, mainly comprised of land classified by the U.S. Geological Survey as "Developed, Open Space" and "Developed, Low Intensity." These are lands that have been disturbed by human activity but have a low percentage of impervious surface. The onshore export cables were sited to avoid undeveloped land, such as forests and scrub/shrub, where possible to minimize disturbance. The onshore export cables pass almost entirely along existing paved roads, with the exception of an approximately 2.3-km stretch where the Sandbridge route and western route option onshore export cable corridors traverse an existing utility ROW between Sandbridge Road and Nimmo Parkway.

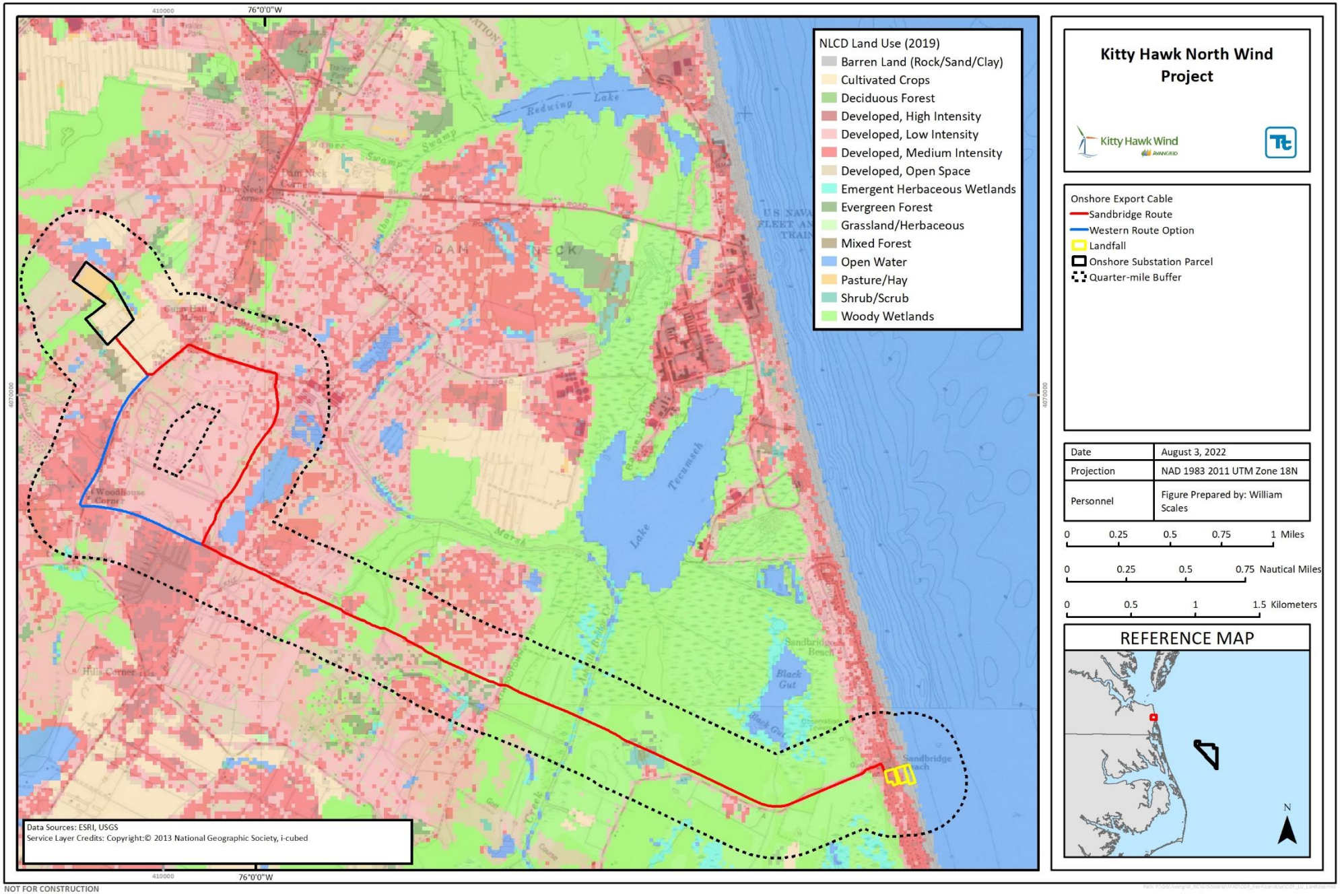


Figure 7.10-1 Land Use in the Review Area

The onshore substation, interconnection lines, and switching station are sited on land owned by the City of Virginia Beach (Virginia Beach Development Authority) within the Corporate Landing Business Park. The area is part of the "Special Economic Growth Area 3 – South Oceana" within the City's 2016 Comprehensive Plan, viewed as having "significant economic value and growth potential, with a primary consideration being adjacency to [NAS] Oceana" (City of Virginia Beach 2018b). Development of this area is part of the City's economic growth strategy. The site is comprised of undeveloped land which includes unused fields and a patch of dense trees, and is bordered to the south by an existing utility ROW. The Company has secured an option to develop the site.

7.10.1.1.1 Military

Naval Air Station Oceana is located to the northeast of the proposed Corporate Landing onshore substation site. The onshore substation site would be located 2.1 km from the edge of NAS Oceana at its closest point. The NAS Oceana Dam Neck Annex is north of the Sandbridge route onshore export cables and is approximately 1.7 km from this onshore export cable corridor at its closest point.

7.10.1.1.2 Recreational

Areas designated as recreational within the review area include Lago Mar at Back Bay Park, Red Mill Farms North Park, Ocean Lakes East Park, Ocean Lakes North Park, Princess Anne Recreation Center, Strawbridge East Park, Malbon Acres Park, and Dunwoody Park. A homeowner's association park is also located 0.3 km from the Sandbridge route. Although these recreation areas are within the review area, none are crossed by the Sandbridge route or western route option onshore export cable installation corridors, which are located entirely within existing ROWs for city roads once they reach Nimmo Parkway. Three parks (Red Mill Farms North Park, Ocean Lakes East Park, and Ocean Lakes North Park) border the Sandbridge route along Upton Drive.

The onshore substation site is located within the Corporate Landing Business Park. Two city parks – Dunwoody Park and Strawbridge East Park – are located within 0.4 km of the onshore substation site, and both have areas of dense, mature trees between the park and onshore substation site. (See Section 7.1 Recreation and Tourism for additional discussion).

7.10.1.1.3 Special Service District

The export cable landfall and approximately 0.24 km of the onshore export cable corridors are located within or immediately adjacent to the Sandbridge Special Service District. Established by Chapter 35.1 of the Virginia Beach Code of Ordinances, in accordance with the Code of Virginia §§ 15.2-2400 *et. seq.*, Special Service Districts are created by localities to "to provide additional, more complete or more timely services of government than are desired in the locality or localities as a whole." In the case of Sandbridge Beach, the Special Service District is used to provide services such as beach re-nourishment and beach access improvement, including the installation of two to three new beach accesses per year (City of Virginia Beach 2017, 2019).

7.10.1.1.4 Protected Lands

Wetlands are found along the onshore export cable routes and at the onshore substation site (see Section 4.2 Water Quality and Section 5.1 Wetlands and Waterbodies). A wetland delineation will be conducted to characterize the hydrology along the onshore export cable corridors and at the onshore substation site to support the USACE permit application and jurisdictional determination.

The portion of the western route option onshore export cable corridor along the public ROW for Sandbridge Road, as well as approximately 1.6 km between the public ROW for Sandbridge Road and Atwoodtown Road, is located within a utility ROW that is bordered on either side by the federally managed Back Bay National Wildlife Refuge (USFWS 2019). The Sandbridge route and western route option onshore installation corridors are located entirely within the existing ROW, which is not part of the refuge.

7.10.1.2 Zoning

Zoning in the review area is a mix of residential, agricultural, commercial, and industrial districts (Figure 7.10-2). The proposed Corporate Landing onshore substation site is located in Zoning District I-1, for light industrial use. The construction of a substation and associated equipment is consistent with current zoning of this area.

Any additional temporary staging areas necessary to support onshore construction activities are anticipated to be located on previously disturbed lands. For apartment (A), business (B), and office (O) districts, public utility installations and substations are a permitted use with appropriate screening; for residential (R) and agricultural (AG) districts, storage or maintenance installation for public utilities are permitted as a conditional use (City of Virginia Beach 2021).

7.10.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For this impact analysis, the maximum design scenario is the full build out of the onshore Project features, including onshore export cables, onshore substation, interconnection lines, switching station, and export cable landfall. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.10.2.1 Construction

During construction, the potential impacts to land use and zoning may include:

- Short-term impacts to beach access due to installation of the onshore export cables along existing roads;
- Short-term disruption to adjacent land uses due to the implementation of safety zones;
- Direct disturbance of the onshore substation site; and
- Direct disturbance of the onshore export cable corridor.

Short-term impacts to beach access due to installation of the onshore export cables along existing roads. The proposed export cable landfall is located within a parking lot inside the Sandbridge Special Service District. The onshore export cable corridor traverses the public ROW for Sandbridge Road, a road commonly used to access Sandbridge Beach. Installation of the export cables via horizontal directional drilling will avoid direct impacts to the beach, producing only short-term impacts to beach access and parking during the construction period. To avoid disruption of recreational uses, installation of the onshore export cables will occur during the off-peak tourism season, to the extent practicable. Once construction is completed, the road and parking lot, with the exception of flush-mounted access covers, will be restored to previous conditions.

To further minimize potential construction effects, adjacent landowners will be provided timely information regarding the planned construction activities and schedule, and work will also be coordinated with the DoD, Virginia Department of Transportation, and the Virginia Beach Public Works Department. The Company will provide regular updates to the local community through social media, public notices, and/or other appropriate communications tools. Potential impacts to traffic are addressed in Section 7.11 Land Transportation and Traffic.

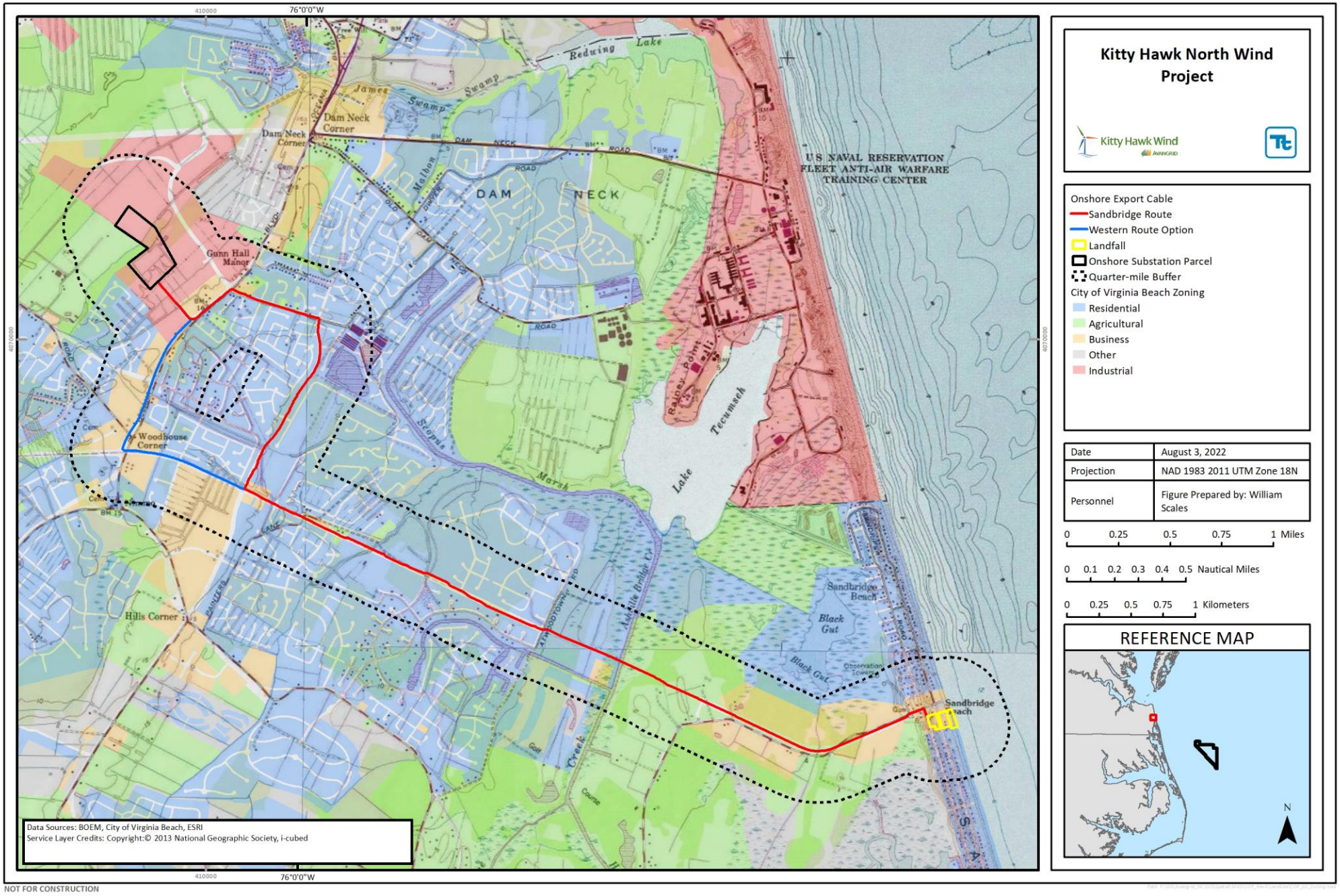


Figure 7.10-2 Zoning in the Review Area

Short-term disruption to adjacent land uses due to the implementation of safety zones. Temporary safety zones will be implemented around onshore construction activities to ensure the safety of the public. As the Project utilizes existing roads and ROWs, impacts resulting from construction activities will be minimized to the extent practicable. Existing land uses may be temporarily restricted by the application of these safety zones; the Company will provide regular updates to the local community through social media, public notices, and/or other appropriate communications tools.

Direct disturbance of the onshore substation site. Construction of the onshore substation, interconnection lines, and switching station will result in disturbance of land, which is currently undeveloped. The portion of the site not required for long-term operation of the onshore substation and switching station will be restored to previous conditions once construction is completed.

Direct disturbance of the onshore export cable corridor. The Sandbridge route and western route option installation corridors have been located entirely within previously disturbed areas and existing road and utility ROWs to minimize impacts to land use and zoning. Installation of the onshore export cables may require tree clearing along the road and within the utility ROW between Sandbridge Road and Atwoodtown Road. Once construction is completed, the installation corridor will be restored to previous conditions, with the exception of required clearance for utility lines.

7.10.2.2 Operations and Maintenance

During operations, the potential impacts to land use and zoning may include:

- Conversion of land use due to the presence of new onshore components.

During operations, no impacts are anticipated to land use and zoning from the onshore export cables, as the Project will utilize existing roads and ROWs to the extent practicable. The onshore export cables associated with the Sandbridge route and western route option may be located entirely underground; the portion of the Sandbridge route and western route option between the public ROW for Sandbridge Road and Atwoodtown Road may be aboveground on utility poles, and would be located within an existing, city-owned utility ROW and adjacent to existing, aboveground utility cables. As such, the existing landscape along the onshore export cable corridor will be preserved, with the exception of trees cleared along the road and within the utility ROW between Sandbridge Road and Atwoodtown Road. The cables will not present any excessive conflict with present or future planned uses within the Project Area and will have at most a minimal impact on any future planned uses.

Conversion of land use due to the presence of new onshore components. The onshore substation site is currently undeveloped land with a patch of dense trees; presence of the onshore substation, interconnection lines, and switching station would result in the conversion of a portion of this site to industrial use. The site is currently zoned I-1 Light Industrial, and development of a substation and associated equipment is consistent with this use; therefore, no long-term impact to zoning is anticipated. Trees may be cleared as necessary to support cable installation, resulting in long-term conversion of wooded area to shrub or grasslands. As the presence of overhead lines is consistent with current uses, no long-term impact to zoning is anticipated.

7.10.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.11 Land Transportation and Traffic

This section describes the land transportation and traffic found within and surrounding the onshore Project Area, including the export cable landfall, onshore export cable corridors, and onshore substation site. Potential impacts to land transportation and traffic resulting from construction, operations, and decommissioning of the Project are discussed. Avoidance, minimization, and mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP that are related to land transportation and traffic include:

- Land Use and Zoning (Section 7.10).

For the purposes of this section, the review area includes the onshore Project components and the areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project.

Data required to complete this analysis comes from the City of Virginia Beach (2021).

7.11.1 Affected Environment

Onshore Project components, including landfall, onshore export cables, the onshore substation, interconnection lines, and switching station, will be located in Virginia Beach, Virginia. The Project will also utilize various ports for staging, construction, and/or for O&M purposes (see Section 3.1.1 Supporting Facilities for a full list of potential ports). Land transportation related to ports will be consistent with the current transportation and traffic patterns occurring at these locations. Therefore, ports are not discussed further in this section.

The onshore export cables make landfall in a parking lot along Sandbridge Beach, just south of the public ROW for Sandbridge Road. From landfall, the Sandbridge route and western route option onshore export cable corridors follow the public ROW for Sandbridge Road west for approximately 1.8 km, then continue straight northwest along an existing 2.3-km utility ROW, crossing Atwoodtown Road and joining Nimmo Parkway. The Sandbridge route option follows Nimmo Parkway for 1.9 km, turns northeast on Upton Drive for 1.5 km, then turns west on Culver Lane for approximately 0.7 km to General Booth Boulevard. The route then heads southwest on General Booth Boulevard for approximately 0.4 km to the onshore substation site. It then turns northwest to cross an empty field to reach the onshore substation site. The western route option follows Nimmo Parkway for 2.9 km, then turns northeast onto General Booth Boulevard, where it continues for 1.2 km and enters the onshore substation site from the south.

Traffic count data for the affected roads was accessed from the City of Virginia Beach, which gathers traffic data from sensors in or along City roadways (City of Virginia Beach, n.d.). From this data, estimates of the average number of vehicles travelling along each segment of road were calculated. Annual Average Daily Traffic was calculated from a 24-hour count of traffic volume in both directions, adjusted with an applicable seasonal factor and axle-correction factor (City of Virginia Beach 2021). The 2020 Annual Average Daily Traffic estimates for road segments along the onshore export cable corridors are shown in Table 7.11-1.

Nimmo Parkway and General Booth Boulevard are designated as “Access Controlled” roads in the City’s Comprehensive Plan, indicating that the City limits direct access points (driveways, intersections, etc.) onto these roads in order to improve traffic flow (City of Virginia Beach 2018).

Table 7.11-1 2020 Average Annual Daily Traffic for Roads Along the Onshore Export Cable Corridors

Road	Location	Road Type	Location ID	Bi-Directional AADT a/
Sandbridge Road	Between Sandpiper Lane and Flanagan's Lane	Two-lane	417	11,367
Nimmo Parkway	Between Camino Real S and Townfield Lane	Two-lane	1386	4,415
Nimmo Parkway b/	Between Townfield Lane and Upton Drive	Two-lane	210	8,344
Nimmo Parkway	Between Upton Drive and General Booth Boulevard	Four-lane divided	157	17,949
General Booth Boulevard	Between Nimmo Parkway and London Bridge Road	Four-lane divided	145	28,714
Upton Drive	Between Nimmo Parkway and Culver Lane	Two-lane	1333	12,875
Culver Lane b/	Between Upton Drive and General Booth Boulevard	Four-lane	129	7,419

Notes:
a/ AADT = Annual Average Daily Traffic
b/ 2021 data
Source: City of Virginia Beach 2021

7.11.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For land transportation and traffic, the maximum design scenario is the full build out of the onshore Project features, including onshore export cables, onshore substation, switching station, and export cable landfall. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.11.2.1 Construction

During construction, the potential impacts to land transportation and traffic may include:

- Increased Project-related construction vehicle traffic due to construction of the onshore components and increased workforce; and
- Temporary modifications to local traffic patterns during installation of the onshore export cables and export cable landfall.

Increased Project-related construction vehicle traffic due to construction of the onshore components and increased workforce. Construction and support vehicles, as well as vehicles transporting the temporary increased workforce, will travel along local roads to reach construction areas (see Section 7.8 Population, Economy, Employment and Housing for additional information on anticipated workforce). Due to the relatively small number of crew expected, the potential impacts to local traffic are anticipated to be small. The Company will develop a Traffic Management Plan in coordination with local authorities. There will be sufficient parking at the onshore substation site to support workers. To further

minimize impacts, onshore construction activities associated with the export cable landfall will be scheduled during the off-peak tourism season to the extent practicable.

Temporary modifications to local traffic patterns during installation of the onshore export cables and export cable landfall. Installation of the onshore export cables may result in temporary closure of sections of roads or individual lanes. Road closures will be localized and limited to the time required for the installation of the onshore export cables. Construction activities associated with the export cable landfall will require temporary closure of a municipally-owned parking lot along Sandbridge Beach. Both portions of the lot, to the north and south of Sandbridge Seaside Market, are under consideration. Once construction is completed, the parking lot will be returned to pre-construction conditions, with the exception of flush-mounted access covers for maintenance access. The Company will provide regular updates through social media, the Project website, and public notices to notify the local community of temporary road and parking lot closures. To further minimize impacts, construction activities associated with the export cable landfall will be scheduled to occur during the off-peak tourism season to the extent practicable.

7.11.2.2 Operations and Maintenance

During operations, the potential impacts to land transportation and traffic may include:

- Increased Project-related vehicle traffic due to O&M activities and workforce; and
- Temporary modifications to local traffic patterns during inspections or repairs to the onshore export cables.

Increased Project-related vehicle traffic due to O&M activities and workforce. Project operations will be based out of O&M facilities, which may include control rooms, administrative and management offices, training space for technicians and engineers, shop space, and/or warehouse space, which will be collocated to the extent practicable (see Section 3.3). The Company is considering the following locations for O&M facilities: Portsmouth, Virginia; Newport News, Virginia; Cape Charles, Virginia; and Chesapeake, Virginia, Virginia. The number of O&M personnel transiting to and from the O&M facility is not anticipated to produce noticeable impacts to local traffic (see Section 7.8 Population, Economy, Employment and Housing for additional information on anticipated workforce). There will be sufficient parking at the O&M facilities to support Project workers.

Additionally, a small number of O&M vehicles will occasionally travel along local roads in Virginia Beach for regular inspections of equipment at the onshore substation site or repairs to the onshore export cables. No impacts to local traffic are anticipated from additional traffic to support regular maintenance activities. There will be sufficient parking at the onshore substation site to support workers.

Temporary modifications to local traffic patterns during inspections or repairs to the onshore export cables. In the unlikely event that repairs of the onshore export cables are required, repairs may result in temporary closure of sections of roads or individual lanes. Regular inspections of onshore export cable splice vaults may also require closures for a brief period of time. Road or lane closures will be localized and limited to the time required for inspections or repairs and may require an approved Traffic Management Plan from the City. The Company will notify the local community of temporary road closures in the event of an inspection or repair.

7.11.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.

7.12 Health and Safety and Low Probability Events

This section describes the public health and safety issues relevant to the Project, including accidents, limiting public access, hazardous materials, non-routine events, and EMF. Potential impacts to health and safety resulting from construction, operations, and decommissioning of the Project are also discussed. Avoidance and minimization, and as necessary, mitigation measures proposed by the Company are also described in this section.

Other assessments detailed within this COP in which health and safety and low probability events are also discussed include:

- Water Quality (Section 4.2);
- Marine Transportation and Navigation (Section 7.3);
- Safety Management System (Appendix F);
- Oil Spill Response Plan (Appendix I); and
- Navigation Safety Risk Assessment (Appendix BB).

For the purposes of this section, the review area includes the offshore Project components, onshore Project components, and the areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project.

Data required to complete this section comes from publicly available information and studies by BOEM, including scientific literature assessing the attributes of EMF.

7.12.1 Affected Environment

For the purposes of this section, the affected environment includes the onshore and offshore Project components and the areas that have the potential to be directly affected by the construction, operations, and decommissioning of the Project. The affected environment as it relates to public health and safety is dependent on the location of Project components in relation to existing infrastructure, public areas, and the user and community groups that may be affected by health and safety risks associated with the Project.

7.12.2 Impacts Analysis for Construction, Operations, and Decommissioning

The potential impact-producing factors resulting from the construction, operations, and decommissioning of the Project are based on the maximum design scenario from the PDE (see Chapter 3 Description of Proposed Activity). For this impact analysis, the maximum design scenario is based on the build out of the Project. The selection of a particular foundation type or onshore route, within the established PDE, is not anticipated to affect the impact analysis. A Summary of Applicant-Proposed Avoidance, Minimization, and Mitigation Measures is provided in Appendix FF.

7.12.2.1 Construction

During construction, the potential impacts to public health and safety may include the following:

- Unauthorized access by non-Project personnel to Project construction sites and/or equipment;
- Low probability events (e.g. extreme weather events, fire and fuel leaks, terrorist attacks); and
- Accidents and accidental releases.

Unauthorized access by non-Project personnel to Project construction sites and/or equipment. Due to the presence of active construction sites onshore and offshore, health and safety risks could occur if members of the public come in close proximity to the construction equipment or vessels. Onshore, safety zones will be established around active construction sites and appropriate security personnel will manage public access into the area. Inactive construction sites will be secured with fences and locks. Video security

will be installed, as necessary, to prevent unauthorized access and potential injury from excavated grounds or Project-related equipment. A detailed Project Execution Plan (or similar) will be developed by the construction contractor prior to the beginning of construction. A Safety Management System is also provided in Appendix F.

Potential offshore risks include allision with Project structures and equipment (see Appendix BB Navigation Safety Risk Assessment), unauthorized access to structures such as foundations, and/or collisions of non-Project vessels with construction and installation vessels. These collisions or allisions may also result in spills (accidental releases), as described below.

Safety zones of up to 500 m radius will be established around construction activities as applicable,[13] and, where feasible, a minimum advisory safe passing distance for cable laying vessels will be implemented, as per the COLREGs. Where USCG Safety Zone authorities are not applicable, the Company will use safety vessels to promote awareness of these activities and the safety of the construction equipment and personnel. The Company will also issue LNMs to inform marine users of the presence of offshore equipment and vessels, as well as any safety zones. Project vessels will observe COLREGs and will be lit in accordance with USCG requirements (see Section 7.3 Marine Transportation and Navigation, and Appendix BB Navigation Safety Risk Assessment for further detail). Furthermore, access to all Project-related structures will be restricted, ladders and doors will be locked and chained when not in use by Project personnel, and video security will be installed as necessary. All offshore construction sites will also be properly lit and marked.

Low probability events (e.g. extreme weather events, fires and fuel leaks, terrorist attacks). Low probability events, such as extreme weather occurrences (e.g. hurricanes, lightning strikes), terrorist attacks or sabotage, fires, or other similar events have the potential to but are unlikely to occur during construction and could result in risk to the public and Project personnel and equipment. A detailed Project Execution Plan (or similar) will be developed by the construction contractor prior to the beginning of construction. Safety plans for extreme weather conditions will be in effect for all construction, operations, and decommissioning activities. Crews will follow all operational limitations and weather-related activity restrictions as defined by equipment manufacturers, and construction will be stopped during any weather event that exceeds the operational limits of the Project, such as lightning storms or excessive wind or waves. Weather-related measures are further addressed in Section 4.1 Physical and Oceanographic Conditions. Emergency response plans will be in place, and will include a clear chain of command, emergency evacuation routes, warning signals, and locations of fire extinguishers, spill kits, and first aid kits. Relevant personnel will be trained in implementing these response plans, should a non-routine event occur. Prevention and response measures for low probability events are further detailed in Appendix F Safety Management System.

Accidents and accidental releases. Accidents during construction, such as equipment failure, have the potential to cause injury to the public and Project personnel, property damage, or harm to the environment. Construction equipment will be maintained and operated by qualified personnel and will be regularly inspected. Furthermore, relevant Project personnel will undergo thorough health and safety training prior to the commencement of construction. This training will be specific to the sites and activities that may occur during construction (e.g. rough sea conditions, hazardous materials). Emergency response plans will be in place, and will include a clear chain of command, emergency evacuation routes, warning signals, and locations of fire extinguishers, spill kits, and first aid kits. Relevant personnel will be trained in implementing these response plans, should an accident occur (see Appendix F Safety Management System).

Fuels, oils, and lubricants, which may present risks to public health when released to the environment, will be used in construction, as detailed in Chapter 3 Description of Proposed Activity. Accidental releases can

[13] Where applicable, safety zones will extend up to 500 m around construction sites, per 33 CFR § 147.15. All areas will be lit and marked in accordance with USCG requirements and monitored by a safety vessel that will be available to assist local mariners. Vessels will not be permitted to enter the safety zone without express consent from the Company.

occur due to improper management, collision, allision, or catastrophic events. The potential impact of a hazardous material depends on the quantity, concentration, and characteristics of the hazardous material. Vessels will have only chemicals needed for construction and reasonable ancillary volumes. To reduce the risk of accidental releases, construction personnel will undergo training prior to the start of activities. Secondary containment measures will be in place on construction sites for oils and greases in accordance with state and federal regulations, and specific consideration will be given to secondary containment during design change management. Spill response kits will also be present at construction sites. Hazardous materials will be transported to and from construction sites in water-tight containers. Prevention and response measures for accidental releases will be further detailed in Appendix I Oil Spill Response Plan. Potential impacts of accidental releases are discussed in Section 4.2 Water Quality.

7.12.2.2 Operations and Maintenance

During operations, the potential impacts to public health and safety may include the following:

- Unauthorized access to Project facilities;
- EMF associated with inter-array and export cables and the onshore substation site;
- Collisions and allisions with O&M vessels and structures;
- Potential interaction with and support of SAR operations;
- Low probability events; and
- Accidents and accidental releases.

Unauthorized access to Project facilities. Due to the long-term presence of offshore structures, health and safety risks could occur if members of the public access offshore Project facilities without proper precautions, such as climbing on WTG and ESP foundations. Access points to WTGs and the ESP will be secured and restricted to properly trained professionals, ladders and doors will be locked and chained when not in use by Project personnel, and video security will be installed as necessary. The presence of high-voltage equipment could present potential dangers to the public if unauthorized access occurs. The onshore substation site will therefore be secured with fences and locks, only properly trained personnel will be permitted to enter, and video security will be installed as necessary. The onshore export cables may be buried underground for a portion of the route or the entirety of the route, and access covers and/or transition joint bays will be secured and restricted to approved personnel. If aboveground is selected for a portion or the entirety of the route, the aboveground portion will be similar to existing overhead power lines. Onshore export cable towers, if used, will be designed to prevent unauthorized access by members of the public. Infrastructure will be properly maintained to minimize risk of a fallen power line. A Safety Management System is provided in Appendix F.

EMF associated with inter-array and export cables and the onshore substation site. The presence and movement of an electrical charge in a wire or cable produces EMF surrounding that wire or cable. The levels of EMF produced by each energized wire are affected by:

- the wire geometry and proximity to other nearby energized conductors;
- the electrical phase of the wire in a three-phase power system;
- the voltage of the electricity (electric fields); and
- the amount of electrical current that is transmitted in the wire (magnetic fields).

In general, EMF strength diminishes as distance from the source cable increases (BOEM 2020). Energy generated by the Project will cause EMF to be created around the inter-array cables, the ESP, the offshore export cables, the onshore export cables, onshore substation, interconnection lines, and switching station.

While there are no federal standards, nor state standards in the Commonwealth of Virginia for the exposure of the general public to EMF, levels of EMF associated with the Project components, as has been demonstrated with other comparable offshore wind projects within the U.S., are anticipated to be below the

limits published by the International Committee on Electromagnetic Safety and International Commission on Non-Ionizing Radiation for both onshore and offshore (ICNIRP 2010; ICES 2005; Epsilon Associates, Inc. 2018). Project levels are anticipated to be consistent with other similar projects and stay below the occupational exposure levels established by the American Conference of Governmental Industrial Hygienists (ACGIH 2001). Additionally, the onshore export cables will be buried within roadways or installed overhead along existing utility ROWs or existing roadways. Here, EMF levels are anticipated to be similar to other transmission lines and existing electrical utilities already located in the area, and are not anticipated to pose adverse effects to human health (NRC 1997).

EMF levels associated with the export cables at the seafloor are well below those recommended for human exposure (BOEM 2019). The magnetic fields from the buried offshore export cables are anticipated to also be below the thresholds for effects on the behavior of magneto-sensitive marine organisms (detailed in Section 5.4 Benthic Resources and Finfish, Invertebrates, and Essential Fish Habitat). Cable separation, burial depth, and distance from the export cables play a role in reducing exposure to EMF and generally, as humans or marine organisms move away from the source, their exposure to EMF decreases (BOEM 2019). Target burial depths for cables of 1.5 to 2.5 m are such that potential impacts to marine life associated with EMF are minimized and should have no impact on human health (see Appendix J Preliminary Cable Burial Risk Assessment). Where cable burial is not achieved and the export cable is exposed or cable protection is used, the exposure of benthic resources and marine life to EMF may be stronger. However, there is no expected impact to human health (BOEM 2020).

At the onshore substation site, public access will be restricted to outside the boundary fence where EMF levels will be near background levels, except where power cables cross the fence into the onshore substation site. Offshore, the ESP will be secured, and access will be restricted to Project-personnel only, greatly reducing potential impacts from EMF to public health at the ESP. Within the onshore substation site, Project personnel access will be limited to O&M activities where EMF levels will be less then occupational exposure levels deemed safe by the American Conference of Governmental Industrial Hygienists. Therefore, no adverse impacts are anticipated to either the general public or Project personnel resulting from exposure to Project-related EMF.

Collisions and allisions with O&M vessels and structures. Collisions may occur between O&M vessels and non-Project related vessels. In general, the risk of vessel collisions is low due to various mitigating factors, including USCG required lighting on vessels, the fact that higher vessel traffic areas were excluded from the WEA (BOEM 2015), and that COLREGs will be followed. The potential for an increase in navigational safety risk due to Project vessel activities was studied (see Appendix BB Navigation Safety Risk Assessment). The long-term presence of offshore structures may result in allisions, which would generally involve vessels alliding with the WTGs or the ESP. The risk of allisions with WTGs or the ESP is low due to mitigating factors, including the distance of the Wind Development Area from typical vessel routes, the spacing between WTGs and other facility components, and the lighting and marking plan that will be in place. AIS will be used to mark structures within the Wind Development Area, pending additional guidance from USCG. Additionally, the specific location of Project components will be provided to USCG and to NOAA for inclusion in nautical charts. As such, impacts from collisions and allisions are unlikely.

Potential interaction with and support of SAR operations. The likelihood of an incident requiring a SAR response in proximity to the Wind Development Area is considered low, and the minimum spacing between offshore wind structures and the two lines of orientation consistent across all internal structures will ensure that access to the sea area occupied by the array for SAR purposes is not compromised significantly (see Section 7.3 Marine Transportation and Navigation). Additionally, the Company will have the capacity for shut-down operations in the event of a SAR mission in the Wind Development Area (Appendix BB Navigation Safety Risk Assessment). All WTGs and the ESP will be lit and marked in accordance with BOEM and USCG requirements, including unique alphanumeric markings determined in coordination with the USCG. This lighting and marking may assist SAR by providing increased visibility and helping mariners determine their exact location. AIS will also be used to mark structures within the Wind Development Area,

pending additional guidance from USCG. The regular presence of O&M vessels in the Wind Development Area also has the potential to assist SAR. The Company will continue to closely coordinate with the USCG regarding SAR operations and the necessary safety measures. In addition, the Company will create and adhere to operational SAR procedures that will instruct Project personnel on how to engage with the USCG in the event of an emergency and assist emergency responders with their missions (Appendix BB Navigation Safety Risk Assessment).

Low probability events. Low probability events, such as extreme weather occurrences (e.g. hurricanes, lightning strikes), terrorist attacks or sabotage, fires or other similar events have the potential to occur but are unlikely during the useful life of the Project. However, these events could result in impacts to the public and Project personnel and equipment. Therefore, Project infrastructure will be designed to withstand weather events that are reasonably foreseeable during the useful life of the Project. WTGs will be rated to withstand (at a minimum) a Category 3 hurricane (see Appendix D Preliminary Hierarchy of Standards). The Company has reviewed and will consider additional guidance (ABS 2020; NREL 2020; and others) in the development of the Project. Emergency response plans will be in place that will include a clear chain of command, emergency evacuation routes, warning signals, and locations of fire extinguishers, spill kits, and first aid kits. Relevant personnel will be trained in implementing these response plans, should a non-routine event occur during O&M activities. Prevention and response measures for low probability events are further detailed in Appendix F Safety Management System. Weather-related measures are further addressed in Section 4.1 Physical and Oceanographic Conditions.

Accidents and accidental releases. Accidents during Project operations, such as equipment failure, have the potential to cause injury, property damage, or harm to the environment. O&M equipment will be maintained and operated by qualified personnel and will be regularly inspected. Furthermore, relevant personnel will undergo thorough health and safety training prior to the start of operations or maintenance activities. Training will continue to occur periodically as needed. This training will be specific to the site location and the activities that may occur (e.g. rough sea conditions, hazardous materials). Emergency response plans will be in place, and will include a clear chain of command, emergency evacuation routes, warning signals, and locations of fire extinguishers, spill kits, and first aid kits. All relevant personnel will be trained in implementing these response plans should an accident occur during O&M activities.

Various fuels, oils, and lubricants will be used in O&M activities, as detailed in Chapter 3 Description of Proposed Activity, and may present risks to public health if they are released to the environment. Volumes of hazardous materials will be low and limited to those used for O&M, including reasonable ancillary volumes. To reduce the risk of accidental releases, operations personnel will undergo training prior to the start of activities and complete periodic training as applicable (see Appendix F Safety Management System). Secondary containment measures will be in place on construction sites for oils and greases in accordance with state and federal regulations. Spill response kits will also be present at O&M sites. Hazardous materials will be transported to and from O&M sites in water-tight containers. Prevention and response measures for accidental releases will be further detailed in Appendix I Oil Spill Response Plan.

7.12.2.3 Decommissioning

Impacts resulting from decommissioning of the Project are expected to be similar or less than those experienced during construction. Decommissioning techniques are further expected to advance during the useful life of the Project. A full decommissioning plan will be provided to BOEM for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time. Special consideration for health and safety will be made during the development of the decommissioning plan to account for potential deterioration of equipment during the useful life of the Project.

7.13 References

See Table 7.13-1 for data sources used in the preparation of this chapter.

Table 7.13-1 Data Sources

Source	Includes	Available at	Metadata Link
BOEM	Lease Area	https://www.boem.gov/BOEM-Renewable-Energy-Geodatabase.zip	N/A
BOEM	State Territorial Waters Boundary	https://www.boem.gov/Oil-and-Gas-Energy-Program/Mapping-and-Data/ATL_SLA(3).aspx	http://metadata.boem.gov/geospatial/OCS_SubmergedLandsActBoundary_Atlantic_NAD83.xml
BOEM	Lease Block	https://www.boem.gov/oil-gas-energy/mapping-and-data/atlantic-cadastral-data	http://metadata.boem.gov/geospatial/OCS_LeaseBlocks_Atlantic_NAD83.xml
BOEM	Sand Borrow Area	http://www.boem.gov/Oil-and-Gas-Energy-Program/Mapping-and-Data/Federal-Sand-n-Gravel-Lease-Borrow-Areas_gdb.aspx	https://mmis.doi.gov/boemmmis/metadata/PlanningAndAdministration/LeaseAreas.xml
BOEM	Aliquot with Sand Resource	https://mmis.doi.gov/BOEMMMIS/	https://mmis.doi.gov/BOEMMMIS/metadata/PlanningAndAdministration/ATLSandAliquots.xml
BOEM	Protraction Area	https://www.boem.gov/oil-gas-energy/mapping-and-data/atlantic-cadastral-data	http://metadata.boem.gov/geospatial/ATL_PROTLMT.xml
BOEM	Call Areas	https://www.boem.gov/BOEM-Renewable-Energy-Geodatabase.zip	N/A
City of Virginia Beach	Zoning	https://data-vbgov.opendata.arcgis.com/datasets/a3558a2790384bd0950cbdbe69e29da8_2	https://www.arcgis.com/home/item.html?id=a3558a2790384bd0950cbdbe69e29da8
HIFLD	USCG Sectors	https://hifld-geoplatform.opendata.arcgis.com/datasets/uscg-districts	https://www.arcgis.com/sharing/rest/content/items/657c4f2d32214ae29e1f709d2917e099/info/metadata/metadata.xml?format=default&output=html
HIFLD	Transmission Lines	https://hifld-geoplatform.opendata.arcgis.com/datasets/electric-power-transmission-lines	https://www.arcgis.com/sharing/rest/content/items/70512b03fe994c6393107cc9946e5c22/info/metadata/metadata.xml?format=default&output=html
MARCO	VTR Data	https://oceandata.rad.rutgers.edu/arcgis/rest/services	N/A

Source	Includes	Available at	Metadata Link
MARCO	Recreational Boating Survey Route	https://portal.midatlanticocean.org/static/data_manager/data-download/Zip_Files/Recreation/RecreationalBoaterSurvey_MidAtl.zip	https://portal.midatlanticocean.org/static/data_manager/metadata/html/RecBoaterSurvey_All_Activities_Pts_metadata.html
MARCO	Diving Wrecks	https://portal.midatlanticocean.org/static/data_manager/data-download/Zip_Files/Recreation/CoastalRecSurvey/REG_Underwater_PUG_final.zip	https://portal.midatlanticocean.org/static/data_manager/metadata/html/CoastalRec_REG_Underwater_PUG_final.html
Marine Cadastre	Aids to Navigation	ftp://csc.noaa.gov/pub/MSP/AidsToNavigation.zip	https://inport.nmfs.noaa.gov/inport/item/56120
Marine Cadastre	Military Operating Area Boundaries Atlantic Gulf of Mexico	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://inport.nmfs.noaa.gov/inport/item/55364
Marine Cadastre	2017 Recreation Boater AIS	ftp://ftp.coast.noaa.gov/pub/MSP/2017AIS/VesselTransitCounts2017.zip	https://inport.nmfs.noaa.gov/inport/item/55363
NC DEQ	Artificial Reefs	https://opendata.arcgis.com/datasets/7ee54636ff024259a579b7e57d241ae9_0.zip?outSR=%7B%22latestWkid%22%3A2264%2C%22wkid%22%3A102719%7D	https://www.arcgis.com/sharing/rest/content/items/7ee54636ff024259a579b7e57d241ae9/info/metadata/metadata.xml?format=default&output=html
NOAA	Territorial Sea (12-nm Limit)	http://maritimeboundaries.noaa.gov/downloads/USMaritimeLimitsAndBoundariesSHP.zip	https://inport.nmfs.noaa.gov/inport-metadata/NOAA/NOS/OCS/inport/xml/39963.xml
NOAA	SAFMC Regulations	https://ocean.floridamarine.org/arcgis/services	N/A
NOAA	Scup Gear Restrictions	http://www.greateratlantic.fisheries.noaa.gov/educational_resources/gis/data/shapefiles/Scup_Gear_Restricted_Areas/Scup_Gear_Restricted_Areas_20161114.zip	http://www.greateratlantic.fisheries.noaa.gov/educational_resources/gis/data/shapefiles/Scup_Gear_Restricted_Areas/Scup_Gear_Restricted_Areas_METADATA.pdf
NOAA	Summer Flounder Fishery/Sea Turtle Protection Area	http://www.greateratlantic.fisheries.noaa.gov/educational_resources/gis/data/shapefiles/Summer_Flounder_Fishery-Sea_Turtle_Protection_Area/Summer_Flounder_Fishery-Sea_Turtle_Protection_Area_20140501.zip	http://www.greateratlantic.fisheries.noaa.gov/educational_resources/gis/data/shapefiles/Summer_Flounder_Fishery-Sea_Turtle_Protection_Area/Summer_Flounder_Fishery-Sea_Turtle_Protection_Area_METADATA.pdf
NOAA	Danger Zone/ Restricted Area	ftp://ftp.coast.noaa.gov/pub/MSP/DangerZonesAndRestrictedAreas.zip	https://inport.nmfs.noaa.gov/inport/item/48876

Source	Includes	Available at	Metadata Link
NOAA	Shipping: Speed Restrictions (Right Whales), Precautionary Area, Separation Zone, Traffic Lane/Fairway, Area to Be Avoided	http://encdirect.noaa.gov/theme_layers/data/shipping_lanes/shippinglanes.zip	https://inport.nmfs.noaa.gov/inport-metadata/NOAA/NOS/OCS/inport/xml/39986.xml
NOAA	Shipwreck/Obstruction (AWOIS)	ftp://ftp.coast.noaa.gov/pub/MSP/WrecksAndObstructions.zip	https://www.fisheries.noaa.gov/inport/item/39961
NOAA	Shipwreck (ENC)	https://opendata.arcgis.com/datasets/46dafe60b47e46a78099c3e62bc935b3_14.zip	https://www.arcgis.com/home/item.html?id=46dafe60b47e46a78099c3e62bc935b3
NOAA	Ocean Disposal Area/Dredged Material Disposal Area	ftp://ftp.coast.noaa.gov/pub/MSP/OceanDisposalSites.zip	https://inport.nmfs.noaa.gov/inport/item/54193
Northeast Ocean Data	AIS Fishing Data	https://www.northeastoceandata.org/files/metadata/Themes/AIS2019_Annual.zip	https://www.northeastoceandata.org/files/metadata/Themes/AIS/FishingAISVesselTransitCounts2019.pdf
Northeast Ocean Data	VMS Fishing Data	https://services.northeastoceandata.org/arcgis1/services	N/A
Northeast Ocean Data	Warning Areas	https://www.northeastoceandata.org/files/metadata/Themes/NationalSecurity.zip	http://northeastoceandata.org/files/metadata/Themes/Security/NEWarningAreas.pdf
Northeast Ocean Data	Military_Range_Complex	https://www.northeastoceandata.org/files/metadata/Themes/NationalSecurity.zip	http://northeastoceandata.org/files/metadata/Themes/Security/NEMilitaryRangeComplex.pdf
Northeast Ocean Data	AIS Vessel Transect Data	https://services.northeastoceandata.org/arcgis1/services	N/A
Northeast Ocean Data	2019-2024 Oil and Gas DPP Exclusion Option Areas	https://www.boem.gov/atl-5yr-2019-2024-excl-opt.zip	https://metadata.boem.gov/geospatial/2019-2024_DPP_Exclusion_Option_Areas.xml
Northeast Ocean Data	2019-2024 Oil and Gas Draft Proposal Program Areas (DPP)	https://www.boem.gov/atl-5yr-2019-2024.zip	https://metadata.boem.gov/geospatial/2019-2024_Draft_Proposed_Program_Area.xml
USACE	Pendleton Danger Zone	https://www.nao.usace.army.mil/Media/Public-Notices/Article/601227/nao-2014-0044/	N/A
USCG	Proposed Fairways	ftp://ftp.coast.noaa.gov/pub/MSP/AtlanticCoastPortAccessRouteStudy.zip	https://www.fisheries.noaa.gov/inport/item/60418

Source	Includes	Available at	Metadata Link
USGS	Land Use	https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/land-cover-data-download?qt-science_center_objects=0#qt-science_center_objects	N/A

7.13.1 Recreation and Tourism

ACS (American Community Survey). 2020. "Population estimates, 2019. QuickFacts: Dare County, North Carolina; Currituck County, North Carolina." Available online at: https://www.census.gov/quickfacts/fact/table/darecountynorthcarolina,currituckcountynorthcarolina/PST045219. Accessed 21 Apr 2020.

BOEM (Bureau of Ocean Energy Management). 2020. *Information Guidelines for a Renewable Energy Construction and Operations Plan*. Available online at: https://www.boem.gov/COP-Guidelines/ Accessed 28 Oct 2020.

Brookins, A. 2017. "Windfarm An Unlikely Tourist Attraction On Block Island." 14 Dec. *WSHU.* Available online at: https://www.wshu.org/post/windfarm-unlikely-tourist-attraction-block-island. Accessed 22 Oct 2020.

City of Virginia Beach. 2020. "Virginia Beach. Virginia Beach Official Destination Lookbook 2020-2021." Available online at: https://issuu.com/vvb1/docs/fy20_lookbook_pdf_for_issuu?fr=sNDgwNDY4MTEyNw. Accessed 24 Apr 2020.

City of Virginia Beach. n.d. "Virginia Beach Park Finder." Available online at: https://www.vbgov.com/parkfinder. Accessed 14 Jun 2021.

Global Insight. 2008. *An Assessment of the Potential Costs and Benefits of Offshore Wind Turbines*. September. Available online at: https://www.bpu.state.nj.us/bpu/pdf/announcements/njoswt.pdf. Accessed 27 Apr 2020.

Lilley, M.B., J. Firestone and W. Kempton. 2010. "The Effect of Wind Power Installations on Coastal Tourism." *Energies*. 3(1), 1-22. Available online at: https://doi.org/10.3390/en3010001. Accessed 28 Oct 2020.

Lutzeyer, S., D. J. Phaneuf, and L. O. Taylor. 2017. *The Amenity Costs of Offshore Windfarms: Evidence from a Choice Experiment.* CEnREP Working Paper No. 17-017. Raleigh, NC. Center for Environmental and Resource Economic Policy. August. Available online at: https://cenrep.ncsu.edu/cenrep/wp-content/uploads/2016/03/WP-2017-017.pdf. Accessed 28 Oct 2020.

Outer Banks Visitors Bureau. 2020. "Outer Banks Attractions. Things to Do: Attractions & Sites." Available online at: https://www.outerbanks.org/things-to-do/attractions/. Accessed 22 Apr 2020.

USFWS (U.S. Fish and Wildlife Service). 2010. *Back Bay National Wildlife Refuge: Draft Comprehensive Conservation Plan and Environmental Assessment.* Available online at: https://www.fws.gov/northeast/planning/back%20bay/pdf/draft_ccp/18w_Entire_Document(5131KB).pdf. Accessed 28 Oct 2020.

U.S. Travel Association. 2015. *U.S. Travel Association's Travel Economic Impact Model (TEIM).* Available online at: https://partners.visitnc.com/files/files/teim/2015-Travel-Economic-Impact-Model-TEIM.pdf. Accessed 22 Apr 2020.

U.S. Travel Association. 2019a. *The Economic Impact of Domestic Travel on Virginia Counties – 2018*. Prepared for the Virginia Tourism Authority. Available online at: https://www.vatc.org/wp-content/uploads/2019/09/2018-Economic-Impact-of-Domestic-Travel-on-Virginia-and-Localities.pdf. Accessed 21 Apr 2020.

U.S. Travel Association. 2019b. *Economic Impact Studies – North Carolina*. Prepared for Visit North Carolina. Available online at: https://partners.visitnc.com/economic-impact-studies. Accessed 21 Apr 2020.

Virginia Beach CVB (Convention and Visitors Bureau). 2020. "Virginia Beach Attractions. Explore: Attractions." Available online at: https://www.visitvirginiabeach.com/explore/attractions/. Accessed 21 Apr 2020.

Virginia Beach Economic Development. 2018. "Tourism. Key Industries: Tourism." Available online at: https://www.yesvirginiabeach.com/Key-Industries/Pages/Tourism.aspx. Accessed 22 Apr 2020.

7.13.2 Commercial and Recreational Fishing

American Sportfishing Association. 2019. "Economic Impacts of Sportfishing – North Carolina." Available online at: https://asafishing.org/state-reports/economic-impacts-of-recreational-fishing-north-carolina/. Accessed 09 Nov 2020.

Bergstrom, L., F. Sundqvist, and U. Bergstrom. 2013. "Effects of an offshore wind farm on temporal and spatial patterns in the demersal fish community." *Marine Ecology Press Series* 485:199-210. Retrieved from: https://doi.org/10.3354/meps10344.

Bergstrom, L., L. Kautsky, T. Malm, R. Rosenberg, M. Wahlberg, M. Capetillo, and D. Wilhelmsson. 2014. "Effects of offshore wind farms on marine wildlife – a generalized impact assessment." *Environmental Research Letters* 9:034012. Retrieved from: http://dx.doi.org/10.1088/1748-9326/9/3/034012.

BOEM (Bureau of Ocean Energy Management). 2015. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina*. Available online at: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NC/NC-EA-Camera-FONSI.pdf. Accessed 09 Oct 2020.

BOEM. 2016. *Collaborative Fisheries Planning for Virginia's Offshore Wind Energy Area.* Available online at: https://www.dmme.virginia.gov/de/LinkDocuments/OffshoreWind/Virginia-Wind-Energy-Area-Collaborative-Fisheries%20Planning-Final-Report.pdf. Accessed 30 Jun 2020.

BOEM. 2020a. *Guidelines for Providing Information on Fisheries Social and Economic Conditions for Renewable Energy Development on the Atlantic Outer Continental Shelf.* Available online at: https://www.boem.gov/sites/default/files/documents/about-boem/Social%20%26amp%3B%20Econ%20Fishing%20Guidelines.pdf. Accessed 09 Oct 2020.

BOEM. 2020b. Electromagnetic Fields and Marine Life. Available online at: https://www.boem.gov/sites/default/files/documents/renewable-energy/mapping-and-data/Electromagnetic-Fields-Marine-Life.pdf. Accessed 09 Nov 2020.

Currin, M. and S. Ross.1999. NC Division of Coastal Management. *Characterization of Recreational and Commercial Fisheries at "The Point" – Offshore North Carolina.*

Fisherman's Post. 2020. "Saltwater Tournament List." Available online at: https://www.fishermanspost.com/tournament-list. Accessed 10 Aug 2020.

GARFO (Greater Atlantic Regional Fisheries Office). 2018. *Permit, Port, and Fishery Revenue Exposure Analysis. Intergovernmental Renewable Energy Task Force Meeting.* Available online at: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NY/NMFS-NY-Press.pdf. Accessed 31 Aug 2020.

Hutt, C. and G. Silva. 2019. *NOAA Technical Memorandum NMFS-OSF-8. Economic Contributions of Atlantic Highly Migratory Species Anglers and Tournaments.* Available online at: https://repository.library.noaa.gov/view/noaa/22420. Accessed 10 Aug 2020.

Kirkpatrick, J. S, Benjamin. G, DePiper. T, Murphy. S, Steinback. C, Demarest. 2017. *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic. Volume II – Appendices. BOEM OCS Study 2017-012.* Available online at: https://tethys.pnnl.gov/sites/default/files/publications/Kirkpatrick-et-al-2017-BOEM-Vol2.pdf. Accessed 12 Aug 2020.

Krone, R., G. Dederer, P. Kanstinger, P. Krämer, C. Schneider, and I. Schmalenbach. 2017. "Mobile demersal megafauna at common offshore wind turbine foundations in the German Bight (North Sea) two years after deployment – increased production rate of *Cancer pagarus*." *Marine Environmental Research* 123:53-61. Retrieved from: http://dx.doi.org/10.1016/j.marenvres.2016.11.011.

NCDEQ (North Carolina Division of Environmental Quality). 2019. Chapter 3: Marine Recreational Fishery Statistics. Available online at: http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=33372974&name=DLFE-141805.pdf. Accessed 10 Aug 2020.

NCDMF (North Carolina Division of Marine Fisheries). n.d. "The North Carolina Division of Marine Fisheries – What We Do." Available online at: http://portal.ncdenr.org/web/mf/about-dmf. Accessed 09 Nov 2020.

NEAMAP (Northeast Area Monitoring and Assessment Program). n.d. "NEAMAP Projects." Available online at: http://www.neamap.net/projects.html. Accessed 09 Nov 2020.

NEFSC (Northeast Fisheries Science Center). 2019. *Resource Survey Report Bottom Trawl Survey Cape Hatteras – Gulf of Maine.* Available online at: https://repository.library.noaa.gov/view/noaa/22695. Accessed 09 Nov 2020.

NOAA. 2018. *NOAA Technical Memorandum NMFS-SEFSC-727. Characterization of the Shark Bottom Longline Fishery: 2017*. Available online at: https://repository.library.noaa.gov/view/noaa/19803. Accessed 09 Nov 2020.

NOAA Fisheries (National Oceanic and Atmospheric Administration's National Marine Fisheries Service). n.d. "Regional Vessel Monitoring Information." Available online at: https://www.fisheries.noaa.gov/national/enforcement/regional-vessel-monitoring-information. Accessed 02 Jun 2020.

NOAA Fisheries. 2012. "Recreational Fisheries Program Overview." Available online at: https://www.st.nmfs.noaa.gov/st1/recreational/overview/overview.html. Accessed 06 Oct 2020.

NOAA Fisheries. 2015. *Endangered Species Section 7 Consultation: Biological Opinion: Deepwater Wind: Block Island Wind Farm and Transmission System.* NER-2015-12248: pp. 270.

NOAA Fisheries. 2017. *Final Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan: Essential Fish Habitat.* Available online at: https://www.fisheries.noaa.gov/action/amendment-10-2006-consolidated-hms-fishery-management-plan-essential-fish-habitat. Accessed 09 Nov 2020.

NOAA Fisheries. 2018a. "Vessel Trip Reporting in the Greater Atlantic Region." Available online at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/resources-fishing/vessel-trip-reporting-greater-atlantic-region. Accessed 09 Nov 2020.

NOAA Fisheries. 2018b. "Top U.S. Ports." Available online at: https://foss.nmfs.noaa.gov/apexfoss/f?p=215:11:0::NO:::&tz=-4:00. Accessed 27 Jun 2020.

NOAA Fisheries. 2019a. "2019 Fall Bottom Trawl Survey Completed in the Northeast." Available online at: https://www.fisheries.noaa.gov/feature-story/2019-fall-bottom-trawl-survey-completed-northeast#:~:text=On%20November%2014%2C%20Northeast%20Fisheries,stations%20(92%20percent%20completion). Accessed 01 Oct 2020.

NOAA Fisheries. 2019b. "MRIP Series Download." Available online at: https://www.st.nmfs.noaa.gov/SASStoredProcess/do?. Accessed 28 Oct 2020.

NOAA Fisheries. 2019c. "Landings." Available online at: https://foss.nmfs.noaa.gov/apexfoss/f?p=215:200:2471864561192::NO. Accessed 28 Oct 2020.

NOAA Fisheries. 2019d. "Southeast Gillnet Observer Program." Available online at: https://www.fisheries.noaa.gov/southeast/fisheries-observers/southeast-gillnet-observer-program. Accessed 28 Oct 2020.

NOAA Fisheries. 2020a. "Types of Recreational Fishing Surveys. Large Pelagics." Available online at: https://www.fisheries.noaa.gov/recreational-fishing-data/types-recreational-fishing-surveys#large-pelagics-survey. Accessed 28 Oct 2020.

NOAA Fisheries 2020b. "Atlantic Highly Migratory Species. Recreational Fishermen." Available online at: https://www.fisheries.noaa.gov/topic/atlantic-highly-migratory-species#recreational-fishermen. Accessed 10 Aug 2020.

NOAA Fisheries. 2020c. "Overview: Spanish Mackerel." Available online at: https://www.fisheries.noaa.gov/species/spanish-mackerel. Accessed 28 Oct 2020.

NOAA Fisheries. 2020d. "Northeast Fisheries Observer Program." Available online at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/fisheries-observers/northeast-fisheries-observer-program Accessed 28 Oct 2020.

Prevost, Lisa. D, Bidwell. 2019. "In Rhode Island, offshore wind farm emerging as popular fishing spot." *Energy News Network*. Available online at: https://energynews.us/2019/11/04/northeast/in-rhode-island-offshore-wind-farm-emerging-as-popular-fishing-spot/. Accessed 28 Oct 2020.

Raoux, A. S, Tecchio, J, Philppe Pezy. G, Lassalle. S, Degraer. D, Wilheilmsson. M, Cachera. B, Emande. C, Guen. M, Haraldsson. K, Grangeré. F, Le Loc'h. J, Dauvin. N, Niquil. 2017. "Benthic and fish aggregation inside an offshore wind farm: Which effects on the trophic web functioning?" *Journal of Ecological Indicators*. Available online at: https://doi.org/10.1016/j.ecolind.2016.07.037. Accessed 14 Sep 2020.

Rein, G., A. Lundin, S. Wilson, and E. Kimbrell. 2013. *Offshore wind energy development site assessment and characterization: Evaluation of the current status and European experience.* Prepared by ESS Group, Inc. pursuant to BOEM Contract No. M12PD00018. Retrieved from: https://espis.boem.gov/final%20reports/5305.pdf.

Reubens, T. S, Degraer. M, Vincx. 2011. "Aggregation and feeding behaviour of pouting (*Trisopterus luscus*) at wind turbines in the Belgian part of the North Sea." *Journal of Fisheries Research*. Available online at: https://doi.org/10.1016/j.fishres.2010.11.025. Accessed 10 Sep 2020.

Reubens, J., S. Degraer, and M. Vincx. 2014. "The ecology of benthopelagic fishes at offshore wind farms: a synthesis of 4 years of research." *Hydrobiologia* 727:121-136. Available online at: https://doi.org/10.1007/s10750-013-1793-1. Accessed 10 Nov 2020.

SAFMC (South Atlantic Fishery Management Council). 2020a. "Dolphin Fish Regulations." Available online at: https://safmc.net/regulations/regulations-by-species/dolphin-fish/. Accessed 12 Sep 2020.

SAFMC. 2020b. "Wahoo Regulations." Available online at: https://safmc.net/regulations/regulations-by-species/wahoo/. Accessed 12 Sep 2020.

SAFMC. 2020c. "Regulations by Species." Available online at: https://safmc.net/regulations/regulations-by-species/. Accessed 17 Sep 2020.

ten Brink, T. T, Dalton. 2018. "Perceptions of Commercial and Recreational Fishers on the Potential Ecological Impacts of the Block Island Windfarm." *Frontiers in Marine Science.* Available online at: https://www.frontiersin.org/articles/10.3389/fmars.2018.00439/full. Accessed 10 Aug 2020.

USCG (United States Coast Guard). 2020. *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study, Final Report.* Docket Number USCG-2019-0131. Available online at: https://www.navcen.uscg.gov/pdf/PARS/FINAL_REPORT_PARS_May_14_2020.pdf. Accessed 10 Aug 2020.

VIMS. (Virginia Institute of Marine Science). 2010. *Monitoring Relative Abundance of American Shad in Virginia Rivers.* Available online at: https://www.vims.edu/research/departments/fisheries/fisheries_draft/programs/american_shad/results/technical_papers/2010_annual_report_FINAL.pdf. Accessed 15 Sep 2020.

VIMS. 2020a. "VIMS Longline Survey." Available online at: https://www.vims.edu/research/departments/fisheries/programs/sharks/programs/longline/index.php. Accessed 27 Aug 2020.

VIMS. 2020b. "VIMS. What is NEAMAP?" Available online at: https://www.vims.edu/research/departments/fisheries/programs/mrg_oldwebsite/neamap/index.php. Accessed 27 Aug 2020.

VMRC (Virginia Marine Resources Commission). 2020a. "Virginia Marine Resources Commission." Available online at: https://www.mrc.virginia.gov/#gsc.tab=0. Accessed 23 Jun 2020.

VMRC. 2020b. "Chapter: Pertaining to the Dredging of Conchs (Also known as Whelks)." Available online at: https://www.mrc.virginia.gov/regulations/fr150.shtm#gsc.tab=0. Accessed 30 Jun 2020.

VMRC. 2021. Public Hearing: Proposal to amend Chapter 4 VAC 20-751-10 *et seq.*, "Pertaining to the Setting and Mesh Size of Gill Nets", to modify the dates of unlawful gill net mesh sizes within the

Restricted Areas of the tributaries in the Chesapeake Bay. Available online at: https://www.youtube.com/watch?v=RBaRLGA59hc Accessed 5 May 2021.

Wahlberg, M. H, Westerberg. 2005. "Hearing in fish and their reactions to sounds from offshore wind farms." *Marine Ecology Progress Series*. Vol. 288: 295–309. Available online at: https://www.int-res.com/articles/meps2005/288/m288p295.pdf. Accessed 14 Sep 2020.

Wilhelmsson, D., T. Malm, and M. Öhman. 2006. "The influence of offshore wind power on demersal fish." *ICES Journal of Marine Science* 63(5):775-784. Available online at: https://doi.org/10.1016/j.icesjms.2006.02.001. Accessed 10 Nov 2020.

7.13.3 Marine Transportation and Navigation

BOEM (Bureau of Ocean Energy Management). 2020a. *Information Guidelines for a Renewable Energy Construction and Operations Plan (COP). Version 4.0*. May 2020. https://www.boem.gov/sites/default/files/documents/about-boem/COP%20Guidelines.pdf. Accessed 26 Oct 2020.

BOEM. 2020b. *Vineyard Wind 1 Offshore Wind Energy Project: Supplement to the Draft Environmental Impact Statement*. Available online at: https://www.boem.gov/sites/default/files/documents/renewable-energy/Vineyard-Wind-1-Supplement-to-EIS.pdf. Accessed 01 Jul 2020.

BOEM. 2021. *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development.* Available online at: https://www.boem.gov/sites/default/files/documents/renewable-energy/2021-Lighting-and-Marking-Guidelines.pdf. Accessed 09 Jun 2021.

Carnival Cruise Lines. 2020. "Cruise from: Norfolk, VA." Available online at: https://www.carnival.com/cruise-from/norfolk.aspx. Accessed 26 Oct 2020.

IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities). 2013. *The Marking of Man-Made Offshore Structures*. O-139, Edition 2.0. Available online at: http://iala-aism.org/product/markingof-man-made-offshore-structures-o-139/.

IMO (International Maritime Organization). 1972. *International Regulations for Preventing Collisions at Sea 1972.* Available online at: https://www.navcen.uscg.gov/pdf/navrules/navrules.pdf. Accessed 10 Nov 2020.

IMO. 2018. *Revised Guidelines for Formal Safety Assessment for Use in the Rule-Making Process.* Available online at: http://research.dnv.com/skj/IMO/MSC-MEPC%202_Circ%2012%20FSA%20Guidelines%20Rev%20III.pdf. Accessed 10 Nov 2020.

Kirkpatrick, J., S. Benjamin, G. DePiper, T. Murphy, S. Steinback, C. Demarest. 2017. "Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic." *The Bureau of Ocean Energy Management*. Available online at: https://espis.boem.gov/final%20reports/5580.pdf. Accessed 26 Oct 2020.

MCA (Maritime and Coastguard Agency). 2008a. *Marine Guidance Note 371 Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues.* Southampton, UK: MCA.

MCA. 2008b. *Marine Guidance Note 372 (Merchant and Fishing) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs.* Southampton, UK: MCA.

MCA. 2016. *Marine Guidance Note 543 (Merchant and Fishing) Safety of Navigation: OREIs – Guidance on UK Navigational Practice, Safety and Emergency Responses*. Southampton, UK: MCA.

MCA. 2021. *Marine Guidance Note 654 (Merchant and Fishing) Safety of Navigation: OREIs – Guidance on UK Navigational Practice, Safety and Emergency Responses*. Southampton, UK: MCA.

MMS (Minerals Management Service). 2009. *Appendix M. Report of the Effect on radar performance of the Proposed Cape Wind Project and advanced copy of USCG Findings and Mitigations*. Available online at: https://www.boem.gov/sites/default/files/renewable-energy-program/Studies/FEIS/Appendix-M---USCG-Report.pdf Accessed 26 Oct 2020.

New Kent County Economic Development. 2020. "Deep Water Ports." Available online at: https://yesnewkent.com/infrastructure/deep-water-ports/. Accessed 26 Oct 2020.

USACE (United States Army Corps of Engineers), Institute for Water Resources. 2018. *Final Waterborne commerce statistics for calendar year 2017: Waterborne commerce national totals and selected inland waterways for multiple years*. Available online at: https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/3002/. Accessed 26 Oct 2020.

USCG (United States Coast Guard). 2015a. *Atlantic Coast Port Access Route Study. Final Report.* Available online at: https://www.navcen.uscg.gov/pdf/PARS/ACPARS_Final_Report_08Jul2015_Executive_Summary.pdf. Accessed 26 Oct 2020.

USCG. 2015b. *Commandant Instruction* M16500.7A. Available online at: COMDTINST M16500.7A. Accessed 26 Aug 2021.

USCG. 2019a. *Navigation and Vessel Inspection Circular (NVIC) No. 01-19. Guidance on the Coast Guard's Roles and Responsibilities for Offshore Renewable Energy Installation Activities.* Available online at: https://www.dco.uscg.mil/Portals/9/DCO%20Documents/5p/5ps/NVIC/2019/NVIC%2001-19-COMDTPUB-P16700-4-dtd-01-Aug-2019-Signed.pdf?ver=2019-08-08-160540-483. Accessed 26 Oct 2020.

USCG. 2019b. *Commandant Instruction 16003.2B*. Available online at: https://media.defense.gov/2019/Jul/10/2002155400/-1/-1/0/CI_16003_2B.PDF. Accessed 15 Oct 2020.

USCG. 2019c. *Mid-Atlantic Maritime Strategy 2019-22*. Available online at: https://www.atlanticarea.uscg.mil/Portals/7/Fifth%20District/D5/Documents/Mid-Atlantic%20MaritimeStrategy%202018-2022.28%20Jun%20Final.pdf?ver=2019-10-18-094021-690. Accessed 26 Oct 2020.

USCG. 2020a. *NC, VA, MD, DE, NJ-Atlantic Ocean-Offshore Structure Paton Marking Guidance*. Published in Local Notice to Mariners; District 5; Week 38/20. Available online at: https://www.navcen.uscg.gov/pdf/lnms/lnm05382020.pdf. Accessed 26 Oct 2020.

USCG. 2020b. *Shipping Safety Fairways along the Atlantic Coast*. 33 CFR 166, Docket No. USCG-2019-0279. Available online at: https://www.federalregister.gov/documents/2020/06/19/2020-12910/shipping-safety-fairways-along-the-atlantic-coast. Accessed 26 Oct 2020.

7.13.4 Department of Defense and Outer Continental Shelf National Security Maritime Uses

BOEM (Bureau of Ocean Energy Management). 2015. Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina Environmental Assessment. Available online at: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NC/BOEM_NC_EA_For-Publication.pdf. Accessed 26 Oct 2020.

BOEM. 2021. *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development.* Available online at: https://www.boem.gov/sites/default/files/documents/renewable-energy/2021-Lighting-and-Marking-Guidelines.pdf. Accessed 09 Jun 2021.

Elizcity.com. 2020. "U.S. Coast Guard Air Station Elizabeth City." Available online at: https://www.elizcity.com/uscg-elizabeth-city.html. Accessed 26 Oct 2020.

IMO (International Maritime Organization). 1972. *International Regulations for Preventing Collisions at Sea 1972.* Available online at: https://www.navcen.uscg.gov/pdf/navrules/navrules.pdf. Accessed 10 Nov 2020.

Military.com. n.d. "Naval Station Norfolk Base Guide." Available online at: https://www.military.com/base-guide/naval-station-norfolk. Accessed 26 Oct 2020.

Military OneSource. 2020a. "Naval Air Station Oceana Dam Neck Annex: In-depth Overview." Available online at: https://installations.militaryonesource.mil/in-depth-overview/naval-air-station-oceana-dam-neck-annex. Accessed 26 Oct 2020.

Military OneSource. 2020b. "MCAS Cherry Point: In-depth Overview." Available online at: https://installations.militaryonesource.mil/in-depth-overview/mcas-cherry-point. Accessed 26 Oct 2020.

USCG (U.S. Coast Guard). 2019a. *Navigation and Vessel Inspection Circular 01-19 Guidance on the Coast Guard's Roles and Responsibilities for Offshore Renewable Energy Installations (OREI);* Available online at: https://www.dco.uscg.mil/Portals/9/DCO%20Documents/5p/5ps/NVIC/2019/NVIC%2001-19-COMDTPUB-P16700-4-dtd-01-Aug-2019-Signed.pdf?ver=2019-08-08-160540-483. Accessed 26 Oct 2020.

USCG. 2019b. "Atlantic Coast Port Access Route Study: Port Approaches and International Entry and Departure Transit Areas." *Federal Register* 84. 9541, (March 15, 2019) Available online at: https://www.govinfo.gov/content/pkg/FR-2019-03-15/pdf/2019-04891.pdf. Accessed 26 Oct 2020.

USCG. 2019c. *Commandant Instruction 16003.2B*. Available online at: https://media.defense.gov/2019/Jul/10/2002155400/-1/-1/0/CI_16003_2B.PDF. Accessed 26 Oct 2020.

USCG. 2020. *NC, VA, MD, DE, NJ-Atlantic Ocean-Offshore Structure Paton Marking Guidance*. Published in Local Notice to Mariners; District 5; Week 38/20. Available online at: https://www.navcen.uscg.gov/pdf/lnms/lnm05382020.pdf. Accessed 26 Oct 2020.

U.S. Navy. n.d. "Welcome to Naval Air Station Oceana." Available online at: https://www.cnic.navy.mil/regions/cnrma/installations/nas_oceana.html. Accessed 26 Oct 2020.

7.13.5 Offshore Renewable Energy, Mineral Exploration, and Infrastructure

BOEM (Bureau of Ocean Energy Management). 2014. *Announcement of Area Identification: Commercial Wind Energy Leasing on the Outer Continental Shelf Offshore North Carolina.* Available online at: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NC/NC_AreaID_Announcement_.pdf. Accessed 19 Oct 2020.

BOEM. 2016. *2017-2022 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program.* November 2016. Available online at: https://www.boem.gov/sites/default/files/oil-and-gas-energy-program/Leasing/Five-Year-Program/2017-2022/2017-2022-OCS-Oil-and-Gas-Leasing-PFP.pdf. Accessed 19 Oct 2020.

BOEM. 2018. *2019-2024 National Outer Continental Shelf Oil and Gas Leasing: Draft Proposed Program.* January 2018. Available online at: https://www.boem.gov/NP-Draft-Proposed-Program-2019-2024/. Accessed 19 Oct 2020.

BOEM. 2020a. *Commercial Lease for Wind Energy Offshore Virginia.* Available online at: https://www.boem.gov/renewable-energy/state-activities/commercial-lease-wind-energy-offshore-virginia. Accessed 24 Jun 2021.

BOEM. 2020b. "Coastal Virginia Offshore Wind Project (CVOW)." Available online at: https://www.boem.gov/renewable-energy/state-activities/coastal-virginia-offshore-wind-project-cvow. Accessed 04 Jun 2020.

BOEM. 2020c. "Marine Minerals Information System." Available online at: https://mmis.doi.gov/BOEMMMIS. Accessed 19 Oct 2020.

Dominion Energy. 2020. "Coastal Virginia Offshore Wind." Available online at: https://www.dominionenergy.com/projects-and-facilities/wind-power-facilities-and-projects/coastal-virginia-offshore-wind. Accessed 19 Oct 2020.

EPA (U.S. Environmental Protection Agency). 2019. "Managing Ocean Dumping in EPA Region 3." Available online at: https://www.epa.gov/ocean-dumping/managing-ocean-dumping-epa-region-3. Accessed 19 October 2020.

NASCA (North Atlantic Submarine Cable Association). 2015. "NASCA Submarine Cables." Available online at: https://inport.nmfs.noaa.gov/inport/item/48900. Accessed 19 Oct 2020.

NOAA. 2020. "NOAA Hydrographic Survey Projects 2020." Available online at: https://www.nauticalcharts.noaa.gov/updates/noaa-releases-2020-hydrographic-survey-season-plans/. Accessed 21 Oct 2020.

OCM Partners. 2020. "2019 USACE NCMP Topobathy Lidar: East Coast (NC) from 2010-06-15 to 2010-08-15." NOAA National Centers for Environmental Information. Available online at: https://www.fisheries.noaa.gov/inport/item/58669. Accessed 21 Oct 2020.

Offshore. 2020. "Coastal Virginia Offshore Wind delivers first power." 19 Oct 2020. Available online at: https://www.offshore-mag.com/renewable-energy/article/14184461/coastal-virginia-offshore-wind-delivers-first-power. Accessed 14 Oct 2020.

Submarine Cable Networks. 2018. "BRUSA and MAREA Cable Systems Terminate at Equinix DC2." Available online at: https://www.submarinenetworks.com/en/systems/brazil-us/brusa/brusa-and-marea-cable-systems-terminate-at-equinix-dc2. Accessed 19 Oct 2020.

U.S. President. 2020. Presidential Determination on the Withdrawal of Certain Areas of the United States Outer Continental Shelf from Leasing Disposition. Issued 25 Sep 2020. Available online at: https://www.whitehouse.gov/presidential-actions/presidential-determination-withdrawal-certain-areas-united-states-outer-continental-shelf-leasing-disposition/. Accessed 03 Nov 2020.

7.13.6 Aviation and Radar

BOEM (Bureau of Ocean Energy Management). 2021. *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development.* Available online at: https://www.boem.gov/sites/default/files/documents/renewable-energy/2021-Lighting-and-Marking-Guidelines.pdf. Accessed 09 Jun 2021.

7.13.7 Other Coastal and Marine Uses

Annapolis Newport Race. 2019. "Race Overview." Available online at: http://www.annapolisnewportrace.com/whatisa2n.html. Accessed 29 Jun 2020.

Bermuda One-Two Yacht Race. 2020. "Bermuda One-Two Yacht Race." Available online at: http://www.bermuda1-2.org/. Accessed 29 Jun 2020.

Bermuda Race Organizing Committee. 2019. "About the Race." Available online at: https://bermudarace.com/race/. Accessed 29 Jun 2020.

Blue Seas. 2020. "Virginia's Entrances, Inlets, & Passes." Available online at https://www.offshoreblue.com/cruise/inlets-va.php. Accessed 01 Oct 2020.

Brookins, A. 2017. "Windfarm An Unlikely Tourist Attraction On Block Island." *New England News Collaborative.* 14 Dec. Available online at: http://www.wshu.org/post/windfarm-unlikely-tourist-attraction-block-island#stream/0. Accessed 22 Apr 2020.

Global Insight. 2008. *An Assessment of the Potential Costs and Benefits of Offshore Wind Turbines*. September. Available online at: https://www.bpu.state.nj.us/bpu/pdf/announcements/njoswt.pdf. Accessed 27 Apr 2020

Lilley, M.B., J. Firestone and W. Kempton. 2010. "The Effect of Wind Power Installations on Coastal Tourism." *Energies*. 3. doi:10.3390/en3010001.

Marinas.com. 2020. "North Carolina, United States Inlets." Available online at: https://marinas.com/browse/inlet/US/NC/1. Accessed 16 May 2020.

Marion – Bermuda Cruising Yacht Race Association, Inc. 2020. "Notice of Race." Available online at: https://www.marionbermuda.com/. Accessed 29 Jun 2020

NC Wreck Diving. 2020. "North Carolina Shipwrecks." Available online at: http://www.nc-wreckdiving.com/shipwrecks.html. Accessed 29 Jun 2020.

Point 97, Surfrider Foundation, Urban Coast Institute at Monmouth University, and The Nature Conservancy. 2013. "Mid Atlantic Coastal and Ocean Recreation Study – Underwater-based Activities." Available online at: http://portal.midatlanticocean.org/static/data_manager/metadata/html/CoastalRec_REG_Underwater_PUG_final.html. Accessed 29 Jun 2020.

Rudee Tours. 2020. "Whale Watching – Virginia Beach." 2020. Available online at: https://www.rudeetours.com/tours-cruises/whale-watching-cruises/. Accessed 19 May 2020

Seabirding. 2020. "Seabirding – Excellence in Pelagic Birding." Available online at: https://patteson.com/. Accessed 21 May 2020.

van der Stap, Tim; Coolen, Joop W.P.; Lindeboom, Han J. 2016. "Marine Fouling Assemblages on Offshore Gas Platforms in the Southern North Sea: Effects of Depth and Distance from Shore on Biodiversity." *PLOS ONE* 11(1): e0146324. Available online at: https://doi.org/10.1371/journal.pone.0146324. Accessed 30 Jun 2020.

Virginia Aquarium. 2020. "Boat Trips." Available online at: https://www.virginiaaquarium.com/visit/Pages/Boat-Trips.aspx. Accessed 29 Jun 2020.

7.13.8 Population, Economy, Employment, and Housing

BOEM (Bureau of Ocean Energy Management). 2020. *Information Guidelines for a Renewable Energy Construction and Operations Plan*. Available online at: https://www.boem.gov/COP-Guidelines/. Accessed 03 Nov 2020.

BVG Associates, Stantec, and GLWN. 2017. *New York State Offshore Wind Master Plan. The Workforce Opportunity of Offshore Wind in New York.* Final Report. Prepared for New York State Energy Research and Development Authority. NYSERDA Report 17-25t. December. Available online at: https://www.nyserda.ny.gov/-/media/Files/Publications/Research/Biomass-Solar-Wind/Master-Plan/17-25t-Workforce-Opportunity-Study.pdf. Accessed 03 Nov 2020.

HRPDC (Hampton Roads Planning District Commission). 2013. "Hampton Roads MSA: Analysis of Recent Delineation." Available online at: https://www.hrpdcva.gov/news/article/march/25/2013/hampton-roads-msa-%3A-analysis-of-recent-delineation/. Accessed 04 Jun 2020.

Jensen et. al. 2018. "The impact of on-shore and off-shore wind turbine farms on property prices." *Energy Policy,* 116, 50-59. Available online at: http://macroecointern.dk/pdf-reprints/Jensen_EP_2018.pdf. Accessed 17 Apr 2020.

U.S. Census Bureau. 2019a. "2019 Population and Housing Unit Estimates." Available online at: https://www.census.gov/programs-surveys/popest.html. Accessed 17 Apr 2020.

U.S. Census Bureau. 2019b. "Table DP03: Selected Economic Characteristics." *2014-2018 American Community Survey 5-Year Estimates*. Available online at: https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2018/.

U.S. Census Bureau. 2019c. "Table DP04: Selected Housing Characteristics." *2014-2018 American Community Survey 5-Year Estimates*. Available online at: https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2018/.

U.S. Census Bureau. 2019d. "Table B25004: Vacancy Status." *2014-2018 American Community Survey 5-Year Estimates*. Available online at: https://data.census.gov/cedsci/. Accessed 21 June 2021.

U.S. Wind. 2018. "Visual Impact of Wind Farms: What You Need to Know." March 21. Available online at: http://www.uswindinc.com/visual-impact-wind-farms-need-know/. Accessed 17 Apr 2020.

VACo (Virginia Association of Counties). 2020. "Virginia Counties." Available online at: https://www.vaco.org/county-profiles/. Accessed 17 Apr 2020.

7.13.9 Environmental Justice

Brookins, A. 2017. "Windfarm An Unlikely Tourist Attraction On Block Island." 14 Dec. *WSHU.* Available online at: http://www.wshu.org/post/windfarm-unlikely-tourist-attraction-block-island#stream/0. Accessed 10 Nov 2020.

CEQ (Council on Environmental Quality). 1997. "Environmental Justice: Guidance Under the National Environmental Policy Act." Available online at: https://ceq.doe.gov/docs/ceq-regulations-and-guidance/regs/ej/justice.pdf.

Commonwealth of Virginia. 2019. *Executive Order Number Twenty-Nine*. Available online at : https://www.governor.virginia.gov/media/governorvirginiagov/executive-actions/EO-29-Establishment-Of-The-Virginia-Council-On-Environmental-Justice.pdf. Accessed 09 Apr 2020.

EPA (U.S. Environmental Protection Agency). 2018. "Learn About Environmental Justice." EPA. Available online at: https://www.epa.gov/environmentaljustice/learn-about-environmental-justice.

EPA. 2019. EJSCREEN. Available online at: https://ejscreen.epa.gov/mapper/. Accessed 09 Apr 2020.

Lilley, M.B., J. Firestone and W. Kempton. 2010. "The Effect of Wind Power Installations on Coastal Tourism." *Energies. 3*. https://doi.org/10.3390/en3010001. Accessed 28 Oct 2020.

NC DEQ (North Carolina Department of Environmental Quality). 2018. Secretary's Environmental Justice and Equity Advisory Board Charter. Available online at https://files.nc.gov/ncdeq/EJ/EJ-ADVISORY-BOARD-CHARTER-updated-2019.pdf. Accessed 20 Jul 2020.

U.S. Census Bureau. 2018. American Community Survey. Available online at: https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/. Accessed 09 Apr 2020.

U.S. Census Bureau. 2019. QuickFacts. Available online at: https://www.census.gov/quickfacts/fact/table/chesapeakecityvirginiacounty,VA,virginiabeachcityvirginiacounty/PST045219. Accessed 09 Apr 2020.

U.S. Census Bureau. 2021. "Poverty Glossary." Available online at: https://www.census.gov/topics/income-poverty/poverty/about/glossary.html. Accessed 07 Feb 2022.

7.13.10 Land Use and Zoning

City of Virginia Beach. 2017. *Sandbridge Beach Access Improvement*. City of Virginia Beach, Department of Public Works. Available online at: https://www.vbgov.com/government/departments/public-works/coastal/Pages/Sandbridge-Beach-Access-Improvement.aspx. Accessed 04 Mar 2020.

City of Virginia Beach. 2018a. *Virginia Beach City Map: Zoning*. Available for download at: https://www.arcgis.com/home/item.html?id=902c402f90214306ad14f9c08cb33bd6. Downloaded 04 Mar 2020.

City of Virginia Beach. 2018b. *Comprehensive Plan: Policy Document*. Available online at: https://www.vbgov.com/government/departments/planning/2016ComprehensivePlan/Documents/Comp%20Plan%20Update/Update%20Added%203-18-2019/EntireDocument_Amended_11.20.18.pdf. Accessed 03 Apr 2020.

City of Virginia Beach. 2019. *Sandbridge Beach Replenishment*. City of Virginia Beach, Department of Public Works. Available online at: https://www.vbgov.com/government/departments/public-works/coastal/Pages/sb-bch-replenish-5-5-17.aspx. Accessed 04 Mar 2020.

City of Virginia Beach. 2021. *Code of the City of Virginia Beach. Appendix A: Zoning Ordinance*. Available online at: https://library.municode.com/va/virginia_beach/codes/code_of_ordinances?nodeId=CO_APXAZOOR. Accessed 11 Jun 2021.

National Land Cover Database. 2016. NLCD 2016 Land Cover Conterminous United States. Available online at: https://www.mrlc.gov/data?f%5B0%5D=category%3Aland%20cover. Accessed 23 Mar 2020.

USFWS (U.S. Fish and Wildlife Service). 2019. *Back Bay National Wildlife Refuge*. Available online at: https://www.fws.gov/refuge/Back_Bay/map.html. Accessed 11 Jun 2021.

USGS (U.S. Geological Survey). 2016. *National Land Cover Database.* Available for download at: https://www.mrlc.gov/data?f%5B0%5D=category%3Aland%20cover&f%5B1%5D=region%3Aconus&f%5B2%5D=year%3A2016. Downloaded 11 Mar 2020.

7.13.11 Land Transportation and Traffic

City of Virginia Beach. 2018. City of Virginia Beach Comprehensive Plan: Policy Document. Available online at: https://www.vbgov.com/government/departments/planning/2016ComprehensivePlan/Documents/Comp%20Plan%20Update/Update%20Added%203-18-2019/EntireDocument_Amended_11.20.18.pdf. Accessed 11 Jun 2021.

City of Virginia Beach. 2021. *Interactive Traffic Control Database System.* Available online at: https://vbgov.ms2soft.com/tcds/tsearch.asp?loc=vbgov. Accessed 11 Jun 2021.

City of Virginia Beach. n.d. *Traffic Count Data.* Available online at: https://www.vbgov.com/government/departments/public-works/traffic/Pages/traffic-count-data.aspx. Accessed 11 Jun 2021.

7.13.12 Health and Safety and Low Probability Events

ABS (American Bureau of Shipping). 2020. Guide for Building and Classing Bottom-Founded Offshore Wind Turbines. Available online at: https://ww2.eagle.org/content/dam/eagle/rules-and-guides/current/offshore/176_bowti/bowt-guide-july20.pdf. Accessed 11 Aug 2020.

ACGIH (American Conference of Governmental Industrial Hygienists). 2001. *Documentation of the Threshold Limit Values and Biological Exposure Indices, 7th Ed*. Publication No. 0100. Cincinnati, OH.

BOEM (Bureau of Ocean Energy Management). 2015. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina: Revised Environmental Assessment.* Available online at: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NC/NC-EA-Camera-FONSI.pdf. Accessed 25 Jun 2020.

BOEM. 2019. *Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England*. Available online at: https://espis.boem.gov/final%20reports/BOEM_2019-049.pdf. Accessed 01 Jul 2020.

BOEM. 2020. *Vineyard Wind 1 Offshore Wind Energy Project: Supplement to the Draft Environmental Impact Statement*. Available online at: https://www.boem.gov/sites/default/files/documents/renewable-energy/Vineyard-Wind-1-Supplement-to-EIS.pdf. Accessed 01 Jul 2020.

Epsilon Associates, Inc. 2018. *Vineyard Wind Connector: Draft Environmental Impact Report EEA #15787*. 30 Apr 2018. Available online at: https://www.capecodcommission.org/resource-library/file/?url=/dept/commission/team/Website_Resources/ProjectFiles/VineyardWind/Application%20Materials/DEIR_Vineyard%20Wind%20Connector-Main%20Document.pdf. Accessed 01 Jul 2020.

ICES (International Committee on Electromagnetic Safety). 2005. *IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields 0 to 3 kHz.* Piscataway, NJ: IEEE. 2002, reaffirmed 2005.

ICNIRP (International Commission on Non-ionizing Radiation Protection). 2010. "Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz)." *Health Phys* 99:818-836. Available online at: https://www.icnirp.org/cms/upload/publications/ICNIRPLFgdl.pdf. Accessed 09 Jun 2020.

NRC (National Research Council). 1997. *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields*. Washington, DC: The National Academies Press. Available online at: https://doi.org/10.17226/5155. Accessed 11 Nov 2020.

NREL (National Renewable Energy Laboratory). 2020. Offshore Wind Electrical Safety Standards Harmonization: Workshop. Proceedings. Available online at: https://www.nrel.gov/docs/fy20osti/76849.pdf. Accessed 08 Jul 2020.