APPENDIX O

Essential Fish Habitat Assessment

May 2019

South Fork Wind Farm

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AC	alternating current
CFR	Code of Federal Regulations
cm	centimeter
CVA	Certified Verification Agent
DWSF	Deepwater South Fork Wind Farm LLC
EEZ	exclusive economic zone
EFH	essential fish habitat
ELMR	Estuarine Living Marine Resources
EMF	electromagnetic fields
FDR	Facility Design Report
FIR	Fabrication and Installation Report
FMC	fishery management councils
FMP	Fishery Management Plan
HDD	horizontal directional drill
HDPE	high-density polyethylene
IPF	impact-producing factor
km	kilometer(s)
kV	kilovolt
LIPA	Long Island Power Authority
LIRR	Long Island Railroad
m	meter(s)
MAFMC	Mid Atlantic Fishery Management Council
MARMAP	Marine Resources Monitoring, Assessment, and Prediction
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MWA	Maximum Work Area
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
nm	nautical miles
NOAA Fisheries	National Oceanic and Atmospheric Administration National Marine Fisheries Service
O&M	Operations and Maintenance

OCS	outer continental shelf
ppt	parts per thousand
ROW	right-of-way
SCADA	supervisory control and data acquisition
SFEC	South Fork Export Cable
SFEC - NYS	South Fork Export Cable – New York State Territorial Waters
SFEC – OCS	South Fork Export Cable – Outer Continental Shelf Waters
SFWF	South Fork Wind Farm
U.S.C.	United States Code
USCG	U.S. Coast Guard
WTG	wind turbine generator
YOY	young-of-the-year

SECTION 1

Description of Proposed Action

Deepwater South Fork Wind Farm LLC (DWSF) is proposing to construct the South Fork Wind Farm (SFWF) and South Fork Export Cable (SFEC) Project. The Project is an offshore wind energy facility consisting of the SFWF and the in-water and onshore components of the SFEC, a submarine electrical energy export cable.

1.1 South Fork Wind Farm

1.1.1 Facilities

The SFWF portion of the Project includes the following components:

- Up to 15 wind turbine generators (WTGs) and associated foundations
- One offshore substation (OSS) and associated foundation
- An inter-array cable connecting the WTGs and the OSS
- Ancillary onshore facilities (not discussed in detail in this report)

The SFWF will be in federal waters on the outer continental shelf (OCS) in Lease OCS-A 0486, approximately 19 miles (30.6 kilometers [km], 16.5 nautical miles [nm]) southeast of Block Island, Rhode Island, and approximately 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York. Water depths in the areas where turbines are proposed range from approximately 105 to 147 feet (32 to 45 meters [m]). The SFWF will interconnect with the Long Island Power Authority (LIPA) transmission system on Long Island, New York, via the SFEC.

Each WTG will be supported by a monopile foundation installed into the seafloor and scour protection will be added if needed.

The OSS will provide the interconnection for the power from the inter-array cable to the SFEC and will either be located on a platform supported by a foundation like that used for the WTGs or will be co-located on a foundation with a WTG mounted above the substation.

The SFWF inter-array cable will either be a 34.5 kilovolt (kV) or 66 kV capacity alternating current (AC) cable that connects individual WTGs and collects and transmits generated power to the OSS.

The temporary and permanent footprints on the seabed for each SFWF component or activity are summarized in Table 1.

Table 1. Footprint of South Fork Wind Farm Project Component or Activity
Maximum temporary and permanent seabed footprint for components of South Fork Wind Farm.

Project Component/Activity	Construction (Temporary)	Operation (Permanent)
Monopile Foundations [a]	14.8 acres (6 ha)	14.6 acres (5.9 ha)
Foundation cable protection [a]	N/A	10.2 acres (4.1 ha)
Vessel anchoring/mooring [b]	820.8 acres (332 ha)	N/A
Inter-array cable [c]	128.2 acres (51.9 ha)	2.4 acres (1.0 ha)

Table 1. Footprint of South Fork Wind Farm Project Component or Activity
Maximum temporary and permanent seabed footprint for components of South Fork Wind Farm.

Project Component/Activity	Construction (Temporary)	Operation (Permanent)
Inter-array cable protection [c]	N/A	20.0 acres (8.1 ha)

Notes:

[a] Conservatively assumes up to 16 foundations will be installed, including 15 foundations for WTGs and 1 foundation for the OSS. Permanent footprint also includes scour protection for 16 foundations and secondary cable protection for 16 foundations. Temporary disturbance includes seabed preparation.

[b] Conservatively assumes that, during typical installation, three vessels will use anchors, three vessels will use spud cans, and all six vessels will visit each of the 16 foundations.

[c] Conservatively assumes the inter-array cable has a maximum length of 20.4 miles (32.9 km, 17.8 nm) and a diameter of 12 inches (0.3 m). Permanent footprint also includes secondary cable protection. Temporary disturbance includes seabed preparation.

ha = hectare(s)
N/A = not applicable

1.1.2 Construction

The general process for installation of the SFWF involves the installation of the foundations to the sea floor through pile driving, and preparation of the structures for the WTGs. Work vessels then supply and assemble all the WTG components and install them on the foundations. All installation activities will occur within the Maximum Work Area (MWA) (Figure 1).

Offshore construction for the SFWF is anticipated to be completed in the following general sequence, which is further described in subsequent sections:

- Mobilization of vessels
- Transportation of the foundations to the WTG installation site
- Installation of the foundations
- Installation of the OSS
- Installation of the inter-array cable
- Installation of the WTGs

The WTG commissioning phase begins when the first WTG is installed offshore.

1.1.2.1 Foundation Installation

The general installation sequence includes the following steps:

1. Prepare sea floor, if necessary.
2. Install foundation, including pile driving.
3. Commission platform, which includes installation of marking and lighting for Private Aid to Navigation required by the U.S. Coast Guard (USCG).
4. Complete quality control checks and inspection in accordance with the Fabrication and Installation Report (FIR).

The installation process is described in further detail below.

Each foundation will be installed within a 328-foot (100 m) diameter circle. Seabed preparation associated with foundation installation, including boulder relocation with a boulder grab and anchoring/mooring, will occur within a 1,312-foot (400 m) diameter circle from the location where the monopile will be installed. The seabed disturbance associated with the foundation installation is included in Tables 1 and 2.

Table 2. South Fork Wind Farm Parameters: Foundations
Summary of maximum parameters for monopile foundation.

Foundation Parameter	Maximum Footprint
Foundation base diameter (feet per foundation)	36 feet (11.0 m)
Maximum Permanent Footprint	
Seabed footprint per foundation with no scour protection (ft^2 [m^2] per foundation)	1,025 ft^2 (95 m^2)
Seabed footprint per foundation with scour protection (ft^2 [m^2] per foundation) [a]	39,765 ft^2 (3,694 m^2)
Total Maximum Permanent Footprint	**635,976 ft^2 (59,084 m^2)** **14.6 acres (5.9 ha)**
Temporary Seabed Disturbance	
Seabed preparation per foundation (ft^2 [m^2] per foundation) [b]	40,365 ft^2 (3,750 m^2)
Vessel anchoring/mooring (ft^2 [m^2] per foundation) [c]	2,233,530 ft^2 (207,500 m^2)
Total Temporary Seabed Disturbance	**36,391,264 ft^2 (3,380,859 m^2)** **835.6 acres (338 ha)**

Notes:

[a] Conservatively assumes scour protection is placed around the base of each foundation in a circle with a diameter of 225 feet (68 m).

[b] Conservatively assumes temporary seabed disturbance from boulder relocation may occur near each foundation. The total seabed disturbance for all 16 foundations will be up to 14.8 acres (6 ha); not all foundations will require boulder relocation.

[c] Conservatively assumes that temporary seabed disturbance from vessel anchoring/mooring will occur during typical foundation installation. The total seabed disturbance for all 16 foundations will be up to 820.8 acres (332 ha). Three vessels will use anchors and three vessels will use spud cans; all six vessels will visit each of the 16 foundations. The vessels with anchors will have a total maximum ground disturbance of 4.51 acres (1.8 ha) per foundation and this ground-disturbing activity will happen 11 times at 16 foundations. The vessels with spud cans will have a total maximum ground disturbance of 0.15 acre (0.06 ha) per foundation and this ground-disturbing activity will happen 11 times at 16 foundations.

ft^2 = square feet
m^2 = square meters

Prior to commencing installation activities, the seabed will be checked for debris and levelness within a 200-foot (61-m) diameter circle from the location where the monopile will be installed. As necessary, significant debris, such as large boulders, will be moved outside this area (as described for the Inter-Array Cable in Section 3.1.3.3).

The foundations will be installed from a jack-up lift barge or derrick barge moored to the seabed or kept in position by the vessel's dynamic positioning system. The hydraulic pile driving hammer and crane used for lifting foundations and piles will be located on the installation barge. Jack-up vessels use metal legs with spud cans attached to the bottom to lift the work vessel out of the water. Once the vessel has completed its task, the vessel lowers back down to the water and lifts the spud cans off the sea floor and moves to the next work location. If a derrick barge is used as the installation vessel, it will be anchored at the location of the foundation. Once the vessel has completed its task, the vessel pulls its anchors and moves to the next work location. Alternatively, the derrick barge could use a dynamic positioning system to maintain position instead of anchors. Material barges will be used to transport the pile driving template, piles, and other structures to the installation site.

Each monopile will be lifted from the material barge, placed onto the seabed, leveled, and made ready for pile driving. Each monopile will then be driven to its final penetration design depth using a hydraulic hammer. Once the driving is complete, a transition section will be bolted to the top of the monopile to complete the installation.

Assuming a 24-hour work window and no delays due to weather, sea conditions, or other circumstances, each monopile will require approximately 2 to 4 days for installation. Duration of pile driving is anticipated to be approximately 2 to 4 hours per pile.

Monopiles will likely require scour protection because of the diameter of the foundation. Scour protection will consist of engineered rock that will be placed around the base of each monopile in a 225-foot (68 m) diameter circle using either a fallpipe vessel or a stone dumping vessel. Alternatively, the scour protection can be installed before the installation of the monopile.

1.1.2.2 Inter-Array Cable Installation

The general installation sequence for the inter-array cable includes the following steps:

1. Prepare sea floor.
2. Install cable.
3. Install secondary cable protection systems.

The installation process is described in further detail below.

Prior to initiation of cable installation, a pre-lay grapnel run will be conducted. The purpose of the pre-lay grapnel run is to remove possible obstructions and debris, such as abandoned fishing nets, wires, and hawsers, from along the cable route. Additionally, boulders may be relocated within sections of the corridor for the cable route. Boulder relocation will occur within 49 feet (15 m) on each side of the centerline. Boulder relocation will typically be completed by a towing tug, with a towed plow generally forming an extended "V"-shaped configuration that forces boulders to the extremities of the plow and establishes a clear centerline for the cable installation equipment. Boulder relocation may require multiple passes. Where appropriate, a boulder grab tool deployed from a dynamic positioning vessel may also be used to relocate isolated or individual boulders. The temporary seabed disturbance from boulder relocation is included in Tables 1 and 3.

Table 3. South Fork Wind Farm Parameters: Inter-array Cable
Summary of parameters for the inter-array cable.

Inter-array cable Parameter	Design Specifications
Cable diameter	6–12 inches (15.2–30.5 centimeters [cm])
Anticipated burial depth[a]	4–6 feet (1.2–1.8 m)
Maximum trench depth	10 feet (3 m)
Cable length	20.5 miles (32.9 km, 17.8 nm)
Maximum Permanent Footprint	
Inter-array cable[b]	2.4 acres (1.0 ha)
Secondary cable protection for inter-array cable[c]	9.8 acres (4.0 ha)
Cable protection at approach to foundations[d]	10.2 acres (4.1 ha)
Total maximum permanent footprint	22.4 acres (9.1 ha)

Table 3. South Fork Wind Farm Parameters: Inter-array Cable

Summary of parameters for the inter-array cable.

Inter-array cable Parameter	Design Specifications
Temporary Seabed Disturbance	
Inter-array cable installation	67.1 acres (27.1 ha)
Boulder relocation[e]	61.1 acres (24.7 ha)
Total temporary disturbance	128.2 acres (51.9 ha)

Notes:

[a] Burial depth is measured from the seabed to the top of the cable.

[b] Conservatively assumes a length of 20.4 miles (32.9 km, 17.8 nm) and a diameter of 12 inches (0.3 m).

[c] Conservatively assumes secondary cable protection will be needed for up to 10 percent of the inter-array cable (2.0 miles [3.2 km, 1.8 nm]). Cable protection will consist of rock or concrete matting (8 feet long by 39 feet wide [2.4 m long by 12 m wide]).

[d] Conservatively assumes each cable approach to a foundation will require approximately 300 feet (91.4 m) of cable protection, including rock or concrete matting (8 feet long by 39 feet wide [2.4 m long by 12 m wide]). The number of cable approaches per foundation will vary by foundation; 13 WTG may have two cable approaches (23,400 ft^2 [2,173.9 m^2]) of cable protection), two WTG may have three cable approaches (35,100 ft^2 [3260.9 m^2]), and the OSS may have up to six cable approaches (70,200 ft^2 [6,521.8 m^2]). Under these assumptions, total cable protection for the approach to all foundations will be 10.2 acres (4.1 ha), based on a total length of 2.2 miles (3.5 km, 1.9 nm) and a width of 39 feet (12 m).

[e] Conservatively assumes that temporary seabed disturbance will include installation equipment with a maximum temporary disturbance of 25 feet (7.5 m), based on a total length of 20.4 miles (32.9 km, 17.8 nm). Additional temporary disturbance may include use of controlled flow excavator during installation. Controlled flow excavator may include total disturbance of 33 feet (10 m) wide. The temporary seabed disturbance includes 8.2 feet (2.5 m) width, in addition to cable installation, for 6.1 miles (9.8 km, 5.3 nm) of the inter-array cable.

[f] Additional temporary disturbance may also include boulder relocation during seabed preparation. Boulder relocation may occur within 49 feet (15 m) of each side of the inter-array centerline and may include total disturbance of 66 feet (20 m) wide for 60 percent of the inter-array cable. The temporary seabed disturbance includes 41.1 feet (12.5 m) width, in addition to cable installation for 12.3 miles (19.7 km, 10.7 nm) of the inter-array cable.

The inter-array cable is expected to be buried using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, each of which is further described below. The burial method is dependent on suitable seabed conditions and sediments along the cable route. The maximum temporary seabed disturbance from cable installation equipment is included in Tables 1 and 3.

- Mechanical Cutter: This technique involves either a cutting wheel or an excavation chain to cut a narrow trench into the seabed allowing the cable to sink under its own weight or be pushed to the bottom of the trench via a cable depressor.
- Mechanical Plow: This technique involves pulling a plow along the cable route to lay and bury the cable. The plow's share cuts into the soil, opening a temporary trench which is held open by the side walls of the share, while the cable is lowered to the base of the trench with a depressor. Some plows may use additional jets to fluidize the soil in front of the share. Mechanical plowing is suited to a range of soil conditions except for very soft soils, hard soils, and rock. Backfill of the trench is expected shortly after installation due to collapse of the trench walls and/or by natural infill.
- Jet-Plow: This technique involves the use of water jets to fluidize the soil temporarily opening a channel to enable the cable to be lowered under its own weight or be pushed to the bottom of the trench with a cable depressor. Typical types of jet-plows include towed jet sleds, tracked jet-remotely operated vehicles, or vertical injectors. Backfill of the trench is expected shortly after installation due to settlement of fluidized sediments and/or trench collapse. Immediately after

installation a trench will likely be visible on the seabed as well as tracks/skids from the installation equipment; however, over time this will backfill to the original seabed level.

Cable lay and burial will be carried out until it reaches a distance of approximately 300 feet (91 m) from each foundation, where the cable will be laid out, cut, and a pulling head will be put on the cable end to allow the cable to be pulled into the foundation. Once the inter-array cable has been installed, scour protection will be installed.

The most effective method of protecting a submarine cable from damage caused by external forces is to bury the cable under the seabed. The target burial depth of the cable is 4 to 6 feet (1.2 to 1.8 m). Remedial burial activities and/or secondary cable protection may occur in areas where target burial depth is not achieved. Remedial burial may be conducted with a jet-plow or controlled flow excavator. A controlled flow excavator is a non-contact methodology with a jetting tool that draws in seawater from the sides and jets the water from a vertical down pipe at a specified pressure and volume. The down pipe is positioned over the cable alignment, enabling the stream of water to fluidize the sands around the cable, which allows the cable to settle into the trench under its own weight. Secondary cable protection systems may also be employed, such as articulated concrete mattresses or rock placement. A cable inspection program will be developed and reviewed by the Certified Verification Agent (CVA), to confirm the cable burial depth along the route and identify any further cable protection that may be needed.

1.1.2.3 Wind Turbine Generator Installation

After installation of the foundation and the pull-in of the inter-array cable (i.e., feeding the cable into each foundation), the WTGs will either be transported from the onshore staging facility by barge to the offshore installation site adjacent to the installation jack-up lift barge, or some WTG components may be transported to the SFWF aboard the installation vessel. In some locations, vessels may use moorings in temporary staging areas adjacent to the installation site. If a U.S.-flagged jack-up lift vessel is available, the WTG components may be loaded directly onto this vessel at the staging port for offshore installation.

After transportation to the SFWF, the WTGs will be installed in accordance with the following general sequence.

1. The jack-up vessel will be located next to each foundation and will individually lift each WTG component in accordance with the final installation strategy that will be described in the FIR. The towers for the WTGs will be installed in sections with the lower tower section lifted first followed by the other tower sections. Alternatively, the complete tower could be installed in one piece.
2. The nacelle will be lifted and connected to the tower, followed by installation of each blade to the hub. Pending final engineering and vessel availability, some tower sections (potentially including the full tower), and the full rotor (potentially including the hub and three blades) might be pre-assembled onshore.
3. Once the components are installed, workers will finalize securing each WTG component.

Installation of each WTG will require up to 3 days to complete, assuming a 24-hour work window and no delays due to weather, sea conditions, or other circumstances.

1.1.2.4 Offshore Substation Installation

The general installation process for the OSS will be very similar to the WTG installation process. The substation will be placed on of the same foundation as a WTG or a similar foundation as the WTGs. The substation will be brought to the foundation on a transportation barge and lifted into place by a jack-up lift barge or a derrick barge.

1.1.3 Operations and Maintenance

DWSF will be responsible for the operations and maintenance (O&M) of the SFWF. The SFWF will operate in accordance with the approved COP, and other applicable approvals and permits. The SFWF will be monitored 24 hours a day, 365 days a year from a remote facility. Any issues that cannot be fixed remotely will be addressed locally by trained technicians.

1.1.3.1 Vessel and Vehicle Mobilization and Material Transportation

During operations, vessels for SFWF maintenance activities will typically be mobilized from one of several port facilities located in New York, Rhode Island, Massachusetts, and Connecticut. In the case of unplanned maintenance, vessels may travel directly to the SFWF from locations that will be determined based on the type of maintenance that is required and vessel availability. These vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports.

1.1.3.2 Foundations

During operations, the primary activity related to foundations will be inspections and any resulting maintenance.

A foundation inspection program will be developed during the Facility Design Report (FDR) phase so that nodes/critical components of the foundations are inspected within a 5-year timeframe. Underwater inspection will include visuals and eddy current tests conducted by divers or remotely operated vehicles. Any observed damage or cracks would be analyzed further and repaired if required.

1.1.3.3 Wind Turbine Generators

Personnel conducting O&M activities will access the SFWF on an as-needed basis with no personnel living offshore. The WTGs are remotely monitored and controlled by the supervisory control and data acquisition (SCADA) system. The SCADA system connects the WTGs to the OSS and the OSS to the SFEC - Interconnection Facility with fiber optic cables that will be embedded in the inter-array and export cables. The SCADA system will provide a live feed of the measured wind speeds within the SFWF, as well as mechanical and electrical status of each WTG. The WTG activation/de-activation and output setpoints will normally be implemented through the fiber optic network that will be housed, in part, within the OSS and the SFEC - Interconnection Facility. This system will store real-time and historical data on performance and environmental conditions and provide a link to appropriate entities to monitor and control the SFWF.

The WTGs are equipped with safety devices to ensure safe operation during their lifetime. These safety devices may vary depending on the WTG selected and will be reviewed by the CVA during the FDR and the FIR phases. They may include, but are not limited to, vibration protection, over-speed protection, and aerodynamic and mechanical braking systems, as well as electrical protection devices.

The WTGs will be maintained in accordance with a dedicated service and maintenance plan developed by the WTG vendor before the start of operations. It is anticipated that each WTG will require approximately 1 week of planned maintenance and approximately 1 week of unplanned maintenance per year. Planned maintenance will be scheduled during low-wind periods of the year. For the SFWF, this is expected to be during the summer. Unplanned maintenance will occur to address issues that cannot be resolved remotely.

For planned maintenance activities, personnel access will be provided using crew transfer vessels. Unscheduled maintenance, including major repairs, may require the use of jack-up or crane barges if repairs to equipment such as power transformers, reactors, or switchgear are necessary. Temporary diesel generators, with secondary containment, may be used during repairs.

1.1.3.4 Inter-Array Cable

The inter-array cable has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated from damage because of outside influences, such as boat anchors. The armoring of the inter-array cable at the J-tubes and the burial of the inter-array cable to target depth will minimize the risk of damage to the cable system. An O&M phase cable inspection program will be developed by DWSF as part of the FDR and reviewed by the CVA.

1.1.3.5 Offshore Substation

The OSS will be monitored and controlled remotely through the SCADA system. The OSS is equipped with devices to ensure safe operation. These safety devices may vary depending on the substation selected and will be reviewed by the CVA as part of the FDR and FIR. They may include, but are not limited to, smoke detection, arc flash and safety signage, and fire suppression. During emergency events in which the power connection may be lost, a utility generator will operate to keep essential systems functional. Unplanned maintenance, which can include major repairs to heavy components like the main transformer, may require the use of jack-up or crane barges.

1.1.4 Conceptual Decommissioning

DWSF will decommission the SFWF in accordance with 30 Code of Federal Regulations (CFR) § 585.902 and 30 CFR §§ 585.905 through 585.912. The first step will be submission of a decommissioning application in accordance with 30 CFR § 585.905. Unless otherwise approved in the decommissioning plan, removal of facilities will be completed in accordance with the approved decommissioning plan and will follow the same relative sequence as construction but in reverse.

The WTG components and OSS will be disconnected and likely be removed using a jack-up lift vessel or a derrick barge. A material barge will then likely transport the components to a recycling yard where the components will be disassembled and prepared for re-use and/or recycling for scrap metal and other materials. Monopile foundations will be cut by an internal abrasive water jet cutting tool at 15 feet (4.6 m) below the seabed in accordance with 30 CFR § 585.910 and returned to shore for recycling in the same manner described for the WTG components and OSS. The inter-array cables will be decommissioned in accordance with the approved decommissioning plan. The decommissioning application will include a plan to clear the area after the SFWF facilities have been decommissioned to ensure that no unauthorized debris remains on the seabed.

1.2 South Fork Export Cable

1.2.1 Facilities

The SFEC portion of the Project includes multiple segments, each of which include various components:

- SFEC – Offshore: a submarine export cable (138 kV), buried beneath the seafloor, from the OSS to the sea-to-shore transition in the town of East Hampton, New York, including a segment in federal waters (SFEC – OCS) and a segment in New York State territorial waters (SFEC – NYS)
- SFEC – Onshore: a terrestrial export cable (138 kV), buried beneath the right-of-way (ROW) of roads and the Long Island Railroad (LIRR) from the sea-to-shore transition to a new interconnection facility (SFEC - Interconnection Facility) where the SFEC will interconnect with the LIPA electric transmission and distribution system at the existing East Hampton substation in the town of East Hampton on Long Island, Suffolk County, New York.

The SFEC – OCS segment of the SFEC - Offshore route extends westward 57.9 miles (93.1 km, 50.3 nm) through federal waters from the SFWF and passes south of Block Island; crosses into New York State territorial waters and extends 3.6 miles (5.8 km, 3.1 nm) to the sea-to-shore transition point at Beach

Lane (or Hither Hills) in East Hampton, New York on Long Island; and continues 4.1 miles (6.6 km, 3.6 nm) from the Beach Lane landing site (or 11.5 miles [18.5 km, 9.9 nm] from the Hither Hills landing site) to the SFEC – Onshore Substation also in East Hampton.

Water depths in the areas where the SFEC is proposed range from 0 feet (0 m) in New York State waters to approximately 170 feet (52 m) in federal waters.

The temporary and permanent footprints on the seabed for each SFEC component or activity are summarized in Table 4. The Project Envelope for the SFEC includes maximum parameters for the offshore segments and New York State segments of the export cable (Table 5).

Table 4. Footprint of South Fork Export Cable Segments

Maximum temporary and permanent seabed footprint for components of South Fork Export Cable.

Project Component/Activity	Temporary	Permanent
SFEC - OCS submarine cable[a]	330.9 acres (133.9 ha)	7.0 acres (2.9 ha)
SFEC - OCS cable protection[b]	N/A	7.6 acres (3.0 ha)
SFEC - NYS submarine cable[a]	18 acres (7.3 ha)	0.4 acres (0.17 ha)
SFEC - NYS cable protection[b]	N/A	0.2 acres (0.08 ha)
SFEC - NYS sediment excavation for an offshore cofferdam for sea-to-shore transition [c]	850 yd^3 (650 m^3)	N/A

Notes:

[a] Conservatively assumes the SFEC has a total permanent diameter of 12 inches (0.3 m), and that temporary seabed disturbance during seabed preparation or installation will have temporary width of between 25 feet (7.5 m) and 66 feet (20 m).

[b] Conservatively assumes additional cable protection, consisting of concrete matting (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to 5 percent of the SFEC - OCS (7.0 acres) and up to 2 percent of the SFEC - NYS (0.2 acres, and for seven locations (0.6 acres) where the SFEC - OCS will cross utility crossings, each of which may need up to 180 linear feet (54.9 m) of concrete matting.

[c] Cofferdam will enclose an area that is 75 feet long by 25 feet wide to a depth of up to 12 feet (22.9 m long by 7.6 m wide to a depth of up to 3.7 m).

m^3 = cubic meter
yd^3 = cubic yard

Table 5. South Fork Export Cable Parameters: Outer Continental Shelf and New York State Export Cable

Anticipated parameters for the export cable.

Parameter	OCS	New York State
Cable diameter	8-12 inches (20 - 30.5 cm)	
Anticipated burial depth[a]	4 - 6 feet (1.2 - 1.8 m)	
Maximum trench depth	10 feet (3 m)	
Maximum length of cable	57.9 miles (93.2 km, 50.3 nm)	3.5 miles (5.6 km, 3.0 nm)
Maximum Permanent Footprint		
Export cable[b]	6.9 acres (2.8 ha)	0.4 acres (0.17 ha)
Cable joints[c]	0.1 acres (.05 ha)	N/A
Secondary cable protection[d]	7.0 acres (2.8 ha) 305,974 ft^2 (28,426 m^2)	0.2 acres (0.08 ha) 7,351 ft^2 (683 m^2)

Table 5. South Fork Export Cable Parameters: Outer Continental Shelf and New York State Export Cable
Anticipated parameters for the export cable.

Parameter	OCS	New York State
Cable protection for existing utility crossing[e]	0.6 acres (0.23 ha) 25,230 ft^2 (2,344 m^2)	N/A
Total maximum permanent footprint	14.6 acres (6.0 ha)	0.6 acres (0.26 ha)
Temporary Seabed Disturbance		
Cable installation[f]	191.7 acres (77.6 ha)	18 acres (7.3 ha)
Cable installation trials[g]	9.3 acres (3.75 ha)	N/A
Boulder relocation[g]	124.9 acres (50.5 ha)	N/A
Cable joint installation[g]	4.9 acres (2 ha)	N/A
Total temporary seabed disturbance	330.9 acres (133.9 ha)	18 acres (7.29 ha)

Notes:

[a] Burial depth is measured from the seabed to the top of the cable.

[b] Conservatively assumes the SFEC - OCS has a length of 57.9 miles (93.2 km, 50.3 nm) and the SFEC - NYS has a length of 3.5 miles (5.6 km, 3.0 nm), and the cable diameter is 12 inches (0.3 m).

[c] Conservatively assumes up to 2 cable joints may be installed for the SFEC – OCS. Each joint has a length of 36 feet (11 m) and a diameter of 3 feet (0.9 m), requires cable protection for 88 feet (27 m), and requires additional cable on each side of the joint for a length of 1,312 feet (400 m).

[d] Conservatively assumes secondary cable protection will be needed for up to 5 percent of the SFEC – OCS and up to 2 percent of the SFEC – NYS, where burial depth may be less than 4 feet (1.2 m). Cable protection will consist of concrete mattresses (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]).

[e] Conservatively assumes additional cable protection, consisting of concrete mattress (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to seven existing cable systems, each of which may need up to 3,600 ft2 (334 m2) of matting for 180 linear feet (54.9 m).

[f] Conservatively assumes that temporary seabed disturbance will include installation equipment with a maximum temporary disturbance of either i) 25 feet (7.5 m) for 49.2 miles (79.2 km, 42.7 nm) for the SFEC – OCS and up to 3.5 miles (5.6 km, 3.0 nm) for the SFEC – NYS or ii) 43 feet (13 m) for up to 9 miles (14 km, 7.5 nm) for the SFEC – OCS.

[g] Conservatively assumes additional temporary disturbance for other seabed preparation and cable installation activities, including installation trials, boulder relocation, and cable joint(s). Up to five installation trials may occur, each of which has a temporary disturbance of 25 feet (7.5 m) wide and 3,280 feet (1,000 m) long. Boulder relocation may occur within 49 feet (15 m) of each side of the cable centerline and will include total disturbance of 66 feet (20 m) wide for up to 50 percent of the total length of the SFEC – OCS; the temporary seabed disturbance includes the width in addition to cable installation (12.5 m for 32.6 km). Placement of cable joint(s) may include use of controlled flow excavator for up to two joints, each of which has a temporary disturbance of 33 feet (10 m) wide and 3,280 feet (1,000 m) long.

1.2.2 Construction

1.2.2.1 South Fork Export Cable - Outer Continental Shelf Waters

The general installation sequence for the SFEC-OCS includes the following steps:

1. Conduct cable installation trials.
2. Prepare sea floor.
3. Install cable, including cable joint(s).
4. Install secondary cable protection systems.

The installation of the SFEC – OCS will follow similar methods as those described in Section 1.1.2.2 for the inter-array cable of the SFWF, including pre-lay grapnel run and boulder relocation. The associated temporary seabed disturbance is included in Table 4.

In addition to the cable installation equipment described for the inter-array cable, the SFEC – OCS installation may also include use of a displacement plow which mechanically displaces materials from the trench so that the cable can be laid in the trench. The tool is commonly used to target challenging ground conditions (i.e., very hard soils and/or where subsurface boulder risk is high).

Additional activities for the installation of the SFEC – OCS will occur and are described below.

Cable installation trials may occur within the cable corridor for the SFEC – OCS to test that the installation equipment is working properly and is appropriate for the seabed conditions. The trial will occur for a maximum length of up to 3,281 feet (1,000 m) in up to five sections, at a depth similar to the target burial depth. Each trial includes operating the installation equipment within the corridor, offset from the centerline, and may also include installing a short section of cable. The trial cable would be recovered towards the end of the cable installation process. The temporary seabed disturbance from cable installation trials is included in Table 5.

Due to the length of the SFEC – OCS, up to two offshore cable joints may be installed to splice two sections of the SFEC – OCS cable. The location of the joints will depend on cable installation and manufacturing and will be confirmed during the FDR/FIR and reviewed by the CVA. The cable joint and cable are lowered to the seabed and either placed within the trench or post-buried. A controlled flow excavator may be used at this location to either prepare the seabed for cable placement or complete post-burial activities for the cable joint. The seabed disturbance from installation of a cable joint is included in Table 5.

Cable lay and burial, as described for the inter-array cable of the SFWF, will be carried out along the entire route until approximately 300 feet (92 m) of the OSS. At that point, cable will be attached to the OSS, in the same process as described for connecting the inter-array cable to WTG in Section 1.1.2.2. Scour protection at the foundation for the OSS will then be installed once the cables are connected.

As described for the inter-array cable, the burial method is dependent on suitable seabed conditions and sediments along the SFEC route. Therefore, in areas where seabed conditions might not allow for cable burial, remedial burial may occur using a controlled flow excavator and/or other methods of cable protection may be employed, such as articulated concrete mattresses.

SFEC – OCS will cross seven existing telecommunications cable systems, some of which are active and others that are inactive, on the seabed. DWSF is consulting with these cable owners to implement a mutually agreeable crossing process. This process will be consistent with industry practice and will typically use articulated concrete mattresses. Where appropriate, inactive cable systems will be cut and cleared from the burial route for a short distance on each side. Any cut and cleared cables will typically have the exposed ends weighted with clump weights or short-section chain so that the cable cannot be snagged by other seabed users, such as fishermen.

A cable inspection program will be developed, and reviewed by the CVA, to confirm the cable burial depth along the route and identify any further cable protection that may be needed.

1.2.2.2 South Fork Export Cable - New York State Territorial Waters

Installation of the SFEC - NYS will follow the same methods described above for the SFEC – OCS, except that no boulder relocation, installation trials, or cable joint installation are expected to occur within New York State waters. No other cable systems along the proposed cable route have been identified within New York State waters.

1.2.2.3 South Fork Export Cable - Sea-to-Shore Transition

Installation of the SFEC - Offshore will start with horizontal directional drill (HDD) within the sea-to-shore transition. The installation process will be the same at Beach Lane or Hither Hills landing sites, although the specific locations of the transition vault and cofferdam will be different at each site.

The workspace for the HDD and drill entry point will be located at least 650 feet (198 m) onshore from the mean high water line at both Beach Lane and Hither Hills. The HDD (as well as the conduit and the cable) will end at least 1,750 feet (533 m) offshore from the mean high water line at both Beach Lane and Hither Hills and will be installed under the beach and intertidal zone.

Before HDD begins, a temporary cofferdam may be installed at the endpoint of the HDD, where the conduit exits from the seabed. Alternatively, the HDD might be installed without a cofferdam. The cofferdam, up to 75 feet by 25 feet (22.9 by 7.6 m), serves as containment for the drilling returns during the HDD installation and keeps the excavation free of debris and from silting back in. The cofferdam, if required, may be installed as either a sheet piled structure into the sea floor or a gravity cell structure placed on the sea floor using ballast weight. Installation of the cofferdam and drilling support will be conducted from an offshore work barge anchored near the cofferdam. A 5-point anchor barge may be employed at the cofferdam site to incorporate a second HDD drill spread in a push-pull drilling operation, which would facilitate removal of drill cuttings, insertion of high-density polyethylene (HDPE) conduit, and grouting. The location will be clearly marked to indicate to vessels that the cofferdam is present below the water surface, and DWSF will coordinate navigational marking and publication of its location with USCG.

- *Sheet Pile Installation.* If the cofferdam is installed using sheet pile, a vibratory hammer will be used to drive the sidewalls and endwalls into the seabed. Installation of a sheet pile cofferdam may take approximately up to 3 days. The sidewalls and endwalls will be driven to a depth of approximately 6 feet (1.8 m); sections of the shoreside endwall will be driven to a depth of up to 30 feet to facilitate the HDD entering underneath the endwall. After the sheet piles are installed, the inside of the cofferdam will be excavated to approximately 12 feet (3.7 m). This depth allows access to the HDD pilot hole for installation of the HDPE conduit. Up to 850 yd^3 (650 m^3) of material will be excavated from the pilot hole and sidecast during installation to naturally disperse. The cofferdam walls will either be cut off at a depth of 4 feet (1.2 m) above the sea floor, or the piles will be fully removed using the vibratory hammer, after HDD operations and conduit are installed. Metal sheeting will be removed, placed on the work barge, and hauled back to shore.
- *Gravity Cell Installation.* If the cofferdam is installed using gravity cell, the cell will be lowered onto the seafloor by a crane that is on a work barge. The sidewalls and seaside wall and end wall will be multi skinned to accommodate a rock ballast fill that will stabilize the cofferdam on the seabed. The cofferdam may be of a multi-sectional design to allow transportation and assembly at the site. Assembled interior dimensions of the cofferdam will be similar to a sheet pile cofferdam with similar volumes of excavated material which is sidecast, allowing access to the HDD conduit by the cable trencher. Once the HDD is complete and the conduit installed, the ballast is lifted out of the cofferdam and the un-ballasted cofferdam lifted off the seabed, placed on the work barge, and hauled to back to shore.

For the construction of the HDD, a drilling fluid of bentonite-water-based mud or another non-toxic drilling fluid will be used to cool the drill bit, maintain bore hole stability, and control fluid loss during operations. Drilling mud will be injected into the drill pipe onshore using pumps that are located within the HDD workspace. The mud will be jetted through a rotating drill bit attached at the end of the drill pipe. Jetting of the mud will cool the drill bit and suspend drill cuttings within the mud solution. Mud and cuttings will flow back to the surface in the gap between the drill pipe and bore hole, which will stabilize the bore hole. Once the mud flows back to the bore hole entry, it will be collected and reused.

The drill bit will enter the cofferdam under the cofferdam shoreside end wall; sufficient clearance will be allowed in the design to facilitate the pilot hole, drill head, and HDPE conduit. When no cofferdam is used, a small construction vessel will monitor the completion of the HDD drilling. This vessel will ensure that no drilling mud will be released.

The conduit, consisting of a thick-walled HDPE pipe with a maximum diameter of 24 inches (61 cm), will be inserted through the entire length of the bore hole through which the submarine cable will be installed. The conduit may be assembled adjacent to the HDD workspace and, after completion of drilling, will be capped, moved across the surface of the beach, and floated to the endpoint of the HDD. The HDD equipment will be used to pull the HDPE pipe through the drill hole to create a stable conduit for bringing the cable ashore.

After installation of the HDPE conduit, a transition vault will be installed onshore around the drill pit. A pull line will be placed inside the finished conduit to facilitate pulling the SFEC through the conduit. After the SFEC is pulled through the conduit, the submarine and fiber optic cables will be spliced to the SFEC - Onshore cable within the transition vault. The transition vault will be sealed, covered, and repaved with manhole covers at the surface.

The temporary cofferdam will be removed after installation of the SFEC - NYS has started. The remaining cofferdam walls will be removed, either by vibratory hammer (for sheet pile cofferdam) or by lifting (for gravity cell cofferdam). The excavated sediments placed in the immediate vicinity of the cofferdam will be allowed to disperse naturally. Cable protection may be placed at the HDD exit point (e.g., one cable mattress)[1].

Depending on site-specific conditions and other external factors, the HDD installation activities are expected to take 10 to 12 weeks, including equipment mobilization and breakdown. In residential areas, HDD activities will be limited to a typical 12-hour working window, with exceptions for extenuating circumstances and for two specific activities (conduit installation and cable pull-in) that require 24-hour operation for a short period of time. HDD activities will be completed outside the summer season, with active drilling expected to be completed before March 31.

1.2.3 Operations and Maintenance

DWSF will be responsible for the operation of the SFEC. As described for the SFWF, the SFEC will be monitored 24 hours a day, 365 days a year from a remote facility. The SFEC is not expected to require planned maintenance; however, inspections and tests will be conducted regularly based on manufacturer-recommended schedules; regular monitoring and any repairs will be based on manufacturer-suggested methods. DWSF will maintain at least 500 feet (152.4 m) of spare cable and underwater splices to facilitate mechanical cable repair that could become necessary through a fault or mechanical damage event.

Monitoring will include a periodic review of anomalies in cable charging current and power factor, as well as review of protection device operation records.

1.2.3.1 Vessel and Vehicle Mobilization and Material Transportation

As described for the SFWF, during operations, vessels for the SFEC - Offshore maintenance activities will typically be mobilized from one of the identified ports. In the case of unplanned maintenance, vessels may travel directly to the work sites from locations to be determined prior to operations. Some of these vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports, depending on charter agreements and vessel availability.

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[11] A mattress placed at the HDD exit point is included within the 0.2 acres (0.08 ha) for cable protection along the SFEC – NYS.

1.2.3.2 South Fork Export Cable - Offshore (OCS and NYS)

The SFEC - Offshore has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated because of damage from outside influences, such as boat anchors. Burial of the cable to the target burial depth will minimize the risk of damage to the cable system. An O&M-phase cable inspection program will be developed by DWSF, included in the FDR, and reviewed by the CVA.

Mechanical inspections will include a cable burial assessment and debris field investigation of the SFEC. The mechanical inspection is planned to occur on a 5-year basis or following a storm event that may necessitate an unplanned inspection.

If mechanical damage to the SFEC - Offshore should occur, the cable will fault immediately. DWSF will identify the location of the fault, and mobilize a repair barge, which would be equipped with water pumps, jetting devices, hoisting equipment, and other tools typically used in repairs of submarine cables. The cable would be exposed with hand-operated jet tools and cut in the middle of the damaged area. The cable would be raised to the repair barge where the damaged portion of the cable would be cut so that cable splicing can occur. The repaired cable would then be reburied to the appropriate depth by hand-operated jet tools.

1.2.4 Conceptual Decommissioning

DWSF will decommission the SFEC in accordance with 30 CFR § 585.902 and 30 CFR §§ 585.905 through 585.912. The first step will be submission of a decommissioning application in accordance with 30 CFR § 585.905. Unless otherwise approved in the decommissioning plan, removal of facilities will be completed in accordance with the approved decommissioning plan and will follow the same relative sequence as construction but in reverse.

SECTION 2

Essential Fish Habitat Review

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

The Sustainable Fisheries Act defined EFH to mean “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity” and added the requirement that the regional fishery management councils (FMC), through Fishery Management Plans (FMPs), should “describe and identify EFH” for the improved management of that fishery. National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) further clarified the terms associated with EFH (50 CFR 600.05-600.930) by the following definitions:

- Waters – Aquatic areas and their associated physical, chemical, and biological properties that are used by fish and, where appropriate, may include aquatic areas historically used by fish;
- Substrate – Sediments, hard bottoms, structures underlying the waters, and associated biological communities;
- Necessary – The habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and
- Spawning, breeding, feeding, or growth to maturity – Stages representing a species’ full life cycle.

2.1 Affected Environment

The affected environment related to the SFWF and SFEC consists of areas of habitat that may be designated as EFH for managed fish, shellfish, and mollusk species that reside within these habitats. Regional FMCs and NOAA work together to delineate areas of EFH and manage them. As part of the management, descriptions for general habitats preferred by individual species are created and used as an identification guide. Additionally, these agencies coordinate to create individual fishery management plans.

Official EFH data relevant to the SFWF and SFEC are published by the New England Fishery Management Council (NEFMC) and Mid Atlantic Fishery Management Council (MAFMC). EFH data and text descriptions were downloaded from the NOAA Habitat Conservation EFH Mapper, an online mapping application (NOAA, 2018). EFH data were queried using GIS software based on SFWF and SFEC project components.

Figure 1 shows the project components for which EFH data were obtained including the SFWF MWA, the SFEC - OCS, and the SFEC - NYS for both Hither Hills and Beach Lane landing sites. A 0.5-mile buffer on either side of the preliminary SFEC route was assumed in order to query the data by the GIS software. Species and life stages with designated EFH in these four component areas are presented in Table 7.

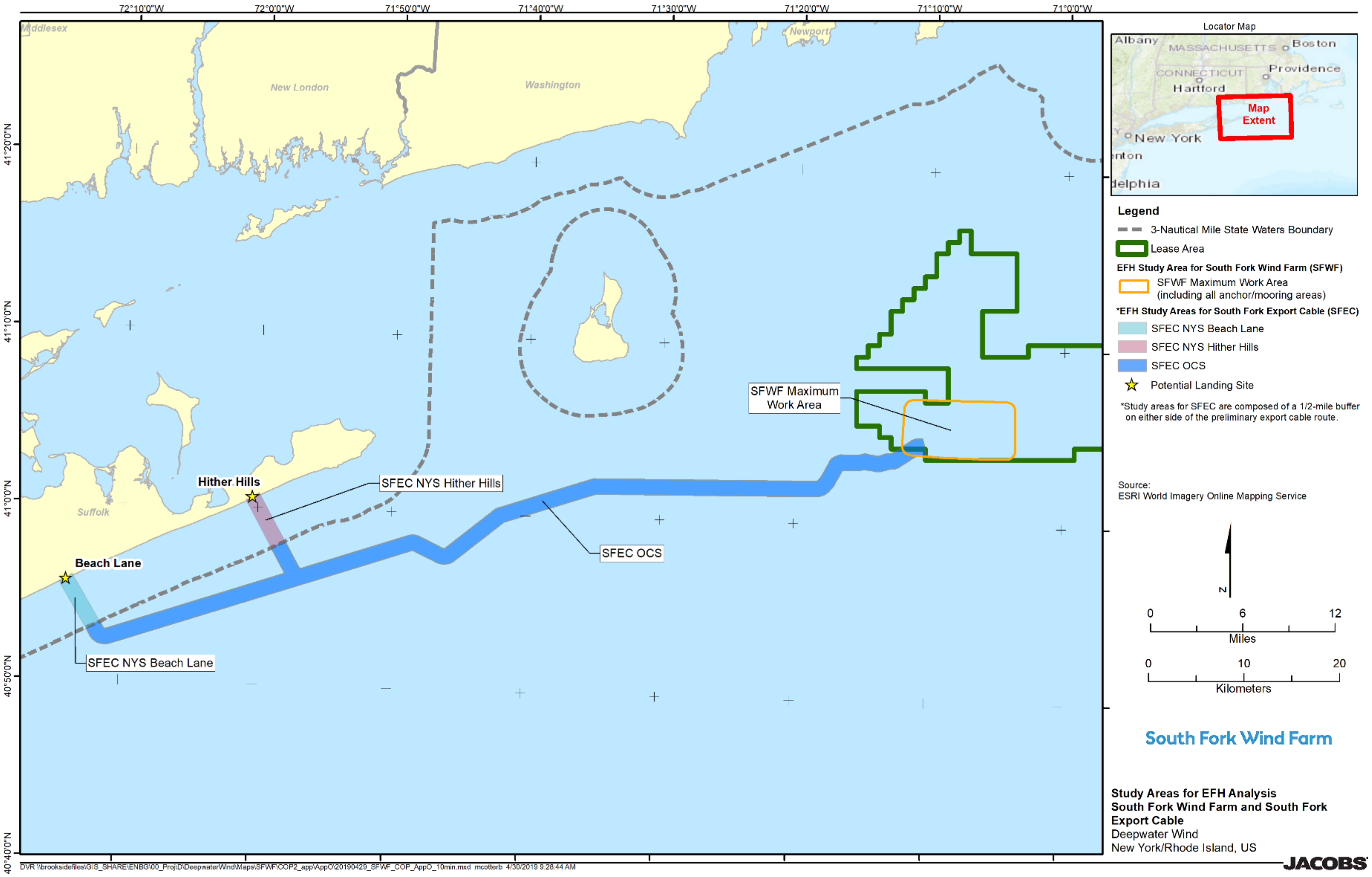

Figure 1. SFWF and SFEC Project Components used for EFH Data Analysis

Map showing SFWF and SFEC project components used for EFH data analysis

New England waters have diverse habitats that are defined by their temperature, salinity, pH, physical structure, biotic structure, depth, and currents. The unique combination of habitat characteristics shapes the community of finfish species that inhabit the area. Habitat types determine species, distribution, and predator/prey dynamics. Each habitat structure supports a community of finfish species that rely on the habitat to survive. Multiple factors directly affect spatial and temporal patterns of fish species.

Based on data from site-specific benthic habitat surveys conducted for the Project, the SFWF has a highly variable and patchy distribution of benthic habitats including sand sheets, sand with mobile gravel, and patchy cobbles and boulders on sand. Although sand sheets were the most common habitat type encountered during the benthic surveys, the heterogeneity of sediment types on small scales was high, with variable presence of gravel (i.e., granules, pebbles, cobbles, boulders) on sandy substrates characterizing much of the SFWF. The presence of cobbles and boulders at the SFWF was patchy and geophysical and geotechnical survey data show that the highest density of boulders was found in the western and central portion of the SFWF (Section 4.3.2 of the Construction and Operations Plan (COP), Benthic and Shellfish Resources). Site-specific sidescan sonar surveys revealed boulder density in relation to project components and showed that the greatest boulder density occurs in the western, southern, and northeastern parts of the MWA, with three higher density boulder areas near the center of the MWA (Figures 3.1-1 and 3.1-2 Appendix H of the COP). Areas of low boulder density correspond to quaternary fluvial-estuarine deposits identified in shallow seismic data (glacial meltwater channels, Figure 4.3-5 and Appendix H of the COP).

All three benthic habitats (sand sheets, sand with mobile gravel, and patchy cobbles and boulders on sand) were observed along the SFEC route; however, their distribution varied with distance from the SFWF and as the SFEC route nears land in NYS waters, where waters are shallower than 25 feet (7 m). The SFEC route was dominated by sand sheet habitats with a few exceptions where this habitat type was interspersed with other habitat types. The SFEC - OCS in areas immediately adjacent to the SFWF were more heterogenous than the remainder of the SFEC, with patchy cobble and boulder on sand habitats observed within 18.6 - 24.9 miles (30 - 40 km, 16.2 - 21.6 nm) of the SFWF. Sand with mobile gravel habitats were observed along the SFEC - OCS route between the SFWF and for about half the distance along the SFEC - OCS to due south of Block Island. These habitats were also present in the section of the SFEC - NYS south of Montauk Point and near the Hither Hills landing point within NYS waters. Within NYS waters, sand sheets were the predominant benthic habitat type, with mobile gravel present at one station, and sediment grain size was largely homogeneous. Sediment grain size was moderately variable on small scales along the SFEC - OCS, but most of the variability was between grain size classes within the overall sand category. Deposits of very fine silt, on the order of 38 inches (15 centimeters [cm]) thick, were observed overlying sand at two locations offshore of the Beach Lane SFEC - NYS landing location; one of these locations fell within NYS waters (see Section 4.3.2 of the COP, Benthic and Shellfish Resources for more detail). A summary of habitat types documented in the four project component areas based on site-specific benthic surveys is presented in Table 6.

Table 6. Summary of Habitat Types Present in the Four Project Component Areas

Project Component	Habitat Types Present
SFWF MWA	Sand Sheet; Sand with Mobile Gravel; Patchy Cobbles & Boulders in Sand
SFEC - OCS	Sand Sheet; Sand with Mobile Gravel; Patchy Cobbles & Boulders in Sand
SFEC-NYS Hither Hills	Sand Sheet; Sand with Mobile Gravel
SFEC - NYS Beach Lane	Sand Sheet

2.2 Essential Fish Habitat Designations

Within the four project component areas that encompass the Project Area (Figure 1), 41 species of finfish and invertebrates have designated EFH for various life stages (Table 7). Full descriptions of each of these species and life stages are included in Section 2.3.

Table 7. EFH Designations for Species in the SFWF and SFEC

Species and Life Stages	Presence in Each Project Component			
	SFWF	SFEC - OCS	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
New England Finfish Species				
Atlantic Cod (*Gadus morhua*)				
Eggs	X	X	X	X
Larvae	X	X	X	X
Juvenile	X	X		
Adult	X	X	X	X
Atlantic Herring (*Clupea harengus*)				
Larvae	X	X	X	
Juvenile	X	X	X	X
Adult	X	X	X	X
Haddock (*Melanogrammus aeglefinus*)				
Larvae	X	X	X	X
Juvenile	X	X	X	
Adult		X		
Monkfish (*Lophius americanus*)				
Eggs	X	X	X	X
Larvae	X	X	X	X
Juvenile		X		
Adult	X	X		
Ocean Pout (*Macrozoarces americanus*)				
Eggs	X	X	X	X
Juvenile	X	X		
Adult	X	X	X	X
Pollock (*Pollachius pollachius*)				
Eggs	X	X		
Larvae	X	X	X	X
Juvenile	X	X		

Table 7. EFH Designations for Species in the SFWF and SFEC

Species and Life Stages	Presence in Each Project Component			
	SFWF	**SFEC - OCS**	**SFEC - NYS Beach Lane**	**SFEC - NYS Hither Hills**
Red Hake (*Urophycis chuss*)				
Eggs	X	X	X	X
Larvae	X	X	X	X
Juvenile	X	X	X	X
Adult		X	X	X
Silver Hake (*Merluccius bilinearies*)				
Eggs	X	X		
Larvae	X	X		
Juvenile		X		
White Hake (*Urophycis tenuis*)				
Juvenile		X		
Windowpane Flounder (*Scophthalmus aquosus*)				
Eggs	X	X	X	X
Larvae	X	X	X	X
Juvenile	X	X	X	X
Adult	X	X	X	X
Winter Flounder (*Pseudopleuronectes americanus*)				
Eggs	X		X	X
Larvae	X	X	X	X
Juvenile	X	X	X	X
Adult	X	X	X	X
Witch Flounder (*Glyptocephalus cynoglossus*)				
Eggs	X	X		
Larvae	X	X	X	X
Yellowtail Flounder (*Limanda ferruginea*)				
Eggs	X	X	X	X
Larvae	X	X	X	X
Juvenile	X	X		
Adult	X	X	X	X

Table 7. EFH Designations for Species in the SFWF and SFEC

Species and Life Stages	Presence in Each Project Component			
	SFWF	SFEC - OCS	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Mid-Atlantic Finfish Species				
Atlantic Butterfish (*Peprilus triacanthus*)				
Eggs	X	X	X	
Larvae	X	X	X	X
Juvenile	X	X	X	X
Adult		X		
Atlantic Mackerel (*Scomber scombrus*)				
Eggs	X	X	X	X
Larvae	X	X		X
Juvenile		X	X	X
Black Sea Bass (*Centropristis striata*)				
Juvenile	X	X	X	X
Adult	X	X	X	
Bluefish (*Pomatomus saltatrix*)				
Eggs	X	X		
Larvae	X	X		
Juvenile		X	X	X
Adult	X	X	X	X
Scup (*Stenotomus chrysops*)				
Juvenile	X	X	X	X
Adult	X	X	X	X
Summer Flounder (*Paralichthys dentatus*)				
Eggs	X	X		
Larvae	X	X		X
Juvenile		X	X	X
Adult	X	X	X	X

Table 7. EFH Designations for Species in the SFWF and SFEC

Species and Life Stages	Presence in Each Project Component			
	SFWF	SFEC - OCS	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Invertebrates				
Atlantic Sea Scallop (*Placopecten magellanicus*)				
Eggs	X	X	X	X
Larvae	X	X	X	X
Juvenile	X	X	X	X
Adult	X	X	X	X
Atlantic Surfclam (*Spisula solidissima*)				
Juvenile		X	X	
Adult		X	X	
Longfin Inshore Squid (*Loligo pealeii*)				
Eggs		X	X	X
Juvenile	X	X	X	X
Adult	X	X		
Ocean Quahog (*Artica islandica*)				
Juvenile	X	X	X	
Adult	X	X	X	
Highly Migratory Species				
Albacore Tuna (*Thunnus alalunga*)				
Juvenile	X	X	X	X
Adult	X	X		
Bluefin Tuna (*Thunnus thynnus*)				
Juvenile	X	X	X	X
Adult	X	X	X	X
Skipjack Tuna (*Katsuwonus pelamis*)				
Juvenile	X	X	X	X
Adult	X	X	X	X
Yellowfin Tuna (*Thunnus albacares*)				
Juvenile	X	X	X	X
Adult	X	X		

Table 7. EFH Designations for Species in the SFWF and SFEC

Species and Life Stages	Presence in Each Project Component			
	SFWF	SFEC - OCS	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Skates				
Barndoor Skate (*Dipturus laevis*)				
Juvenile		X		
Adult		X		
Little Skate (*Leucoraja erinacea*)				
Juvenile	X	X	X	X
Adult	X	X	X	
Winter Skate (*Leucoraja ocellate*)				
Juvenile	X	X	X	X
Adult	X	X	X	X
Sharks				
Basking Shark (*Cetorhinus maximus*)				
Neonate	X	X	X	
Juvenile	X	X	X	
Adult	X	X	X	
Blue Shark (*Prionace glauca*)				
Neonate	X	X		
Juvenile	X	X		
Adult	X	X		
Common Thresher Shark (*Alopias vulpinus*)				
Neonate	X	X	X	X
Juvenile	X	X	X	X
Adult	X	X	X	X
Dusky Shark (*Carcharhinus obscurus*)				
Neonate	X	X	X	X
Juvenile	X	X	X	X
Adult	X	X	X	X
Sand Tiger Shark (*Carcharias taurus*)				
Neonate	X	X	X	X
Juvenile	X	X	X	X

Table 7. EFH Designations for Species in the SFWF and SFEC

Species and Life Stages	Presence in Each Project Component			
	SFWF	SFEC - OCS	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Sandbar Shark (*Carcharhinus plumbeus*)				
Neonate		X	X	X
Juvenile	X	X	X	X
Adult	X	X	X	X
Shortfin Mako Shark (*Isurus oxyrinchus*)				
Neonate	X	X		
Juvenile	X	X		
Adult	X	X		
Smoothhound Shark Complex (Atlantic Stock) (*Mustelus*)				
Neonate	X	X	X	X
Juvenile	X	X	X	X
Adult	X	X	X	X
Spiny Dogfish (*Squalus acanthias*)				
Adult	X	X	X	X
Tiger Shark (*Galeocerdo cuvieri*)				
Juvenile		X		
Adult		X		
White Shark (*Carcharodon carcharias*)				
Neonate	X	X	X	X
Juvenile	X	X	X	X
Adult	X	X	X	X

2.3 Essential Fish Habitat Species and Life Stages

2.3.1 New England Finfish Species

2.3.1.1 Atlantic Cod

Atlantic cod have two separate stocks managed by NOAA, the Gulf of Maine and Georges Bank and southward; these two stocks rarely mix (Fahay et al., 1999a). Cod range from Cape Chidley, Labrador to Cape Henry, Virginia and can be found at depths between 32 and 492 feet (10 and 150 m) during both cold and warm seasons. The highest concentrations of cod are on Georges Bank and the western portion of the Gulf of Maine (Fahay et al., 1999a). Cod are historically an important commercial and recreational species and are still fished at low levels; however, as of the 2015 stock assessment, both the stocks are considered overfished and are currently subject to overfishing (NEFMC, 2015). This fish species prefers muddy, gravelly, or rocky substrates. In New York State waters, cod can be found year-round but peak in winter and spring both nearshore and offshore. Cod typically move south and into deeper water in the winter and spring, and spawn nearshore in the winter months (Collette and Klein-MacPhee, 2002).

Eggs: EFH is pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as shown on Map 38 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), and in the high salinity zones of the bays and estuaries listed in Table 19 of NEFMC (2017a).Cod eggs are most often observed beginning in the fall, with peaks in the winter and spring. EFH for cod eggs has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Larvae: EFH is pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as shown on Map 39 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), and in the high salinity zones of the bays and estuaries listed in Table 19 of NEFMC (2017a). Cod larvae are most often observed in the spring. EFH for cod larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

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

2.3.1.2 Atlantic Herring

The Atlantic herring is managed in one stock-complex of Georges Bank and the Gulf of Maine, with two major spawning components. Atlantic herring have a range from Labrador, Canada to Cape Hatteras, North Carolina and are highly concentrated in Georges Bank, the Gulf of Maine, and Nantucket Shoals (Reid et al., 1999). The Atlantic herring is typically present in the winter and average depths of about 120 to 360 feet (36 to 110 m) (Collette and Klein-MacPhee, 2002). Atlantic herring have and continue to be an important commercial fishery in New England as their stock biomass has exponentially increased since the 1980s (Reid et al., 1999). Herring tend to prefer open waters and almost always travel in schools (Collette and Klein-MacPhee, 2002). Spawning grounds are limited to rocky, gravelly, or pebbly bottom and on clay, but never on soft mud from 12 to 180 feet (3 to 55 m) deep (Collette and Klein-MacPhee, 2002).

Larvae: EFH is inshore and offshore pelagic habitats in the Gulf of Maine, on Georges Bank, and in the upper Mid-Atlantic Bight, as shown on Map 99 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), and in the bays and estuaries listed in Table 30 of NEFMC (2017a). Atlantic herring have a very long larval stage, lasting 4-8 months, and are transported long distances to inshore and estuarine waters where they metamorphose into early stage juveniles in the spring. Atlantic herring larvae are observed between August and April, with peaks from September through November. EFH for larvae has been identified in the SFWF, SFEC - OCS, and SFEC - NYS Beach Lane.

Juveniles: EFH is intertidal and sub-tidal pelagic habitats to 984 feet (300 m) throughout the region, as shown on Map 100 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), including the bays and estuaries listed in Table 30 of NEFMC (2017a). One and two-year old juveniles form large schools and make limited seasonal inshore-offshore migrations. Older juveniles are usually found in water temperatures of 37 to 59 degrees Fahrenheit (°F; 3 to 15 degrees Celsius [°C]) in the northern part of their range and as high as 72 °F (22 °C) in the Mid-Atlantic. Young-of-the-year juveniles can tolerate low salinities, but older juveniles avoid brackish water. EFH for juveniles has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

2.3.1.3 Haddock

Haddock are managed by NOAA in three stocks, Gulf of Maine, Georges Bank, and Brown’s Bank (Cargnelli et al., 1999a) and range from Cape Charles, Virginia to Labrador, Canada. Haddock are most concentrated on Georges Bank, the Scotian Shelf, and the southern Grand Bank. Haddock are found at depths ranging from 59 to 1,148 feet (15 to 350 m) and there is a very minimal seasonal difference between depths aside from a slightly wider range of depths in the fall (Cargnelli et al., 1999a). As of the 2015 stock assessment, the Georges Bank and Gulf of Maine stocks are not overfished and are not subject to overfishing (NEFSC, 2015). These finfish prefer gravely, pebbly, clay, and sandy substrates and avoid ledges and large rocks (Collette and Klein-MacPhee, 2002). Haddock are found within New York State waters in winter and spring and spawn in areas of a large amount of suitable substrate in nearshore areas.

Larvae: EFH is pelagic habitats in coastal and offshore waters in the Gulf of Maine, the Mid-Atlantic, and on Georges Bank, as shown on Map 45 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a). Haddock larvae are most often observed in these areas from January through July with peaks in April and May. EFH for haddock larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

Adults: EFH is sub-tidal benthic habitats between 164 and 525 feet (50 and 160 m) in the Gulf of Maine, on Georges Bank, and in southern New England, as shown on Map 47 of the Final Omnibus EFH

Amendment 2 (NEFMC, 2017a). Essential fish habitat for adult haddock occurs on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel substrates. They also are found adjacent to boulders and cobbles along the margins of rocky reefs in the Gulf of Maine. EFH for haddock adults has been identified in the SFEC - OCS.

2.3.1.4 Monkfish

Monkfish are managed in two stocks by NOAA Fisheries, a northern stock, and a southern stock and are present from summer to fall from the tideline down to 2,160 feet (658 m) (Collette and Klein-MacPhee, 2002). They are common and concentrate on Brown's and Georges Banks. Monkfish prefer hard sand, pebbly bottom, gravel, and broken shells for their habitats (Collette and Klein-MacPhee, 2002). Monkfish spawn in spring and summer, as early as May in New England waters.

Eggs and Larvae: EFH is pelagic habitats in inshore areas, and on the continental shelf and slope throughout the Northeast region, as shown on Map 82 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a). Monkfish eggs are shed in very large buoyant mucoidal egg "veils." Monkfish larvae are more abundant in the Mid-Atlantic region and occur over a wide depth range, from the surf zone to depths of 3,281 to 4,921 feet (1,000 to 1,500 m) on the continental slope. Monkfish egg veils and larvae are most often observed during the months from March to September. EFH for eggs and larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

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

2.3.1.5 Ocean Pout

The ocean pout is currently managed in two stocks, a northern and a southern, and ranges from Labrador, Canada to Virginia (Steimle et al., 1999a). This finfish is typically present in southern New England from late summer to winter. According to the 2015 stock assessment, ocean pout is overfished and is not currently experiencing overfishing (NEFSC, 2015). Ocean pout are present in habitats that contain sandy mud, sticky sand, broken bottom, or on pebbles and gravel (Collette and Klein-MacPhee, 2002). The finfish spawn in protected habitats, such as rock crevices and man-made artifacts, where it lays eggs in nests that it guards (Steimle et al., 1999a).

Eggs: EFH is hard bottom habitats on Georges Bank, in the Gulf of Maine, and in the Mid-Atlantic Bight (see Map 48 in NEFMC [2017a]), as well as the high salinity zones of the bays and estuaries listed in Table 20 of NEFMC (2017a). Eggs are laid in gelatinous masses, generally in sheltered nests, holes, or rocky crevices. Essential fish habitat for ocean pout eggs occurs in depths less than 328 feet (100 m) on rocky bottom habitats. Ocean pout egg development takes 2 to 3 months during late fall and winter. EFH for eggs has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

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

2.3.1.6 Pollock

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

Larvae: EFH is pelagic inshore and offshore habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as shown on Map 52 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), including the bays and estuaries listed in Table 21 of (NEFMC, 2017a). EFH for larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

2.3.1.7 Red Hake

Red hake are managed by the Northeast Fisheries Science Center (NEFSC) and are present in two stocks, a northern and southern. Differentiation of the two stocks occurs at Georges Bank (Steimle et al., 1999b). Red hake range from Newfoundland to North Carolina; however, most are concentrated around Georges Bank. During warmer seasons, red hake are common at depths greater than 328 feet (100 m), and during colder months, their depth range is from 90 to 1,214 feet (30 to 370 m) (Steimle et al., 1999b). According to the 2014 stock assessment, the Gulf of Maine, and Northern Georges Bank (northern), and Southern Georges Bank and Mid-Atlantic (southern) stocks are not considered overfished and are not subject to overfishing (NEFMC, 2015). This groundfish species prefers deep water environments with bottom habitat consisting of both soft and pebbly substrate. Spawning occurs uniformly from Georges Bank to Nova Scotia and typically occurs nearshore as early as June and continues through fall (Collette and Klein-MacPhee, 2002).

Eggs and Larvae: EFH is pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid- Atlantic, as shown on Map 77 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), and in the bays and estuaries listed in Table 27 of NEFMC (2017a). Red hake eggs are most often observed during the months from May to November, with peaks in June and July and red hake larvae are most often observed from May through December, with peaks in September to October. EFH for red hake eggs and larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

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

2.3.1.8 Silver Hake

NOAA manages two stocks of silver hake in U.S. waters, one stock occurs in the Gulf of Maine to northern Georges Bank and the second stock occurs from southern Georges Bank to Cape Hatteras, North Carolina (Morse et al., 1999). Silver hake are found from Cape Sable, Nova Scotia to Cape Hatteras, North Carolina and are concentrated in deep basins in the Gulf of Maine and along the continental slope in winter and spring. These demersal finfish are generally present from 420 to 600 feet (128 to 183 m) deep (Collette and Klein-MacPhee, 2002). Silver hake are commercially and recreationally important and as of the 2013 stock assessment, the stocks are not overfished and are not subject to overfishing (NEFMC, 2014). Silver hake have been found associated with all bottom types, from gravel to fine silt and clay, but mainly with silts and clay (Scott, 1982). Silver hake is found in the SFWF and SFEC in the winter and spring and major spawning areas are within coastal Gulf of Maine, Southern Georges Bank, and waters that are south of Rhode Island.

Eggs and Larvae: EFH is pelagic habitats from the Gulf of Maine to Cape May, New Jersey, including Cape Cod and Massachusetts Bays (see Map 74 and Table 26 in NEFMC [2017a]). Silver hake eggs are observed all year, with peaks from June through October; silver hake larvae are observed all year, with peaks from July through September. EFH for silver hake eggs and larvae has been identified in the SFWF and SFEC - OCS.

Juveniles: EFH is pelagic and benthic habitats in the Gulf of Maine, including the coastal bays and estuaries listed in Table 26 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), and on the continental shelf as far south as Cape May, New Jersey, at depths greater than 33 feet (10 m) in coastal waters in the Mid-Atlantic and between 131 and 1,312 feet (40 and 400 m) in the Gulf of Maine, on

Georges Bank, and in the middle continental shelf in the Mid- Atlantic, on sandy substrates (see Map 75 in NEFMC [2017a]). Juvenile silver hake are found in association with sand-waves, flat sand with amphipod tubes, and shells, and in biogenic depressions. Juveniles in the New York Bight settle to the bottom at mid-shelf depths on muddy sand substrates and find refuge in amphipod tube mats. EFH for silver hake juveniles has been identified in the SFEC - OCS.

2.3.1.9 White Hake

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

2.3.1.10 Windowpane Flounder

Windowpane flounder is separated into two stocks managed by the NEFMC, a northern stock in the Gulf of Maine-Georges Bank and a southern stock, Southern New England-Middle Atlantic Bight (Chang et al., 1999). Windowpane spawning occurs from April to December along areas of the northwest Atlantic. Windowpane range from just below the tide line to 150 feet (46 m) deep (Collette and Klein-MacPhee, 2002). According to the 2015 stock assessment (NEFSC, 2015), the northern stock is overfished but not experiencing overfishing. Windowpane typically prefers sandy bottom habitats (Collette and Klein-MacPhee, 2002).

Eggs and Larvae: EFH is pelagic habitats on the continental shelf from Georges Bank to Cape Hatteras and in mixed and high salinity zones of coastal bays and estuaries throughout the region (see Map 59, Map 60, and Table 23 in NEFMC [2017a]). Windowpane flounder eggs and larvae are often observed from February to November with peaks in May and October in the middle Atlantic, and July to August on Georges Bank. EFH for eggs and larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

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

2.3.1.11 Winter Flounder

Winter flounder is managed in three different stocks: The Gulf of Maine, Georges Bank, and the Middle Atlantic (Pereira et al., 1999). Winter flounder ranges from Labrador to Georgia but are highly concentrated nearshore from Massachusetts to New Jersey and are present in the Georges Bank area year-round. They range between 270 and 420 feet (886 and 1,378 m) deep in their range (Collette and Klein-MacPhee, 2002). Winter flounder are a valuable commercially important species; stock assessments suggest that the Georges Bank and New England/Mid-Atlantic stocks are overfished, while the results were uncertain for the Gulf of Maine stock (NEFSC, 2015). Winter flounder prefer muddy, sandy, cobbled, gravely, or boulder substrate in mostly nearshore environments (Pereira et al., 1999). Winter flounder spawn on sandy bottom in shallow habitats.

Eggs: EFH is sub-tidal estuarine and coastal benthic habitats from mean low water to 16 feet (5 m) from Cape Cod to Absecon Inlet (39° 22′ N), and as deep as 230 feet (70 m) on Georges Bank and in the Gulf of Maine (see Map 63 in NEFMC [2017a]), including mixed and high salinity zones in the bays and estuaries listed in Table 24 of NEFMC (2017a). The eggs are adhesive and deposited in clusters on the bottom. Essential habitats for winter flounder eggs include mud, muddy sand, sand, gravel, macroalgae, and submerged aquatic vegetation. Bottom habitats are unsuitable if exposed to excessive sedimentation which can reduce hatching success. Winter flounder eggs are often observed from February to June with a peak in April on Georges Bank. Winter flounder EFH for eggs has been identified in the SFWF, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Larvae: EFH is estuarine, coastal, and continental shelf water column habitats from the shoreline to a maximum depth of 230 feet (70 m) from the Gulf of Maine to Absecon Inlet (39° 22′ N), and including Georges Bank, as shown on Map 65 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), including mixed and high salinity zones in the bays and estuaries listed in Table 24 of NEFMC (2017a). Larvae hatch in nearshore waters and estuaries or are transported shoreward from offshore spawning sites where they metamorphose and settle to the bottom as juveniles. They are initially planktonic but become increasingly less buoyant and occupy the lower water column as they get older. Winter flounder larvae are often observed from March to July with peaks in April and May on Georges Bank. Winter flounder EFH for larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

Adults: EFH is estuarine, coastal, and continental shelf benthic habitats extending from the intertidal zone (mean high water) to a maximum depth of 230 feet (70 m) from the Gulf of Maine to Absecon Inlet (39° 22′ N), and including Georges Bank, as shown on Map 65 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), and in mixed and high salinity zones in the bays and estuaries listed in Table 24 of NEFMC (2017a). Essential fish habitat for adult winter flounder occurs on muddy and sandy substrates, and on hard bottom on offshore banks. In inshore spawning areas, essential fish habitat includes a variety of substrates where eggs are deposited on the bottom (see eggs). Winter flounder EFH for adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.1.12 Witch Flounder

Witch flounder stocks are managed under NOAA Fisheries Multispecies FMP and range from the Gulf of Maine to Cape Hatteras, North Carolina (Cargnelli et al., 1999b). Witch flounder are present year-round and tend to concentrate near the southwest portion of the Gulf of Maine (Collette and Klein-MacPhee, 2002). Witch flounder is a commercial and recreational species, and as of the 2015 stock assessment is considered overfished and experiencing overfishing (NEFSC, 2015). Spawning occurs from May through September and peaks in July and August.

Eggs and Larvae: EFH is pelagic habitats on the continental shelf throughout the Northeast region, as shown on Map 66 and Map 67 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a). Witch flounder eggs are most often observed during the months from March through October and witch flounder larvae are most often observed from March through November, with peaks in May to July. EFH for witch flounder eggs has been identified in the SFWF and SFEC - OCS and witch flounder larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.1.13 Yellowtail Flounder

Yellowtail flounder is separated into five stocks: Southern New England, Georges Bank, Cape Cod, Nova Scotia, and Grand Bank (Johnson et al., 1999). These five stocks are distributed along the Atlantic coast from St. Lawrence, Labrador to the Chesapeake Bay. Yellowtail flounder are most abundant within the western half of Georges Bank. Yellowtail flounder are present in Georges Bank from March to August; the finfish tend to move east in the spring and summer and west in the fall and winter (Johnson et al., 1999). Yellowtail flounder are commercially and recreationally important; as of the 2015 stock assessment (NEFSC, 2015), the Southern New England/Mid-Atlantic stock, and the Cape Cod/Gulf of Maine stock are considered overfished and subject to overfishing’. According to the 2013 stock assessment, the Georges Bank stock is overfished and subject to overfishing (TRAC, 2013). These bottom-dwelling finfish prefer a mixture of sand and mud (Collette and Klein-MacPhee, 2002). Spawning occurs in both inshore areas as well as on offshore banks in July (on Georges Bank).

Eggs: EFH is coastal and continental shelf pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region as far south as the upper Delmarva peninsula, as shown on Map 70 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), including the high salinity zones of the bays and estuaries listed in Table 25 of NEFMC (2017a) . Yellowtail flounder eggs are most often observed during the months from mid-March to July, with peaks in April to June in southern New England. EFH for eggs has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Larvae: EFH is coastal marine and continental shelf pelagic habitats in the Gulf of Maine, and from Georges Bank to Cape Hatteras, as shown on Map 71 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), including the high salinity zones of the bays and estuaries listed in Table 25 of NEFMC (2017a). Yellowtail flounder larvae are most often observed from March through April in the New York bight and from May through July in southern New England and southeastern Georges Bank. EFH for larvae has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

Adults: EFH is sub-tidal benthic habitats in coastal waters in the Gulf of Maine and on the continental shelf on Georges Bank and in the Mid-Atlantic as shown on Map 73 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), including the high salinity zones of the bays and estuaries listed in

Table 25 of NEFMC (2017a). Essential fish habitat for adult yellowtail flounder occurs on sand and sand with mud, shell hash, gravel, and rocks at depths between 82 and 295 feet (25 and 90 m). EFH for adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.2 Mid-Atlantic Finfish Species

2.3.2.1 Atlantic Butterfish

The Atlantic butterfish is a pelagic, surface-dwelling fish that tends to form schools and ranges from Newfoundland to Florida but concentrates in the Gulf of Maine down to Cape Hatteras, North Carolina (Cross et al., 1999). Butterfish are managed as one stock in the northern region (New England to Cape Hatteras) and two stocks south of Cape Hatteras. Butterfish are present in New England waters from spring to fall and are found from the surface to 180 feet (54 m) deep in the summer, but as deep as 690 feet (210 m) in the winter (Collette and Klein-MacPhee, 2002). Butterfish are a commercially and recreationally important fish, mostly targeted by pound nets, floating traps, purse seins, and otter trawls. Butterfish prefer sandy bottom environments rather than rocky environments. Spawning occurs on the continental shelf and nearshore areas and is very common in Long Island Sound and the New York Bight (Cross et al., 1999).

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

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

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

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

2.3.2.2 Atlantic Mackerel

The Atlantic Mackerel is a pelagic, schooling species that is managed as one stock under the MAFMC through the Squid-Mackerel-Butterfish FMP (MAFMC, 2011). The mackerel ranges from the Gulf of St.

Lawrence to Cape Lookout, North Carolina (Studholme et al., 1999). This finfish species is migratory throughout New England waters, appearing in near-surface waters in the spring and summer. In New York State waters, mackerel have been reported at depths of 60 to 120 feet (18 to 36 m) (Collette and Klein-MacPhee, 2002). The current trend of mackerel stock biomass is increasing (Studholme et al., 1999). Mackerel tend to congregate in open waters towards the surface and in nearshore environments. Mackerel spawn off the coast in deeper waters across from a range between Cape Hatteras to the Gulf of St. Lawrence covering almost the entire continental shelf. Spawning occurs in early summer and continues until the water temperature reaches 46 °F (8 °C). There is no preferred breeding habitat (Collette and Klein-MacPhee, 2002).

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

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

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

2.3.2.3 Black Sea Bass

The black sea bass is a demersal finfish species that range from Nova Scotia to Florida and is managed in three stocks: northern, southern and the Gulf of Mexico (Steimle et al., 1999c). The depth range of the black sea bass extends from the tide line down to 420 feet (128 m). This finfish is found in New England and off Long Island, New York near the shore in early May, and then does not appear again until October and November (Collette and Klein-MacPhee, 2002). Black sea bass prefer structured habitats such as reefs, shipwrecks, and lobster pots along the continental shelf (Steimle et al., 1999c). Black sea bass spawn in May along the North Carolina coast, then spawn from the middle of May until the end of June in New Jersey, New York, and southern New England waters (Collette and Klein-MacPhee, 2002).

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

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

2.3.2.4 Bluefish

Bluefish range from Nova Scotia to Bermuda and are often observed as a schooling species that seasonally migrates to the mid-Atlantic bight during the spring (Fahay et al., 1999b). Bluefish are organized and managed in one stock and are present in New England waters from spring to fall concentrated at mid-shelf depths (Collette and Klein-MacPhee, 2002). Bluefish are targeted by recreational anglers (Collette and Klein-MacPhee, 2002). Bluefish prefer open water environments and can be found both nearshore and offshore. Bluefish spawn in late spring through August. There is little other documentation about bluefish spawning, and they are thought to seek deeper offshore waters (Collette and Klein-MacPhee, 2002).

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

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

Juveniles: North of Cape Hatteras, EFH is pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) from Nantucket Island, Massachusetts south to Cape Hatteras, in the highest 90 percent of the area where juvenile bluefish are collected in the NEFSC trawl survey. EFH also includes the "slope sea" and Gulf Stream between latitudes 29° 00 N and 40° 00 N. Inshore, EFH is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Generally juvenile bluefish occur in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from May through October, and South Atlantic estuaries March through December, within the "mixing" and "seawater" zones (Nelson et al., 1991; Jury et al., 1994; Stone et al., 1994). Distribution of juveniles by temperature, salinity, and depth over the continental shelf is undescribed (Fahay, 1998). EFH for juveniles has been identified in the SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Adults: North of Cape Hatteras, EFH is the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from Cape Cod Bay, Massachusetts south to Cape Hatteras, in the highest 90 percent of the area where adult bluefish were collected in the NEFSC trawl survey. Inshore, EFH is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Adult bluefish are found in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from April through October, and in South Atlantic estuaries from May through January in the "mixing" and "seawater" zones (Nelson et al., 1991; Jury et al., 1994; Stone et al., 1994). Bluefish adults are highly migratory, and distribution varies seasonally and according to the size of the individuals comprising the schools. Bluefish are generally found in normal shelf salinities (greater than 25 ppt). EFH for adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.2.5 Scup

Scup are demersal finfish that have a range from the Gulf of Maine to North Carolina. Scup were managed historically in two stocks, but recent discoveries has deemed that there is little to no separation between regions; scup are currently managed as one stock within the Middle Atlantic Bight (Steimle et al., 1999d). Scup are known to congregate in nearshore areas of New England from early April to December, at depths between 270 and 420 feet (82 to 128 m) (Collette and Klein-MacPhee, 2002). Scup are an important food species for other commercially important species (Collette and Klein-MacPhee, 2002). Scup prefer smooth to rocky bottom habitats and usually form schools around such bottoms. Spawning occurs nearshore and in relatively shallow waters over sandy bottom between May and August (Steimle et al., 1999d).

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

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

2.3.2.6 Summer Flounder

Summer flounder are a demersal species known to have a range from Maine to South Carolina but predominantly concentrate south of Cape Cod and are split and managed in several stocks, chiefly one stock north of Cape Hatteras and one south (Packer et al., 1999a). Summer flounder are present in New England waters during the warmer seasons of summer and fall and have been found at depths between 48 and 450 feet (15 and 137 m). Summer flounder is a commercially and recreationally important flatfish in New England (Collette and Klein-MacPhee, 2002). Summer flounder prefer sandy or muddy bottom habitats. Not much is known about spawning, it is believed to occur offshore in open ocean areas along the shelf (Packer et al., 1999a).

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

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

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

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

2.3.3 Invertebrates

2.3.3.1 Atlantic Sea Scallop

The Atlantic sea scallop is managed under NEFMC's Sea Scallop Management Plan and focuses on the stock present within the Gulf of Maine, Georges Bank, and the Middle Atlantic Bight (Hart and Chute, 2004). The sea scallop occurs along the continental shelf at depths ranging from 59 to 360 feet (18 to 110 m) and is generally found in seabed areas with coarse substrates consisting of gravel, shells, and rocks; the species prefers areas with low levels of inorganic suspended particles (Packer et al., 1999b). The sea scallop spawning season is in September and they rely on the currents to spread eggs and larvae in different areas. Sea scallop abundance has increased dramatically in recent years and has driven a highly profitable commercial fishery (NEFMC, 2017b).

Eggs: EFH is benthic habitats in inshore areas and on the continental shelf as shown on Map 97 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a), in the vicinity of adult scallops. Eggs are heavier than seawater and remain on the seafloor until they develop into the first free-swimming larval stage. EFH for eggs has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

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

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

2.3.3.2 Atlantic surfclam

The Atlantic surfclam is a bivalve mollusk that occupies areas along the continental shelf from southern portions of the Gulf of St. Lawrence to Cape Hatteras, North Carolina (Cargnelli et al., 1999c). The Atlantic surfclam is managed under the MAFMC. Surfclams spawn in the summer and early fall and is not associated with temperature or temperature changes. The surfclam prefers sandy habitats along the continental shelf (Cargnelli et al., 1999c).

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

2.3.3.3 Longfin Squid

The longfin squid is a pelagic, schooling species that has a general range from Newfoundland to the Gulf of Venezuela but is abundant enough to be considered commercially important from Georges Bank to Cape Hatteras (Cargnelli et al., 1999d). This population is managed in a single stock. Longfin squid are typically found in waters that have a temperature of at least 48 °F (9 °C); therefore, they move with a pattern of seasonal migrations. They move offshore in late fall and overwinter along the edge of the continental shelf; they move both inshore and north as the water temperatures raise with the seasons. Most eggs are spawned in May and hatch in July, although there are two broods, an early spring and late summer. Longfin squid prefer varying depths of the water column in open waters (Cargnelli et al., 1999d).

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

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

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

2.3.3.4 Ocean Quahog

The ocean quahog is a bivalve mollusk that is found in a range from Newfoundland to Cape Hatteras distributed along the continental shelf (Cargnelli et al., 1999e). The highest concentrations of quahogs are offshore south of Nantucket to the Delmarva Peninsula. The quahog prefers medium to fine sandy bottom with mud and silt. The ocean quahog reproduces very slowly but occurs from spring to fall with multiple annual spawning events. According to NOAA Fisheries, the ocean quahog is not presently in a state of overfishing (Cargnelli et al., 1999e).

Juveniles and Adults: EFH is throughout the substrate, to a depth of 3 feet (1 m) below the water/sediment interface, within federal waters from the eastern edge of Georges Bank and the Gulf of

Maine throughout the Atlantic EEZ, in areas that encompass the top 90 percent of all the ranked 10-minute squares for the area where ocean quahogs were caught in the NEFSC surfclam and ocean quahog dredge surveys. Distribution in the western Atlantic ranges in depths from 30 feet (9 m) to about 800 feet (244 m). Ocean quahogs are rarely found where bottom water temperatures exceed 60 °F (16 °C) and occur progressively further offshore between Cape Cod and Cape Hatteras. EFH for juveniles and adults has been identified in the SFWF, SFEC - OCS, and SFEC - NYS Beach Lane.

2.3.4 Highly Migratory Species

2.3.4.1 Albacore Tuna

Albacore Tuna is a global, pelagic species that is managed in three stocks (North Atlantic, South Atlantic, and Mediterranean) and has a wide range from north to south, Newfoundland to the Gulf of Mexico, and east to west, from the western Atlantic to the Mediterranean (NOAA, 2009). Albacore tuna spawn in the spring and summer in the western tropical areas of the Atlantic, and then they move northward and use the central and northern portions of the Atlantic as their wintering area. Albacore tuna prefer open ocean and can adapt to a wide variety of oceanic properties. The northern stock of albacore tuna is commercially and recreationally important and is currently overfished (NOAA, 2009).

Juveniles: EFH is offshore, pelagic habitats of the Atlantic Ocean from the outer edge of the U.S. EEZ through Georges Bank to pelagic habitats south of Cape Cod, and from Cape Cod to Cape Hatteras, North Carolina. EFH for juveniles has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Adults: EFH is offshore, pelagic habitats of the Atlantic Ocean from the outer edge of the U.S. EEZ through Georges Bank to pelagic habitats south of Cape Cod, and from Cape Cod to Cape Hatteras, North Carolina. EFH for adults has been identified in the SFWF and SFEC - OCS.

2.3.4.2 Bluefin Tuna

Bluefin tuna are managed in two stocks: western and eastern and range from Labrador to the Gulf of Mexico (NOAA, 2009). The Bluefin tuna migrates from the spawning ground in the Gulf of Mexico in the spring, moving north into New England and Canada through the summer and beginning of fall; the tuna can be found off the coast of New Jersey, Long Island, and southern New England in June (Collette and Klein-MacPhee, 2002). Bluefin tuna are found at depths ranging from near the surface to 300 feet (91 m) deep and tend to jump out of the water singly or in schools when near the surface. Bluefin tuna is considered overfished but remains an important commercial and recreational target species that is caught using longlines, purse seines, traps, and various hand gears (NOAA, 2009). Bluefin tuna inhabit open ocean environments with variable temperature and salinity levels, given the wide geographic range they cover through migration.

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

Adults: EFH is located in offshore and coastal regions of the Gulf of Maine the mid-coast of Maine to Massachusetts; on Georges Bank; offshore pelagic habitats of southern New England; from southern New England to coastal areas between the mouth of Chesapeake Bay and Onslow Bay, North Carolina;

from coastal North Carolina south to the outer extent of the U.S. EEZ, inclusive of pelagic habitats of the Blake Plateau, Charleston Bump, and Blake Ridge. EFH for adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.4.3 Skipjack Tuna

The skipjack tuna is a global, pelagic species that is managed in two units or stocks (eastern and western) and has a range from Newfoundland to Brazil (NOAA, 2009). Skipjack tuna spawn opportunistically in warm waters near the equator from spring to fall, with most spawning occurring in the summer. Skipjack tuna are commercially and recreationally important and are typically caught using surface gear. Currently, the overfishing status of this tuna is unknown. Skipjack tuna prefer convergences and tend to associate with birds, drifting objects, whales, and sharks.

Juveniles: EFH is offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts) and coastal and offshore habitats between Massachusetts and South Carolina. In all areas juveniles are found in waters greater than 66 feet (20 m). EFH for juveniles has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Adults: EFH is coastal and offshore habitats between Massachusetts and Cape Lookout, North Carolina and localized areas in the Atlantic off South Carolina and Georgia, and the northern east coast of Florida. EFH for adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.4.4 Yellowfin Tuna

Yellowfin tuna are circumglobal and have a wide range. The population ranges from the central region of the Gulf of Mexico from Florida to Southern Texas and from the mid-east coast of Florida and Georgia to Cape Cod. They are also located south of Puerto Rico. The species is managed as a single stock. Yellowfin tuna travel in schools and prefer the upper 39.4 inches (100 cm) of the water column in open ocean. Spawning occurs throughout the year between 15 °N and 15 °S latitude and in the Gulf of Mexico and the Caribbean in May through November and are believed to spawn serially. Yellowfin tuna are considered close to reaching the condition of being overfished but are still considered a commercially and recreationally important target species and are caught with purse seine, troll, handline, and longline gear (NOAA, 2009).

Juveniles: EFH is offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank and Cape Cod, Massachusetts. Offshore and coastal habitats from Cape Cod to the mid-east coast of Florida and the Blake Plateau. EFH for juveniles has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Adults: EFH is offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank and Cape Cod, Massachusetts. Offshore and coastal habitats from Cape Cod to North Carolina, and offshore pelagic habitats of the Blake Plateau. EFH for adults has been identified in the SFWF and SFEC - OCS.

2.3.5 Skates

2.3.5.1 Barndoor Skate

Juveniles and Adults: EFH is benthic habitats on the continental shelf, primarily on Georges Bank and in southern New England, in depths of 131 – 1,312 feet (40 – 400 m), and on the continental slope to a maximum depth of 2,461 feet (750 m), as shown on Map 89 of the Final Omnibus EFH Amendment 2 (NEFMC, 2017a). Essential fish habitat for juvenile and adult barndoor skates occurs on mud, sand, and gravel substrates. Both life stages are usually found on the continental shelf in depths less than 525 feet

(160 m), but the adults also occupy benthic habitats between 984 and 1,312 feet (300 and 400 m) on the outer shelf. EFH for juveniles and adults has been identified in the SFEC - OCS.

2.3.5.2 Little Skate

The little skate is a demersal species that has a range from Nova Scotia to Cape Hatteras and is highly concentrated in the Mid-Atlantic Bight and on Georges Bank. On Georges Bank, the little skate is found year-round and tolerates a wide range of temperatures (Packer et al., 2003a), and prefers sandy or pebbly bottom, but is also found on mud and ledges (Collette and Klein-MacPhee, 2002). The little skate is present in New England year-round, and mating may take place at any time throughout the year, although there is evidence that most egg cases are found fully or partially developed from late October to January and from June to July. The average female little skate spawns twice per year, once in the spring and once in the fall (Packer et al., 2003a).

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

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

2.3.5.3 Winter Skate

The winter skate has a range from the southern coast of Newfoundland to Cape Hatteras and has concentrated populations on Georges Bank and the northern section of the Mid-Atlantic Bight (Packer et al., 2003b). The winter skate has very similar temperature ranges and migration patterns as the little skate. The winter skate is not heavily targeted for commercial fishing but is often bycatch in otter trawls; currently, winter skates are not in an overfished condition (Collette and Klein-MacPhee, 2002).

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

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

2.3.6 Sharks

2.3.6.1 Basking Shark

The basking shark has a wide temporal and spatial range in both the northwestern and eastern Atlantic that is thought to be influenced by seasonal water stratifications, temperature, and prey abundance (NOAA, 2009). Basking sharks are observed in surface waters from spring to fall. They are also observed off the Atlantic coast more frequently in the winter time. Concentrations of basking sharks are known to appear south and southwest of Long Island. Very little is known about the basking shark reproductive processes. Fishing for the basking shark is prohibited, and the species is listed as “Vulnerable” in the International Union for the Conservation of Nature Red List of Threatened Species. (NOAA, 2009).

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

2.3.6.2 Blue Shark

The blue shark is one of the most common and wide-ranging sharks that has a presence in temperate, tropical, and subtropical waters (NOAA, 2009). The blue shark is pelagic and prefers deep, clear, blue waters with temperatures ranging from 50 to 68 °F (10 to 20 °C). This species is at risk for overfishing because it is commonly caught as bycatch and subject to “finning.”

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

Juveniles and Adults: EFH includes localized areas in the Atlantic Ocean in the Gulf of Maine, from Georges Bank to North Carolina, South Carolina, Georgia, and off Florida. EFH for juveniles and adults has been identified in the SFWF and SFEC - OCS.

2.3.6.3 Common Thresher Shark

The common thresher shark is found in both coastal and oceanic and cool and warm waters (NOAA, 2009). The thresher shark has a range from the south Atlantic to the Gulf of Maine. Female threshers give birth to young once a year in the spring.

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

2.3.6.4 Dusky Shark

The dusky shark has a range among warm and temperate coastal waters in the Atlantic, Pacific, and Indian oceans (NOAA, 2009). The dusky shark prefers both inshore waters and deeper waters along the continental shelf edge. Dusky sharks often use coastal waters as nurseries. The shark species gives birth in the Chesapeake Bay in Maryland in June and July (NOAA, 2009).

Neonate/YOY: EFH in the Atlantic Ocean includes offshore areas of southern New England to Cape Lookout, North Carolina. Specifically, EFH is associated with habitat conditions including temperatures from 65 to 72 °F (18.1 to 22.2 °C), salinities of 25 to 35 ppt and depths at 14 to 51 feet (4.3 to 15.5 m). Seaward extent of EFH for this life stage in the Atlantic is 197 feet (60 m) in depth. EFH for neonates/ YOY has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Juveniles and Adults: EFH is coastal and pelagic waters inshore of the continental shelf break (< 656 feet (200 m) in depth) along the Atlantic east coast from habitats offshore of southern Cape Cod to Georgia, including the Charleston Bump and adjacent pelagic habitats. Inshore extent for these life stages is the 66 foot (20 m) bathymetric line, except in habitats of southern New England, where EFH is extended seaward of Martha's Vineyard, Block Island, and Long Island. Pelagic habitats of southern Georges Bank and the adjacent continental shelf break from Nantucket Shoals and the Great South Channel to the eastern boundary of the United States EEZ. Adults are generally found deeper (to 6,562 feet [2,000 m]) than juveniles; however, there is overlap in the habitats utilized by both life stages. EFH for juveniles and adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.6.5 Sand Tiger Shark

Sand tiger sharks occur off the coast of the northwest Atlantic and have been known to make transoceanic migrations (NOAA, 2009) and in North America they are rarely encountered north of the Mid-Atlantic Bight. Nurseries for sand tiger sharks are most likely offshore, although little is known about the pupping grounds.

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

2.3.6.6 Sandbar Shark

The sandbar shark ranges within subtropical and warm temperate waters with the North Atlantic population ranging from Cape Cod to the western Gulf of Mexico. The sandbar shark prefers bottom habitats and is most common in 66 to 180 feet (20 to 55 m) of water, but occasionally found at depths of about 656 feet (200 m). In the United States, sandbar shark nursery areas consist of shallow coastal waters from Cape Canaveral, Florida to Martha's Vineyard, Massachusetts. The sandbar shark stock assessment considered the species to be overfished in 2006; the stock was reassessed in 2008 and was deemed to be vulnerable to overfishing. (NOAA, 2009)

Neonate/YOY: EFH is Atlantic coastal areas from Long Island, New York to Cape Lookout, North Carolina, and from Charleston, South Carolina to Amelia Island, Florida. Important neonate/YOY EFH includes:

Delaware Bay (Delaware and New Jersey) and Chesapeake Bay (Virginia and Maryland), where the nursery habitat is limited to the southeastern portion of the estuaries (salinity is greater than 20.5 ppt and depth is greater than 18 feet [5.5 m]); Great Bay, New Jersey; and the waters off Cape Hatteras, North Carolina. In all nursery areas between New York and North Carolina, unless otherwise noted, EFH is associated with water temperatures that range from 59 to 86 °F (15 to 30 °C); salinities that vary from 15 to 35 ppt; water depths that range from 2.7 to 75 feet (0.8 to 23 m); and sand, mud, shell, and rocky sediments/benthic habitat. EFH for neonates/YOY has been identified in the SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

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

Adults: EFH in the Atlantic Ocean includes coastal areas from southern New England to the Florida Keys, ranging from inland waters of Delaware Bay and the mouth of Chesapeake Bay to the continental shelf break. EFH for adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.6.7 Shortfin Mako Shark

The shortfin mako shark is an oceanic species ranging across warm and warm-temperate waters throughout all oceans. Little information is known on the breeding habits of the shortfin mako shark; pregnant shortfin makos have only been captured between 20 and 30 °N or S, but the mating location is unknown. The shortfin mako is a common bycatch in tuna and swordfish fisheries. Shortfin makos are usually the only sharks retained in some pelagic fleets with high shark bycatch rates because they have high market value. (NOAA, 2009)

Neonate/YOY, Juveniles, and Adults: At this time, available information is insufficient for the identification of EFH by life stage, therefore all life stages are combined in the EFH designation. EFH in the Atlantic Ocean includes pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts) to Cape Cod (seaward of the 656 foot [200 m] bathymetric line); coastal and offshore habitats between Cape Cod and Cape Lookout, North Carolina; and localized habitats off South Carolina and Georgia. EFH for neonates, juveniles, and adults has been identified in the SFWF and SFEC - OCS.

2.3.6.8 Smoothhound Shark Complex (Atlantic Stock)

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

2.3.6.9 Spiny Dogfish

The spiny dogfish is a circumboreal, coastal shark that has a presence everywhere in the northern and southern temperate zones along the continental shelf (McMillan and Morse, 1999), and is the most abundant shark in the northwest Atlantic. The shark is highly migratory, and migration patterns are reliant on prey species. Spiny dogfish are very common in New England and are found on Georges Bank from March to April (Collette and Klein-MacPhee, 2002). The dogfish spawn in deeper waters along the continental shelf.

Adults: EFH is pelagic and epibenthic habitats throughout the region for adult females. Adult male EFH is the same, however, primarily in the Gulf of Maine and on the outer continental shelf from Georges Bank to Cape Hatteras. Adult males and females are found over a wide depth range in full salinity seawater (32 to 35 ppt) where bottom temperatures range from 45 to 59°F (7 to 15°C). Adult males and females are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59°F (15°C). Comparatively, adult males are not as widely distributed over the continental shelf as the females and are generally found in deeper water. EFH for adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.3.6.10 Tiger Shark

The tiger shark is a pelagic, highly migratory shark with a range that is within warm waters in both deep oceanic and shallow coastal regions. Tiger sharks prefer coastal and offshore waters from approximately 40 to 0°N and have been known to make transoceanic migrations. They are rarely encountered north of the Mid Atlantic Bight. Nurseries for the tiger shark appear to be in offshore areas but have not been well documented. Neonate sharks have been caught frequently in the northern portion of the Gulf of Mexico, but specific pupping areas have not been identified. (NOAA, 2009)

Juveniles and Adults: EFH in the Atlantic Ocean extends from offshore pelagic habitats associated with the continental shelf break at the seaward extent of the U.S. EEZ boundary (south of Georges Bank, off Massachusetts) to the Florida Keys, inclusive of offshore portions of the Blake Plateau. EFH for juveniles and adults has been identified in the SFEC - OCS.

2.3.6.11 White Shark

The white shark ranges within all temperate and tropical belts of oceans, including the Mediterranean Sea. The white shark occurs in coastal and offshore waters and has a very sporadic presence. Because of the shark's sporadic presence, very little is known about its breeding habits. Sightings of the white shark in the Mid Atlantic Bight occur from April to December. The white shark prefers open ocean habitat. In U.S. waters, white sharks are targeted in a catch-and-release-only recreational fishery, as possession of the species is prohibited. (NOAA, 2009)

Neonate/YOY: EFH includes inshore waters out to 65 miles (105 km) from Cape Cod, Massachusetts, to an area offshore of Ocean City, New Jersey. EFH for neonates/YOY has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

Juveniles and Adults: Known EFH includes inshore waters to habitats 65 miles (105 km) from shore, in water temperatures ranging from 48 to 82 °F (9 to 28 °C), but more commonly found in water temperatures from 57 to 73 °F (14 to 23 °C) from Cape Ann, Massachusetts, including parts of the Gulf of Maine, to Long Island, New York, and from Jacksonville to Cape Canaveral, Florida. EFH for juveniles and adults has been identified in the SFWF, SFEC - OCS, SFEC - NYS Beach Lane, and SFEC - NYS Hither Hills.

2.4 Summary of Essential Fish Habitat within the Project Area

EFH and EFH-designated species will be affected by construction, installation, decommissioning, and O&M of the SFWF and SFEC based in part on the life stage and habitat-type of the organism at the time of various project activities. Tables 8a and 8b summarize early and late benthic life stages of species with designated EFH; indicate whether they are present in the SFWF, SFEC, or both; provide a description of preferred habitat for designated life stages; and provide an assessment of whether the preferred habitat is present in the SFWF and SFEC. Tables 9a and 9b summarize early and late pelagic life stages of species with designated EFH and indicate whether they are present in the SFWF, SFEC, or both.

Table 8a. Early Benthic Life Stages of Species with Designated EFH Potentially Present in the SFWF and/or SFEC

Species with Early Benthic Life Stages	Eggs	Larvae	Description of Preferred Habitat	Preferred Habitat Present?
Finfish				
Ocean pout	SFWF and SFEC		<u>Eggs</u>: Hard bottom habitats – sheltered nests, holes, and crevices.	Yes
Winter flounder	SFWF and SFEC	SFWF and SFEC	<u>Eggs</u>: Bottom habitats with substrate of mud, muddy sand, sand, gravel, macroalgae, and submerged aquatic vegetation. <u>Larvae</u>: Pelagic and bottom waters.	Yes
Invertebrates				
Atlantic sea scallop	SFWF and SFEC	SFWF and SFEC	<u>Eggs</u>: Coarse substrates of gravel, shells, and rocks. <u>Larvae</u>: Hard surfaces for pelagic larvae to settle, including shells, pebbles, and gravel. Larvae also attach to macroalgae and other benthic organisms such as hydroids.	Yes
Longfin squid	SFEC		<u>Eggs</u>: Egg masses or "mops" are laid on a variety of substrates, including hard bottom (shells, lobster pots, fish traps, boulders, and rocks), SAV (e.g. Fucus), sand, and mud.	Yes

Table 8b. Late Benthic Life Stages of Species with Designated EFH Potentially Present in the SFWF and/or SFEC

Species with Late Benthic Life Stages	Juveniles	Adults	Description of Preferred Habitat	Preferred Habitat Present?
Finfish				
Atlantic cod	SFWF and SFEC	SFWF and SFEC	<u>Juveniles</u>: Bottom habitats with a substrate of gravel, cobble, and boulder habitats, especially those with attached organisms. <u>Adults</u>: Bottom habitats with a substrate of rocks, pebbles, gravel, or boulders. Also found on sandy substrates.	Yes
Black sea bass	SFWF and SFEC	SFWF and SFEC	<u>Juveniles</u>: Usually found in association with rough-bottom, shellfish and eelgrass beds, and man-made structures in sandy-shelly areas; offshore clam beds and shell patches may also be used during the winter. <u>Adults</u>: Usual substrate preference is structured habitats (natural and man-made), sand, and shell.	Yes
Haddock	SFWF and SFEC	SFEC	<u>Juveniles</u>: Young-of-the-year juveniles settle on sand and gravel but are found predominantly on gravel pavement areas. As they grow, they disperse over a greater variety of substrate types. <u>Adults:</u> Hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel substrates. Also found adjacent to boulders and cobbles along the margins of rocky reefs in the Gulf of Maine.	Yes

Table 8b. Late Benthic Life Stages of Species with Designated EFH Potentially Present in the SFWF and/or SFEC

Species with Late Benthic Life Stages	Juveniles	Adults	Description of Preferred Habitat	Preferred Habitat Present?
Monkfish	SFEC	SFWF and SFEC	Juveniles and Adults: Bottom habitats with substrates of a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or soft mud.	Yes
Ocean pout	SFWF and SFEC	SFWF and SFEC	Juveniles: Bottom habitats on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel. Adults: Mud and sand, particularly in association with structure forming habitat types; i.e. shells, gravel, or boulders.	Yes
Pollock	SFWF and SFEC		Juveniles: Rocky bottom habitats with attached macroalgae (rockweed and kelp).	Yes
Red hake	SFWF and SFEC	SFEC	Juveniles: Intertidal and sub-tidal benthic habitats on mud and sand substrates. Bottom habitats providing shelter, including: mud substrates with biogenic depressions, substrates providing biogenic complexity (e.g., eelgrass, macroalgae, shells, anemone and polychaete tubes), and artificial reefs. Newly settled juveniles occur in depressions on the open seabed. Older juveniles are commonly associated with shelter or structure and often inside live bivalves. Adults: Shell beds, soft sediments (mud and sand), and artificial reefs. Usually found in depressions in softer sediments or in shell beds and not on open sandy bottom.	Yes
Scup	SFWF and SFEC	SFWF and SFEC	Juveniles: Associated with various sands, mud, mussel, and eelgrass bed type substrates. Adults: Prefer smooth to rocky bottom habitats.	Yes
Silver hake	SFEC		Juveniles: Sandy substrates; found in association with sand-waves, flat sand with amphipod tubes, and shells, and in biogenic depressions.	Yes
Summer flounder	SFEC	SFWF and SFEC	Juveniles: Prefer sandy or muddy bottom habitats. Use estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas. Adults: Prefer sandy or muddy bottom habitats. Inhabit shallow coastal and estuarine waters.	Yes
White hake	SFEC		Juveniles: Fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats.	Yes
Windowpane flounder	SFWF and SFEC	SFWF and SFEC	Adults and Juveniles: Bottom habitats with a substrate of mud or sand.	Yes
Winter flounder	SFWF and SFEC	SFWF and SFEC	Juveniles: Variety of bottom types such as mud, sand, rocky substrates with attached macroalgae, tidal wetlands, and eelgrass. YOY juveniles found inshore on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks. They tend to settle to the bottom in soft-sediment depositional areas and disperse into coarser-grained substrates as they get older. Adults: Muddy and sandy substrates, and on hard bottom on offshore banks.	Yes

Table 8b. Late Benthic Life Stages of Species with Designated EFH Potentially Present in the SFWF and/or SFEC

Species with Late Benthic Life Stages	Juveniles	Adults	Description of Preferred Habitat	Preferred Habitat Present?
Yellowtail flounder	SFWF and SFEC	SFWF and SFEC	Juveniles: Sand and muddy sand. Adults: Sand and sand with mud, shell hash, gravel, and rocks.	Yes
Invertebrates				
Atlantic sea scallop	SFWF and SFEC	SFWF and SFEC	Juveniles: Bottom habitats with a substrate of shells, gravel, and small rocks (pebble, cobble), preferring gravel. Adults: Bottom habitats with sand and gravel substrates.	Yes
Atlantic surfclam	SFEC	SFEC	Juveniles and Adults: Prefers sandy habitats along the continental shelf.	Yes
Ocean quahog	SFWF and SFEC	SFWF and SFEC	Juveniles and Adults: Prefers medium to fine sandy bottom with mud and silt.	Yes
Skates				
Barndoor skate	SFEC	SFEC	Juveniles and Adults: Mud, sand, and gravel substrates.	Yes
Little skate	SFWF and SFEC	SFWF and SFEC	Juveniles and Adults: Bottom habitats with a sandy or gravelly substrate or mud.	Yes
Winter skate	SFWF and SFEC	SFWF and SFEC	Juveniles and Adults: Bottom habitats with a substrate of sand and gravel or mud.	Yes
Sharks				
Sand tiger shark	SFWF and SFEC		Juveniles: Sand, mud, and rocky substrates. Coastal and shallow bays; generally near bottom.	
Sandbar shark	SFWF and SFEC	SFWF and SFEC	Juveniles and Adults: Sand, mud, shell, and rocky sediments/benthic habitat. Also, pelagic.	
Smoothhound shark complex (Atlantic Stock)*	SFWF and SFEC	SFWF and SFEC	Juveniles and Adults: Near or on the bottom.	
Spiny dogfish		SFWF and SFEC	Adults: Pelagic and epibenthic habitats.	Yes

*Neonate/young-of-the year for shark species is considered more similar to juvenile life stage than larval life stage for this analysis.

Table 9a. Early Pelagic Life Stages of Species with Designated EFH Potentially Present in the SFWF and/or SFEC

Species with Early Pelagic Life Stages	Eggs	Larvae
Finfish		
Atlantic butterfish	SFWF and SFEC	SFWF and SFEC
Atlantic cod	SFWF and SFEC	SFWF and SFEC
Atlantic mackerel	SFWF and SFEC	SFWF and SFEC
Atlantic herring		SFWF and SFEC
Bluefish	SFWF and SFEC	SFWF and SFEC

Table 9a. Early Pelagic Life Stages of Species with Designated EFH Potentially Present in the SFWF and/or SFEC

Species with Early Pelagic Life Stages	Eggs	Larvae
Haddock		SFWF and SFEC
Monkfish	SFWF and SFEC	SFWF and SFEC
Pollock	SFWF and SFEC	SFWF and SFEC
Red hake	SFWF and SFEC	SFWF and SFEC
Silver hake	SFWF and SFEC	SFWF and SFEC
Summer flounder	SFWF and SFEC	SFWF and SFEC
Windowpane flounder	SFWF and SFEC	SFWF and SFEC
Winter flounder		SFWF and SFEC
Witch flounder	SFWF and SFEC	SFWF and SFEC
Yellowtail flounder	SFWF and SFEC	SFWF and SFEC

Table 9b. Late Pelagic Life Stages of Species with Designated EFH Potentially Present in the SFWF and/or SFEC

Species with Late Pelagic Life Stages	Juveniles	Adults
Finfish		
Atlantic butterfish	SFWF and SFEC	SFEC
Atlantic mackerel	SFEC	
Atlantic herring	SFWF and SFEC	SFWF and SFEC
Bluefish	SFEC	SFWF and SFEC
Pollock	SFWF and SFEC	
White hake	SFEC	
Invertebrates		
Longfin squid	SFWF and SFEC	SFWF and SFEC
Highly Migratory Species		
Albacore tuna	SFWF and SFEC	SFWF and SFEC
Bluefin tuna	SFWF and SFEC	SFWF and SFEC
Skipjack tuna	SFWF and SFEC	SFWF and SFEC
Yellowfin tuna	SFWF and SFEC	SFWF and SFEC
Sharks		
Basking shark*	SFWF and SFEC	SFWF and SFEC
Blue shark*	SFWF and SFEC	SFWF and SFEC
Common thresher shark*	SFWF and SFEC	SFWF and SFEC
Dusky shark*	SFWF and SFEC	SFWF and SFEC
Sandbar shark*	SFWF and SFEC	SFWF and SFEC

Table 9b. Late Pelagic Life Stages of Species with Designated EFH Potentially Present in the SFWF and/or SFEC

Species with Late Pelagic Life Stages	Juveniles	Adults
Shortfin mako shark*	SFWF and SFEC	SFWF and SFEC
Spiny dogfish		SFWF and SFEC
Tiger shark	SFEC	SFEC
White shark*	SFWF and SFEC	SFWF and SFEC

*Neonate/young-of-the year for shark species is considered more similar to juvenile life stage than larval life stage for this analysis.

SECTION 3

Assessment of Impacts

Construction, O&M, and decommissioning activities associated with the Project have the potential to impact EFH through both direct and indirect effects as discussed in the following sections. Certain impact-producing factors (IPFs) may result in various levels of impacts to EFH and the species/life stages associated with that EFH. Neither the SFWF nor the SFEC is expected to have major short or long-term impacts to EFH during construction, operation, or decommissioning. Impacts to EFH vary by habitat, species, and life stage as discussed below, with some species/life stages being more vulnerable than others.

The analysis of impacts to EFH are discussed separately for the SFWF and SFEC in the following sections. The IPFs for the SFWF and SFEC are further subdivided into IPFs during the construction and decommissioning phases of the Project and the O&M phase of the Project.

3.1 South Fork Wind Farm

3.1.1 Impact Producing Factors

IPFs resulting in potential impacts to EFH in the SFWF are described in Table 10 for the construction and decommissioning phases and in Table 11 for the O&M phase. The IPFs most likely to impact EFH associated with the SFWF include seafloor disturbance, sediment suspension and deposition, noise, and traffic.

Table 10. IPFs and Potential Levels of Impact on EFH for the SFWF during Construction, Installation, and Decommissioning

IPF	Potential Impact	Maximum Level of Impact to EFH Benthic/Demersal Early Life Stages [a]	 Pelagic Early Life Stages [a]	 Benthic/Demersal Later Life Stages [a]	 Pelagic Later Life Stages [a]	Description
Seafloor Disturbance	Seafloor Preparation	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** Adverse impacts to EFH associated with seafloor preparation will primarily be associated with species that have benthic/demersal early life stages (eggs and larvae – Table 8a) and later life stages (juveniles and adults – Table 8b) as the benthos will be disturbed during seafloor preparation which could cause injury or mortality to these species or adversely impact EFH for these species. These impacts are expected to be short-term as the direct impacts will cease after seafloor preparation is completed in that area, and minor as they will disturb a small portion of available EFH in the area. Species with designated EFH that have pelagic early and/or later life stages within the SFWF (Tables 9a and 9b) are expected to have negligible impacts to the EFH associated with those life stages as the pelagic zone will not be directly affected by seafloor preparation. Areas requiring boulder relocation will experience temporary disturbance to attached fauna and any species sheltering in the boulders or cobble will have to relocate to a nearby similar habitat. **Indirect Impacts:** Immediately following impact-producing activities, species with designated EFH are expected to move back into the area; however, demersal/benthic habitat recovery and benthic infaunal and epifaunal species abundances may take up to 1 to 3 years to recover to pre-impact levels, resulting in a minor long-term indirect adverse impact to designated EFH for species with benthic/demersal life stages. Recolonization of sediments by epifaunal and infaunal species and the return of mobile fish and invertebrate species will allow this area to continue to serve as foraging habitat for EFH species. Relatively rapid (< 1 year) recolonization of areas that undergo boulder relocation is expected (Guarinello et al., 2017) and will return these boulders to their pre-project habitat function. Additionally, if relocation results in aggregation of boulders, these new features could serve as high value refuge habitat for juvenile lobster and fish as they may provide more complexity and opportunity for refuge than surrounding patchy habitat. EFH for pelagic species/life stages are expected to have negligible short-term indirect adverse impacts as pelagic habitat will be less affected by project activities, but these species are expected to temporarily vacate the habitat during seafloor preparation.
	Pile Driving/Foundation Installation	Minor short-term direct	Negligible short-term direct	Minor short-term direct	Negligible short-term direct	**Direct Impacts:** Direct impacts associated with pile driving and installation of the foundations and scour protection are expected to result in similar direct adverse impacts to EFH as seafloor preparation. These direct adverse impacts to EFH will be primarily associated with species that have benthic/demersal life stages. Negligible short-term direct adverse impacts to EFH are expected for pelagic species for the same reasons as noted in seafloor preparation.
	Offshore substation (OSS) platform installation	Minor short-term direct	Negligible short-term direct	Minor short-term direct	Negligible short-term direct	**Direct Impacts:** Direct impacts to EFH associated with the OSS platform are expected to be similar to those discussed in seafloor preparation and pile driving/foundation installation.
	SFWF inter-array cable installation	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible short-term indirect	**Direct Impacts:** Direct impacts to EFH associated with the inter-array cable installation are expected to result in similar adverse impacts to those discussed in seafloor preparation as the inter-array cable will be installed in the same area that was disturbed during seafloor preparation. In addition, fish eggs and larvae (ichthyoplankton), as well as zooplankton, are expected to be entrained if a jet plow is used for installation of the inter-array cable. Jet plow equipment uses seawater to circulate through hydraulic motors and jets during installation. Although this seawater is released back into the ocean, it is assumed that all entrained eggs, larvae, and zooplankton will be killed. To assess the potential loss of fish and zooplankton related to jet plow activity, an ichthyoplankton and zooplankton assessment was conducted using data from NOAA's Marine Resource Monitoring, Assessment and Prediction (MARMAP) Program and their subsequent Ecosystem Monitoring (EcoMon) plankton sampling programs (see Attachment 1). The results indicate that total estimated losses of zooplankton and ichthyoplankton related to entrainment from jet plow embedment of the inter-array cable were less than 0.001% of the total zooplankton and ichthyoplankton abundance present in the study region (see Attachment 1). Therefore, impacts to early life stages of EFH species from entrainment caused by jet plow embedment of the inter-array cable are expected to be negligible to minor and short-term. **Indirect Impacts:** Indirect impacts to EFH associated with the inter-array cable installation are expected to result in similar adverse impacts as those discussed in Seafloor Preparation. Indirect impacts associated with installation of armoring for the cable are discussed in the O&M phase in Table 11.
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** Direct impacts to EFH associated with vessel anchoring (including spuds) are similar to those discussed in seafloor preparation. **Indirect Impacts:** Indirect impacts to EFH associated with vessel anchoring (including spuds) are similar to those discussed in seafloor preparation.
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Negligible short-term direct Negligible long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** There will be temporary increases in sediment suspension and deposition associated with seafloor disturbance activities. In order to estimate the extent of potential impacts from sediment suspension and deposition generated by jet plow installation, one of three potential types of equipment to be used for cable installation, a modeling simulation was conducted on a representative section of the inter-array cable. Results indicate that the maximum modeled TSS concentration from SFWF inter-array cable installation using a jet plow is 100 mg/L. Water column concentrations of 100 mg/L are predicted to extend up to 131 feet (40 m) from the jet plow and TSS concentrations are predicted to return to ambient levels (<10 mg/L) within 18 minutes (0.3 hour) from the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation (Appendix I of the COP). The model also predicted that sediment deposition resulting from the installation of the inter-array cable using a jet plow will be limited to the area immediately adjacent to the burial route, typically, extending no more than 196 feet (60 m) from the cable-laying track. The maximum predicted deposition thickness is estimated to be 0.4 inches (10 mm) and limited to within 26 feet (8 m) from the burial route, covering an estimated cumulative area of 0.1 acres (0.04 ha). Deposition exceeding 0.04 inch (1 mm) is predicted to be confined to the area within 144 feet (44 m) of the inter-array cable route (Appendix I of the COP). These increases in sediment suspension and deposition may cause a

Table 10. IPFs and Potential Levels of Impact on EFH for the SFWF during Construction, Installation, and Decommissioning

IPF	Potential Impact	Maximum Level of Impact to EFH				Description
		Benthic/Demersal Early Life Stages [a]	**Pelagic Early Life Stages [a]**	**Benthic/Demersal Later Life Stages [a]**	**Pelagic Later Life Stages [a]**	
						short-term minor adverse impact to EFH because of decreases in habitat quality for benthic species, with greater impacts occurring to benthic early life stages. Older benthic life stages may temporarily vacate the habitat because of elevated suspended sediment levels in the water column and are therefore expected to experience negligible impacts. Negligible short-term adverse impacts to EFH are expected for pelagic life stages as once suspended sediment levels decrease, pelagic habitat quality and EFH is expected to quickly return to pre-disturbance levels. **Indirect Impacts:** Increased sediment deposition may cover adjacent areas and smother adjacent benthic habitat, and this habitat and associated infaunal and epifaunal species may take up to 1 to 3 years to recover to pre-impact levels, resulting in a minor long-term indirect adverse impact to designated EFH for species that have benthic/demersal life stages, particularly those with early life stages present. As demonstrated by the model (Appendix I of the COP), this is expected to occur only in a narrow impact area when using a jet plow, and the vicinity of the SFWF is expected to be subject to regular disturbances through storms and waves, which similarly result in increased sediment suspension and deposition. Elevated suspended sediment is not expected to result in indirect adverse impacts to EFH.
Noise	Pile Driving	Moderate short-term direct	Moderate short-term direct	Moderate short-term direct	Moderate short-term direct	**Direct Impacts:** Underwater noise generated by pile driving (both vibratory and impact) has the potential for direct impacts on finfish species, particularly those with swim bladders. Hearing among fish vary among species and auditory physiology. Fishes hear sounds using pressure and particle motion and detect the motion of surrounding water (Popper et al., 2008). It is more likely that pile driving noise would elicit behavioral responses in exposed fish, but injury is also possible for fish within proximity to the activity. Impact pile driving has the greatest potential to cause harassment or injury through the generation of intense underwater sound pressure waves and particle motion. In-water pile driving for bridge construction has resulted in high underwater sound pressures that have proved lethal to fishes (Thalheimer et al., 2014, Popper et al., 2016). Generally, pelagic species have swim bladders and are susceptible to pressure waves, while benthic/demersal species do not have swim bladders and detect sound through particle motion. Direct impacts associated with these sound pressure waves and particle motion may include changes in fish behavior and injury or mortality caused by rupturing swim bladders or by internal hemorrhaging. Noise from impact pile driving can also cause fish to be temporarily stunned, which might make them more susceptible to predation. In general, pile driving is expected to have an adverse impact to EFH for species that are mobile and can detect sound. The estimated ranges to applicable thresholds for injury and behavior impacts in fish are presented in the sound propagation modeling report (Appendix J to the COP). The pile driving noise modeling considers various design parameters and acoustic thresholds for fish published by GARFO (2016) and Popper et al. (2014). For exposed species, the noise levels may result in a direct adverse impact to EFH as elevated noise levels will temporarily make the habitat less suitable for the species and cause them to temporarily vacate the area. It is possible, but not likely, that elevated noise may interrupt migration patterns of finfish through the area because they may avoid elevated noise levels. Impact pile driving is expected to result in a direct minor to moderate adverse impact to EFH for both pelagic and demersal life stages, but this impact will be short-term as once pile driving is completed, the habitat suitability is expected to return to pre-pile driving conditions.
	Ship Noise, Trenching Noise, Aircraft Noise	Minor short-term direct	Minor short-term direct	Minor short-term direct	Minor short-term direct	**Direct Impacts:** Adverse impacts to EFH is expected for species with designated EFH that can detect pressure waves or particle motion associated with ship noise, trenching noise, or aircraft noise. However, these adverse impacts are expected to be short-term and minor, and similar to those that currently occur when vessels and aircraft transit the area. Direct adverse impacts to EFH may result from a temporary degradation of habitat for species that vacate the area because of elevated noise levels. This may be a temporary adverse impact to EFH for species with both pelagic and demersal life stages.
Traffic		See seafloor disturbance, noise, sediment suspension and deposition, and lighting IPFs.				
Lighting		Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	**Direct Impacts:** Reactions to artificial light is highly species dependent, resulting in an adverse impact to EFH either through avoidance or attraction of species with EFH in the area. However, because of the limited area that will have artificial lighting relative to the surrounding areas, and that no underwater lighting is proposed, overall impacts to EFH is expected to be negligible.
Discharges and Releases		Negligible short-term direct				**Direct Impacts:** Multiple vessels will be used during the construction of the SFWF. All vessels will comply with USCG requirements for management of onboard fluids and fuels, including maintaining and implementing spill prevention, control, and countermeasure (SPCC) plans. Vessels will be navigated by trained, licensed vessel operators who will adhere to navigational rules and regulations and vessels will be equipped with spill handling materials adequate to control or clean up any accidental spill. The likelihood of discharges and releases is expected to be low and impacts to EFH is considered negligible. Some liquid wastes are allowed to be discharged to marine waters during the construction phase of the SFWF. These discharges include domestic water, deck drainage, treated sump drainage, uncontaminated ballast water, and uncontaminated bilge water and are not expected to pose an impact to EFH.
Trash and Debris		Negligible short-term direct				**Direct Impacts:** Trash and debris generated during construction of the SFWF will be contained on vessels or at staging areas until disposal at an approved facility. Measures will be implemented prior to and during construction to avoid, minimize, and mitigate impacts related to trash and debris disposal. Disposal of any solid waste or debris in the water will be prohibited. Work crews will be required to visually scan work areas continually and at the end of each day to identify and capture any floating debris. Impacts from trash and debris on EFH are expected to be negligible.

[a] Early life stages include eggs and larvae. Later life stages include juveniles and adults

Table 11. IPFs and potential levels of impact on EFH for the SFWF during Operations and Maintenance

		Maximum Level of Impact to EFH				
IPF	**Potential Impact**	**Benthic/Demersal Early Life Stages [a]**	**Pelagic Early Life Stages [a]**	**Benthic/Demersal Later Life Stages [a]**	**Pelagic Later Life Stages [a]**	**Description**
Seafloor Disturbance	Foundation	Minor long-term indirect	Minor long-term indirect	Minor long-term indirect	Minor long-term indirect	**Indirect Impacts:** Presence of the foundations and associated scour protection may result in both adverse and beneficial indirect impacts to EFH. Impacts may occur through habitat conversion and the associated reef effect when soft-bottom habitat within the SFWF is replaced with hard-bottom habitat. EFH for species that have life stages associated with soft-bottom habitat may have long-term adverse impacts, as available habitat for the species will be decreased. EFH for species that are associated with harder bottom habitat may have a beneficial impact as the foundations and scour protection will serve as habitat in an area that has little available hard-bottom habitat. Habitat conversion is expected to cause a long-term minor indirect impact because individual WTGs and associated scour protection may be installed in sand sheet, sand with mobile gravel, or in patchy cobble and boulder on sand habitats that are present in and around the SFWF. Data collected as part of the geophysical and geotechnical survey at the SFWF (Appendix H of the COP) and other database reviews (McMullen et al., 2007a, 2007b, 2008; Poppe et al., 2011, 2014a, 2014b, 2014c; McMaster, 1960; LaFrance et al., 2010) indicate that sand sheet, sand with mobile gravel, and patchy cobble and boulder on sand habitats are not a limiting habitat in the region, and that numerous hard bottom boulder habitats are also present within the area. As a result, the conversion of a small area of these habitats to hard bottom habitat is unlikely to result in perceptible changes to the benthic community outside of the immediate area impacted.
	Offshore substation (OSS) platform	Minor long-term indirect	Minor long-term indirect	Minor long-term indirect	Minor long-term indirect	**Indirect Impacts:** Indirect impacts to EFH associated with the presence of the OSS platform are expected to be similar to those discussed for the foundation above.
	SFWF inter-array cable	Minor short-term direct Minor long-term indirect	Negligible short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Minor long-term indirect	**Direct Impacts:** Minimal operational impacts to EFH are expected from the presence of the inter-array cable because it will be buried beneath the seabed. However, some maintenance may be required for the inter-array cable. This maintenance is expected to result in similar direct adverse impacts to EFH as those discussed in the construction/decommissioning section (Table 10). However, the impact area to EFH will be much smaller than the impact area from construction/decommissioning. **Indirect Impacts:** Indirect impacts to EFH associated with O&M activities on the inter-array cable are expected to result in similar adverse impacts as those discussed in Table 10 but will occur in a much smaller impact area. The armoring of the cable may result in the long-term conversion of soft-bottom habitat to hard-bottom habitat which could result in a "reef effect." Similar to the foundation, the cable armoring may have a long-term adverse impact to EFH for species associated with soft-bottom habitat and a long-term beneficial impact to EFH for species associated with hard-bottom habitat.
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** Vessels are not expected to anchor during O&M activities unless the inter-array cable or WTGs require maintenance. Adverse impacts to EFH resulting from potential vessel anchoring during O&M activities are expected to be similar to those discussed in Table 10. **Indirect Impacts:** Indirect impacts to EFH associated with vessel anchoring (including spuds) are similar to those discussed in Table 10.
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Negligible short-term direct Negligible long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** Increases in sediment suspension and deposition during the O&M phase will result from vessel anchoring and any maintenance activities that will require exposing the inter-array cable. Both activities are expected to be non-routine events and not expected to occur with any regularity. Adverse impacts to EFH resulting from sediment suspension and deposition during the O&M phase are expected to be similar to those discussed in the construction and decommissioning phase (Table 10), just on a more limited spatial scale. **Indirect Impacts:** Adverse indirect impacts to EFH from sediment suspension and deposition are expected to be similar to those discussed in the construction and decommissioning phase in Table 10, just on a more limited spatial scale.
Noise	Ship Noise and Aircraft Noise,	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	**Direct Impacts:** Adverse impacts to EFH from ship and aircraft noise during SFWF O&M are expected to be similar to those discussed in the construction/decommissioning phase (Table 10).
	WTG Operational Noise	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	**Direct Impacts:** The underwater noise produced by wind turbines are within the hearing ranges of fish. Depending on the noise intensity, such noises could disturb or displace fish within the surrounding area or cause auditory masking (MMS, 2007). Noise levels are not expected to result in injury or mortality and finfish may become habituated to the operational noise (Thomsen et al., 2006; Bergström et al., 2014). A recent study also found no difference in the residency times of juvenile cod around monopiles between periods of turbine operation or when turbines were out-of-order. This study also found that sand eels (*Ammodytes marinus* and *Ammodytes tobianus*) did not avoid the wind farm (Lindeboom et al., 2011). In a similar study, the abundance of cod, eel, shorthorn sculpin (*Myoxocephalus scorpius*), and goldsinny wrasse (*Ctenolabrus rupestris*), were found to be higher near WTGs, indicating potential noise impacts from operation did not override the "reef effect." Avoidance of WTGs was not observed in this study either (Bergström et al., 2013). With generally low noise levels generated by the WTGs, fish will be impacted only at close ranges, within approximately 328 feet (100 m) (Thomsen et al., 2006). Thomsen et al. (2006) reviewed the findings of observations of fish behaviors in proximity to an operational turbine and found varying results from no perceived changes in swimming behavior (European eels); and both increased and decreased catch rates of cod within 328 feet (100 m) of turbines. Because these studies indicated that there was no detectable effect of operational noise on individual species, it can be inferred that operational noise will have no adverse impact to EFH for species regardless of their ability to detect the noise.

Table 11. IPFs and potential levels of impact on EFH for the SFWF during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact to EFH				Description
		Benthic/Demersal Early Life Stages [a]	Pelagic Early Life Stages [a]	Benthic/Demersal Later Life Stages [a]	Pelagic Later Life Stages [a]	
Electromagnetic Field (EMF)		Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	**Direct Impacts:** A modeling analysis of the magnetic fields and induced electric fields anticipated to be produced during operation of the SFWF inter-array cable and SFEC was performed and results are included in Appendix K of the COP. These modeling results were compared to published studies available in the scientific literature on the sensitivity of marine species to EMF. The modeling results and scientific literature analysis indicates that the EMF associated with the operational, buried submarine cable will not be detected by bony fish, elasmobranch, or invertebrate species. Given that the calculated values are below the thresholds of detection reported in the scientific literature, behavioral effects impacting regional abundances and distributions of such species are not expected. Additional field data from 50-Hz submarine cable sites and offshore windfarms support this conclusion, indicating no distributional or behavioral effects on resident fish, elasmobranchs, or invertebrates. It should be noted that these conclusions are in line with the findings of a previous comprehensive review of the ecological impacts of Marine Renewable Energy (MRE) projects, where it was determined that "to date there has been no evidence to show that EMFs at the levels expected from MRE devices will cause an effect (whether negative or positive) on any species" (Copping et al., 2016). Given these findings and the findings presented in Appendix K of the COP, impacts from EMF on EFH or finfish with designated EFH within the SFWF are expected to be negligible.
Traffic		See seafloor disturbance, noise, sediment suspension and deposition, and lighting IPFs.				
Lighting		Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	**Direct Impacts:** Artificial lighting during O&M will be associated with vessels, the WTGs, and the OSS. Reaction of species with EFH at the SFWF to artificial light is highly species-dependent, resulting in an adverse impact to EFH either through avoidance or attraction of species. However, because of the limited area that will have artificial lighting relative to the surrounding areas, and that no underwater lighting is proposed, overall impacts to EFH is expected to be negligible.
Discharges and Releases		Negligible short-term direct				**Direct Impacts**: The operation of the SFWF is not anticipated to generate any sources of pollutants to the marine environment. To make sure that no discharges of fluids (oil, hydraulic, cooling, etc.) occur even under abnormal circumstances, the WTG and the OSS will be designed for secondary levels of containment. Most maintenance will occur inside the WTGs, thereby reducing the risk of a spill, and no oils or other waste is expected to be discharged during service events. The original coating system on the towers is designed to last the lifetime of the structure; therefore, no painting is anticipated during the life of the turbines other than to repair minor surface damage. As a result, impacts to surface water quality and to EFH during O&M is expected to be negligible. As with vessels associated with construction, any vessels used for O&M activities will comply with USCG regulations and applicable SPCC plans; therefore, potential impacts from spills are unlikely and considered to have negligible impacts to EFH. The proposed inter-array cable and SFEC do not contain any fluid. There will be no risk to the environment if they are disturbed by anchors or keels because no fluids or materials will be released.
Trash and Debris		Negligible short-term direct				Adverse impacts to EFH during SFWF O&M are expected to be similar to, but less than those discussed in the construction/decommissioning phase (Table 10).

[a] Early life stages include eggs and larvae. Later life stages include juveniles and adults

3.1.2 Summary of Impacts to EFH Resulting from IPFs at SFWF

Based on the IPFs discussed in Tables 10 and 11, minor impacts to EFH are generally associated with species that have demersal/benthic life stages, while negligible impacts to EFH are generally associated with species that have pelagic life stages.

Short-term direct impacts to EFH are expected to be either negligible or minor for species with benthic/demersal life stages and negligible for pelagic life stages, except for noise impacts which are expected to have minor to moderate short-term direct impacts to both benthic and pelagic species. Short-term indirect impacts to EFH are only expected to affect pelagic species and are anticipated to be negligible. Many IPFs result in no short-term indirect impacts to EFH for benthic or pelagic species.

Negligible long-term direct impacts to EFH are expected to result from WTG operational noise, lighting, and EMF. Long-term indirect impacts to EFH are expected to range from negligible to minor impacts for benthic/demersal life stages and are expected to be negligible for pelagic life stages. However, long-term indirect impacts caused by conversion of sand sheet and/or sand with mobile gravel habitat to hard-bottom habitat associated with the WTGs, scour protection, and cable armoring are expected to have a minor long-term indirect impact to EFH for certain benthic and pelagic species.

3.1.2.1 EFH Species Least Likely to Experience Impacts

Of the species with EFH designated at the SFWF, **those that are least likely to experience impacts** have both pelagic early and late life stages or only have EFH at the SFWF associated with pelagic environments. They include the following species and life stages:

New England Finfish Species:
Atlantic herring (larvae, juvenile, adult)
Witch flounder (egg, larvae)

Mid-Atlantic Finfish Species:
Atlantic butterfish (egg, larvae, juvenile)
Atlantic mackerel (egg, larvae)
Bluefish (egg, larvae, adult)

Highly Migratory Species:
Albacore tuna (juvenile, adult)
Bluefin tuna (juvenile, adult)
Skipjack tuna (juvenile, adult)
Yellowfin tuna (juvenile, adult)

Sharks:
Basking shark (neonate, juvenile, adult)
Blue shark (neonate, juvenile, adult)
Common thresher shark (neonate, juvenile, adult)
Dusky shark (neonate, juvenile, adult)
Shortfin mako shark (neonate, juvenile, adult)
White shark (neonate, juvenile, adult)

3.1.2.2 EFH Species Most Likely to Experience Impacts

Of the species with EFH designated at the SFWF that also have preferred habitat present, those that have EFH associated with **benthic-demersal early and/or older life stages**, are the most likely to experience **minor short-term direct impacts** to EFH because of the construction, O&M, and decommissioning phases of the SFWF. This is because the benthos is the habitat that will primarily be affected by SFWF activities.

The species and associated life stages expected to experience these impacts are listed below.

Species Expected to Experience Minor Short-Term Direct Impacts

New England Finfish Species:
Atlantic cod (juvenile, adult)
Haddock (juvenile)
Monkfish (adult)
Ocean pout (egg, juvenile, adult)
Pollock (juvenile)
Red hake (juvenile)
Windowpane flounder (juvenile, adult)
Winter flounder (egg, larvae, juvenile, adult)
Yellowtail flounder (juvenile, adult)

Mid-Atlantic Finfish Species:
Black sea bass (juvenile, adult)
Scup (juvenile, adult)
Summer flounder (adult)

Invertebrates:
Atlantic sea scallop (egg, larvae, juvenile, adult)
Ocean quahog (juvenile, adult)

Skates:
Little skate (juvenile, adult)
Winter skate (juvenile, adult)

Sharks:
Sand tiger shark (neonate, juvenile)
Sandbar shark (juvenile, adult)
Smoothhound shark (neonate, juvenile, adult)
Spiny dogfish (adult)

Conversion of habitat associated with the WTGs, scour protection, and cable armoring may have a **minor long-term indirect impact** to EFH for species that have **demersal/benthic life stages**. These long-term impacts associated with habitat conversion may be considered adverse to species with life stages associated with soft-bottom habitat and **beneficial** to species with life stages associated with hard-bottom habitat. Species with life stages associated with both habitats are not considered to have an adverse or beneficial impact. Species and associated life stages that are expected to have an **adverse** impact to their EFH associated with the WTGs, scour protection, and sections of the inter-array cable where protective armoring may be required are listed below. However, these effects only have the potential to occur at each WTG (approximately 14.6 acres [5.9 hectares] total) and from cable protection of the inter-array cable at the approach to the foundations (10.2 acres [4.1 hectares] and as secondary cable protection (9.8 acres [4.0 hectares]) along a few short sections of the inter-array cable where additional protective armoring may be required. Except for the conversion of sand sheet, sand with mobile gravel, and patchy cobble and boulder on sand habitat into hard-bottom habitat, the substrates within the SFWF in other areas are expected to remain fundamentally the same as pre-existing conditions, and therefore are expected to allow the continued use by designated EFH species.

Species Expected to Experience Minor Long-Term Indirect Adverse Impacts

New England Finfish Species:
Monkfish (adult)
Ocean Pout (juvenile)

Windowpane flounder (juvenile, adult)
Winter flounder (egg, juvenile, adult)
Yellowtail flounder (juvenile, adult)

Mid-Atlantic Finfish Species:
Scup (juvenile)
Summer flounder (adult)

Invertebrates:
Atlantic sea scallop (egg, larvae, juvenile, adult)
Ocean quahog (juvenile, adult)

Skates:
Little skate (juvenile, adult)
Winter skate (juvenile, adult)

Species and associated life stages that are expected to have a **beneficial** impact to their EFH associated with the WTGs and sections of the inter-array cable where protective armoring may be required are listed below.

Species Expected to Experience Minor Long-Term Indirect Beneficial Impacts

New England Finfish Species:
Atlantic cod (juvenile, adult)
Ocean pout (egg)
Pollock (juvenile)

Mid-Atlantic Finfish Species:
Black sea bass (juvenile, adult)

3.2 South Fork Export Cable

3.2.1 Impact Producing Factors

IPFs resulting in potential impacts to EFH in the SFEC are described in Table 12 for the construction and decommissioning phases and in Table 13 for the O&M phase. The IPFs most likely to impact EFH associated with the SFEC include seafloor disturbance, sediment suspension and deposition, noise, and traffic.

Table 12. IPFs and Potential Levels of Impact on EFH for the SFEC during Construction, Installation, and Decommissioning

IPF	Potential Impact	Maximum Level of Impact to EFH				Description
		Benthic/Demersal Early Life Stages [a]	Pelagic Early Life Stages [a]	Benthic/Demersal Later Life Stages [a]	Pelagic Later Life Stages [a]	
Seafloor Disturbance	Seafloor Preparation	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** As discussed in Table 10, the potential impacts to EFH from seafloor preparation are primarily associated with species that have benthic/demersal life stages (Tables 8a and 8b). Seafloor preparation is expected to have negligible impacts to EFH of species that have pelagic early or later life stages. Direct impacts to EFH in the SFEC from seafloor preparation are expected to be similar to those discussed in Table 10. **Indirect Impacts:** Indirect adverse impacts to EFH associated with seafloor preparation for the SFEC are expected to be similar to those discussed in Table 10.
	Pile Driving/Cofferdam Installation	Minor short-term direct	Negligible short-term direct	Minor short-term direct	Negligible short-term direct	**Direct Impacts:** Vibratory pile driving will only be associated with the temporary cofferdam that will be installed at the HDD exit point. Direct impacts to EFH are expected to be similar to those discussed in Table 10; however, at a much smaller scale because the area of impact to EFH associated with installation of the cofferdam is much smaller than the area of impact associated with construction of the SFWF. As such, the short-term direct impact area to EFH will be much smaller than that discussed in Table 10.
	SFEC installation	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible short-term indirect	**Direct Impacts:** Direct impacts to EFH associated with the SFEC installation are expected to result in similar adverse impacts to those discussed in Table 10. In addition, as described in Table 10, fish eggs and larvae (ichthyoplankton), as well as zooplankton, are expected to be entrained if a jet plow is used for installation of the SFEC. An ichthyoplankton and zooplankton assessment was conducted to analyze the potential loss of fish and zooplankton related to jet plow activity (see Attachment 1). The results indicate that total estimated losses of zooplankton and ichthyoplankton related to entrainment from jet plow embedment of the longest potential SFEC route were less than 0.001% of the total zooplankton and ichthyoplankton abundance present in the study region (see Attachment 1). Therefore, impacts to early life stages of EFH species from entrainment caused by jet plow embedment of the SFEC are expected to be negligible to minor and short-term. **Indirect Impacts:** Indirect impacts to EFH associated with the SFEC installation are expected to result in similar adverse impacts as those discussed in Table 10. Indirect impacts associated with installation of armoring for the SFEC are discussed in the O&M phase in Table 13.
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** Direct impacts to EFH associated with vessel anchoring (including spuds) are similar to those discussed in Table 10. **Indirect Impacts:** Indirect impacts to EFH associated with vessel anchoring (including spuds) are similar to those discussed in Table 10.
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct, Negligible short-term indirect	Negligible short-term direct Negligible long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** There will be temporary increases in sediment suspension and deposition associated with seafloor disturbance activities. To estimate the extent of potential impacts from sediment suspension and deposition generated by jet plow installation, one of three potential types of equipment to be used for cable installation, a modeling simulation of the burial of the SFEC was conducted. Results indicate that the maximum modeled TSS concentration from SFEC - OCS installation using a jet plow is 1,347 mg/L and from SFEC - NYS installation using a jet plow is 578 mg/L. The highest TSS concentrations are predicted to occur in locations where the hydro-plow passes over pockets of finer sediments as identified in Appendix H of the COP, but concentrations above 30 mg/L otherwise remain within approximately 328 feet (100 m) of the source during the simulation. Water column concentrations of 100 mg/L or greater are predicted to extend up to 1,115 feet (340 m) from the jet plow for the SFEC - OCS portion of the route and up to 394 feet (120 m) for the SFEC - NYS portion of the route. TSS concentrations are predicted to return to ambient levels (<10 mg/L) in 1.4 hours after the conclusion of jet plow trenching for the SFEC - OCS portion of the route and in 1.3 hours for the SFEC - NYS portion of the route. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation (see Appendix I of the COP). The model also predicted that sediment deposition resulting from the installation of the SFEC using a jet plow will be limited to the area immediately adjacent to the burial route, typically, extending no more than 328 feet (100 m) from the cable-laying track. The maximum predicted deposition thickness is estimated to be 0.45 inches (11.4 mm) for the SFEC - OCS and 0.39 inches (10 mm) for the SFEC - NYS. Sedimentation at or above 0.4 inch (10 mm) extends a maximum of 29.5 feet (9 m) from the burial route and covers a cumulative area of 4.3 acres (1.72 ha) of the seabed for the SFEC - OCS and SFEC - NYS portions of the route. Sedimentation exceeding 0.04 inch (1 mm) is predicted to be confined to the area within 400 feet (122 m) of the SFEC - OCS route and to within 141 feet (43 m) of the SFEC - NYS route (Appendix I). A modeling simulation of dredging and side-casting at the HDD sea-to-shore transition vault was also conducted. The model predicted that sedimentation will be limited to the area immediately adjacent to the exit pit (within 656 feet (200 m) of the source). The maximum predicted deposition thickness is 12.5 inches (318 mm). Sedimentation at or above 10 mm extends a maximum of 177 feet (54 m) from the side-cast point and covers a cumulative area of only 1.38 acres (0.56 ha) of the seabed. Sedimentation exceeding 0.04 inch (1 mm) is predicted to be confined to the area within 266 feet (81 m) of the side-cast point (Appendix I). Adverse direct impacts to EFH resulting from sediment suspension and deposition are expected to be similar to those discussed in Table 10, and primarily associated with impacts to benthic early life stages. **Indirect Impacts:** Indirect adverse impacts to EFH resulting from sediment suspension and deposition are expected to be similar to those discussed in Table 10.

Table 12. IPFs and Potential Levels of Impact on EFH for the SFEC during Construction, Installation, and Decommissioning

IPF	Potential Impact	Maximum Level of Impact to EFH				Description
		Benthic/Demersal Early Life Stages [a]	Pelagic Early Life Stages [a]	Benthic/Demersal Later Life Stages [a]	Pelagic Later Life Stages [a]	
Noise	Pile Driving/Cofferdam Installation	Minor short-term direct	Minor short-term direct	Minor short-term direct	Minor short-term direct	**Direct Impacts:** Direct impacts to EFH associated with noise generated by vibratory pile driving has the potential to affect EFH for species that can detect the sound waves or particle motion associated with the sound. No impact pile driving is expected. Because of the reduced sound levels and increased sound attenuation expected in shallower waters during vibratory pile driving, impacts to EFH associated with pile driving are only expected where the cofferdam may be installed. For these species, the noise levels may result in a direct adverse impact to EFH similar to impacts described in Table 10, as elevated noise levels may temporarily cause these species to vacate the area and may temporarily decrease the habitat suitability. This direct adverse impact to EFH may occur for species with both pelagic and demersal life stages.
	Ship Noise, Trenching Noise, Aircraft Noise	Minor short-term direct	Minor short-term direct	Minor short-term direct	Minor short-term direct	**Direct Impacts:** Adverse direct impacts to EFH resulting from ship noise, trenching noise, and aircraft noise are expected to be similar to those discussed in Table 10.
Traffic		See Seafloor disturbance, noise, sediment suspension and deposition, and lighting IPFs.				
Lighting		Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	**Direct Impacts:** During construction and decommissioning activities, lighting will be associated with the vessels that will be installing or decommissioning the SFEC. Direct adverse impacts to EFH are expected to be short-term and highly localized because the vessels are expected to pass quickly along the SFEC route during cable installation. These impacts to EFH are highly species dependent and may include attraction or avoidance of the artificially lit area. However, because of the limited duration of artificial lighting and that no underwater lighting is proposed, overall adverse impacts to EFH are expected to be negligible.
Discharges and Releases		Negligible short-term direct				**Direct Impacts:** Impacts associated with discharges and releases during construction of the SFEC are expected to be similar to those described for the SFWF.
Traffic and Debris		Negligible short-term direct				**Direct Impacts:** Impacts associated trash and debris during construction of the SFEC are expected to be similar to those described for the SFWF.

[a] Early life stages include eggs and larvae. Later life stages include juveniles and adults

Table 13. IPFs and potential levels of impact on EFH for the SFEC during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact to EFH				Description
		Benthic/Demersal Early Life Stages [a]	Pelagic Early Life Stages [a]	Benthic/Demersal Later Life Stages [a]	Pelagic Later Life Stages [a]	
Seafloor Disturbance	Cofferdam	No impact	No impact	No impact	No impact	The cofferdam will be a temporary structure used during construction only. Therefore, no conversion of habitat is expected, and the cofferdam will be removed prior to the O&M phase.
	SFEC	Minor short-term direct Minor long-term indirect	Negligible short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Minor long-term indirect	**Direct Impacts:** Minimal operational impacts to EFH are expected from the presence of the SFEC cable because it will be buried beneath the seabed. However, some maintenance may be required, and this may result in similar direct adverse impacts to EFH as those discussed in Table 10 for construction of the inter-array cable. However, the impact area to EFH during O&M will be much smaller than the impact area from construction/decommissioning. **Indirect Impacts:** Indirect impacts to EFH associated with O&M activities on the SFEC are expected to result in similar adverse impacts as those discussed in Table 10 for construction of the inter-array cable but will occur in a much smaller impact area. The armoring of the cable may result in the long-term conversion of soft-bottom habitat to hard-bottom habitat, which could result in a “reef effect.” Similar to foundation installation, the cable armoring may have a long-term adverse impact to EFH for species associated with soft-bottom habitat and a long-term beneficial impact to EFH for species associated with hard-bottom habitat.
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** Vessels are not expected to anchor during O&M activities unless the SFEC requires maintenance. Adverse impacts to EFH resulting from potential vessel anchoring are expected to be similar to those discussed in Table 10. **Indirect Impacts:** Indirect impacts to EFH associated with vessel anchoring (including spuds) are similar to those discussed in Table 10.
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Negligible short-term direct Negligible long-term indirect	Negligible short-term direct Negligible short-term indirect	**Direct Impacts:** Increases in sediment suspension and deposition during the O&M phase will result from vessel anchoring and any maintenance activities that will require exposing the SFEC. Both activities are expected to be non-routine events and not expected to occur with any regularity. Adverse impacts to EFH resulting from sediment suspension and deposition during the O&M phase are expected to be similar to those discussed for the SFWF in Table 11. **Indirect Impacts:** Adverse indirect impacts to EFH from sediment suspension and deposition are expected to be similar to those discussed in the construction and decommissioning phase in Table 12, just on a more limited spatial scale.
Ship Noise and Aircraft Noise		Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	**Direct Impacts:** Adverse impacts to EFH from ship and aircraft noise during SFEC O&M are expected to be similar to those discussed for the SFWF in Tables 10 and 11.
Electromagnetic Field		Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	**Direct Impacts:** Negligible adverse impacts to EFH from EMF during SFEC O&M are expected to be similar to those discussed for the inter-array cable in Table 11.
Traffic		See IPFs for seafloor disturbance, ship and aircraft noise, sediment suspension and deposition, and lighting.				
Lighting		Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	**Direct Impacts:** Artificial lighting during O&M in the SFEC will only be associated with O&M vessels. Reaction of species with EFH at the SFWF to artificial light is highly species-dependent, resulting in an adverse impact to EFH either through avoidance or attraction of species. However, because of the limited area that will have artificial lighting relative to the surrounding areas, and that no underwater lighting is proposed, overall impacts to EFH is expected to be negligible.
Discharges and Releases		Negligible short-term direct				**Direct Impacts:** Impacts associated with discharges and releases during O&M of the SFEC are expected to be similar to those described for O&M of the SFWF inter-array cable.
Trash and Debris		Negligible short-term direct				**Direct Impacts:** Impacts associated trash and debris during O&M of the SFEC are expected to be similar to those described for O&M of the SFWF inter-array cable.

[a] Early life stages include eggs and larvae. Later life stages include juveniles and adults

3.2.2 Summary of Impacts to EFH resulting from IPFs at SFEC

Based on the IPFs discussed in Tables 12 and 13, minor impacts to EFH are generally associated with species that have demersal/benthic life stages, while negligible impacts to EFH are generally associated with species that have pelagic life stages.

Short-term direct impacts to EFH are expected to be either negligible or minor for species with benthic/demersal life stages and negligible for pelagic life stages, except for noise impacts which are expected to have minor short-term direct impacts to both benthic and pelagic species. Short-term indirect impacts to EFH are only expected to affect pelagic species and are anticipated to be negligible. Many IPFs result in no short-term indirect impacts to EFH for benthic or pelagic species.

Negligible long-term direct impacts to EFH are expected to result from lighting and EMF. Long-term indirect impacts to EFH are expected to range from negligible to minor impacts for benthic/demersal life stages and are expected to be negligible for pelagic life stages. However, long-term indirect impacts caused by conversion of sand sheets and/or sand with mobile habitat to hard-bottom habitat associated with SFEC cable armoring are expected to have a minor long-term indirect impact to EFH for certain benthic and pelagic species.

3.2.2.1 EFH Species Least Likely to Experience Impacts

Of the species with EFH designated at the SFEC, **those that are least likely to experience impacts** have both pelagic early and late life stages or only have EFH at the SFEC associated with pelagic environments. They include the following species and life stages:

New England Finfish Species:
Atlantic herring (larvae, juvenile, adult)
Witch flounder (egg, larvae)

Mid-Atlantic Finfish Species:
Atlantic butterfish (egg, larvae, juvenile, adult)
Atlantic mackerel (egg, larvae, juvenile)
Bluefish (egg, larvae, juvenile, adult)

Highly Migratory Species:
Albacore tuna (juvenile, adult)
Bluefin tuna (juvenile, adult)
Skipjack tuna (juvenile, adult)
Yellowfin tuna (juvenile, adult)

Sharks:
Basking shark (neonate, juvenile, adult)
Blue shark (neonate, juvenile, adult)
Common thresher shark (neonate, juvenile, adult)
Dusky shark (neonate, juvenile, adult)
Shortfin mako shark (neonate, juvenile, adult)
Tiger shark (juvenile, adult)
White shark (neonate, juvenile, adult)

3.2.2.2 EFH Species Most Likely to Experience Impacts

Of the species with EFH designated at the SFEC that also have preferred habitat present, those that have EFH associated with **benthic/demersal early and/or late life stages**, are the most likely to experience **minor short-term direct impacts** to EFH because of the construction, O&M, and decommissioning phases of the SFEC. This is because the benthos is the habitat that will primarily be affected by SFEC activities. The species and associated life stages expected to experience these impacts are listed below.

Species Expected to Experience Minor Short-Term Direct Impacts

New England Finfish Species:
Atlantic cod (juvenile, adult)
Haddock (juvenile, adult)
Monkfish (juvenile, adult)
Ocean pout (egg, juvenile, adult)
Pollock (juvenile)
Red hake (juvenile, adult)
Silver hake (juvenile)
White hake (juvenile)
Windowpane flounder (juvenile, adult)
Winter flounder (egg, larvae, juvenile, adult)
Yellowtail flounder (juvenile, adult)

Mid-Atlantic Finfish Species:
Black sea bass (juvenile, adult)
Scup (juvenile, adult)
Summer flounder (juvenile, adult)

Invertebrates:
Atlantic sea scallop (egg, larvae, juvenile, adult)
Atlantic surfclam (juvenile, adult)
Longfin squid (eggs)
Ocean quahog (juvenile, adult)

Skates:
Barndoor skate (juvenile, adult)
Little skate (juvenile, adult)
Winter skate (juvenile, adult)

Sharks:
Sand tiger shark (neonate, juvenile)
Sandbar shark (neonate, juvenile, adult)
Smoothhound shark complex (Atlantic stock) (neonate, juvenile, adult)
Spiny dogfish (adult)

Conversion of habitat associated with the armoring for the SFEC may have a **minor long-term indirect impact** to EFH for species that have **demersal/benthic life stages**. These long-term impacts associated with habitat conversion may be **adverse** to species with life stages associated with soft-bottom habitat and **beneficial** to species with life stages associated with hard-bottom habitat. Species with life stages associated with both habitats are not considered to have an adverse or beneficial impact. Species and associated life stages that are expected to have an **adverse** impact to their EFH along sections of the SFEC route where protective armoring may be required are listed below. However, these effects only have the potential to occur along the sections of the SFEC where additional protective armoring may be required (totaling no more than 7.6 acres [3.0 hectares] along the SFEC-OCS route and no more than 0.2 acre [0.08 hectare] along the SFEC-NYS route). Except for the conversion of sand sheet, sand with mobile gravel, and patchy cobble and boulder on sand habitat into hard-bottom habitat, the substrata within the SFEC in other areas are expected to remain fundamentally the same as pre-existing conditions, and therefore are expected to allow the continued use by designated EFH species.

Species Expected to Experience Minor Long-Term Indirect Adverse Impacts

New England Finfish Species:
Monkfish (juvenile, adult)
Ocean Pout (juvenile)
Silver hake (juvenile)
White hake (juvenile)
Windowpane flounder (juvenile, adult)
Winter flounder (egg, juvenile, adult)
Yellowtail flounder (juvenile, adult)

Mid-Atlantic Finfish Species:
Scup (juvenile)
Summer flounder (juvenile, adult)

Invertebrates:
Atlantic sea scallop (egg, larvae, juvenile, adult)
Atlantic surfclam (juvenile, adult)
Ocean quahog (juvenile, adult)

Skates:
Barndoor skate (juvenile, adult)
Little skate (juvenile, adult)
Winter skate (juvenile, adult)

Species and associated life stages that are expected to have a **beneficial** impact to their EFH in areas where protective armoring may be required are listed below.

Species Expected to Experience Minor Long-Term Indirect Beneficial Impacts

New England Finfish Species:
Atlantic cod (juvenile, adult)
Ocean pout (egg)
Pollock (juvenile)

Mid-Atlantic Finfish Species:
Black sea bass (juvenile, adult)

SECTION 4

Minimization/Mitigation of Potential Impacts

To ensure that impacts related to the SFWF and SFEC are minimal, DWSF is proposing the following measures to minimize/mitigate impacts to EFH and EFH-designated species. These measures are based on protocols and procedures that were successfully implemented for similar offshore projects.

- **Ramp-up and Soft-start Procedures** – A ramp-up or soft-start will be used at the beginning of each pile segment during impact pile driving and vibratory pile driving to provide additional protection to finfish near the SFWF and SFEC by allowing them to vacate the area prior to the commencement of pile-driving activities. The soft-start requires an initial set of three strikes from the impact and/or vibratory hammer at 40 percent energy with a 1-minute waiting period between subsequent three-strike sets. The procedure will be repeated two additional times.
- **Pile driving noise mitigation/noise attenuation systems** - During impact pile driving, one or more noise attenuation systems may be applied to reduce the propagation of impulsive sounds and to decrease the area in which finfish are exposed to injurious or disturbing noise levels. Noise mitigation assumptions for SFWF underwater acoustic modeling included soft starts for each pile, small bubble curtains, big bubble curtains and hydro sound dampers (HSD).
- **Hard Bottom Assessment** - Prior to commencing construction, a monitoring plan will be prepared to assess any hard-bottom habitat impacts that could not be avoided. The monitoring plan will provide an assessment of impacts on the hard-bottom habitat, as well as a plan for assessing recovery time for this sensitive habitat. The plan will also include a means of recording observations of any increased coverage of invasive species in the impacted hard-bottom area. The monitoring plan and subsequent reports will be provided to the U.S. Army Corps of Engineers, NOAA Fisheries, and Bureau of Ocean Energy Management for review and comment.
- **Hard Bottom Habitat Mapping and Avoidance** - Vessel operators will be provided with maps of sensitive hard-bottom habitat in the SFWF and SFEC, as well as a proposed anchoring plan that will minimize impacts on the hard-bottom habitat to the greatest extent practicable. These plans will be provided for all anchoring activity, including construction, maintenance, and decommissioning.
- **Intake Screens on Pump Intakes** - All jet-plow or self-propelled mechanical plow water intakes will be covered with a mesh screen or screening device to minimize potential for impingement or entrainment of fish species. A qualified biologist will verify that the screens are in place at the beginning of each jet-plow or self-propelled mechanical plow work period and examine them for impinged fish species whenever the screens are cleaned or the hydroplow is raised out of the water during the cable laying.

SECTION 5

Conclusion

Most of the impacts to EFH habitat will be temporary and reversible as natural processes are expected to return the impacted areas to pre-construction conditions apart from new manmade structures on the seafloor and in the water column. The extent of anticipated habitat impact is small compared to the available habitat upon the western Atlantic OCS and those few isolated areas that may be considered habitat of greater value will be avoided or impacts minimized. The overall impacts of the SFWF and SFEC on EFH and EFH species will be minor.

Habitat disturbance from construction will largely be associated with the disturbance of sand sheet and sand with mobile gravel habitats. Based on the SFWF Project Envelope, approximately 42.3 acres (17.2 hectares) could be permanently converted to hard substrate by the foundations and scour protection (14.6 acres), and the additional protective armoring along the inter-array cable (20.0 acres) and SFEC routes (7.7 acres). However, following construction, areas of new hard-bottom habitat will become suitable for colonization by sessile benthic species and may provide some additional habitat for structure-oriented species such as Atlantic cod, black sea bass, and the egg and larval stages of ocean pout, thus allowing these areas to continue to serve as foraging habitat for EFH species.

Decommissioning activities associated with the SFWF and SFEC, similar to construction activities, will result in temporary disturbances to EFH and EFH species, but effects and recovery rates are expected to be similar to those described for construction with no long-term impacts.

When considered together with the existing EFH in the SFWF and SFEC, the impacts associated with the construction, operation, and decommissioning of the SFWF and SFEC are minor and not significant.

SECTION 6

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Attachment 1

Ichthyoplankton and Zooplankton Assessment – Jet Plow Entrainment Report

ICHTHYOPLANKTON AND ZOOPLANKTON ASSESSMENT– JET PLOW ENTRAINMENT REPORT

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REVISION HISTORY

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05/07/2019	2	Revised EFH Species. Updated all maps with MWA and SFWF logo.	JRJ	EBF	JDB
05/21/2018	1	Revised Submittal	RB	EBF	DAC
04/17/2018	0	Submittal for Client Review	RB	EBF	DAC

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BOEM	Bureau of Ocean Energy Management
COP	Construction and Operation Plan
DWSF	Deepwater Wind South Fork, LLC
EcoMon	Ecosystem Monitoring (zooplankton and ichthyoplankton research survey)
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
MARMAP	Marine Resource Monitoring, Assessment and Prediction
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Atmospheric and Oceanic Administration
OCS	Outer Continental Shelf
OSS	Offshore Sub-station
SFEC	South Fork Export Cable
SFEC-NYS	Segment of the South Fork Export Cable from the boundary of New York state waters to a sea-to-shore transition vault
SFEC-OCS	Segment of the South Fork Export Cable within federal waters on the Outer Continental Shelf
SFWF	South Fork Wind Farm
WTG	Wind Turbine Generator

1.0 INTRODUCTION

1.1 Project Background

Deepwater Wind South Fork, LLC (DWSF) and the U.S. Department of Interior's Bureau of Ocean Energy Management (BOEM) executed a commercial lease for the development of a wind energy facility on the Outer Continental Shelf (OCS) offshore Rhode Island and Massachusetts (Lease OCS-A 0486, effective October 1, 2013). The South Fork Wind Farm (SFWF) would be located within the Lease Area and would consist of up to 16 wind turbine generators (WTGs), one offshore sub-station (OSS), inter-array cables and an export cable from the OSS to a location on Long Island, New York (Figure 1-1). The WTGs would be founded on monopiles. The SFWF inter-array cable and South Fork Export Cable (SFEC) would be buried to a target depth of 4-6 feet (1.2 to 1.8 m). All analyses in this report consider installation with jet plow.

Fish eggs and larvae (ichthyoplankton), as well as zooplankton are expected to be entrained during cable burial by jet plow activities at the SFWF inter-array cable and SFEC. Jet plow equipment uses seawater to circulate through hydraulic motors and jets during installation. Although this seawater is released back into the ocean, it is assumed that all entrained eggs, larvae, and zooplankton will be killed. The cable installation equipment modeled in this study (jet plow) is assumed to have a nominal power of 1,600 kW and would circulate 1674 yd^3 (1,400 m^3) of seawater per hour. INSPIRE Environmental scientists conducted an entrainment assessment to analyze the potential loss of early life history (eggs and larvae) fish and zooplankton related to jet plow activity planned for the SFWF inter-array cable and SFEC burial operations.

The jet plow entrainment assessment was conducted to address several federal regulatory requirements and guidelines. The Magnuson-Stevens Fishery Conservation and Management Act mandates that federal agencies conduct an essential fish habitat (EFH) consultation with the National Oceanic and Atmospheric Administration (NOAA) Fisheries agency regarding any of their actions authorized, funded, or undertaken that may adversely affect EFH. This mandate applies to offshore wind development on the OCS overseen by BOEM. Additionally, BOEM has produced regulations and guidelines for preparing a Construction and Operation Plan (COP) for the proposed development of all offshore wind projects in U.S. federal waters. Specifically, the ichthyoplankton and zooplankton entrainment assessment was conducted to provide Jacobs and DWSF with data contributing to:

1) The Magnuson-Stevens Fishery Conservation and Management Act:
    - Provide NOAA with pertinent data to assist in an EFH consultation.
2) BOEM's Guidelines for Information Requirements for a Renewable Energy Construction and Operation Plan (COP) (BOEM, 2016):
    - § 585.626 – Provide results of biological surveys with supporting data on fish populations.

  - § 585.627 – Assist BOEM in complying with the National Environmental Policy Act (NEPA) and other relevant laws by providing detailed information on fish biological resources.

3) Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585 (BOEM, 2013):
   - "Identify… the dominant benthic, demersal, and pelagic fish species within the project footprint and surrounding areas."

Entrainment assessments are frequently employed to analyze the loss of zooplankton and ichthyoplankton related to cooling water intakes for power plants (EPA, 2000). As such, assessment methodologies have been developed and thoroughly reviewed by regulatory agencies to quantify estimated losses related to entrainment. Furthermore, the entrainment model calculations, assessment, and results are well-suited to inform constituents and stakeholders of potential order of magnitude losses related to jet plowing. Entrainment assessments have recently been used to support Atlantic offshore development Environmental Impact Statement (EIS) documentation for the Northeast Gateway Liquified Natural Gas (LNG) Port (Northeast Gateway, 2005) and the Cape Wind offshore wind project (MMS, 2008).

Five distinct spatial areas were delineated for the SFWF entrainment assessment: the SFWF inter-array cable, the section of the SFEC that is in federal waters on the OCS (SFEC-OCS) leading to the Beach Lane landing, the section of the SFEC that is in federal waters on the OCS (SFEC-OCS) leading to the Hither Hills landing, the section of the SFEC that is within New York state waters (SFEC-NYS) leading to the Beach Lane landing, and the section of the SFEC that is within New York state waters (SFEC-NYS) leading to the Hither Hills landing (Figure 1-2). If permitted, cable burial and jet plowing will only occur along one of the SFEC landing location routes, in addition to the SFWF inter-array cable. This assessment provides the range of possible values related to both potential SFEC routes.

1.2 Objectives

The purpose of the SFWF jet plow entrainment assessment was to provide data about ichthyoplankton and zooplankton communities present at the SFWF and along the SFEC during potential cable burial time windows (spring-summer) and to provide an order of magnitude assessment of potential losses of fish eggs and larvae and zooplankton related to jet plow activities. Results from the SFWF jet plow entrainment assessment are intended to contribute to DWSF's ability to satisfy multiple BOEM COP Guidelines and support EFH consultation with NOAA Fisheries.

The specific objectives of the SFWF jet plow entrainment assessment were to:

- Determine the zooplankton and ichthyoplankton taxa present within the general region of the SFWF and SFEC during spring and summer seasons when biomass is at its greatest.
- Calculate the mean, 5th percentile, and 95th percentile densities of zooplankton and ichthyoplankton taxa present by month within the general region of the SFWF from a NOAA National Marine Fisheries Service (NMFS)-provided database.
- Apply simple catchability corrections to ichthyoplankton densities accounting for extrusion through the sampling net to calculate corrected densities of ichthyoplankton present during proposed construction time periods.
- Apply an order of magnitude estimate to back-calculate fish egg densities from ichthyoplankton densities.
- Calculate a range of potential losses for zooplankton, fish eggs, and ichthyoplankton taxa related to each respective section of the SFWF inter-array cable and SFEC cable burial jet plowing assuming 100% mortality of entrained individuals.
- Present the estimated losses of the SFWF entrainment study in context with other impingement and entrainment studies conducted in the region and in oceanic environments.

2.0 METHODS

2.1 Data Inputs and Preparation

To assess the potential loss of fish and zooplankton related to jet plow activity, data for the SFWF, SFEC, and surrounding area were obtained from NOAA's Marine Resource Monitoring, Assessment and Prediction (MARMAP) Program and their subsequent Ecosystem Monitoring (EcoMon) plankton sampling programs. MARMAP and EcoMon datasets, in the form of the Northeast Fisheries Science Center's (NEFSC's) plankton dataset, were provided to INSPIRE Environmental by Harvey Walsh of the NOAA NEFSC (Appendix A). Ichthyoplankton and zooplankton densities were calculated for the region surrounding the SFEC and SFWF (Figure 2-1) from the MARMAP/EcoMon datasets (https://www.st.nmfs.noaa.gov/copepod/data/us-05101/). MARMAP and EcoMon data used in analysis were extracted from a linearly buffered region of 15 km around the SFEC and the SFWF (Figure 2-1). The selected sampling areas represent portions of the Middle Atlantic Bight and southern New England sub-regions of the EcoMon sampling plan. This study region was implemented to represent an area reflecting the habitat of the SFWF and SFEC and to maximize the number of samples used in analysis. In order to model entrainment losses, certain assumptions needed to be made regarding the time of year cable burial could occur in. For this model, it was determined that because the greatest densities of zooplankton and ichthyoplankton corresponded with spring and summer months, using that timeframe for calculations would produce the most conservative entrainment loss estimates.

The selected sampling area included 249 zooplankton tows and 186 ichthyoplankton tows within the spring/summer timeframe of the entrainment analysis. While, jet plow cable burial for the SFEC route and the SFWF inter-array cable may occur at any time of year, in order to estimate the potential greatest losses of zooplankton and ichthyoplankton related to jet plow entrainment spring and summer months (April-August) were analyzed (Table 2-1). Due to physical and biological oceanographic processes, zooplankton and ichthyoplankton abundances vary greatly both inter- and intra-annually. Therefore, the months with greatest densities of zooplankton and ichthyoplankton were used as representative densities for model calculations.

2.1.1 Zooplankton Data Preparation

Zooplankton samples were only used in analysis when collected using 0.333-mm mesh nets ('zoo_gear' = '6B3' or '6B3Z'). Zooplankton density per tow were extracted from the density per '100_m3' columns of the MARMAP/EcoMon database (# of individuals/100 m^3). For the calculation of total zooplankton density, all taxa (including Pisces spp.) were summed into a single zooplankton density (# of individuals/100 m^3) by tow. Presence/absence of each zooplankton taxa by month was noted and is provided in the Results section.

Mean, 5th percentile, and 95th percentile zooplankton densities were calculated for each study month respectively and for all study months combined from April through August.

No catchability/extrusion corrections were applied to zooplankton densities after calculation of mean, 5th, and 95th percentile densities.

2.1.2 Ichthyoplankton Data Preparation

Ichthyoplankton samples were only used in analysis when collected using 0.505-mm mesh nets (‘ich_gear’ = ‘6B5’). Ichthyoplankton density per tow were extracted from the density per 100 m^3 columns of the database (# of individuals/100 m^3). Presence/absence of each taxa by month was noted and is provided in the Results section.

Mean, 5th percentile, and 95th percentile ichthyoplankton densities were calculated for each taxon respectively for each individual month and for all months combined from April through August.

2.2 Data Assumptions and Assessment

Five primary spatial areas were grouped for assessment: the SFWF, the section of the SFEC that is in federal waters on the OCS (SFEC-OCS) leading to the Beach Lane landing, the section of the SFEC that is in federal waters on the OCS (SFEC-OCS) leading to the Hither Hills landing, the section of the SFEC that is within New York state waters (SFEC-NYS) leading to the Beach Lane landing, and the section of the SFEC that is within New York state waters (SFEC-NYS) leading to the Hither Hills landing (Table 2-1).

Data from the MARMAP and EcoMon databases were aggregated by fisheries biologists at the NEFSC. Only zooplankton and ichthyoplankton taxa were included in the aggregated database. Ichthyoplankton were identified to the lowest possible taxonomic identification. In the majority of cases this was to the species level, but several taxa are identified to the genus level. Due to this distinction, ichthyoplankton are referred to as ‘ichthyoplankton taxa’ as opposed to ‘ichthyoplankton species’ throughout this report. Although fish eggs were collected and identified as part of the MARMAP protocol, that data has not been included in the database. See Section 2.2.3 for a discussion of fish egg back-calculations.

MARMAP

- Zooplankton, fish eggs, and larvae were sampled on the continental shelf in waters ≥8 m.
- Program was conducted from 1977-1987 with monthly to bimonthly surveys from North Carolina to Cape Sable.
- Samples were collected using a 61-cm bongo net (Posgay and Marak, 1980) fitted with 0.505-mm and 0.333-mm mesh netting and a flow meter to determine the volume of water filtered during each tow (Jossi and Marak, 1983).
- Oblique tows were completed from approximately 5 m off the seafloor to the water’s surface (Hare, 2005).

EcoMon

- Program was conducted from 1995 through 2015.
- Program designed in part after the MARMAP Program.
- Regular processing of ichthyoplankton only began in 2000.
- Fish eggs were not processed.

2.2.1 Zooplankton Density Calculation

Mean densities and standard errors for the zooplankton samples were calculated using one of two methods based on the distribution of the data. A logarithmic transform was performed on monthly datasets with high dispersion (wherein variance of data is at least 2 times larger than the mean) and no extreme outliers. An arithmetic mean was calculated using the transformed data, then the inverse logarithm of the mean was taken (this methodology is identical to calculating the geometric mean of a dataset). Taking the inverse logarithm of a standard error calculated with logarithmic transformed data does not directly produce an un-transformed standard error. The standard error can be estimated using a variety of approximation methods, however, they work best when the variance is much smaller than the mean (which is not the case for these datasets), therefore the standard error was not presented in the results for these datasets.

When the zooplankton sample had high dispersion and outliers, a negative binomial model was used to determine the mean density and standard error. The intercept of the negative binomial data was modeled using the zooplankton counts as the response variable. The result is an estimated mean density and standard error for the zooplankton sample. To calculate the 5th and 95th (or 99th) percentiles, the data were sorted in increasing order, where the largest value is the nth sample (n = total number of samples). Multiplying n by 0.05 produced a value that corresponded to a single zooplankton count in the ordered data; this count represented at least 5% of the data (5th percentile), the same calculation was used to find the 95th and 99th percentiles.

2.2.2 Ichthyoplankton Density Calculation

Mean densities and standard errors for the ichthyoplankton samples were calculated using either a negative binomial or a Poisson model. Both models handle count data that may be zero-inflated or over-dispersed; all ichthyoplankton samples used in this analysis were zero-inflated and over-dispersed. Each ichthyoplankton taxon in each month was modeled separately. The intercept of the negative binomial or Poisson data was modeled using the counts of a single ichthyoplankton taxa as the response variable. The result is an estimated mean density and standard error for the ichthyoplankton taxon sample in that month.

Mean density was not calculated if the taxon sample contained 90% or more zeros, as the usable number of samples was too small to appropriately apply any model. Low densities, and more importantly, low frequencies, are expected in these samples due to the absence of the species from the majority of tows within the time period (e.g., month) of analysis. To calculate the 5th and 95th (or 99th) percentiles the data was sorted in increasing order, where the largest value is the nth sample (n = total number of samples). Multiplying n by 0.05 produced a value that corresponded to a single ichthyoplankton species count in the ordered data; this count represented at least 5% of the data (5th percentile), the same calculation was used to find the 95th and 99th percentiles.

Each calculated ichthyoplankton taxon density was subsequently multiplied by a correction factor to account for extrusion through the 0.505-mm mesh netting used in the MARMAP and EcoMon programs. Based on methodologies used in the Northeast Gateway EIS (2005) entrainment calculations, species specific extrusion correction factors (e.g., catchability Q) were applied for select species (Table 2-2). An extrusion correction factor of 2 was used for all other ichthyoplankton taxa where not correction factor was available in the scientific literature. In relation to the extrusion correction factors used for the well-studied taxa (Johnson and Morse, 1994), the correction factor of 2 most likely provides an overestimate for a majority of ichthyoplankton collected as part of the MARMAP and EcoMon programs.

$$CorrectedDensity_{SM} = Density_{SM} * Q_S$$

Where:
S – species
M – month
Q – extrusion correction factor

2.2.3 Fish Egg Density Calculation

Fish eggs were not collected as part of the EcoMon program and fish eggs collected through the MARMAP program are not provided within the NEFSC plankton database used in this analysis. In order to provide an estimate of egg density for each fish taxonomy a standard multiplier of 10 was used to back-calculate egg density present from the corrected ichthyoplankton taxa density (Dahlberg, 1979; Pepin, 1991).

$$BackCalculatedEggDensity_{SM} = CorrectedDensity_{SM} * 10$$

Due to the wide variety of species present throughout the study time period and the varied length of the egg stage across species and seasons, a standard back-calculation value will provide an overestimate for many species and a potential underestimate for other species. For instance, winter flounder most commonly lay eggs in estuaries and in inshore waters. It is unlikely that the majority of winter flounder eggs would be exposed to jet plow entrainment. While this calculation provides a gross generalization of egg density, the result will provide a conservative, order of magnitude estimate of potential egg losses by taxa. As the jet plowing is a one-time event, the calculation of more detailed egg data (e.g., life table calculations) was not conducted.

2.2.4 Entrainment Calculations

Standard entrainment calculations were performed assuming 100% mortality of entrained zooplankton and fish eggs and larvae. This calculation provides an overestimate of potential loss.

$$Loss_{SML} = CorrectedDensity_{SM} * WaterUse_{ML}$$

Where:
L – location

For each taxa, the month with the greatest density within the analysis time period was used as the representative density for entrainment calculations for all jet plow operation days. So, although the number of days required to complete the OCS subsection of the SFEC is greater than one month, a single highest month's density was assumed across the entire period of the water withdrawal. This calculation assumption was used for all zooplankton, ichthyoplankton, and fish egg direct kill calculations.

Water use values have been provided by DWSF for the SFWF inter-array cable and each section of the SFEC (Table 2-1). The equipment used will be the SeaRex jet plow or similar technology; the SeaRex uses 1,400 m^3 of seawater per hour and is assumed to operate 24 hours a day, 7 days a week during construction. Based on an advance rate of 1 mile per day, the estimated duration of operation is determined by rounding up the distance in miles to the nearest mile and equating this distance to days (Table 2-1).

Table 2-1. Modeled Jet Plow Details for SFEC Locations and SFWF Inter-Array Cable. Months Used for Data Analysis Are Based on Time Period of Greatest Densities in Each Region.

Location	Months Used for Modeled Data Analysis	Distance	Duration (days)	Total Water Withdrawal (m^3)
SFEC - OCS Beach Lane	April-July	57.9 miles (93.2 km)	58	1,948,800
SFEC - NYS Beach Lane	April-July	3.5 miles (5.6 km)	4	134,400
SFEC – OCS Hither Hills	April-July	46 miles (74.0 km)	46	1,545,600
SFEC – NYS Hither Hills	April-July	3.5 miles (5.6 km)	4	134,400
SFWF Inter-Array	June-August	26 miles (41.8 km)	26	873,600

Table 2-2. Adjustment Factors (Catchability) Used to Account for Extrusion Through the 0.505-mm Mesh Netting Used in the MARMAP Ichthyoplankton Sampling Program. Table extracted from the Northeast Gateway EIS Ichthyoplankton Assessment (Northeast Gateway 2005)

Species	Scientific Name	Extrusion Factor	Reference
Atlantic herring	*Clupea harengus*	1.06	Johnson and Morse 1994
Atlantic cod	*Gadus morhua*	1.11	Johnson and Morse 1994
Haddock	*Melanogrammus aeglefinus*	1.11	Johnson and Morse 1994
Silver hake	*Merluccius bilinearies*	1.54	Johnson and Morse 1994
Pollock	*Pollachius pollachius*[1]	1.39	Johnson and Morse 1994
Red/white hake	*Urophycis chuss/ Urophycis tenuis*[2]	2.18	Johnson and Morse 1994
Sand lance	*Ammodytes americanus*[3]	1.40	Johnson and Morse 1994
Cunner	*Tautogolabrus adspersus*	1.75	Johnson and Morse 1994
Butterfish	*Peprilus triacanthus*[4]	1.93	Johnson and Morse 1994
Atlantic mackerel	*Scomber scombrus*	1.60	Johnson and Morse 1994
Yellowtail flounder	*Limanda ferruginea*	1.20	Johnson and Morse 1994
Winter flounder	*Pseudopleuronectes americanus*	4.00	Northeast Gateway 2005

1 – Applied to *Pollachius virens*

2 – Applied to *Urophycis spp.*

3 – Applied to *Ammodytes spp.*

4 – Applied to *Peprilus spp.*

3.0 RESULTS

Section 3.1 summarizes the taxa of zooplankton and ichthyoplankton found within the study region during the modeled study time period (April-August). Sections 3.2 through 3.4 summarize the calculated densities of zooplankton, ichthyoplankton, and fish eggs that were used in entrainment calculations. Sections 3.5 through 3.7 summarize the estimates of direct kill related to entrainment for zooplankton, ichthyoplankton, and fish eggs by location, taxonomy, and month.

3.1 Species/Taxa Present

Presence/absence by month was determined for zooplankton and ichthyoplankton taxa within the study region.

3.1.1 Zooplankton

The MARMAP and EcoMon zooplankton dataset included ninety-one (91) taxa (Table 3-1). Fifty-six (56) of these taxa were present within the study region at some point during the modeled study time period. The majority of taxa that were caught at any time within the study region were present throughout the entire study time period. Zooplankton taxonomic richness increased slightly in the late summer (July – 46, August – 53) compared with late spring and early summer (April – 38, May – 43, June – 38).

3.1.2 Ichthyoplankton

The MARMAP and EcoMon ichthyoplankton dataset included forty-five (45) taxa (Table 3-2). Thirty (30) of these taxa were present within the study region during the study time period. The majority of taxa that were caught within the study region were present for multiple months throughout the entire study time period. Ichthyoplankton taxonomic richness remained similar throughout the study time period ranging from a low of thirteen (13) identified taxa in April to a high of nineteen (19) identified taxa in July.

3.2 Zooplankton Densities

Mean, 5th percentile, and 95th percentile densities were calculated for zooplankton taxa (Table 3-3 and Figure 3-1). All 0.333-mm tows conducted within the study area during the study time period included zooplankton in the catch. Peak zooplankton densities occurred during May and June and lower densities occurred during the surrounding months. High variability in zooplankton densities was demonstrated in the very large ranges found between the 5th and 95th percentile densities across all months.

3.3 Ichthyoplankton Densities

Mean, 5th percentile, and 95th percentile densities were calculated for each respective ichthyoplankton taxa in the MARMAP and EcoMon dataset for taxa that were present during the study period (Table 3-4). Densities were not calculated for taxa that were present within less than 10% of tows conducted within a given analysis time period (e.g., month). Taxa were classified as having a low likelihood of occurrence (‘L-L’) if they were caught in less than 10% of tows within a month. Taxa were considered not present if they were not caught in any tows within a month.

Density data for ichthyoplankton species with EFH (NEFMC, 2017) for egg or larval stages which occurred in or near the SFWF and SFEC (Table 3-2; see asterisks) are presented in maps across the model study months (April-August), and for each respective month (Figures 3-2 through 3-14).

After the calculation of mean, 5th percentile, and 95th percentile densities from the ichthyoplankton dataset, extrusion correction factors were applied to the initial calculated densities. Net extrusion correction coefficients by taxa are reported in Table 2-2. Extrusion corrected ichthyoplankton taxa densities are presented in Table 3-4.

Taxa caught in the greatest densities included cunner, Atlantic mackerel, and sand lance (Figures 3-15, 3-8, and 3-16). Distinct patterns in density were found among taxa with high densities occurring for certain taxa in spring and high densities for other taxa occurring in summer months. Black sea bass, wolffish, and summer flounder ichthyoplankton were not collected in the MARMAP/EcoMon tows during the study months.

3.4 Fish Egg Densities

Back-calculated fish egg densities (see Section 2.2.3) for each ichthyoplankton taxa are one order of magnitude greater than the corresponding ichthyoplankton taxa density. As fish egg densities were calculated using a standard 10x multiplier from the ichthyoplankton taxa, those taxa found in greatest densities as ichthyoplankton were mirrored in the fish egg densities.

3.5 Estimated Zooplankton Entrainment Losses

Estimated zooplankton entrainment losses (i.e., direct kill) are presented in Tables 3-5 and 3-6. Direct kill calculations were performed using the month from the modeling study time period with the greatest densities present in order to provide an estimate of greatest potential losses related to jet plow activities. The month of May had the greatest estimated zooplankton density and was therefore used as the representative density for loss calculations. The greatest losses for an individual subsection were from the SFEC-OCS Beach Lane subsection (the longest subsection) with a mean estimate of 5.7 billion zooplankton entrained ranging up to a 95th percentile estimate of 13 billion entrained. The estimated loss for the combined subsections (OCS + NYS) of the Beach Lane landing was a mean of 6 billion and 95th percentile of 14 billion. The estimated loss for the combined subsections (OCS + NYS) of the Hither Hills landing was a mean of 4.9 billion and 95th percentile of 12 billion. Estimated losses of zooplankton related to the longest potential SFEC cable route (Beach Lane) were estimated to be approximately 0.001% of the total zooplankton abundance present in the study region.

The month of June, used as the representative density for zooplankton for the SFWF inter-array cable, had the greatest estimated zooplankton losses for the SFWF inter-array cable jet plow activity. The mean estimated zooplankton losses from jet plow activities related to the SFWF inter-array cable was 2.4 billion ranging up to a 95th percentile of 6 billion. The total estimated zooplankton loss for the longest potential jet plow route (SFEC-Beach Lane + SFWF inter-array) ranged from 975 million (5th percentile) to 20 billion (95th percentile) individuals. Estimated losses of zooplankton related to the SFWF inter-array cable were estimated to be less than 0.001% of the total zooplankton abundance present in the study region. Estimated losses of zooplankton related to the longest potential cable route (SFWF inter-array cable + Beach Lane) were estimated to be approximately 0.002% of the total zooplankton abundance present in the study region.

3.6 Estimated Ichthyoplankton Entrainment Losses

Estimated ichthyoplankton entrainment losses (i.e., direct kill) are presented in Tables 3-7 and 3-8. Direct kill calculations were performed using the modeling study month with the greatest densities of each respective taxa present in order to provide an estimate of greatest potential losses related to jet plow activities. The greatest losses for individual taxa for SFEC subsections included cunner, Atlantic mackerel, and sand lance. There was high variability in potential losses based on representative month and density percentile of each taxa. The greatest losses for individual taxa for the SFWF inter-array cable included cunner, Atlantic mackerel, and Phycid hake.

The mean estimated ichthyoplankton loss across all taxa from jet plow activities related to the SFEC Beach Lane landing (OCS + NYS) cable was 11 million ranging up to a 95th percentile of 43 million. Estimated losses of ichthyoplankton related to the longest potential SFEC cable route (Beach Lane) were estimated to be approximately 0.001% of the total ichthyoplankton abundance present in the study region. The mean estimated ichthyoplankton loss from jet plow activities related to the SFWF inter-array cable was 3.8 million ranging up to a 95th percentile of 15 million. Estimated losses of ichthyoplankton related to the SFWF inter-array cable were estimated to be less than 0.001% of the total ichthyoplankton abundance present in the study region. The total estimated ichthyoplankton loss for the longest potential jet plow route (SFEC-Beach Lane + SFWF inter-array) ranged from 0 (no fish) (5th percentile) to 58 million (95th percentile) individuals. Estimated losses of ichthyoplankton related to the longest potential cable route (SFWF inter-array cable + Beach Lane) were estimated to be approximately 0.002% of the total ichthyoplankton abundance present in the study region.

3.7 Estimated Fish Egg Entrainment Losses

Estimated fish egg entrainment losses (i.e., direct kill) are presented in Tables 3-9 and 3-10. As egg densities were calculated as a direct scalar (10x) of ichthyoplankton densities, egg direct losses scaled evenly with ichthyoplankton losses.

Table 3-1. Zooplankton Taxa Presence/Absence Within Study Area and Modeling Study Time Period Derived from MARMAP/EcoMon Dataset

Taxa	April	May	June	July	August
Centropages typicus	✓	✓	✓	✓	✓
Calanus finmarchicus	✓	✓	✓	✓	✓
Pseudocalanus spp.	✓	✓	✓	✓	✓
Penilia spp.		✓		✓	✓
Temora longicornis	✓	✓	✓	✓	✓
Centropages hamatus	✓	✓	✓	✓	✓
Echinodermata	✓	✓	✓		✓
Appendicularians	✓	✓	✓	✓	✓
Paracalanus parvus	✓	✓	✓	✓	✓
Gastropoda	✓	✓	✓	✓	✓
Acartia spp.	✓	✓	✓	✓	✓
Metridia lucens	✓	✓	✓	✓	✓
Evadne spp.	✓	✓	✓	✓	✓
Salpa	✓	✓		✓	✓
Oithona spp.	✓	✓	✓	✓	✓
Cirripedia	✓	✓	✓	✓	✓
Chaetognatha	✓	✓	✓	✓	✓
Hyperiidea	✓	✓	✓	✓	✓
Gammaridea	✓	✓	✓	✓	✓
Evadne nordmanni	✓	✓	✓	✓	✓
Calanus minor			✓	✓	✓
Copepoda	✓	✓		✓	✓
Clausocalanus arcuicornis	✓	✓	✓	✓	✓
Decapoda	✓	✓	✓	✓	✓
Euphausiacea	✓	✓	✓	✓	✓
Protozoa	✓		✓		✓
Acartia longiremis	✓	✓	✓	✓	✓
Eucalanus spp.					✓
Pelecypoda	✓	✓	✓	✓	✓
Polychaeta	✓	✓	✓	✓	✓
Podon spp.		✓	✓	✓	✓
Pisces	✓	✓	✓	✓	✓
Bryozoa	✓	✓	✓	✓	✓
Clausocalanus furcatus					✓
Calanus spp.				✓	✓

Taxa	April	May	June	July	August
Oncaea spp.					✓
Corycaeidae					✓
Ostracoda	✓	✓		✓	
Temora stylifera					✓
Oithona spinirostris	✓	✓	✓	✓	✓
Mysidacea	✓	✓		✓	✓
Temora spp.		✓		✓	✓
Tortanus discaudatus	✓	✓	✓	✓	✓
Paracalanus spp.					✓
Scyphozoa					
Anthozoa					
Siphonophores	✓	✓	✓	✓	✓
Hydromedusea					
Coelenterates	✓	✓	✓	✓	✓
Ctenophores		✓	✓	✓	✓
Euphausiacea	✓	✓	✓	✓	✓
Thysanoessa inermis				✓	✓
Meganyctiphanes norvegica				✓	
Thysanoessa raschii					✓
Thysanoessa longicaudata		✓		✓	
Euphausia americana					
Euphausia krohnii					
Euphausia spp.					
Thysanoessa gregaria					
Nematoscelis spp.					
Stylocheiron spp.					
Stylocheiron elongatum					
Nematoscelis megalops					
Thysanoessa spp.					
Thysanopoda acutifrons					
Thypanvessa spinifera					
Nematobrachion boopis					
Thecosomata	✓	✓	✓	✓	✓
Spiratella retroversa		✓	✓	✓	✓
Spiratella helicina					
Spiratella inflata					
Spiratella trochiformes					
Spiratella spp.	✓	✓	✓	✓	✓

Taxa	**April**	**May**	**June**	**July**	**August**
Clione spp.					
Creseis virgula conica					
Diacria trispinosa					
Clione cuspidata					
Clione pyramidata					
Cavolina uncinata					
Cavolina inflexa					
Cavolina longirostris					
Styliola subula					
Spiratella bulimoides					
Creseis spp.					
Cavolinia					
Cavoliniidae					
Gymnosomata					✓
Pneumodermopsis					
Paedoclione doliiformis					
Clione limacina					
Pneumodermopsis paucidens					

Table 3-2. Fish Taxa Presence/Absence Within Study Area and Modeling Study Time Period Derived from MARMAP/EcoMon Dataset. Asterisks in 'Common Name' column indicate egg or larval EFH exists within the study area (NEFMC, 2017).

Common Name	Scientific Name	April	May	June	July	August
Atlantic menhaden	*Brevoortia tyrannus*					
Atlantic herring*	*Clupea harengus*	✓				
Bristlemouth	*Cyclothone spp*					
Lanternfish	*Diaphus spp*				✓	
Madeira lanternfish	*Ceratoscopelus maderensis*					
Lanternfish	*Benthosema spp*	✓				
Phycid hake	*Urophycis spp*			✓	✓	✓
Fourbeard rockling	*Enchelyopus cimbrius*		✓	✓	✓	✓
Atlantic cod*	*Gadus morhua*	✓	✓	✓		
Haddock*	*Melanogrammus aeglefinus*	✓	✓		✓	
Pollock*	*Pollachius virens*	✓	✓			
Offshore hake	*Merluccius albidus*					✓
Silver hake*	*Merluccius bilinearis*	✓	✓	✓	✓	✓
Black sea bass*	*Centropristis striata*					
Bluefish*	*Pomatomus saltatrix*			✓	✓	✓
Weakfish	*Cynoscion regalis*					
Spot	*Leiostomus xanthurus*					
Kingfish	*Menticirrhus spp*					
Atlantic croaker	*Micropogonias undulatus*					
Cunner	*Tautogolabrus adspersus*		✓	✓	✓	✓
Tautog	*Tautoga onitis*			✓	✓	✓
Frigate tuna	*Auxis spp*					
Atlantic mackerel*	*Scomber scombrus*		✓	✓	✓	✓
Butterfish*	*Peprilus spp*		✓		✓	✓
Rockfish	*Sebastes spp*					
Searobin	*Prionotus spp*				✓	✓
Grubby	*Myoxocephalus aenaeus*	✓	✓			
Longhorn sculpin	*Myoxocephalus octodecemspinosus*	✓	✓			
Sand lance	*Ammodytes spp*	✓	✓	✓		
Rock gunnel	*Pholis gunnellus*	✓				
Radiated shanny	*Ulvaria subbifurcata*		✓	✓		
Wolffish*	*Anarhichas spp*					
Gulf stream flounder	*Citharichthys arctifrons*				✓	✓
Large-tooth flounder	*Etropus spp*				✓	✓

Common Name	**Scientific Name**	**April**	**May**	**June**	**July**	**August**
Large-tooth flounder	*Syacium spp*					
Bothid flounder	*Bothus spp*					
Fourspot flounder	*Hippoglossina oblonga*			✓	✓	✓
Summer flounder*	*Paralichthys dentatus*					
Winter flounder*	*Pseudopleuronectes americanus*	✓	✓	✓		
American plaice	*Hippoglossoides platessoides*	✓	✓		✓	
Yellowtail flounder*	*Limanda ferruginea*	✓	✓	✓	✓	✓
Witch flounder*	*Glyptocephalus cynoglossus*		✓	✓	✓	
Windowpane flounder*	*Scophthalmus aquosus*		✓	✓	✓	✓
Tonguefish	*Symphurus spp*					
Monkfish*	*Lophius americanus*			✓	✓	✓

* EFH species - egg or larval within the study area

Table 3-3. Calculated Zooplankton 5th Percentile, Mean, and 95th Percentile Densities Across All Modeled Study Months and by Each Month Respectively

Biological Resource	Month	Total # of Tows	Percent of Tows with Catch	Density (# ind/100m^3)		
				5th	Mean	95th
Zooplankton	All Study Months	249	100	25,008	235,082	676,728
	April	45	100	5,157	185,104	363,748
	May	67	100	12,932	291,791	688,786
	June	34	100	80,870	274,534	689,168
	July	46	100	25,008	117,195	323,064
	August	57	100	19,508	141,420	668,423

Table 3-4. Calculated Raw and Extrusion Coefficient Corrected Ichthyoplankton 5th Percentile, Mean, and 95th Percentile Densities Across All Modeled Study Months and by each Month Respectively. 'L-L' indicates taxa with a low likelihood of being present due to being caught in less than 10% of all tows conducted during the month. '-' indicates the taxa was not present during the month in any tow.

Taxa	Month	Total # of Tows	Percent of Tows with Catch	Density (# ind/100m^3)			Extrusion Correction Coefficient	Corrected Ichthyoplankton Density (# ind/100m^3)		
				5th	Mean	95th		5th	Mean	95th
Atlantic herring (*Clupea harengus*)	All Study Months	186	2	0.00	L-L	L-L	1.06	0.00	L-L	L-L
	April	41	10	0.00	L-L	L-L	1.06	0.00	L-L	L-L
	May	47	0	-	-	-	1.06	-	-	-
	June	21	0	-	-	-	1.06	-	-	-
	July	43	0	-	-	-	1.06	-	-	-
	August	34	0	-	-	-	1.06	-	-	-
Lanternfish (*Diaphus spp.*)	All Study Months	186	1	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	0	-	-	-	2	-	-	-
	July	43	2	0.00	L-L	L-L	2	0.00	L-L	L-L
	August	34	0	-	-	-	2	-	-	-
Lanternfish (*Benthosema spp.*)	All Study Months	186	1	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	2	0.00	L-L	L-L	2	0.00	L-L	L-L
	May	47	0	-	-	-	2	-	-	-
	June	21	0	-	-	-	2	-	-	-
	July	43	0	-	-	-	2	-	-	-
	August	34	0	-	-	-	2	-	-	-

Taxa	**Month**	**Total # of Tows**	**Percent of Tows with Catch**	**Density (# ind/100m^3)**			**Extrusion Correction Coefficient**	**Corrected Ichthyoplankton Density (# ind/100m^3)**		
				5th	**Mean**	**95th**		**5th**	**Mean**	**95th**
Phycid hake (*Urophycis spp.*)	All Study Months	186	24	0.00	7.20	37.00	2.18	0.0	15.7	80.7
	April	41	0	-	-	-	2.18	-	-	-
	May	47	0	-	-	-	2.18	-	-	-
	June	21	10	-	-	-	2.18	-	-	-
	July	43	28	0.00	10.60	56.00	2.18	0.0	23.1	122.1
	August	34	88	0.00	25.94	62.00	2.18	0.0	56.6	135.2
Fourbeard rockling (*Enchelyopus cimbrius*)	All Study Months	186	24	0.00	0.74	4.00	2	0.00	1.48	8.00
	April	41	0	-	-	-	2	-	-	-
	May	47	34	0.00	0.94	6.00	2	0.00	1.87	12.00
	June	21	57	0.00	3.00	15.00	2	0.00	6.00	30.00
	July	43	19	0.00	0.40	2.00	2	0.00	0.79	4.00
	August	34	24	0.00	0.41	2.00	2	0.00	0.82	4.00
Atlantic cod (*Gadus morhua*)	All Study Months	186	18	0.00	0.40	2.00	1.11	0.00	0.44	2.22
	April	41	39	0.00	0.98	4.00	1.11	0.00	1.08	4.44
	May	47	36	0.00	0.66	2.00	1.11	0.00	0.73	2.22
	June	21	5	0.00	L-L	L-L	1.11	0.00	L-L	L-L
	July	43	0	-	-	-	1.11	-	-	-
	August	34	0	-	-	-	1.11	-	-	-
Haddock (*Melanogrammus aeglefinus*)	All Study Months	186	5	0.00	L-L	L-L	1.11	0.00	L-L	L-L
	April	41	5	0.00	L-L	L-L	1.11	0.00	L-L	L-L
	May	47	15	0.00	0.77	6.00	1.11	0.00	0.85	6.66
	June	21	0	-	-	-	1.11	-	-	-
	July	43	2	0.00	L-L	L-L	1.11	0.00	L-L	L-L
	August	34	0	-	-	-	1.11	-	-	-

Taxa	Month	Total # of Tows	Percent of Tows with Catch	Density (# ind/100m^3)			Extrusion Correction Coefficient	Corrected Ichthyoplankton Density (# ind/100m^3)		
				5th	Mean	95th		5th	Mean	95th
Pollock (*Pollachius virens*)	All Study Months	186	3	0.00	L-L	L-L	1.39	0.00	L-L	L-L
	April	41	7	0.00	L-L	L-L	1.39	0.00	L-L	L-L
	May	47	6	0.00	L-L	L-L	1.39	0.00	L-L	L-L
	June	21	0	-	-	-	1.39	-	-	-
	July	43	0	-	-	-	1.39	-	-	-
	August	34	0	-	-	-	1.39	-	-	-
Offshore hake (*Merluccius albidus*)	All Study Months	186	1	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	0	-	-	-	2	-	-	-
	July	43	0	-	-	-	2	-	-	-
	August	34	6	0.00	L-L	L-L	2	0.00	L-L	L-L
Silver hake (*Merluccius bilinearis*)	All Study Months	186	24	0.00	3.31	11.00	1.54	0.00	5.10	16.94
	April	41	2	0.00	L-L	L-L	1.54	0.00	L-L	L-L
	May	47	2	0.00	L-L	L-L	1.54	0.00	L-L	L-L
	June	21	19	0.00	1.38	4.00	1.54	0.00	2.13	6.16
	July	43	40	0.00	6.51	27.00	1.54	0.00	10.03	41.58
	August	34	65	0.00	8.97	10.00	1.54	0.00	13.81	15.40
Bluefish (*Pomatomus saltatrix*)	All Study Months	186	5	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	5	0.00	L-L	L-L	2	0.00	L-L	L-L
	July	43	14	0.00	1.26	7.00	2	0.00	2.51	14.00
	August	34	6	0.00	L-L	L-L	2	0.00	L-L	L-L

Taxa	Month	Total # of Tows	Percent of Tows with Catch	Density (# ind/100m^3)			Extrusion Correction Coefficient	Corrected Ichthyoplankton Density (# ind/100m^3)		
				5th	Mean	95th		5th	Mean	95th
Cunner (*Tautogolabrus adspersus*)	All Study Months	186	24	0.00	25.36	28.00	1.75	0.00	44.38	49.00
	April	41	0	-	-	-	1.75	-	-	-
	May	47	2	0.00	L-L	L-L	1.75	0.00	L-L	L-L
	June	21	14	0.00	0.24	1.00	1.75	0.00	0.42	1.75
	July	43	51	0.00	106.49	437.00	1.75	0.00	186.35	764.75
	August	34	53	0.00	3.85	15.00	1.75	0.00	6.74	26.25
Tautog (*Tautoga onitis*)	All Study Months	186	8	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	5	0.00	L-L	L-L	2	0.00	L-L	L-L
	July	43	16	0.00	2.47	16.00	2	0.00	4.93	32.00
	August	34	21	0.00	0.65	4.00	2	0.00	1.30	8.00
Atlantic mackerel (*Scomber scombrus*)	All Study Months	186	15	0.00	10.54	13.00	1.6	0.00	16.86	20.80
	April	41	0	-	-	-	1.6	-	-	-
	May	47	19	0.00	15.17	110.00*	1.6	0.00	24.27	176.00
	June	21	67	0.00	58.95	262.00	1.6	0.00	94.32	419.20
	July	43	9	0.00	L-L	L-L	1.6	0.00	L-L	L-L
	August	34	3	0.00	L-L	L-L	1.6	0.00	L-L	L-L
Butterfish (*Peprilus spp.*)	All Study Months	186	19	0.00	3.18	14.00	1.93	0.00	6.13	27.02
	April	41	0	-	-	-	1.93	-	-	-
	May	47	2	0.00	L-L	L-L	1.93	0.00	L-L	L-L
	June	21	0	-	-	-	1.93	-	-	-
	July	43	28	0.00	7.49	33.00	1.93	0.00	14.45	63.69
	August	34	68	0.00	7.88	16.00	1.93	0.00	15.21	30.88

Taxa	Month	Total # of Tows	Percent of Tows with Catch	Density (# ind/100m^3)			Extrusion Correction Coefficient	Corrected Ichthyoplankton Density (# ind/100m^3)		
				5th	Mean	95th		5th	Mean	95th
Searobin (*Prionotus spp.*)	All Study Months	186	3	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	0	-	-	-	2	-	-	-
	July	43	9	0.00	L-L	L-L	2	0.00	L-L	L-L
	August	34	6	0.00	L-L	L-L	2	0.00	L-L	L-L
Grubby (*Myoxocephalus aenaeus*)	All Study Months	186	4	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	12	0.00	0.51	4.00	2	0.00	1.02	8.00
	May	47	4	0.00	L-L	L-L	2	0.00	L-L	L-L
	June	21	0	-	-	-	2	-	-	-
	July	43	0	-	-	-	2	-	-	-
	August	34	0	-	-	-	2	-	-	-
Longhorn sculpin (*Myoxocephalus octodecemspinosus*)	All Study Months	186	10	0.00	L-L	L-L	2	-	-	-
	April	41	44	0.00	1.61	5.00	2	0.00	3.22	10.00
	May	47	2	0.00	L-L	L-L	2	-	-	-
	June	21	0	-	-	-	2	-	-	-
	July	43	0	-	-	-	2	-	-	-
	August	34	0	-	-	-	2	-	-	-
Sand lance (*Ammodytes spp.*)	All Study Months	186	37	0.00	20.75	67.00	1.4	0.00	29.05	93.80
	April	41	95	0.00	87.59	283.00	1.4	0.00	122.62	396.20
	May	47	60	0.00	5.68	29.00	1.4	0.00	7.95	40.60
	June	21	10	0.00	L-L	L-L	1.4	0.00	L-L	L-L
	July	43	0	-	-	-	1.4	-	-	-
	August	34	0	-	-	-	1.4	-	-	-

Taxa	**Month**	**Total # of Tows**	**Percent of Tows with Catch**	**Density (# ind/100m^3)**			**Extrusion Correction Coefficient**	**Corrected Ichthyoplankton Density (# ind/100m^3)**		
				5th	**Mean**	**95th**		**5th**	**Mean**	**95th**
Rock gunnel (*Pholis gunnellus*)	All Study Months	186	2	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	7	0.00	L-L	L-L	2	0.00	L-L	L-L
	May	47	0	-	-	-	2	-	-	-
	June	21	0	-	-	-	2	-	-	-
	July	43	0	-	-	-	2	-	-	-
	August	34	0	-	-	-	2	-	-	-
Radiated shanny (*Ulvaria subbifurcata*)	All Study Months	186	7	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	23	0.00	1.15	8.00	2	0.00	2.30	16.00
	June	21	10	0.00	L-L	L-L	2	0.00	L-L	L-L
	July	43	0	-	-	-	2	-	-	-
	August	34	0	-	-	-	2	-	-	-
Gulf stream flounder (*Citharichthys arctifrons*)	All Study Months	186	10	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	0	-	-	-	2	-	-	-
	July	43	16	0.00	0.49	3.00	2	0.00	0.98	6.00
	August	34	32	0.00	4.91	13.00	2	0.00	9.82	26.00
Large-tooth flounder (*Etropus spp.*)	All Study Months	186	3	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	0	-	-	-	2	-	-	-
	July	43	5	0.00	L-L	L-L	2	0.00	L-L	L-L
	August	34	9	0.00	L-L	L-L	2	0.00	L-L	L-L

Taxa	Month	Total # of Tows	Percent of Tows with Catch	Density (# ind/100m^3)			Extrusion Correction Coefficient	Corrected Ichthyoplankton Density (# ind/100m^3)		
				5th	Mean	95th		5th	Mean	95th
Fourspot flounder (*Hippoglossina oblonga*)	All Study Months	186	18	0.00	2.22	11.00	2	0.00	4.44	22.00
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	10	0.00	L-L	L-L	2	0.00	L-L	L-L
	July	43	30	0.00	6.77	46.00	2	0.00	13.53	92.00
	August	34	53	0.00	3.53	16.00	2	0.00	7.06	32.00
Winter flounder (*Pseudopleuronectes americanus*)	All Study Months	186	10	0.00	L-L	L-L	4	0.00	L-L	L-L
	April	41	27	0.00	1.27	7.00	4	0.00	5.07	28.00
	May	47	13	0.00	0.64	5.00	4	0.00	2.55	20.00
	June	21	5	0.00	L-L	L-L	4	0.00	L-L	L-L
	July	43	0	-	-	-	4	-	-	-
	August	34	0	-	-	-	4	-	-	-
American plaice (*Hippoglossoides platessoides*)	All Study Months	186	3	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	2	0.00	L-L	L-L	2	0.00	L-L	L-L
	May	47	6	0.00	L-L	L-L	2	0.00	L-L	L-L
	June	21	0	-	-	-	2	-	-	-
	July	43	5	0.00	L-L	L-L	2	0.00	L-L	L-L
	August	34	0	-	-	-	2	-	-	-
Yellowtail flounder (*Limanda ferruginea*)	All Study Months	186	37	0.00	4.99	28.00	1.2	0.00	5.99	33.60
	April	41	5	0.00	L-L	L-L	1.2	0.00	L-L	L-L
	May	47	74	0.00	9.04	30.00	1.2	0.00	10.85	36.00
	June	21	81	0.00	21.76	75.00	1.2	0.00	26.11	90.00
	July	43	30	0.00	0.98	5.00	1.2	0.00	1.17	6.00
	August	34	3	0.00	L-L	L-L	1.2	0.00	L-L	L-L

Taxa	Month	Total # of Tows	Percent of Tows with Catch	Density (# ind/100m^3)			Extrusion Correction Coefficient	Corrected Ichthyoplankton Density (# ind/100m^3)		
				5th	Mean	95th		5th	Mean	95th
Witch flounder (*Glyptocephalus cynoglossus*)	All Study Months	186	12	0.0	0.33	1.00	2	0.00	0.67	2.00
	April	41	0	-	-	-	2	-	-	-
	May	47	15	0.00	0.32	2.00	2	0.00	0.64	4.00
	June	21	38	0.00	1.90	14.00	2	0.00	3.81	28.00
	July	43	16	0.00	0.16	1.00	2	0.00	0.33	2.00
	August	34	0	-	-	-	2	-	-	-
Windowpane flounder (*Scophthalmus aquosus*)	All Study Months	186	21	0.00	0.58	3.00	2	0.00	1.16	6.00
	April	41	0	-	-	-	2	-	-	-
	May	47	9	-	L-L	L-L	2	0.00	L-L	L-L
	June	21	57	0.00	1.19	3.00	2	0.00	2.38	6.00
	July	43	40	0.00	1.51	10.00	2	0.00	3.02	20.00
	August	34	18	0.00	0.24	1.00	2	0.00	0.47	2.00
Monkfish (*Lophius americanus*)	All Study Months	186	8	0.00	L-L	L-L	2	0.00	L-L	L-L
	April	41	0	-	-	-	2	-	-	-
	May	47	0	-	-	-	2	-	-	-
	June	21	14	0.00	0.19	1.00	2	0.00	0.38	2.00
	July	43	19	0.00	0.35	2.00	2	0.00	0.70	4.00
	August	34	12	0.00	0.21	1.00	2	0.00	0.41	2.00

* - 99th percentile

Table 3-5. Total Number of Zooplankton Individuals Estimated to be Killed Through Entrainment by SFEC Location, Month of Greatest Density, and Density Calculation (5th Percentile, Mean, 95th Percentile)

Biological Resource	Month of Greatest Density	Density Percentile	Estimated # of Zooplankton Entrained			
			SFEC - OCS Beach Lane	SFEC - OCS Hither Hills	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Zooplankton	May	5th	2.52E+08	2.00E+08	1.74E+07	1.74E+07
		Mean	5.69E+09	4.51E+09	3.92E+08	3.92E+08
		95th	1.34E+10	1.06E+10	9.26E+08	9.26E+08

1 – See Table 3-3 for density calculations by month

Table 3-6. Total Number of Zooplankton Individuals Estimated to be Killed Through Entrainment for SFWF Inter-Array Cable by Month of Greatest Density, and Density Calculation (5th Percentile, Mean, 95th Percentile)

Biological Resource	Month of Greatest Density[1]	Density Percentile	Estimated # of Zooplankton Entrained
			SFWF - Inter-Array Cable
Zooplankton	June	5th	7.06E+08
		Mean	2.40E+09
		95th	6.02E+09

1 – See Table 3-3 for density calculations by month

Table 3-7. Total Number of Ichthyoplankton Individuals Estimated to be Killed Through Entrainment by Taxa, Month of Greatest Density, Density Calculation (5th Percentile, Mean, 95th Percentile), and SFEC Location

Taxa	Month of Greatest Density[1]	Density Percentile	Estimated # of Fish Entrained			
			SFEC - OCS Beach Lane	SFEC - OCS Hither Hills	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Atlantic herring (*Clupea harengus*)	April	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Lanternfish (*Diaphus spp.*)	July	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Lanternfish (*Benthosema spp*.)	April	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Phycid hake (*Urophycis spp.*)	July	5th	0	0	0	0
		Mean	4.51E+05	3.57E+05	3.11E+04	3.11E+04
		95th	2.38E+06	1.89E+06	1.64E+05	1.64E+05
Fourbeard rockling (*Enchelyopus cimbrius*)	June	5th	0	0	0	0
		Mean	1.17E+05	9.27E+04	8.06E+03	8.06E+03
		95th	5.85E+05	4.64E+05	4.03E+04	4.03E+04
Atlantic cod (*Gadus morhua*)	April	5th	0	0	0	0
		Mean	2.11E+04	1.67E+04	1.46E+03	1.46E+03
		95th	8.65E+04	6.86E+04	5.97E+03	5.97E+03
Haddock (*Melanogrammus aeglefinus*)	May	5th	0	0	0	0
		Mean	1.66E+04	1.31E+04	1.14E+03	1.14E+03
		95th	1.30E+05	1.03E+05	8.95E+03	8.95E+03
Pollock (*Pollachius virens*)	April	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Offshore hake (*Merluccius albidus*)	Not Present	5th	0	0	0	0
		Mean	0	0	0	0
		95th	0	0	0	0
Silver hake (*Merluccius bilinearis*)	July	5th	0	0	0	0
		Mean	1.95E+05	1.55E+05	1.35E+04	1.35E+04
		95th	8.10E+05	6.43E+05	5.59E+04	5.59E+04

Taxa	Month of Greatest Density[1]	Density Percentile	Estimated # of Fish Entrained			
			SFEC - OCS Beach Lane	SFEC - OCS Hither Hills	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Bluefish (*Pomatomus saltatrix*)	July	5th	0	0	0	0
		Mean	4.89E+04	3.88E+04	3.38E+03	3.38E+03
		95th	2.73E+05	2.16E+05	1.88E+04	1.88E+04
Cunner (*Tautogolabrus adspersus*)	July	5th	0	0	0	0
		Mean	3.63E+06	2.88E+06	2.50E+05	2.50E+05
		95th	1.49E+07	1.18E+07	1.03E+06	1.03E+06
Tautog (*Tautoga onitis*)	July	5th	0	0	0	0
		Mean	9.61E+04	7.62E+04	6.63E+03	6.63E+03
		95th	6.24E+05	4.95E+05	4.30E+04	4.30E+04
Atlantic mackerel (*Scomber scombrus*)	June	5th	0	0	0	0
		Mean	1.84E+06	1.46E+06	1.27E+05	1.27E+05
		95th	8.17E+06	6.48E+06	5.63E+05	5.63E+05
Butterfish (*Peprilus spp.*)	July	5th	0	0	0	0
		Mean	2.82E+05	2.23E+05	1.94E+04	1.94E+04
		95th	1.24E+06	9.84E+05	8.56E+04	8.56E+04
Searobin (*Prionotus spp.*)	July	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Grubby (*Myoxocephalus aenaeus*)	April	5th	0	0	0	0
		Mean	1.99E+04	1.58E+04	1.37E+03	1.37E+03
		95th	1.56E+05	1.24E+05	1.08E+04	1.08E+04
Longhorn sculpin (*Myoxocephalus octodecemspinosus*)	April	5th	0	0	0	0
		Mean	6.27E+04	4.98E+04	4.33E+03	4.33E+03
		95th	1.95E+05	1.55E+05	1.34E+04	1.34E+04
Sand lance (*Ammodytes spp.*)	April	5th	0	0	0	0
		Mean	2.39E+06	1.90E+06	1.65E+05	1.65E+05
		95th	7.72E+06	6.12E+06	5.32E+05	5.32E+05
Rock gunnel (*Pholis gunnellus*)	April	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Radiated shanny (*Ulvaria subbifurcata*)	May	5th	0	0	0	0
		Mean	4.48E+04	3.55E+04	3.09E+03	3.09E+03
		95th	3.12E+05	2.47E+05	2.15E+04	2.15E+04
Gulf stream flounder (*Citharichthys arctifrons*)	July	5th	0	0	0	0
		Mean	1.90E+04	1.51E+04	1.31E+03	1.31E+03
		95th	1.17E+05	9.27E+04	8.06E+03	8.06E+03

Taxa	**Month of Greatest Density[1]**	**Density Percentile**	**Estimated # of Fish Entrained**			
			SFEC - OCS Beach Lane	**SFEC - OCS Hither Hills**	**SFEC - NYS Beach Lane**	**SFEC - NYS Hither Hills**
Large-tooth flounder (*Etropus spp.*)	July	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Fourspot flounder (*Hippoglossina oblonga*)	July	5th	0	0	0	0
		Mean	2.64E+05	2.09E+05	1.82E+04	1.82E+04
		95th	1.79E+06	1.42E+06	1.24E+05	1.24E+05
Winter flounder (*Pseudopleuronectes americanus*)	April	5th	0	0	0	0
		Mean	9.89E+04	7.84E+04	6.82E+03	6.82E+03
		95th	5.46E+05	4.33E+05	3.76E+04	3.76E+04
American plaice (*Hippoglossoides platessoides*)	May	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Yellowtail flounder (*Limanda ferruginea*)	June	5th	0	0	0	0
		Mean	5.09E+05	4.04E+05	3.51E+04	3.51E+04
		95th	1.75E+06	1.39E+06	1.21E+05	1.21E+05
Witch flounder (*Glyptocephalus cynoglossus*)	June	5th	0	0	0	0
		Mean	7.42E+04	5.89E+04	5.12E+03	5.12E+03
		95th	5.46E+05	4.33E+05	3.76E+04	3.76E+04
Windowpane flounder (*Scophthalmus aquosus*)	July	5th	0	0	0	0
		Mean	5.89E+04	4.67E+04	4.06E+03	4.06E+03
		95th	3.90E+05	3.09E+05	2.69E+04	2.69E+04
Monkfish (*Lophius americanus*)	July	5th	0	0	0	0
		Mean	1.36E+04	1.08E+04	9.38E+02	9.38E+02
		95th	7.80E+04	6.18E+04	5.38E+03	5.38E+03

1 – See Table 3-4 for density calculation by month

Table 3-8. Total Number of Ichthyoplankton Individuals Estimated to be Killed Through Entrainment for the SFWF Inter-Array Cable by Taxa, Month, and Density Calculation (5th Percentile, Mean, 95th Percentile)

Taxa	Month of Greatest Density[1]	Density Percentile	Estimated # of Fish Entrained
			SFWF - Inter-Array Cable
Atlantic herring (*Clupea harengus*)	Not Present	5th	0
		Mean	0
		95th	0
Lanternfish (*Diaphus spp.*)	July	5th	0
		Mean	L-L
		95th	L-L
Lanternfish (*Benthosema spp.*)	Not Present	5th	0
		Mean	0
		95th	0
Phycid hake (*Urophycis spp.*)	August	5th	0
		Mean	4.94E+05
		95th	1.18E+06
Fourbeard rockling (*Enchelyopus cimbrius*)	June	5th	0
		Mean	5.24E+04
		95th	2.62E+05
Atlantic cod (*Gadus morhua*)	June	5th	0
		Mean	L-L
		95th	L-L
Haddock (*Melanogrammus aeglefinus*)	Not Present	5th	0
		Mean	L-L
		95th	L-L
Pollock (*Pollachius virens*)	Not Present	5th	0
		Mean	L-L
		95th	L-L
Offshore hake (*Merluccius albidus*)	August	5th	0
		Mean	L-L
		95th	L-L
Silver hake (*Merluccius bilinearis*)	August	5th	0
		Mean	1.21E+05
		95th	1.35E+05
Bluefish (*Pomatomus saltatrix*)	July	5th	0
		Mean	2.19E+04
		95th	1.22E+05

Taxa	**Month of Greatest Density**[1]	**Density Percentile**	**Estimated # of Fish Entrained**
			SFWF - Inter-Array Cable
Cunner (*Tautogolabrus adspersus*)	July	5th	0
		Mean	1.63E+06
		95th	6.68E+06
Tautog (*Tautoga onitis*)	July	5th	0
		Mean	4.31E+04
		95th	2.80E+05
Atlantic mackerel (*Scomber scombrus*)	June	5th	0
		Mean	8.24E+05
		95th	3.66E+06
Butterfish (*Peprilus spp.*)	August	5th	0
		Mean	1.33E+05
		95th	2.70E+05
Searobin (*Prionotus spp.*)	July	5th	0
		Mean	L-L
		95th	L-L
Grubby (*Myoxocephalus aenaeus*)	Not Present	5th	0
		Mean	0
		95th	0
Longhorn sculpin (*Myoxocephalus octodecemspinosus*)	Not Present	5th	0
		Mean	0
		95th	0
Sand lance (*Ammodytes spp.*)	June	5th	0
		Mean	L-L
		95th	L-L
Rock gunnel (*Pholis gunnellus*)	Not Present	5th	0
		Mean	0
		95th	0
Radiated shanny (*Ulvaria subbifurcata*)	June	5th	0
		Mean	L-L
		95th	L-L
Gulf stream flounder (*Citharichthys arctifrons*)	August	5th	0
		Mean	8.58E+04
		95th	2.27E+05
Large-tooth flounder (*Etropus spp.*)	August	5th	0
		Mean	L-L
		95th	L-L

Taxa	Month of Greatest Density[1]	Density Percentile	Estimated # of Fish Entrained
			SFWF - Inter-Array Cable
Fourspot flounder (*Hippoglossina oblonga*)	July	5th	0
		Mean	1.18E+05
		95th	8.04E+05
Winter flounder (*Pseudopleuronectes americanus*)	June	5th	0
		Mean	L-L
		95th	L-L
American plaice (*Hippoglossoides platessoides*)	July	5th	0
		Mean	L-L
		95th	L-L
Yellowtail flounder (*Limanda ferruginea*)	June	5th	0
		Mean	2.28E+05
		95th	7.86E+05
Witch flounder (*Glyptocephalus cynoglossus*)	June	5th	0
		Mean	3.33E+04
		95th	2.45E+05
Windowpane flounder (*Scophthalmus aquosus*)	July	5th	0
		Mean	2.64E+04
		95th	1.75E+05
Monkfish (*Lophius americanus*)	July	5th	0
		Mean	6.10E+03
		95th	3.49E+04

1 – See Table 3-4 for density calculation by month

Table 3-9. Total Number of Fish Eggs Estimated to be Killed Through Entrainment by Taxa, Month of Greatest Density, Density Calculation (5th Percentile, Mean, 95th Percentile), and SFEC Location

Taxa	Month of Greatest Density	Density Percentile	Estimated # of Fish Eggs Entrained			
			SFEC - OCS Beach Lane	SFEC - OCS Hither Hills	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Atlantic herring (*Clupea harengus*)	April	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Lanternfish (*Diaphus spp.*)	July	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Lanternfish (*Benthosema spp.*)	April	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Phycid hake (*Urophycis spp.*)	July	5th	0	0	0	0
		Mean	4.51E+07	3.57E+07	3.11E+06	3.11E+06
		95th	2.38E+08	1.89E+08	1.64E+07	1.64E+07
Fourbeard rockling (*Enchelyopus cimbrius*)	June	5th	0	0	0	0
		Mean	1.17E+07	9.27E+06	8.06E+05	8.06E+05
		95th	5.85E+07	4.64E+07	4.03E+06	4.03E+06
Atlantic cod (*Gadus morhua*)	April	5th	0	0	0	0
		Mean	2.11E+06	1.67E+06	1.46E+05	1.46E+05
		95th	8.65E+06	6.86E+05	5.97E+05	5.97E+05
Haddock (*Melanogrammus aeglefinus*)	May	5th	0	0	0	0
		Mean	1.66E+06	1.31E+06	1.14E+05	1.14E+05
		95th	1.30E+07	1.03E+07	8.95E+05	8.95E+05
Pollock (*Pollachius virens*)	April	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Offshore hake (*Merluccius albidus*)	Not Present	5th	0	0	0	0
		Mean	0	0	0	0
		95th	0	0	0	0
Silver hake (*Merluccius bilinearis*)	July	5th	0	0	0	0
		Mean	1.95E+07	1.55E+07	1.35E+06	1.35E+06
		95th	8.10E+07	6.43E+07	5.59E+06	5.59E+06

Taxa	**Month of Greatest Density**	**Density Percentile**	**Estimated # of Fish Eggs Entrained**			
			SFEC - OCS Beach Lane	**SFEC - OCS Hither Hills**	**SFEC - NYS Beach Lane**	**SFEC - NYS Hither Hills**
Bluefish (*Pomatomus saltatrix*)	July	5th	0	0	0	0
		Mean	4.89E+06	3.88E+06	3.38E+05	3.38E+05
		95th	2.73E+07	2.16E+07	1.88E+06	1.88E+06
Cunner (*Tautogolabrus adspersus*)	July	5th	0	0	0	0
		Mean	3.63E+08	2.88E+08	2.50E+07	2.50E+07
		95th	1.49E+09	1.18E+09	1.03E+08	1.03E+08
Tautog (*Tautoga onitis*)	July	5th	0	0	0	0
		Mean	9.61E+06	7.62E+06	6.63E+05	6.63E+05
		95th	6.24E+07	4.95E+07	4.30E+06	4.30E+06
Atlantic mackerel (*Scomber scombrus*)	June	5th	0	0	0	0
		Mean	1.84E+08	1.46E+08	1.27E+07	1.27E+07
		95th	8.17E+08	6.48E+08	5.63E+07	5.63E+07
Butterfish (*Peprilus spp.*)	July	5th	0	0	0	0
		Mean	2.82E+07	2.23E+07	1.94E+06	1.94E+06
		95th	1.24E+07	9.84E+07	8.56E+06	8.56E+06
Searobin (*Prionotus spp.*)	July	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Grubby (*Myoxocephalus aenaeus*)	April	5th	0	0	0	0
		Mean	1.99E+06	1.58E+06	1.37E+05	1.37E+05
		95th	1.56E+07	1.24E+07	1.08E+06	1.08E+06
Longhorn sculpin (*Myoxocephalus octodecemspinosus*)	April	5th	0	0	0	0
		Mean	6.27E+06	4.98E+06	4.33E+05	4.33E+05
		95th	1.95E+07	1.55E+07	1.34E+06	1.34E+06
Sand lance (*Ammodytes spp.*)	April	5th	0	0	0	0
		Mean	2.39E+08	1.90E+08	1.65E+07	1.65E+07
		95th	7.72E+08	6.12E+08	5.32E+07	5.32E+07
Rock gunnel (*Pholis gunnellus*)	April	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Radiated shanny (*Ulvaria subbifurcata*)	May	5th	0	0	0	0
		Mean	4.48E+06	3.55E+06	3.09E+05	3.09E+05
		95th	3.12E+07	2.47E+07	2.15E+06	2.15E+06
Gulf stream flounder (*Citharichthys arctifrons*)	July	5th	0	0	0	0
		Mean	1.90E+06	1.51E+06	1.31E+05	1.31E+05
		95th	1.17E+07	9.27E+06	8.06E+05	8.06E+05

Taxa	Month of Greatest Density	Density Percentile	Estimated # of Fish Eggs Entrained			
			SFEC - OCS Beach Lane	SFEC - OCS Hither Hills	SFEC - NYS Beach Lane	SFEC - NYS Hither Hills
Large-tooth flounder (*Etropus spp.*)	July	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Fourspot flounder (*Hippoglossina oblonga*)	July	5th	0	0	0	0
		Mean	2.64E+07	2.09E+07	1.82E+06	1.82E+06
		95th	1.79E+08	1.42E+08	1.24E+07	1.24E+07
Winter flounder (*Pseudopleuronectes americanus*)	April	5th	0	0	0	0
		Mean	9.89E+06	7.84E+06	6.82E+05	6.82E+05
		95th	5.46E+07	4.33E+07	3.76E+06	3.76E+06
American plaice (*Hippoglossoides platessoides*)	May	5th	0	0	0	0
		Mean	L-L	L-L	L-L	L-L
		95th	L-L	L-L	L-L	L-L
Yellowtail flounder (*Limanda ferruginea*)	June	5th	0	0	0	0
		Mean	5.09E+07	4.04E+07	3.51E+06	3.51E+06
		95th	1.75E+08	1.39E+08	1.21E+07	1.21E+07
Witch flounder (*Glyptocephalus cynoglossus*)	June	5th	0	0	0	0
		Mean	7.42E+06	5.89E+06	5.12E+05	5.12E+05
		95th	5.46E+07	4.33E+07	3.76E+06	3.76E+06
Windowpane flounder (*Scophthalmus aquosus*)	July	5th	0	0	0	0
		Mean	5.89E+06	4.67E+06	4.06E+05	4.06E+05
		95th	3.90E+07	3.09E+07	2.69E+06	2.69E+06
Monkfish (*Lophius americanus*)	July	5th	0	0	0	0
		Mean	1.36E+06	1.08E+06	9.38E+04	9.38E+04
		95th	7.80E+06	6.18E+06	5.38E+05	5.38E+05

Table 3-10. Total Number of Fish Eggs Estimated to be Killed Through Entrainment for the SFWF Inter-Array Cable by Taxa Month of Greatest Density, and Density Calculation (5th Percentile, Mean, 95th Percentile)

Biological Resource	Month of Greatest Density	Density Percentile	Estimated # of Fish Eggs Entrained
			SFWF - Inter-Array Cable
Atlantic herring (*Clupea harengus*)	Not Present	5th	0
		Mean	0
		95th	0
Lanternfish (*Diaphus spp.*)	July	5th	0
		Mean	L-L
		95th	L-L
Lanternfish (*Benthosema spp.*)	Not Present	5th	0
		Mean	0
		95th	0
Phycid hake (*Urophycis spp.*)	August	5th	0
		Mean	4.94E+07
		95th	1.18E+08
Fourbeard rockling (*Enchelyopus cimbrius*)	June	5th	0
		Mean	5.24E+06
		95th	2.62E+07
Atlantic cod (*Gadus morhua*)	June	5th	0
		Mean	L-L
		95th	L-L
Haddock (*Melanogrammus aeglefinus*)	Not Present	5th	0
		Mean	L-L
		95th	L-L
Pollock (*Pollachius virens*)	Not Present	5th	0
		Mean	L-L
		95th	L-L
Offshore hake (*Merluccius albidus*)	August	5th	0
		Mean	L-L
		95th	L-L
Silver hake (*Merluccius bilinearis*)	August	5th	0
		Mean	1.21E+07
		95th	1.35E+07
Bluefish (*Pomatomus saltatrix*)	July	5th	0
		Mean	2.19E+06
		95th	1.22E+07

Biological Resource	**Month of Greatest Density**	**Density Percentile**	**Estimated # of Fish Eggs Entrained**
			SFWF - Inter-Array Cable
Cunner (*Tautogolabrus adspersus*)	July	5th	0
		Mean	1.63E+08
		95th	6.68E+08
Tautog (*Tautoga onitis*)	July	5th	0
		Mean	4.31E+06
		95th	2.80E+07
Atlantic mackerel (*Scomber scombrus*)	June	5th	0
		Mean	8.24E+07
		95th	3.66E+08
Butterfish (*Peprilus spp.*)	August	5th	0
		Mean	1.33E+07
		95th	2.70E+07
Searobin (*Prionotus spp.*)	July	5th	0
		Mean	L-L
		95th	L-L
Grubby (*Myoxocephalus aenaeus*)	Not Present	5th	0
		Mean	0
		95th	0
Longhorn sculpin (*Myoxocephalus octodecemspinosus*)	Not Present	5th	0
		Mean	0
		95th	0
Sand lance (*Ammodytes spp.*)	June	5th	0
		Mean	L-L
		95th	L-L
Rock gunnel (*Pholis gunnellus*)	Not Present	5th	0
		Mean	0
		95th	0
Radiated shanny (*Ulvaria subbifurcata*)	June	5th	0
		Mean	L-L
		95th	L-L
Gulf stream flounder (*Citharichthys arctifrons*)	August	5th	0
		Mean	8.58E+06
		95th	2.27E+07
Large-tooth flounder (*Etropus spp.*)	August	5th	0
		Mean	L-L
		95th	L-L

Biological Resource	**Month of Greatest Density**	**Density Percentile**	**Estimated # of Fish Eggs Entrained**
			SFWF - Inter-Array Cable
Fourspot flounder (*Hippoglossina oblonga*)	July	5th	0
		Mean	1.18E+07
		95th	8.04E+07
Winter flounder (*Pseudopleuronectes americanus*)	June	5th	0
		Mean	L-L
		95th	L-L
American plaice (*Hippoglossoides platessoides*)	July	5th	0
		Mean	L-L
		95th	L-L
Yellowtail flounder (*Limanda ferruginea*)	June	5th	0
		Mean	2.28E+07
		95th	7.86E+07
Witch flounder (*Glyptocephalus cynoglossus*)	June	5th	0
		Mean	3.33E+06
		95th	2.45E+07
Windowpane flounder (*Scophthalmus aquosus*)	July	5th	0
		Mean	2.64E+06
		95th	1.75E+07
Monkfish (*Lophius americanus*)	July	5th	0
		Mean	6.10E+05
		95th	3.49E+06

4.0 DISCUSSION

The purpose of the SFWF jet plow entrainment assessment was to calculate a range of potential order of magnitude losses to zooplankton, ichthyoplankton, and fish eggs related to the cable burial of the SFEC and SFWF inter-array cable. Results from this assessment may be used to contribute to regulatory requirements and guidelines for the permitting of the SFWF. Results from this assessment highlight species that may be most impacted by jet plow activities during the planned construction periods (Table 4-1). Estimated losses of zooplankton and ichthyoplankton related to the longest potential cable route (SFWF inter-array cable + Beach Lane) were estimated to be approximately 0.002% of the total zooplankton and ichthyoplankton abundance present in the study region.

Calculated impacts to larvae and zooplankton are similar to those found for the Cape Wind EIS (MMS, 2008). The Cape Wind Project proposed a total jet plow length of ~79 miles while the SFWF will, at its greatest length, including inter-array cable, be ~87 miles in length. Most fish species as well as zooplankton losses due to entrainment calculated as part of this study fell within an order of magnitude of those presented in the Cape Wind EIS.

Because jet plow cable burial is a one-time event and the water usage of the jet plow is relatively low, the estimated impact to ichthyoplankton and zooplankton resources as part of the SFWF construction is minor when compared with power plant entrainment losses (ARCADIS et al., 2008). Data available through 316(b) (Clean Water Act) regulations provide direct comparisons of entrainment losses for a few species found in this present assessment (EPA, 2000) (Table 4-2). It is important to keep in mind that entrainment values presented in Table 4-2 for the SFWF are the totals across the entire length of the project, while those listed for power plant cooling water entrainment are annual values that may occur every year for upwards of 30+ years.

Table 4-1. Summary of Estimated Entrainment from Cable Jet Plow to EFH, Commercially Important, and High-Density Taxa of Fish and Zooplankton Resources. 'L-L' indicates a low likelihood of occurrence or impact.

Biological Resource	Estimated Density During Anticipated Period of Jet Plow Operation (# ind/m^3)	Estimated Impact to Larvae (individuals entrained)
Atlantic herring	L-L	L-L
Atlantic cod	1.08	23,000
Haddock	0.85	18,000
Pollock	L-L	L-L
Silver hake	13.8	330,000
Bluefish	2.51	74,000
Cunner	186	5.5 million
Tautog	4.93	146,000
Atlantic mackerel	94.3	2.8 million
Butterfish	15.2	434,000
Sand lance	122	2.5 million
Winter flounder	5.07	106,000
Yellowtail flounder	26.1	770,000
Witch flounder	3.81	113,000
Windowpane flounder	3.02	89,000
Monkfish	0.70	21,000
Zooplankton (All Taxa)	290,000	8.5 billion

Table 4-2. Comparison of Estimated Entrainment Losses Between the SFWF Cable Burial (This Assessment) and Power Plant Cooling Water Intakes (EPA, 2000)

Biological Resource	Mean Estimated Total Entrainment of Eggs and Larvae as part of SFWF Cable Burial	Mean Annual Entrainment of Eggs, Larvae, and Juveniles per Power Plant Facility
Tautog (estuaries)	1.6 million	6.1 billion
Tautog (ocean)	1.6 million	911 million
Atlantic menhaden	Not present	3.1 billion
Winter flounder	1.2 million	952 million
Cunner	60.5 million	1.6 billion
Atlantic mackerel	30.8 million	312 million

5.0 REFERENCES

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APPENDIX A

NOAA – NMFS Data Use and Acknowledgement Policy

These data are provided by the Northeast Fisheries Science Center of the U.S. National Marine Fisheries Service (NMFS). A number of different vessels have been involved in sampling, and gear and methods have evolved over time. All of these factors affect sampling and the interpretation of data. The agency has developed correction factors to adjust for these changes and use other statistical tools for population estimates. The data we present here can be used as an index of abundance (over time or space) within a species or among species with similar vulnerability to the sampling gear (see list of references below). Please contact Harvey Walsh (harvey.walsh@noaa.gov) with any questions about data collection and processing.

The data available here are intended for scholarly use by the academic and scientific community. We hope to facilitate collaboration between scientists, to allow the combination of multiple data sets for interdisciplinary and comparative studies, and the development and testing of new theories. Please properly acknowledge the originating data collection source (Oceans and Climate Branch of NMFS Northeast Fisheries Science Center) in any presentations or publications. Use or reproduction of any material herein for any commercial purpose is prohibited without prior written permission from the Northeast Fisheries Science Center.

ICHTHYOPLANKTON AND ZOOPLANKTON ASSESSMENT– JET PLOW ENTRAINMENT REPORT

FIGURES

Prepared for:

JACOBS™

Jacobs Engineering Group

And

South Fork Wind Farm

Deepwater Wind South Fork, LLC

Submitted by:

INSPIRE ENVIRONMENTAL

INSPIRE Environmental
513 Broadway Suite 314
Newport, RI, 02840

May 2019

LIST OF FIGURES

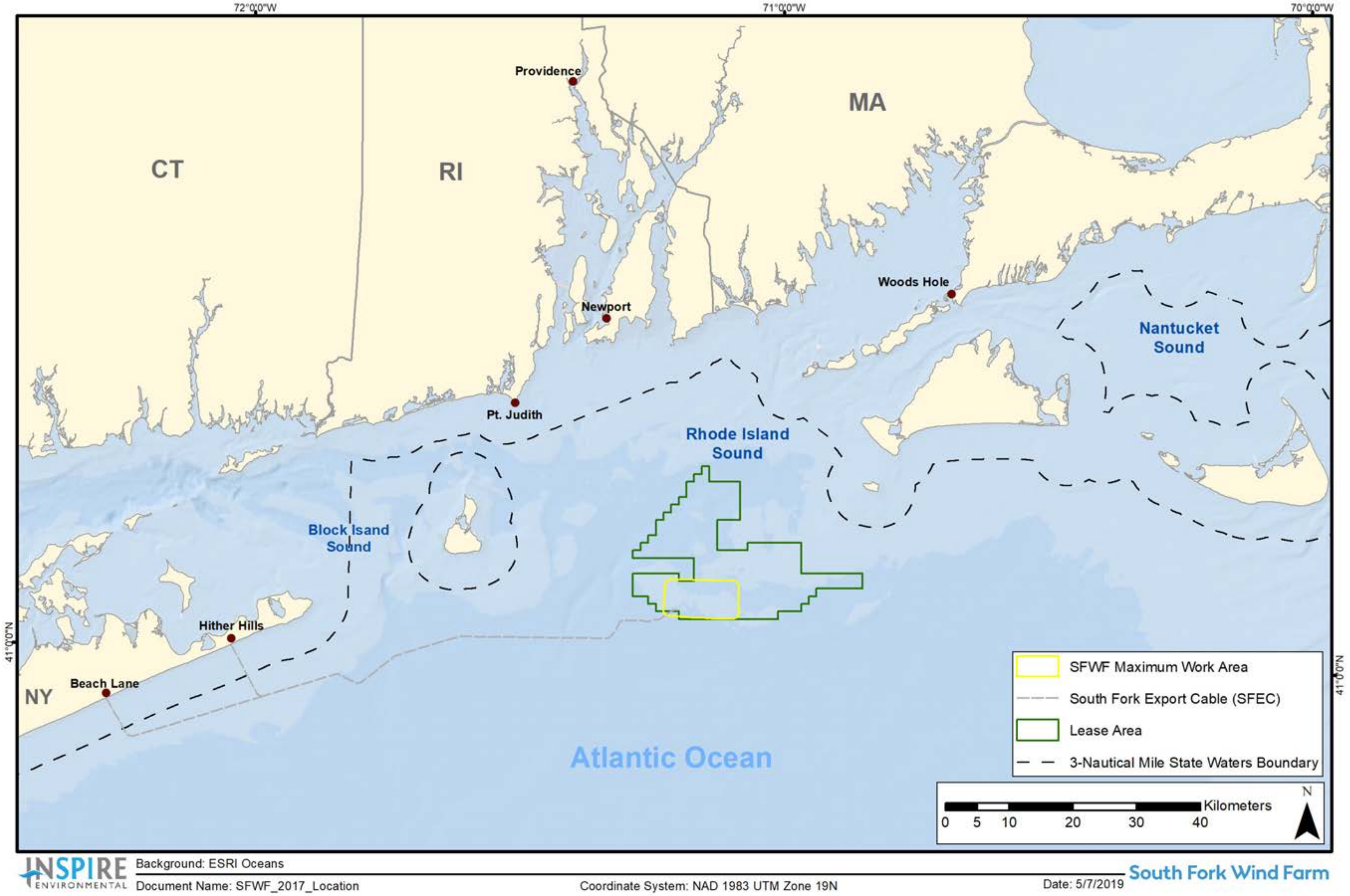


Figure 1-1. Location of the South Fork Wind Farm survey area

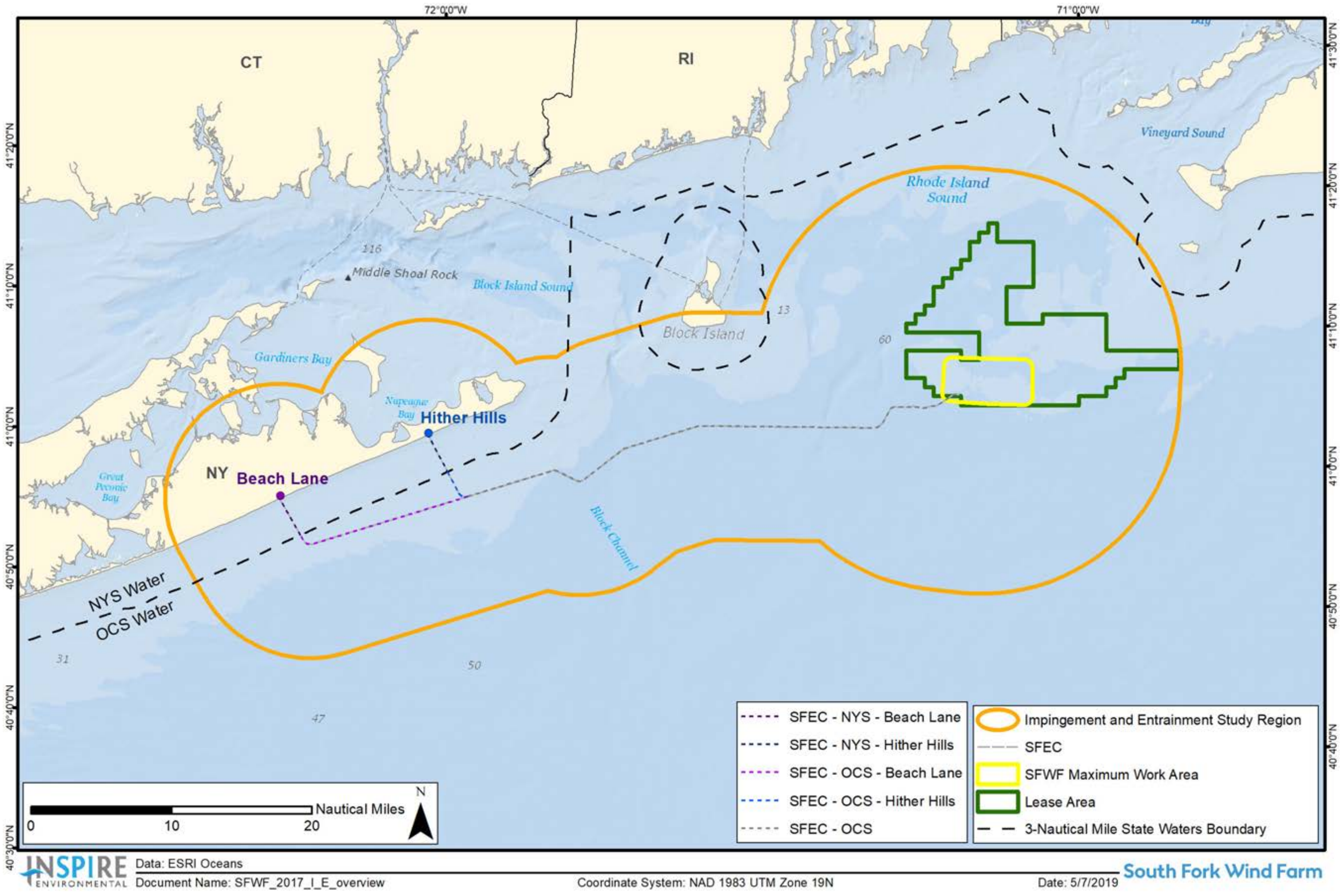


Figure 1-2. **Subsections of the SFWF inter-array cable and the SFEC**

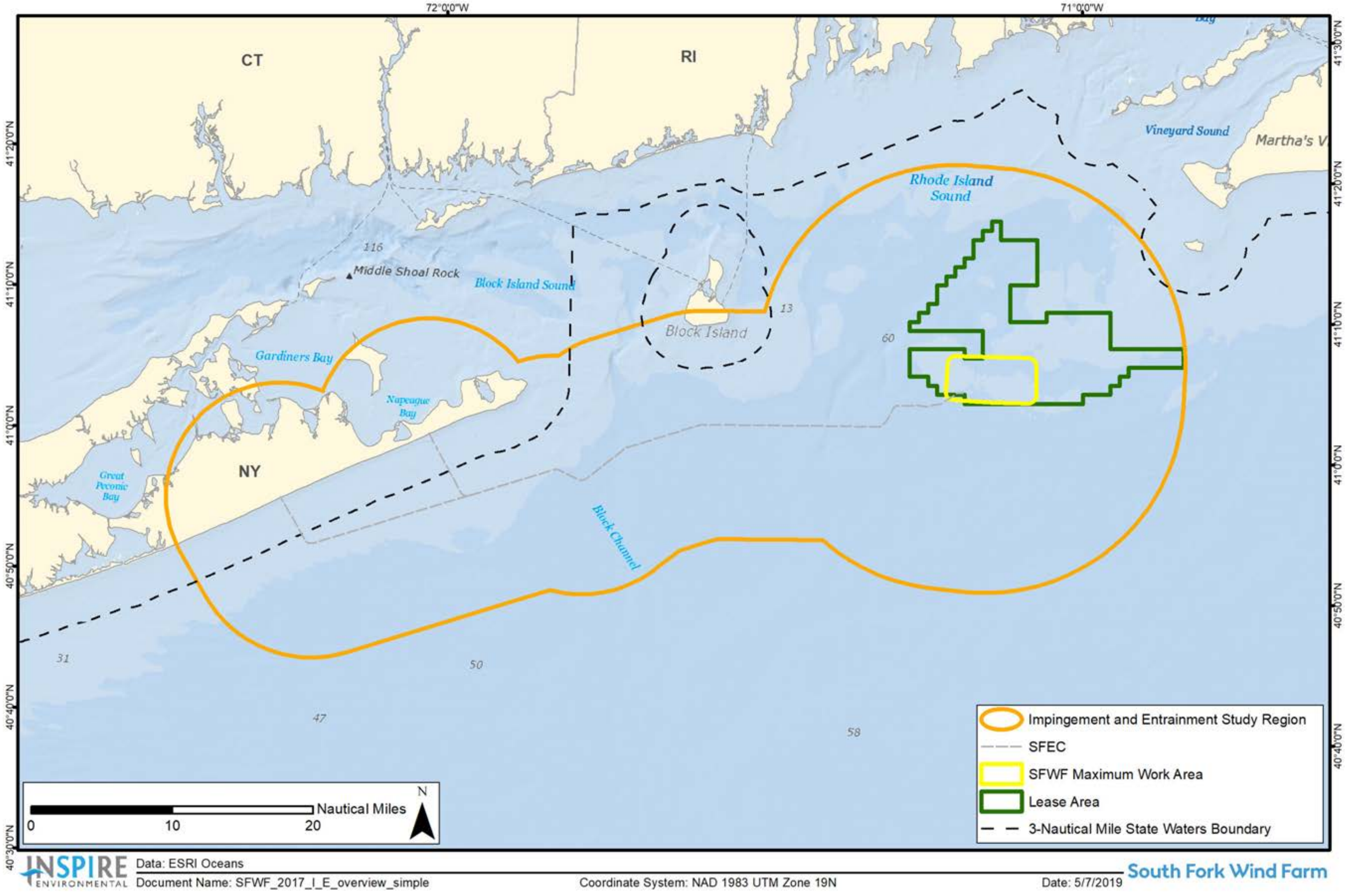
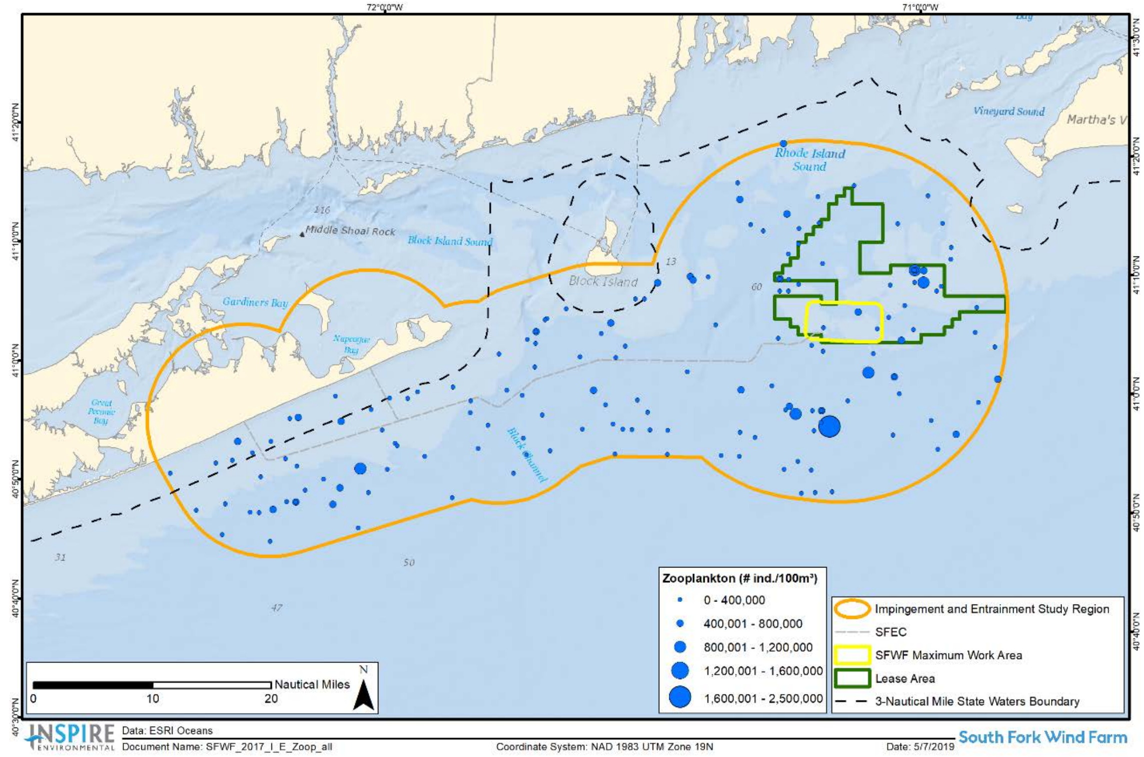


Figure 2-1. Impingement and entrainment study area around the SFWF and SFEC



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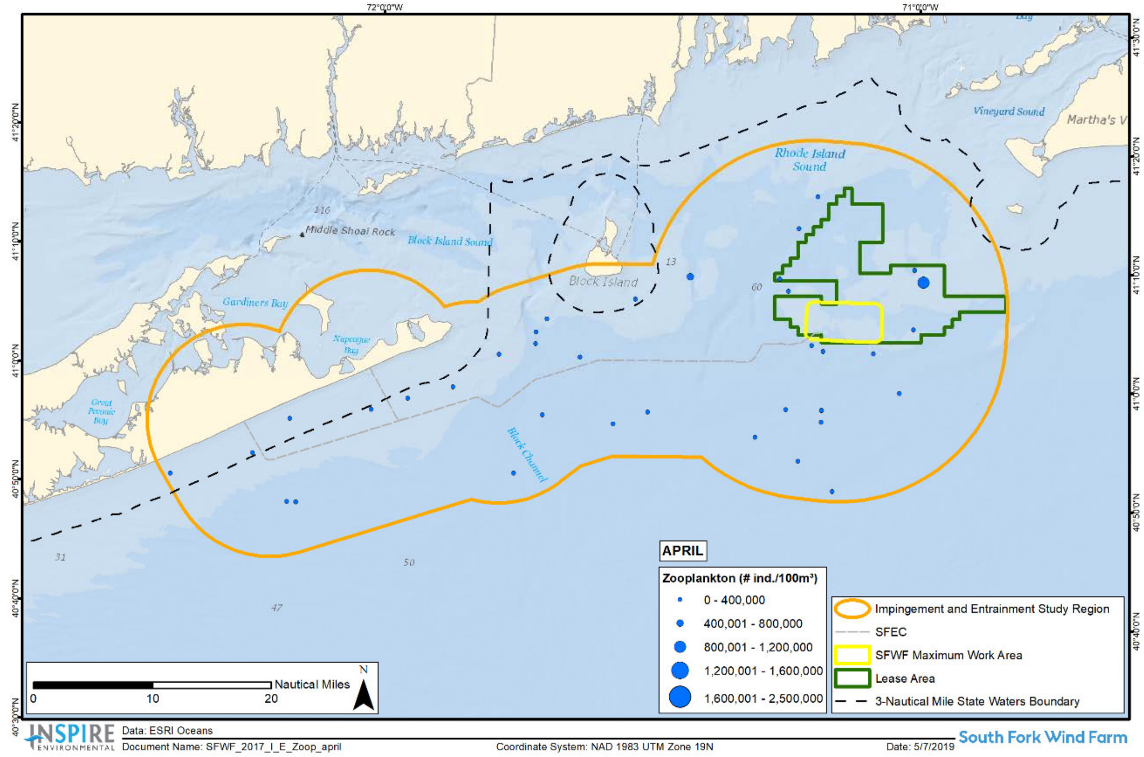
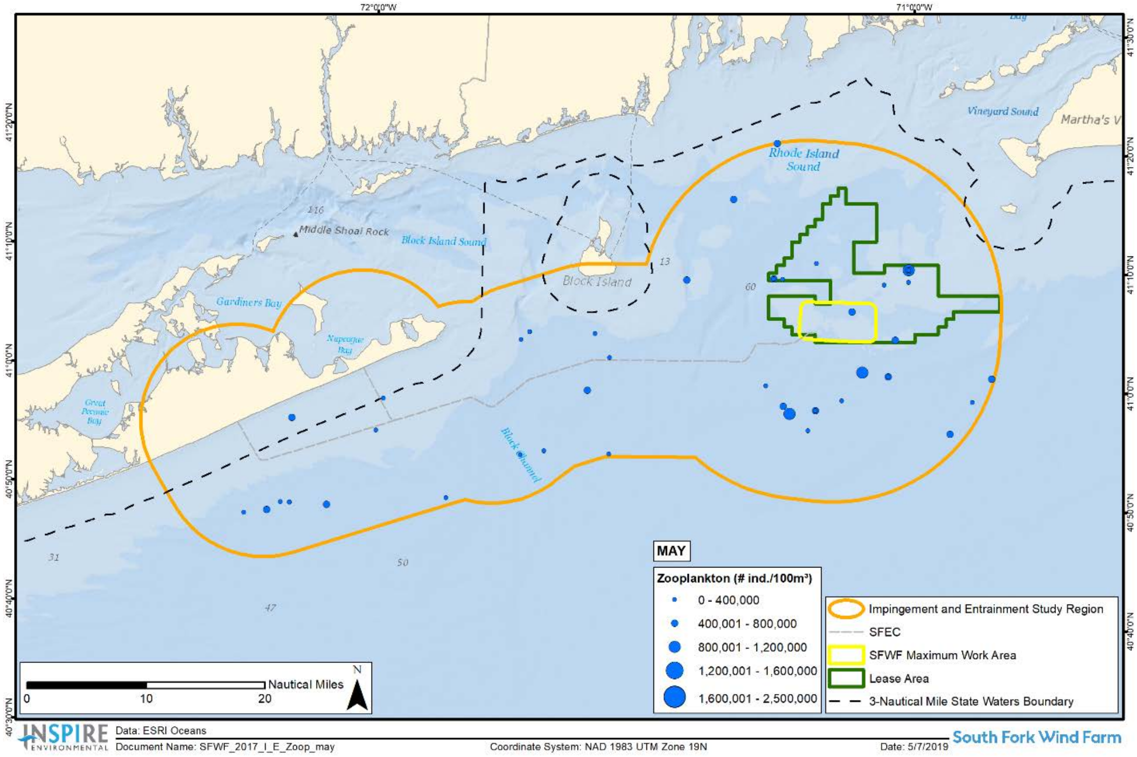


April

Figure 3-1a. **Raw MARMAP and EcoMon zooplankton densities across all study time period months (top panel) and for the month of April (bottom panel). Zooplankton densities shown are the sum of all zooplankton taxonomies present in the MARMAP and EcoMon datasets at each location.**



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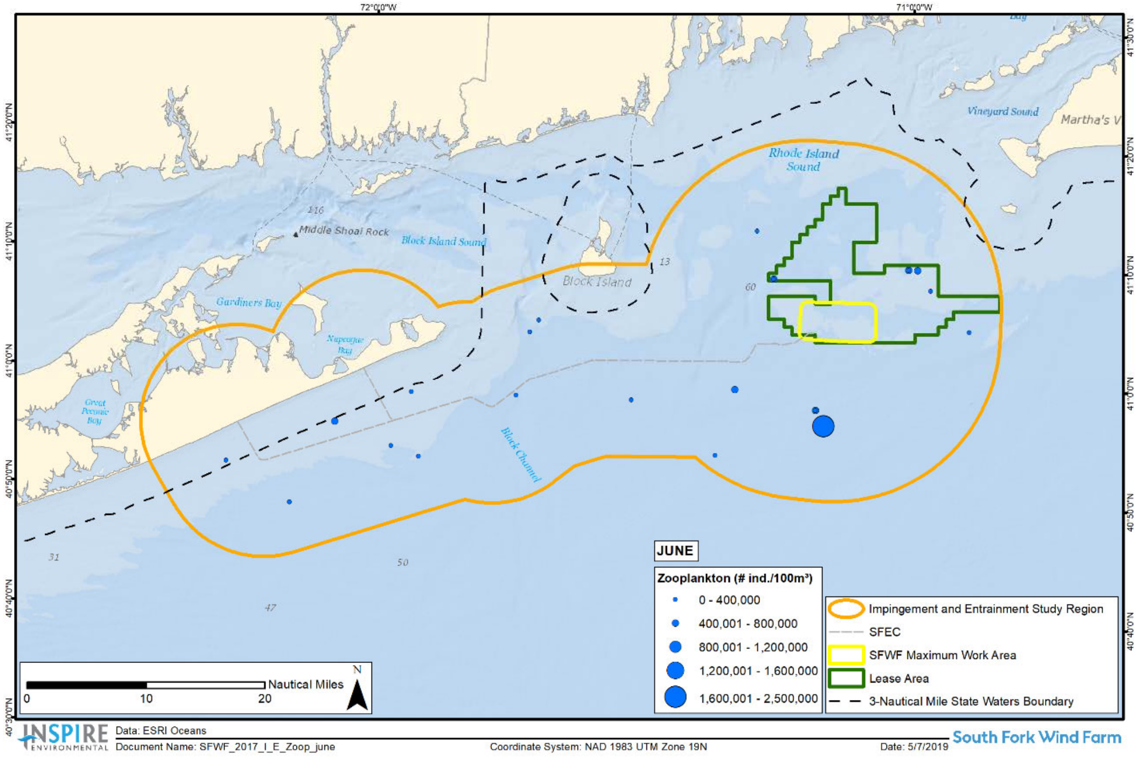
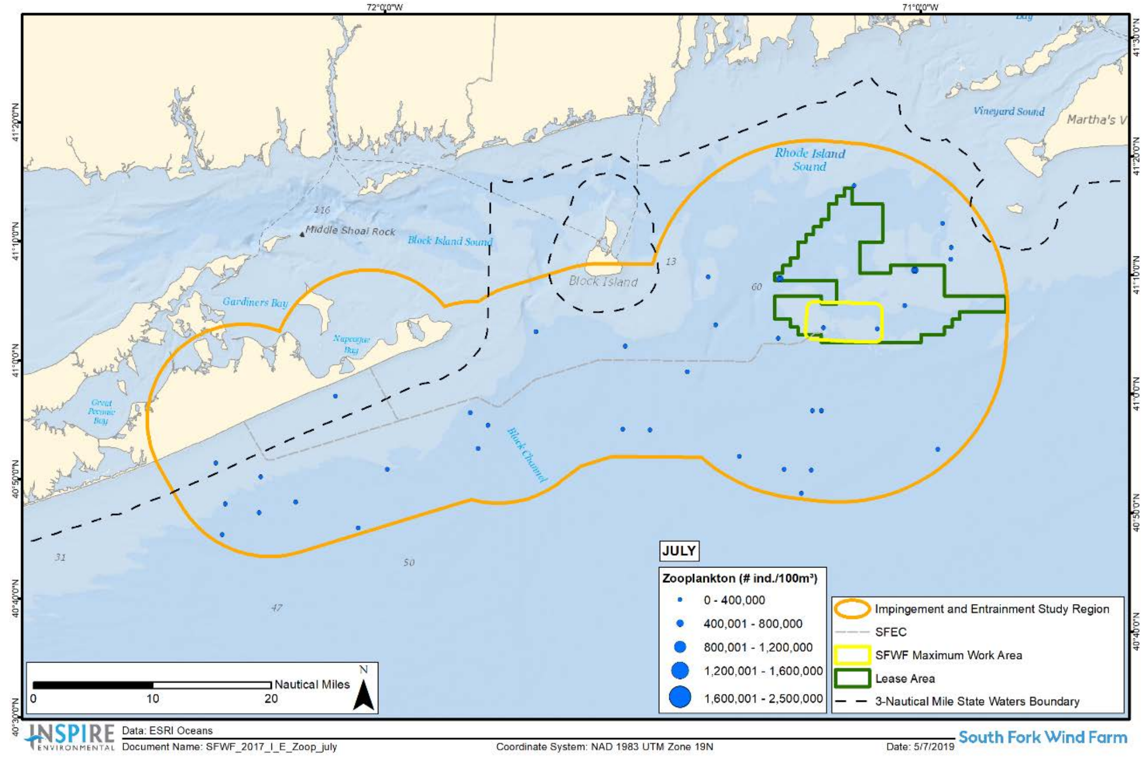


June

Figure 3-1b. Raw MARMAP and EcoMon zooplankton densities for the months of May (top panel) and June (bottom panel). Zooplankton densities shown are the sum of all zooplankton taxonomies present in the MARMAP and EcoMon datasets at each location.



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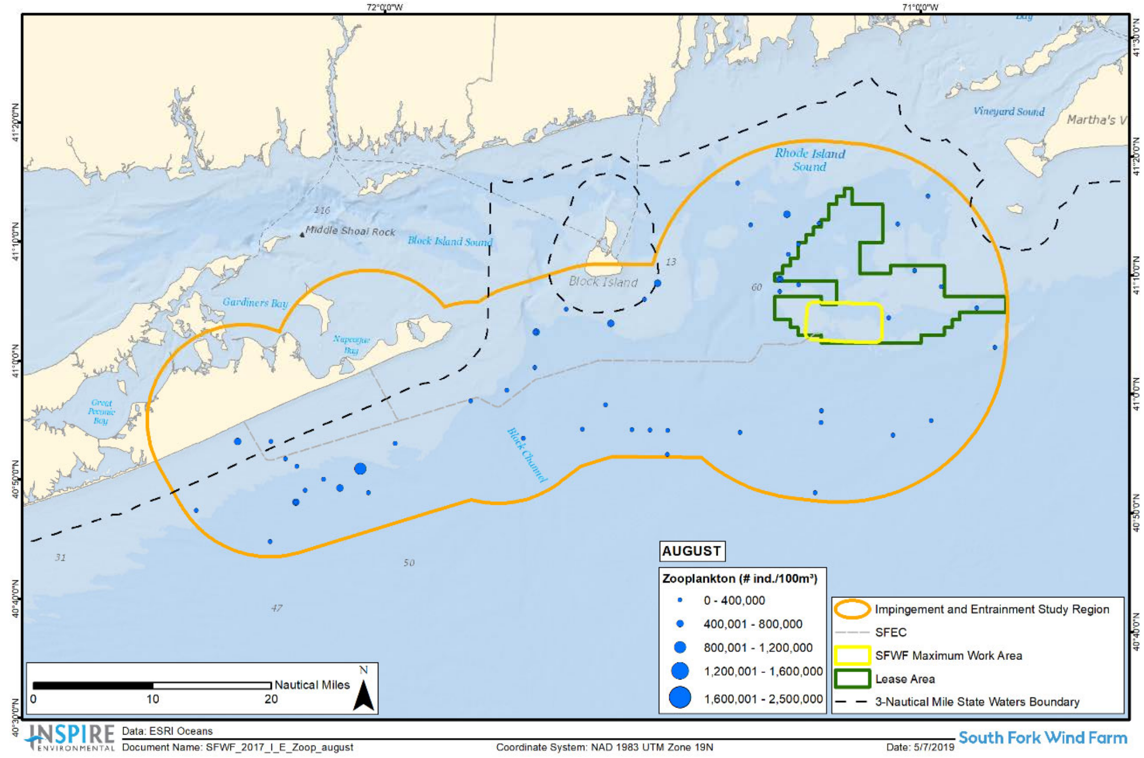
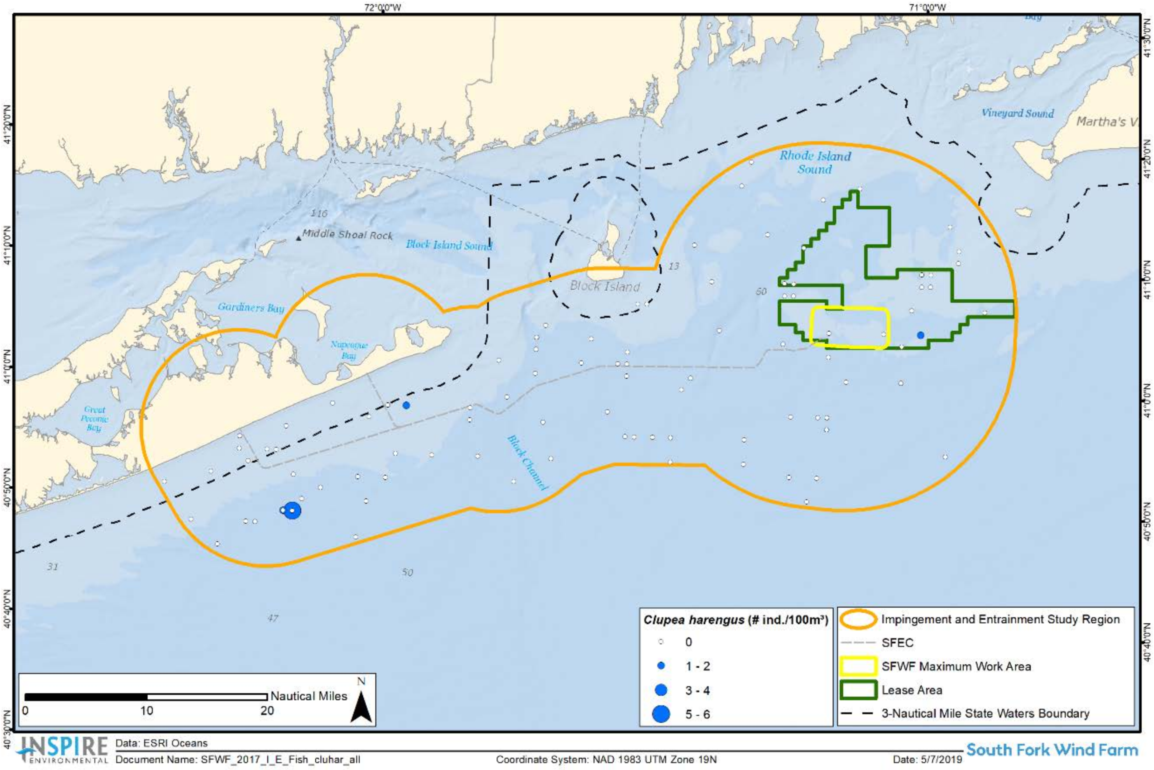


August

Figure 3-1c. Raw MARMAP and EcoMon zooplankton densities for the months of July (top panel) and August (bottom panel). Zooplankton densities shown are the sum of all zooplankton taxonomies present in the MARMAP and EcoMon datasets at each location.



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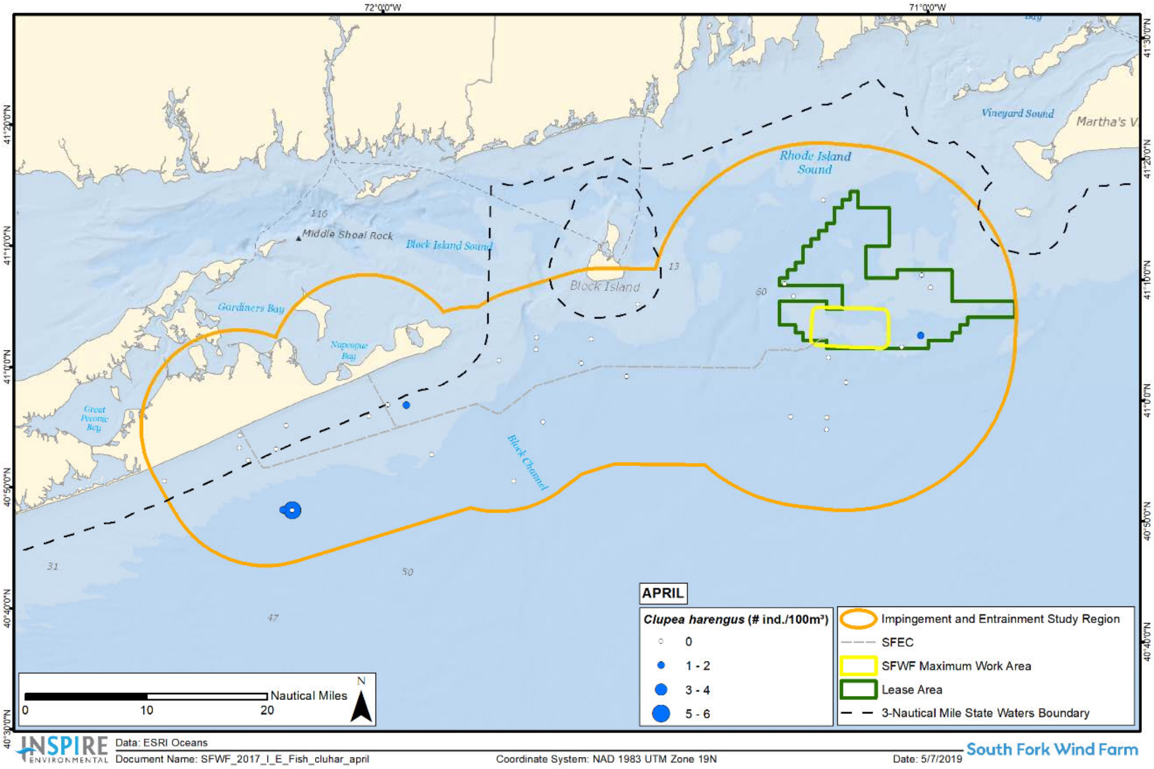
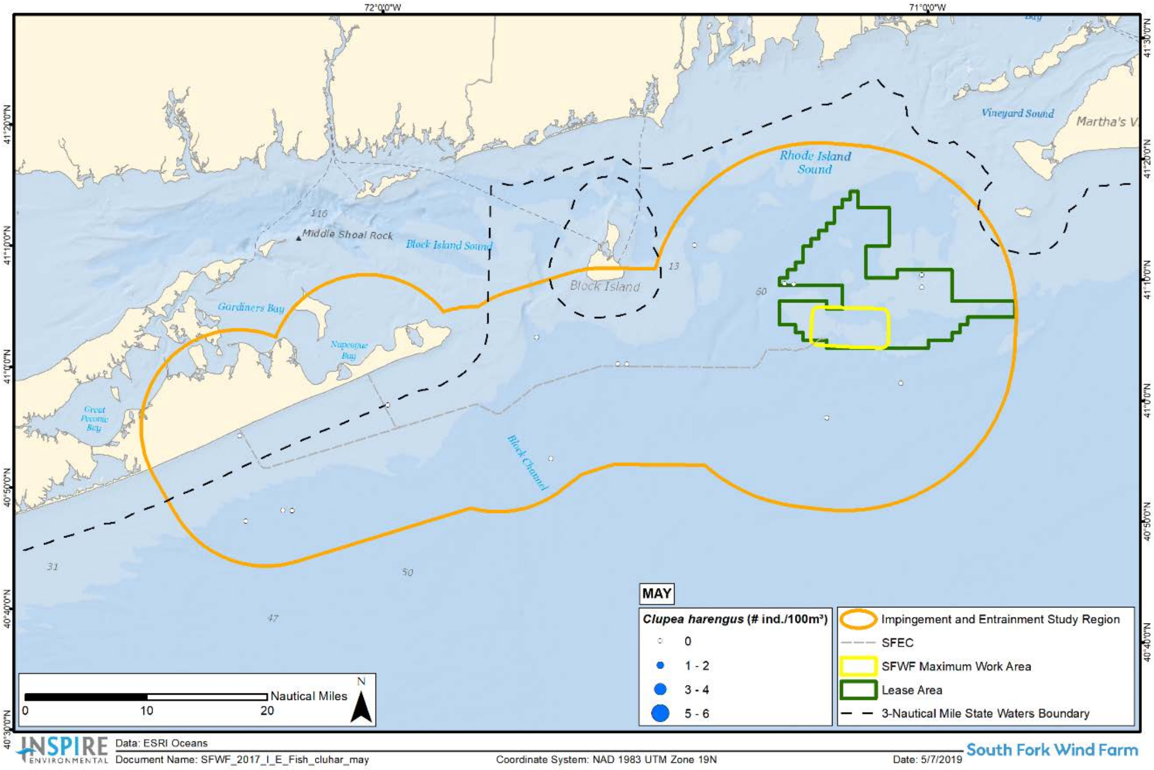


April

Figure 3-2a. Raw MARMAP and EcoMon Atlantic herring (*Clupea harengus*) densities across all study time period months (top panel) and for the month of April (bottom panel).



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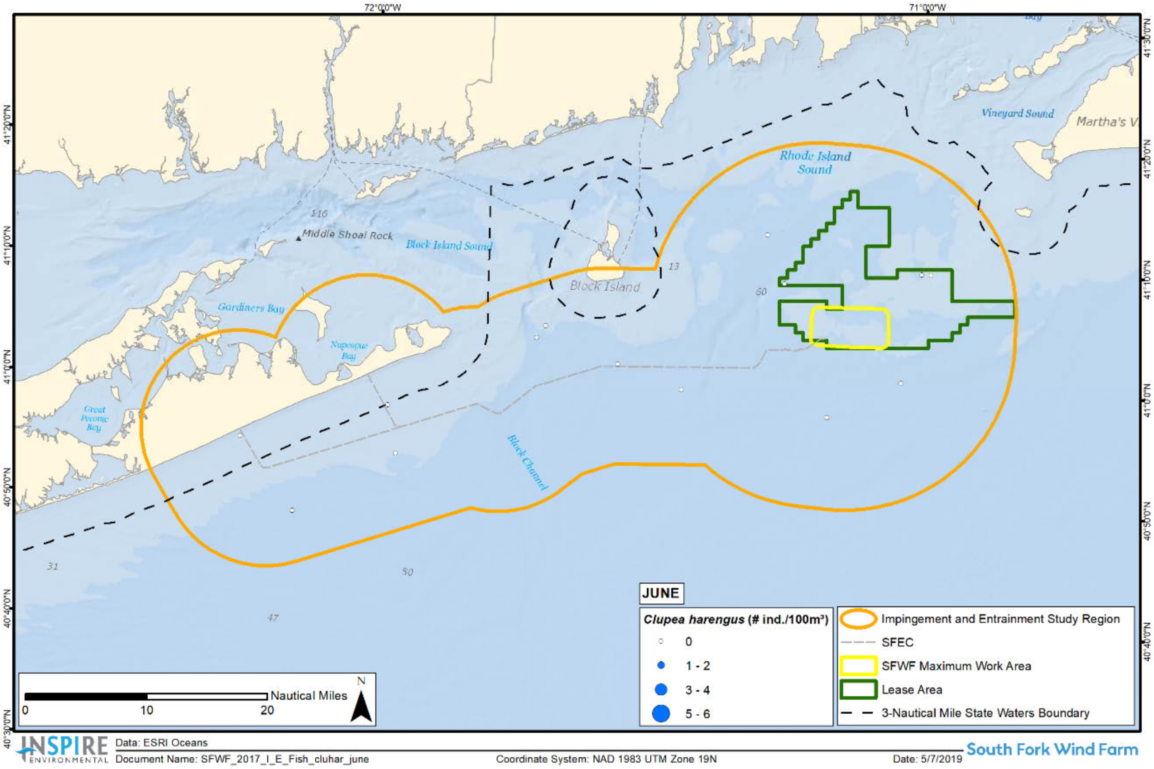

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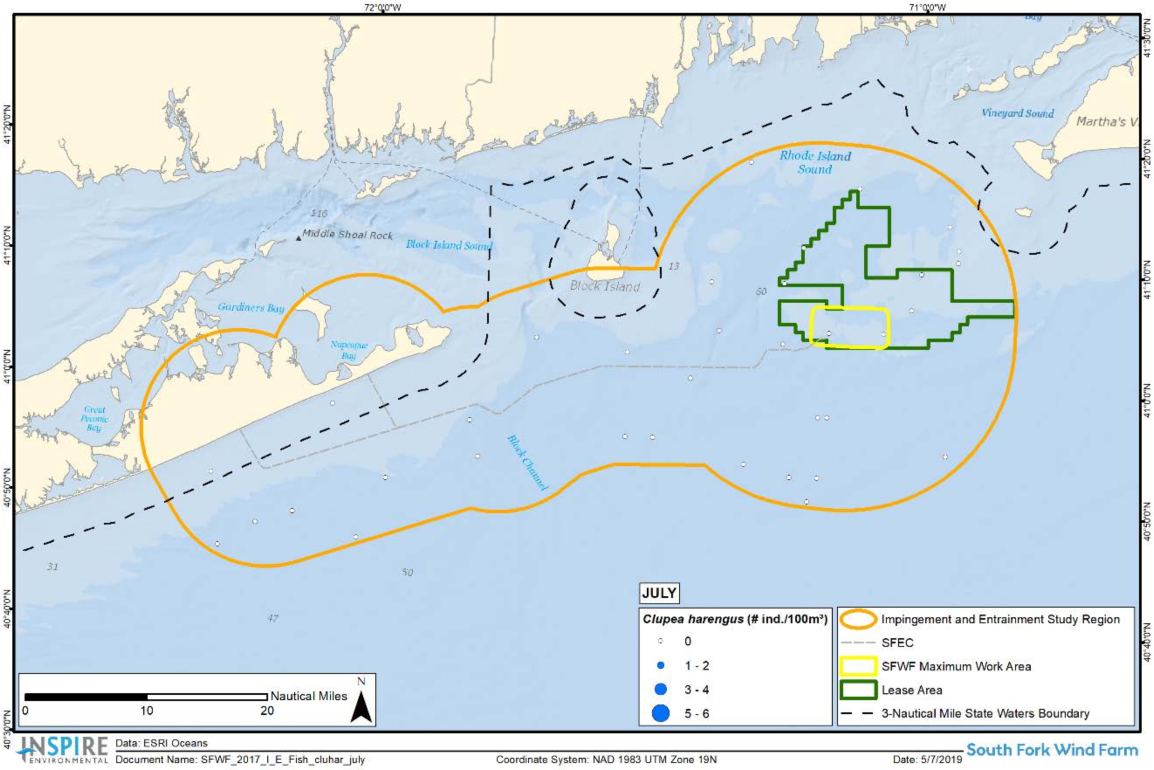
Figure 3-2b. Raw MARMAP and EcoMon Atlantic herring (*Clupea harengus*) densities for the months of May (top panel) and June (bottom panel).



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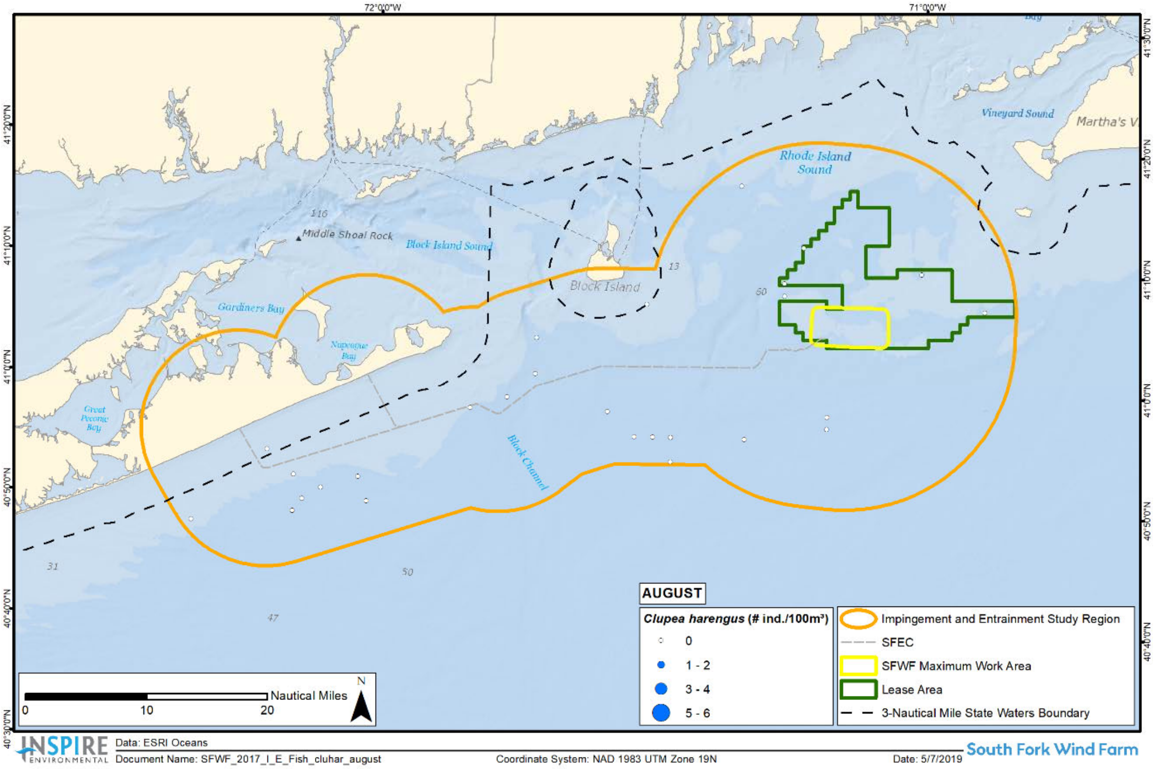

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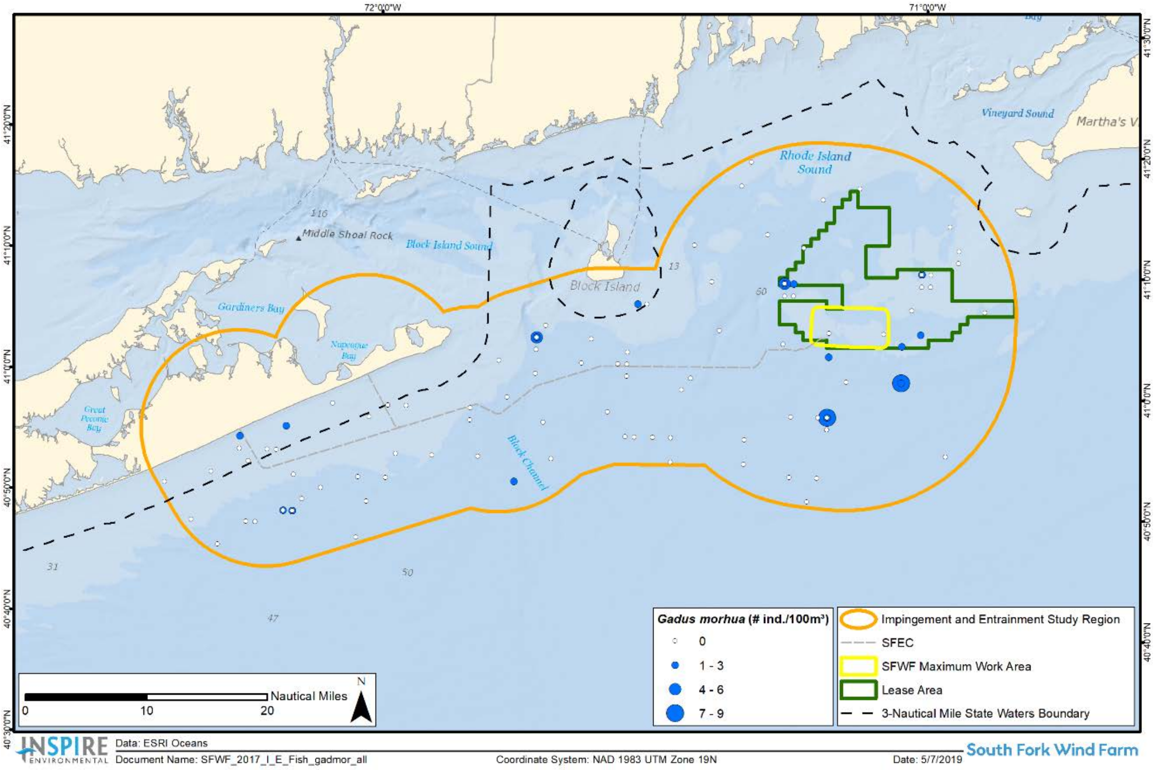
Figure 3-2c. Raw MARMAP and EcoMon Atlantic herring (*Clupea harengus*) densities for the months of July (top panel) and August (bottom panel).



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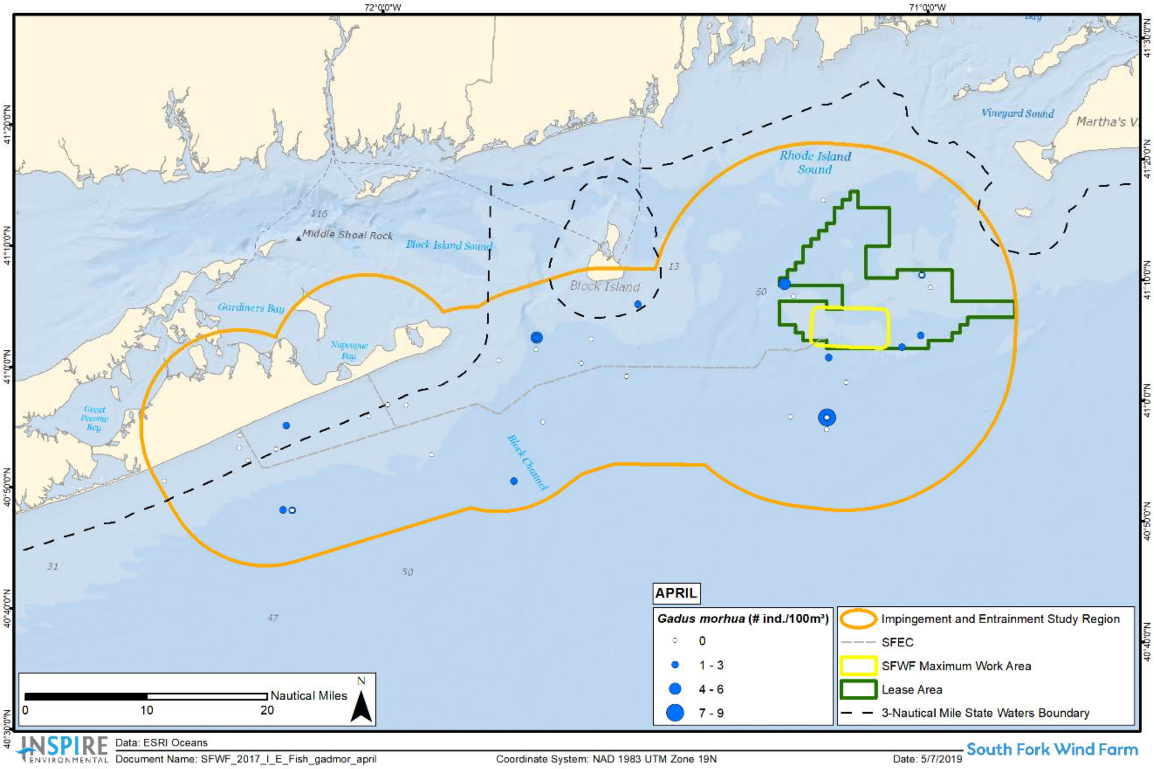

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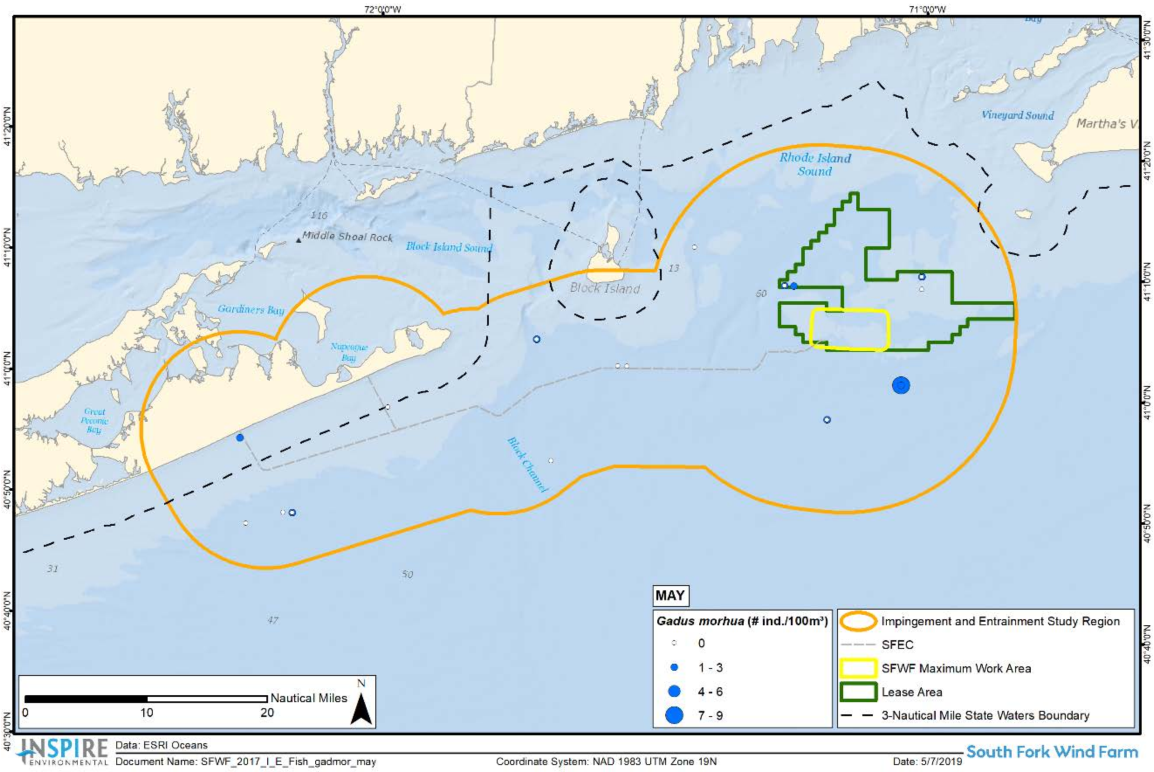
Figure 3-3a. Raw MARMAP and EcoMon Atlantic cod (Gadus morhua) densities across all study time period months (top panel) and for the month of April (bottom panel).



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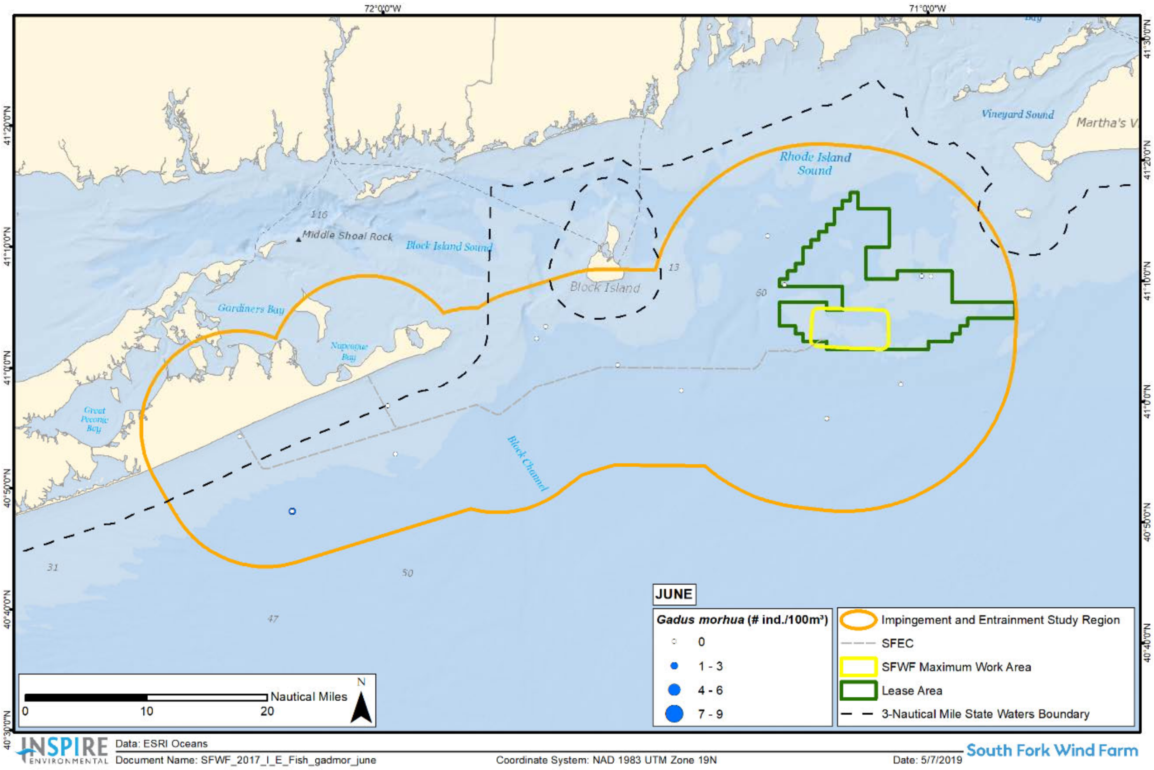

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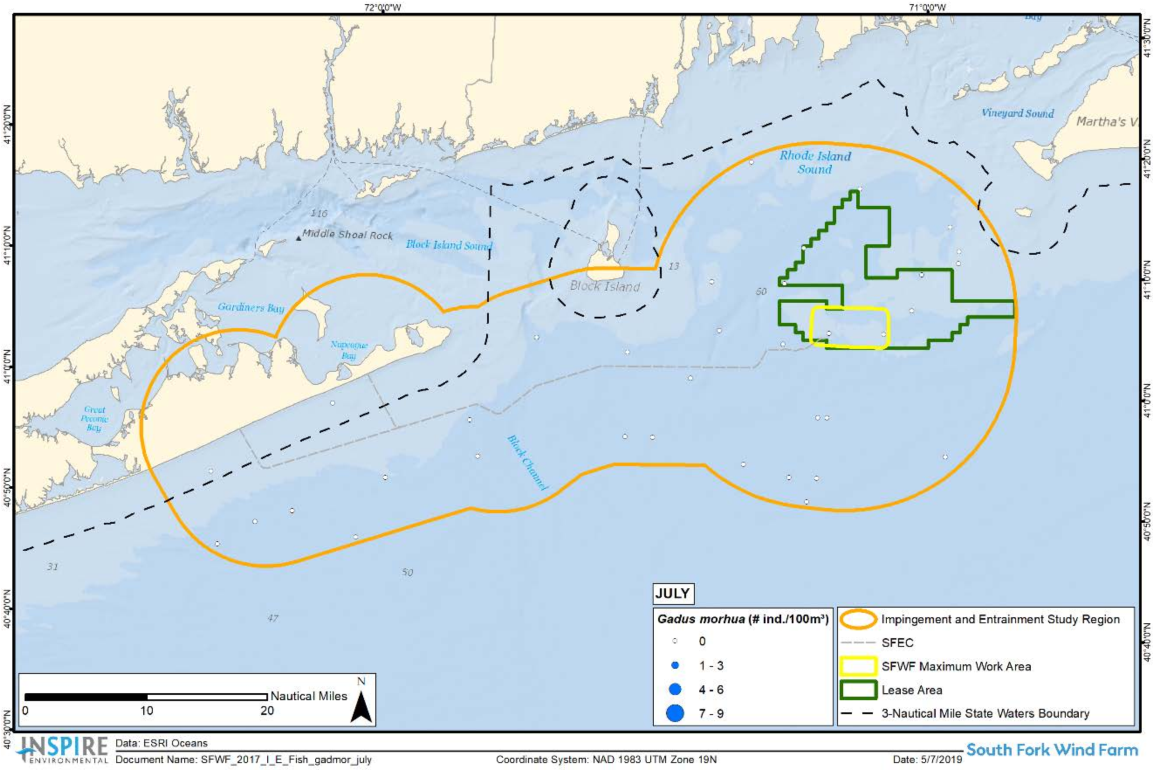
Figure 3-3b. Raw MARMAP and EcoMon Atlantic cod (*Gadus morhua*) densities for the months of May (top panel) and June (bottom panel).



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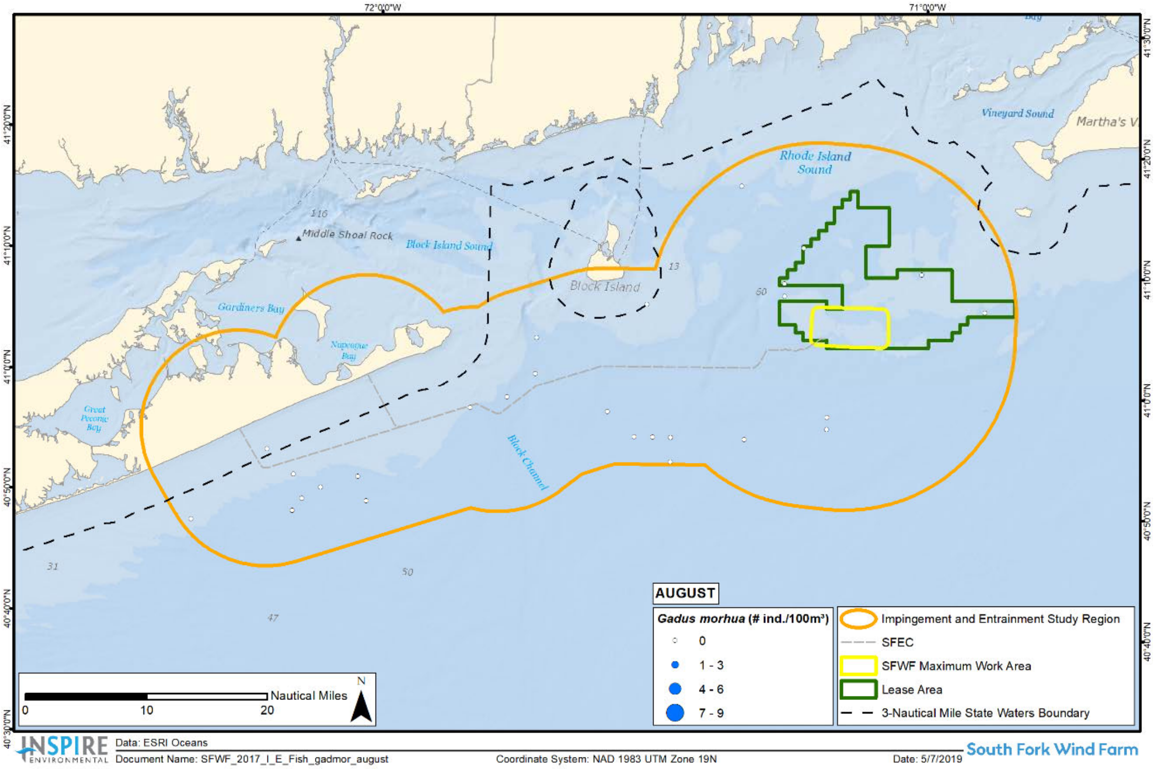

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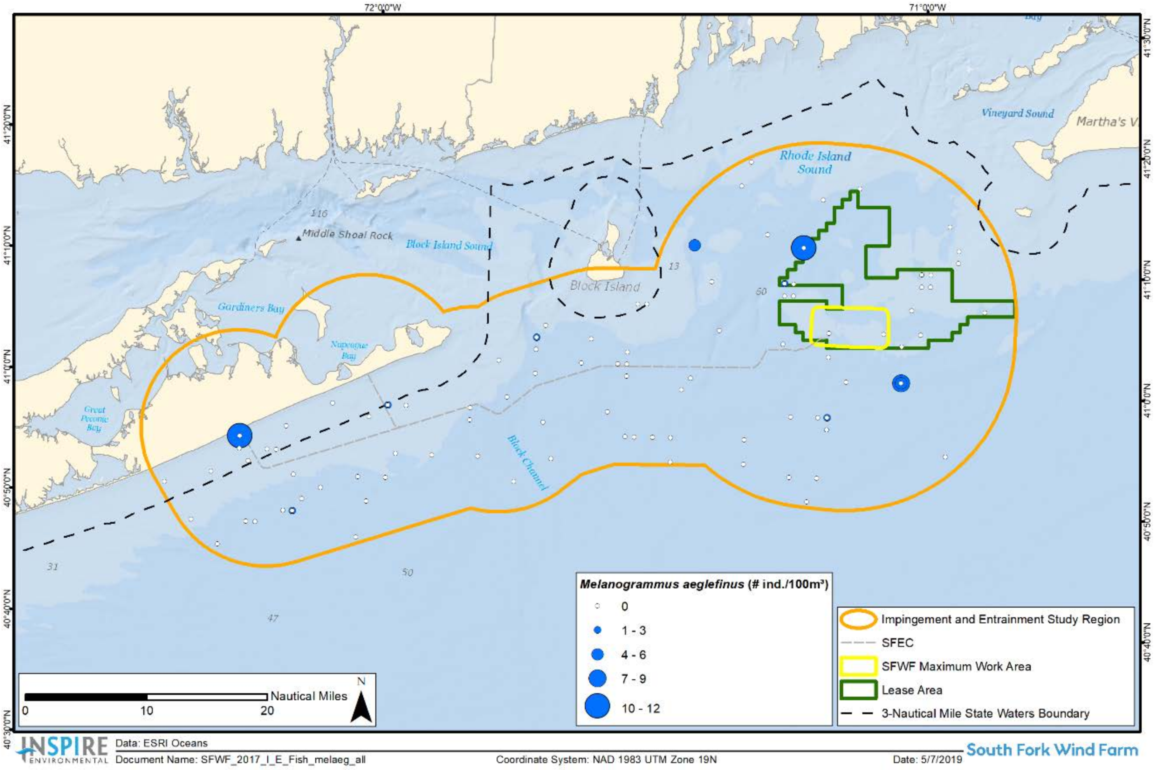
Figure 3-3c. Raw MARMAP and EcoMon Atlantic cod (*Gadus morhua*) densities for the months of July (top panel) and August (bottom panel).



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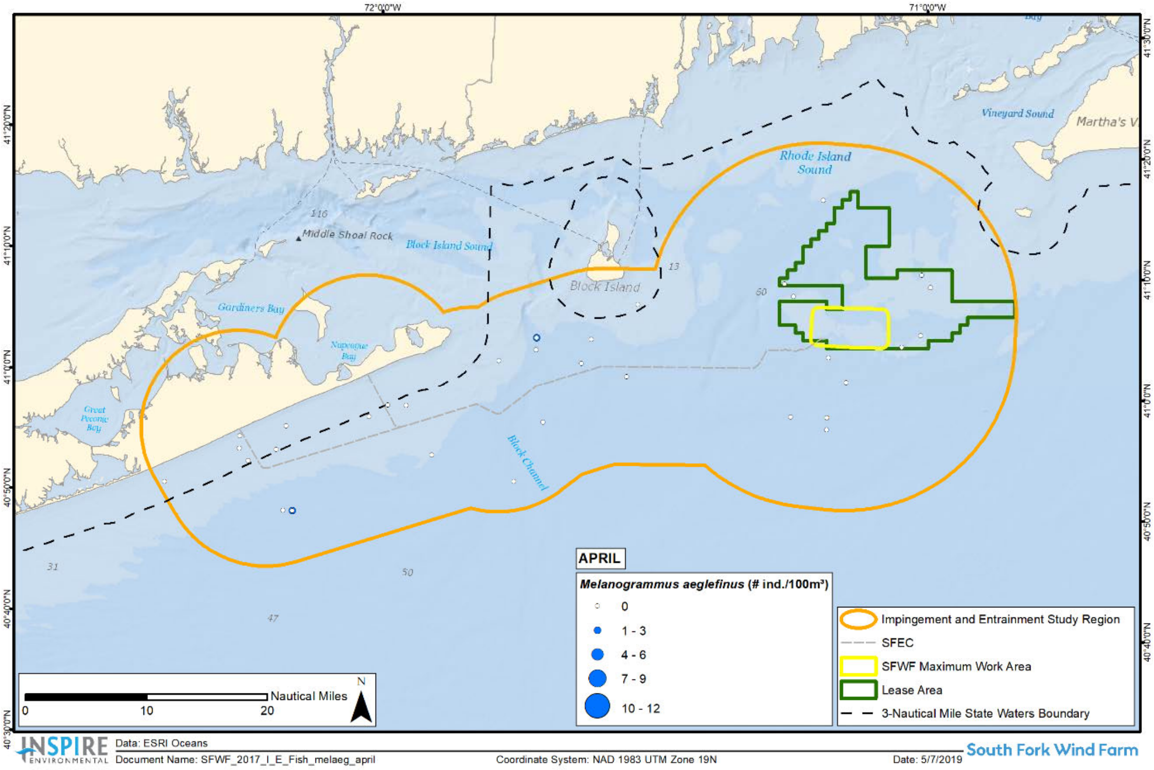

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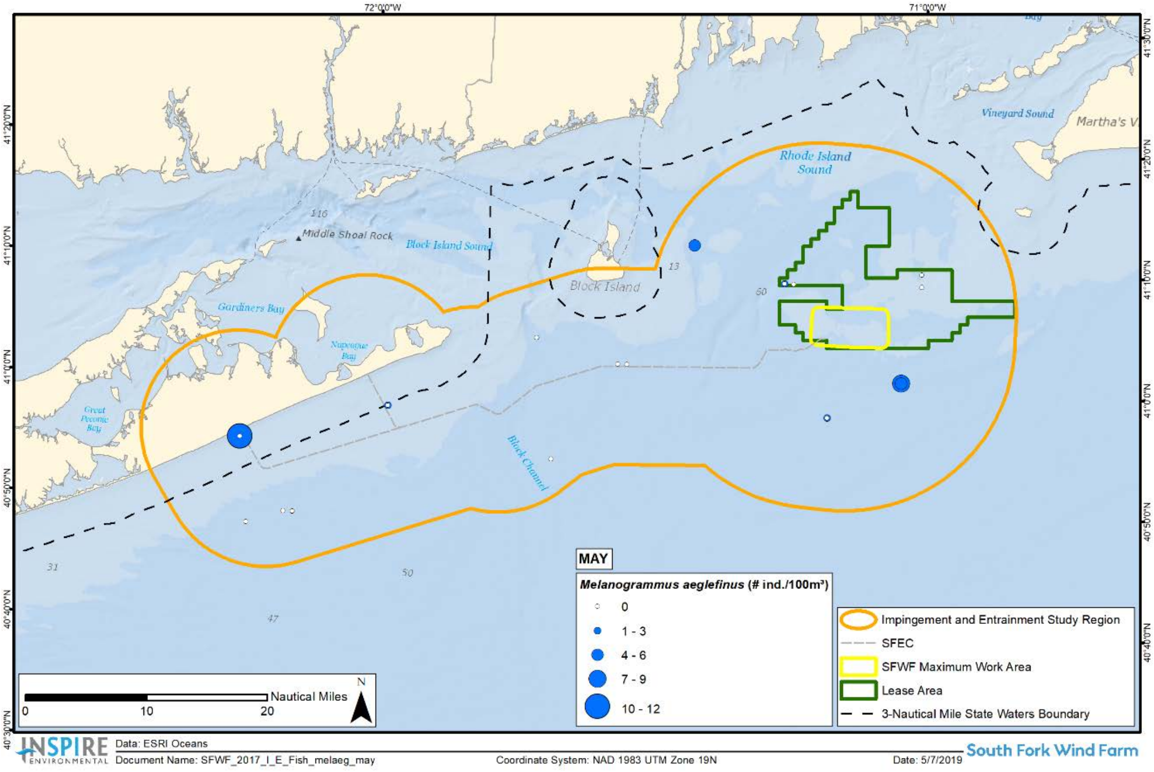
Figure 3-4a. Raw MARMAP and EcoMon Haddock (*Melanogrammus aeglefinus*) densities across all study time period months (top panel) and for the month of April (bottom panel).



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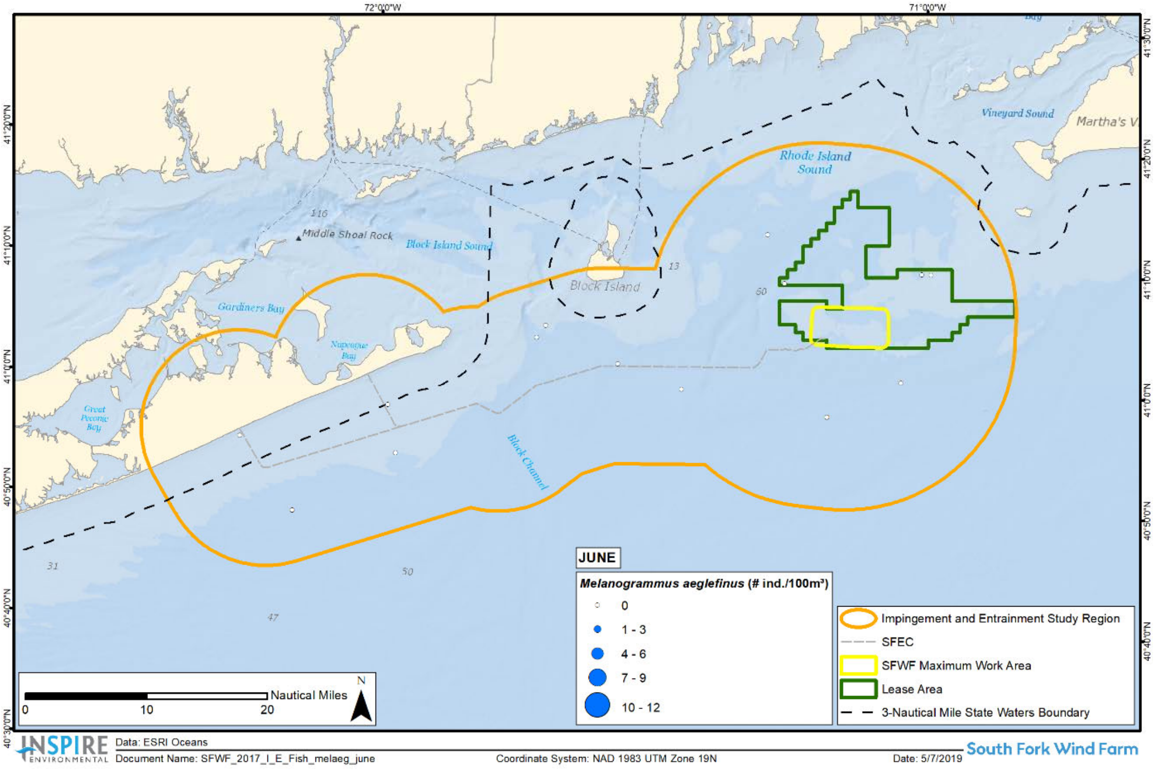

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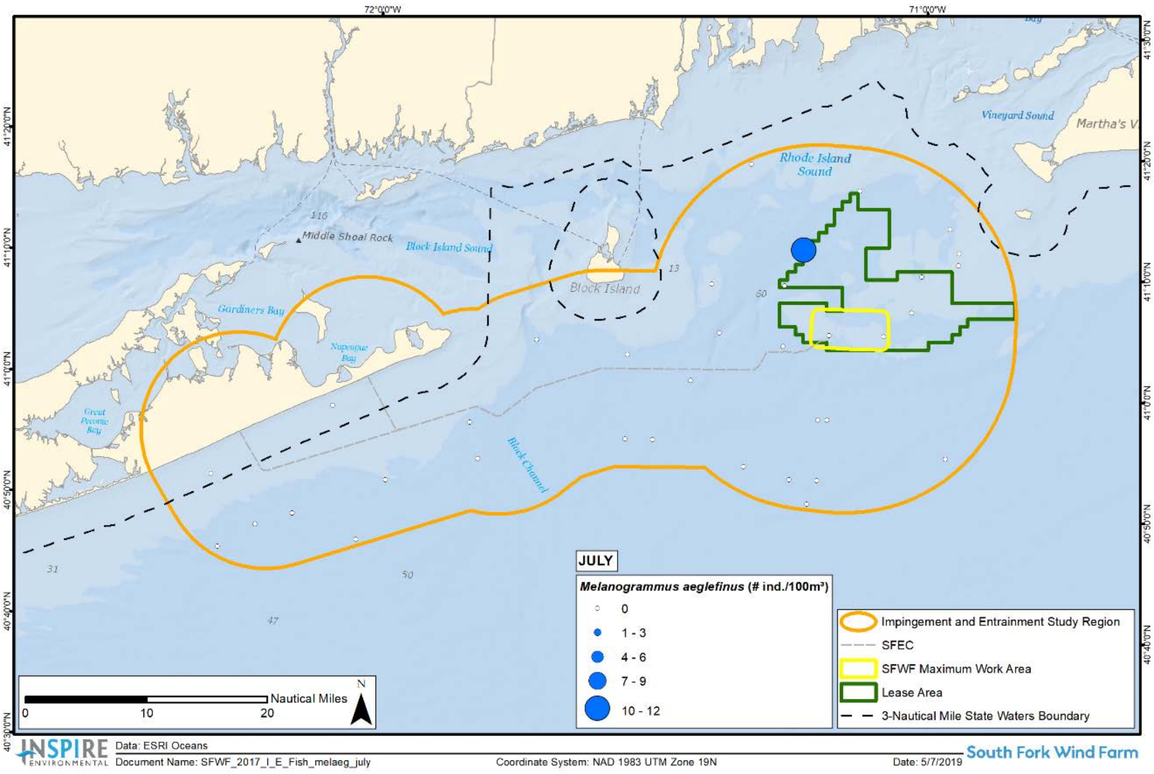
Figure 3-4b. Raw MARMAP and EcoMon Haddock (*Melanogrammus aeglefinus*) densities for the months of May (top panel) and June (bottom panel).



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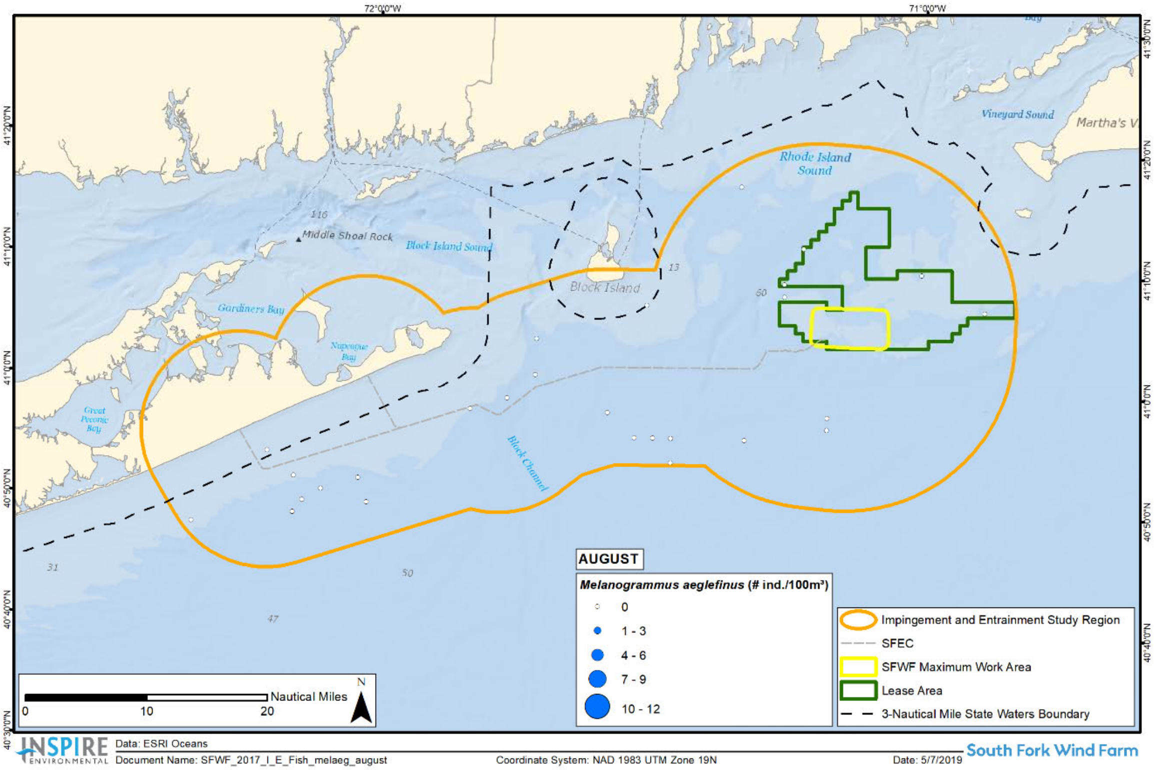

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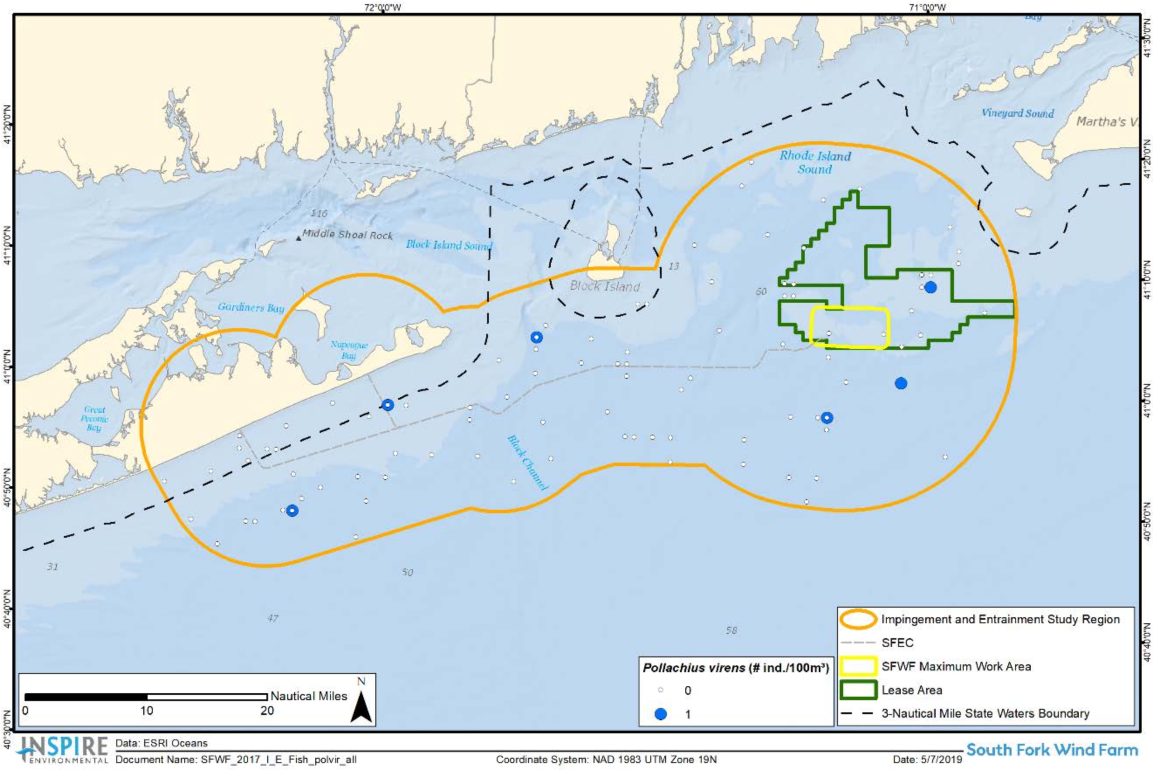
Figure 3-4c. Raw MARMAP and EcoMon Haddock (*Melanogrammus aeglefinus*) densities for the months of July (top panel) and August (bottom panel).



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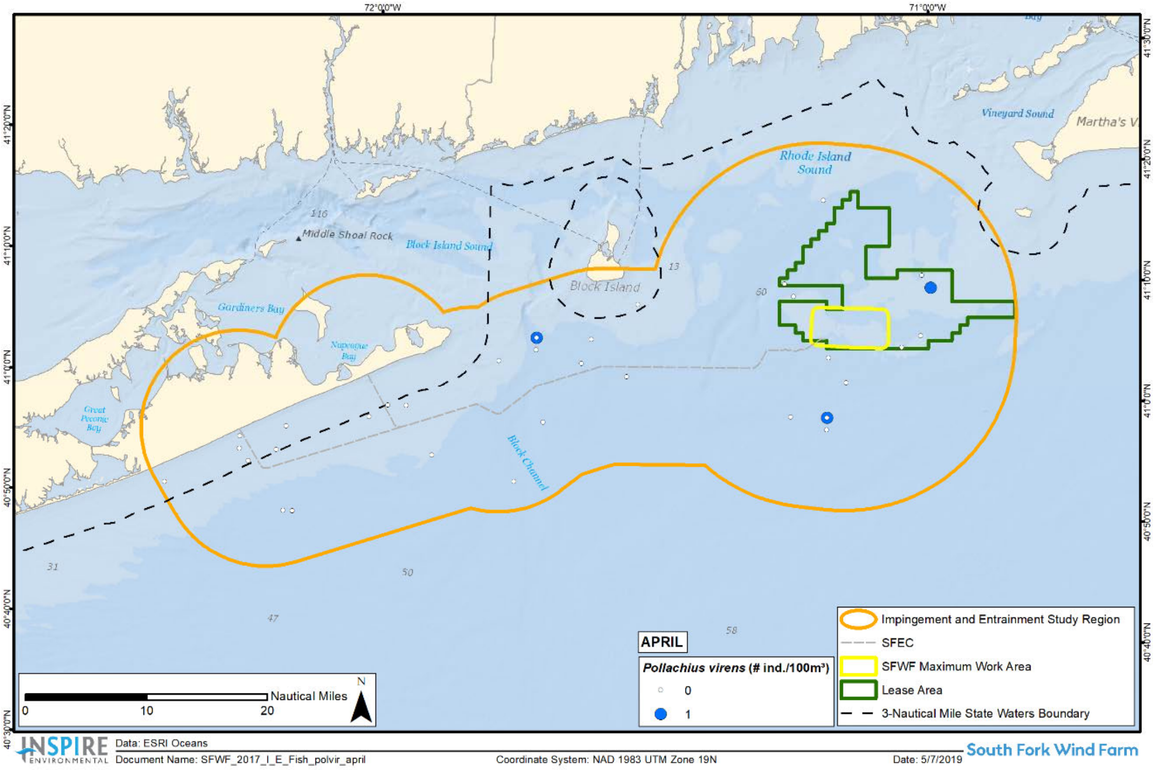

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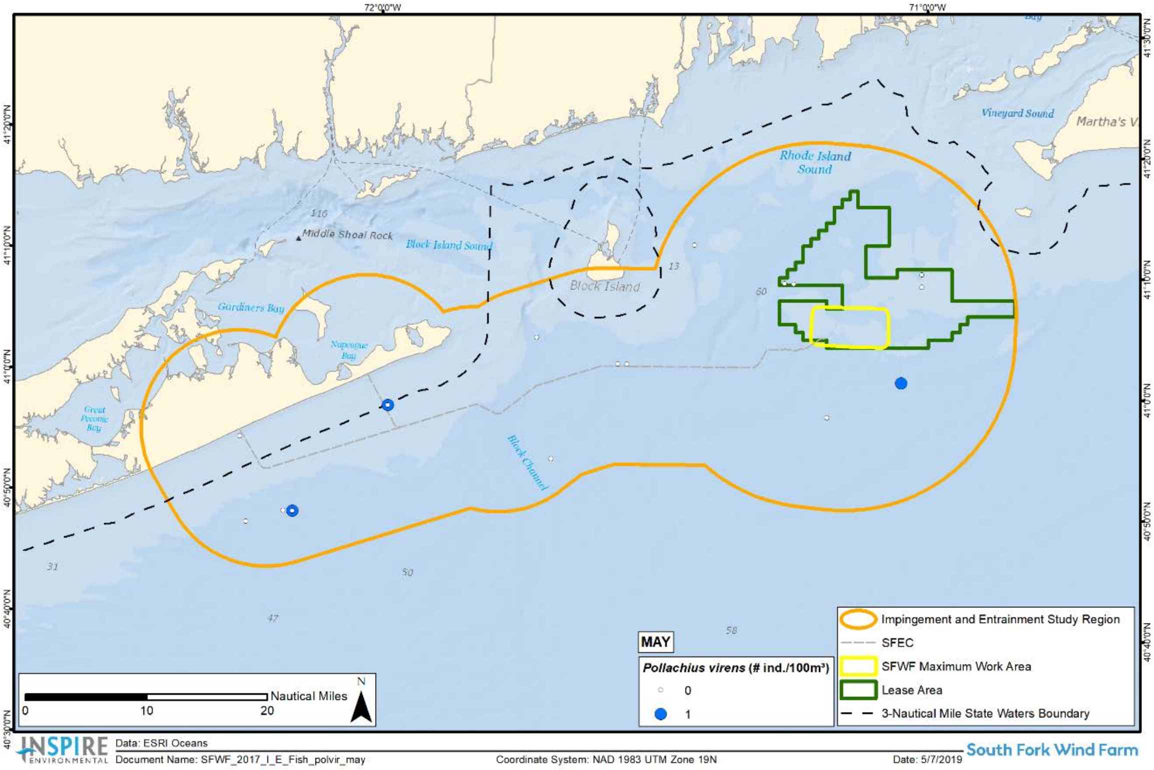
Figure 3-5a. Raw MARMAP and EcoMon Pollock (*Pollachius virens*) densities across all study time period months (top panel) and for the month of April (bottom panel).



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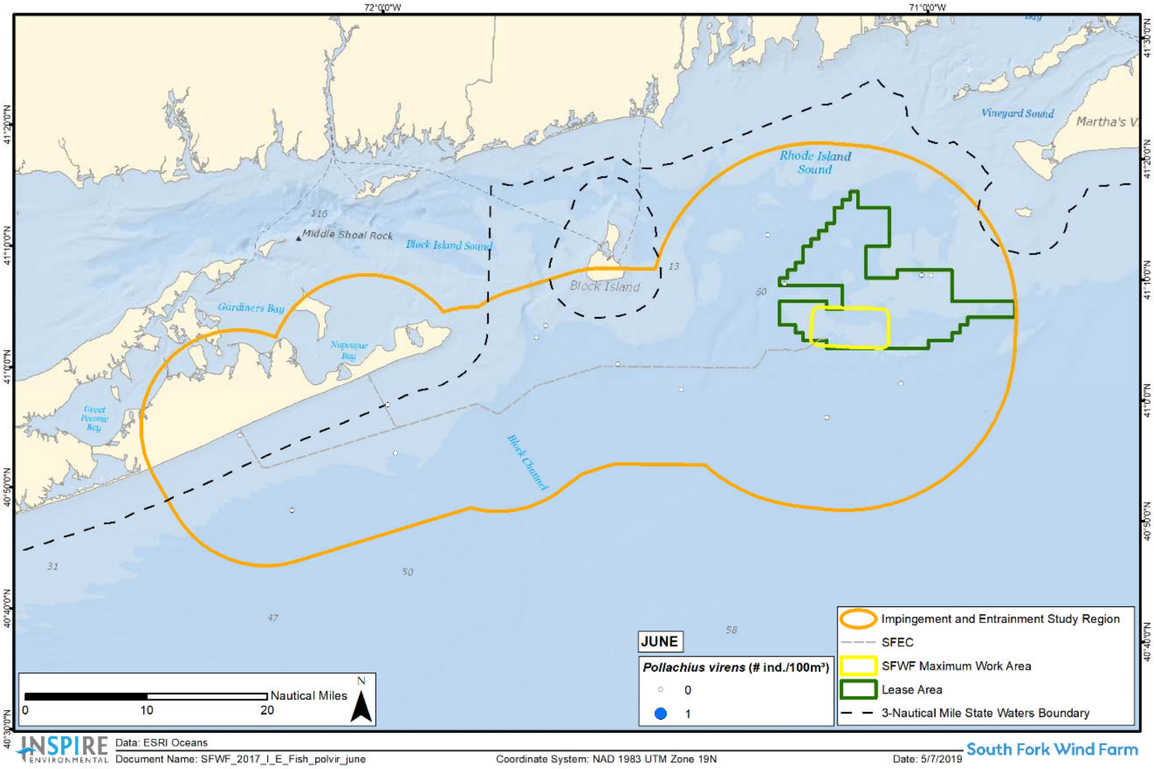

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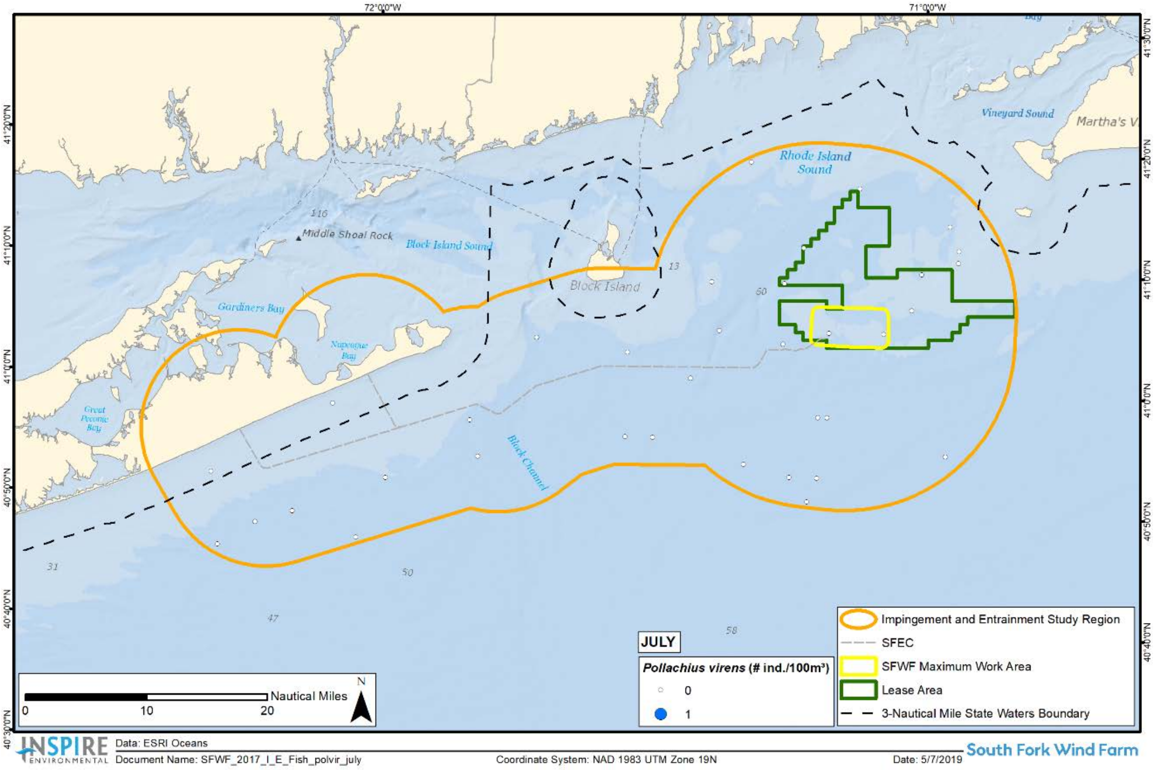
Figure 3-5b. Raw MARMAP and EcoMon Pollock (*Pollachius virens*) densities for the months of May (top panel) and June (bottom panel).



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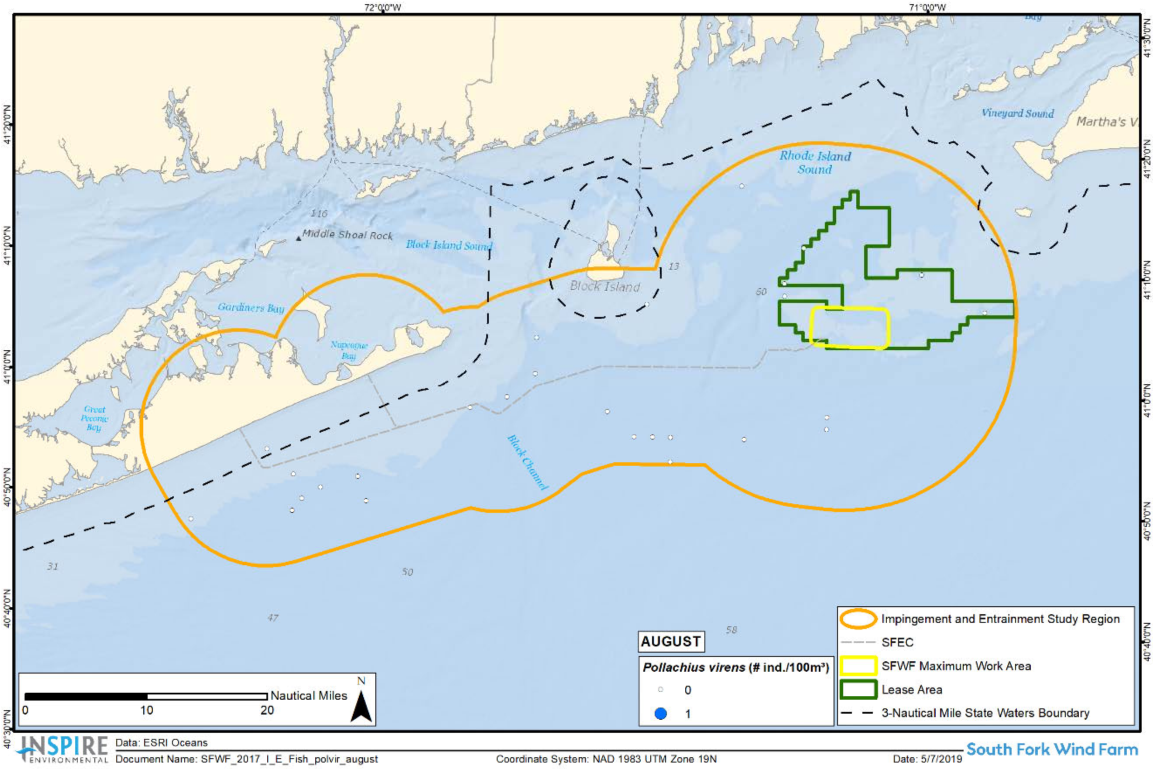

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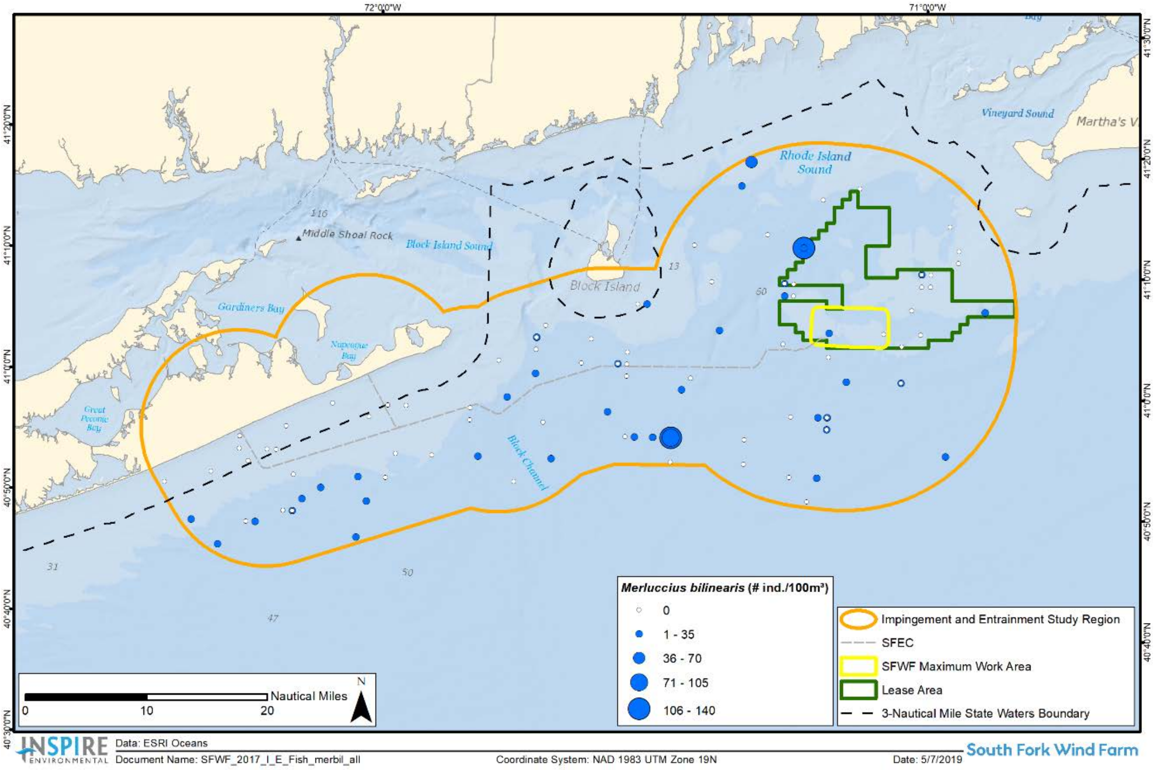
Figure 3-5c. Raw MARMAP and EcoMon Pollock (*Pollachius virens*) densities for the months of July (top panel) and August (bottom panel).



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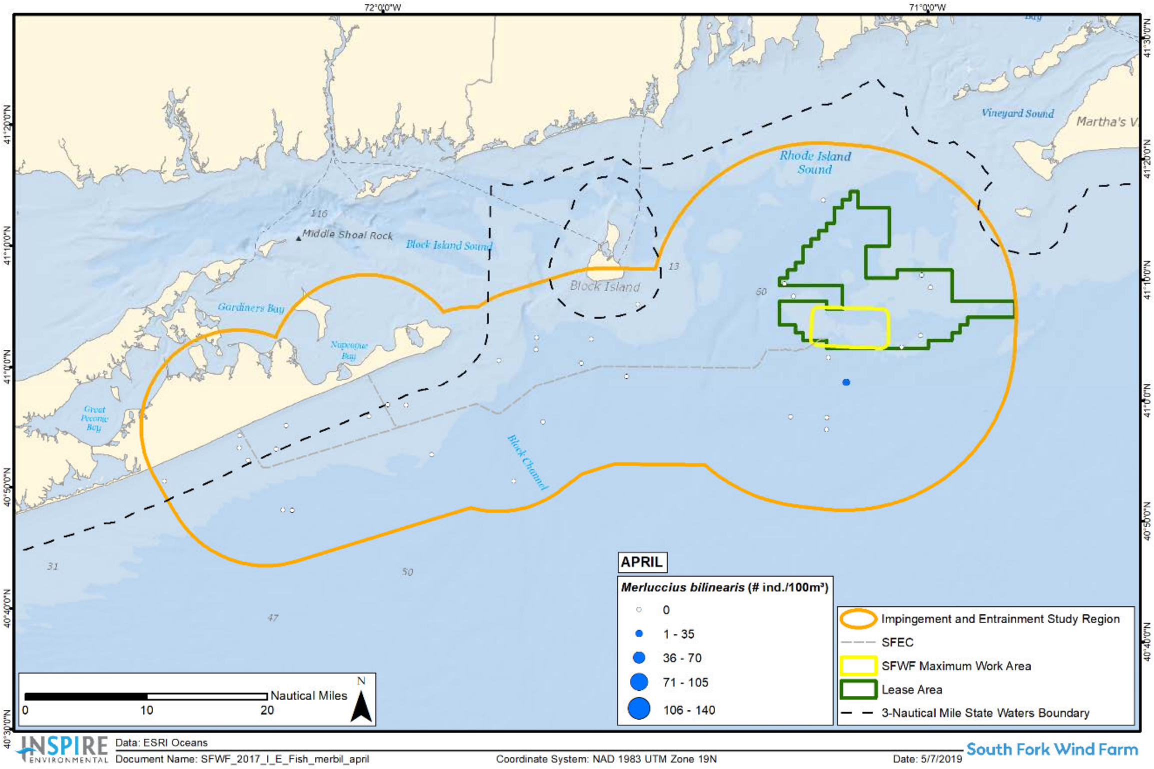
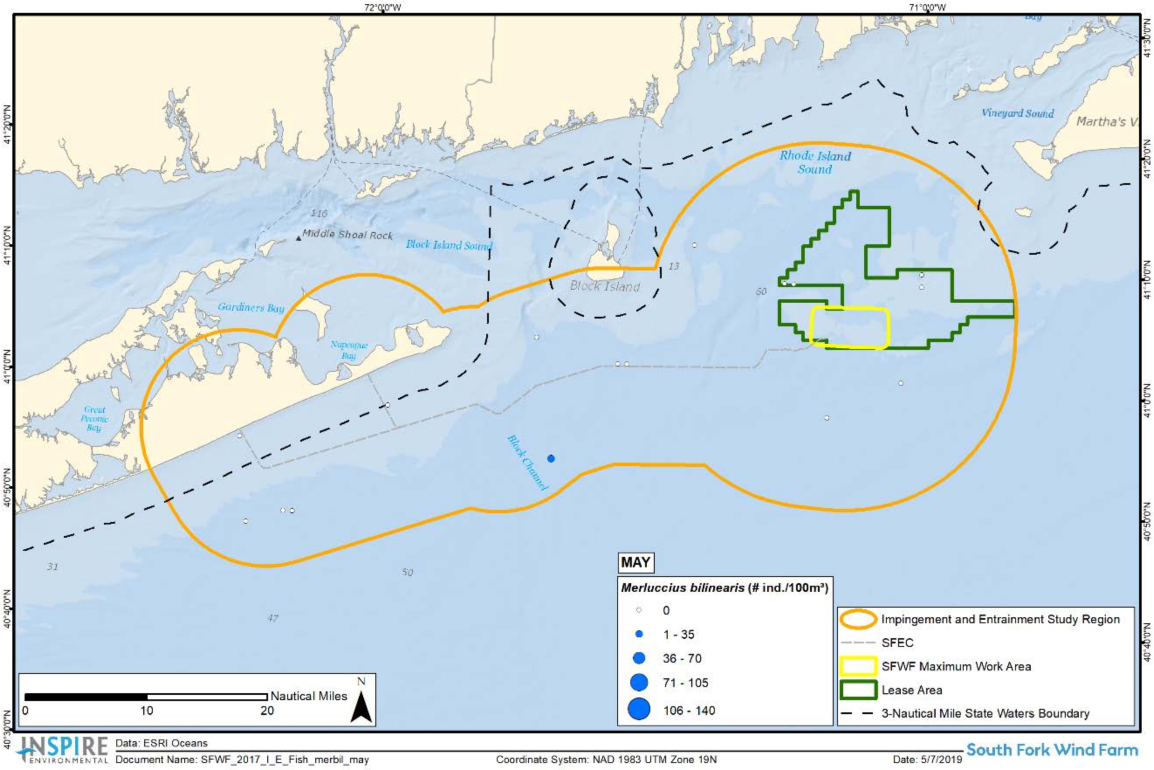


April

Figure 3-6a. Raw MARMAP and EcoMon Silver hake (*Merluccius bilinearis*) densities across all study time period months (top panel) and for the month of April (bottom panel).



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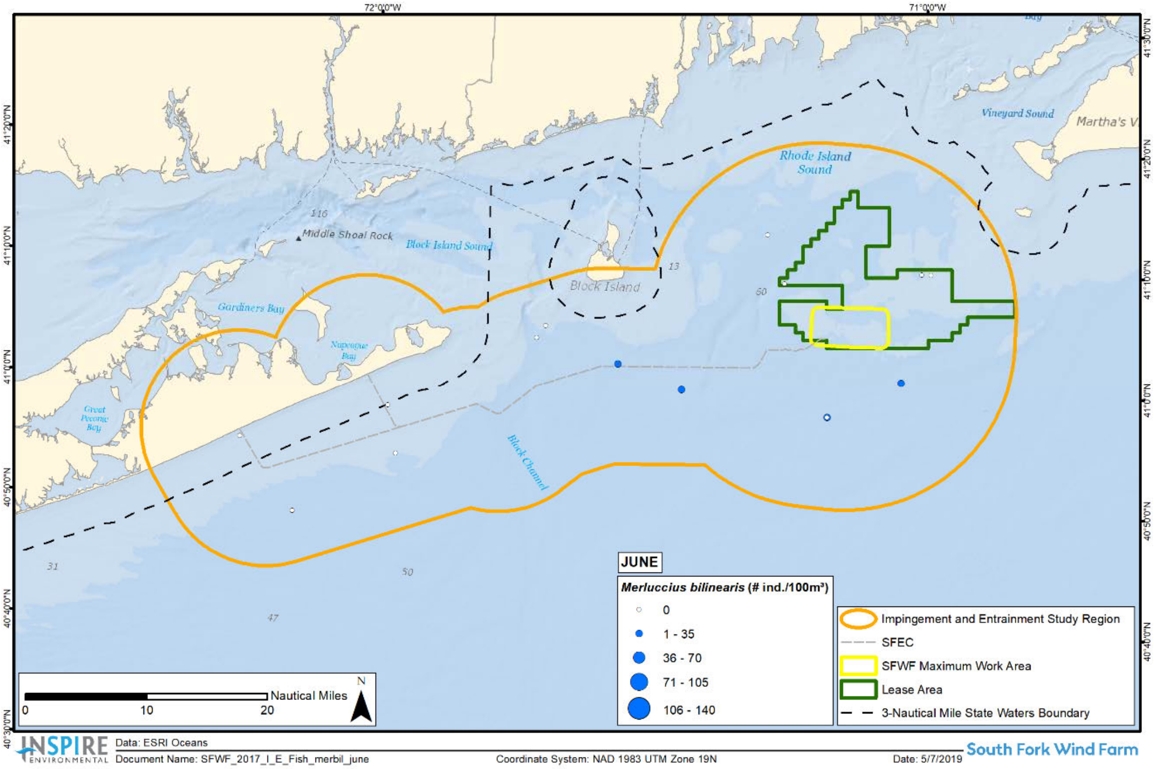

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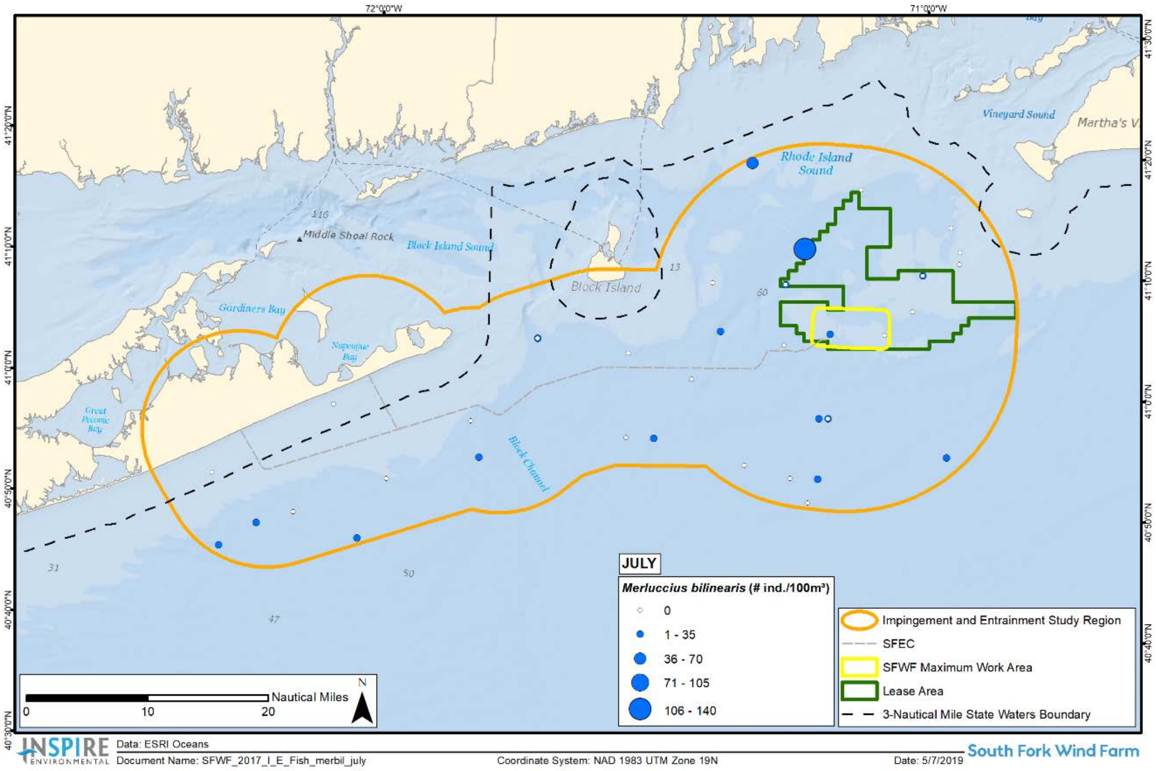
Figure 3-6b. Raw MARMAP and EcoMon Silver hake (*Merluccius bilinearis*) densities for the months of May (top panel) and June (bottom panel).



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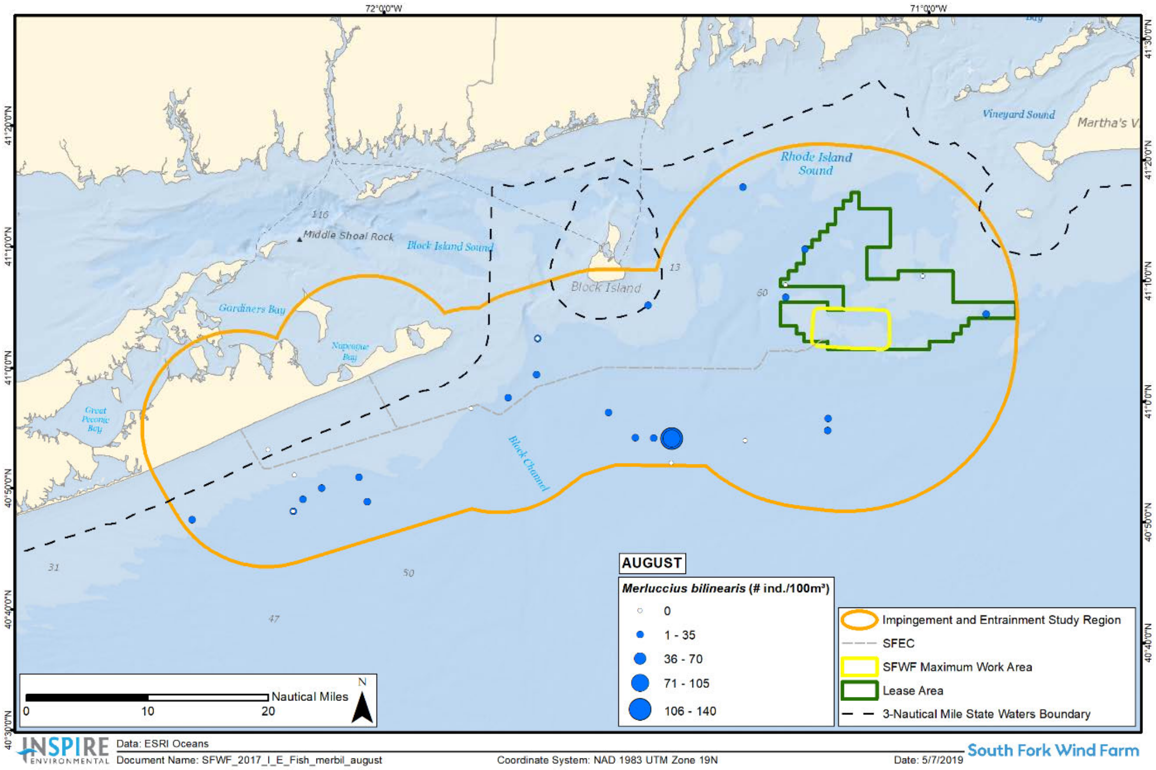
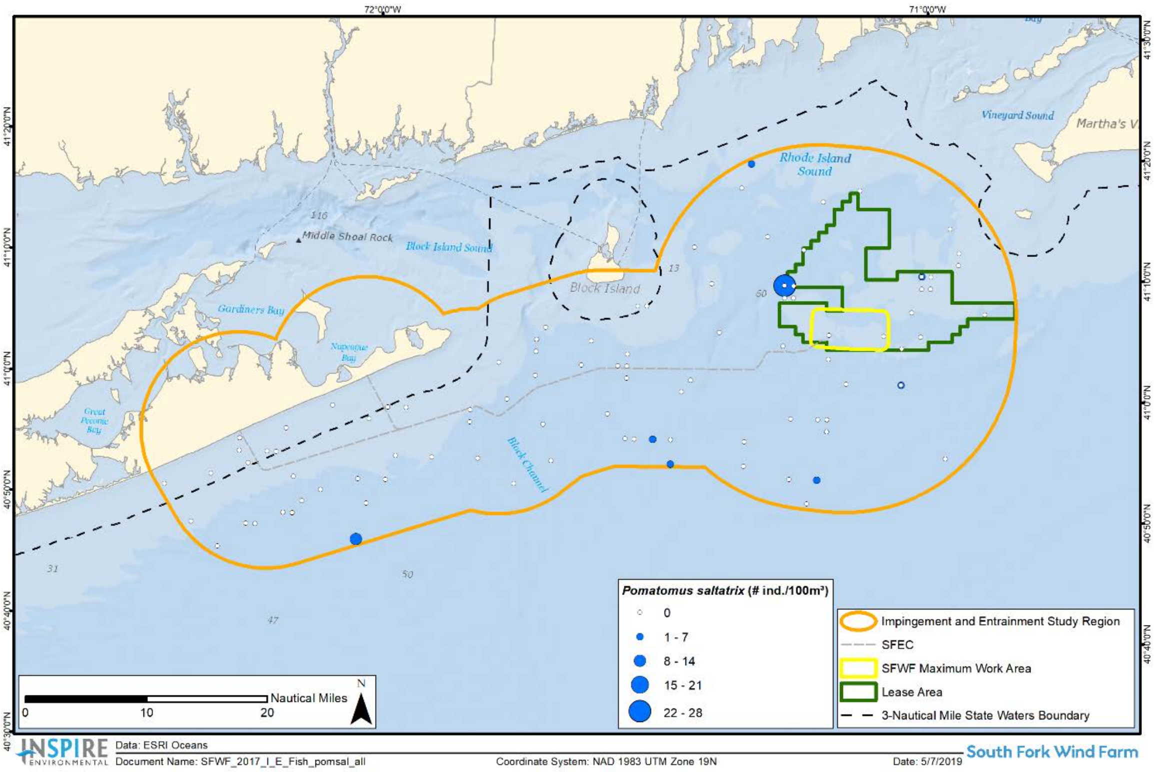


August

Figure 3-6c. Raw MARMAP and EcoMon Silver hake (*Merluccius bilinearis*) densities for the months of July (top panel) and August (bottom panel).



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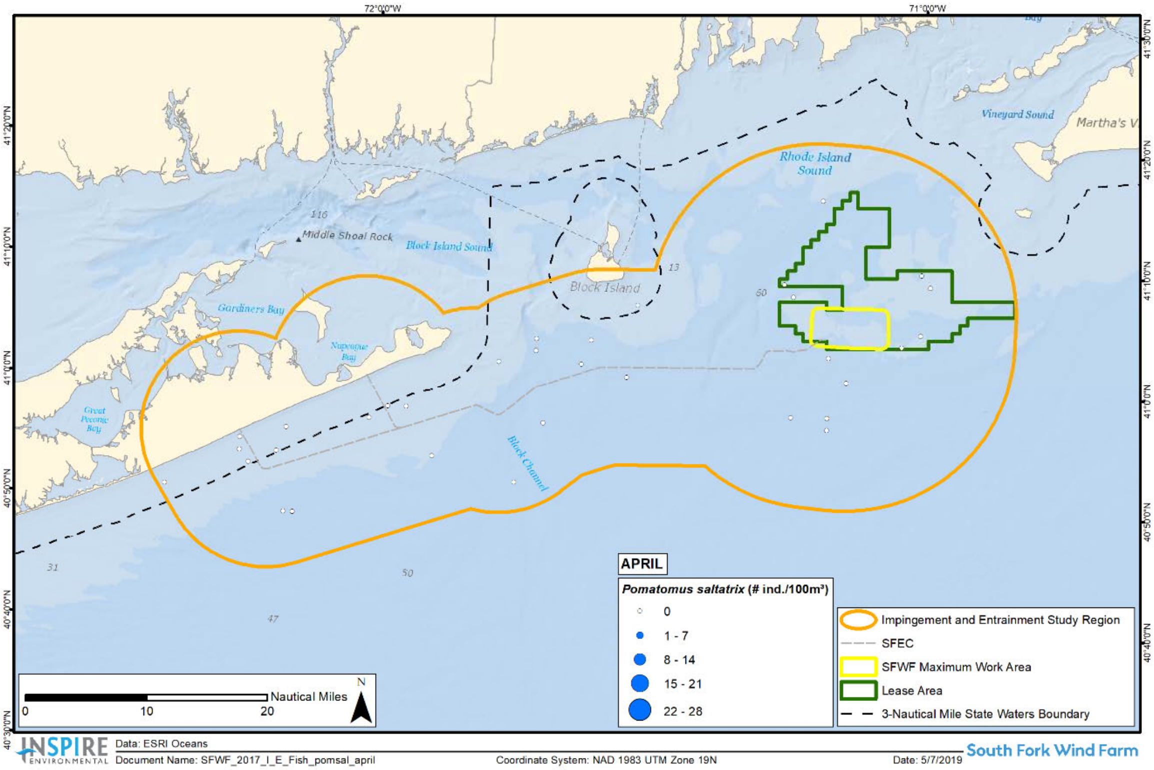

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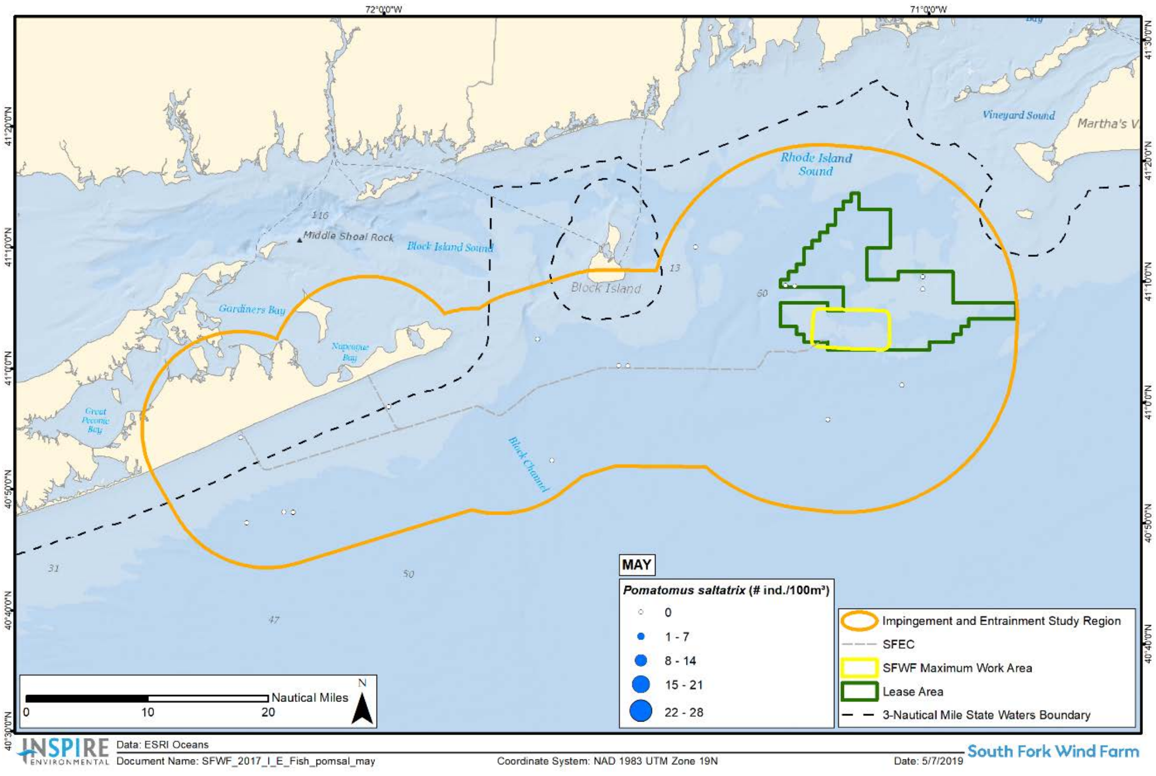
Figure 3-7a. Raw MARMAP and EcoMon Bluefish (*Pomatomus saltatrix*) densities across all study time period months (top panel) and for the month of April (bottom panel).



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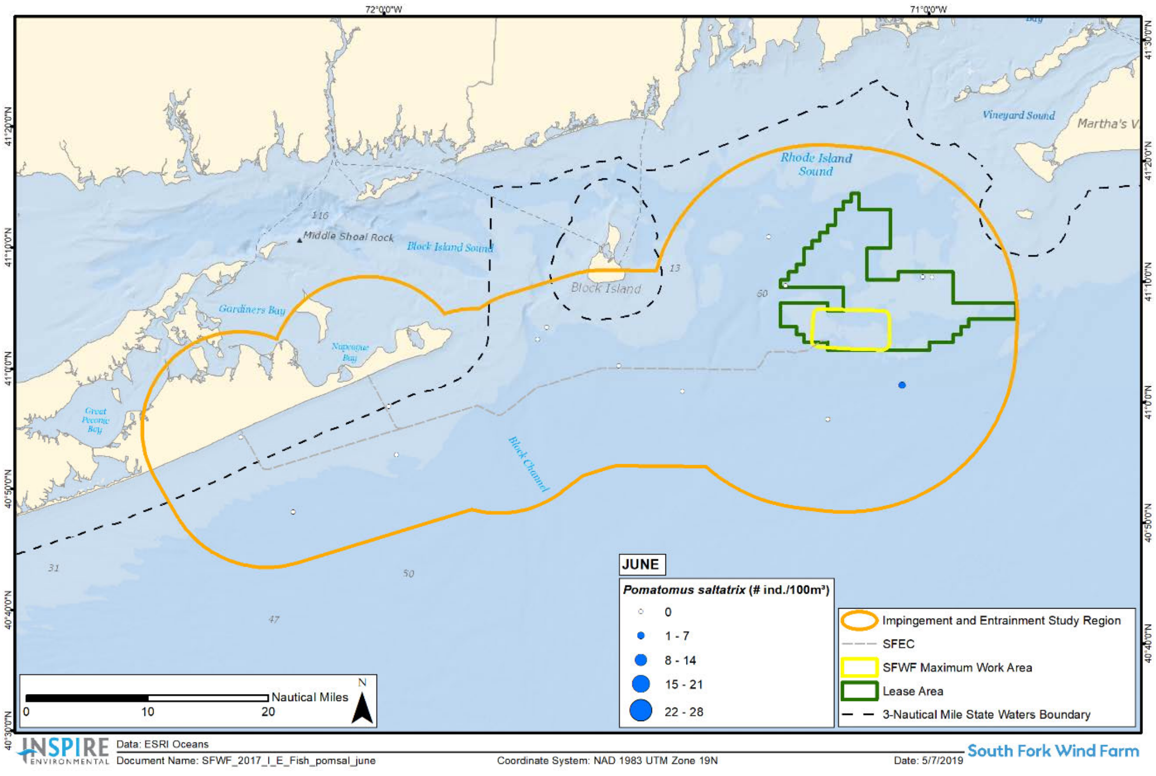
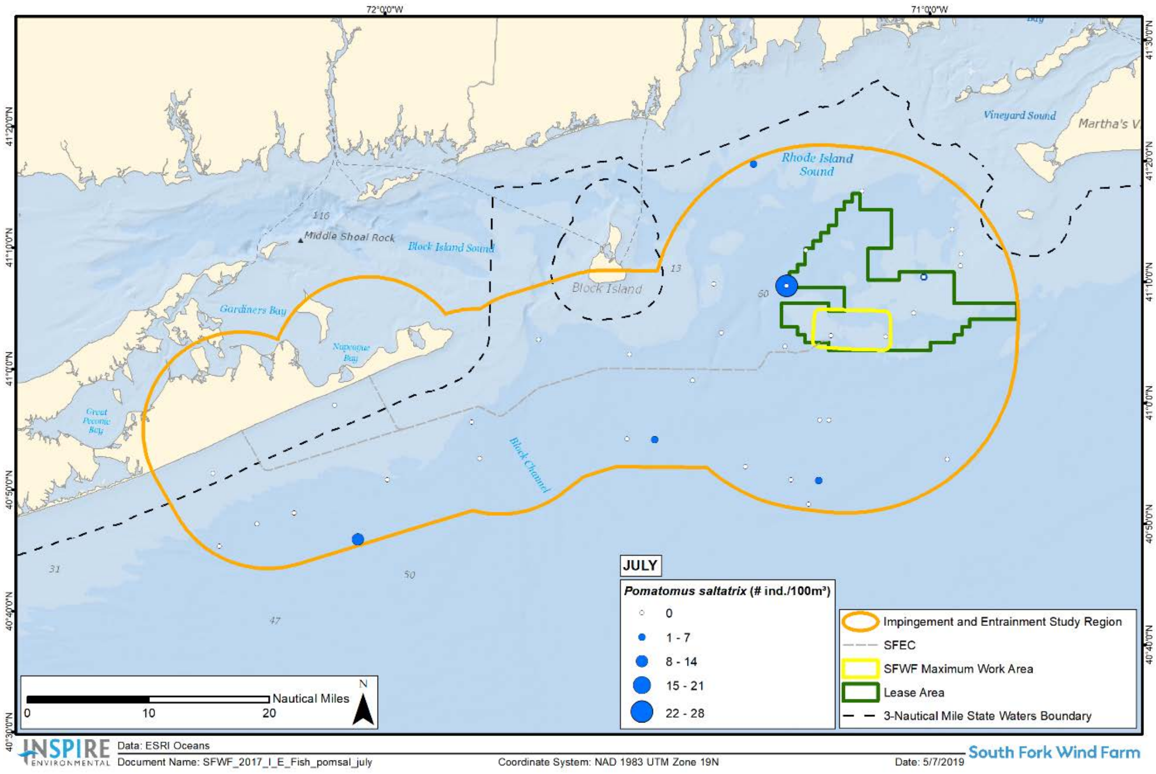
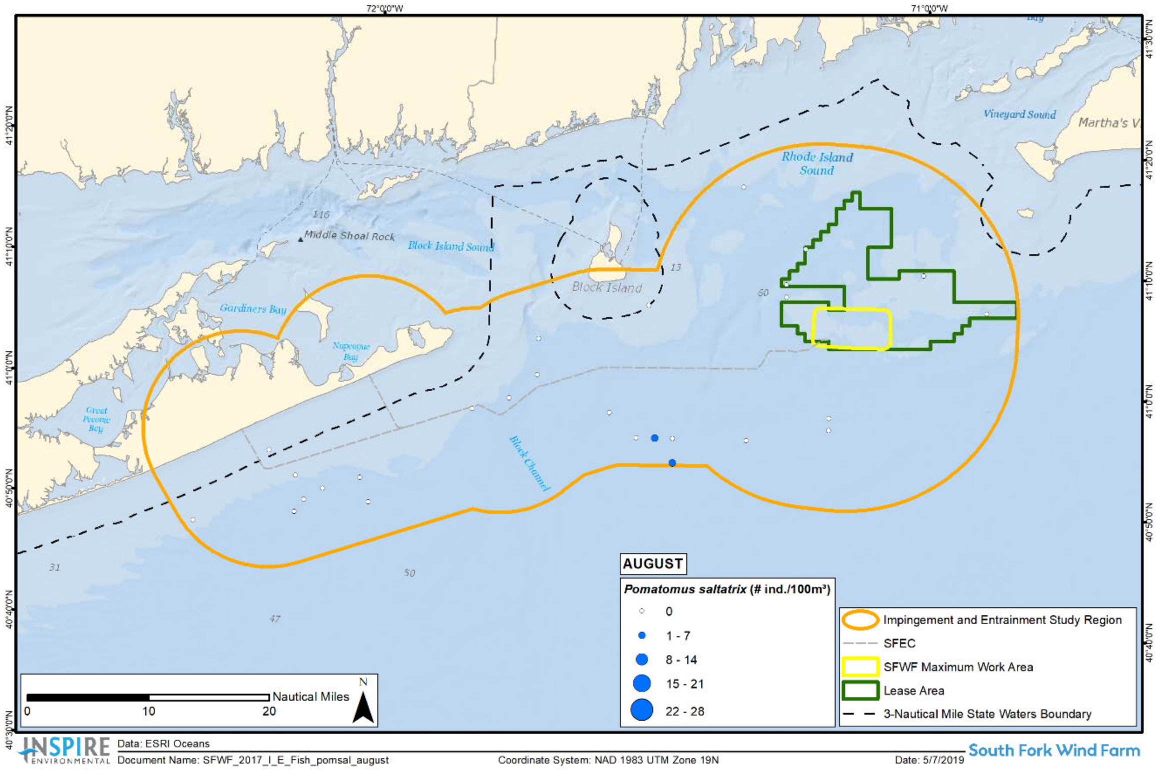


June

Figure 3-7b. Raw MARMAP and EcoMon Bluefish (*Pomatomus saltatrix*) densities for the months of May (top panel) and June (bottom panel).

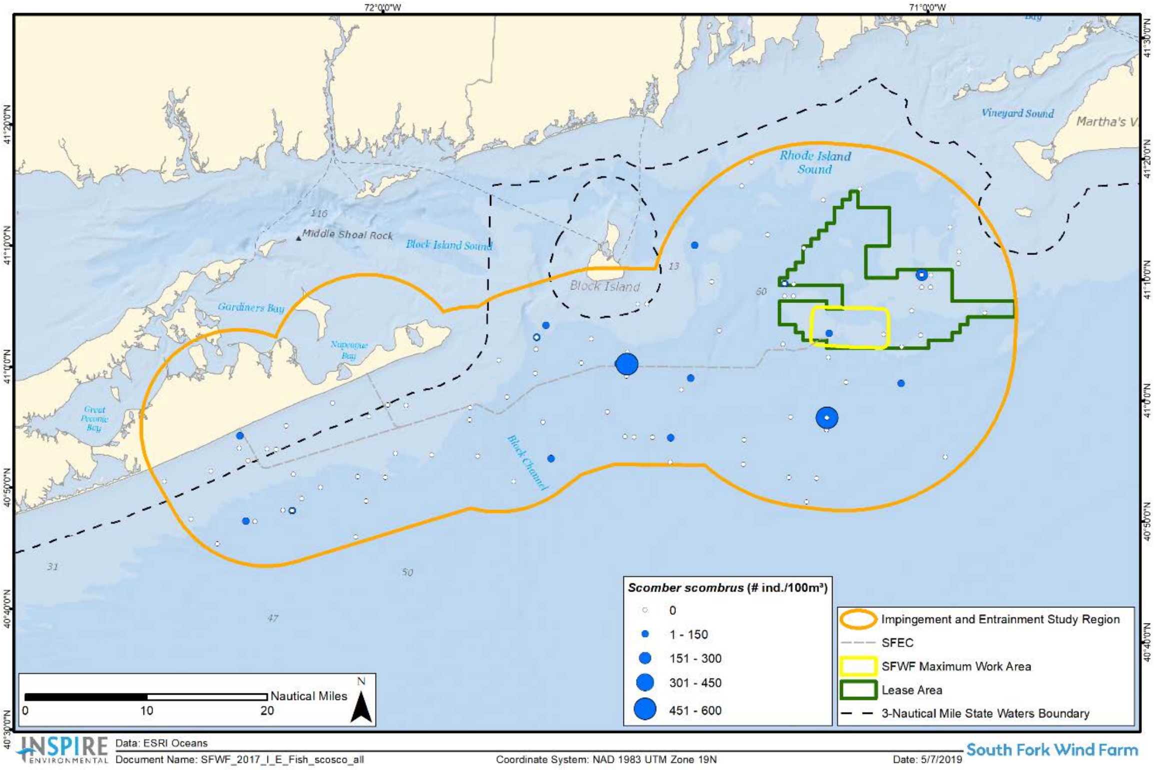


July

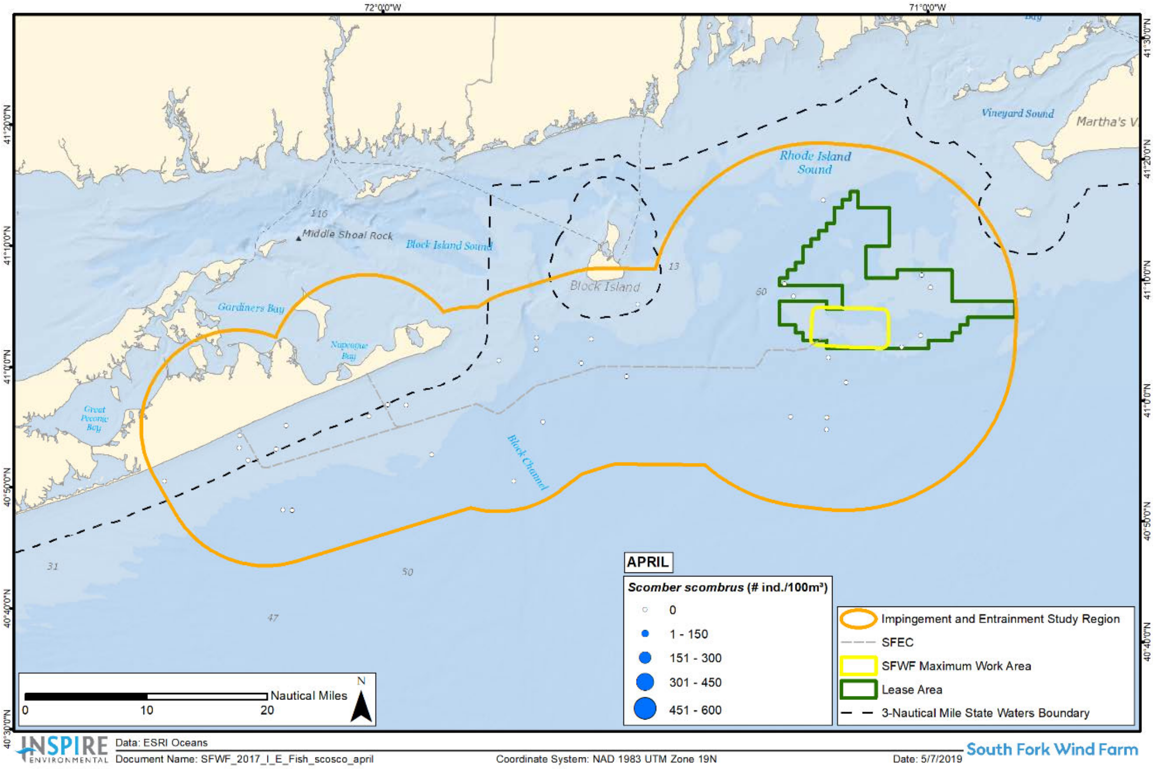


August

Figure 3-7c. Raw MARMAP and EcoMon Bluefish (*Pomatomus saltatrix*) densities for the months of July (top panel) and August (bottom panel).

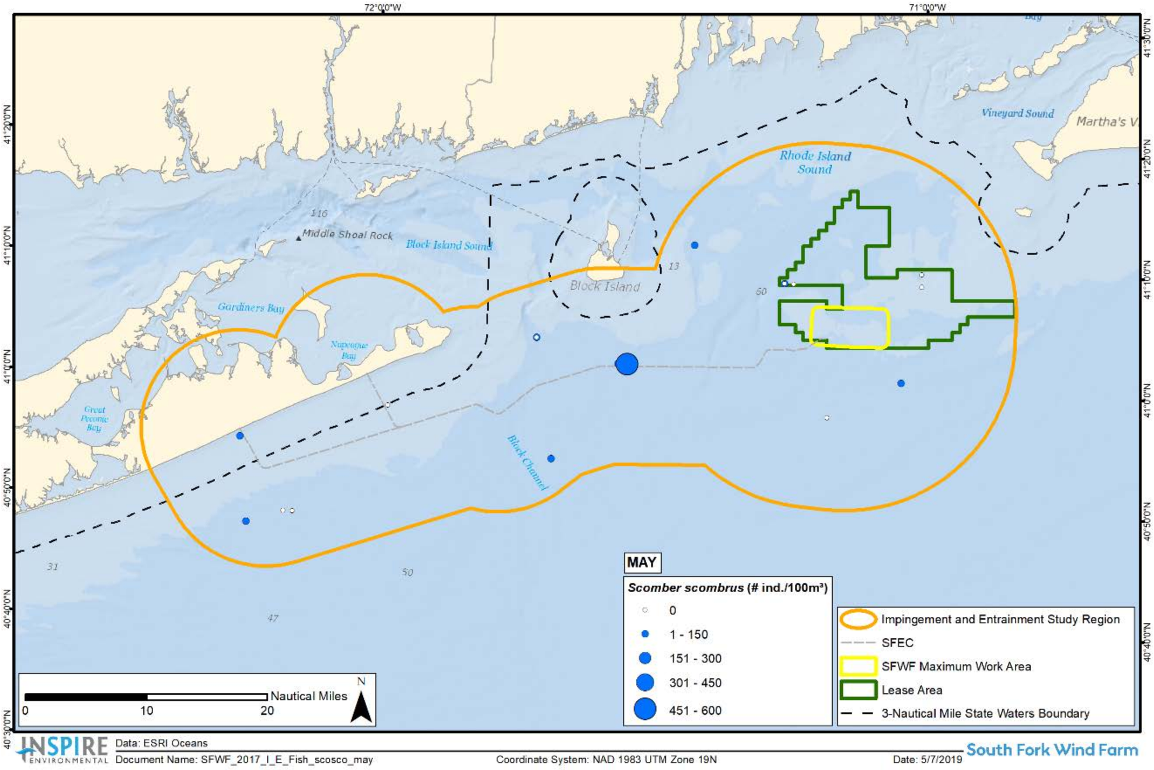


All Study Months (April – August)

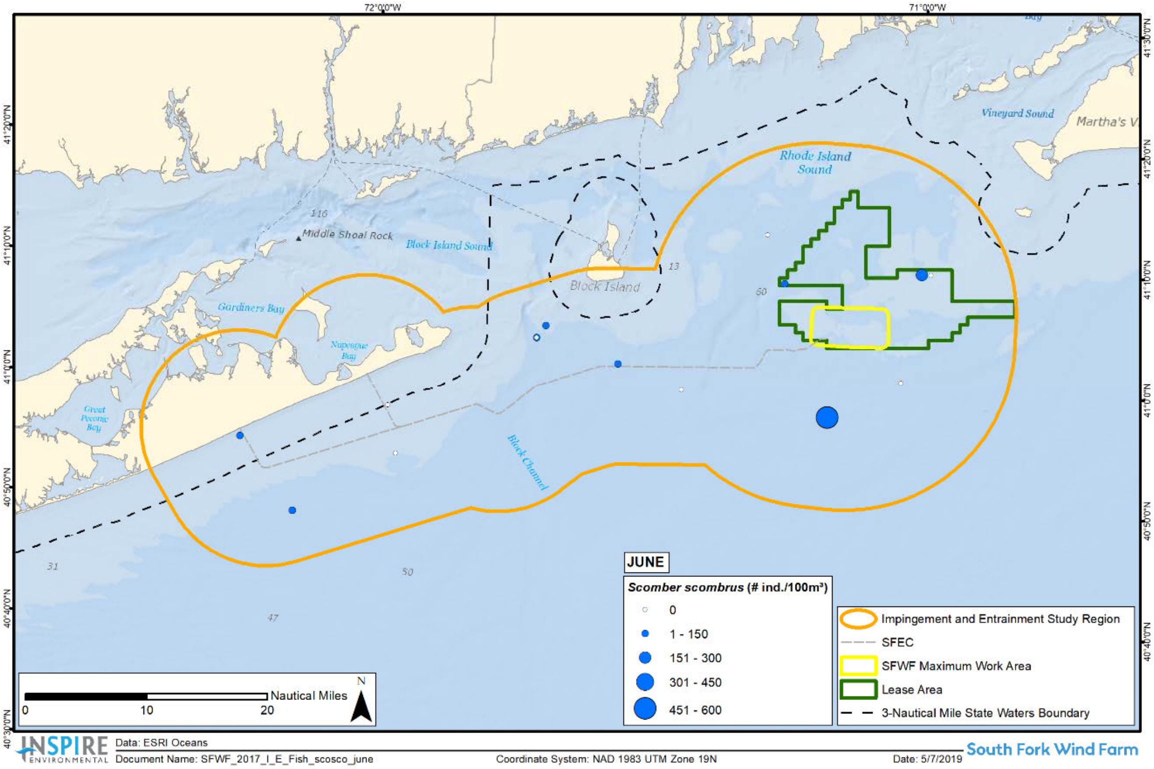


April

Figure 3-8a. Raw MARMAP and EcoMon Atlantic mackerel (*Scomber scombrus*) densities across all study time period months (top panel) and for the month of April (bottom panel).

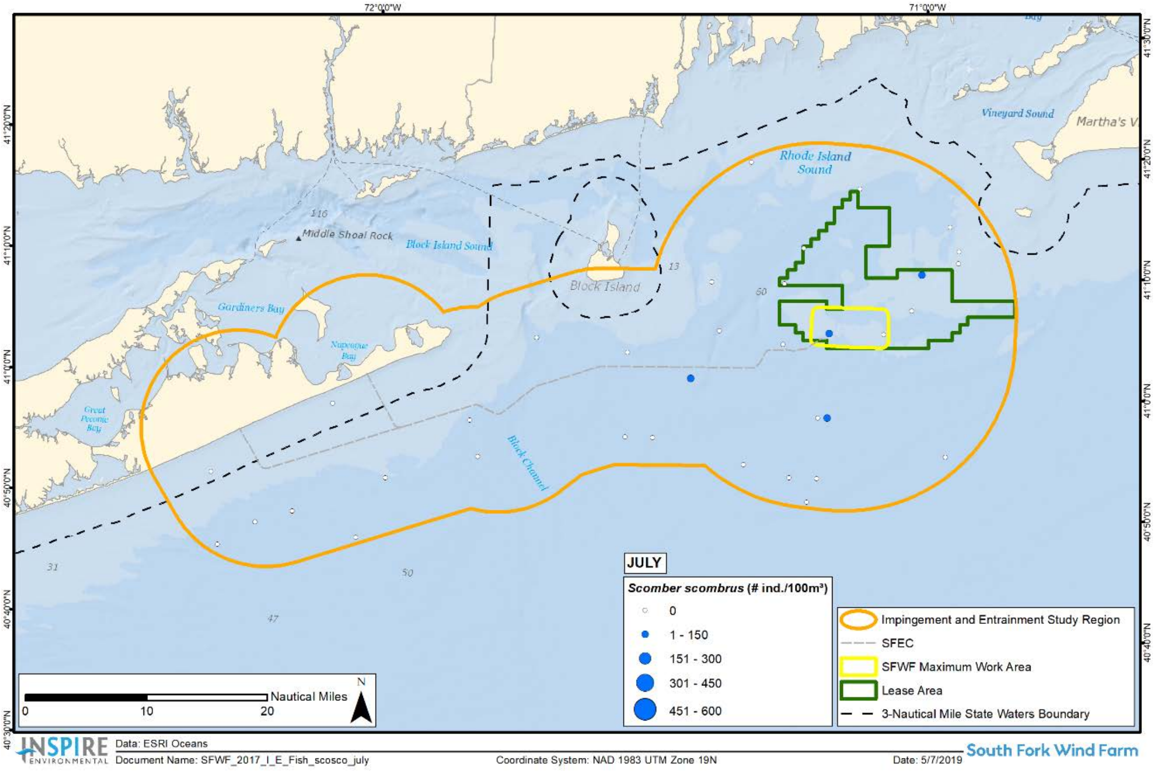


May

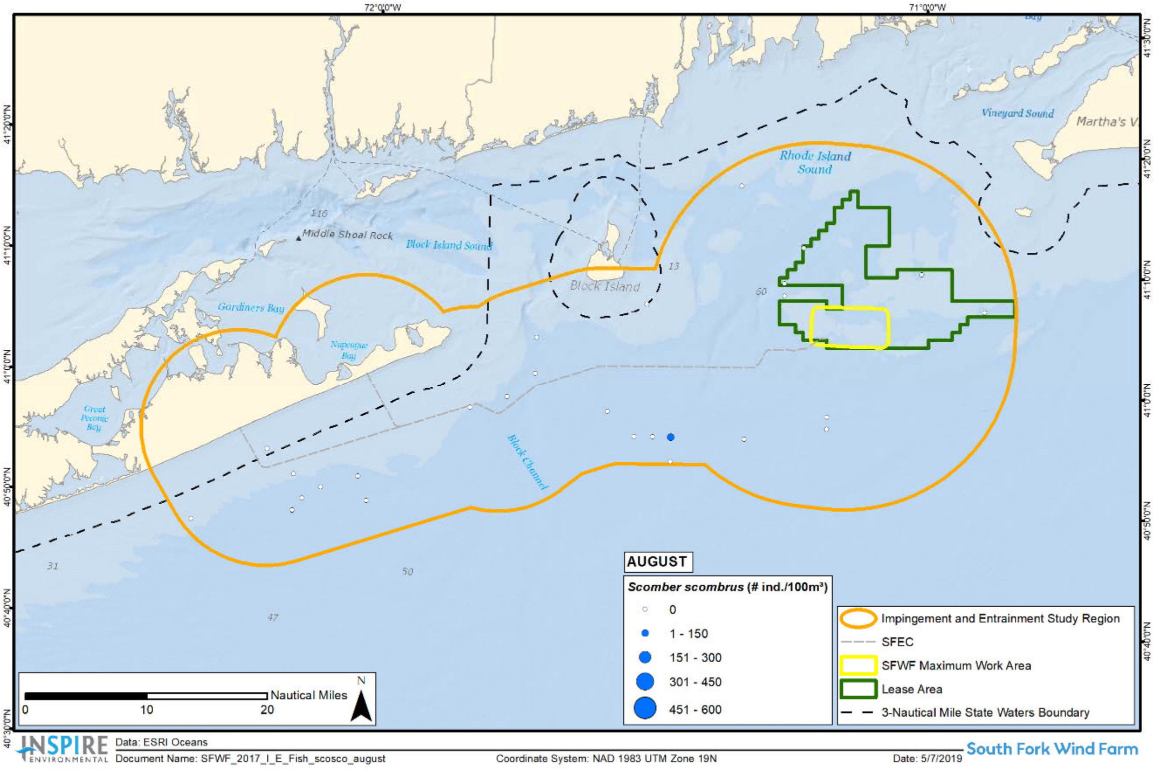


June

Figure 3-8b. Raw MARMAP and EcoMon Atlantic mackerel (*Scomber scombrus*) densities for the months of May (top panel) and June (bottom panel).

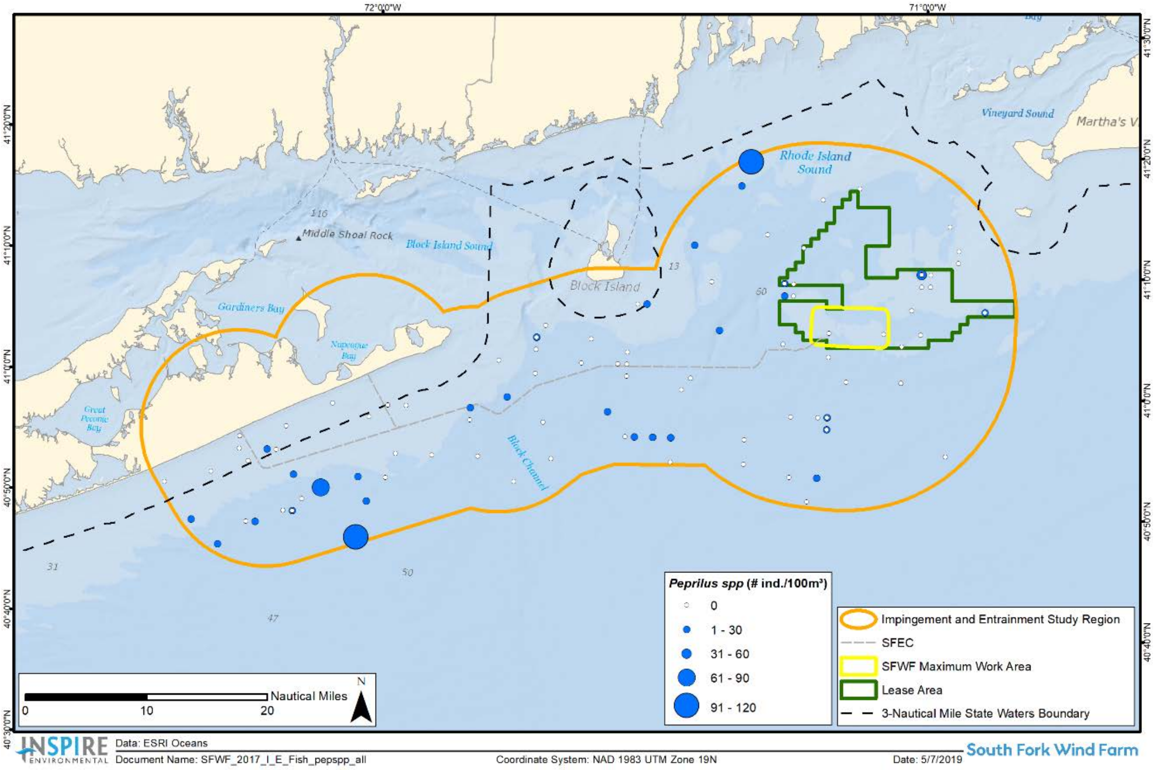


July

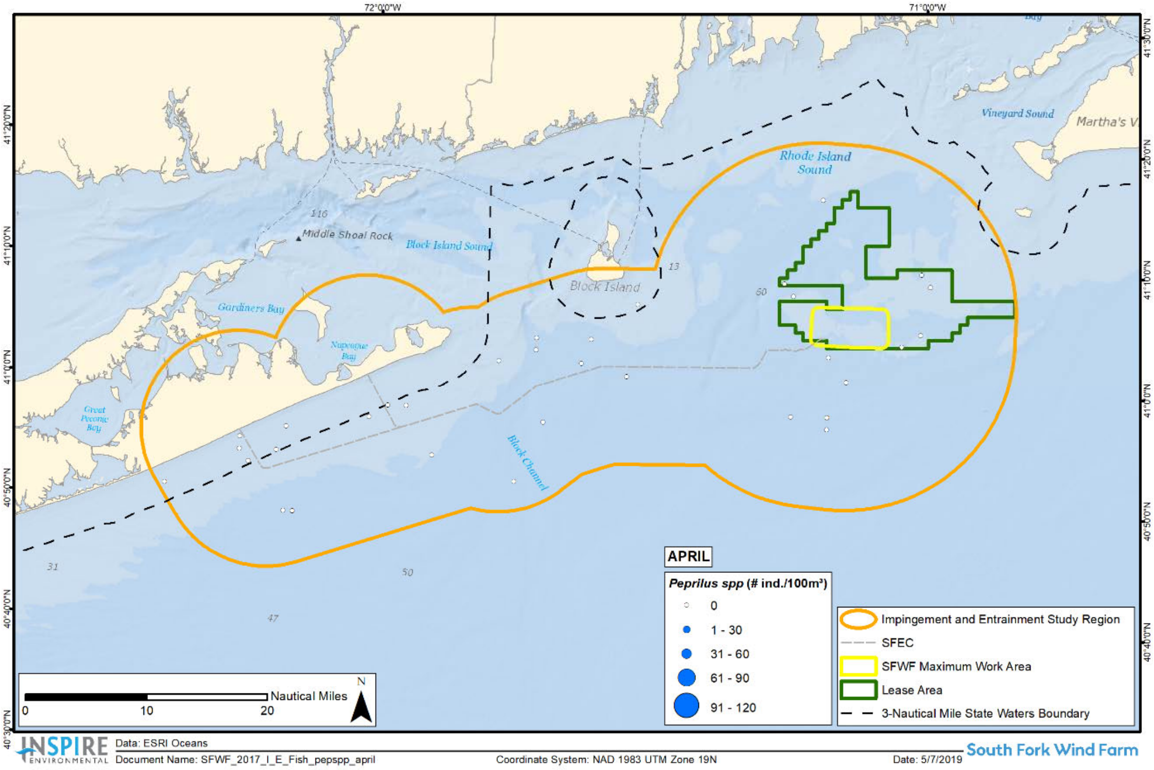


August

Figure 3-8c. Raw MARMAP and EcoMon Atlantic mackerel (*Scomber scombrus*) densities for the months of July (top panel) and August (bottom panel).

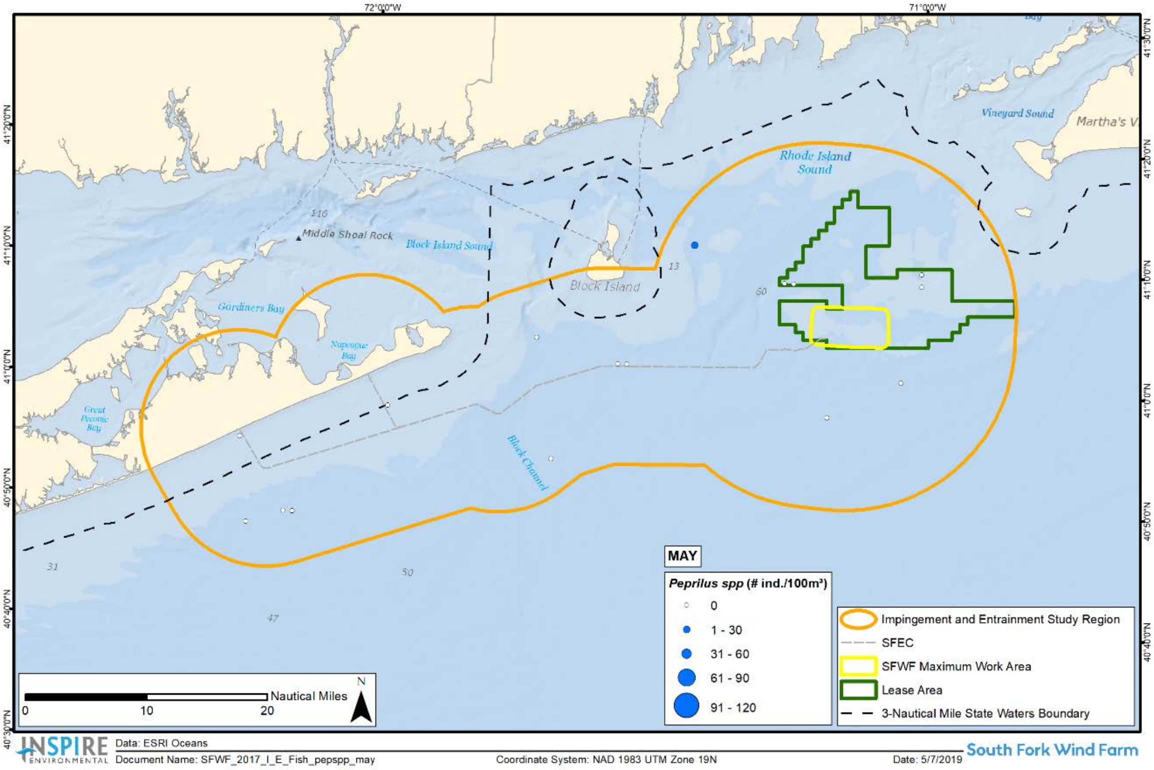


All Study Months (April – August)

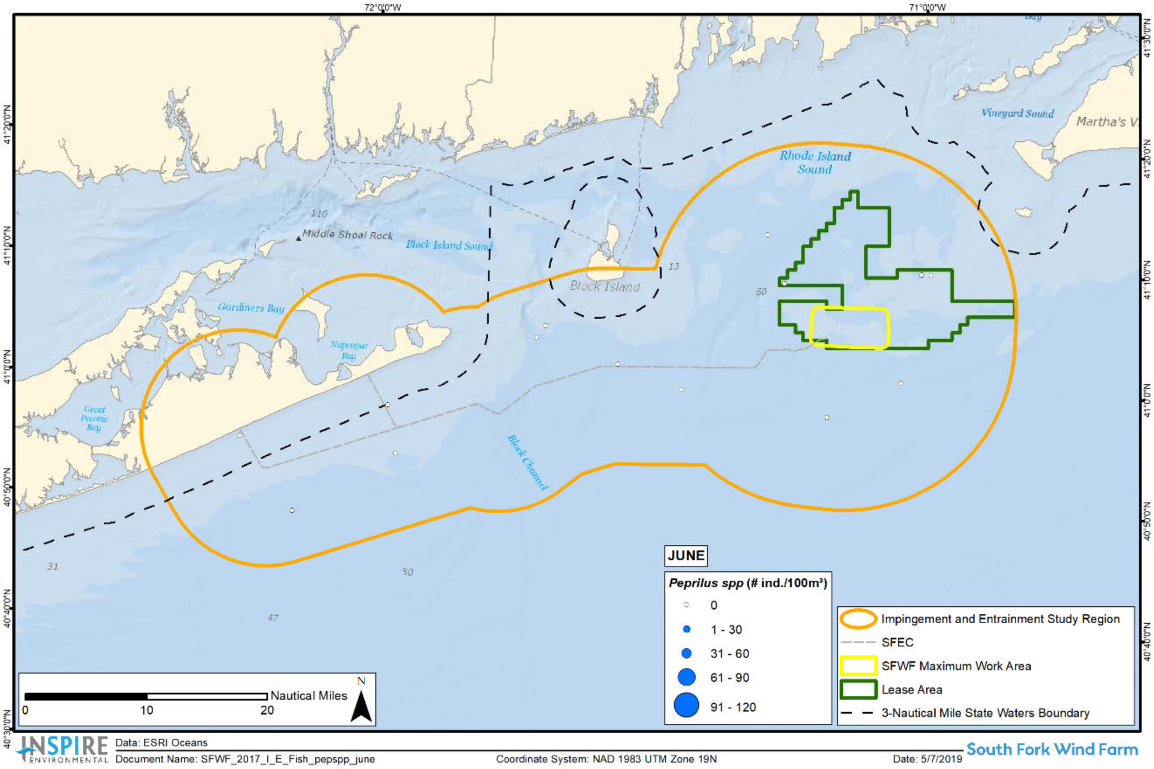


April

Figure 3-9a. Raw MARMAP and EcoMon Butterfish (Peprilus spp) densities across all study time period months (top panel) and for the month of April (bottom panel).

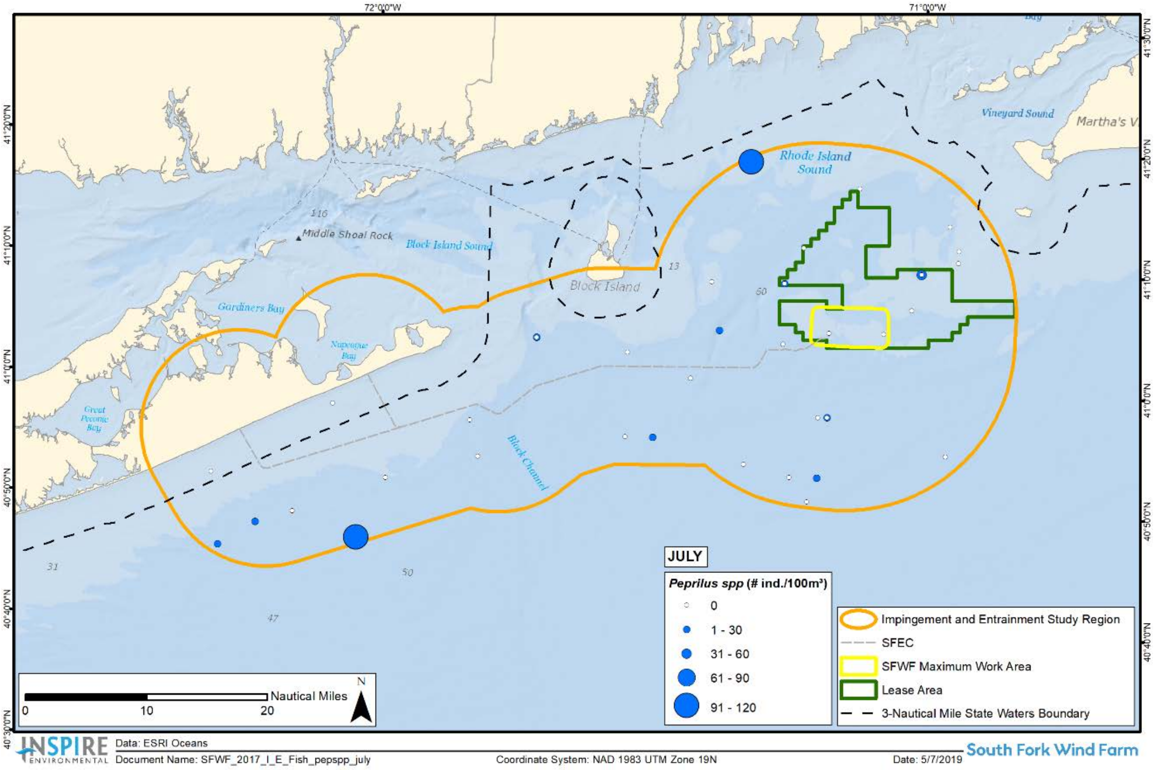


May

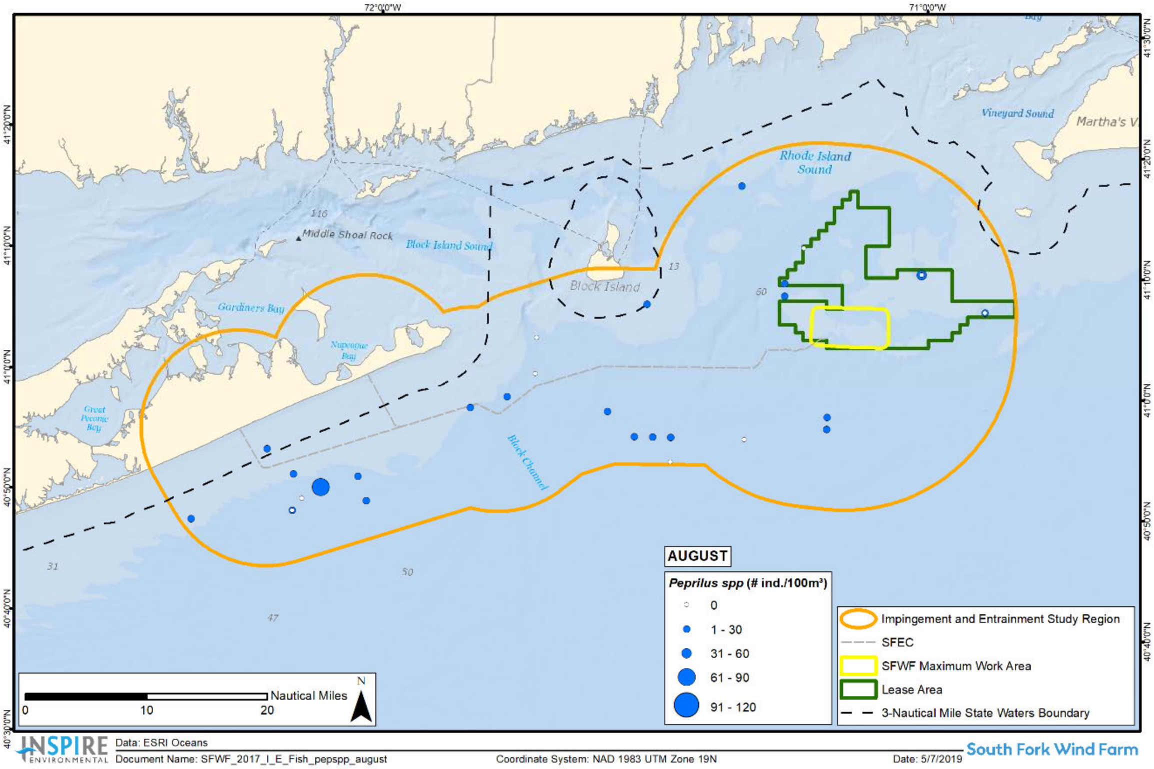


June

Figure 3-9b. Raw MARMAP and EcoMon Butterfish (Peprilus spp) densities for the months of May (top panel) and June (bottom panel).

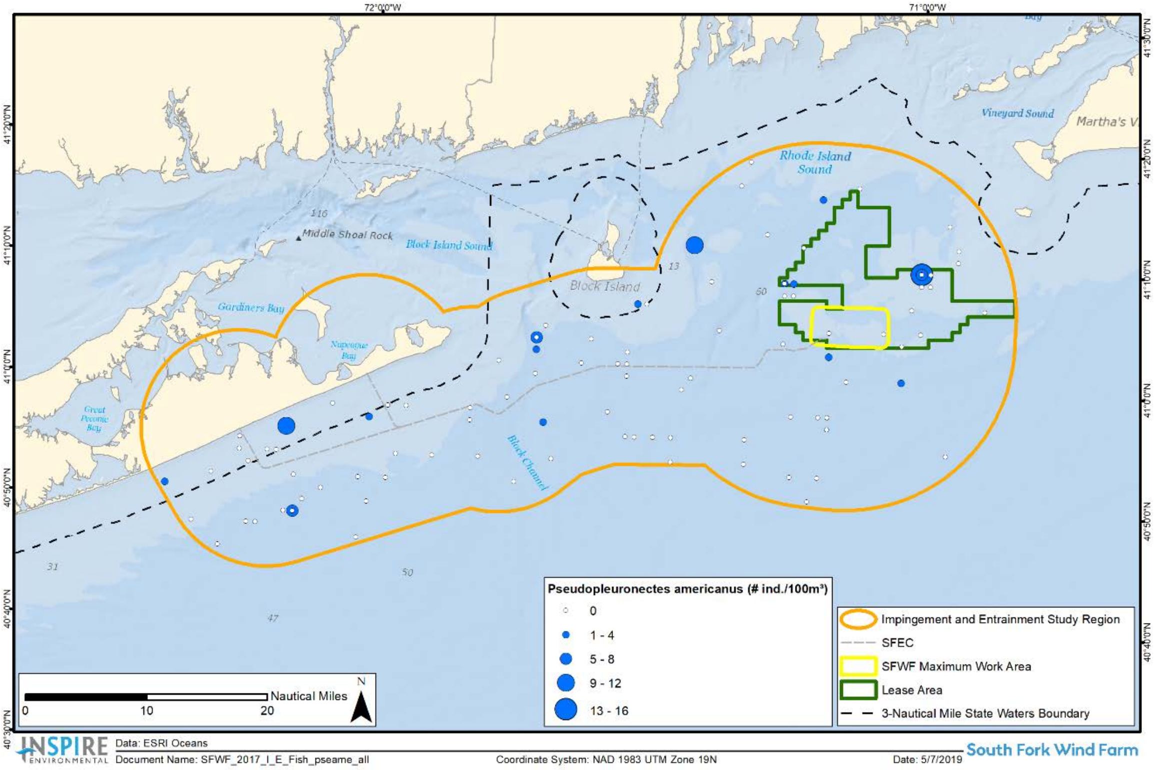


July

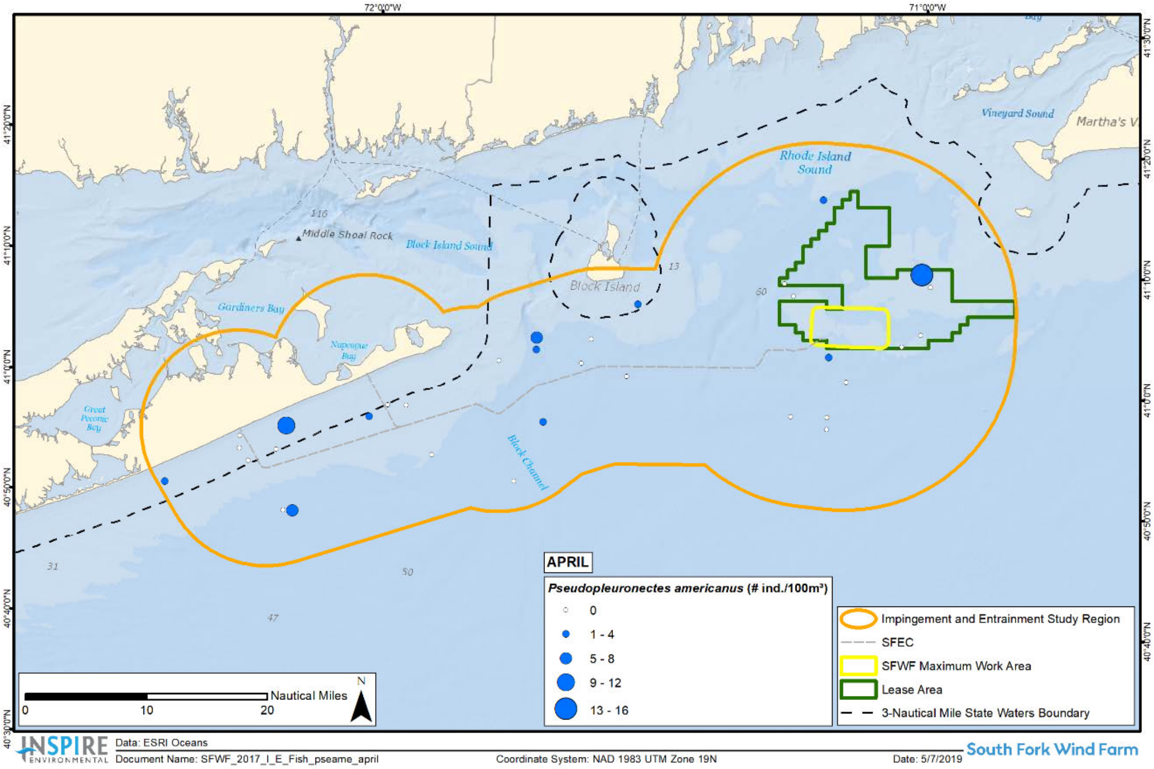


August

Figure 3-9c. Raw MARMAP and EcoMon Butterfish (Peprilus spp) densities for the months of July (top panel) and August (bottom panel).

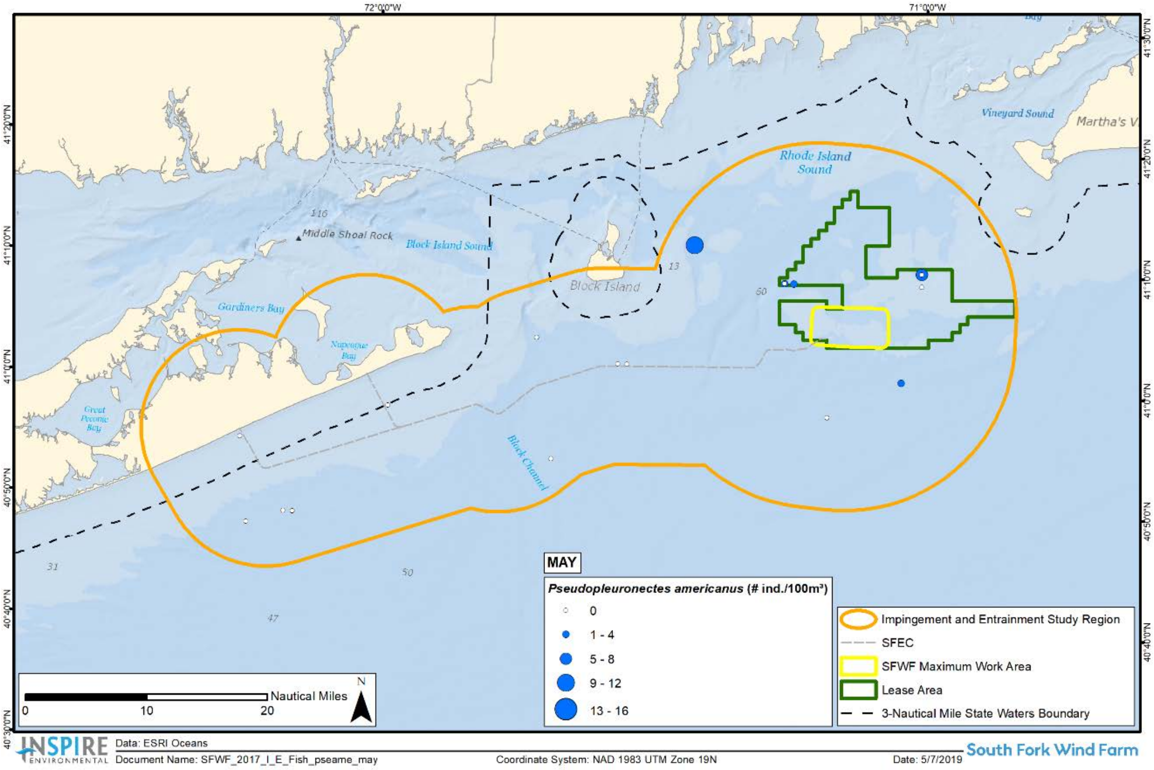


All Study Months (April – August)

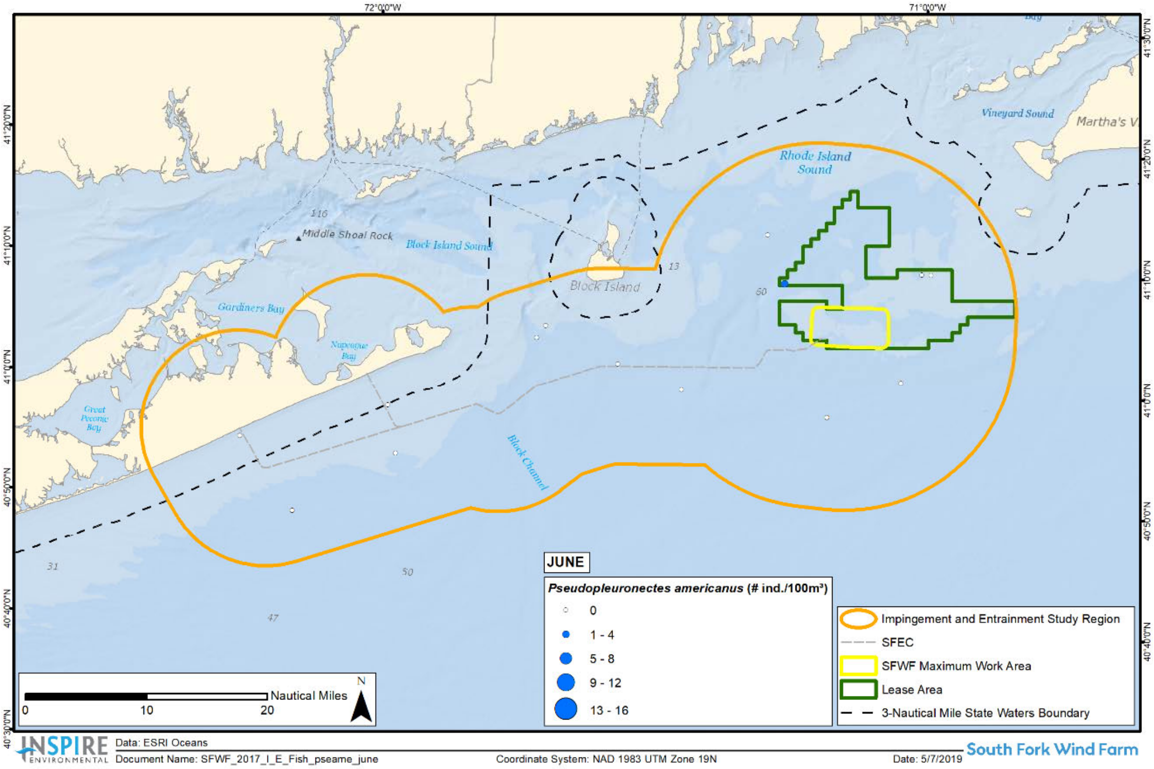


April

Figure 3-10a. Raw MARMAP and EcoMon Winter flounder (*Pseudopleuronectes americanus*) densities across all study time period months (top panel) and for the month of April (bottom panel).

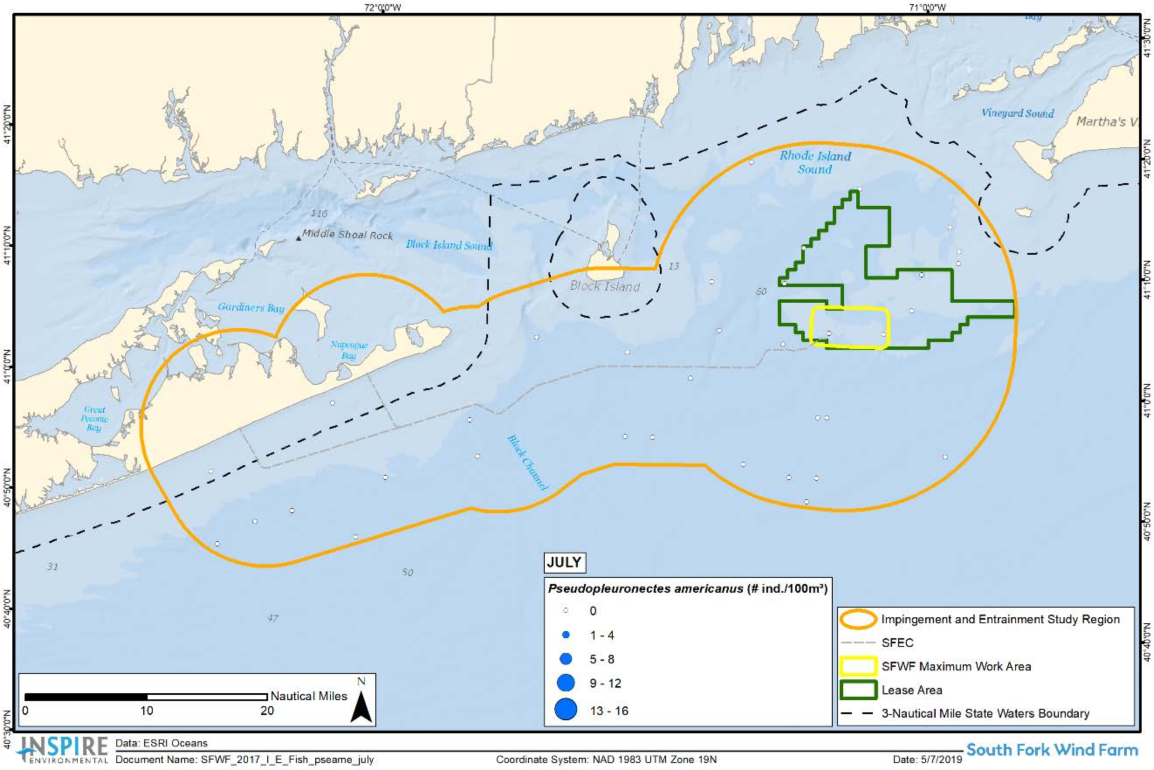


May

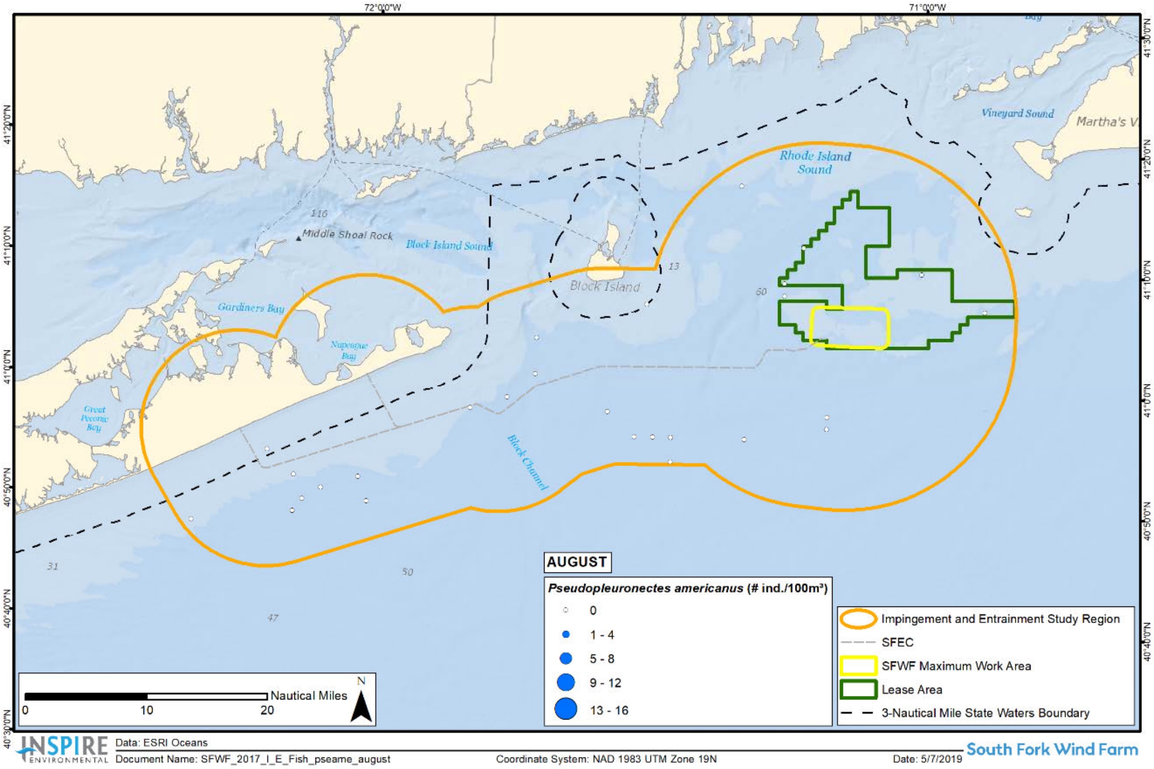


June

Figure 3-10b. Raw MARMAP and EcoMon Winter flounder (*Pseudopleuronectes americanus*) densities for the months of May (top panel) and June (bottom panel).

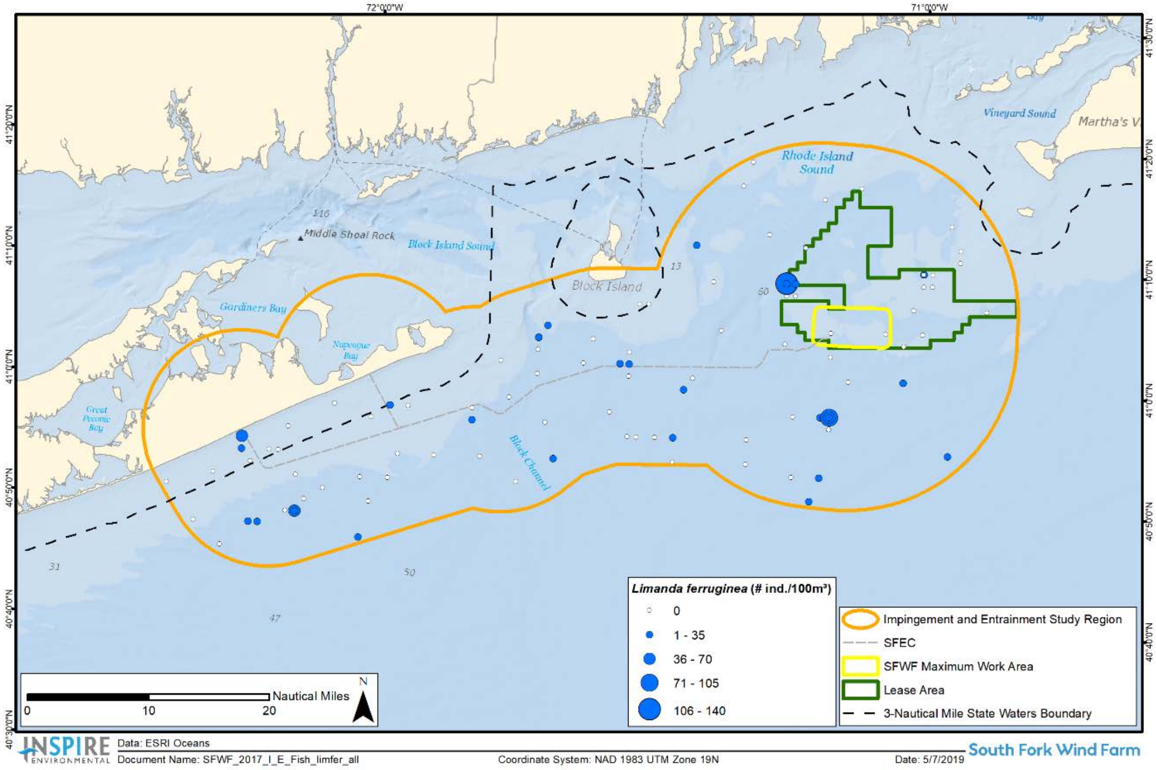


July

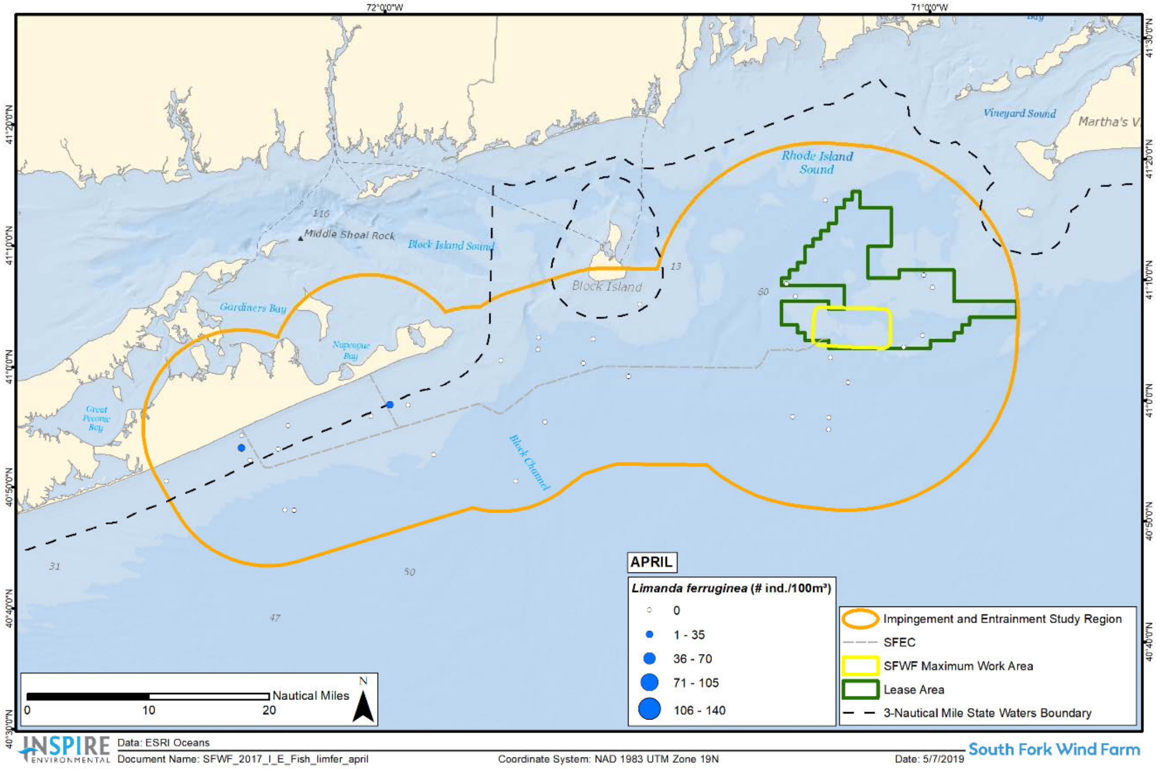


August

Figure 3-10c. Raw MARMAP and EcoMon Winter flounder (*Pseudopleuronectes americanus*) densities for the months of July (top panel) and August (bottom panel).

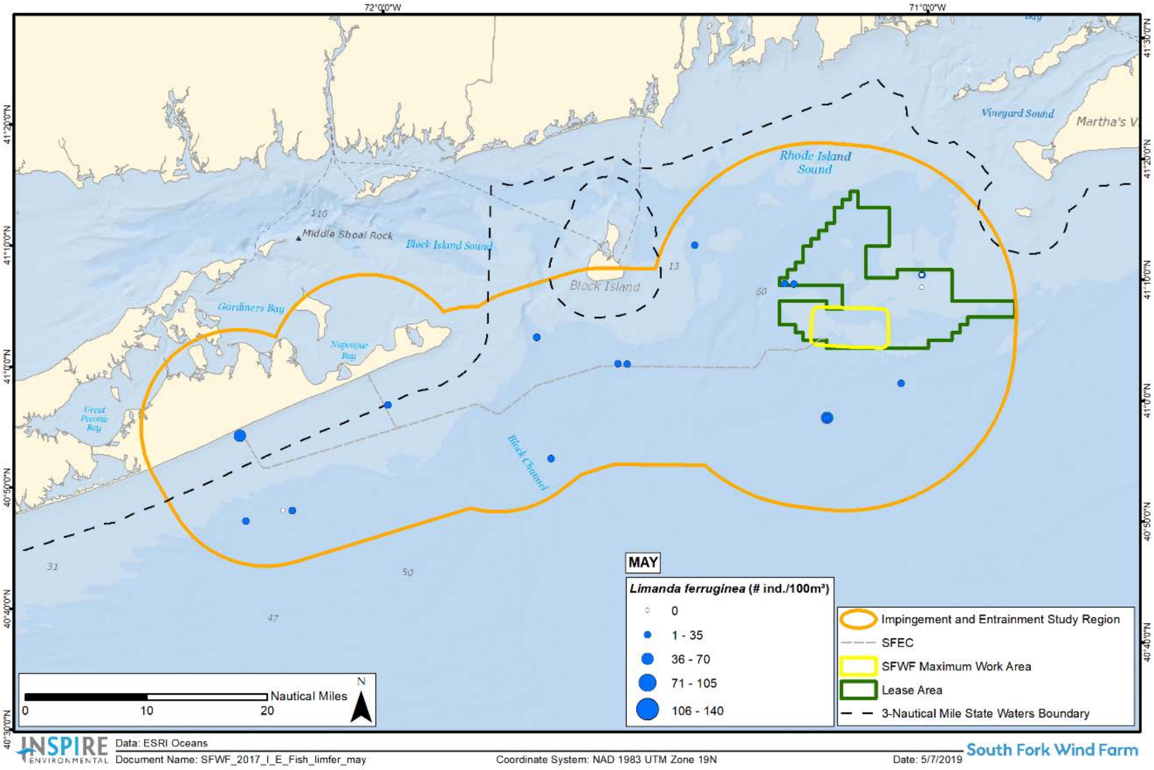


All Study Months (April – August)

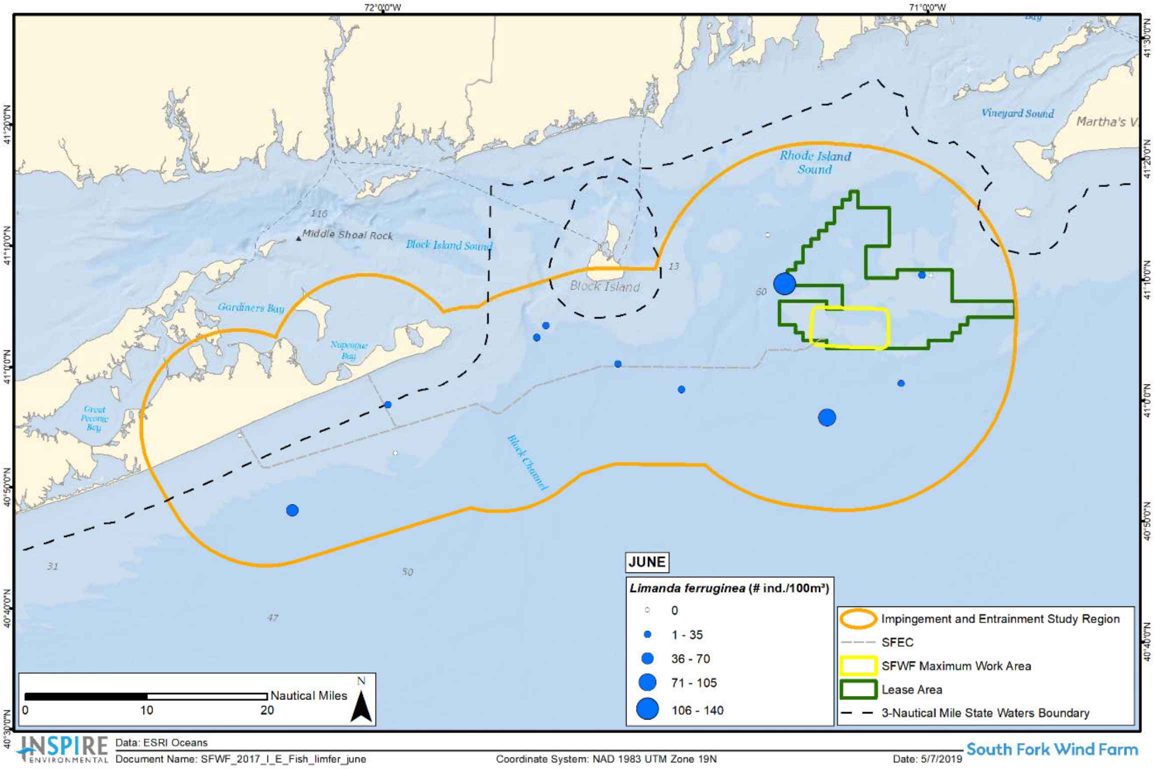


April

Figure 3-11a. Raw MARMAP and EcoMon Yellowtail flounder (*Limanda ferruginea*) densities across all study time period months (top panel) and for the month of April (bottom panel).

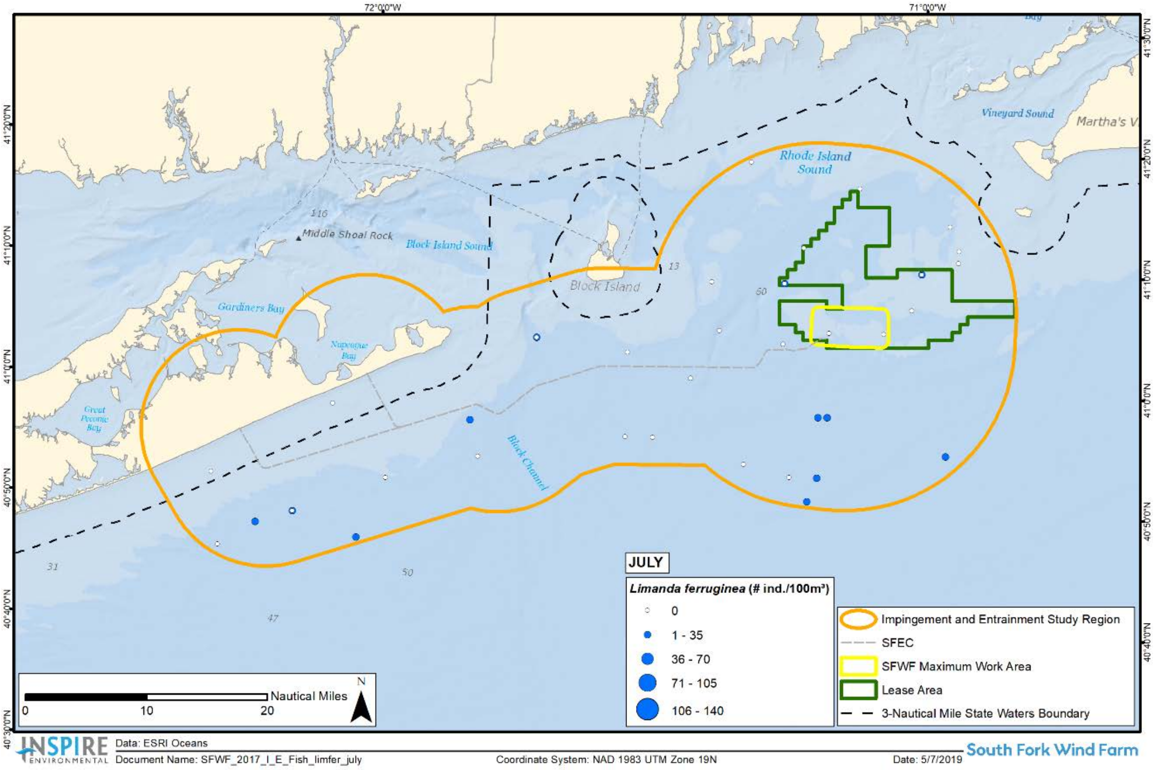


May

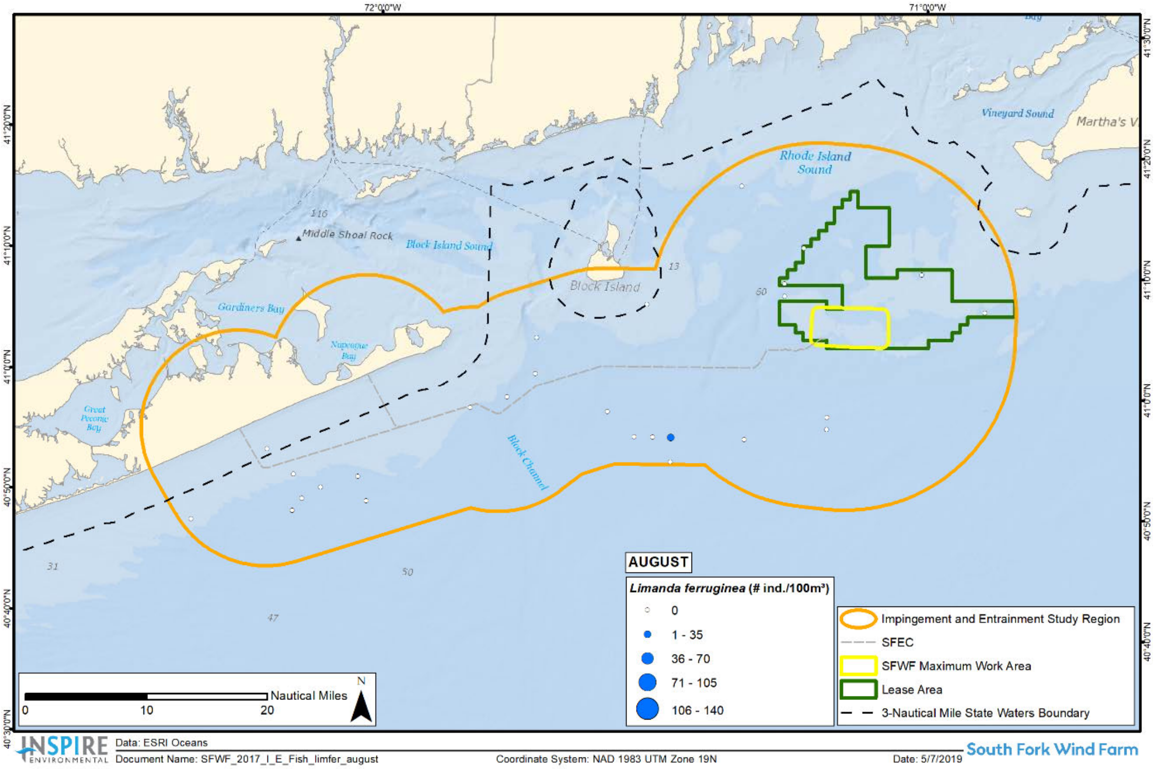


June

Figure 3-11b. Raw MARMAP and EcoMon Yellowtail flounder (*Limanda ferruginea*) densities for the months of May (top panel) and June (bottom panel).

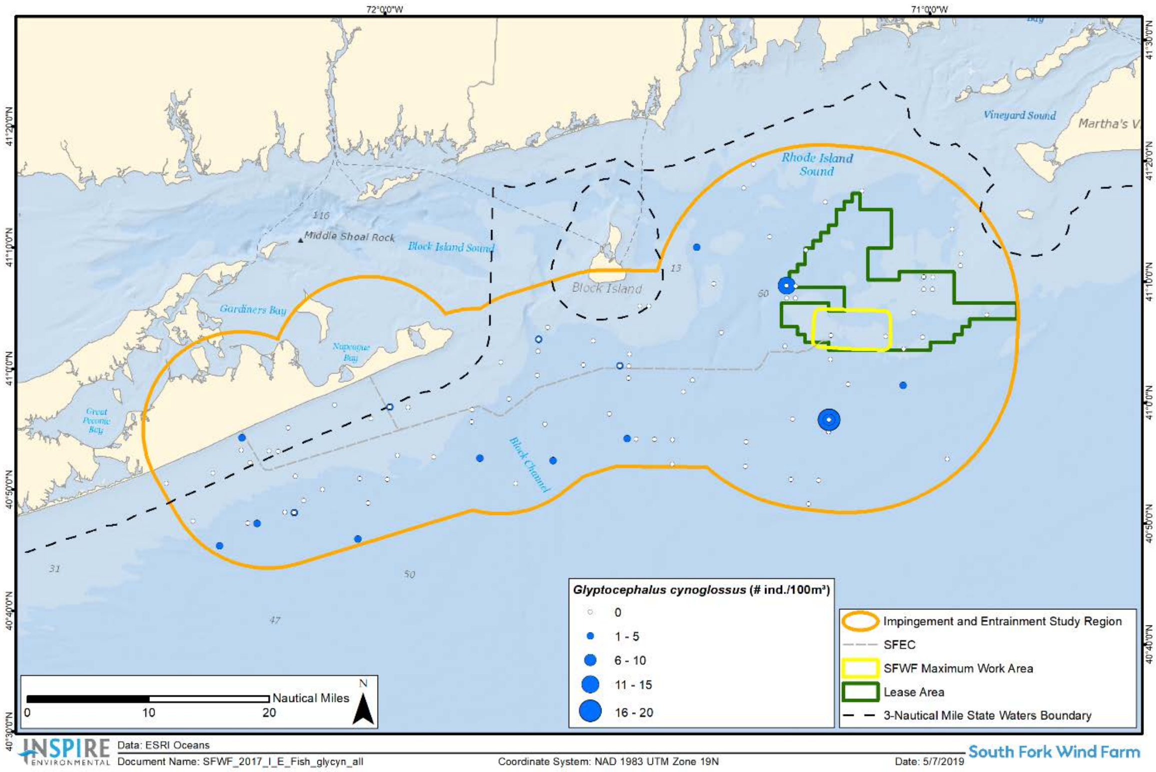


July

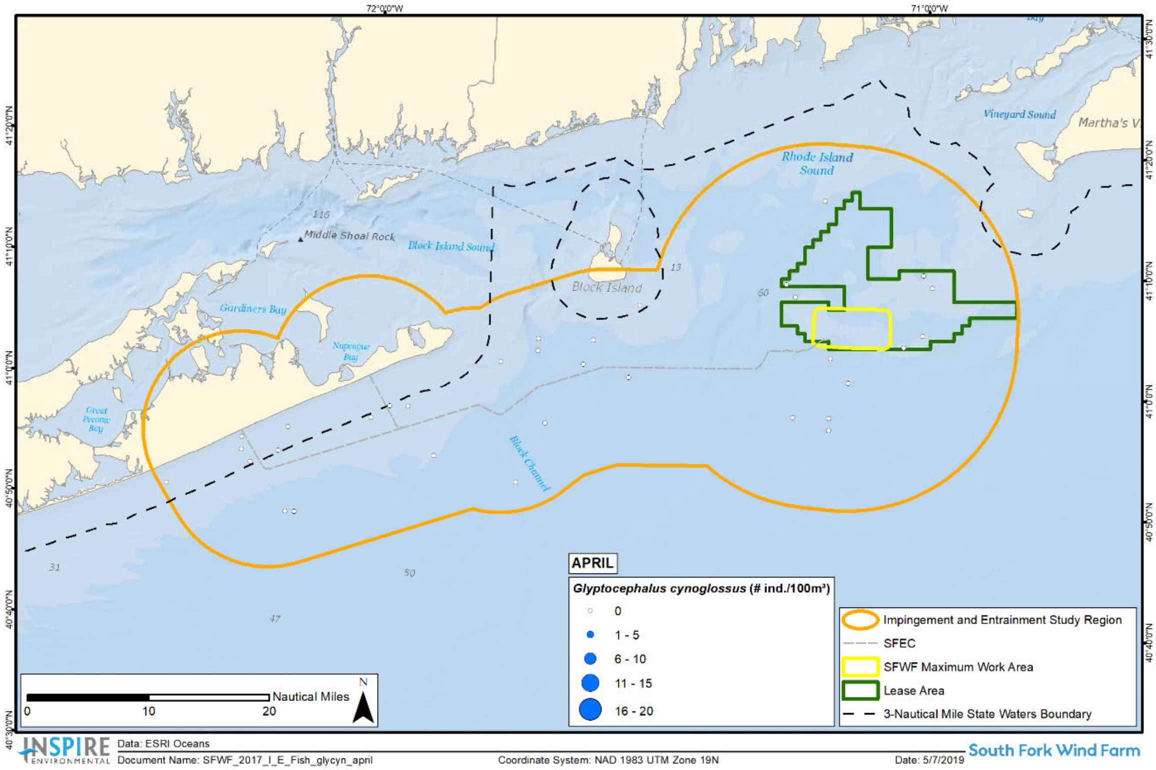


August

Figure 3-11c. Raw MARMAP and EcoMon Yellowtail flounder (*Limanda ferruginea*) densities for the months of July (top panel) and August (bottom panel).

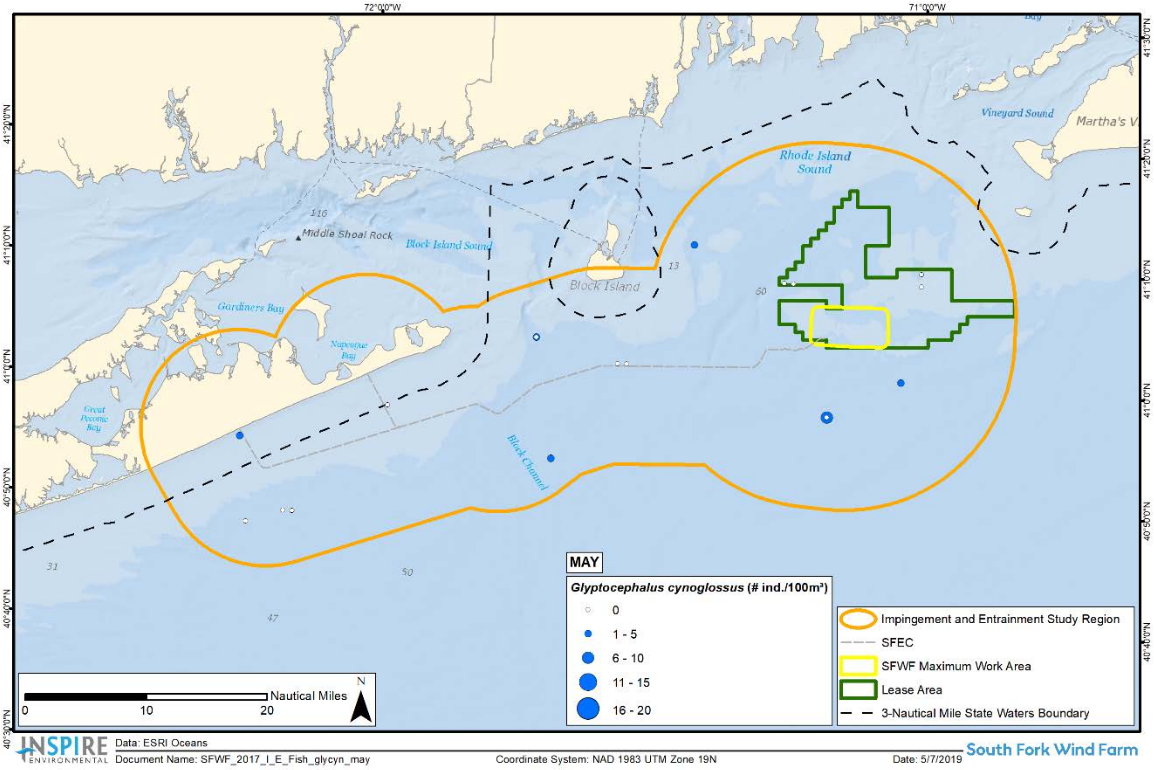


All Study Months (April – August)

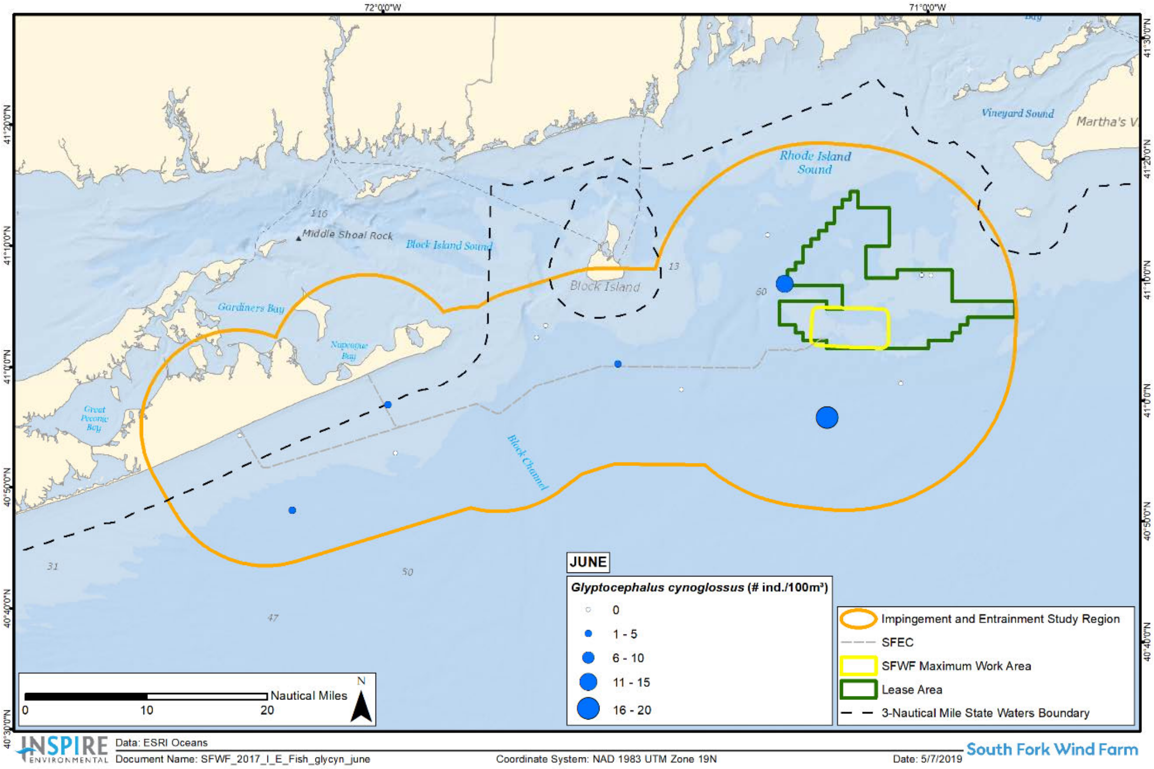


April

Figure 3-12a. Raw MARMAP and EcoMon Witch flounder (*Glyptocephalus cynoglossus*) densities across all study time period months (top panel) and for the month of April (bottom panel).

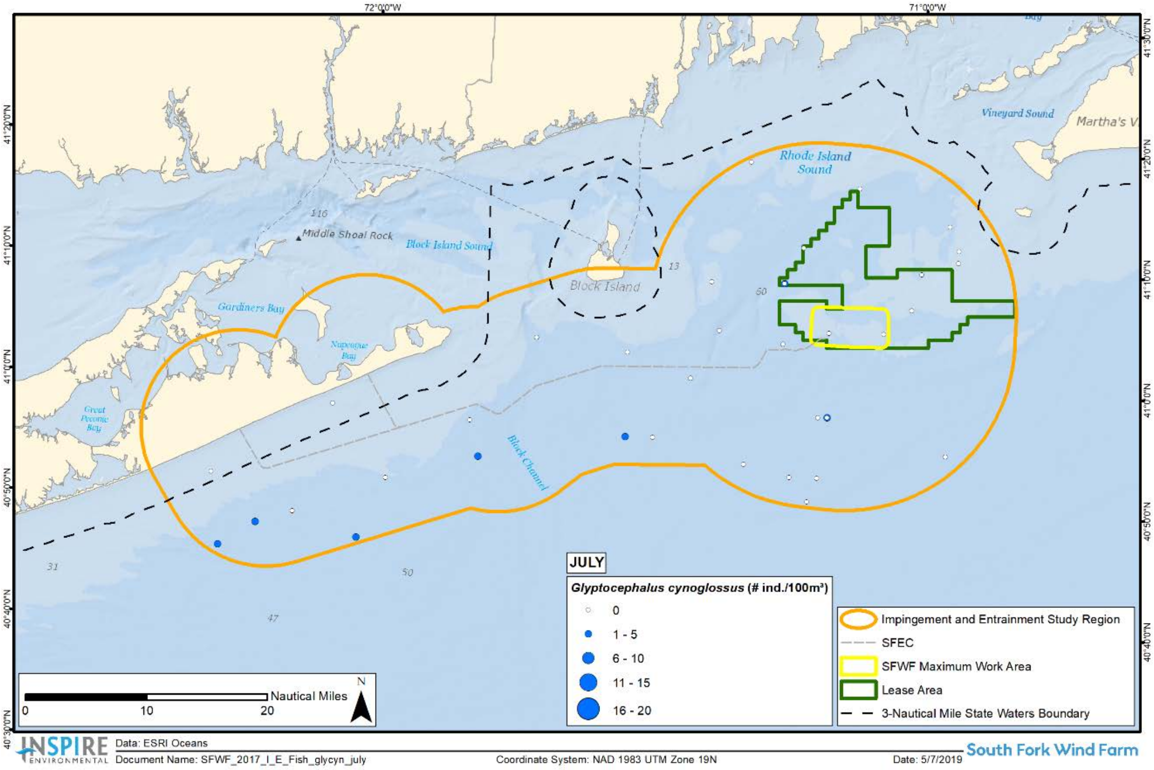


May

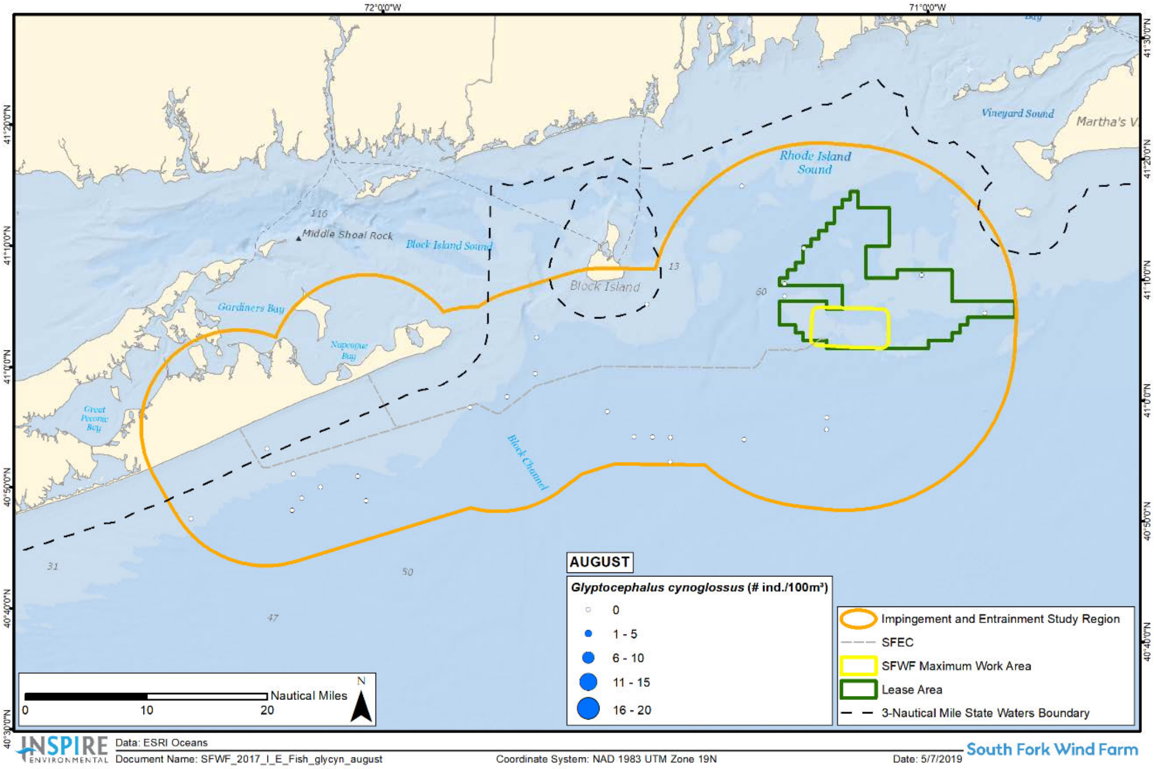


June

Figure 3-12b. Raw MARMAP and EcoMon Witch flounder (*Glyptocephalus cynoglossus*) densities for the months of May (top panel) and June (bottom panel).

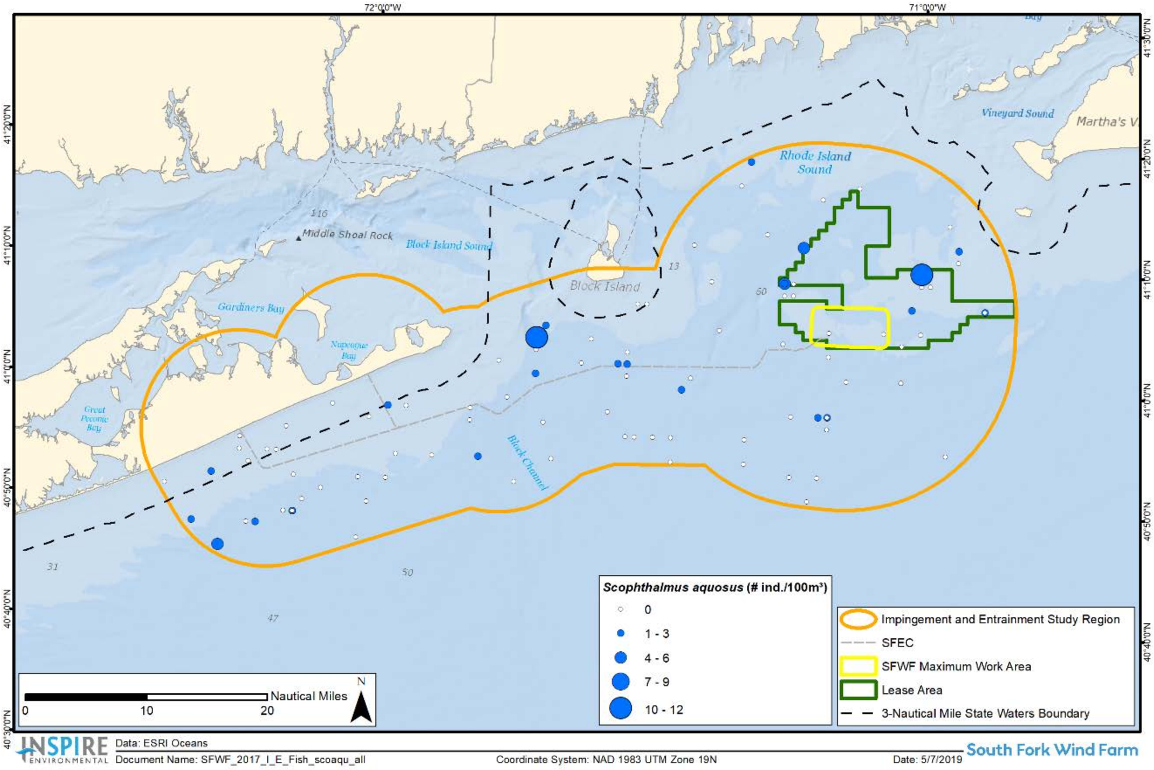


July

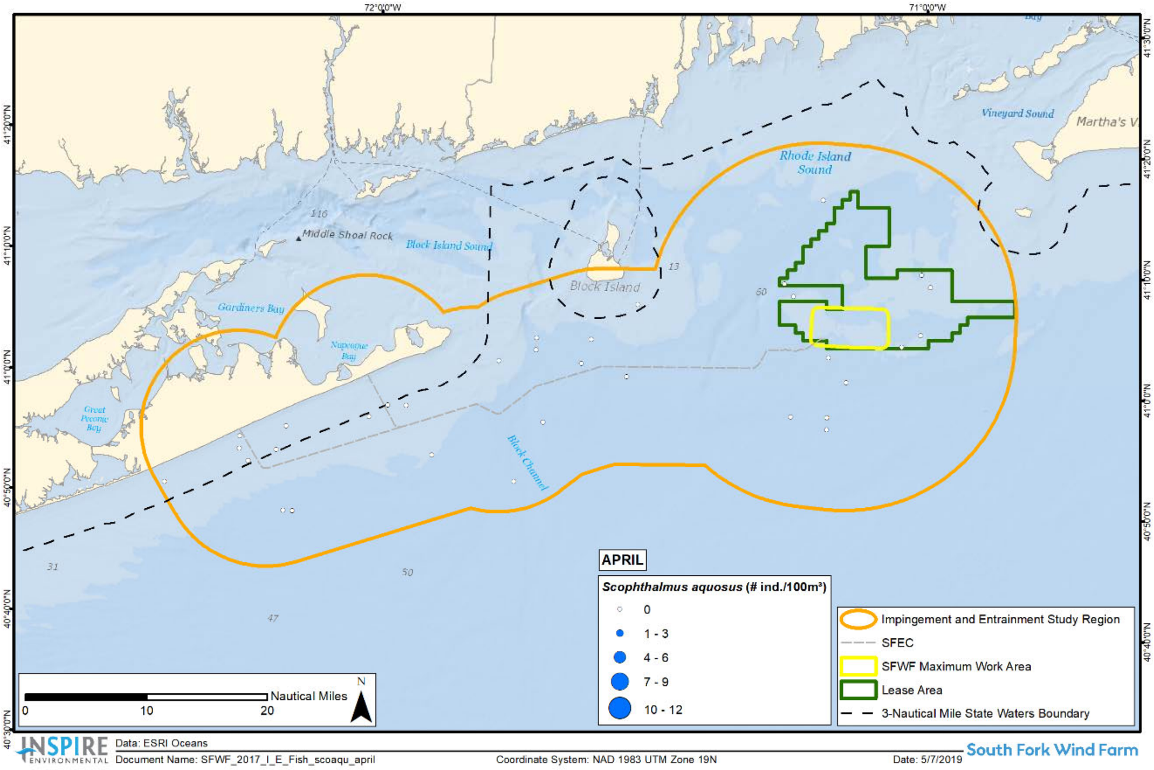


August

Figure 3-12c. Raw MARMAP and EcoMon Witch flounder (*Glyptocephalus cynoglossus*) densities for the months of July (top panel) and August (bottom panel).

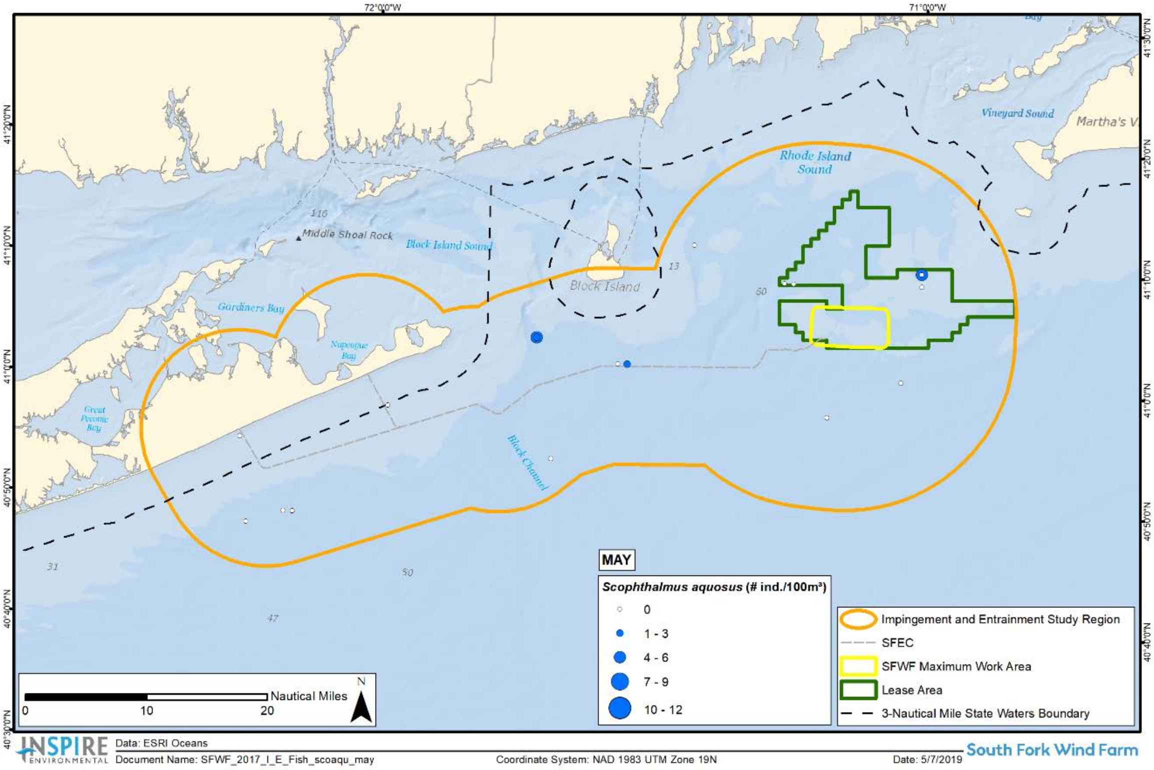


All Study Months (April – August)

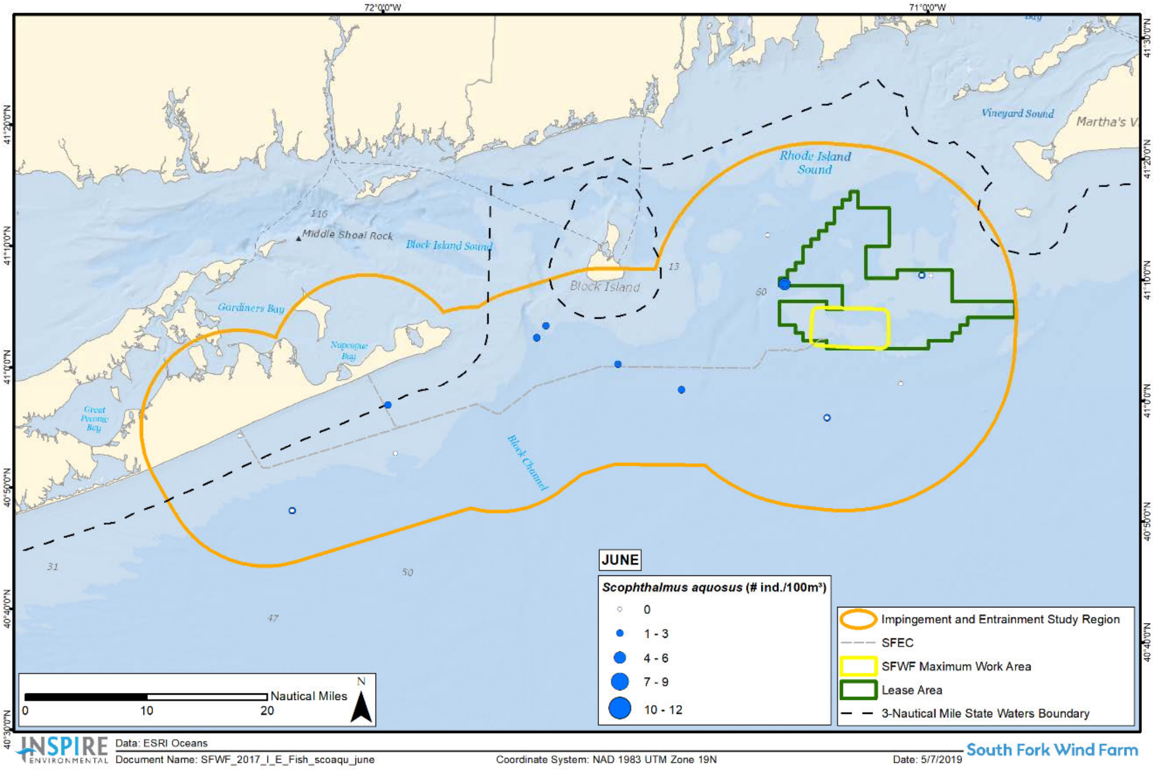


April

Figure 3-13a. Raw MARMAP and Windowpane flounder (*Scophthalmus aquosus*) densities across all study time period months (top panel) and for the month of April (bottom panel).

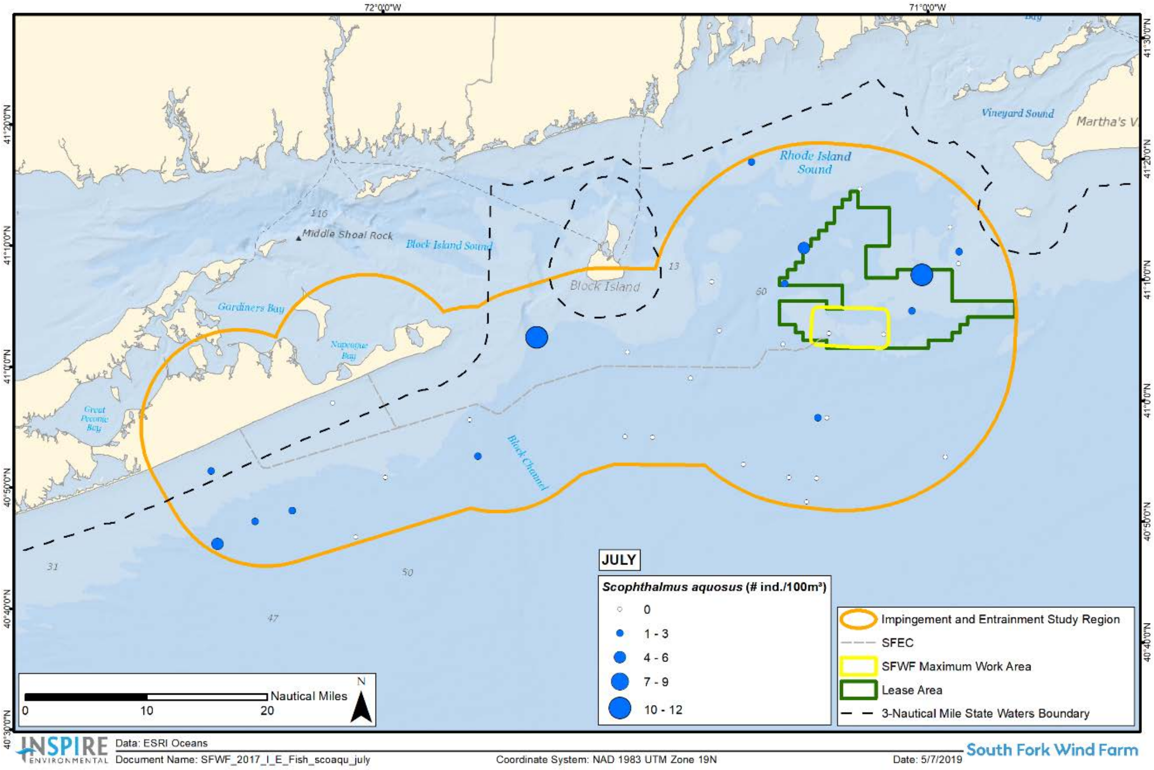


May

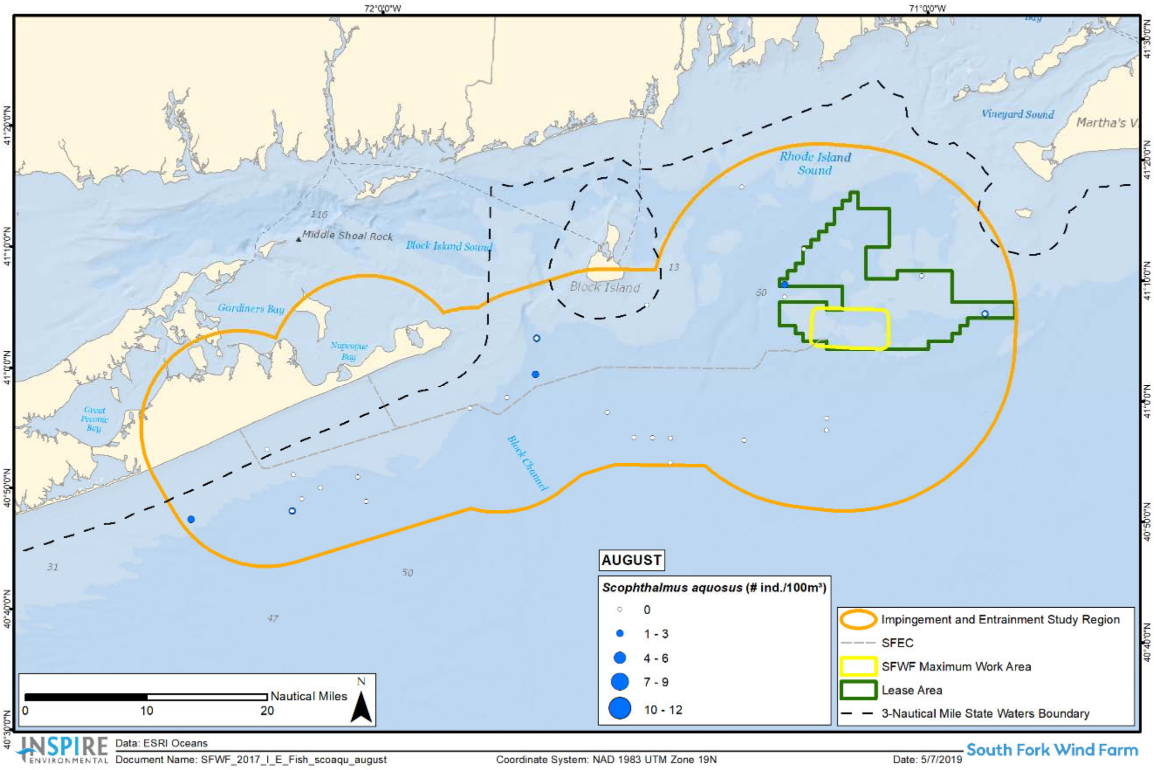


June

Figure 3-13b. Raw MARMAP and EcoMon Windowpane flounder (*Scophthalmus aquosus*) densities for the months of May (top panel) and June (bottom panel).

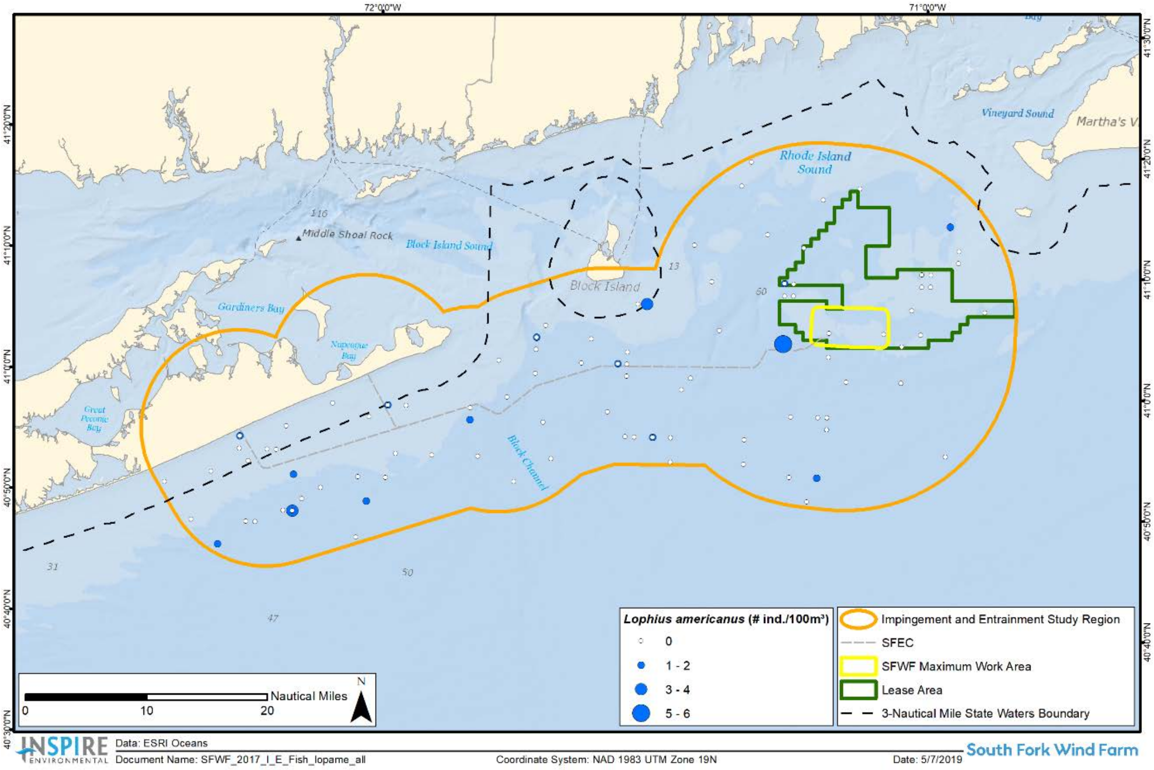


July

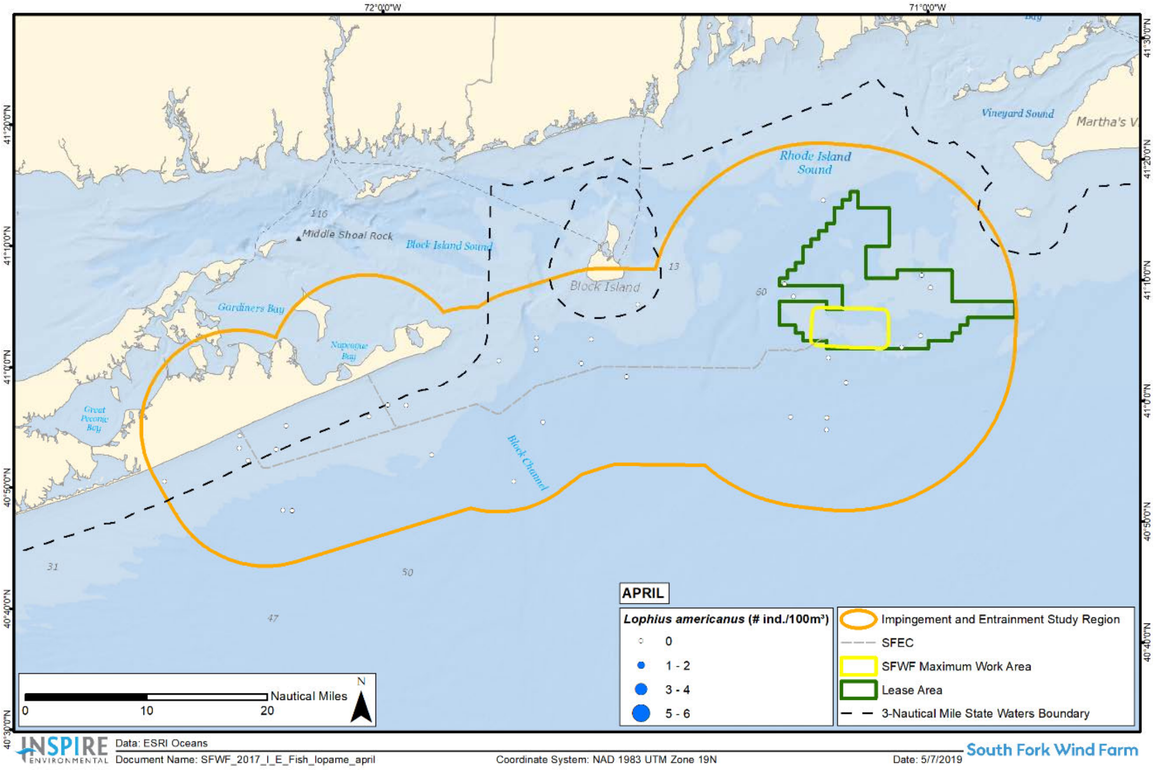


August

Figure 3-13c. Raw MARMAP and EcoMon Windowpane flounder (*Scophthalmus aquosus*) densities for the months of July (top panel) and August (bottom panel).

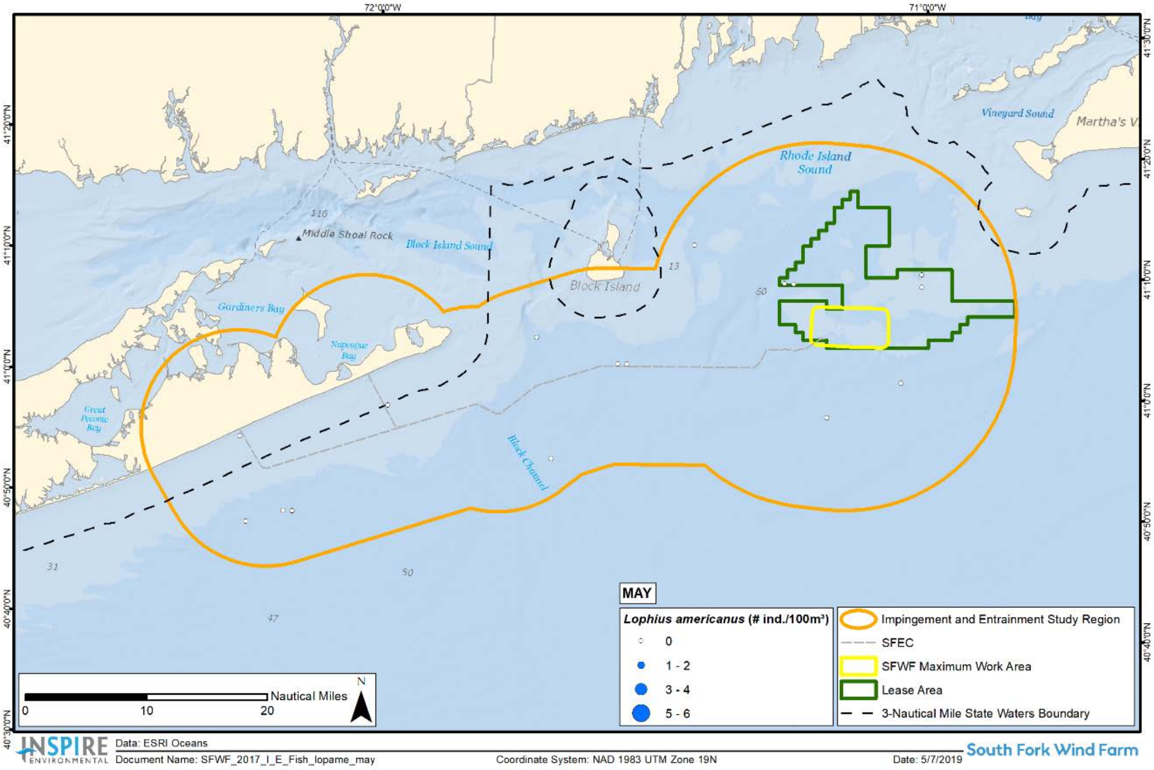


All Study Months (April – August)

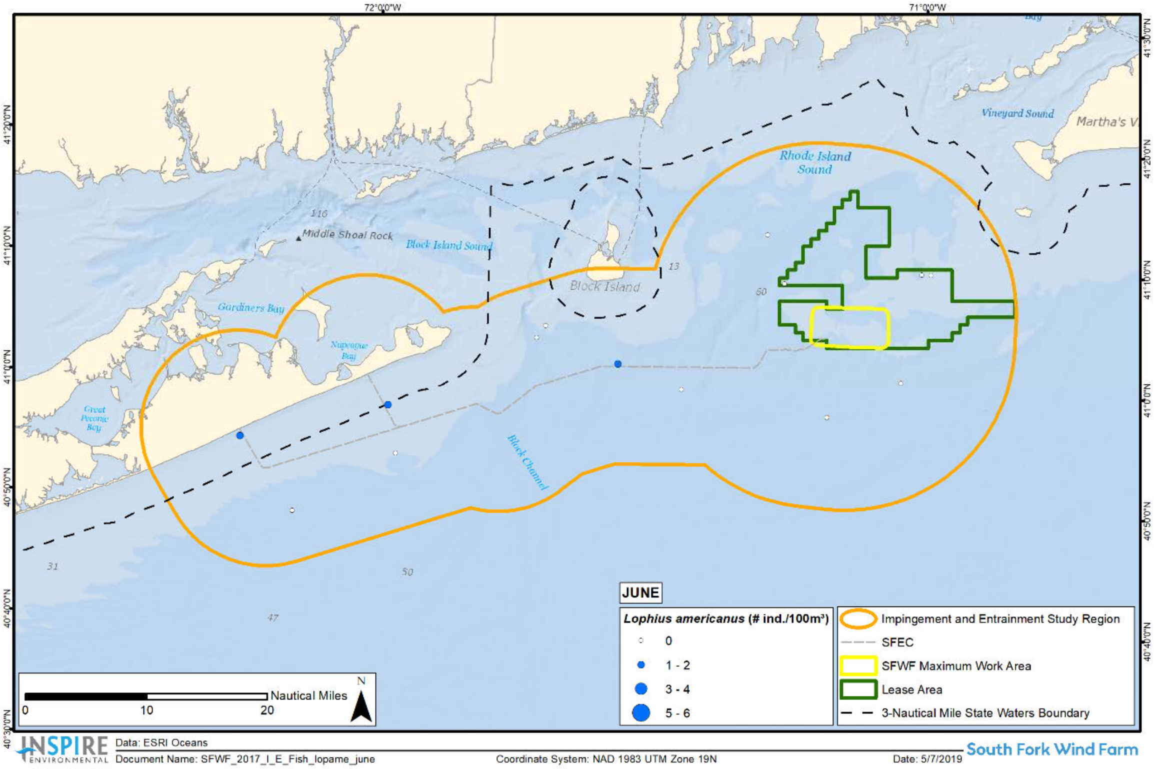


April

Figure 3-14a. Raw MARMAP and EcoMon Monkfish (*Lophius americanus*) densities across all study time period months (top panel) and for the month of April (bottom panel).

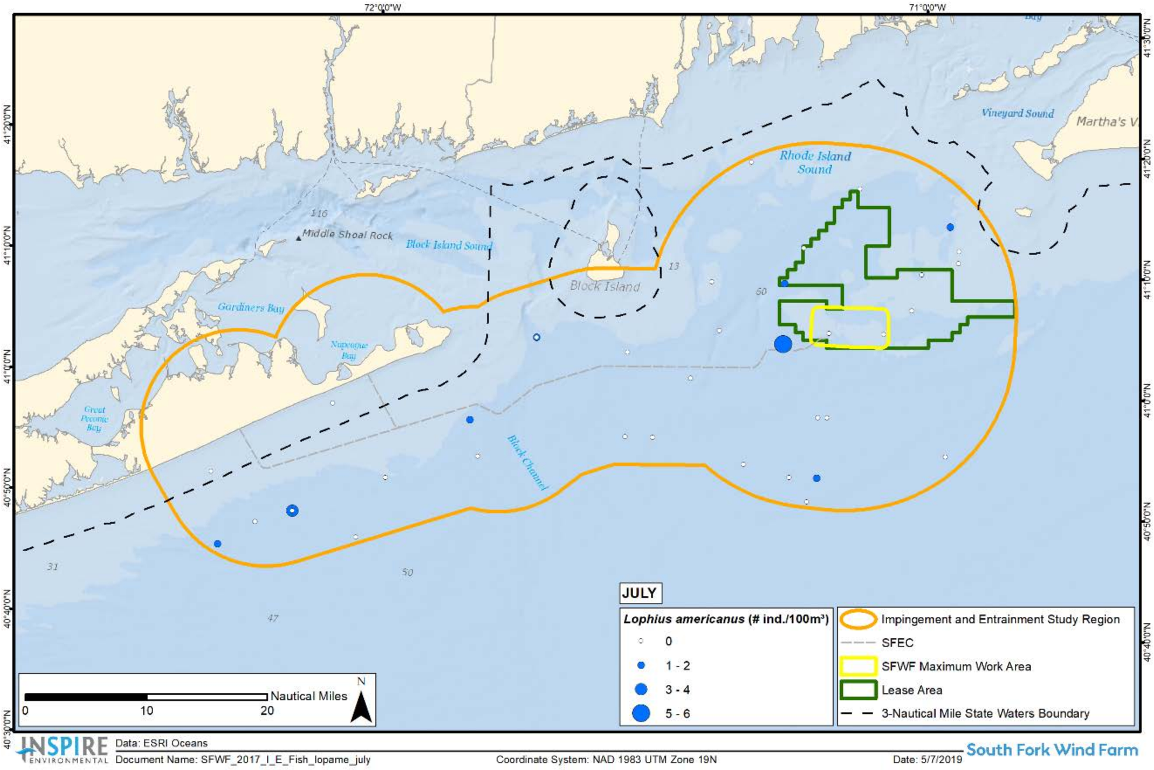


May

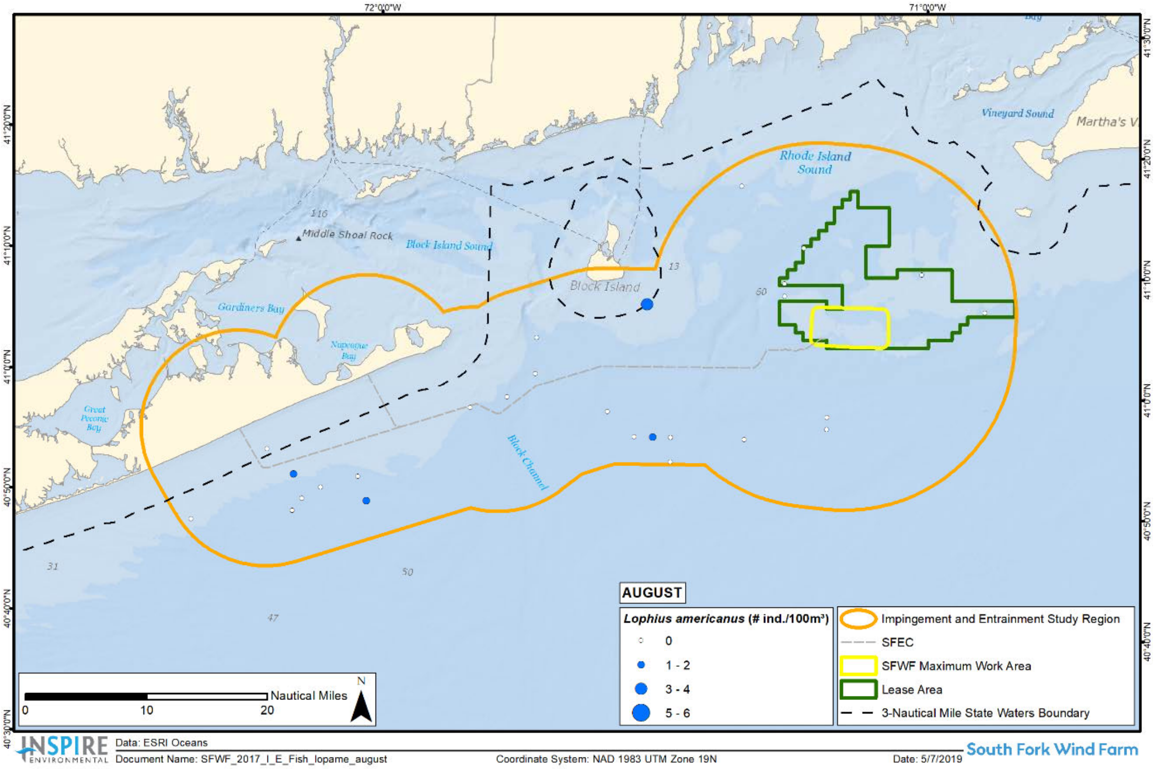


June

Figure 3-14b. Raw MARMAP and EcoMon Monkfish (*Lophius americanus*) densities for the months of May (top panel) and June (bottom panel).

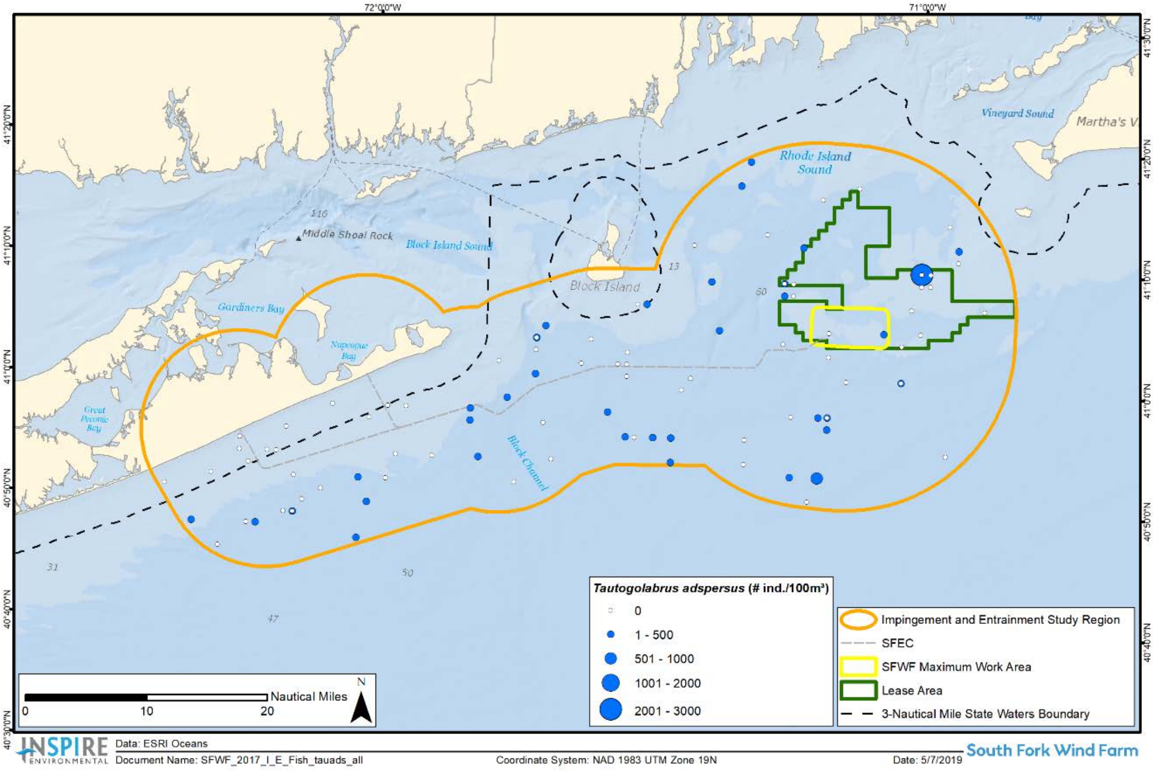


July

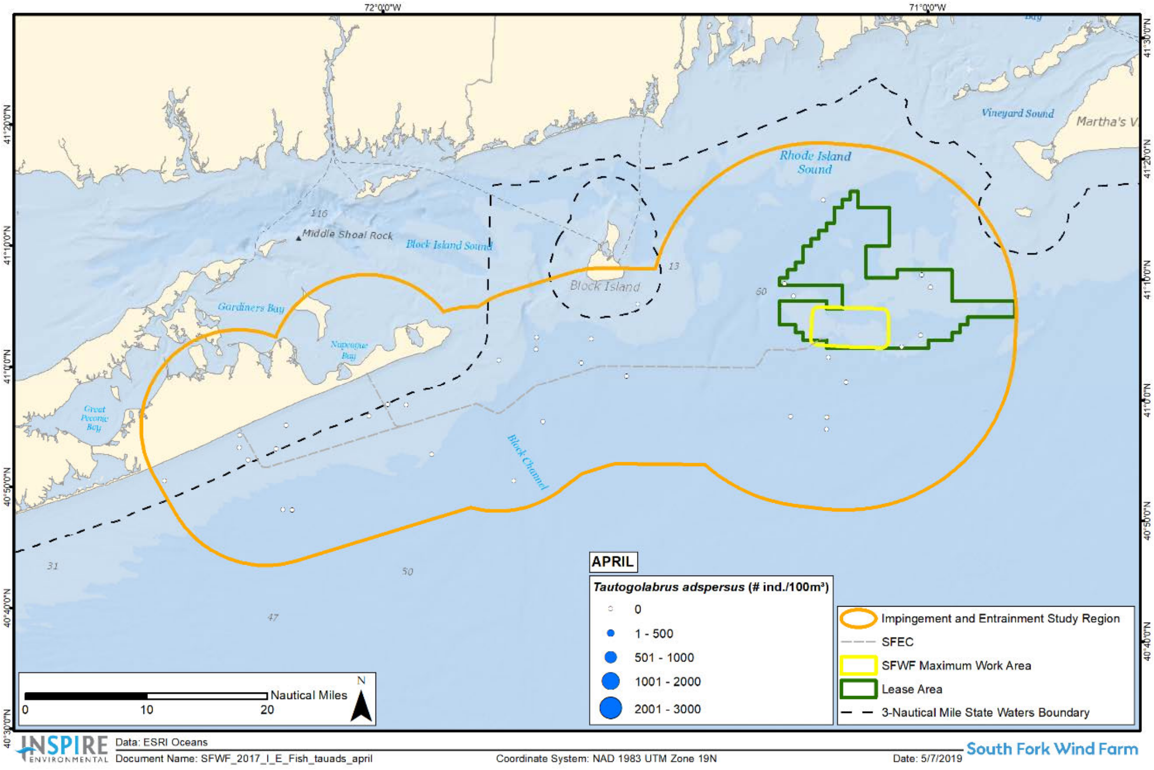


August

Figure 3-14c. Raw MARMAP and EcoMon Monkfish (*Lophius americanus*) densities for the months of July (top panel) and August (bottom panel).

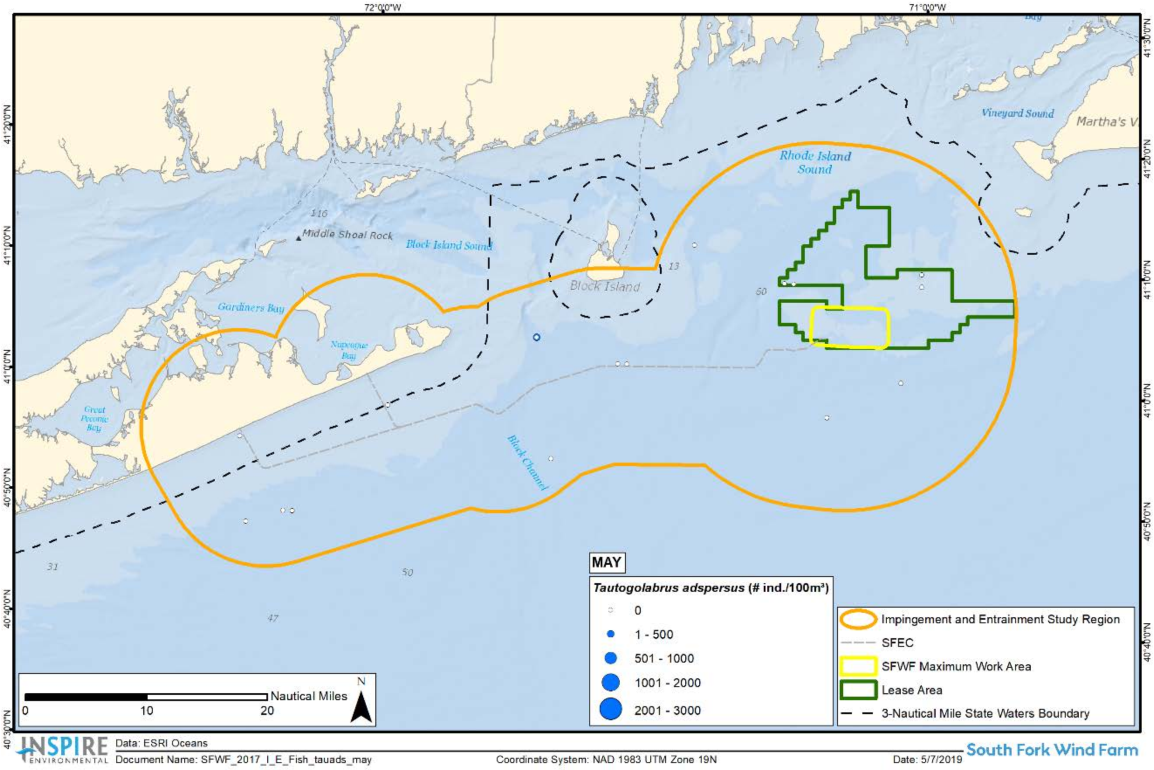


All Study Months (April – August)

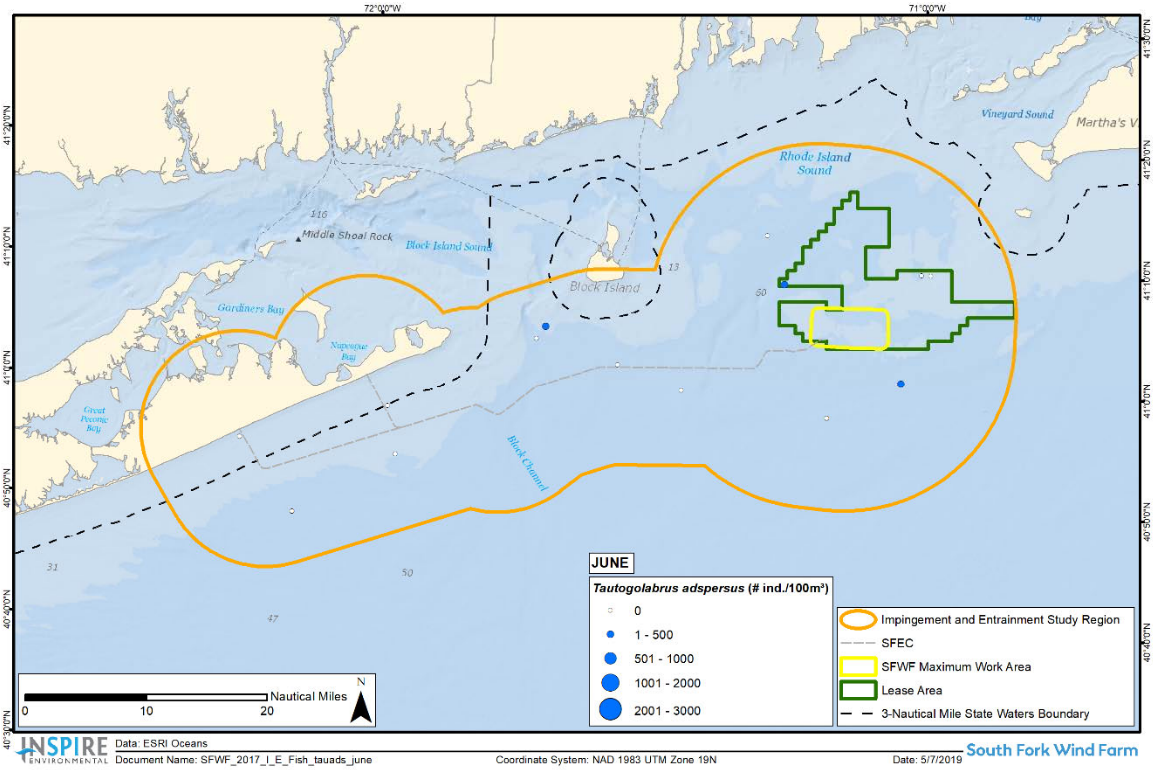


April

Figure 3-15a. **Raw MARMAP and EcoMon Cunner (*Tautogolabrus adspersus*) densities across all study time period months (top panel) and for the month of April (bottom panel).**

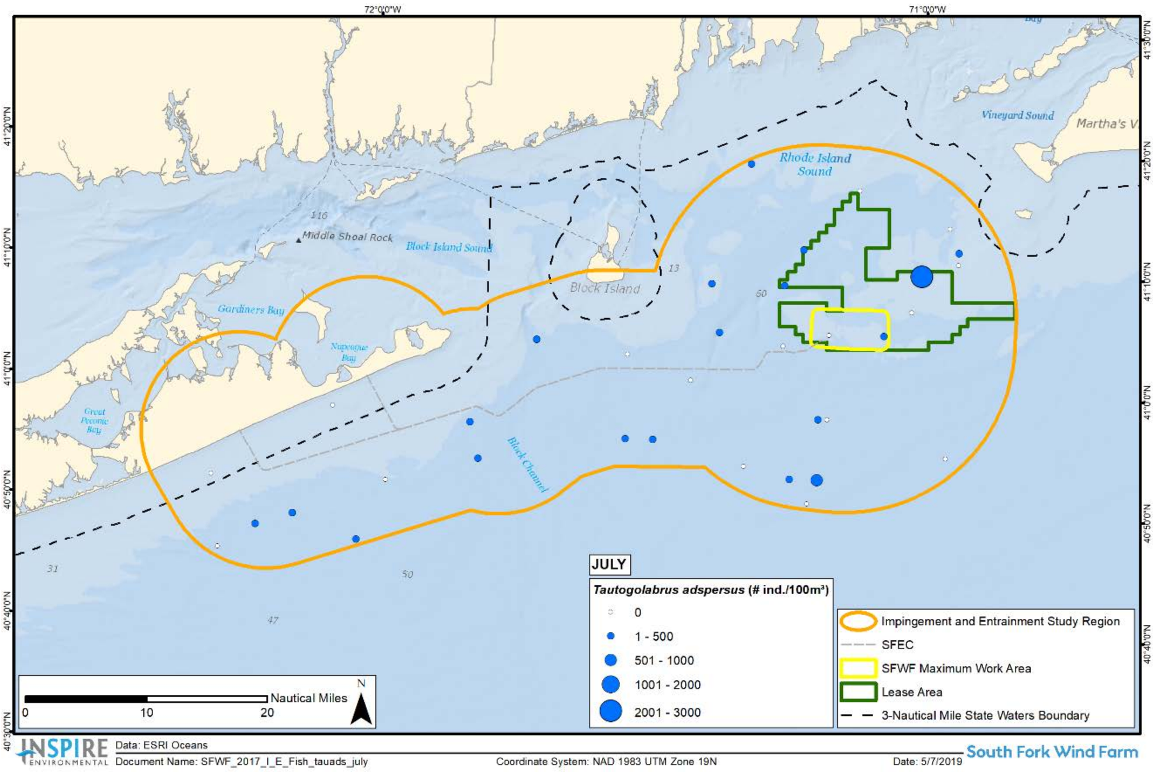


May

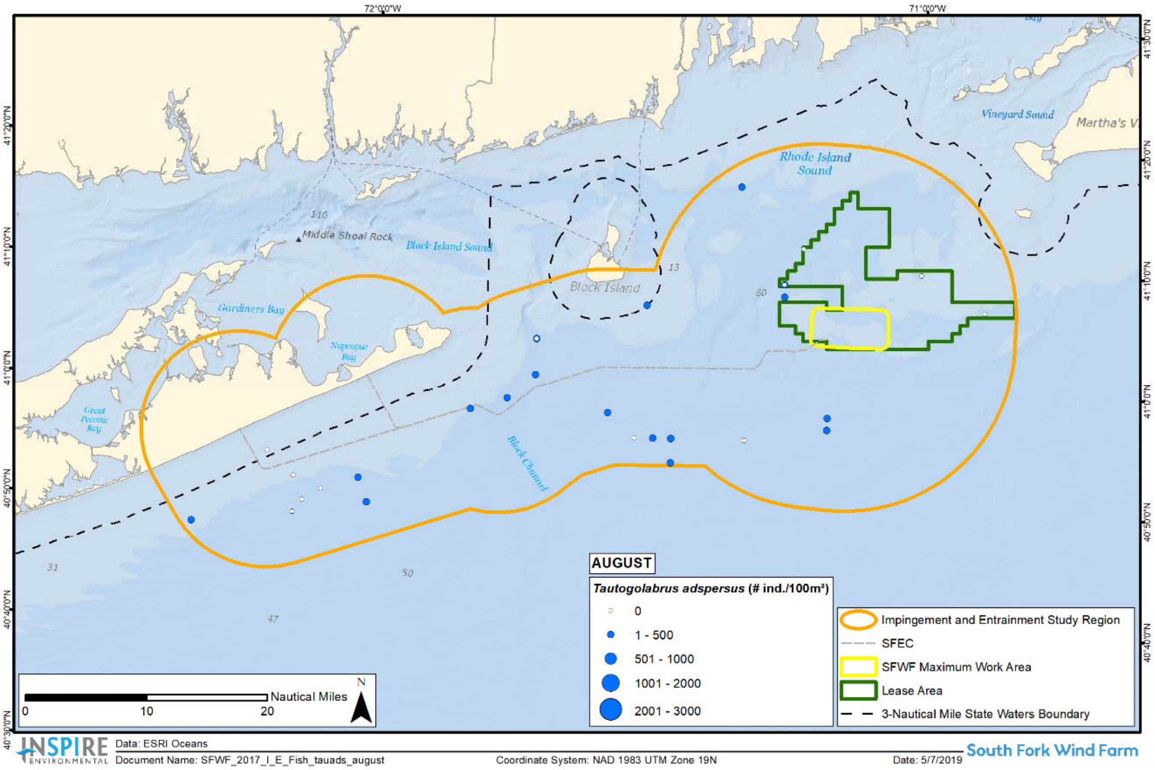


June

Figure 3-15b. Raw MARMAP and EcoMon Cunner (*Tautogolabrus adspersus*) densities for the months of May (top panel) and June (bottom panel).

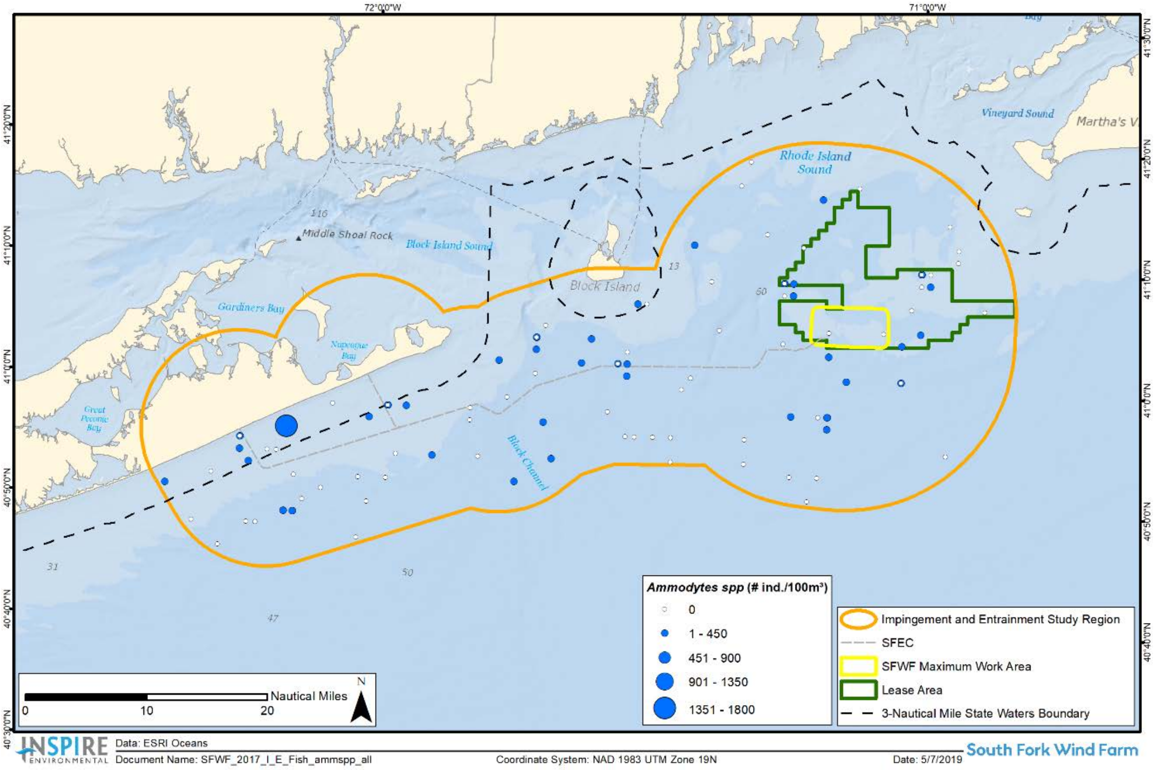


July

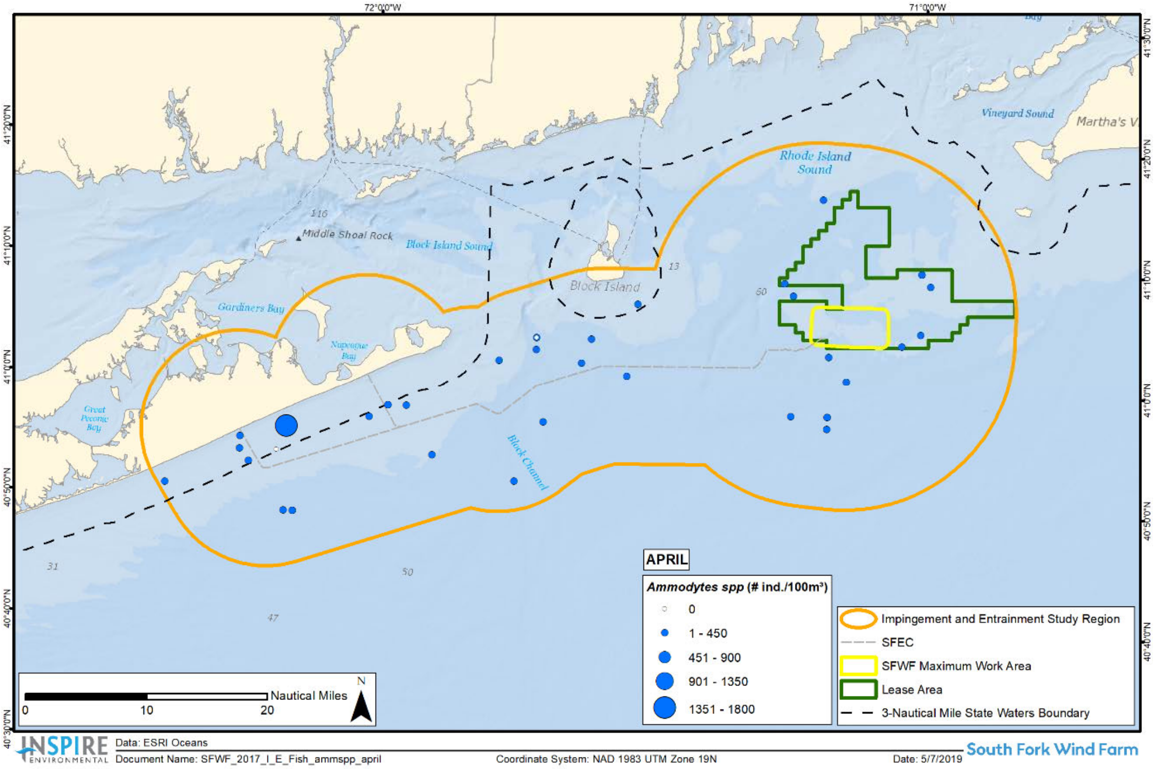


August

Figure 3-15c. Raw MARMAP and EcoMon Cunner (*Tautogolabrus adspersus*) densities for the months of July (top panel) and August (bottom panel).

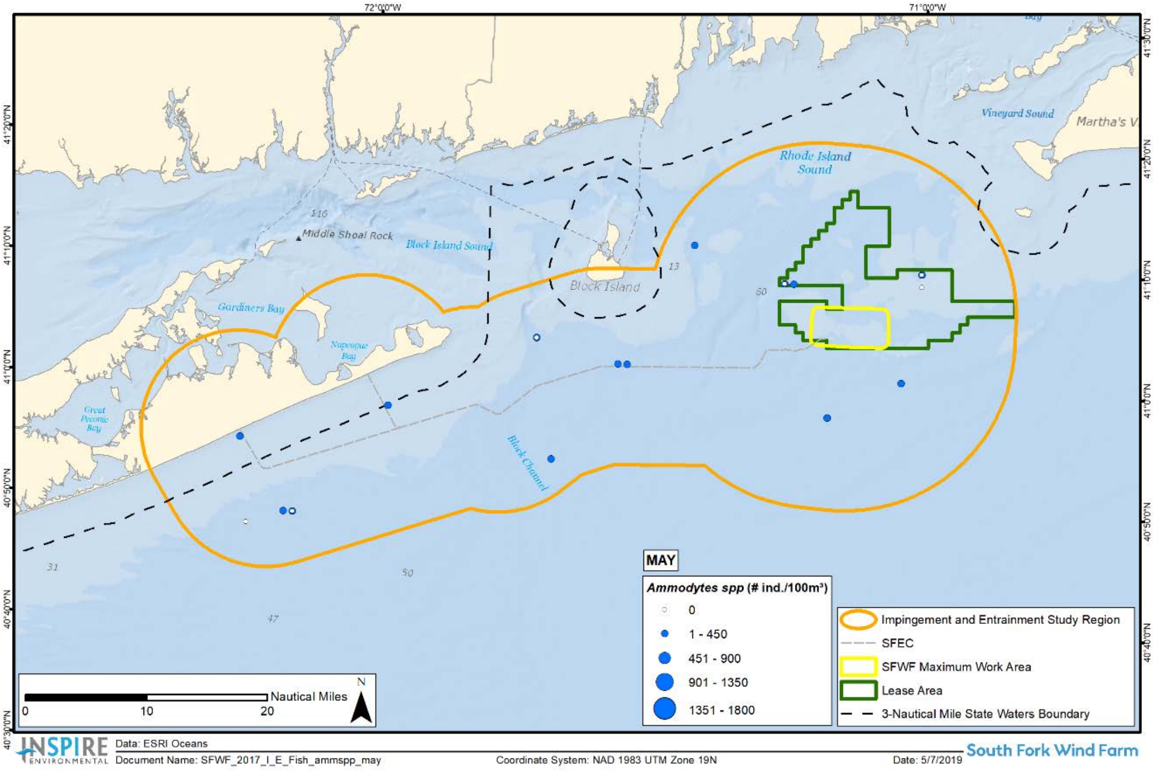


All Study Months (April – August)

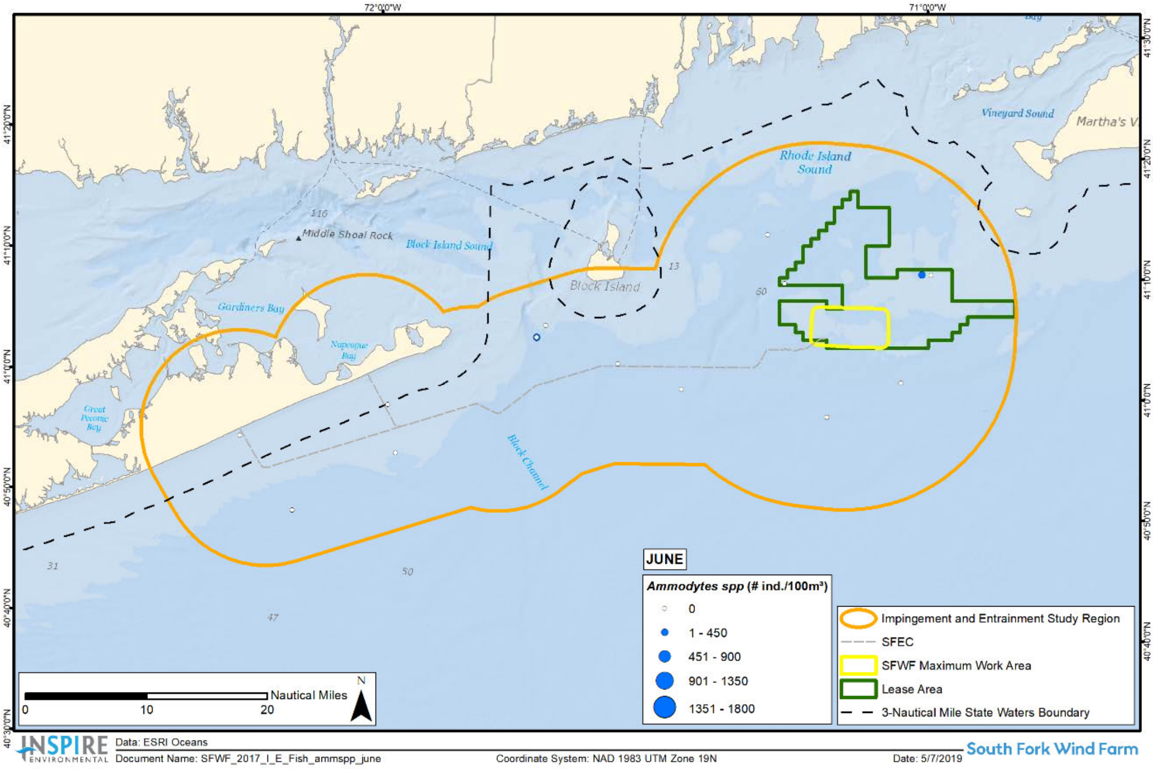


April

Figure 3-16a. Raw MARMAP and EcoMon Sand lance (Ammodytes spp) densities across all study time period months (top panel) and for the month of April (bottom panel).

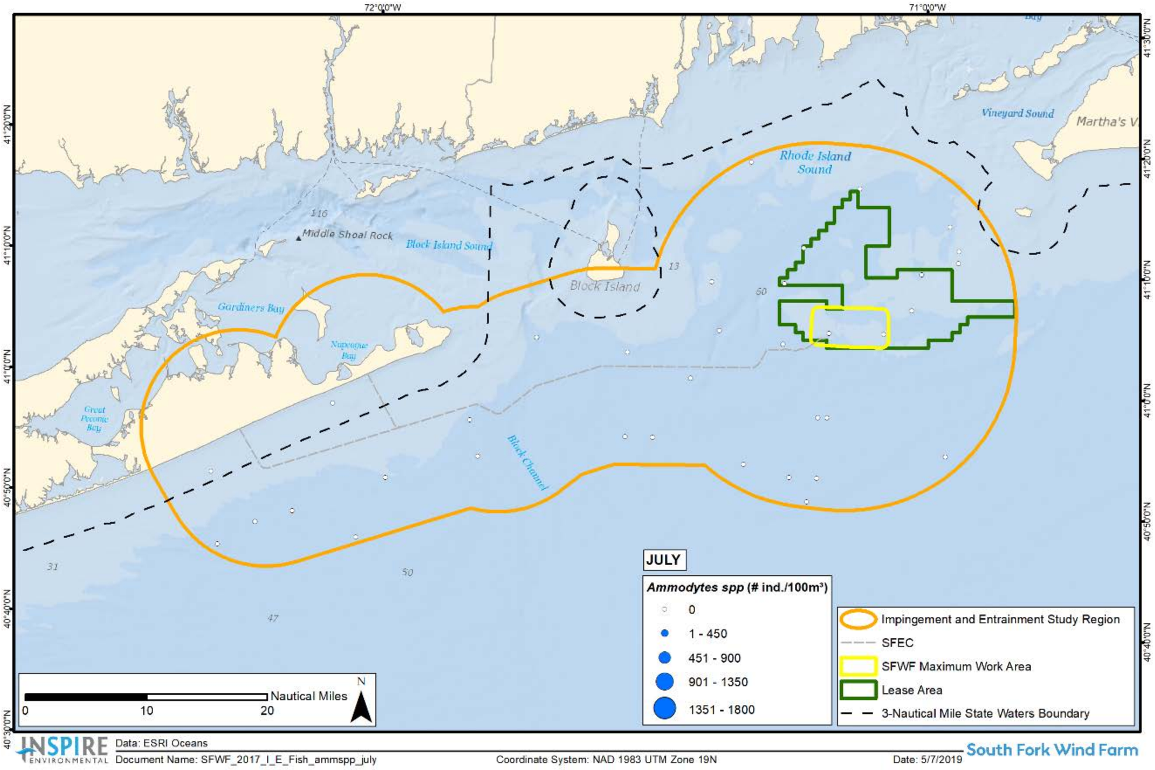


May

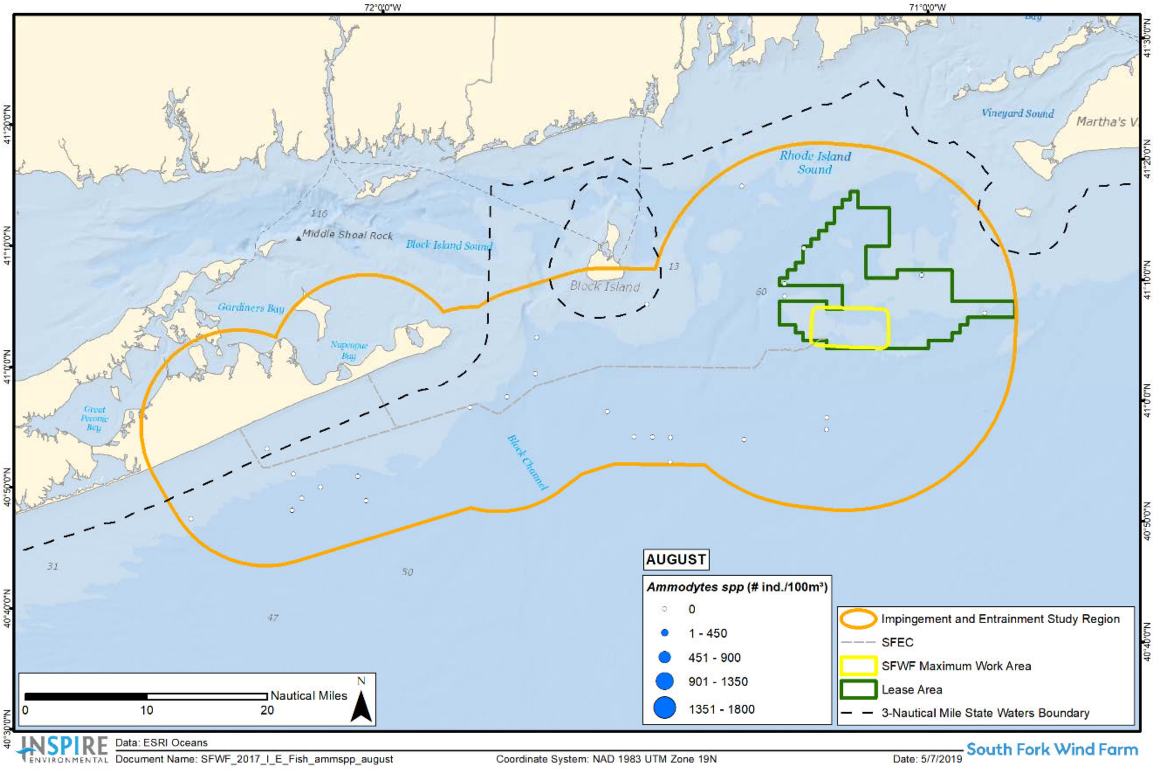


June

Figure 3-16b. Raw MARMAP and EcoMon Sand lance (Ammodytes spp) densities for the months of May (top panel) and June (bottom panel).



July



August

Figure 3-16c. Raw MARMAP and EcoMon Sand lance (Ammodytes spp) densities for the months of July (top panel) and August (bottom panel).