ATTACHMENT M5

ESSENTIAL FISH HABITAT DOCUMENTATION

Essential Fish Habitat Assessment

In support of the Environmental Assessment for the
State Pier Infrastructure Improvements

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Table of Contents

Figures

Tables

Acronyms

ACFCMA	Atlantic Coastal Fisheries Cooperative Management Act
ASMFC	Atlantic States Marine Fisheries Commission
CAHMSFP	Consolidated Atlantic Highly Migratory Species Fishery Management Plan
COP	Certificate of Permission
CPA	Connecticut Port Authority
CT DEEP	Connecticut Department of Energy and Environmental Protection
CT GP	Connecticut General Permits (USACE)
CVRR	Central Vermont Railroad
DO	Dissolved Oxygen
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FHWA	Federal Highway Administration
FHWG	Fisheries Hydroacoustic Working Group
FMC	Fishery Management Council
FMP	Fishery Management Plan
GARFO	Greater Atlantic Regional Fisheries Office (NMFS)
HAPC	Habitat Areas of Particular Concern
HMS	Highly Migratory Species
ICNAF	International Commission for the Northwest Atlantic Fisheries
JPA	Joint Permit Application
LWRD	Land and Water Resources Division (CT DEEP)
MAFMC	Mid Atlantic Fishery Management Council
MRIP	Marine Recreational Information Program
MSFMCA	Magnuson-Stevens Fishery Management and Conservation Act
NASCO	North Atlantic Salmon Conservation Organization
NDDB	Natural Diversity Data Base (CT DEEP)
NEFMC	New England Fishery Management Council
NFMA	Northern Fish Management Area
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OSF	Office of Sustainable Fisheries (NOAA Fisheries)
SAFMC	South Atlantic Fishery Management Council
SAV	Submerged Aquatic Vegetation
SPII/Project	State Pier Infrastructure Improvements Project
SFA	Sustainable Fisheries Act
USACE	U.S. Army Corps of Engineers (aka Corps)
USFWS	U.S. Fish and Wildlife Service

Abbreviations

ac	Acre
BMPs	Best Management Practices
cm	Centimeter
cSEL	Cumulative SEL
CT	Connecticut
CY	Cubic Yards
°C	Degrees Celsius or Centigrade
DAS	Days at Sea
DML	Dorsal Mantle Length
ESA	Endangered Species Act
FY	Fishing Year
°F	Degrees Fahrenheit
FL	Fork Length
ft	Feet
GB	Georges Bank
GOM	Gulf of Maine
HAPC	Habitat Areas of Particular Concern
ha	Hectare
in	Inch
JPA	Joint Permit Application
kg	Kilograms
km	Kilometers
lbs	Pounds
m	Meter
MA	Massachusetts
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
N	North
NA	Not applicable
NAVD88	North American Vertical Datum of 1988
NC	North Carolina
NE	New England
NJ	New Jersey
nmi	Nautical miles
NY	New York
PKD	Plymouth, Kingston, Duxbury, MA
ppt	Parts per thousands
RMS	Root Mean Square
RI	Rhode Island
SAV	Submerged aquatic vegetation
SEL	Sound exposure level
sSEL	Single Strike SEL
State Pier	Admiral Shear State Pier
State Pier Facility	CVRR Pier, State Pier, Upland and In-water areas
TAL	Total Allowable Landings
TL	Total Length
TOY	Time-of-Year
US	United States
VA	Virginia
W	West
WTG	Wind Turbine Generator
YOY	Young of the Year

1. Introduction

The purpose of this document is to present the findings of the Essential Fish Habitat (EFH) Assessment conducted as part of the environmental assessment of the proposed State Pier Infrastructure Improvements, in New London, Connecticut (SPII or Project), as required by the Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA) of 1976, as reauthorized in 2006 and signed into law in January of 2007.

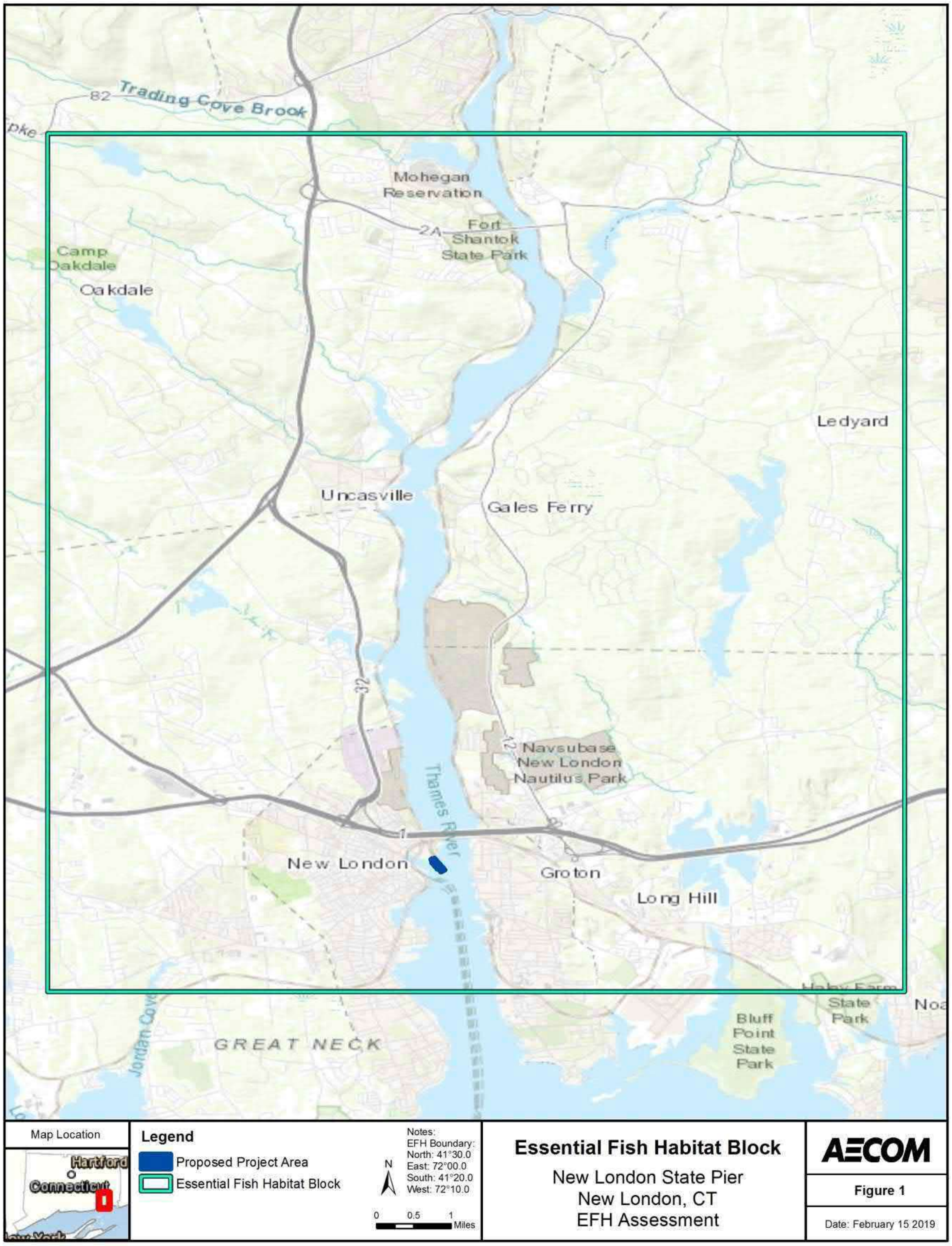
The objectives of this EFH assessment are to describe how the actions proposed by the Project may affect EFH designated by the National Oceanic and Atmospheric Administration (NOAA) Fisheries, New England Fishery Management Council (NEFMC), the Mid-Atlantic Fishery Management Council (MAFMC), and Atlantic States Marine Fisheries Commission (ASMFC), for the area disturbed by Project installation and operation.

EFH within the Project area is defined to encompass all estuarine and marine waters and substrates within the coordinate 10 x 10 minute block of North 41°30.0 N, East 72°00.0 W, South 41°20.0 N, and West 72°10.0 W, which includes the Connecticut River estuary affecting the following: within New London Harbor from Long Island Sound on the south, north up to just north of Smith Cove within the Thames River. These waters affect the following: Greens Harbor, Hog Back, White Rock, Melton Ledge, Groton, CT., and New London CT., Winthrop Pt., Jacobs Rock, Bailey Pt., Mamacoke River, and Harrison, CT. Also, the waters within this block are found within the Poquonock River north of the Groton-New London Airport, and affect waters within northern Jordan Cove, Jordan Brook, and North Wing Brook, near Jordan CT. (Figure 1).

This assessment includes a description of the proposed action and a preliminary analysis of the potential direct, indirect, and cumulative effects on EFH for all managed fish and invertebrate species and their major food sources. Opinions regarding the effects of the proposed action and proposed measures to avoid, minimize, and mitigate potential adverse impacts of the Project are also presented.

The existing conditions were obtained through review of publicly available literature and documentation provided by the Connecticut Port Authority (CPA) from prior investigations completed at the site, as well as site specific benthic surveys completed in 2019.

Figure 1. Map showing proposed Project area in relation to the 10 x 10 minute EFH block.



2. Project Description

The Project is proposed by the CPA in order to create infrastructure in Connecticut that will serve as a long-term, regional wind turbine generator (WTG) port facility while at the same time continuing to support other existing long-term breakbulk operations for steel, coil steel, lumber, copper billets, as well as other cargo. The proposed Project includes onshore site work and in-water activities in the Thames River, New London, Connecticut.

As part of the SPII, CPA proposes to fill an approximately 7.4-acre area between the existing Central Vermont Railroad (CVRR) Pier and Admiral Shear State Pier (State Pier) that would require the placement of approximately 400,000 cubic yards (CY) of material. Placement of an additional 0.7 acres of material may occur for the creation of the East Berth Heavy Lift Area in an area currently comprised of riprap slope beneath the Admiral Shear State Pier. The Project also involves various dredging activities to improve navigational access for WTG support and other cargo vessels.

A steel king pile wall will be installed at the southern end of the two piers to facilitate construction of the new “Central Wharf” filled area. CPA plans to use material dredged from the vessel berthing pockets and turning basin to fill in the area between the piers. In addition to this dredged material being used as fill, CPA plans to grade and level an upland area onsite to provide approximately 190,000 CY of the required fill material. Additional fill materials may be required from offsite sources and some offsite sediment disposal may also be required. The final elevation of the filled area will match the existing State Pier deck elevation of nine feet (+9 ft.) NAVD88. The filled material will be confined by the existing and modified structures: State Pier to the east, the CVRR Pier earth fill to the west and new king pile wall to the south. Heavy Lift Area construction on the east side of the existing State Pier is also proposed.

The proposed work is anticipated to occur in two phases, with some overlap in activities anticipated between Phase 1 and Phase 2. Work activities will only progress once applicable permits have been obtained. As described herein, the Project will be completed in phases – generally moving from upland areas to in-water work. Anticipated SPII components are detailed below.

Phase 1 work generally consists of the on-shore improvements and activities at the site, as well as select in-water activities. Work will include demolition of buildings, excavation, grading and installation of a stormwater management system and utilities. The site will be leveled and graded to accommodate future uses. Specifically, the entire upland portion of the site will be provided with a level, compacted gravel surface for use by any cargo handling and storage activities. Select in-water activities, such as derelict structure removal and bulkhead oversheeting, which have been authorized through the CT Department of Energy and Environmental Protection (CT DEEP) Land and Water Resources Division (LWRD) Certificate of Permission (COP) and the U.S. Army Corps of Engineers Connecticut General Permit (GP) process will be conducted under Phase 1.

Phase 2 work generally consists of the in-water and over-water improvements such as dredging, fill placement and marine structure construction for creation of the new Central Wharf area and heavy-lift pad installation.

<u>Phase 1 Work (Uplands and NE Bulkhead/Dolphin Removal)</u>

<u>Onshore Demolition Activities</u>

- Demolition of various existing buildings (including the Administration Building and Warehouse 1) and site utilities in upland area.
- Demolition of a segment of State Pier Road, including the bridge and bridge abutment.
- Offsite relocation of NOAA station.
- Removal of existing onsite rail tracks.

In-Water and Over-Water Demolition Activities

- Demolition of existing unused berthing dolphins (permitted under CT DEEP Certificate of Permission (201910828-COP) and USACE CT General Permit process (NAE-2018-02161).
- Demolition of Northeast Annex timber pile supported concrete deck on east side of Admiral Shear State Pier along shoreline under same CT DEEP COP / USACE GP process.

Onshore Improvements

- Cutting of the onsite hill (±190,000 CY). Soils to be used as fill between the piers during Phase 2.
- Overall grading and compaction of the site and installation of a gravel surface.
- Installation of retaining wall or earth embankment to maintain existing State Pier Road.
- Installation of new drainage and stormwater treatment system to meet stormwater quality requirements.
- Onshore installation of an anchored heavy-lift relieving platform on the existing Northeast Bulkhead (bulkhead work permitted separately under above CT DEEP COP / USACE GP).
- Installation of fendering and bollards at Northeast Bulkhead.
- Installation of new electrical utilities. High mast light poles will be installed. Electrical equipment may include electrical substations, transformers and powered racks for nacelles.
- Installation of new fire protection mains, hydrants and potable water supply lines.
- Installation or upgrade of sanitary sewers.
- Installation of perimeter security fencing and gate.
- New roadway entrance to the site.

Phase 2 Work (Waterfront Works: State Pier / CVRR Pier / Central Wharf)

In-Water, Over-Water and On-Shore Improvements

- Demolition of approximately 420 linear feet (~84,000 SF) of State Pier to facilitate construction of the heavy lift pile supported area and bulkhead at the State Pier East Berth.
- Demolition of additional segments (~34,000 SF) of the west face of State Pier concrete deck to facilitate fill placement between the piers.
- Demolition of two areas at the east face and southeast corner of State Pier (each approximately 1,500 SF) to facilitate mooring bollard installation.
- Dredging of Turning Basin including approaches to both berths. Dredging to -39.8’ NAVD88 (-36’ MLLW + 2’ overdredge), matching the existing New London Federal Channel depths. This includes removal of approximately 55,000 CY of material, including overdredge, generated from approximately 241,000 SF . The majority of this material will be generated in the northern portion of the turning basin.
- Dredging of vessel berthing areas to -41.8’ NAVD88 (-38’ MLLW + 2’ overdredge) for berthing layout and up to -66.8’ NAVD88 (-63’ MLLW + 2’ overdredge) to accommodate the seabed preparation work described below. Dredging to be completed at the proposed Northeast Berth (Up to ~240,000 SF; ±222,000 CY) and East Berth (Up to ~210,000 SF; ±122,000 CY) proximate to the new heavy lift areas.
- Seabed preparations would be completed after the above dredging to allow for berthing of vessels equipped with jack up legs (or similar) at the Northeast Bulkhead and East Berth heavy lift areas. Jack-up pockets will be constructed by filling the dredged pockets with crushed stone or gravel, to provide a stable jacking platform and to protect the seafloor from damage during install vessel jacking operations. Dredging and rock pad design utilizes a tiered approach, with stone pad thickness of 13’ to 27’ (maximum; in the eastern portions). Up to 107,000 CY of crushed stone would be placed in each pocket. The East Berth seabed preparation would be completed first and the Northeast Bulkhead seabed preparation work would be constructed at a later stage. This stone bed will be maintained throughout the duration of WTG operations.
- Installation of longitudinal steel sheeting or protected slope at CVRR pier.

- Installation of king pile bulkhead between the State Pier and the CVRR Pier, extending into the CVRR pier, tying into the new longitudinal sheet pile wall/slope along the CVRR pier.
- Filling approximately 7.4 acres (~322,000 SF; ±400,000 CY) between the CVRR Pier and State Pier to create the new Central Wharf operational area and East Berth Heavy Lift area. Approximately 308,600 CY will be placed below MHHW (+1.21 ft. NAVD88) and the balance will be placed above this elevation to raise the Central Wharf to finish grades. Relative to the DEEP New London Coastal Jurisdiction Line (CJL; elevation of +2.1 ft. NAVD88), approximately 315,900 CY of fill would be placed between the piers for Central Wharf creation.
- Installation of a series of ~3' wide stone columns, or comparable technology, in the filled area of the new Central Wharf created between the piers and at the East Berth Heavy Lift area.
- Installation of steel sheet pile to enclose the State Pier heavy lift platform and filling approximately 33,600 SF between the existing State Pier riprap slope and the proposed sheet pile wall along its East Face . Approximately 15,000 CY will be placed below MHHW (+1.21 ft. NAVD88) for the East Face Heavy lift area creation. Relative to the CJL (+2.1 ft. NAVD88), approximately 15,600 CY of fill would be installed for East Face Heavy Lift area creation.
- Installation of steel toewall system at the base of the State Pier heavy lift platform. ~1,115 LF of toewall is proposed at and adjacent to the heavy lift platform.
- Installation of upgraded fendering and mooring bollards at the State Pier East Face Berth.
- Installation of a toewall to protect an existing eelgrass bed from dredging activities. Toewall will consist of up to ~170 linear feet of combination sheet pile (to extend ~1 foot above mudline).
- Installation of high mast lights at the State Pier Facility.
- Installation of cold ironing infrastructure.
  Installation of piles and associated gangway to support ConnDOT Chester-Hadlyme ferry overwintering at the Northwest Bulkhead area.

The Project's in-water and upland work are proposed within an existing working waterfront area that has supported port terminal operations for over 100 years. Existing benthic conditions within the Project work areas must be considered in assessing potential impacts to EFH. Recent field investigations indicate that riverine sediments in the Project's new "Central Wharf Area", which would be filled, are comprised primarily of dark to black silts throughout, with various typical estuarine inclusions (occasional shells, benthic invertebrates, etc.) and fine sand noted, typically at trace levels or less. Fill would be placed atop existing substrate in support of the Central Wharf Area creation. After removal of the existing State Pier deck apron and underlying riprap, fill material would be confined and placed atop the existing earthen slope within this pier's footprint. No deck or riprap removal is required for construction work beyond the existing pier footprint.

Recent field investigations also indicated that riverine sediments in the Project's dredge footprint areas are also characterized primarily as dark to black silts, with various typical estuarine inclusions and occasional fine sand noted (typically trace or less). Existing armored materials (riprap) will be removed from the dolphin pile areas. The northern portion of the proposed Turning Basin area will require side slope cutting to approximate the bathymetry of the existing (former) Navy Anchorage area. A bed of eelgrass (*Zostera marina*), approximately 4,600 sf in size, was identified during site surveys in July 2019. This submerged aquatic vegetation (SAV) bed is located adjacent to, but wholly outside of, the Project work areas. This SAV would be isolated by physical means (toewall to retain slope integrity; and, turbidity curtain enclosure), as further described below.

Additional information regarding benthic conditions is presented in the Project's Joint Permit Application (JPA), Attachments M1 (Natural Resources Evaluation Report) and M2 (Sediment and Site Assessment Reports), as well as Attachment M1B, the Project's Benthic Habitat Assessment Report.

3. Construction Schedule

The construction would be competed in two (2) phases, “Phase 1: Uplands and NE Bulkhead” work and “Phase 2: Waterfront Works”. As noted above, some overlap between the phases may occur. Construction is anticipated to start in February 2021. The final Project schedule will be determined by multiple factors, including regulatory approvals, contracting and other variables. Regardless of schedule changes, if any are ultimately required, adherence to the following time of year restrictions is anticipated.

To protect spawning species, and as based on initial input from CT DEEP Inland Fisheries, NOAA NMFS and CT Bureau of Aquaculture, a “no in-water-work” window is anticipated from June through September, annually[2]. In addition, the CPA anticipates that the Project would have a Time-of-Year (TOY) window which allows for dredging activities between October 1 through January 31, annually.

To address concerns relative to potential Peregrine Falcon (*Falco peregrinus*) nesting, CT DEEP Natural Diversity Data Base (NDDB) has indicated that no Project construction activities should occur during the period of April 1 to June 30; or, if required, work during this timeframe should occur in accordance with the CT DEEP NDDB-approved Project Peregrine Falcon Protection Plan (NDDB # 201901490 REVISED: see Attachment C).

Based on language included in the USACE CT GP, CPA anticipates that the following schedule and mitigation considerations may also be applicable to the Project: “*Piles should either be installed between November 1 and March 15 OR must use a soft start each day of pile driving, building up power slowly from a low energy start-up over a period of 20-40 minutes to provide adequate time for fish and marine mammals to leave the vicinity. The buildup of power should occur in uniform stages to provide a constant increase in output. Bubble curtains can be used to reduce sound pressure levels during vibratory or impact hammer pile driving*.”

Further details regarding the anticipated Project schedule are presented below.

Phase 1 Work (Uplands and NE Bulkhead/Dolphin Removal)

- Upland demolition and regrading, February 2021 to October 2021.
- Upland construction, February 2021 to November 2021 (Phase 2 Uplands construction into 2022).
- In-water work (under COP / GP2 authorizations): Northeast Bulkhead oversheeting, Northeast Annex Demolition, Mooring Dolphin Demolition, February 2021 to June 2021.

Phase 2 Work (Waterfront Works: State Pier / CVRR Pier / Central Wharf)

- Pier Work (Pier demolition, sheeting and elevation improvements, heavy lift area construction, pier-side mooring structure installation, etc.), February 2021 to August 2022.
- Install King Pile bulkhead (and complete associated demolition work) at south end of Admiral Shear State Pier and CVRR Pier, February 2021 through September 2021.
- Dredging of NE bulkhead berth and jack-up pocket and transport of dredged material for onsite re-use/offsite disposal (as needed), October 2021 to December 2021.
- Dredging of Turning Basin and transport of dredged material for onsite re-use/offsite disposal (as needed), December 2021 to January 2022.

[2] CPA understands that select, confined in-water Project activities may progress behind sheeting and/or turbidity curtains once established, if within this period.

- Dredging of jack-up pocket at East Berth and transport of dredged material for onsite re-use/offsite disposal (as needed), January 2022.
- Filling of newly created Central Wharf area between the existing Admiral Shear State Pier and the CVRR Pier. Work includes placement of suitable onsite dredged materials, materials from the onsite uplands and additional offsite fill, compaction, stone column installation, aggregate surface installation, September 2021 to November 2022.
- Install temporary offices, September 2021 to May 2022.
- Utilities demolition, June 2021 to July 2021 and installation, July 2022 to October 2022.

The entire project is expected to be completed over a 2-year period with construction finished in 2022.

4. Essential Fish Habitat Mandate, Statutes, Definitions, and Managed Species

The 1996 amendments to the MSFMCA set forth a new mandate for NOAA Fisheries, regional Fishery Management Councils (FMCs), and other federal agencies to identify and protect important marine and anadromous fisheries habitat, referred to as EFH. To achieve this goal, suitable marine fishery habitat needs to be maintained. NOAA Fisheries and the regional FMCs are required to delineate EFH in Fishery Management Plans (FMPs) for all federally managed fisheries. The 1996 amendments also require that EFH consultation be conducted for any activity that may adversely affect important habitats of federally managed marine and anadromous fish species.

As such, EFH has been identified and described within the Project location based upon areas where various life stages of managed species occur. These species were selected for discussion because they are managed species for which EFH exists under the NEFMC, MAFMC or NOAA Fisheries FMPs. These species are those for which data were adequate to define and describe EFH.

The MSFMCA (16 U.S.C. § 1801-1882) establishes regional FMCs and mandates that FMPs be developed to responsibly manage exploited fish and invertebrate species in federal waters of the U.S. When Congress reauthorized this act in 1996, as the Sustainable Fisheries Act (SFA), several reforms were made. One change was to charge NOAA Fisheries with designating and conserving EFH for species managed under existing FMPs. This is intended to minimize, to the extent practicable, any adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of such habitat. In 2006, Congress passed another significant amendment, the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, which was signed into law in January 2007. This law was groundbreaking in several respects as it featured a number of new requirements to: prevent overfishing by establishing annual catch limits and accountability measures; promote market-based management strategies, including limited access privilege programs, such as catch shares; strengthen the role of science through peer review, the Councils' Scientific and Statistical Committees, and the Marine Recreational Information Program; and enhance international fisheries sustainability by addressing illegal, unregulated, and unreported fishing and bycatch.

EFH has been defined as (16 U.S.C. § 1801[10]):

> *"those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity."*

The EFH final rule summarizing EFH regulations (50 CFR § 600.10) outlines additional interpretation of the EFH definition as follows:

> *'Waters' include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic habitat historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means 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' covers a species' full life cycle."*

EFH is separated into estuarine and marine components. The estuarine component is generally defined as all estuarine waters and substrates including the subtidal vegetation and adjacent inter-tidal vegetation. Specific habitats in this definition include, but are not limited to, emergent wetlands, estuarine scrub/shrub wetlands, submerged aquatic vegetation, reefs and shell banks, intertidal flats, aquatic beds, and the estuarine water column. The marine component is generally defined as all waters and substrates from the shoreline to the seaward limit of the Exclusive Economic Zone (EEZ). Specific habitats included in this definition are live/hard bottom, coral and coral reefs, artificial and manmade reefs, *Sargassum*, and the marine water column.

EFH in the Project's area of affect has been identified and described for various life stages of managed fish and invertebrate species that collectively comprise 8 FMPs. A provision of the MSFMCA requires that Fishery Management Councils (FMC) identify and protect EFH for every species managed under a particular FMP (U.S.C. 1853(a) (7)). The species within these FMPs have EFH designations for some, or all, of their life cycle within the proposed Project area. The species included in these FMPs have been determined to be commercially important and their collective habitat types occur throughout the estuarine waters within the Project area.

Parties interested in any proposed action within project areas containing EFH must consult with NOAA Fisheries and present an environmental assessment that states the effects of construction and potential risks to commercial and recreational fisheries and fish habitat. The MSFCMA also establishes the requirement to describe and identify EFH within each FMP using text and geographical location information. The Mid-Atlantic and New England regions have been divided into 10-minute x 10-minute blocks from the coastline out to the limits of the EEZ, and the life stages of each species occurring within each block has been identified (NOAA Fisheries/NERO 2017). EFH is also mapped throughout the U.S. This mapping is available online and can be queried to determine a list of species with EFH within any proposed Project area (NOAA Habitat 2019/2020).

Within the Mid-Atlantic and New England regions, EFH has been identified for a total of 38 managed species (26 in New England and 12 from the Mid-Atlantic) of fish and invertebrates covered by 16 FMPs. Highly migratory species are managed by the NOAA Fisheries Highly Migratory Species Management Unit, Office of Sustainable Fisheries and an FMP for 23 species has recently been developed for these species; which include EFH descriptions for sharks, tunas, swordfish, and billfishes (NOAA Fisheries 2006). EFH information on five coastal pelagic species was taken from an FMP prepared by the South Atlantic Fisheries Management Council (SAFMC) (SAFMC 1998) to address EFH for migratory fishes that occur in multiple regions along the Atlantic coast. Thus, fish such as mackerel have EFH designations in the North Atlantic due to the distribution of this management unit. In total, sixteen (16) species have EFH designated for all, or a portion, of their life stages in the block where the proposed Project will be located (Table 1). Also included is an assessment of potential impact to NOAA trust resources known to occur within the project areas as well as federally protected species. NOAA-trust resources include anadromous fish, shellfish, crustaceans, and their habitats. Additional detail is also available in the Biological Assessment (BA: AECOM, May 2020) document submitted in conjunction with the SPII JPA.

Table 1. Federally Regulated Fish Species Potentially Present within the Project Area Managed by the Fishery Management Councils and their respective Fishery Management Plans

Fishery Management Council/Jurisdiction	Council-Managed Species		
	Common Name	**Scientific Name**	**Fishery Management Plan**
Mid-Atlantic Fishery Management Council	Scup	*Stenotomus chrysops*	Summer Flounder, Scup, Black Sea Bass FMP
	Longfin Inshore Squid	*Doryteuthis pealeii*	Atlantic Mackerel, Squid & Butterfish FMP Amendment 11
	Atlantic Mackerel	*Scomber scombrus*	Atlantic Mackerel, Squid & Butterfish FMP Amendment 11
	Bluefish	*Pomatomus saltatrix*	Bluefish FMP
	Atlantic Butterfish	*Peprilus triacanthus*	Atlantic Mackerel, Squid & Butterfish FMP Amendment 11
	Summer Flounder	*Paralichthys dentatus*	Summer Flounder, Scup, Black Sea Bass FMP
	Black Sea Bass	*Centropristis striata*	Summer Flounder, Scup, Black Sea Bass FMP
New England Fishery Management Council	Winter Flounder	*Pseudopleuronectes americanus*	Northeast Multispecies FMP
	Little Skate	*Leucoraja erinacea*	Northeast Skate Complex FMP
	Atlantic Herring	*Clupea harengus*	Atlantic Herring FMP
	Pollock	*Pollachius virens*	Northeast Multispecies FMP
	Red Hake	*Urophycis chuss*	Small Mesh Multispecies FMP
	Windowpane Flounder	*Scophthalmus aquosus*	Northeast Multispecies FMP
	Winter Skate	*Leucoraja ocellate*	Northeast Skate Complex FMP
Secretarial*	Smoothhound Shark Complex / Smooth Dogfish	*Mustelus canis*	Amendment 10 to the 2006 Consolidated HMS FPM: EFH
	Sand Tiger Shark	*Carcharias taurus*	Amendment 10 to the 2006 Consolidated HMS FPM: EFH

* NOAA EFH Mapper indicates Smooth Dogfish EFH located only in the far western extent of the Project area (i.e. Winthrop Cove) and the majority of the site is outside of Sand Tiger Shark EFH, with only limited EFH occurrence at southern tip of the CVRR Pier.

The proposed Project area will be contained within one 10 x 10-minute EFH block (Figure 1). Only those species of fish that have EFH designations for all or part of their life stages within this block are described below in Section 5.0. The information from the 10-minute block is based primarily on offshore trawl survey data collected by NOAA, which was subsequently used to support the regional FMCs' EFH designations (NOAA Fisheries/NERO 2017).

Table 1 summarizes the species, respective jurisdiction, and correlating FMPs for species within the Project area; only fish and cephalopod (squid) species were identified for this Project. These species are managed under respective FMPs from the NEFMC or MAFMC, or under FMPs developed for highly migratory, and coastal migratory species.

Within the EFH designated for various species, areas termed Habitat Areas of Particular Concern (HAPCs) have also been identified and mapped throughout the U.S. HAPCs either play important roles in the life history (e.g., spawning areas) of federally managed fish species or are especially vulnerable to degradation from fishing or other human activities. In many cases, HAPCs represent areas where detailed information is available on the structure and function within the larger EFH.

Per the EFH Mapper tool (NOAA Habitat 2020), Summer Flounder HAPC is absent between the CVRR Pier and Admiral Shear State Pier and near the Project's Northeast Bulkhead. It is depicted at other locations onsite in the mapper tool. In accordance with the accompanying NMFS EFH Assessment worksheet, "*Summer flounder HAPC is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. In locations where native species have been eliminated from an area, then exotic species are included. Use local information to determine the locations of HAPC*."

As noted above, an extant bed of eelgrass, approximately 4,600 sf in size, was identified in July 2019 adjacent to, but wholly outside of, the Project work areas. Based on the survey data, eelgrass within the stand was extremely patchy and the relative density ranged from sparse to moderate with a plant height of 1-3 feet. Plants were covered with epiphytic algae and bryozoans and were not robust. Water column visibility at the time of the survey was poor and abundant macroalgae indicate potential elevated nutrient levels. No eelgrass was observed between the piers. Macroalgal species observed during the eelgrass survey include kelp (*Saccharina latissima*), sea lettuce (*Ulva lactuca*), purple laver (*Porphyra spp*.), dulse (*Palmaria palmata*), as well as unidentifiable red and brown algae. The majority of SAV observed in the Project area was noted at this eelgrass bed located near the NE bulkhead. This bed will be protected from construction activities and impacts as described herein. Some other sporadic occurrences of SAV (e.g. macroalgae, dulse individuals) were noted in other work areas, though none were observed in mapped summer flounder HAPC areas. Protection measures will be employed to isolate the eelgrass bed from Project activities during in-water dredging activities (to be completed in winter, outside of the growing season). As no SAV beds will be impacted, CPA understands that summer flounder HAPC would not be affected by the Project. No other species with designated EFH within the Project have identified HAPCs within the Project area.

5. Managed Fish Species

Table 3 summarizes the federally managed fish species that exhibit EFH designations for all or part of their life cycles within the 10-minute EFH block in which the proposed Project is located. The source of this information is from the NOAA Northeast Region EFH designations and the NOAA EFH mapper websites (NOAA Fisheries/NERO 2019a and NOAA Habitat 2019/2020 respectively). Table 2 summarizes habitat characteristics and parameters for each of the New England Fishery Management Council managed species that occur within the Project area. Federally managed species listed in Table 3 that exhibit EFH within the Project area are further discussed and subdivided by FMP. These descriptions include a brief summary of distribution and natural history as well as EFH designations.

Table 2 Summary of Essential Fish Habitat and General Habitat Parameters for Federally Managed Species Under New England Fishery Management Council Plans that Exhibit EFH for All or Part of Their Life Cycle Within the Project Area.[1]

Species	Life Stage	Geographic Area	Temp. (ºC)	Salinity ‰	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Winter Flounder	Eggs	GB, inshore GOM, southern NE, Mid-Atlantic south to Delaware Bay	<10	10-30	<5	Feb-June, peak in April on GB	Bottom habitats with substrate of sand, muddy sand, and gravel	
	Larvae	Pelagic and bottom waters of GB, inshore GOM, middle Atlantic south to Delaware Bay	<15	4-30	<6	March-July, peaks in April and May on GB		
	Juvenile	GB, inshore GOM, southern NE, Mid-Atlantic south to Delaware Bay	<25	10-30	1-50		Bottom substrate of mud or fine grained sand	Young-of-the-Year generally found in shallower water.
	Adult	GB, inshore GOM, southern NE, and middle Atlantic south to Delaware Bay	<25	15-33	1-100		Bottom substrates of mud, sand, or gravel	
	Spawning Adult	GB, inshore GOM, southern NE, Mid-Atlantic south to Delaware Bay	<15	5.5-36	<6	Feb-June	Estuarine substrates of sand, muddy sand, and gravel	Spawning on GB occurs as deep as 80 meters
Little Skate	Juveniles	GB through Mid-Atlantic Bight to Cape Hatteras	4-15		73-91		Bottom habitats with sandy or gravelly substrate or mud	Found from shore to 137 meters
	Adults	GB through Mid-Atlantic Bight to Cape Hatteras	2-15		73-91		Bottom habitats with sandy or gravelly substrate or mud	Found from shore to 137 meters
Winter Skate	Juveniles	Cape Cod Bay, GB, southern NE, through Mid-Atlantic Bight to North Carolina	4-16		<111		Bottom habitats with substrate of sand and gravel or mud	Found from shore to 400 meters
	Adults	Cape Cod Bay, GB, southern NE, through Mid-Atlantic Bight to North Carolina	5-15		<111		Bottom habitats with substrate of sand and gravel or mud	Found from shore to 371 meters
Windowpane Flounder	Eggs	GOM, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy to Great Bay; Mass Bay to Delaware Inland bays	<20		<70	Feb-Nov, peaks May and Oct in middle Atlantic. July-Aug on GB	Surface waters	
	Larvae	Same as above	<20		<70	Feb-Nov, peaks May and Oct in middle Atlantic. July-Aug on GB	Pelagic waters	

Species	Life Stage	Geographic Area	Temp. (ºC)	Salinity ‰	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juvenile	Same as above but the following estuaries: Passamaquoddy to Great Bay; Mass Bay to Chesapeake Bay	<25	5.5-36	1-100		Bottom habitats with substrate of mud or fine grained sand	
	Adult	GOM, GB, southern NE, middle Atlantic south to VA-NC border and the following estuaries: Passamaquoddy to Great Bay; Mass Bay to Chesapeake Bay	<26.8	5.5-36	1-75		Bottom habitats with substrate of mud or fine grained sand	Major prey: polychaetes, small crustaceans, mysids, small fish
	Spawning Adult	Same as above but the following estuaries: Passamaquoddy to Great Bay; Mass Bay to Delaware Inland Bays	<21	5.5-36	1-75	Feb-Dec, peak in May in middle Atlantic	Bottom habitats with substrate of mud or fine grained sand	
Pollock	Juveniles	Bottom habitats with aquatic vegetation or a substrate of sand, mud or rocks in the Gulf of Maine and Georges Bank	<18	29-32	0-250			
	Adults	Bottom habitats in the Gulf of Maine and Georges Bank and hard bottom habitats (including artificial reefs) off southern New England and the middle Atlantic south to New Jersey	<14	31-34	15-365			
	Spawning Adult	Bottom habitats with a substrate of hard, stony or rocky bottom in the Gulf of Maine and hard bottom habitats (including artificial reefs) off southern New England and the middle Atlantic south to New Jersey	<8	32-32.8	15-365	Sept-April with peaks from Dec-Feb		
Atlantic sea herring	Juveniles	Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic to Cape Hatteras.	<10	26-32	15-135		Pelagic waters and bottom habitats.	
	Adults	Same as juveniles.	<10	28	20-130		Pelagic waters and bottom habitats.	

Species	Life Stage	Geographic Area	Temp. (ºC)	Salinity ‰	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Red Hake	Eggs	GOM, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras.	<10	<25		May to November, with peaks June-July	Surface waters	
	Larvae	GOM, GB, continental shelf off southern NE and middle Atlantic south to Cape Hatteras and the following estuaries: Sheepscot R., Mass Bay to Cape Cod Bay; Buzzards Bay, Narragansett Bay, Hudson R./Raritan Bay	<19	>0.5	<200	May to Dec, peaks in Sept and Oct	Surface waters	Newly settled larvae need shelter, including live sea scallops, floating or mid-water objects
	Juvenile	Same as Larvae but in the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./Raritan Bay, Chesapeake Bay	<16	31-33	<100		Bottom habitats with substrate of shell fragments, including areas with an abundance of live scallops	
	Adult	Same as Larvae but in the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./Raritan Bay, Delaware Bay, Chesapeake Bay	<12	33-34	10-130		Bottom depressions with substrates of sand and mud	Major prey : fish and crustaceans
	Spawning Adult	GOM, southern edge of GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and following estuaries: Sheepscott R., Mass Bay, Cape Cod Bay, Buzzards Bay, and Narragansett Bay	<10	>25	<100	May to November, with peaks June-July	Bottom depressions with substrates of sand and mud	

Notes:

EEZ = Exclusive Economic Zone
GB = Georges Bank
GOM = Gulf of Maine
GSC = Great South Channel
HAPC = Habitat Area of Particular Concern
NC = North Carolina
NE = New England
NJ = New Jersey
NY = New York
VA = Virginia
YOY = Young of Year
MA = Massachusetts

1 = All information in this table was compiled by NOAA Fisheries/NERO2019b or NOAA Habitat 2019. All information presented is part of Regional Fishery Management Council's EFH designations, except text contained within the comment section of this table.

Table 3. Summary of Essential Fish Habitat Designations for the Project Area EFH Block for all Life Stages of Fish and Invertebrates

Species	Scientific Name	Eggs	Larvae	Juveniles	Adults
Scup	*Stenotomus chrysops*	X	X	X	X
Bluefish	*Pomatomus saltatrix*			X	X
Atlantic Butterfish	*Peprilus triacanthus*	X	X	X	X
Black Sea Bass	*Centropristis striata*			X	
Summer Flounder	*Paralichthys dentatus*			X	X
Winter Flounder	*Pseudopleuronectes americanus*	X	X	X	X
Little Skate	*Leucoraja erinacea*			X	X
Winter Skate	*Leucoraja ocellate*			X	X
Atlantic Sea Herring	*Clupea harengus*			X	X
Pollock	*Pollachius virens*			X	X
Red Hake	*Urophycis chuss*	X	X	X	X
Windowpane Flounder	*Scopthalmus aquosus*	X	X	X	X
Sand Tiger Shark*	*Carcharias taurus*			X[1]	
Smooth Dogfish*	*Mustelus canis*	X	X	X	X
Longfin Inshore Squid	*Doryteuthis pealeii*	X	X	X	X
Atlantic Mackerel	*Scomber scombrus*	X	X	X	X

[1] This includes neonates and juveniles.

* 2020 NOAA EFH Mapper returns intermittent results for this species/EFH in or adjacent to the Project area. NOAA EFH Mapper indicates majority of Project site is outside of Sand Tiger Shark EFH, with only a limited occurrence of EFH at the southern tip of the CVRR Pier. Smooth Dogfish EFH appears only at / near the extreme western edge of the Project work area (west of the CVRR Pier), per the NOAA EFH Mapper

"X"= Life Stage occurs in the 10-minute EFH block within Project boundaries.

5.1 Ecological Notes on Managed Species

The following subsections provide detailed discussions for each managed species per its respective FMP. Included in these discussions is ecological information for only those species or groups of species that have EFH designations for all or parts of their life cycle within the proposed Project area. This information was compiled from multiple sources including NOAA and FMC websites, EFH source documents, and research papers.

Because the MSFCMA requires the regional FMCs, after receiving recommendations from NOAA Fisheries, to amend their existing FMPs for the species under their management and to address the EFH provisions, the NEFMC chose to develop a single, stand-alone FMP amendment that addressed the EFH requirements of all NEFMC-council managed species. This document, entitled the “omnibus” EFH amendment (NEFMC 1998) was submitted to NOAA Fisheries in October of 1998 and included Amendment 11 to the Northeast Multispecies Groundfish FMP, Amendment 9 to the Atlantic Sea Scallop FMP, Amendment 1 to the Monkfish FMP, Amendment 1 to the Atlantic Salmon FMP, and components of the proposed Atlantic Herring FMP. Amendment 12 to the Northeast Multispecies FMP extended the NEFMC management to the offshore hake and included the required EFH designations and review for this species. This “omnibus” amendment was also used in the preparation of the text in the following subsections.

Similarly, the MAFMC has developed and amended their FMPs to address EFH provisions for their council-managed species. The information from these FMPs was used in the preparation of the text in the following subsections.

5.1.1 Northeast Multispecies (Large Mesh/Groundfish) Fishery Management Plan

The Northeast Multispecies Large Mesh/Groundfish FMP manages 13 species of demersal fish species, which include Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, Atlantic wolfish, redfish, ocean pout, and white hake. The groundfish species exhibiting any portion of their life stage within the 10 x 10-minute block where the proposed Project is located are summarized in Table 3. Three of the 13 species contained within the FMP have some form of their respective life stage within the Project area and are described below. The following paragraphs briefly describe the natural history and EFH designations for these groundfish species.

5.1.1.1 Pollock

Pollock (*Pollachius virens*) are a member of the cod family which inhabit coastal and offshore waters. Their geographic range extends from the Gulf of Mexico to Georges Bank, and the northern part of the Middle Atlantic Bight. Juveniles of this species inhabit bottom habitats, with aquatic vegetation or substrates consisting of sand, mud, and rocks. Adults of this species inhabit waters with hard bottom habitats including artificial reefs (Cargnelli et al. 1999). Juveniles primarily feed on crustaceans while adults feed on fish and mollusks. Pollock are a schooling species which exhibits substantial shifts in abundance by area through movements and migrations associated with their search for food and for the purposes of spawning. According to the 2017 stock assessment, Atlantic pollock are not overfished and are not subject to overfishing (Cargnelli et al. 1999).

The juvenile and adult life stages of pollock have been identified to exhibit EFH within the 10-minute block where the proposed Project is located (Table 3). The lifestage descriptions for juvenile and adult pollock have been taken directly from the Omnibus Essential Fish Habitat Amendment 2 (updated October 2017).

Juveniles: Inshore and offshore pelagic and benthic habitats from the intertidal zone to 180 meters in the Gulf of Maine, in Long Island Sound, and Narragansett Bay, between 40 and 180 meters on western Georges Bank and the Great South Channel, and in mixed and full salinity waters in a number of bays and estuaries north of Cape Cod. 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 (including *Zostera marina*) 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.

Adults: Offshore pelagic and benthic habitats in the Gulf of Maine and, to a lesser extent, on the southern portion of Georges Bank between 80 and 300 meters, and in shallower sub-tidal habitats in Long Island Sound, Massachusetts Bay, and Cape Cod Bay. Essential habitats for adult pollock are the tops and edges of offshore banks and shoals (e.g., Cashes Ledge) with mixed rocky substrates, often with attached macro algae.

A full summary of EFH designations for pollock along with general habitat parameters is provided in Table 2. The EFH designation for pollock juvenile and adult life stages in Long Island Sound, includes the seawater salinity zone (salinity >25 ppt), suggesting salinities <25ppt would not serve as EFH for these life stages (Table 21 of Omnibus Essential Fish Habitat Amendment 2).

5.1.1.2 Windowpane Flounder

The windowpane flounder (*Scophthalmus aquosus*) is a species that inhabits estuaries, nearshore waters, and the continental shelf in the northwest Atlantic from the Gulf of St. Lawrence south to Florida but is most abundant from Georges Bank to the Chesapeake Bay (Chang et al. 1999). This species generally inhabits shallow waters less than 360 ft (110 m) with sand to sand/silt or mud substrates and is most abundant from 3–7 ft (1–2 m). Spawning adults would most likely be found within the Project area from February to December with peaks occurring in May, while eggs and larvae are most likely to be found from February to November with peaks in May and October (Chang et al. 1999). There are two managed stocks of windowpane flounder in U.S. waters: the Gulf of Maine/Georges Bank stock and the southern New England/Middle Atlantic stock. The Southern New England/Middle Atlantic stock is currently not considered to be overfished, and overfishing is currently not occurring; the Gulf of Maine/Georges Bank stock is currently overfished, but overfishing is not actively occurring. (NOAA Fisheries/OSF 2019).

All life stages of windowpane flounder have been identified to exhibit EFH within the 10-minute block where the proposed Project is located (Table 3). The lifestage descriptions for windowpane flounder have been taken directly from the Omnibus Essential Fish Habitat Amendment 2 (updated October 2017).

Eggs and Larvae: 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.

Juveniles: Intertidal and sub-tidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to northern Florida, including mixed and high salinity zones in the bays and estuaries identified as EFH. 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 60 meters. Young-of-the-year juveniles prefer sand over mud.

Adults: Intertidal and sub-tidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to Cape Hatteras, including mixed and high salinity zones in the bays and estuaries identified as EFH. 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 70 meters.

A full summary of EFH designations for windowpane flounder along with general habitat parameters is provided in Table 2.

5.1.1.3 Winter Flounder

Winter flounder (*Pseudopleuronectes americanus*) occur in shelf waters of the Atlantic coast, however; the highest concentrations of this species occur in nearshore habitats in the northern portion of the range.

The designated EFH for winter flounder eggs in the Project vicinity is described as sub-tidal waters from the shoreline to a maximum depth of 5 meters. Many factors influence larval and juvenile growth and survival, including temperature, salinity, dissolved oxygen, and food availability (Berry et al., 1965). Shallow coastal environments and estuaries provide suitable spawning grounds for winter flounder throughout their range (Bigelow et al., 2002). Pereira et al. (1999) described sandy or muddy substrate of inshore waters of less than 6 meters as preferred spawning habitat for the species. During spawning, females release demersal (negatively or neutrally buoyant) adhesive eggs whose properties facilitate retention within spawning grounds (Butts et al., 2012). The adhesion of the eggs to the substrate, combined with the sedentary and benthic nature of the fish, encourage the isolation of local populations (Perlmutter, 1947). This isolation causes local populations to become particularly vulnerable to natural and anthropogenic disturbances (Howell et al., 1999).

EFH has been designated for all life stages of winter flounder at the Project location in the Thames River. The lifestage descriptions for winter flounder have been taken directly from the Omnibus Essential Fish Habitat Amendment 2 (updated October 2017).

Eggs: Sub-tidal estuarine and coastal benthic habitats from mean low water to 5 meters from Cape Cod to Absecon Inlet (39° 22’ N), and as deep as 70 meters on Georges Bank and in the Gulf of Maine, including mixed and high salinity zones in the bays and estuaries. The eggs are adhesive and deposited in clusters on the bottom. Essential habitats for winter flounder eggs include mud, muddy sand, sand, gravel, macroalgae, and submerged aquatic vegetation. Bottom habitats are unsuitable if exposed to excessive sedimentation which can reduce hatching success.

Larvae: Estuarine, coastal, and continental shelf water column habitats from the shoreline to a maximum depth of 70 meters from the Gulf of Maine to Absecon Inlet (39° 22’ N), and including Georges Bank, including mixed and high salinity zones in the bays and estuaries. Larvae hatch in nearshore waters and estuaries or are transported shoreward from offshore spawning sites where they metamorphose and settle to the bottom as juveniles. They are initially planktonic but become increasingly less buoyant and occupy the lower water column as they get older.

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

Adults: Estuarine, coastal, and continental shelf benthic habitats extending from the intertidal zone (mean high water) to a maximum depth of 70 meters from the Gulf of Maine to Absecon Inlet (39° 22’ N), and including Georges Bank, and in mixed and high salinity zones in the bays and estuaries. 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).

A full summary of EFH designations for winter flounder along with general habitat parameters is provided in Table 2.

5.1.2 Atlantic Sea Herring Fishery Management Plan

5.1.2.1 Atlantic Herring

The Atlantic sea herring (*Clupea harengus*) is a species that is managed through a single species FMP. Originally the Atlantic herring fishery was managed by the International Commission for the Northwest Atlantic Fisheries (ICNAF) from 1972 until 1976, where the United States withdrew from the organization and began developing its own herring FMP. Currently the NEFMC, MAFMC, and ASMFC have developed a joint FMP that took effect March 19, 1979. The goal of the FMP was to manage herring stocks on Georges Bank and the Gulf of Maine to achieve higher levels of spawning and rebuild a juvenile herring resource and sardine fishery in the Gulf of Maine (NEFMC 1999).

The Atlantic sea herring are plankton-feeding fish that form large schools in coastal and continental shelf waters from Labrador to Virginia. Juveniles undergo seasonal inshore-offshore migrations and are abundant in shallow, inshore waters during warm months. Adults migrate south from summer/fall spawning grounds in the Gulf of Maine and Georges Bank to southern New England and the mid-Atlantic in the winter. Spawning habitat is rock, gravel or sandy bottoms ranging in depth from 50-150 feet. Herring form the base of the food chain as a forage fish for marine mammals, seabirds and many fish throughout the northeast. They are also affordable bait for lobster, blue crab, and tuna fishermen and are also sold as canned sardines, steaks and kippers (ASMFC 2017). According to NOAA Fisheries, the Atlantic herring is not currently overfished, and overfishing is not occurring (NOAA Fisheries/OSF 2019).

EFH for the juvenile and adult life stages of Atlantic sea herring have been identified within the 10-minute block where the proposed Project is located (Table 3). The life stage descriptions for Atlantic herring have been taken directly from the Omnibus Essential Fish Habitat Amendment 2 (updated October 2017).

Juveniles: Intertidal and sub-tidal pelagic habitats to 300 meters throughout the region, including the bays and estuaries. 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 3 to 15°C in the northern part of their range and as high as 22°C in the Mid-Atlantic. Young-of-the-year juveniles can tolerate low salinities, but older juveniles avoid brackish water.

Adults: Sub-tidal pelagic habitats with maximum depths of 300 meters throughout the region, including the bays and estuaries. 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 100 meters and – unless they are preparing to spawn – usually remain near the surface. They generally avoid water temperatures above 10°C and low salinities. Spawning takes place on the bottom, generally in depths of 5 – 90 meters on a variety of substrates.

EFH designations along with general habitat parameters for larval, juvenile, and adult Atlantic sea herring are provided in Table 2.

5.1.3 Small Mesh Multispecies Fishery Management Plan

In May 2000 Amendment 12 (amending Amendment 11 included in omnibus amendment) to the Northeast Multispecies FMP was implemented, which separated three species of groundfish from that FMP and placed them under a separate small mesh multispecies management program. These species were red hake, silver hake (whiting), and offshore hake. The objective of this management program was to reduce fishing mortality on silver hake and red hake and to rebuild the small mesh multispecies stocks to their long-term sustainable levels. Under this program, small mesh fisheries are managed primarily through a combination of mesh size restrictions and possession limits. Small mesh closed areas are also utilized as a management tool in this fishery. Of the three species, only red hake is designated to have EFH within the Project area and will be the only species discussed below.

5.1.3.1 Red Hake

Red hake (*Urophycis chuss*) is a demersal species that occurs from North Carolina north to Southern Newfoundland where it is most abundant between Georges Bank and New Jersey in water depths ranging from 1 to 3,000 ft (1 to 900 m) (Steimle et al. 1999). Red hake make seasonal migrations to follow preferred temperature ranges where they are found in depths less than 330 ft (100 m) during warmer months and depths greater than 330 ft (100 m) in colder months (Steimle et al. 1999). There are two stocks recognized within the North Atlantic: the Gulf of Maine/Northern Georges Bank and the Southern Georges Bank/Mid-Atlantic stocks. Based upon an assessment of stock size, NOAA Fisheries has determined that neither stock of red hake is currently overfished, nor is overfishing occurring (NOAA Fisheries/OSF 2019).

All life stages of red hake have EFH designations within the 10-minute block where the Project is located (Table 3). The lifestage descriptions for red hake have been taken directly from the Omnibus Essential Fish Habitat Amendment 2 (updated October 2017).

Eggs and Larvae: Pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid- Atlantic, and in the bays and estuaries identified as EFH.

Juveniles: Intertidal and sub-tidal benthic habitats throughout the region on mud and sand substrates, to a maximum depth of 80 meters, including the bays and estuaries. 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.

Adults: Benthic habitats in the Gulf of Maine and the outer continental shelf and slope in depths of 50 – 750 meters and as shallow as 20 meters in a number of inshore estuaries and embayments 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 designations along with general habitat parameters for larval, juvenile, and adult stages of red hake are provided in Table 2.

5.1.4 Coastal Migratory Pelagic Fishery Management Plan

This FMP provides for the management of the Northeast Regions skate complex (seven species), including winter skate, barndoor skate (*Dipturis laevis*), thorny skate (*Amblyraja radiate*), smooth skate (*Malacoraja senta*), little skate, clearnose skate (*Raja eglanteria*), and rosette skate (*Leucoraja garmani*). These seven species are distrubited along the coast of the northeast United States from the tide lines to depths greater than 700 meters (NEFMC-NMFS, 2016).

One major issue with this group of fish is the difficulty in identification due to the similarities in appearance and overlap of habitats (NEFMC-NMFS, 2016). Of the seven species contained within this FMP, only two species (little skate and winter skate) have designated EFH within the 10-minute block where the proposed Project is located (Table 3). The other five species of skate do not have any EFH identified within the Project area and will not be discussed.

5.1.4.1 Little Skate

The little skate occurs from Nova Scotia to Cape Hatteras (Packer et al., 2003a) and is a dominant member of the benthic fish community in the northwest Atlantic Ocean (Bigelow and Schroder, 1953; McEachran and Musick, 1975). The little skate makes no extensive migrations but will move onshore and offshore as temperatures seasonally change (Bigelow and Schroeder, 1953). Fertilized eggs are encapsulated in a leathery case and egg cases are laid in pairs on the bottom. Juveniles are fully developed when they hatch, resembling adults of the species in shape and coloration (Packer et al., 2003a).

Juvenile and adult life stages of the little skate have EFH designations within the 10-minute block where the Project is located (Table 3). The lifestage descriptions for little skate have been taken directly from the Omnibus Essential Fish Habitat Amendment 2 (updated October 2017).

Juveniles: 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 80 meters, and including high salinity zones in the bays and estuaries identified as EFH. Essential fish habitat for juvenile little skates occurs on sand and gravel substrates, but they are also found on mud.

Adults: 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 100 meters, and including high salinity zones in the bays and estuaries identified as EFH. Essential fish habitat for adult little skates occurs on sand and gravel substrates, but they are also found on mud.

EFH designations along with general habitat parameters for juvenile and adult stages of little skate are provided in Table 2.

5.1.4.2 Winter Skate

The winter skate occurs from Newfoundland and southern Gulf of St. Lawrence, south to Cape Hatteras (Packer et al., 2003b). The species ranges from the shoreline to depths of 371 meters but are most abundant at depths less than 100 meters (Packer et al., 2003b). Immature juveniles of this species are often confused with juvenile little skates (McEachran, 2002). A single fertilized egg is encapsulated in a leathery case and deposited on the bottom, and egg deposition may continue from summer through January in southern New England (Packer et al., 2003b). Upon hatching, juveniles are fully developed.

Juvenile and adult life stages of the winter skate have EFH designations within the 10-minute block where the Project is located (Table 3). The lifestage descriptions for winter skate have been taken directly from the Omnibus Essential Fish Habitat Amendment 2 (updated October 2017).

Juveniles: 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 90 meters, including the high salinity zones of the bays and estuaries identified as EFH. Essential fish habitat for juvenile winter skates occurs on sand and gravel substrates, but they are also found on mud.

Adults: 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 80 meters, including the high salinity zones of the bays and estuaries identified as EFH. Essential fish habitat for adult winter skates occurs on sand and gravel substrates, but they are also found on mud.

EFH designations along with general habitat parameters for juvenile and adult stages of winter skate are provided in Table 2.

5.1.5 Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan

The *Summer Flounder, Scup, and Black Sea Bass FMP*, is intended to manage the summer flounder, scup, and black sea bass fisheries pursuant to the Magnuson-Stevens Fishery Conservation Act.

5.1.5.1 Black Sea Bass

Juvenile life stages of black sea bass have EFH designations within the 10-minute block where the Project is located (Table 3). The life stage descriptions for black sea bass have been taken directly from Amendment 12 to the *Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan* (MAFMC 1998).

Juveniles (<19 cm TL): 1) 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% of all the ranked squares of the area where juvenile black sea bass are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where black sea bass are identified as being common, abundant, or highly abundant in the 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 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, man-made structures in sandy shelly areas; offshore clam beds and shell patches may also be used during the wintering.

5.1.5.2 Scup

All life stages of scup have EFH designations within the 10-minute block where the Project is located (Table 3). The life stage descriptions for scup have been taken directly from Amendment 12 to the *Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan* (MAFMC 1998).

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

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

Juveniles (≤15 cm TL): 1) 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% of all the ranked ten-minute squares of the area where juvenile scup are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where scup are identified as being 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 and salinities greater than 15 ppt.

Adults (>15 cm TL): 1) 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% of all the ranked ten-minute squares of the area where adult scup are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where scup were identified as being 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.

5.1.5.3 Summer Flounder

Adult and juvenile stages of summer flounder have EFH designations within the 10-minute block where the Project is located (Table 3). The life stage descriptions for summer flounder have been taken directly from Amendment 12 to the *Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan* (MAFMC 1998).

Juveniles (<28 cm TL): 1) 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% of all the ranked ten-minute squares for the area where juvenile summer flounder are collected in the NEFSC trawl survey. 2) South of Cape Hatteras, EFH is the waters over the continental shelf (from the coast out to the limits of the EEZ) to depths of 500 ft, from Cape Hatteras, North Carolina to Cape Canaveral, Florida. 3) Inshore, EFH is all of 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 and salinities from 10 to 30 ppt range.

Adults (≥28 cm TL): 1) 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% of all the ranked ten-minute squares for the area where adult summer flounder are collected in the NEFSC trawl survey. 2) South of Cape Hatteras, EFH is the waters over the continental shelf (from the coast out to the limits of the EEZ) to depths of 500 ft, from Cape Hatteras, North Carolina to Cape Canaveral, Florida. 3) Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally, summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore on the outer continental shelf at depths of 500 ft in colder months.

5.1.6 Bluefish Fishery Management Plan

Adult and juvenile stages of bluefish have EFH designations within the 10-minute block where the Project is located (Table 3). The life stage descriptions for bluefish have been taken directly from Amendment 1 to the *Bluefish Fishery Management Plan* (MAFMC 1998).

Juveniles (<35 cm TL): 1) North of Cape Hatteras, 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% of the area where juvenile bluefish are collected in the NEFSC trawl survey; 2) South of Cape Hatteras, 100% of the pelagic waters over the continental shelf (from the coast out to the eastern wall of the Gulf Stream) through Key West, Florida; 3) the "slope sea" and Gulf Stream between latitudes 29° 00 N and 40° 00 N; and 4) all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Generally juvenile bluefish occur in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from May through October, and South Atlantic estuaries March through December, within the "mixing" and "seawater" zones. Distribution of juveniles by temperature, salinity, and depth over the continental shelf is undescribed

Adults (≥35 cm TL): 1) North of Cape Hatteras, 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% of the area where adult bluefish were collected in the NEFSC trawl survey; 2) South of Cape Hatteras, 100% of the pelagic waters over the continental shelf (from the coast out to the eastern wall of the Gulf Stream) through Key West, Florida; and 3) all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Adult bluefish are found in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from April through October, and in South Atlantic estuaries from May through January in the "mixing" and "seawater" zones. Bluefish adults are highly migratory and distribution varies seasonally end according to the size of the individuals comprising the schools. Bluefish are generally found in normal shelf salinities (> 25 ppt).

5.1.7 Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan

The *Atlantic Mackerel, Squid, and Butterfish FMP* is intended to manage these species pursuant to the Magnuson-Stevens Fishery Conservation Act.

5.1.7.1 Atlantic Butterfish

All life stages of Atlantic butterfish have EFH designations within the 10-minute block where the Project is located (Table 3). The life stage descriptions for Atlantic butterfish have been taken directly from Amendment 11 to the *Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan* (MAFMC 2011).

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 1,500 meters or less where average temperatures in the upper 200 meters of the water column are 6.5-21.5°C.

Larvae: EFH is pelagic habitats in inshore estuaries and embayments in Boston harbor, from the south shore of Cape Cod to the Hudson River, and in Delaware and Chesapeake bays, and on the continental shelf from the Great South Channel (western Georges Bank) to Cape Hatteras, North Carolina. EFH for

Atlantic butterfish larvae is generally found over bottom depths between 41 and 350 meters where average temperatures in the upper 200 meters of the water column are 8.5-21.5°C.

Juveniles (≤11 cm FL): 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 and outer continental shelf from southern New England to South Carolina. EFH for juvenile Atlantic butterfish is generally found over bottom depths between 10 and 280 meters where bottom water temperatures are between 6.5 and 27°C and salinities are above 5 ppt. Juvenile butterfish feed mainly on planktonic prey.

Adults (≥12 cm FL): 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 outer continental shelf from southern New England to South Carolina. EFH for adult Atlantic butterfish is generally found over bottom depths between 10 and 250 meters where bottom water temperatures are between 4.5 and 27.5°C and salinities are above 5 ppt. Spawning probably does not occur at temperatures below 15°C. Adult butterfish feed mainly on planktonic prey, including squids and fishes.

5.1.7.2 Atlantic Mackerel

All life stages of Atlantic mackerel have EFH designations within the 10-minute block where the Project is located (Table 3). The life stage descriptions for Atlantic mackerel have been taken directly from Amendment 11 to the *Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan* (Mid-Atlantic Fishery Management Council, May 2011).

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 100 meters or less with average water temperatures of 6.5-12.5°C in the upper 15 meters of the water column.

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

Juveniles (≤25 cm FL): 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 10 and 110 meters and in water temperatures of 5 to 20°C. Juvenile Atlantic mackerel feed primarily on small crustaceans, larval fish, and other pelagic organisms.

Adults (≥26 cm FL): EFH is pelagic habitats in inshore estuaries and embayments from Passamaquoddy Bay, Maine to the Hudson River, and on the continental shelf from Georges Bank to Cape Hatteras, North Carolina. EFH for adult Atlantic mackerel is generally found over bottom depths less than 170 meters and in water temperatures of 5 to 20°C. Spawning occurs at temperatures above 7°C, with a peak between 9 and 14°C. Adult Atlantic mackerel are opportunistic predators feeding primarily on a wider range and larger individuals of pelagic crustaceans than juveniles, but also on fish and squid.

5.1.7.3 Longfin Inshore Squid

All life stages of longfin inshore squid have EFH designations within the 10-minute block where the Project is located (Table 3). The following life stage descriptions have been taken directly from

Amendment 11 to the *Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan* (Mid-Atlantic Fishery Management Council, May 2011).

Eggs: EFH for *Doryteuthis pealeii* eggs occurs in inshore and offshore bottom habitats from Georges Bank southward to Cape Hatteras, generally where bottom water temperatures are between 10°C and 23°C, salinities are between 30 and 32 ppt, and depth is less than 50 meters. *Doryteuthis pealeii* eggs have also been collected in bottom trawls in deeper water at various places on the continental shelf. Like most loliginid squids, *D. 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.

Pre-recruits (≤8 cm DML): 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 recruit longfin inshore squid is generally found over bottom depths between 6 and 160 meters where bottom water temperatures are 8.5-24.5°C and salinities are 28.5-36.5 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 up in the water column at night and down in the daytime. Small immature individuals feed on planktonic organisms while larger individuals feed on crustaceans and small fish.

Recruits (≥9 cm DML): 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 6 and 200 meters where bottom water temperatures are 8.5-14°C and salinities are 24-36.5 ppt. Recruits inhabit the continental shelf and upper continental slope to depths of 400 meters. They migrate offshore in the fall and overwinter in warmer waters along the edge of the shelf. Like the prerecruits, they make daily vertical migrations. Individuals larger than 12 cm feed on fish and those larger than 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 50 meters.

5.1.8 Highly Migratory Species

5.1.8.1 Sand Tiger Shark

Neonate and juvenile stages of sand tiger shark have EFH designations within the 10-minute block where the Project is located (Table 3). The life stage descriptions for sand tiger shark have been taken directly from Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan: Essential Fish Habitat (CAHMSFP 2017).

Neonate/YOY (< 109 cm FL) and Juvenile (109 to 193 cm FL): Neonate EFH ranges from Massachusetts to Florida, specifically the 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. Juveniles EFH includes habitats between Massachusetts and New York (notably the PKD bay system), and between mid-New Jersey 253 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 19 to 25 °C, salinities range from 23 to 30 ppt at depths of 2.8-7.0 m in sand and mud areas, and in coastal North Carolina habitats with temperatures from 19 to 27 °C, salinities from 30 to 31 ppt, depths of 8.2-13.7 m, in rocky and mud substrate or in areas surrounding Cape Lookout that contain benthic structure.

5.1.8.2 Smooth Dogfish

All life stages of smooth dogfish, which is treated under the Smoothhound Shark Complex (Atlantic Stock) have EFH designations within the 10-minute block where the Project is located (Table 3). The following information regarding the Smoothhound Shark Complex (Atlantic Stock) has been taken directly from Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan: Essential Fish Habitat (CAHMSFP 2017):

Smooth dogfish is a common coastal shark species found in the Atlantic Ocean from Massachusetts to northern Argentina. They are primarily demersal sharks that inhabit continental shelves and are typically found in inshore waters down to 200m depth (Compagno, 1984). Smooth dogfish is a migratory species that responds to changes in water temperature. They primarily congregate between southern North Carolina and the Chesapeake Bay in the winter. In the spring, smooth dogfish move along the coast when bottom water warms up to at least 6 to 7 °C. As temperatures get colder, smooth dogfish move offshore to their wintering areas (Compagno, 1984). Smooth dogfish can tolerate a range of temperatures from 6 to 27 °C. Able et al. (2014) used acoustic telemetry to track the seasonal use of New Jersey estuaries by smooth dogfish, with tagged individuals leaving by September. The NMFS Cooperative Shark Tagging Program reported a maximum displacement distance of 460 nm, distance traveled increased with increasing fork length (FL), and none of the tagged smooth dogfish moved between the Atlantic and the Gulf of Mexico (Kohler et al. 2014). Smooth dogfish have diets that are dominated by invertebrates (Scharf et al. 2000). They primarily feed on large crustaceans, consisting mostly of crabs (Gelsleichter et al. 1999), but also rely heavily on American lobsters. In the New England waters during the spring, smooth dogfish feed on small bony fish, including menhaden, stickleback, wrasses, porgies, sculpins, and puffers (Compagno 1984). In Delaware Bay, smooth dogfish fed on invertebrates with larger sharks shifting to large crabs and teleosts (McElroy 2009).

The maximum size limit for smooth dogfish is 150 cm TL. Males mature at 2-3 years old (about 82 cm TL) and females mature between 4-7 years old, which is about 90 cm TL (Compagno 1984; Conrath et al. 2002). The length at 50 percent maturity for females is 102 cm TL, while males reach 50 percent maturity at 86 cm TL. Female smooth dogfish have an 11 – 12-month gestation period with mating occurring between May and September. The fecundity of smooth dogfish ranges between 3 and 18 pups per litter (Conrath and Musick 2002). The size range at birth is between 28 and 39 cm (Rountree and Able, 1996). Marsh creeks may be particularly important to newborn smooth dogfish during June and July. Young of year (YOY) pups grow rapidly in these areas to a size of 55-70 cm TL, prior to migration from the estuaries by the end of October. The abundance of YOY within estuaries strongly suggests that estuaries are critically important nursery habitats for smooth dogfish within the Mid-Atlantic Bight (Rountree and Able, 1996).

At this time, available information is insufficient for the identification of EFH for [the Neonate/YOY, Juvenile, and Adult life stages], 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.

5.2 Non-Federally Managed Species Accounts

Several species are important to commercial and recreational fishermen in the area or are listed as threatened or endangered through the Endangered Species Act (ESA), but are either not covered under federal FMPs, or are managed differently within state waters. The Atlantic States Marine Fisheries Commission (ASMFC) was formed in 1942 to serve as a deliberative body of the Atlantic coastal states coordinating the conservation and management of 27 nearshore species or species groups (American eel, American lobster, Atlantic croaker, Atlantic herring, Atlantic menhaden, Atlantic striped bass, Atlantic sturgeon, black drum, black sea bass, bluefish, coastal sharks, horseshoe crab, Jonah crab, northern shrimp, red drum, scup, shad and river herring, Spanish mackerel, spiny dogfish, spot, spotted seatrout, summer flounder, tautog, weakfish and winter flounder). For species that have significant fisheries in both state and federal waters (e.g., Atlantic herring, summer flounder, Spanish mackerel, spiny dogfish, etc.), the Commission works jointly with the relevant East Coast regional fishery management council to develop fishery management plans. The Commission also works with the NMFS to develop compatible regulations for the waters within the exclusive economic zone (3 – 200 miles offshore). These species are considered NOAA-trust resources and includes anadromous fish, shellfish, crustaceans, and their habitats. The species descriptions provided below include ASMFC managed species and NOAA-trust resources that may be found within the Project area.

Management of the **Atlantic sturgeon (*Acipenser oxyrhynchus*)** is conducted under the auspices of the ASMFC. An Interstate FMP was implemented in 1990 which implemented strict state regulations on sturgeon fisheries. The Plan was amended in 1998 in response to a marked decline in sturgeon population abundance. Directed fisheries for Atlantic sturgeon are currently prohibited in all participating states' waters, and a moratorium has been in effect in the EEZ since 1999 under provisions of the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). The goal of the FMP is to restore sturgeon spawning biomass to provide for a sustainable fishery. Management now requires at least 20 protected year classes of females to be present in any river stock of sturgeon before considering allowing a fishery on that stock. The FMP also emphasizes research programs to evaluate stock status of Atlantic sturgeon. The Gulf of Maine distinct population segment (DPS) is considered threatened, while the New York Bight DPS is considered to be endangered under the Endangered Species Act (ESA) (NOAA Fisheries OPR 2019).

In a study of Atlantic sturgeon abundance and distribution along the Northwest Atlantic coast, Dunton *et al.* (2010) reported only one Atlantic sturgeon captured in 5,563 random stratified tows at sampling depths ranging from 4–86 m) with a peak in sampling effort occurring at a depth of 20m. The Atlantic sturgeon was captured in the spring at 41 m.

NOAA states that some adult Atlantic Sturgeon are expected to be in the Thames River year-round, in addition to being present as they opportunistically forage during their coastal migration. Atlantic sturgeon is listed as having presence in the Thames River where the Project is located. Sturgeon may utilize the full extent of the river including various tributaries. They may aggregate in ocean and estuarine areas during certain times of year and exhibit seasonal coastal movements in the spring and fall (Hilton et al., 2006).

There is limited potential for the Project to impact Atlantic sturgeon. Potential impacts include temporary physical and chemical impacts to aquatic habitat and long- and short-term physical impacts to substrate. Underwater noise above a certain threshold, generated by construction activities, could potentially result in negative impacts and may cause injury or interfere with normal behavior, if left unmitigated. Additional information regarding Atlantic sturgeon is presented in the Project's Biological Assessment, submitted under separate cover.

Management of the **shortnose sturgeon (*Acipenser brevirostrum*)** is conducted under the auspices of the ASMFC. The shortnose sturgeon is a long-lived estuarine dependent anadromous fish that can reach lengths of up to 4.5 ft. and can weigh up to 50 lbs. They undergo seasonal migrations between freshwater habitats and marine waters, although their offshore dispersal is not as extensive as Atlantic sturgeon. The shortnose sturgeon primarily occupies rivers and estuaries, occasionally moving short distances to the mouths of estuaries and into the nearshore coastal waters (Dadswell 2006; NOAA Fisheries 1998). Foraging patterns are variable, but shortnose sturgeon often feed in freshwater during summer and over sand-mud bottoms in the lower estuary during fall, winter, and spring (NOAA Fisheries 1998). In estuarine systems, the shortnose sturgeon occupies areas with little or no current over a bottom composed primarily of mud and sand (Secor et al. 2000). Adults are found in deep water (35–100 ft. or 10–30 meters) in winter and in shallow water (7–35 ft. or 2–10 meters) during summer (Welsh et al. 2002). Spawning adults generally move upriver during spring and summer, then following spawning, move back downriver during the fall and winter. Juveniles typically inhabit deep channels of swiftly flowing rivers above the salt wedge (NOAA Fisheries 1998; Secor et al. 2000).

There is a lack of published research available on the Thames River for shortnose sturgeon. NOAA conservatively assumes that adult shortnose sturgeon could be present anywhere in the Thames River year-round up to the Greenville Dam. This assumption is based on documented occurrences of Atlantic sturgeon in the river. Therefore, there is limited potential for the Project to impact shortnose sturgeon. Potential impacts may include temporary physical and chemical impacts to aquatic habitat and long- and short-term physical impacts to substrate. Underwater noise above a certain threshold, generated from construction activities, could potentially cause injury or interfere with normal behavior, if left unmitigated. Additional information regarding shortnose sturgeon is presented in the Project's Biological Assessment, submitted under separate cover.

The **blueback herring (*Alosa aestivalis*)** is managed by the ASMFC in state waters. Blueback herring range is from St. Johns River, Florida to Cape Breton, Nova Scotia and the Miramichi River, New Brunswick. Blueback herring are most abundant from warmer waters of the Chesapeake Bay southward, occurring in most tributaries of the Chesapeake Bay, in the Delaware River, and in adjacent offshore waters (ASMFC, 2009). Blueback herring (*Alosa aestivalis*) are an anadromous, highly migratory, euryhaline, pelagic, schooling species. Blueback herring spend most of their lives at sea, returning to freshwater only to spawn (Colette and Klein-MacPhee 2002).

Adults and sub-adult blueback herring spend most of their lives at sea following a north-south seasonal migration along the Atlantic coast, only returning to rivers to spawn. Adults begin moving coastward in response to changes in water temperature and light intensity. After spawning, fish return downstream. Eggs are buoyant in flowing water but settle along the bottom in still water (ASMFC, 2009). Larvae drift passively downstream. Juveniles spend 3-9 months in their natal rivers before moving to the ocean. They move downstream in waves in response to dropping water temperatures beginning in late summer and generally are found in the lower ends of rivers and in freshwater tributaries. Other factors prompting downstream migration include changes in water flow, water levels, precipitation, and light intensity. Many juveniles spend their first winter close to the mouth of the river (ASMFC, 2009).

Blueback herring generally spawn in freshwater inland of the tidal influence. Spawning runs begin in the south and move north as the season progresses and water temperatures increase. Spawning typically occurs over an extended period with groups or waves of migrants (ASMFC, 2009). Blueback herring are repeat spawners that are assumed to return to their natal rivers. In regions where blueback herring co-occur with alewife, they select fast-moving waters, but in regions where they do not co-occur with alewife they may select slower-flowing tributaries (ASMFC, 2009).

As a euryhaline species, blueback herring can tolerate a wide range of salinities. Adults often spawn in areas of rivers where there is gravel or clean sand substrates. In the Rappahannock River, Virginia, spawning substrates include sand, pebbles, and cobbles. Substrates with 75% silt or other soft material containing detritus and vegetation are suggested as optimal for spawning, egg and larval habitat. Juvenile bluebacks have been found among submerged aquatic vegetation beds in the lower Chesapeake Bay, which have been linked to improved water quality. Blueback herring are found at depths of 27-55 m throughout their offshore range (ASMFC, 2009).

The blueback herring is listed as a species of special concern within the state of Connecticut. Threats to blueback herring include dams and other physical obstructions, water withdrawal facilities, thermal and toxic discharges, changes in pH levels, and other anthropogenic forces (ASMFC, 2009). Blueback herring have the potential to occur proximal to the Project. Therefore, impacts to blueback herring EFH may occur. Potential impacts may include temporary physical and chemical impacts to aquatic habitat and long- and short-term physical impacts to substrate. Underwater noise from construction activities may also cause injury or interfere with normal behavior, if above a certain threshold and left unmitigated.

The **alewife (*Alosa pseudoharengus*)** is managed by the ASMFC in state waters. Historically, the coastal range of alewife is from South Carolina to northeastern Newfoundland; however, updated surveys indicate they do not occur south of North Carolina (ASMFC, 2009).

Adults and sub-adults spend most of their lives at sea following a north-south seasonal migration along the Atlantic coast and only return to rivers to spawn. After spawning, fish return downstream. Eggs and larvae are found near or slightly downstream of presumed spawning areas (ASMFC, 2009). Beginning in late summer, juveniles move downstream in waves in response to dropping water temperatures and generally are found in the lower ends of rivers and in freshwater tributaries. Other factors prompting downstream migration include changes in water flow, water levels, precipitation, and light intensity. Most juveniles emigrate offshore their first year but others may spend their first winter in inshore waters (ASMFC, 2009).

Spawning runs begin in the south and move progressively north as the season progresses and water temperatures increase. Alewife spawn in slow-moving shallow sections of rivers or streams, and in lakes, freshwater coves behind barrier beaches, and ponds that form headwaters. Spawning has been reported in rivers as far south as North Carolina and as far north as the St. Lawrence River, Canada. Spawning migration is triggered mostly by water temperature, but water flow may also be a factor. They are believed to be repeat spawners, generally returning to their natal rivers (ASMFC, 2009).

Alewife can adjust to a wide range of salinities and may prefer cooler water than other anadromous fish. Spawning habitat ranges from areas with sand, gravel, or coarse stone substrate to those containing SAV or organic detritus (ASMFC, 2009). Substrates with 75% silt or other soft material containing detritus and vegetation are suggested as optimal for spawning, egg, and larval habitat. In the Chesapeake Bay, juveniles can be found among SAV beds, which have been linked to improved water quality. Offshore, alewife have been caught most frequently in water depths between 56 -110 m (ASMFC, 2009).

The **American shad (*Alosa sapidissima*)** is managed by the ASMFC in state waters. American shad range from St. Johns River, Florida to the St. Lawrence River, Canada. Shad spend most of their life in the Atlantic Ocean but migrate to coastal rivers and tributaries to spawn (ASMFC, 2009). Spawning adults are capable of migrating hundreds of miles upstream where impediments do not block movement; however, in most river systems, they do not spawn as far upstream as they did historically. Adults return to the sea soon after spawning. Eggs and larvae are found at or downstream of spawning locations. Juveniles disperse downstream and spend their first summer in the lower portion of their natal river, before migrating to the ocean (ASMFC, 2009). Adults are highly migratory along the coast with primary summer feeding grounds located in the Bay of Fundy and three primary offshore wintering grounds located off the Scotian Shelf/Bay of Fundy, in the Middle Atlantic Bight (Maryland to North Carolina), and off the Florida coast (ASMFC, 2009).

Spawning typically occurs in tidal and non-tidal freshwater regions of rivers and tributaries and is primarily triggered by water temperature, and other factors including photoperiod, water flow and velocity, and turbidity (ASMFC, 2009). Spawning runs begin in the south and move progressively north as the season progresses and water temperatures increase. Most fish return to their natal rivers and tributaries to spawn. Fish that spawn north of Cape Hatteras are repeat spawners, while most fish that spawn to the south die after spawning (ASMFC, 2009). Spawning generally occurs between 12-21°C and in river areas that are less than 10 feet deep. Eggs are released and fertilized in open water (ASMFC, 2009).

Spawning occurs in areas where the bottom substrate often consists of sand, silt, muck, gravel, or boulders. Factors influencing egg survival include current velocity, dissolved oxygen, pH, water temperature, suspended sediments, pollution, and predation (ASMFC, 2009). Although bottom substrate type may not be predictive of spawning areas, egg survival may be higher where gravel and rubble structures are present. Rivers, bays and estuaries associated with spawning rivers are used as nursery areas. Factors triggering juvenile emigration include water temperatures and reduced water flow. Juveniles were found to be most abundant where boulder, cobble, gravel and sand were present (ASMFC, 2009).

The **hickory shad (*Alosa mediocris*)** is managed by the ASMFC in state waters. Hickory shad are distributed along the Atlantic coast from the Bay of Fundy to the Tomoka River, Florida. The greatest abundance of hickory shad occurs from New York southward (ASMFC, 2009). Hickory shad spend most of their adult lives at sea but ascend coastal rivers during spring migration. It is assumed that adults move gradually downstream and return to the ocean by mid-summer. Most young juveniles move downstream in summer and migrate to estuarine nursery areas. Other juveniles move directly into saltwater. Almost nothing is known about sub-adult and adult distribution and movements once they return to the ocean (ASMFC, 2009).

Most spawning occurs in freshwater reaches of coastal rivers, flooded swamps, and channels of tributary creeks from Maryland south. Hickory shad are repeat spawners. Spawning activity has been reported from water temperatures ranging from 8-22°C. Adults are noted to prefer deep and dark-water tributaries for spawning in the Neuse River, North Carolina (ASMFC, 2009).

Little is known about its life history and specific habitat requirements; however, coastal migrations and habitat requirements are thought to be similar to that of other alosines, especially American shad. Adult hickory shad have been reported in Maryland waters where structures such as ledges and fallen trees are present. Bottom composition for spawning in these waters tends to be mud, sand, and gravel (ASMFC, 2009).

The **striped bass (*Morone saxatilis*)** is managed by the ASMFC in state waters. The EEZ (3–200 mi [5–320 km] offshore) is closed to the harvest or possession of striped bass. From 2007 to 2014, total recreational landings along the coast have averaged just over 25 million pounds annually. In 2015, recreational anglers harvested an estimated 18.2 million pounds, which can be attributed to implementation of more restrictive regulations. Of those coast wide recreational landings, Maryland landed the largest percent in numbers of fish (30%), followed by New Jersey (21%), New York (20%), Massachusetts (13%) and Virginia (7%). Maine, New Hampshire, Rhode Island, Connecticut and Delaware accounted for the remaining harvest (9%) (ASMFC 2016). The most recent stock assessment for the species in 2016 shows that striped bass are not overfished nor experiencing overfishing in 2016 (ASMFC 2016). Striped bass live in marine waters but spawn in rivers. Spawning occurs in the Hudson River (late April/early May). Juvenile and adult striped bass were reported to avoid areas where total dissolved solid concentrations exceeded 180 mg/L (Limburg 1966: Murawski 1969a cited Greene *et al*. 2009).

The **American eel (*Anguilla rostrata*)** is a catadromous fish species, spending most of their life in freshwater or estuarine environments, moving to spawning grounds in the Sargasso Sea as adults to reproduce and die. American eel is an important resource as a prey species for many fish, aquatic mammals and fish-eating birds, and support valuable commercial, recreational and subsistence fisheries (ASMFC 2017). State reported landings of yellow and silver eels in 2015 totaled approximately 884,000 pounds, which was 11% lower than in 2014. Landings from the 1970s to the mid-1980s ranged from 2.5-3.6 million pounds and have ranged from 700,000 to 1.5 million pounds since 1987 (ASMFC 2017). In 2015, Rhode Island landings were only 1,538 pounds and valued at $3,955 (NOAA Fisheries/OSF 2019a). Recreational harvest peaked in 1985 at 160,000 eel and has declined ever since. The harvest was last estimated to be around 6,000 in 2009, which is the last year the Marine Recreational Information Program (MRIP) collected data on American eel. Little information is known about the abundance, status at all life stages and habitat requirements. The stock is at near or historically low levels due to historical overfishing, habitat loss, food web alterations, predation, turbine mortality, environmental changes, toxins and contaminants, and disease (ASMFC 2017). The U.S. Fish and Wildlife Service (USFWS, 2019) initiated a status review in 2011 under the ESA, and on October 7, 2015 announced that the eel remains stable and does not need protection under the ESA.

6. Analysis of Impacts

Construction related activities that have the potential to cause adverse effects include demolition of existing piers and bulkheads, installation of coffer dams, bulkheads, and piles, as well as dredging of an inbound delivery vessel berthing pocket and dredging of the outbound installation vessel berthing pocket for WTG support. Potential adverse effects to fish and fish habitat directly related to construction activities include temporary alteration of the benthos, impairment of water quality, and underwater noise. These impacts may have direct and indirect effects on the fish, EFH, NOAA trust resources, and protected species. Potential impacts have been minimized to the extent practicable. The impacts to fish, EFH, NOAA trust resources, and protected species associated with the Proposed Action and discussed in this section would be temporary in nature and would result from in-water demolition and construction and associated disturbance activities (i.e., dredge and fill activities). No substantial long-term fisheries impacts (e.g., altered migration routes, loss of rare species, or change in regional fisheries populations) are identified or anticipated as a result of the Proposed Action. Additional information regarding potential impacts to federally listed species is presented in the Project's Biological Assessment, submitted under separate cover.

6.1 Direct Impacts

6.1.1 Dredging and Fill Related Activities

6.1.1.1 Benthic Impacts

The proposed Project would result in changes to the local bathymetry due to the placement of material for Central Wharf and for the East Berth Heavy Lift area creation. The existing bathymetry in the area between the piers ranges from MHHW (+1.21 feet NAVD88) to approximately -38 feet NAVD88. Recent field investigations indicate that sediments in the Project's Central Wharf fill areas are comprised primarily of dark to black silts throughout, with various typical estuarine inclusions (occasional shells, invertebrates, etc.) and fine sand, typically trace or less, noted. Fill would be placed atop existing substrate in support of the Central Wharf Area creation. After removal of the existing State Pier deck apron and underlying riprap, fill material would be confined and placed atop the existing earthen slope within this pier's footprint. No deck or riprap removal is required for construction work beyond the existing pier footprint.

As fill material is placed between the piers, direct impact to the benthos will occur. Most sessile marine invertebrates will not survive burial (e.g., suffocation, burial). Some motile marine organisms would be buried and unable to survive, while others such as burrowing specialists or others may survive. Survival rates would depend primarily on burial depth, construction speed and organism mobility speed. Therefore, fill related activities are expected to substantially and permanently affect and/or remove benthic habitat.

Dredging would have direct, temporary effects on benthic habitat from direct removal of the substrate by the dredging operation. Recent field investigations indicate that riverine sediments in the Project's dredge footprints are characterized almost exclusively as dark to black silts throughout, with various typical estuarine inclusions and occasional fine sand noted (typically trace or less). Armored materials (riprap) will be removed from the dolphin pile areas. Excavation of sediment at the vessel berthing pockets would result in mortality of many of the smaller benthic organisms residing on the river bottom in those locations. Following dredging at these locations, re-colonization of the substrate within the dredged area would occur via larval recruitment and emigration of benthic organisms from the surrounding area. Benthic populations would be expected to recover in three to five years. Therefore, dredging related activities would not substantially affect benthic habitat on a long-term basis.

Project activities have been designed to avoid a narrow band of eelgrass mapped at the northern Project dredging extents. No direct impacts from dredging or other activities are anticipated at this eelgrass bed and the feature will be isolated during construction using floating turbidity curtains.

6.1.1.2 Water Quality Impacts

Water quality impacts from the sediment fill activities, dredging, and cofferdam, bulkhead, and pile removal/installation may include physical and chemical impacts. Changes to the water turbidity, water chemistry, and dissolved oxygen may be expected during this work; however, construction would progress in accordance with regulatory requirements for water quality and turbidity monitoring and management.

The impacts to water quality that are expected during dredging, dredged material disposal, and cofferdam, bulkhead, and pile removal/installation would be temporary in nature and these impacts would diminish with distance from these activities and would disappear completely with the cessation of these activities. Implementing best management practices such as controlling bucket speeds and preventing barge overflow would minimize anticipated changes to water quality. No appreciable or permanent changes to salinity regime, tidal cycle, or current patterns are anticipated.

6.1.1.3 Physical Impacts

Physical impairment of the water column, resulting from sediment fill activities and dredging occurs from increases in turbidity with a resultant decrease in light penetration. The extent and duration of the increase in turbidity depends on sediment grain size and organic matter content. The water column proximal to the dredging and sediment fill activity would experience temporary physical impairment due to increased turbidity from suspended sediments. The temporary impacts to the water column attributed to dredging would diminish with distance from the activity and would cease following completion of that Project activity. Impacts to the water column attributed to fill would be permanent as the area is converted to upland and/or other non-aquatic conditions.

6.1.1.4 Chemical Impacts

Chemical impairment of the water column produced by sediment fill and dredging is caused by release of various chemical contaminants that may occur within the sediment when re-suspended into the water column. Contaminants are introduced into the sediment media via a variety of sources including but not limited to surface runoff (non-point sources), industrial stormwater discharges, accidental and incidental spills, inadvertent discharges, historic industrial uses, etc. Sediment characteristic information is presented in JPA Appendix M2.

6.1.1.5 Physical Impairment / Injury

Sediment fill and dredging activities can impact fish and other marine organisms as a result of increased turbidity. Increases in turbidity can result in gill abrasion, reduced respiratory functions, and death. The sensitivity of species to suspended sediments is highly variable and dependent on the nature of the sediment, the species, and the life stage of the organism. The eggs and larval stages of marine and estuarine fish are generally more sensitive to sediment exposure (Wilber and Clark 2001). Direct impacts to EFH species would be minimal due to the highly motile nature of the subject species and the unlikelihood of sensitive life stages (e.g., eggs, larvae) being present in the Project area.

6.1.2 Construction Impacts

Impacts to EFH from construction activities would primarily be associated with turbidity (re-suspended sediments) and noise generated during cofferdam, bulkhead, and pile removal and installation. In-water work for the demolition of portions of the Admiral Shear State Pier, southern portion of CVRR pier, Northeast Bulkhead and installation of new bulkheads including the king pile wall between the two piers would require the use of a vibratory and/or impact hammer pile driver/extractor for pile removal, vibratory and impact pile drivers for pile installation and other specialized equipment. In addition to noise impacts, the demolition of parts of these piers would result in a long-term loss of cover for marine species.

However, these losses would be offset by the colonization of the newly installed infrastructure features, combined with the implementation of the living shoreline component of the Project's mitigation plan.

6.1.2.1 Water Quality Impacts

Physical impairment of the water column would result from removal and installation of pier piles, bulkheads, and cofferdams and would be similar to that described for sediment fill and dredging. However, water quality impacts resulting from pile removal and installation would be intermittent and localized and would cease at the completion of in-water construction activities.

6.1.2.2 Noise

Underwater noise will be generated during most in-water construction components of the proposed Project. However, construction elements expected to generate noise with the potential for affecting listed species behaviorally or physiologically will largely be confined to the installation of the various types of piles. Installation of piles is currently anticipated to occur with normal daytime construction hours and will not occur around the clock. However, there is a small chance of very limited pile installation occurring during extended shifts.

The majority of the following text was derived from the Project's BA, which was prepared relative to potential impacts to protected marine species listed under the federal ESA of 1973, as amended. Details regarding the literature citations are available in the BA.

Acoustic effects thresholds for fish were proposed by the Fisheries Hydroacoustic Working Group in 2008 and have generally been used by NMFS as interim criteria in the analysis of pile driving impacts to fish. Pile driving activities related to the proposed Project may generate noise sufficient to cause behavior disturbance for a certain distance from the point of generation. Vibratory extraction of piles may also generate cumulative noise at levels that may be injurious to small fish (<2g) to a certain distance from the point of generation.

Background on Underwater Noise Effects

Under certain conditions, underwater noise generated from construction activities may cause behavioral or physiological changes to aquatic organisms. Sound under water creates a pressure wave that can be harmful. The types of effects and the response from aquatic animals to a sound depend on the distance of the animal from the sound source. The potential for effects declines as distance increases between the animal and the source. Very close to the source, effects can range from mortality to pronounced physiological or behavioral changes. Further from the source, mortality becomes less likely and effects can range from behavioral to physiological. The actual nature of effects depends on factors, such as hearing sensitivity, sound levels, whether the animal stays in the vicinity of the source, and motivation level of the animal to move from the source. Generally speaking, different species are thought to have varying tolerances to noise and may exhibit different responses to the same noise source.

Behavioral changes often include avoidance of the source area, disruption of foraging attempts, or interruption of reproduction. Physiological effects vary depending on the duration and intensity of sound produced during construction. Aquatic animals could suffer temporary or permanent hearing loss, or percussion-type injuries such as bruising, ruptures to capillaries, hemorrhaging of organ systems, damage to the swim bladder and internal organs, or death (Halvorsen et al. 2011).

The intensity of sound wave pressure in water is expressed in terms of decibels relative to 1 micro-Pascal (dB re µPa). Decibels are measured on a log scale; each 10-dB increase is a 10-fold increase in sound pressure. Accordingly, a 20-dB increase is a 100x increase in sound pressure. The following are commonly used measures of sound:

- Peak sound pressure level (PEAK SPL): the maximum sound pressure level (highest level of sound) in a signal measured in dB re 1 µPa.

- Sound exposure level (SEL): the integral of the squared sound pressure over the duration of the pulse (e.g., a full pile driving strike). SEL is the integration over time of the square of the acoustic pressure in the signal and is thus an indication of the total acoustic energy received by an organism from a source (such as pile strikes), measured in dB re 1μPa2-s.
- Single Strike SEL (sSEL): the amount of energy in one strike of a pile (i.e., with a hammer).
- Cumulative SEL (cSEL): the energy accumulated over multiple strikes. cSEL indicates the full energy to which an animal is exposed during any kind of signal. The rapidity with which the cSEL accumulates depends on the level of the single strike SEL. The actual level of accumulated energy (cSEL) is the logarithmic sum of the total number of single strike SELs. Thus, cSEL (dB) = Single-strike SEL + 10log10(N); where N is the number of strikes.
- Root Mean Square (RMS): the average level of a sound signal over a period of time, such as for continuous drilling, vibratory pile driving, vessel operation, and background noise.

Behavioral Effects

Sounds must be louder than background-level noise and at a frequency that is detectable by a given species to be detected by fish. Additionally, a sound may need to be biologically relevant to an individual to elicit a behavioral response (Plachta and Popper 2003, Doksaeter et al. 2009). Behavioral responses could range from a temporary startle to avoidance of an ensonified area.

NMFS generally uses 150 dB re 1 μPa RMS as the threshold for behavioral effects to all fish species (Buehler et al. 2015, NMFS 2019c). This generally accepted threshold is considered a conservative estimate for most species of fish. Exposure to noise levels of 150 dB re 1 μPa RMS will not always result in effects on an organism's behavior, and behavioral modifications will not always result in adverse effects (i.e., harm or harassment to listed species), but there is the potential for behavioral response upon exposure to sound pressure levels of 150 dB re 1 μPa RMS (NMFS 2012a) or higher (NMFS 2012a).

Physiological Effects

The Fisheries Hydroacoustic Working Group (FHWG) comprises biologists from NMFS, USFWS, Federal Highway Administration (FHWA), and the California, Washington, and Oregon DOTs. In June 2008, the agencies developed the Agreement in Principal for Interim Criteria for Injury to Fish from Pile Driving Activities, which identifies the following thresholds for onset of physical injury to fish. These are criteria for the onset of physiological effects, and not levels at which fish are necessarily mortally damaged, and they were developed for green sturgeon and Pacific salmon (FHWG 2008). NMFS has relied on these criteria in determining the potential for physiological effects in ESA Section 7 consultations for most listed fish species (NMFS 2019c). The physiological effects of noise on fish varies by species due to differences in swim bladder configurations and other morphological variation. At this time, however, these criteria represent the best available conservative estimates on the thresholds at which physiological effects to all species of fish are likely to occur. The Project's BA applied the following criteria to sturgeon and turtle species potentially present at this site. All sturgeon at the site would be above 2 grams (0.07 ounces) since there are no spawning grounds near the site. These threshold criteria are listed below:

- For all sized fish, exposure to a peak sound pressure level (SPL) of 206 decibels referenced 1 micropascal (dB re 1 μPa) is assumed to cause injury.
- For all fish, exposure to a root mean square (RMS) SPL of 150 dB re 1 μPa is assumed to cause behavioral disturbance.
- For small (<2 g) fish, exposure to an accumulated sound exposure level (SEL) of 183 decibels referenced to 1 micropascal squared second (dB re 1 μPa^2 sec) is assumed to cause injury.
- For larger (≥ 2 g) fish, exposure to an accumulated SEL of 187 dB re 1 μPa^2 sec is assumed to cause injury.

Physiological effects to fish from underwater noise may range from minor injuries, resulting in complete recovery, to death. The severity of injury is related to the distance of the fish from the pile being installed and the duration of exposure - the closer the fish is to the source and the greater the duration of the exposure, the higher the likelihood of significant injury.

Fish with swim bladders are particularly sensitive to impulsive underwater sounds with a sharp sound pressure peak occurring in a short interval of time (Caltrans 2001). As the pressure wave passes through a fish, the swim bladder is rapidly squeezed due to the high pressure, and then rapidly expanded as the under-pressure component of the wave passes through the fish. The pneumatic pounding on tissues contacting the swim bladder may rupture capillaries in the internal organs as indicated by studies that have observed blood in the abdominal cavity, and maceration of the kidney tissues (Caltrans 2001).

Based on limited data, mortality appears to occur when fish are close to (within a few ft to 30 ft) impact driving of relatively large diameter piles. Caltrans (2001) showed some mortality for several different species of wild fish exposed to driving of steel pipe piles 8 ft in diameter.

Ruggerone et al. (2008) found no mortality to caged yearling coho salmon (*Oncorhynchus kisutch*) placed as close as 2 ft from a 1.5-ft-diameter pile and exposed to over 1,600 impact strikes. Recent studies of the effects of pile driving sounds on fish showed a clear relationship between onset of physiological effects and single strike and cumulative sound exposure levels. Initial effects are very small and would not harm an animal, and recovery is rapid and complete, whereas the most intense signals (e.g., >210 dB cSEL) may result in tissue damage that could have fatal effects over the long term (Halvorsen et al. 2011, Casper et al. 2012).

Estimated Noise Effects from SPII

Approximately 405 pipe piles and 660 sheet piles will be used to construct the face of the new bulkhead along portions of the proposed perimeter of the State Pier Facility, including mooring bollards for vessels, and a toe wall to protect the eel grass bed in the northeast extent of the Project. The proposed new bulkhead design would consist of a combination wall with a tie back system to accommodate the heavier loads required to support wind energy construction operations. This type of wall will use both typical Z-pile type sheets as well as pipe piles driven on the seaward side of the existing sheets. Flowable fill is then poured between the existing and proposed sheets to create a robust stiff bulkhead that can facilitate heavy lift operations. The pipe piles may be driven by a vibratory hammer down to the design depth. However, if needed, an impact hammer will be used to bring the pile to design depth to facilitate full load bearing capacity and functionality of the pile. The larger piles may also be fully vibrated in place, depending on substrate conditions and piles utilized. The sheets between the pipes will likely be fully vibrated into place. Piles associated with the mooring dolphins in the turning basin will also be removed by vibratory methods. Pile driving and removal would occur between October 1 and May 31 in any given year.

The NMFS Greater Atlantic Regional Fisheries Office (GARFO) Acoustic Tool using the Simple Attenuation Formula (NMFS 2019c) was used to estimate the noise impacts from pile driving. For this analysis, measurements from proxy projects that have noise effect data are selected based on their applicability to this Project. Pile sizes, pile types, methods, and environments are matched to calculate the likely noise impacts (see Table 4). This tool uses ICF Jones & Stokes (2015), which has summarized records from numerous construction projects in the *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish* and presented the expected noise levels for steel pile and sheet pile driving shown in Table 5. Acoustic threshold levels for the Managed Fish Species documented in this EFH Assessment can be approximated in the GARFO tool since the same thresholds apply to other fish beyond salmon and sturgeon.

Table 4 Proxy Projects for Estimating Underwater Noise from the NMFS Greater Atlantic Regional Fisheries Office (GARFO) Acoustics Tool (NMFS 2019c).

Project Location	Water Depth (m)	Pile Size (inches)	Pile Type	Hammer Type	Attenuation rate (dB/10m)
Not Available	15	24"	AZ Steel Sheet	Vibratory	5
San Rafael, CA - San Francisco Bay	4-5	30"	Steel Pipe	Vibratory	5
San Rafael, CA - San Francisco Bay	4-5	30"	Steel Pipe	Impact	5
Not Available	5	36"	Steel Pipe	Vibratory	5
Not Available	10	36"	Steel Pipe	Impact	5
Alameda, CA	13	40"(1)	Steel Pipe	Vibratory	5
Alameda, CA	13	40"(2)	Steel Pipe	Impact	5
NBPL Fuel Pier, San Diego, CA	9	13-24”	Concrete	Hydraulic Cutter	5
Not Available	5	12"	Steel H-Type	Vibratory	5
Norfolk, VA	12.2	12-16"	Timber	Vibratory	5

Notes:
1. Used sound measurements for impact installation of 40" pilings as a surrogate since it was the closest size to 42” provided in the tool. Then these measurements were converted to vibratory by subtracting 10 dB from the sound pressure measurements that are used to calculate distances as advised by Zach Jylkka from NOAA/NMFS/GARFO on 7/24/19.
2. Used provided sound measurements for 40" pilings as a surrogate since it was the closest size to 42” provided in the tool.

Table 5 Summary of near-source (10 m [33 ft]) unattenuated sound pressures for installation of sheet and pipe piles using proxy project data for vibratory hammers and impact hammers, with comparison to behavioral and physiological thresholds. Values that are above any corresponding threshold below are shown in bold.

Pile Type and Driving Method	Number of Piles	Hammer Type	Average Sound Pressure (dB)		
			Estimated Peak Noise Level - Peak SPL (dB)	Estimated Pressure Level - RMS SPL (dB)	Estimated Single Strike Sound Exposure Level - sSEL (dB)
24" AZ Steel Sheet	660	Vibratory	182	**165**	165
30" Steel Pipe	74	Vibratory	195	**180**	170
30" Steel Pipe	-	Impact(2)	205	**190**	180
36" Steel Pipe	4	Vibratory	185	**175**	175
36" Steel Pipe	-	Impact(2)	**210**	**193**	183
42" Steel Pipe(3)	327	Vibratory	198	**185**	170
42" Steel Pipe(4)	-	Impact(2)	**208**	**195**	180
12" Steel H-Type	48	Hydraulic Cutter(5)	182	**165**(5)	165
12" Steel H-Type	96	Vibratory	165	**150**	150
12-16" Timber	12	Vibratory	176	**165**	165
Behavioral and Physiological Thresholds for Fish Species(2)					
Behavioral Fish Threshold			-	150	-
Physiological (Injury) Fish Threshold			206	-	187

Notes:
1. Sound pressure levels for 24” sheet piles represent the “loudest” values used by GARFO.
2. Impact pile driving will only be used if the vibratory method cannot install a pile to the required depth (Grey shading).
3. Used sound measurements for impact installation of 40" pilings as a surrogate since it was the closest size to 42” provided in the tool. Then these measurements were converted to vibratory by subtracting 10 dB from the sound pressure measurements that are used to calculate distances as advised by Zach Jylkka from NOAA/NMFS/GARFO on 7/24/19.
4. Used provided sound measurements for 40" pilings as a surrogate since it was the closest size to 42” provided in the tool.
5. A value for the hydraulic pile cutter maximum RMS SPL was obtained from 82 FR 36360 and conservatively applied here. The other parameters were derived from this value.
6. Table adapted from NMFS 2019c/GARFO tool

Table 6 presents distance-to-threshold data from the NMFS GARFO Acoustic Tool using the Simple Attenuation Formula (NMFS 2019c). Note that the GARFO tool presents two sets of data for 24-inch AZ steel sheet pile, including a “typical” sound pressure level and the “loudest” sound pressure level from proxy project data. As a conservative measure, data below for sheet piles are based on the loudest values only.

Table 6. Estimated distances to fish injury and behavioral thresholds.

Pile Type	Hammer Type	Distance (m) to 206 dB_{Peak} (injury)	Distance (m) to sSEL of 150 dB (surrogate for 187 dB cSEL injury)	Distance (m) to Behavioral Disturbance Threshold (150 dB_{RMS})
24" AZ Steel Sheet	Vibratory	NA	40.0	40.0
30" Steel Pipe	Vibratory	NA	50.0	70.0
30" Steel Pipe	Impact(1)	8.0	70.0	90.0
36" Steel Pipe	Vibratory	NA	60.0	60.0
36" Steel Pipe	Impact(1)	18.0	76.0	96.0
40" Steel Pipe	Vibratory	NA	50.0	80.0
40" Steel Pipe	Impact(1)	14.0	70.0	100.0
36" Steel Pipe (cutter)	Hydraulic Cutter	NA	40.0	40.0
12" Steel H-Type	Vibratory	NA	10.0	10.0
12 -16" Timber	Vibratory	NA	39.0	39.0

Notes:
1. Impact pile driving will only be used if the vibratory method cannot install a pile to the required depth (Grey shading).

Sheet Driving

Sheet piles to be installed via the vibratory method. Data presented in Table 5 indicates that using a vibratory hammer to install sheet piles may cause injury and behavioral disturbance to fish at 40 meters distance from the source. However, injury is unlikely because the managed fish species noted herein are very mobile, would not have a tendency to have affinity for a small territory, and would not remain in the sound field long enough to accumulate injurious levels of sound pressure. Affected individuals would avoid the ensonified area by moving away to other (quieter) areas of the river when pile installation begins. Managed fish species would most likely respond with behavioral avoidance when presented with noise caused during sheet pile installation, and therefore the risk of injury from hydroacoustic effects is very low from this Project component.

Pile Driving

Steel pipe piles that are 30,36, and 42 inches in diameter will be installed for this project. The piles will serve as bulkhead structural supports and bollards for vessel docking. As shown in Tables 8, 9, and 10 the effects from underwater noise varies greatly with the size of the pile. The duration of the work that involves installation of each pile size is estimated below:

- 30-inch pipe piles - 16 days
- 36-inch pipe piles - 1 days;
- 42-inch pipe piles - 37 days; and
- Sheet piles - 37 days.

Vibratory hammers have less hydroacoustic impacts as compared to impact hammers. Therefore, the first attempt at fully installing all pipe piles will be the use of a vibratory hammer. If the pile cannot go to the designed depth with this method, then an impact hammer would be utilized. In the event of impact hammer utilization, a “soft start” would be used to build up power slowly, starting from a low energy output and slowly increasing power over a period of 20-40 minutes. This approach would provide adequate time for fish and other wildlife to leave the ensonified area.

Vibratory pile driving will constitute most of the pile driving effort. Table 5 above shows the likely maximum noise outputs. The estimated peak noise levels [peak SPL (dB)] at vibratory hammer installation are all lower than the injury threshold for fish.

Vibratory pile driving will create a range of 150 to 195 dB root mean squared sound pressure level (RMS SPL). This sound pressure level is representative of the average sound pressure experienced at 10 meters distance from the source and applies to fish that remain in the sound field for an extended period of time and do not exhibit avoidance behaviors. The values exceed behavioral thresholds that apply to this metric using the RMS SPL. However, the managed and endangered fish subject to this EFH are highly mobile and migratory species that do not typically exhibit site affinities that are less than the spatial scale of this project. They can easily avoid stimulus, so they are not in the injurious sound field with enough time to experience cumulative exposure. Also, the sound field area they would have to avoid is small relative to the surrounding river.

As seen in Table 6, vibratory hammer sound energy for the Project's activities attenuate to levels that are not injurious to fish with cumulative exposure at 8-60 meters distance from the source. The sound pressure from a vibratory hammer does not create a behavioral disturbance for fish beyond a range of 10-80 meters from the source.

In the case that vibratory hammers cannot be used to finish the setting of piles, then impact hammers may be used for a small portion of the pile driving. For the pile sizes being installed, impact hammers would create a potential zone of injury from cumulative exposure that extends no further than 70 to 76 meters from the noise source for fish, if the fish were to stay in the sound field. The zone of behavioral disturbance for impact hammers would extend no further than 90 to 100 meters from the noise source. Injury from the most intense part of the sound pressure wave of the noise from the hammer strike (dB_{Peak}) could go as far as 18 meters from a 36-inch pipe being driven by impact and could reach out to 6 meters from a 72-inch pipe. Impact hammers will be used with a soft start to give fish a chance to avoid the sound from the strike before it becomes potentially injurious. Small areas of increasing temporary disturbance like this are particularly easy for fish to identify the source and avoid.

Demolition of Derelict Mooring Dolphins

In order to facilitate access to the Northeast Bulkhead, the four existing mooring dolphins will be demolished. Each mooring dolphin was constructed with a substructure containing approximately 32 steel H-piles held together with a concrete cap that holds mooring bollards. The two northern mooring dolphins have eight additional timber bearing piles each and a walkway between them held up by another eight timber piles. According to the underwater inspection conducted by Marine Solutions in 2018, the mooring dolphins are currently in serious condition and are not structurally sound. A typical steel pile has severe corrosion and has sections that are 90% to 100% corroded. A typical timber pile has some areas with up to 100% section loss with checks, splits, and wood boring isopod damage throughout.

To demolish these structures the concrete caps will be strapped to a barge mounted crane as the piles are removed from underneath it. Most of the derelict piles can likely be removed using a hydraulic excavator grab because of their failing condition. Many piles are expected to fall apart during removal. The piles that remain connected to the cap, if any, will be cut using hydraulic pile cutters below the waterline. Sound pressure levels for hydraulic pile cutters were used from a proxy project at the San Diego NBPL Fuel Pier that cut 13-24" steel reinforced concrete piles and measured noise from the activity (82 FR 36360). The maximum SPL values were conservatively applied. A value for the hydraulic pile cutter maximum RMS SPL was obtained from the proxy project and the other parameters were derived from this value. Based on this analysis, cutting of the steel piles will likely result in sound pressures that are above the behavioral threshold for fish. The distance to behavioral disturbance is 40 meters from hydraulic pile cutting. However, the noise duration for this activity is typically short, ranging from only 20 seconds to 2 minutes.

After the cap is removed by a large barge mounted crane, the remaining sections of the piles that were not removed using a hydraulic grab will be removed in their entirety using a vibratory hammer to facilitate dredging in the turning basin. It is very likely that most of the timber piles will be removed by an excavator because of their derelict condition. Pile removal with vibratory methods will likely result in noise levels that are similar to installation with the vibratory method. The impact calculations for pile removal are included in Tables 4, 5, and 6 under the steel H-pile vibratory method. None of the piles that will be removed are expected to create sounds over the injury threshold or have any measurable effect on sea turtles. If fish species remained in this area for a long period of time and the noise continued constantly, then cumulative injuries may occur. However, it is anticipated that fishes will move from the noise as part of their behavioral response and that the activity will not be continuous throughout the workday. This demolition work will last a maximum of 30 days, and piles will likely be removed with the vibratory method for portions of 20 of those days. In the instance that pile removal with vibratory hammers is ineffective, then the piles will be cut at the mudline with hydraulic pile cutters and the remainder will be removed during dredging.

Vessel Noise during Project Construction and Operation

Some studies report that vessels effect fish avoidance behavior (Vabø et al. 2002, Sara et al. 2007, Peng et al. 2015). Observed effects from vessel noise have largely been behavioral, but vessel noise may create auditory masking that exposes individual fish to risk. Proposed construction in the SPII area will include vessel traffic as a source of underwater noise. Existing, ongoing vessel traffic in the navigational channel and elsewhere in the harbor, including the adjacent operations at Cross Sound Ferry, is currently providing a source of background noise in the Project area. Proposed Project construction vessels will produce additional noise during the construction period. However, because the Facility would not be accepting ship calls during construction of the Project, overall, vessel traffic is expected to be reduced during the construction period, as compared to when the Facility was processing cargo. Fish in the Project area will therefore experience decreased exposure to vessel noise during construction. Fish species are likely to move away from vessel traffic if noise levels reach the threshold for behavioral responses, as the river is wide enough to provide zones of passage for this type of avoidance behavior. The avoidance response is not likely to result in harm or harassment to these species.

Vessel noise during construction of the Project is therefore not likely to adversely affect the federally managed fish species documented herein.

Summary of Hydroacoustic Effects

Using vibratory hammers for most of pile driving, limiting use of impact hammers to the extent feasible combined with a “slow start” and implementing the proposed avoidance and minimization measures for underwater noise will reduce sound levels and associated effects distances as compared to using impact hammers alone to drive sheet and piles. Underwater noise generated from a vibratory hammer and limited or no impact hammer utilization, with a “soft start” for sheet piles for the bulkhead is unlikely to cause physical harm to the life stages of federally managed species, which may occur in the Project area during construction. Negative effects to federally managed species are further reduced by implementing a TOY restriction on sheet and pile driving from June through September or requiring a soft start each day of pile driving, building up power slowly from a low energy start-up over a period of 20-40 minutes to provide adequate time for fish and marine mammals to leave the vicinity.

In most cases, underwater noise from vibratory and impact hammer pile driving and construction vessels is likely to result in behavioral responses rather than physical injury, whereby the managed aquatic species (if present) would move to other areas of the Thames River to avoid the construction site during periods of elevated noise. Because the Thames River is over 1,000 ft wide in this area, up-river and down-river zones of passage for fish will not be blocked by noise effects during active construction. It is expected that such temporary behavioral responses will not have long-term consequences to any EFH species that may encounter and subsequently avoid the sound field, and therefore any effects to the species would be insignificant and/or discountable.

6.1.2.3 Loss of Habitat

The greatest impact to fish and fisheries from the proposed Project will be the permanent loss of habitat through filling or conversion via dredging. The Project is proposing to fill approximately 7.4 acres between the two existing pier structures as well as potential placement of 0.7 acres of fill atop an existing riprap slope beneath the Admiral Shear State Pier. These areas, which may currently be used by a variety of fish, will no longer be available once Project construction is complete. Approximately 0.85 acres of areas intended for fill are less than 5 meters (16.4 feet) deep, the depth identified as usable by winter flounder for spawning[3]. However, substrates in these locations consist of soft silts and muds or riprap beneath pile supported piers and are not ideal winter flounder spawning habitat.

Proposed dredging at the site will impact approximately 15.9 acres of habitat. Dredging is necessary to accommodate vessel drafts and will result in the deepening of a turning basin as well as other areas along the pier and bulkheads. Approximately 0.41 acres of area intended for dredging are less than 5 meters (~16.4 ft) and may be suitable spawning habitat for winter flounder. A 0.09 acre subset of this area would be dredged and subsequently backfilled with crushed stone. The finish grades of the areas to be dredged and prepared for jack-up legs will be maintained at a depth of approximately -38 feet MLLW (with a 2'overdredge allowance) in the berthing pockets and at approximately -36 feet MLLW (with a 2'overdredge allowance) in the turning basins.

Portions of these dredge areas currently above ~16.4 feet would therefore no longer function as suitable winter flounder spawning habitat (though dredging side slope creation will provide some new suitable habitat). However, these dredged areas will still function as habitat for the other species and life stages identified as EFH in the Project area. Regarding suitable winter flounder spawning habitat, Project assessments indicate that approximately 6.61 acres of shallow shelf habitat currently exists within the Project areas and that 4.3 acres would remain at existing depths after construction.

The removal of berthing dolphins would result in a permanent loss of substrate for sessile marine organisms such as barnacles and mussels as well as permanent loss cover for fish species. However, new piles will be installed in Winthrop Cove to support of the Chester-Hadlyme ferry overwintering installation and would offer similar habitat for marine organisms, thereby reducing these losses. In addition, implementation of the living shoreline component of the Project's mitigation plan will provide significant replacement of habitat for marine organisms.

6.2 Indirect Impacts

6.2.1 Species Displacement

Temporary turbidity and noise generated by the Proposed Action could indirectly impact fish species by preventing or confounding movement of these species as they avoid the area. Migratory species such as alewife, blueback herring, and shad are particularly susceptible. These anadromous species are present in the Thames River during spawning migrations generally occurring in the late spring and early summer. Sediment fill and dredging activities performed outside of this time of year are not likely to interfere with anadromous fish species movements to and from spawning areas. Noise impacts would occur sporadically throughout the construction period and if underwater noise exceeds a certain threshold and is left unmitigated, such an impact could temporarily inhibit fish passage up and down the Thames River.

6.2.2 Temporary Loss of Prey / Foraging Areas

The abundance and local distribution of prey species for local biota may indirectly be impacted during sediment fill and dredging activities as some finfish species identified within the Project area may prey on benthic marine organisms living in or on the sediment. A loss of prey species may temporarily degrade the habitat value of higher trophic level biota inhabiting the Project area by depleting the food sources of those organisms. This impact would be temporary in nature and benthic organisms would repopulate the dredge sites via emigration from adjacent areas. Within the area where sediment fill is to be placed, foraging areas would be permanently lost. Given the size of adjacent forage areas within the Thames River and New London Harbor, this fill would result in only relatively minor long-term adverse effects.

[3] Suitable depth as identified by A. Verkade of NOAA NMFS during 04/04/2019 SPII Fisheries meeting.

6.3 Impacts to Managed Species and NOAA Trust Resources

6.3.1 Sediment Fill / Dredging / Construction Activity Impacts

Direct effects caused by pile, cofferdam, and bulkhead removal/installation, dredging, and sediment fill activity include alteration of the benthos (burial or removal) and physical and chemical impairment of water quality, and physical impairment/injury. The indirect effects of these impacts include species displacement and temporary loss of prey/foraging areas.

Sessile, demersal, and low mobility biota, or biota with demersal or low mobility life stages (e.g., eggs, larvae) would be most susceptible to benthic impacts such as direct burial by resuspended sediment or removal and/or burial from dredged and disposed sediment. It is primarily the egg, embryonic, and larval stages of finfish that are most susceptible to mortality and injury (Newcombe and Jensen 1996). Windowpane flounder was identified as having demersal eggs and larvae that could be present in the proposed Project area. The implementation of best management practices during dredging and disposal activities would avoid and/or minimize impacts to these sensitive life stages. Pelagic or highly mobile fish are more likely to avoid the areas affected by construction activities, sediment fill, and dredging.

As detailed in Section 7, the Project will adhere to all permit requirements, including TOY activity restrictions and turbidity monitoring, in order to avoid and minimize potential adverse impacts to fisheries to the extent practicable.

6.3.2 Noise

A detailed noise analysis was prepared relative to species listed under the federal Endangered Species Act. Additional detail regarding this assessment is available in the Project's Biological Assessment, submitted under separate cover.

7. Impact Avoidance, Minimization and Mitigation

The construction, dredging, and sediment fill activities conducted in the Project area are likely to result in minor, limited, and temporary impact to some EFH species. CPA is committed to construction phase avoidance and minimization procedures designed to reduce potential impacts to federal listed species, as well as other species of fish and wildlife, including managed species, that may be present in the Project area. These include procedures to minimize the effects of construction noise related to utilizing impact and vibratory hammers, as well as lessening the impacts of suspended sediments associated with dredging and measures to reduce the likelihood of a vessel strike on fish and wildlife.

In addition to the measures identified above, to mitigate for unavoidable Project impacts to coastal resources, especially impacts to fisheries habitats, CPA will continue to work with the CT DEEP, the USACE, NMFS and other federal agencies to identify viable and appropriate fishery projects that are currently without funding. It is anticipated that in addition to funding one or more fisheries projects through the Project's Fisheries Management Plan, the SPII compensatory mitigation package would include other aspects including improvements to the storm water runoff quality from the site, the implementation of a "Living Shoreline" along areas of the Thames River shoreline immediately north of the Project location near Winthrop Point and expansion of an eelgrass bed, discovered during one of the Project's existing conditions surveys near the Northeast Bulkhead. These latter two components are anticipated to be mutually beneficial, with the "Living Shoreline" providing shelter for the existing eelgrass bed and expansion areas from river currents, as well as tidal influences. Other fisheries habitat enhancements may also be considered, in continued consultation with CT DEEP and NMFS, including the possible creation of winter flounder spawning habitat proximate to the Project location. Additional detail on the anticipated mitigation measures are presented in the accompanying draft Project Mitigation Plan.

The Project will adhere to all permit requirements, including TOY activity restrictions, in order to avoid and minimize potential adverse impacts to fisheries to the extent practicable. As noted, in Section 3, the following TOY restrictions, as based on initial input from CT DEEP Inland Fisheries and NOAA NMFS, are anticipated: a "no in-water-work" window is anticipated in June through September, annually[4]. In addition, the CPA anticipates that the Project would have a Time-of-Year window which allows for dredging activities between October 1 through January 31, annually. Avoidance and minimization strategies specific to identified activities are discussed below.

Based on language included in the USACE CT GP, CPA anticipates that the following schedule and mitigation considerations may also be applicable to the Project: "*Piles should either be installed between November 1 and March 15 OR must use a soft start each day of pile driving, building up power slowly from a low energy start-up over a period of 20-40 minutes to provide adequate time for fish and marine mammals to leave the vicinity. The buildup of power should occur in uniform stages to provide a constant increase in output. Bubble curtains can be used to reduce sound pressure levels during vibratory or impact hammer pile driving.*"

7.1 Sediment Fill / Dredging

Not all fish species would incur the same degree of impact from dredging and sediment fill activity. Demersal fish species such as flounder are more susceptible to impacts than pelagic species since most dredging related disturbance occurs near the bottom. Additionally, eggs and larvae life cycle stages would be more vulnerable to dredging and disposal related impacts than juveniles or adults due to differences in mobility. Those species with demersal eggs such as winter flounder are more susceptible to impacts of dredging than those with pelagic (planktonic) eggs suspended within the water column. The

[4] CPA understands that select, confined in-water Project activities may progress behind sheeting and/or turbidity curtains once established, if within this period.

eggs and larvae of species with demersal eggs may be killed from exposure to elevated concentrations of suspended solids and associated water quality impacts. While adult and juvenile demersal and pelagic fish can avoid a sediment plume produced by dredging, small larval fish are less able to swim away from impact areas (Massachusetts Office of Coastal Zone Management 2002).

CPA would comply with all specified permit conditions to avoid generating excessive amounts of sediment and soil erosion, to avoid other potential adverse impacts to water quality (i.e. from concrete truck washouts, treated wood disposal or similar) and avoid causing irreversible impacts to estuarine and marine resources during construction activities. Construction BMPs will be followed to avoid adverse water quality impacts. Adherence to agency recommended fisheries TOY restrictions will also result in the avoidance and minimization of Project related impacts.

As noted above, some area of shallow shelf habitat of suitable depths will be created from side slope creation during dredging activities and other areas currently at suitable depths for winter flounder (of varying substrate types) would be deepened as part of the Project. As detailed in Attachment M8, the Project's living shoreline creation may provide additional suitable sheltered, shallow habitat for winter flounder demersal eggs through the creation of shallower waters which may be supportive of eelgrass bed expansion.

7.2 Construction Noise

Noise impacts may have temporary impacts on juvenile and adult fish and may have the greatest impact on anadromous fish or spawning fish that use the upper reaches of the Thames River for reproduction. Noise impacts may cause behavioral disturbance in fish species that could temporarily displace them from the Project area. The following avoidance and minimization measures and best management practices would be implemented within the construction area to avoid or minimize impacts from noise to fish and EFH in those locations.

- CPA has committed to restrict pile driving within the identified "No In-water Work Period" of June through September, or must use a soft start each day of pile driving, building up power slowly from a low energy start-up over a period of 20-40 minutes to provide adequate time for fish and marine mammals to leave the vicinity.. Additionally, while pile driving is active the noise levels from vibratory pile driving are expected to be below the threshold for physical injury to fish and would elicit only behavioral responses (i.e., avoidance).
- Pile Driving: Sheet and pile driving will largely be accomplished with vibratory hammers to reduce noise levels as compared to using an impact hammer. However, impact hammers may be utilized to ensure piles are driven to a depth that ensure maximum efficacy and stability.
- Impacts to fish from underwater noise would be minimized by using a "soft start" of the pile driving equipment to allow fish to move away from the area in response to the construction sound. The use of soft start pile driving techniques is expected to help clear fish to a safe distance from the construction area before peak instantaneous sound levels are reached. Fish species are expected to return to the area after pile driving activities have been completed. Fish that may avoid the Project area due to noise will have a sufficient zone of passage because the river at the Project location, as measured from the southern end of the State Pier to the Groton Shoreline, is over 1,000 feet wide.
- The Connecticut Port Authority would comply with all specified permit conditions to avoid generating excessive amounts of noise and causing irreversible impacts to marine resources during construction, dredging, and dredged material disposal activities.
- Construction impacts will be confined to the minimum area necessary to complete the Project.

8. Summary of Potential Impacts to Federally Managed Species

The summary of potential impacts to all federally managed species from construction and operation of the proposed Project are summarized by species in Table 7. Finfish juvenile and adult stages would likely leave the construction areas and move to nearby unaffected habitat during construction. Impacts to these life stages would consist of a temporary displacement and a temporary loss of a very small portion of food/foraging area. Impacts to demersal eggs, larvae, and to a lesser extent, juveniles may include mortality from construction methods. No impacts to pelagic eggs and larvae are expected. Overall, the impacts to federally managed species would be temporary, and are not expected to have any lasting effect upon the status or sustainability of the fisheries.

Table 6. Summary of Potential Impacts to Federally Managed Species that may Utilize the Project Area for Habitat.

Common Name	Scientific Name	Comment
Black Sea Bass	*Centropristis striata*	Juveniles have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for black sea bass juveniles. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage and shelter habitat until the benthic habitat stabilizes and recovers.
Scup	*Stenotomus chrysops*	All life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for scup. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities.
Summer Flounder	*Paralichthys dentatus*	Juvenile and adult life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for juvenile and adult summer flounder. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage and shelter habitat until the benthic habitat stabilizes and recovers. Summer Flounder HAPC is comprised of SAV beds. An eelgrass bed, approximately 4,600 SF in size in July, 2019, was noted during recent surveys. This SAV will be isolated and protected from Project activities. No other eelgrass beds, and only limited occurrences of other SAV (individual dulse specimens, macroalgae), were noted elsewhere in the Project footprint. The area between the piers and directly east of the State Pier are not mapped as summer flounder HAPC. No adverse impacts to summer flounder HAPC are anticipated.
Bluefish	*Pomatomus saltatrix*	Juvenile and adult life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for juvenile and adult bluefish. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage habitat until the benthic habitat stabilizes and recovers.

Common Name	Scientific Name	Comment
Atlantic Butterfish	*Peprilus triacanthus*	Juvenile and adult life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for juvenile and adult butterfish. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage habitat until the benthic habitat stabilizes and recovers.
Sand Tiger Shark	*Carcharias taurus*	All life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for sand tiger sharks. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage habitat for these life stages, until the benthic habitat stabilizes and recovers.
Winter Flounder	*Pseudopleuronectes americanus*	All life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for winter flounder at all life stages. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage and shelter habitat until the benthic habitat stabilizes and recovers. For winter flounder, spawning habitat will be impacted from dredging due to the deepening of some locations that may currently serve as spawning habitat. Approximately 6.61 acres of substrate (all types) exists at suitable winter flounder spawning depths (<5m) currently. A total of approximately 1.35 acres of impacts to substrates at these depths are anticipated from the Project. These construction impacts include, approximately 0.85 acres impacted by fill, 0.41 acres affected by dredging and up to 0.09 acres from jack-up pad creation.
Little Skate	*Leucoraja erinacea*	Juvenile and adult life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for juvenile and adult little skates. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage and shelter habitat until the benthic habitat stabilizes and recovers.
Winter Skate	*Leucoraja ocellata*	Juvenile and adult life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for juvenile and adult winter skates. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage and shelter habitat until the benthic habitat stabilizes and recovers.
Pollock	*Pollachius virens*	Juvenile and adult life stages have EFH listed within the waters of the Project area. The proposed filling approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for juvenile and adult pollock. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage habitat until the benthic habitat stabilizes and recovers. Adult pollock prefer water depths >50 ft, so are not likely to be found in the Project area.

Common Name	Scientific Name	Comment
Red Hake	*Urophycis chuss*	All life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for red hake at all life stages. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage and shelter habitat until the benthic habitat stabilizes and recovers.
Windowpane Flounder	*Scopthalmus aquosus*	All life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for windowpane flounder at all life stages. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage and shelter habitat until the benthic habitat stabilizes and recovers. Eggs are found in surface waters and larvae in pelagic waters, so impacts to these life stages would be limited.
Atlantic Sea Herring	*Clupea harengus*	Juvenile and adult life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for juvenile and adult sea herring. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities
Smoothhound Shark Complex / Smooth Dogfish	*Mustelus canis*	All life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for sooth dogfish. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage habitat for these life stages, until the benthic habitat stabilizes and recovers.
Atlantic Mackerel	*Scomber scombrus*	All life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for Atlantic mackerel. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage habitat for these life stages, until the benthic habitat stabilizes and recovers.
Longfin Inshore Squid	*Doryteuthis pealeii*	All life stages have EFH listed within the waters of the Project area. The proposed filling of approximately 7.4 acres of habitat between the piers, as well as 0.7 acres of potential fill at the existing riprap slope, will have a negative impact on the available habitat for longfin inshore squid. In addition, the substrates in the proposed dredge areas will be temporarily affected until the benthic fauna recovers from these activities and may provide less suitable forage habitat for these life stages, until the benthic habitat stabilizes and recovers.

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