



Essential Fish Habitat Assessment

West Point In-River Transmission Cable Project
Hudson River, New York

PREPARED FOR:

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Fairfield, Connecticut 06825

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Waltham, MA 02451

ESS Project No. W296-006

June 17, 2013





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TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 DESCRIPTION OF PROPOSED ACTION	1
2.0 ESSENTIAL FISH HABITAT REVIEW.....	1
2.1 EFH Designations.....	1
2.2 Ecological Habitat.....	3
2.2.1 Benthic Sediment.....	3
2.2.2 Water Quality	4
2.2.3 Dissolved Oxygen	4
2.2.4 Primary Productivity	5
2.2.5 Salinity.....	5
2.2.6 Temperature.....	5
2.2.7 Depth.....	5
2.3 EFH Species/Lifestages Potentially Present in Project Area	5
2.3.1 Red Hake (<i>Urophycis chuss</i>).....	6
2.3.2 Winter Flounder (<i>Pseudopleuronectes americanus</i>)	6
2.3.3 Windowpane Flounder (<i>Scophthalmus aquosus</i>).....	7
2.3.4 Bluefish (<i>Pomatomus saltatrix</i>).....	8
2.3.5 Atlantic Butterfish (<i>Peprilus triacanthus</i>).....	9
2.3.6 Summer Flounder (<i>Paralichthys dentatus</i>)	10
2.4 EFH Species/Lifestages Absent From Project Area.....	11
2.4.1 Red Hake (<i>Urophycis chuss</i>).....	11
2.4.2 Winter Flounder (<i>Pseudopleuronectes americanus</i>)	12
2.4.3 Pollock (<i>Pollachius virens</i>).....	13
2.4.4 Atlantic Herring (<i>Clupea harengus</i>).....	13
2.4.5 Atlantic Mackerel (<i>Scomber scombrus</i>).....	14
2.4.6 Scup (<i>Stenotomus chrysops</i>).....	14
2.4.7 Black Sea Bass (<i>Centropristus striata</i>).....	15
2.4.8 Coastal Migratory Pelagic Species	16
2.4.8.1 King Mackerel (<i>Scomberomorus cavalla</i>).....	16
2.4.8.2 Spanish Mackerel (<i>Scomberomorus maculatus</i>)	17
2.4.8.3 Cobia (<i>Rachycentron canadum</i>).....	17
2.4.9 Skates	18
2.4.9.1 Clearnose Skate (<i>Raja eglanteria</i>)	18
2.4.9.2 Little Skate (<i>Leucoraja erinacea</i>).....	18
2.4.9.3 Winter Skate (<i>Leucoraja ocellata</i>)	19
2.4.10 Sharks.....	19
2.4.10.1 Sand Tiger Shark (<i>Carcharias taurus</i>).....	19
2.4.10.2 Dusky Shark (<i>Carcharhinus obscurus</i>).....	19
2.4.10.3 Sandbar Shark (<i>Carcharhinus plumbeus</i>).....	19
3.0 ASSESSMENT OF IMPACTS	20
3.1 Construction Impacts.....	20
3.1.1 Direct Impacts	21
3.1.1.1 Benthic Habitat	21
3.1.1.2 Finfish	22
3.1.2 Indirect Impacts.....	23
3.1.2.1 Total Suspended Sediments (TSS).....	23
3.1.2.2 Sedimentation.....	25
3.1.2.3 Effect of Sediment Contaminants.....	26
3.1.2.4 Effects of Accidental Spill	26
3.1.2.5 Effects of Possible Bentonite Release	26
3.1.2.6 Acoustical Impacts.....	26
3.2 Operational Impacts	27



**TABLE OF CONTENTS
(Continued)**

<u>SECTION</u>	<u>PAGE</u>
3.2.1 In-River Transmission Cable.....	27
3.3 Summary of Impacts.....	28
4.0 CONCLUSION	28
5.0 REFERENCES.....	32

TABLES

Table A	Summary of Specific Lifestage EFH Designations for Species in the Hudson River/Raritan/Sandy Hook Bays, New York/New Jersey
Table B	Seasonality of Benthic and Pelagic Lifestages of Species with Designated EFH Potentially Present in the Project Area
Table C	Potential Impacts to Benthic and Pelagic Lifestages of Species with Designated EFH Potentially Present in the Project Area



1.0 DESCRIPTION OF PROPOSED ACTION

The West Point Transmission Project (West Point Project or the Project) is a high voltage direct current (HVDC) 1,000 MW electric transmission facility connecting the existing National Grid Leeds substation (Leeds Substation) in Athens, Greene County, New York, and the existing Consolidated Edison (Con Edison) Buchanan North substation (Buchanan Substation) in the Village of Buchanan, Westchester County, New York.

The Project is comprised of the following elements:

1. Approximately 77.3 miles of In-River 320 kV HVDC Transmission Cable (In-River Cable) together with associated communications fiber to be buried in the bed of the Hudson River.
2. Two (2) Converter Stations, one at each end of the HVDC cable. These will be Voltage Source Conversion-High Voltage Direct Current (VSC-HVDC) Converter Stations, which are required to link the HVDC Project to the 345 kV AC grid. The Northern and Southern Converter Stations will be located close to the Leeds and Buchanan Substation Interconnection Points respectively.
3. Two (2) short lengths of high voltage (345 kV) AC Land Cable connecting the VSC-HVDC Converter Stations to the Leeds and Buchanan Substation Interconnection Points. The AC Land Cables will be installed in underground conduits for the Northern Interconnection, and in buried, enclosed duct banks for the southern interconnection.
4. Two (2) short lengths of 320 kV HVDC Land Transmission Cable (Land Transmission Cable) with associated communications fiber linking the In-River Cable to the Converter Stations. These Land Transmission Cables will be installed in conduits buried underground.
5. Two (2) underground Transition Vaults where the In-River Cable will be spliced to the Land Transmission Cables.

For most of its length, the Project will be buried in the bed of the Hudson River in submerged lands owned by the State of New York. At either end of the In-River Cable Route, the Land Cables will be located primarily in existing public rights-of-way and, to a lesser extent, in rights-of-way secured from private landowners. The Converter Stations will be located on private property proximate to the existing Leeds and Buchanan Substations.

The portion of the Project applicable to Essential Fish Habitat (EFH) is the installation and operation of the In-River Cable. The In-River Cable Route extends from Athens, New York (RM 118) at the northernmost extent to Cortlandt, New York in the south (RM 42). The entire In-River Cable Route is within the Hudson River Estuary, which stretches between the Troy Dam and New York Harbor (NYSDEC 2012).

2.0 ESSENTIAL FISH HABITAT REVIEW

2.1 EFH Designations

The Magnuson-Stevens Fishery Conservation and Management Act and the 1996 Sustainable Fisheries Act mandate that NOAA identify and protect important marine and anadromous fish habitat. This essential fish habitat (EFH) is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity” (16 U.S.C.1802 § 3). The Magnuson-Stevens Act requires consultation with NOAA National Marine Fisheries Service (NOAA Fisheries) for proposed activities that may “adversely effect” EFH. An “adverse effect” is defined as any impact which reduces quality and/or quantity of EFH, including direct, indirect, individual, cumulative or synergistic impacts.

NOAA Fisheries designates EFH for most species in association with a grid of 10 x 10 minute squares, which covers all marine habitats along the United States coastline. NOAA Fisheries also designates EFH for estuarine waters (including estuaries, bays and rivers). EFH within the Project Area would most

closely fall under the EFH designations for the square covering the Atlantic Ocean within the Hudson River estuary (Grid 40407350), as well as in the Hudson River/Raritan/Sandy Hook Bays Estuary in New York waters. Although the In-River Transmission Cable Route is located north (up-river) of the Hudson River estuary 10 x 10 minute grid square and the area defined by the Hudson River/Raritan/Sandy Hook Bay Estuary it may contain habitat that is essential to certain EFH species. Thirteen species have designated EFH in the NOAA-defined Hudson River/Raritan/Sandy Hook Bays Estuary area. Four additional species were identified in the square covering the Atlantic Ocean within the Hudson River estuary. Three skate species were also identified as potentially having EFH in the Project Area based on the skate EFH designations.

A list of species with EFH designated within the Project Area is provided in Table A. Of these 20 species, five (scup, Atlantic mackerel, and three skate species) have been designated only within the seawater salinity zone, and seven (king mackerel, Spanish mackerel, cobia, pollock, and three shark species) have been identified with no salinity zone specifications, although their life history descriptions indicates that they prefer high-salinity waters. The remaining eight species are either listed as occurring within the mixing water/brackish/seawater or freshwater zones. Further analysis of Project-specific habitat conditions may indicate that EFH does not exist for some of these species or lifestages in the Project Area.

Table A: Summary of Specific Lifestage EFH Designations for Species in the Hudson River/Raritan/Sandy Hook Bays, New York/New Jersey

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Red hake (<i>Urophycis chuss</i>)		M,S	M,S*	M,S*	
Winter flounder (<i>Pseudopleuronectes americanus</i>)	M,S*	M,S	M,S	M,S*	M,S*
Windowpane flounder (<i>Scophthalmus aquosus</i>)	M,S	M,S	M,S*	M,S*	M,S
Bluefish (<i>Pomatomus saltatrix</i>)			M,S	M,S	
Atlantic butterfish (<i>Peprilus triacanthus</i>)		M	M,S	M,S	
Summer flounder (<i>Paralichthys dentatus</i>)		F,M,S*	M,S*	M,S*	
Pollock (<i>Pollachius virens</i>)			X*	X*	
Atlantic herring (<i>Clupea harengus</i>)		M,S*	M,S*	M,S*	
Atlantic mackerel (<i>Scomber scombrus</i>)			S*	S*	
Scup (<i>Stenotomus chrysops</i>)	S*	S*	S*	S*	
Black sea bass (<i>Centropristis striata</i>)			M,S*	M,S*	
King mackerel (<i>Scomberomorus cavalla</i>)	X*	X*	X*	X*	
Spanish mackerel (<i>Scomberomorus maculatus</i>)	X*	X*	X*	X*	
Cobia (<i>Rachycentron canadum</i>)	X*	X*	X*	X*	
Clearnose skate (<i>Raja eglanteria</i>)			S*	S*	
Little skate (<i>Leucoraja erinacea</i>)			S*	S*	
Winter skate (<i>Leucoraja ocellata</i>)			S*	S*	
Sand tiger shark (<i>Carcharias taurus</i>)		X*			

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Dusky shark (<i>Carcharhinus obscurus</i>)		X*			
Sandbar shark (<i>Carcharhinus plumbeus</i>)		X*			X*

[†]The In-River Transmission Cable Route is located north (up-river) of the 10 x 10 minute grid square defined by NMFS as well as the area defined by the Hudson River/Raritan/Sandy Hook Bay Estuary.

S = Includes the seawater salinity zone (>25 ppt)

M = Includes the mixing water/ brackish salinity zone (0.5 ppt to 25 ppt)

F = Includes tidal freshwater salinity zone (0.0 ppt to 0.5 ppt)

X = Designated EFH but no salinity specified.

* = Unlikely to be found in project area due to salinity conditions.

2.2 Ecological Habitat

2.2.1 Benthic Sediment

Sediments in the Hudson River can be characterized regionally based on their geotechnical and chemical properties. In addition to these large-scale characteristics, local variations can be significant determinants in benthic habitats and contaminant distribution. The leading determinants of local sediment variation are local bedrock morphology, tributary input, local hydrodynamics, and human impact.

The Hudson River Benthic Mapping Project identified regional sediment distributions within the Hudson River, from south to north, consisting primarily of marine sands in the Upper Bay, mud-dominated sediments between Battery and Kingston, fluvial sand between Kingston and Albany, and gravel-dominated sediments between Albany and Troy (Nitsche et al. 2007). These findings were confirmed with the results of the NYSDEC Biocriteria Project, in which muddy substrates predominated in the lower portion of the estuary below Kingston and sandy (< 10% silt-clay) and mixed substrates predominated in the upper portion of the estuary, between Kingston and Troy (Llansó et al. 2003).

The Hudson River has a long history of direct disposal of industrial chemical waste into the river. Elevated levels of polychlorinated biphenyl (PCB) contamination were first discovered in the sediments and fish of the Hudson River in the 1970's and by 1977 the production of PCBs was banned in the United States. Although the majority of PCB contamination was isolated to areas immediately downstream from the sources, the contamination has spread down to New York Bay, a distance of over 140 miles (Farley et al. 2006).

A comprehensive field program, including a sediment coring and sampling survey, was conducted along the In-River Cable Route to characterize the sediment in the Project Area. The sampling program was conducted in accordance with an In-River Geotechnical Sediment Sampling and Analysis Plan ("SAP"), approved by the NYSDEC and NYSDPS (see Appendix 4B). Detailed descriptions of the field surveys, including field observations and analytical results are presented in the "In-River Cable Route Field Evaluations Report" provided in Appendix 4B and summarized below.

Sediment cores were collected from 56 vibracore locations along the proposed In-River Cable Route with a total of 60 sediment samples analyzed. Fifty (50) cores were collected along the proposed jet-plow embedment area of the route, three cores were collected from the proposed northern cofferdam/dredge landfall location, and three cores were collected from the proposed southern cofferdam/dredge landfall location. Cores collected along the northern portion of the route (RM 116 through RM 96) were composed primarily of sand, while the remainder of the cores collected along the southern portion of the route (RM 96 through RM 41) were composed predominately of silt and clay.

Although detectable concentrations of PCBs, PAHs, pesticides, dioxin/furans, and metals were found in samples collected along the In-River Cable Route, the majority of samples contained sediments that were classified as either Class A (no appreciable contamination) or Class B (moderate contamination).

The bulk physical and chemical characteristics of the sediment are further summarized in Exhibit 4, Sections 4.4 and 4.5 respectively.

2.2.2 Water Quality

New York State Water Quality Standards promulgated under 6 NYCRR Part 703 set the required water quality criteria that must be met to support the best use indicated. The In-River Cable Route traverses three NYSDEC water body classes including Class A, Class B, and Class SB waters. The northern portion of the In-River Cable Route is classified as Class A (freshwater), suitable as a drinking water source, for primary and secondary contact recreation, fishing, and fish, shellfish, and wildlife propagation. The middle and lower portions of the In-River Cable Route are classified as Class B (fresh surface water) and Class SB (saline surface water) respectively. These classifications are suitable for primary and secondary contact recreation, fishing, and fish, shellfish, and wildlife propagation (6 NYCRR §701).

Waterbodies that do not meet the criteria associated with their use classification are considered to be impaired. NYSDEC maintains the Waterbody Inventory and Priority Waterbodies List (WI/PWL), a database that contains information on water quality, the ability of waters to support their use classifications, and known or suspected sources of contamination. All portions of the Hudson River within this area are listed as impaired for fish consumption due to PCBs, heavy metals (cadmium), and other contaminants (sourced from sediments). The contamination is considered to be the result of past industrial discharges, particularly PCB discharges in the Upper Hudson River (NYSDEC 2012).

2.2.3 Dissolved Oxygen

Adequate dissolved oxygen (DO) levels are critical to the survival of fish and other aquatic organisms. DO concentrations are determined by several factors, including the degree of tidal mixing, photosynthesis rates, temperature, microbial decomposition of organic matter, and organism respiration levels. Photosynthesis, a high degree of tidal mixing, and relatively low temperatures generally result in an increase in DO concentrations, while higher organism respiration rates, microbial decomposition of organic material, chemical oxidation, and high air and water temperatures generally depress DO levels. In the Hudson River, between Catskill and Albany, DO levels range from 10.0 - 12.0 parts per million (ppm) in the spring, to 7.0 - 8.0 ppm in the summer (Dyneyg 2006). Isolated declines in oxygen levels can be attributed to the species invasion of zebra mussels (*Dreissena polymorpha*). On average, DO levels (expressed as percent saturation) are highest in the upper river reaches and decline in the downstream direction as the solubility of oxygen decreases with increasing salinity levels.

In the late summer of 2000 and 2001, NYSDEC conducted the Hudson River Biocriteria Project to develop indicators of biological conditions for the Hudson River Estuary. Sampling sites in the Hudson River from Troy to The Battery had mean bottom DO levels of 8.6 to 8.8 ppm and temperatures of 19.4 to 21.7°C, typical for late summer conditions of well-mixed temperate systems. Vertical stratification of the water column was also found to be insignificant, as tidal flow kept the water column well-mixed vertically (Strayer and Smith 2000); therefore low DO was not typically a problem (Llansó et al. 2003).

2.2.4 Primary Productivity

Chlorophyll, the pigment found in plants and algae, facilitates photosynthesis and growth. The amount of chlorophyll-a in a water system is often measured as an indicator of the biological productivity of the waterbody (NYCDEP 2003). Currently, there are no water quality standards established for chlorophyll-a, although values greater than 10 micrograms per liter ($\mu\text{g/l}$) are usually indicative of a eutrophic (nutrient rich) system (Wetzel 2001). According to data collected at Norrie Point by the Hudson River Environmental Conditions Observing System (HRECOS) between 2009 and 2010, chlorophyll-a concentrations ranged from 0.0 to 379.3 $\mu\text{g/l}$ and averaged about 4.8 $\mu\text{g/l}$ (HRECOS 2012).

2.2.5 Salinity

Salinity influences the distribution and function of both plants and animals within estuarine environments. The Hudson River estuary can be divided into four salinity zones: polyhaline (18 to 30 parts per thousand [ppt]) from Manhattan north to Yonkers, mesohaline (5 to 18 ppt) from Yonkers north to Stony Point, oligohaline (0.5 to 5 ppt) from Stony Point (RM 41) north to about Wappinger Falls (RM 68), and freshwater tidal (<0.5 ppt) from Wappinger Falls north to the Troy Dam. The salinity levels of the estuary are primarily governed by daily tides and the volume of freshwater flowing into the estuary. Under high-flow conditions, freshwater overrides the salt layer and salinity differences of up to 20 percent can be established (Busby and Darmer 1970). Average salinities collected at Iona Island Marsh and Piermont Marsh in the winter and spring were approximately one-fourth that of summer and fall (NERRS 2009). Under normal seasonal tide and inflow conditions, the salt front and associated transition zone ranges from below Hastings-on-Hudson (RM 21.5) during high-flow periods in spring to New Hamburg (RM 67.7) during low-flow periods in late-summer, a distance of about 50 miles (de Vries and Weiss 2001). Along the proposed In-River Transmission Cable Route measured salinities ranged from 0.1 ppt to 5.40 ppt in data compiled from HRECOS, USGS, and Riverkeeper.

Given the broad range of salinities found within the river system, the Project Area is typically populated or traversed by a variety of marine, estuarine, freshwater, anadromous, and catadromous fish species (USFWS 1997). The In-River Cable Route extends from River Mile 42 to River Mile 116; placing it within the oligohaline (0.5 to 5 ppt) and tidal freshwater (< 0.5 ppt) zones.

2.2.6 Temperature

Average monthly surface water temperatures range from 0.3 to 25.6°C along the Hudson River below Poughkeepsie between 1992 and 2010. The lowest temperatures were recorded in January and February while the highest temperatures were recorded in July and August (USGS 2013).

2.2.7 Depth

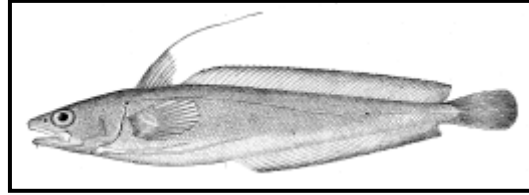
Average depths within the Hudson River range from 5 to 20 m. Along the proposed route, maximum depths are found in the Hudson Highlands at West Point (56 m). The large embayments of the Tappan Zee, Haverstraw Bay, and Newburgh Bay are relatively shallow. North of Kingston the estuary shoals gradually. The maximum depth in the northern section is less than 10 m and is maintained by dredging until north of Albany (Nitsche et al. 2007).

2.3 EFH Species/Lifestages Potentially Present in Project Area

The physical and chemical characteristics of the Project Area and the NOAA Fisheries definition of species-specific habitat conditions were reviewed to determine whether EFH may be present in the Project Area. Offshore EFH is defined as being over pelagic continental shelf waters, and thus not considered in this assessment. The following species and/or their designated inshore EFH have the potential to occur within the Project Area.

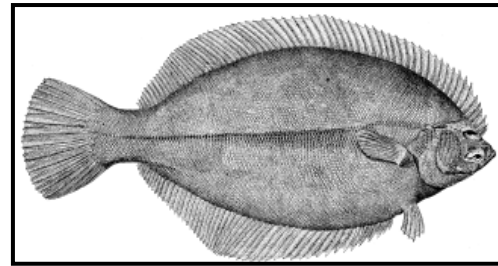
2.3.1 Red Hake (*Urophycis chuss*)

LARVAE. EFH is the surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras (NOAA Fisheries 2013). Although red hake larvae are more restricted to larger systems east and north of the Project Area (Able and Fahay 1998), they have been reported in the marine parts of several bays and estuaries in the Mid-Atlantic Bight, including the Hudson-Raritan estuary (Jury et al. 1994, Stone et al. 1994). Generally, red hake larvae require the following habitat conditions: sea surface temperatures below 19°C, water depths less than 200 m, and salinity greater than 0.5 ppt. Red hake larvae are most often observed from May through December, with peaks in September and October (Steimle et al. 1999). NOAA Fisheries has designated saline and brackish regions in the Hudson-Raritan estuary as EFH for this lifestage (NOAA Fisheries 2013).



2.3.2 Winter Flounder (*Pseudopleuronectes americanus*)

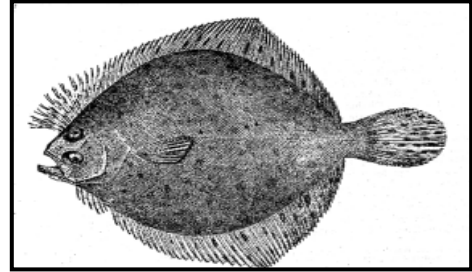
LARVAE. EFH for the larvae of this species is listed as the pelagic and bottom waters of Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder larvae are found: sea surface temperatures less than 15°C, salinities between 4 and 30 ppt, and water depths less than 6 meters (NOAA Fisheries 2013). Larvae are initially planktonic but become increasingly bottom-oriented as metamorphosis approaches. Extremes in salinity may lower larval survival success (Buckley 1989). Winter flounder larvae have been documented in the Hudson-Raritan estuary from January to June and from November to December (Stone et al. 1994). NOAA Fisheries has designated saline and brackish regions of the Hudson River/Raritan Bay as EFH for this lifestage (NOAA Fisheries 2013).



“YOUNG-OF-THE-YEAR” JUVENILES. Winter flounder less than one year old (young-of-the-year [YOY]) are treated separately for this species because their habitat requirements are different from those of larger juveniles (>1 yr) (Pereira et al. 1999). EFH includes bottom habitat with a substrate of mud or fine grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder young-of-the-year are found: water temperatures below 28°C, depths from 0.1 to 10 m, and salinities between 5 and 33 ppt (NOAA Fisheries 2013). Sandy coves appear to be the preferred habitat for YOY juveniles in the very shallow waters of estuaries and bays where they were spawned (Hildebrand and Schroeder 1928). However, recent comparisons of habitat-specific patterns of abundance and distribution of YOY winter flounder in the Hudson-Raritan estuary, along with many others, support the conclusion that habitat utilization by YOY winter flounder is not consistent across habitat types and is highly variable among systems and from year to year (Pereira et al. 1999, Goldberg et al. 2002). YOY winter flounder tolerate lower salinities (5 ppt) than do yearling flounder (10 ppt). NOAA Fisheries has designated saline and brackish regions of the Hudson River/Raritan Bay as EFH for this lifestage (NOAA Fisheries 2013).

2.3.3 Windowpane Flounder (*Scophthalmus aquosus*)

EGGS. EFH for windowpane flounder eggs exists in the surface waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras, generally where sea surface temperatures are less than 20°C and water depths less than 70 m. Windowpane flounder eggs are often observed from February to November with peaks in May and October in the middle Atlantic and July to August on Georges Bank (NOAA Fisheries 2013). Although eggs are more common in the saline waters (>25 ppt) than the brackish waters (0.5–25 ppt) (Stone et al. 1994), NOAA Fisheries has designated both saline and brackish regions of the Hudson River/Raritan Bay as EFH for this lifestage (NOAA Fisheries 2013).



LARVAE. EFH for windowpane flounder larvae exists in the pelagic waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Windowpane flounder larvae are found throughout the polyhaline portion of estuaries in the spring, but primarily on the shelf in fall (Morse and Able 1995). NEFSC bottom trawl surveys (Chang et al. 1999) found the majority of larvae were collected at integrated water column temperatures of 3–14°C in spring, 10–17°C in summer, and 13–19°C in fall, at depths less than 70 m. They are often observed from February to November with peaks in May and October in the middle Atlantic. NOAA Fisheries has designated saline and brackish regions of the Hudson River/Raritan Bay as EFH for this lifestage (NOAA Fisheries 2013).

JUVENILES. Juvenile windowpane flounder EFH is bottom habitat with a substrate of mud or preferably sand and fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder juveniles are found: water temperatures below 25°C, depths from 1 to 100 meters, and salinities between 5.5 and 36 ppt (NOAA Fisheries 2013). In extensive collections in estuarine shallows, juveniles were never collected in intertidal areas, but they occurred frequently along subtidal shores (Able et al. 1996) and in a variety of deeper (<1–8 m) habitats (Szedlmayer and Able 1996). In the Hudson-Raritan estuary, NEFSC bottom trawl surveys (Chang et al. 1999) showed that juveniles were fairly evenly distributed throughout the estuary, but they were most abundant in the deeper channels in winter and summer (Wilk et al. 1996). For all seasons combined, juveniles were collected at bottom temperatures of 0–24°C, at depths < 25 m with salinities of 15–33 ppt, and dissolved oxygen (DO) levels of 2–13 mg/l (Wilk et al. 1996). Juvenile windowpane flounder were most abundant at bottom water temperatures of 5–23°C, depths of 7–17 m, salinities of 22–30 ppt, and DO levels of 7–11 mg/l (Wilk et al. 1996). Windowpane flounder juveniles are reported by Stone et al. (1994) as being common year-round in the Hudson-Raritan estuary.

Although NOAA Fisheries has designated the saline and brackish regions of the Hudson River/Raritan Estuary as EFH for windowpane flounder juveniles (NOAA Fisheries 2013), the salinity in the Project Area is lower than their preferred range, suggesting that it is unlikely EFH exists in the specific Project Area.

ADULTS. EFH exists in bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to the Virginia-North Carolina border. Generally, the following conditions exist where windowpane flounder adults are found: water temperatures below 26.8°C, depths from 1 to 75 meters, and salinities between 5.5 and 36 ppt (NOAA Fisheries 2013). Adult windowpane flounder occur primarily on sand substrates off southern New England and the Middle Atlantic Bight, but are frequently caught on mud grounds in the Gulf of Maine (Langton et al. 1994). Adults are euryhaline,

typically occurring at salinities of 5.5-36.0 ppt (Tagatz 1967). In the Hudson-Raritan estuary, adults were fairly evenly distributed, but they were more abundant in deeper channels in the summer (Wilk et al. 1996). For all seasons combined, adults were collected at bottom temperatures of 0-24°C, depths < 25 m, salinities of 15-33 ppt, and DO levels of 2-13 mg/l (Wilk et al. 1996). Windowpane adults are reported by Stone et al. (1994) as being common year-round in the Hudson-Raritan estuary.

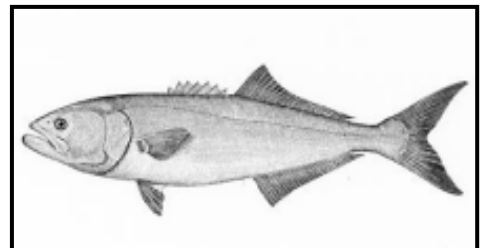
Although NOAA Fisheries has designated the saline and brackish regions of the Hudson River/Raritan Bay as EFH for windowpane flounder adults (NOAA Fisheries 2013), the salinity in the Project Area is lower than their preferred range, suggesting that it is unlikely that EFH exists in the specific Project Area.

SPAWNING ADULTS. EFH for spawning adult windowpane flounder exists in bottom habitats with substrate of mud or fine-grained sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border. Generally, the following conditions exist where windowpane flounder adults are found: water temperatures below 21°C, depths from 1 to 75 meters, and salinities between 5.5 and 36 ppt (NOAA Fisheries 2013). Spawning occurs throughout most of the year with peaks in May and September (Chang et al. 1999). Windowpane flounder spawn at night on or near the bottom at temperatures less than 15°C (Ferraro 1980). Most spawning occurs along inner shelf waters but some spawning may occur in the high salinity portions of estuaries in the Middle Atlantic Bight.

Although spawning adults are more common in the saline waters (>25 ppt) than the brackish waters (0.5–25 ppt) (Stone et al. 1994), NOAA Fisheries has designated both saline and brackish regions of the Hudson River/Raritan Bay as EFH for this lifestage (NOAA Fisheries 2013).

2.3.4 Bluefish (*Pomatomus saltatrix*)

JUVENILES. EFH for juvenile bluefish is found over the continental shelf from Nantucket Island, MA south to Cape Hatteras, South Carolina and the Florida Keys, and in all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. In the New York Bight, there are two periods of migration by pelagic juveniles into estuarine habitats: 1) between May 28 and June 15 (Cowen et al. 1993), and 2) mid- to late-August (McBride and Conover 1991). Distribution of juveniles by temperature, salinity, and depth over the continental shelf is undescribed, and it is presently unknown if bluefish depend on estuaries during the juvenile phase (Fahay et al. 1999). However, juveniles were present in NEFSC bottom trawl surveys conducted in the Hudson-Raritan estuary during summer and fall (May to October) over a depth range of 5-20 m at bottom temperatures of 12-24°C, and salinities ranging from 19-32 ppt (Fahay et al. 1999). There were no juveniles present during the winter in the Hudson-Raritan estuary. Juveniles begin to depart Mid-Atlantic Bight estuaries in October and migrate south to spend the winter months south of Cape Hatteras (Fahay et al. 1999). Other studies show juvenile bluefish will occasionally ascend into estuaries where salinities may be less than 10 ppt (Lippson and Lippson 1984). Juvenile bluefish are reported by Stone et al. (1994) as abundant from May to October in the Hudson-Raritan estuary. NOAA Fisheries (NOAA Fisheries 2013) has designated saline and brackish regions of the Hudson River/Raritan Bay as EFH for this lifestage. However, since the salinity in the Project Area is lower than their preferred range, it is unlikely that EFH exists in the specific Project Area.

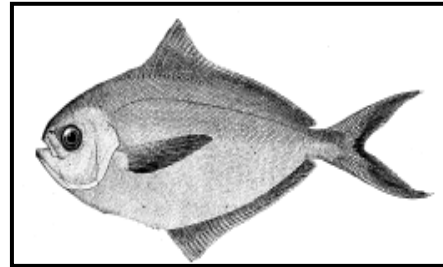


ADULTS. EFH for adult bluefish is found over the continental shelf from Cape Cod Bay, MA south to Cape Hatteras, South Carolina and the Florida Keys and includes all major estuaries between

Penobscot Bay, Maine and St. Johns River, Florida. Inshore, EFH is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida (NOAA Fisheries 2013). Adult bluefish inhabit the North Atlantic estuaries from June through October and Mid-Atlantic estuaries from April through October, or until estuarine water temperatures decline below 14-16°C (Jury et al. 1994, Stone et al. 1994, Fahay et al. 1999). Bluefish are highly migratory and distribution varies seasonally and according to the size of the individuals comprising schools. NEFSC bottom trawl surveys in the Hudson-Raritan estuary (Fahay et al. 1999) showed that no adults were seen in winter and only a few in spring. Adult bluefish generally prefer water temperatures of 18-22°C (Pottern et al. 1989) and a salinity range greater than 25 ppt. However, adults will occasionally ascend into estuaries where salinities may be less than 10 ppt (Lippson and Lippson 1984). Adult bluefish are reported by Stone et al. (1994) as common from May to October in the Hudson-Raritan estuary. NOAA Fisheries has designated saline and brackish regions of the Hudson River/Raritan Bay as EFH for adult bluefish (NOAA Fisheries 2013). However, since the salinity in the Project Area is lower than their preferred range, it is unlikely that EFH exists in the specific Project Area.

2.3.5 Atlantic Butterfish (*Peprilus triacanthus*)

LARVAE. Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where butterfish larvae are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, butterfish larvae are collected in depths between 33 ft and 6000 ft and temperatures between 48°F (8.9°C) and 66°F (18.9°C) (NOAA Fisheries 2013). They are common to abundant in the high salinity zones of some estuaries in the Mid-Atlantic Bight (Cross et al. 1999). During the NEFSC Marine Resources Monitoring, Assessment and Prediction (MARMAP) ichthyoplankton survey (Cross et al. 1999), butterfish larvae were mostly found at depths less than 120 m, water temperatures of 9-19°C, and at salinities ranging from 6.4-37 ppt. According to the ELMR database (Stone et al. 1994), butterfish larvae are considered common in the brackish regions (0.5-25 ppt) of the Hudson River/Raritan Bay estuary from June to August and rare in the freshwater (< 0.5 ppt) and saline (> 25 ppt) regions. NOAA Fisheries has designated the brackish regions of the Hudson River/Raritan Bay as EFH for Atlantic butterfish larvae (NOAA Fisheries 2013).



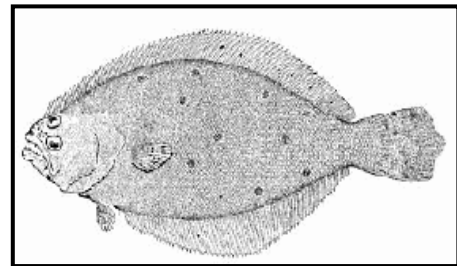
JUVENILES. Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where juvenile butterfish are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, juvenile butterfish are collected in depths between 33 ft and 1200 ft and temperatures between 37°F (2.8°C) and 82°F (27.8°C) (NOAA Fisheries 2013). Smaller juveniles often aggregate under floating objects including jellyfish. Juveniles typically occur in the high salinity and mixed salinity zones of most estuaries from the Gulf of Maine to Florida. In the Hudson-Raritan estuary, NEFSC bottom trawl surveys (Cross et al. 1999) revealed juveniles preferred water temperatures of 8-26°C, depths of 3-23 m, and a salinity range from 19-32 ppt, although juveniles have been found at salinities as low as 3.0 ppt. Butterfish juveniles are reported as common from April to November in the brackish and saline regions of Hudson-Raritan estuary (Stone et al. 1994). NOAA Fisheries has designated the saline and brackish regions of the Hudson River/Raritan Bay as EFH for Atlantic butterfish juveniles (NOAA Fisheries 2013).

ADULTS. Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where adult butterfish are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, adult butterfish are collected in depths between 33 ft and 1,200 ft and temperatures between 37°F (2.8°C) and 82°F (27.8°C) (NOAA Fisheries 2013).

Fisheries 2013). Older juveniles and adults are frequently found over sand, mud, and mixed substrates. Adult butterfish are typically found offshore in the winter and move inshore and north with increasing water temperatures. During the summer, butterfish range from the Gulf of Maine to the South Atlantic Bight where they are commonly found in sheltered bays and estuaries. NEFSC bottom trawl surveys in the Hudson-Raritan estuary (Cross et al. 1999) revealed adults preferred water temperatures of 8-26°C, depths of 3-23 m, and a salinity range from 19-32 ppt, although adults have been found at salinities as low as 3.8 ppt. Butterfish adults are reported by Stone et al. (1994) as common in the saline and brackish zones of the Hudson-Raritan estuary from April to November. NOAA Fisheries has designated the saline and brackish regions of the Hudson River/Raritan Bay as EFH for Atlantic butterfish adults (NOAA Fisheries 2013).

2.3.6 Summer Flounder (*Paralichthys dentatus*)

LARVAE. Inshore, EFH is all the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database, in the "mixing" (defined in ELMR as 0.5 to 25.0 ppt) and "seawater" (defined in ELMR as greater than 25 ppt) salinity zones. In general, summer flounder larvae are most abundant nearshore (12-50 miles from shore) at depths between 30 to 230 ft (9.1-70.1 m) (NOAA Fisheries 2013). Summer flounder larvae are most frequently found in the northern part of the



Mid-Atlantic Bight from September to February, and in the southern part from November to May. Studies have shown that from October to May, summer flounder larvae and post-larvae migrate inshore, entering coastal and estuarine nursery areas to complete transformation (Packer et al. 1999). Transforming larvae and juveniles are most often captured in the higher salinity portions of estuaries. In New Jersey, Festa (1974) captured larval summer flounder in salinities of 26.6-35.6 ppt, while in two marsh creeks larvae occurred at salinities ranging from 20-33 ppt (Able and Kaiser 1994). Summer flounder larvae rarely occur in the Hudson-Raritan system (Able and Fahay 1998). In addition, Stone et al. (1994) report summer flounder larvae as rare in the brackish and saline regions of the Hudson River/Raritan Bay estuary.

Although NOAA Fisheries has designated the saline, brackish and tidal fresh regions of the Hudson River/Raritan Estuary as EFH for summer flounder larvae (NOAA Fisheries 2013), there is little evidence of summer flounder occurring in the Hudson River/Raritan Bay system, particularly in the tidal fresh regions. This suggests that EFH is unlikely to be present in the specific Project Area.

JUVENILES. 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 (2.8°C) and salinities from 10 to 30 ppt (NOAA Fisheries 2013). In the Hudson-Raritan estuary, NEFSC bottom trawl surveys (Packer et al. 1999) show juveniles to be present in small numbers throughout the estuary in all seasons, with slightly higher numbers seen in the spring. According to Stone et al. (1994), summer flounder juveniles are common in the saline and brackish zones from May to October and generally rare the rest of the year in the Hudson-Raritan estuary.

Although NOAA Fisheries has designated the saline and brackish regions of the Hudson River/Raritan Estuary as EFH for summer flounder juveniles (NOAA Fisheries 2013), the salinity in the Project Area is lower than their preferred range, suggesting that EFH is unlikely to be present in the specific Project Area.

ADULTS. 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 (NOAA Fisheries 2013). Some evidence suggests that older adults may remain offshore all year (Festa 1977). Summer flounder occupy a variety of habitats over sand, mud, and vegetated substrate including marsh creeks (Able and Fahay 1998). Tagging studies (Poole 1962, Lux and Nichy 1981) on flounder released off Long Island and southern New England revealed that adults usually began seaward migrations in September or October. The 1992-1997 Hudson-Raritan surveys show the adults to be present in moderate numbers throughout the estuary in all seasons except winter. They occur in an extremely wide temperature range, between 2-27°C, but appear to prefer higher salinity portions of estuaries (> 15 ppt) (Packer et al. 1999). However, studies (Burke 1991, Burke et al. 1991) have indicated that the summer flounder's distribution is due primarily to substrate preference and is not affected by salinity. Summer flounder adults are reported by Stone et al. (1994) as common from May to October and generally rare the rest of the year in the saline and brackish regions of the Hudson-Raritan estuary.

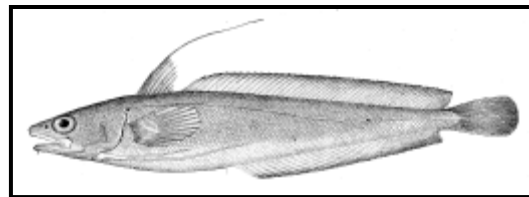
Although NOAA Fisheries has designated the saline and brackish regions of the Hudson River/Raritan Estuary as EFH for summer flounder adults (NOAA Fisheries 2013), the salinity in the Project Area is lower than their preferred range, suggesting that EFH is unlikely to be present in the specific Project Area.

2.4 EFH Species/Lifestages Absent From Project Area

The following species and lifestages were designated by NOAA Fisheries as having EFH within the 10 x 10 minute grid square covering the Atlantic Ocean within the Hudson River Estuary (Grid 40407350) and/or within the Hudson River/Raritan/Sandy Hook Bays Estuary in New York waters. However, a review of the physical and chemical properties of the In-River Cable Route and the NOAA Fisheries definition of species-specific habitat conditions (NOAA Fisheries 2013) determined that EFH for the following species and lifestages is not present in the Project Area. Therefore, construction of the proposed project is not expected to have impacts on the following species and/or their designated EFH.

2.4.1 Red Hake (*Urophycis chuss*)

JUVENILES. EFH is listed as bottom habitat with a substrate of shell fragments, including areas with an abundance of live scallops, in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where red hake juveniles are found: water temperatures below 16°C, depths less than 100 meters and a salinity range from 31 to 33 ppt (NOAA Fisheries 2013). In the Hudson-Raritan estuary, juveniles were collected at similar temperatures and depths and salinities between 22 and 28 ppt (Steimle et al. 1999). Red hake juveniles can be found in the Hudson-Raritan estuary throughout the year, but are considered common from November to May and rare in June and October (Stone et al. 1994).



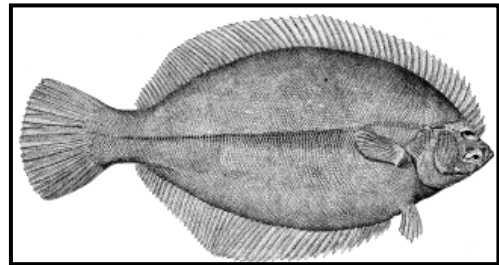
Although NOAA Fisheries has designated the saline and brackish regions of the Hudson-Raritan estuary as EFH for red hake juveniles (NOAA Fisheries 2013), the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

ADULTS. Adult red hake EFH is bottom habitat in depressions with a substrate of sand and mud in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where red hake adults are found: water temperatures below 12°C, depths from 10 to 130 meters, and a salinity range from 33 to 34 ppt (NOAA Fisheries 2013). Adults may be found in the estuary during cooler seasons (i.e., November to May), although not in abundance (Steimle et al. 1999); they are rarely seen in the estuary from June to October (Stone et al. 1994). NEFSC bottom trawl surveys (Steimle et al. 1999) found adults preferred a salinity range of 20-33 ppt.

Although NOAA Fisheries has designated saline and brackish regions of the Hudson-Raritan estuary as EFH for red hake adults (NOAA Fisheries 2013), the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

2.4.2 Winter Flounder (*Pseudopleuronectes americanus*)

EGGS. EFH for winter flounder eggs is bottom habitat with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder eggs are found: water temperatures less than 10°C, salinities between 10 and 30 ppt, and water depths less than 5 meters (NOAA Fisheries 2013). Eggs have been documented in the Hudson-Raritan estuary from January to April and from November to December (Stone et al. 1994). The optimal salinity range for egg survival is 15-35 ppt and extremes in salinity may lower egg hatching success (Buckley 1989).



Although NOAA Fisheries has designated saline and brackish regions of the Hudson River/Raritan Bay as EFH for winter flounder eggs (NOAA Fisheries 2013); the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

AGE 1+ JUVENILES. Older juveniles have EFH in bottom habitats with a substrate of mud or fine-grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where juvenile winter flounder are found: water temperatures below 25°C, depths from 1 to 50 meters, and salinities between 10 and 30 ppt (NOAA Fisheries 2013). Winter flounder juveniles are reported as abundant in the Hudson-Raritan estuary from November to June and common the rest of the year (Stone et al. 1994).

Although NOAA Fisheries has designated saline and brackish regions of the Hudson River/Raritan Bay as EFH for juvenile winter flounder (NOAA Fisheries 2013), the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

ADULTS. EFH for adult winter flounder is listed as bottom habitat, including estuaries, with a substrate of mud, sand, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where winter flounder adults are found: water temperatures below 25°C, depths from 1 to 100 meters, and salinities between 15 and 33 ppt (NOAA Fisheries 2013). Winter flounder adults are reported as abundant in the Hudson-Raritan estuary from January to April and common or rare the rest of the

year (Stone et al. 1994). In the Hudson-Raritan estuary, most adults were captured at temperatures ranging from 4-12°C and at salinities greater than 22 ppt (Pereira et al. 1999).

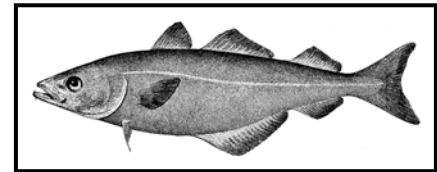
Although NOAA Fisheries has designated saline and brackish regions of the Hudson River/Raritan Bay Estuary as EFH for adult winter flounder (NOAA Fisheries 2013); the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

SPAWNING ADULTS. For spawning winter flounder, EFH is bottom habitat, including estuaries, with a substrate of sand, mud, muddy sand, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder adults are found: water temperatures below 15°C, depths less than 6 meters, except on Georges Bank where they spawn as deep as 80 meters, and salinities between 5.5 and 36 ppt (NOAA Fisheries 2013). Spawning adults have been recorded in the Hudson River/Raritan Bay estuary from January through April and from November to December (Stone et al. 1994). Salinity preferences range from 31 to 32.5 ppt in inshore waters, and at slightly higher salinities, 32.7-33 ppt, on Nantucket Shoals and Georges Bank (Bigelow and Schroeder 1953).

Although NOAA Fisheries has designated saline and brackish regions of the Hudson River/Raritan Estuary as EFH for winter flounder spawning adults (NOAA Fisheries 2013); the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

2.4.3 Pollock (*Pollachius virens*)

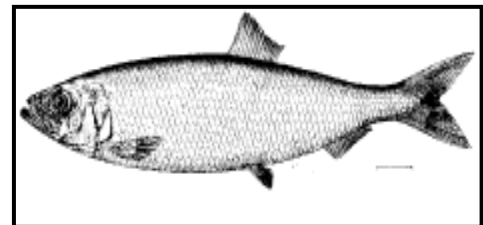
JUVENILES. EFH for juvenile pollock is bottom habitats with aquatic vegetation or a substrate of sand, mud or rocks in the Gulf of Maine and Georges Bank. They are generally found at depths from 0 – 250 m, water temperatures below 18°C, and salinities between 29 – 32 ppt (NOAA Fisheries 2013). NOAA Fisheries has designated Atlantic Ocean waters, including the Hudson River estuary, as EFH for this lifestage; however, the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore no EFH exists in the specific Project Area and no further analysis is required.



ADULTS. EFH for adult Pollock is 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. They are generally found at depths from 15-365 m, water temperatures below 14°C, and salinities between 31 – 34 ppt (NOAA Fisheries 2013). NOAA Fisheries has designated Atlantic Ocean waters, including the Hudson River estuary, as EFH for this lifestage; however, the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

2.4.4 Atlantic Herring (*Clupea harengus*)

LARVAE. EFH for Atlantic herring larvae is listed as the pelagic waters in the Gulf of Maine, Georges Bank, and southern New England. Generally, the following conditions exist where Atlantic herring larvae are found: sea surface temperatures below 16°C, water depths from 50-90 meters, and salinities around 32 ppt (NOAA Fisheries 2013). NOAA Fisheries has designated saline and brackish water regions



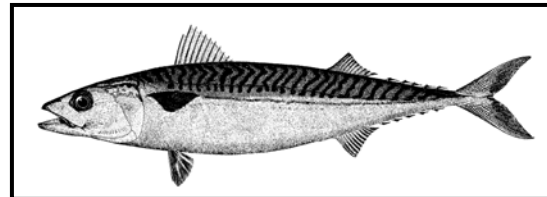
of the Hudson River/Raritan Bay as EFH for this lifestage; however, the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

JUVENILES. The pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras are EFH for juvenile Atlantic herring. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures below 10°C, water depths from 15 -135 meters, and a salinity range from 26 - 32 ppt (NOAA Fisheries 2013). NOAA Fisheries has designated the saline and brackish regions of the Hudson River/Raritan Bay as EFH for juvenile herring; however, the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

ADULTS. EFH is the pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where Atlantic herring adults are found: water temperatures below 10°C, water depths from 20 -130 meters, and salinities above 28 ppt (NOAA Fisheries 2013). NOAA Fisheries has designated the saline and brackish regions of the Hudson River/Raritan Bay as EFH for adult herring; however, the salinity in the Project Area is lower than the salinity range listed in the EFH description (NOAA Fisheries 2013); therefore, no EFH exists in the specific Project Area and no further analysis is required.

2.4.5 Atlantic Mackerel (*Scomber scombrus*)

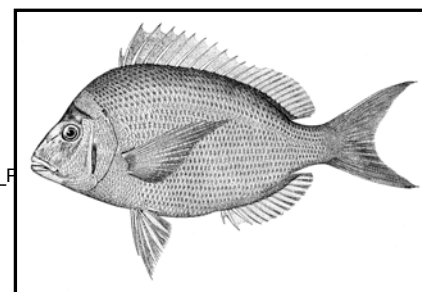
JUVENILES. Inshore, EFH for juvenile Atlantic mackerel is the "mixing" and/or "seawater" portions of all the estuaries where juvenile Atlantic mackerel are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, juvenile Atlantic mackerel are collected from shore to 1,050 ft (320 m) and temperatures between 39°F (3.9°C) and 72°F (22.2°C) (NOAA Fisheries 2013). NOAA Fisheries has only designated the saline regions of the Hudson River/Raritan Bay as EFH for juvenile Atlantic mackerel (NOAA Fisheries 2013); however, the Project Area only traverses the brackish and freshwater regions of the Hudson River. Therefore, no EFH exists in the specific Project Area and no further analysis is required.



ADULTS. Inshore, EFH for adult Atlantic mackerel is the "mixing" and/or "seawater" portions of all the estuaries where adult Atlantic mackerel are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia (NOAA Fisheries 2013). Generally, adult Atlantic mackerel are collected from shore to 1,250 ft and temperatures between 39°F (3.9°C) and 61°F (16.1°C) and salinities greater than 25 ppt (Studholme et al. 1999). Atlantic mackerel adults are not present in the Hudson-Raritan estuary mixing zone but are common in the saline zone (Stone et al. 1994). NOAA Fisheries has only designated the saline regions of the Hudson River/Raritan Bay as EFH for juvenile Atlantic mackerel (NOAA Fisheries 2013); however, the Project Area only traverses the brackish and freshwater regions of the Hudson River. Therefore, no EFH exists in the specific Project Area and no further analysis is required.

2.4.6 Scup (*Stenotomus chrysops*)

EGGS & LARVAE. 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



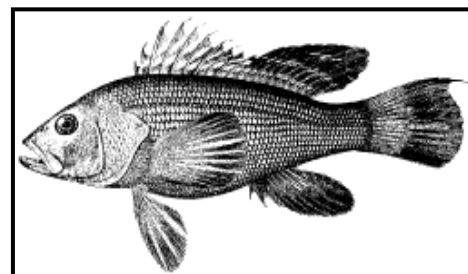
(NOAA Fisheries 2013). In general scup eggs are found from May through August in southern New England to coastal Virginia, in waters between 55 and 73°F (12.8 and 22.8°C) and in salinities greater than 15 ppt and scup larvae are most abundant nearshore from May through September, in waters between 55 and 73°F (12.8 and 22.8°C) and in salinities greater than 15 ppt (NOAA Fisheries 2013). Eggs and larvae are considered common in the saline zone (>25 ppt) and rare in the mixing zone (0.5 to 25 ppt) of the Hudson River/Raritan Bay Estuary (Stone et al. 1994). NOAA Fisheries has only designated the saline regions of the Hudson River/Raritan Bay as EFH for scup eggs and larvae (NOAA Fisheries 2013); however, the Project Area is located entirely within the brackish and freshwater regions of the Hudson River. Therefore, no EFH exists in the specific Project Area and, no further analysis is required.

JUVENILES. 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. Juvenile scup are generally found during the summer and spring in estuaries and bays between Virginia and Massachusetts, in association with various sands, mud, mussel and eelgrass bed type substrates and in water temperatures greater than 45°F (7.2°C) and salinities greater than 15 ppt (NOAA Fisheries 2013). Juveniles are reported as being abundant in the seawater zone (>25 ppt) of the Hudson-Raritan estuary, and rare in the mixing zone (0.5-25.0 ppt) (Stone et al. 1994). NOAA Fisheries has only designated the saline regions of the Hudson River/Raritan Bay as EFH for scup juveniles (NOAA Fisheries 2013); however, the Project Area is located entirely within the brackish and freshwater regions of the Hudson River. Therefore, no EFH exists in the specific Project Area and no further analysis is required.

ADULTS. 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 (7.2°C) (NOAA Fisheries 2013). Adults are reported in the ELMR database as common in the seawater zone (>25 ppt) and rare in the mixing zone (0.5 to 25 ppt) of the Hudson River/Raritan Bay; spawning adults are only reported as common in the seawater zone of the Hudson River/Raritan Bay (Stone et al. 1994). NOAA Fisheries has only designated the saline regions of the Hudson River/Raritan Bay as EFH for adult and spawning adult scup (NOAA Fisheries 2013); however, the Project Area is located entirely within the brackish and freshwater regions of the Hudson River. Therefore, no EFH exists in the specific Project Area and no further analysis is required.

2.4.7 Black Sea Bass (*Centropristus striata*)

JUVENILES. 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 (NOAA Fisheries 2013). Juveniles are found in the estuaries in the summer and spring. Generally, juvenile black sea bass are found in waters warmer than 43°F (6.1°C) with salinities greater than 18 ppt and coastal areas between Virginia and Massachusetts. They reportedly winter offshore from New Jersey south (NOAA Fisheries 2013). NOAA Fisheries has designated the brackish and saline regions of the Hudson River/Raritan Bay as EFH for juvenile black sea bass (NOAA Fisheries 2013); however, juvenile black sea bass were identified as rare in the mixing and seawater zones of the Hudson River/Raritan Bay Estuary in the ELMR database (Stone et al. 1994). Therefore, as defined by the EFH description (NOAA Fisheries 2013), EFH is absent from the specific Project Area and no further analysis is required.



ADULTS. Inshore, EFH is the estuaries where adult black sea bass were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Black sea bass are generally found in estuaries from May through October. Wintering adults (November through April) are generally offshore, south of New York to North Carolina. Temperatures above 43°F (6.1°C) seem to be the minimum requirements. Structured habitats (natural and man-made), sand, and shell are usually the substrate preference (NOAA Fisheries 2013). NOAA Fisheries has designated the brackish and saline regions of the Hudson River/Raritan Bay as EFH for adult black sea bass (NOAA Fisheries 2013); however, adult black sea bass were identified as rare in the mixing and seawater zones of the Hudson River/Raritan Bay Estuary in the ELMR database (Stone et al. 1994). Therefore, as defined by the EFH description (NOAA Fisheries 2013), EFH is absent from the specific Project Area and no further analysis is required.

2.4.8 Coastal Migratory Pelagic Species

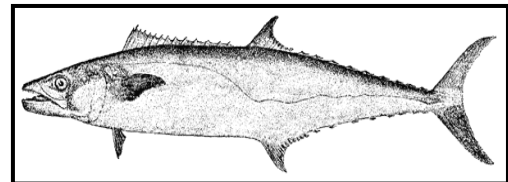
EFH for all coastal migratory pelagic species (including King Mackerel, Spanish mackerel, and cobia) includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, and from the Gulf Stream shoreward, including *Sargassum*. In addition, all coastal inlets and all state-designated nursery habitats are of particular importance to coastal migratory pelagic species. For cobia, EFH also includes high salinity bays, estuaries, and seagrass habitat. In addition the Gulf Stream is EFH because it provides a mechanism to disperse coastal migratory pelagic larvae. For king, Spanish mackerel, and cobia, EFH occurs in the South Atlantic and Mid-Atlantic Bights (NOAA Fisheries 2013).

They are all currently managed within the jurisdiction of the South Atlantic Fisheries Management Council and are presumed rare in the Project Area. Therefore, no EFH designations should apply to the Project Area and no further analysis is required. Particular habitat characteristics for each of these species are described below.

2.4.8.1 King Mackerel (*Scomberomorus cavalla*)

EGGS. Studies in Godcharles and Murphy (1986) reveal that king mackerel spawn in the coastal waters of the northern Gulf of Mexico, and off the south Atlantic coast. There is no documentation found of king mackerel eggs occurring in the Project Area, which is located outside of the typical distribution range reported for this species.

LARVAE. King mackerel larvae have been collected near the surface on the Atlantic coast from May through October in surface water temperatures of 26-31°C and in a salinity range of 26-37 ppt (Godcharles and Murphy 1986). Larval distribution indicates that spawning occurs in the western Atlantic off the Carolinas, Cape Canaveral and Miami. There does not appear to be a well-defined area for spawning. There is no documentation found of king mackerel larvae occurring in the Project Area, which is located outside of the typical distribution range reported for this species.



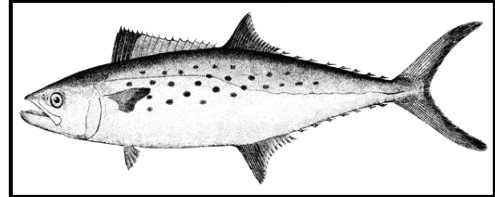
JUVENILES. King mackerel are concentrated off the coast of the Carolinas in the spring, summer and fall and off southern Florida and Louisiana in winter (Godcharles and Murphy 1986). Most juvenile king mackerel are found in saline waters, south of the Project Area. Therefore, it is unlikely that juvenile king mackerel would occur in the Project Area.

ADULTS. King mackerel adults range from the Gulf of Maine to Rio de Janeiro, Brazil; however, they are most commonly found from Chesapeake Bay southward. Migratory patterns are driven heavily by water temperature, preferring waters greater than 20°C. Adult king mackerel appear to spawn over a protracted period, with several peaks. Adult king mackerel are typically found in

more saline waters, south of the Project Area. Therefore, it is unlikely that adult king mackerel would occur in the Project Area.

2.4.8.2 Spanish Mackerel (*Scomberomorus maculatus*)

EGGS. All lifestages of Spanish mackerel are primarily seen in waters above 17.7°C and within a salinity range of 32-36 ppt (Godcharles and Murphy 1986). There is no evidence of Spanish mackerel eggs occurring in the Project Area, which has physical properties that are not consistent with the preferred habitat characteristics.



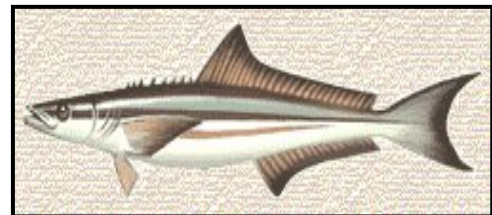
LARVAE. Larvae are generally found in surface water temperatures of 19.6-29.8°C and salinity range of 28.3-37.4 ppt or higher (Fishbase 2013). Godcharles and Murphy (1986) report larvae as being most abundant near spawning areas, which include the northeastern Gulf of Mexico and the Atlantic coast from Cape Fear, NC to Cape Canaveral, FL. Literature cited in Godcharles and Murphy (1986) suggests Spanish mackerel larvae develop in the southern Mid-Atlantic and south Atlantic estuaries. There is no evidence of larval Spanish mackerel occurring in the Project Area, which has physical properties that are not consistent with the preferred habitat characteristics.

JUVENILES. Some juvenile Spanish mackerel apparently use estuaries as nursery grounds, but most stay nearshore in open beach waters (Godcharles and Murphy 1986). All lifestages of Spanish mackerel are primarily seen in waters above 17.7°C and within a salinity range of 32-36 ppt (Godcharles and Murphy 1986). Therefore, it is unlikely that juvenile Spanish mackerel would occur in the Project Area, which has physical properties that are inconsistent with the preferred habitat characteristics.

ADULTS. Spanish mackerel adults range from the Gulf of Maine to the Yucatan Peninsula, but are considered uncommon north of the Chesapeake Bay. Migratory patterns for this species are driven by water temperature, with a preferred range of 21.1-31.1°C. All lifestages of Spanish mackerel are primarily seen in waters above 17.7°C and within a salinity range of 32-36 ppt (Godcharles and Murphy 1986). Adults spawn off the coast of Virginia over a long period between late spring and late summer. It is unlikely that adult Spanish mackerel would occur in the Project Area, which has physical properties that are inconsistent with the preferred habitat characteristics.

2.4.8.3 Cobia (*Rachycentron canadum*)

EGGS. Cobia eggs are commonly found in offshore waters adjacent to the mouth of the Chesapeake Bay and south to Virginia from late June through mid-August (Shaffer and Nakamura 1989). There is no evidence of cobia eggs occurring in the Project Area, which is located outside of the typical distribution range reported for this species.



LARVAE. Most cobia larvae are found in offshore waters adjacent to the mouth of the Chesapeake Bay and south to Virginia (Shaffer and Nakamura 1989) where they may inhabit the *Sargassum*. There is no evidence of cobia larvae occurring in the Project Area, which is located outside of the typical distribution range reported for this species.

JUVENILES. Juvenile cobia move inshore and inhabit coastal areas, near beaches, river mouths, barrier islands, lower reaches of bays and inlets, or bays of relatively high salinities (Shaffer and

Nakamura 1989). It is unlikely that juvenile cobia would occur in the Project Area, which has physical properties that are inconsistent with the preferred habitat characteristics.

ADULTS. Cobia adults range from Cape Cod to Argentina. They undergo extensive migrations from overwintering grounds near the Florida Keys to more northerly spawning/feeding grounds in spring and summer months (Richards 1967). Cobia can be found in high salinity bays, estuaries, and seagrass habitat in a variety of locations over mud, gravel, or sand bottoms, coral reefs, and man-made sloughs. They often congregate along reefs and around buoys, pilings, wrecks, anchored boats, and other stationary or floating objects. It is unlikely that adult cobia would occur in the Project Area, which has physical properties that are inconsistent with the preferred habitat characteristics.

2.4.9 Skates

EFH for clearnose, little, and winter skate include coastal areas of the Mid-Atlantic and they are considered common in the Hudson River/Raritan Bay estuary from May to October (NOAA 2000). However, juvenile and adult skates are typically found in highly saline waters. Therefore, it is unlikely that skates would occur in the Project Area and no further analysis is required. Particular habitat characteristics for each of these species are described below.

2.4.9.1 Clearnose Skate (*Raja eglanteria*)

EFH for clearnose skate juveniles and adults includes soft bottom, rocky, or gravelly substrates along the coast from Nova Scotia to northeastern Florida as well as in the northern Gulf of Mexico. Juveniles and adults occur in the Hudson River/Raritan Bay estuary in April and stay until October or November, at which point they move offshore. The spring and fall 1963-2002 NEFSC trawl surveys from the Gulf of Maine to Cape Hatteras indicated that both juveniles and adults were found in the spring over a depth of 1-300 m, and during the fall between about 1-80 (juveniles) or 1-50 m (adults). The 1992-1997 Hudson-Raritan estuary trawl surveys showed that most juveniles were found at around 5-7 m and most adults were captured at 5-8 m. Juvenile and adult skate were collected over a temperature range of 4-27°C, with most fish found at cooler temperatures in the spring (7-16°C), as opposed to the fall (18-22°C). During the 1992-1997 Hudson-Raritan trawl surveys, juveniles were found at salinities between 20-32 ppt (Packer et al. 2003a).

2.4.9.2 Little Skate (*Leucoraja erinacea*)

EFH for little skate juveniles and adults includes sandy, gravelly, or mud substrates along the coast from Nova Scotia to Cape Hatteras. Little skates are one of the dominant members of the demersal fish community of the northwest Atlantic. They tend to concentrate in the nearshore Middle Atlantic Bight during the spring and move into deeper waters in the winter. Juveniles were fairly well distributed throughout the Hudson-Raritan estuary in fall, winter and spring, but rare in the summer. Very few adults were caught in the Hudson-Raritan estuary, particularly in the spring and summer (Packer et al. 2003b). The 1963-2002 NEFSC trawl surveys from the Gulf of Maine to Cape Hatteras indicated that during spring and fall most juveniles occurred at depths < 70 m, while most adults were found in deeper waters (<120 m). Juveniles were collected in water temperatures ranging from 1-21°C, although in the Hudson-Raritan estuary, juveniles were generally found in waters 16-18°C. In the Hudson-Raritan estuary, juveniles were typically found between 4-24 m, with most caught between 5-8 m. In the summer, they tended to be caught in slightly deeper water (10-20 m). Salinities ranged between 17-35 ppt, but most were found at salinities greater than 25 ppt. Adults were found less frequently in the Hudson River-Raritan estuary. They were found over range of temperatures from 1-18°C and a depth range of about 5-

16 m, with most at 7-8 m. Their salinities ranged between 18-34 ppt, most were found at salinities greater than 25 ppt (Packer et al. 2003b).

2.4.9.3 Winter Skate (*Leucoraja ocellata*)

EFH for winter skate juveniles and adults include sand and gravel or mud substrates along the coast from Newfoundland to Cape Hatteras. In the Hudson-Raritan estuary, juveniles are generally absent from the estuary during the summer months, but fairly well distributed in winter, spring and fall. They are found in warmer waters during the spring and fall as compared to winter, and remain mostly around depths of 5-8 m during those three seasons. Juveniles were found between 0-21°C. Salinities ranged between 15-35 ppt, but most were found at salinities greater than 20 ppt. Very few adults were caught in the Hudson River/Raritan Bay estuary; however, adults were caught at temperatures between 2-19°C. They were found at salinities of between 30-36 ppt, with the majority at 32-33 ppt (Packer et al. 2003c).

2.4.10 Sharks

Despite the inclusion of the following shark species by NOAA Fisheries in the EFH designation for the Project Area (see Table A), the official NOAA Fisheries description of the EFH range, as described below, for these sharks (NOAA Fisheries 2013) is outside of the Project Area. Therefore no further analysis is required.

2.4.10.1 Sand Tiger Shark (*Carcharias taurus*)

The sand tiger shark is a common littoral shark found in temperate and tropical waters from Gulf of Maine to Florida. It ranges from the surf zone, in shallow bays, and around coral and rocky reefs down to at least 191 m depth on the outer continental shelf. Juveniles are commonly found in estuaries of the eastern United States and are susceptible to runoff and pollution (Compagno 1984). EFH for the early juvenile (neonate) and adult stages of sand tiger shark include shallow coastal waters to the 25 m isobath from Barnegat Inlet, NJ south to Cape Canaveral, FL.

2.4.10.2 Dusky Shark (*Carcharhinus obscurus*)

The dusky shark is a large, highly migratory species that is common in warm and temperate continental waters throughout the world. Major nursery areas for dusky sharks have been identified off the coast from New Jersey to South Carolina (Musick and Colvocoresses 1988, NOAA Fisheries 2013), although dusky sharks do not prefer areas with reduced salinities and tend to avoid estuaries (Compagno 1984). EFH for early juveniles is listed as shallow coastal waters, inlets and estuaries from the eastern end of Long Island to West Palm Beach, FL. EFH for late juveniles is listed as coastal and pelagic waters off the coast of southern New England between the 25 m and 200 m isobath and shallow coastal waters, inlets and estuaries from Assateague Island (VA/MD) to Dry Tortugas, FL.

2.4.10.3 Sandbar Shark (*Carcharhinus plumbeus*)

The sandbar shark is an abundant, coastal-pelagic shark that is found on continental and insular shelves and is common at bay mouths, in harbors, inside shallow muddy or sandy bays, and at river mouths, but tends to avoid sandy beaches and the surf zone. Sandbar sharks are one of the most common large sharks in coastal New York and New Jersey waters during the summer months (Bigelow and Schroeder 1953). Sandbar sharks migrate north and south along the Atlantic coast, reaching as far north as Massachusetts in the summer. Sandbar sharks bear live young in shallow Atlantic coastal waters between Great Bay, NJ and Cape Canaveral, FL. The young inhabit shallow coastal nursery grounds during the summer and move offshore into deeper, warmer water in winter. Late juveniles and adults occupy coastal waters as far north as southern New England and Long Island (Compagno 1984). EFH for early juveniles is shallow

coastal areas to the 25 m isobath from Montauk, Long Island, NY to Cape Canaveral, FL, with a preference towards salinities greater than 22 ppt and temperature greater than 21°C. EFH for late juveniles is coastal, pelagic waters offshore southern New England and Long Island as well as shallow coastal waters (to 25 m isobath) from Barnegat Inlet, NJ, to Cape Canaveral, FL. EFH also includes the shelf break (100-200 m) in the Mid-Atlantic Bight. Important nursery and pupping grounds have been identified as Habitat Areas of Particular Concern (HAPC) in shallow areas and the mouth of Great Bay, NJ, lower and middle Delaware Bay, lower Chesapeake Bay, MD and near the Outer Banks, NC, in areas of Pamlico Sound adjacent to Hatteras and Ocracoke Islands and offshore those islands.

3.0 ASSESSMENT OF IMPACTS

3.1 Construction Impacts

A summary of the proposed construction methods is provided below.

The In-River Cable will be buried to specific target depths below the river bed of the Hudson River largely in state-owned submerged lands below the river's high water mark. Low impact jet plow embedment will be utilized for the majority of the In-River Cable Route. Horizontal Directional Drilling (HDD) will be used at the Northern and Southern Landfalls to minimize any direct disturbance of natural aquatic habitat and adjacent shoreline areas. To avoid impacts to recreational and commercial navigation occurring in the River along the Project's linear route, the In-River Cable will be buried in the riverbed to a minimum depth of 15 feet below the authorized Federal Navigation Channel depth at that location, and to a depth of 8 feet below present river bottom in areas of the riverbed located outside of the Federal Navigation Channels. Once the In-River Cable makes landfall at either end of the In-River Cable Route, it will be spliced to the associated Land Cables that will connect with the converter stations and the interconnecting substations.

Temporary cofferdams will be installed in-river at the endpoint of each HDD conduit exit point in the river prior to the beginning of the HDD borehole construction, and will remain in place until jet plow embedment installation of the In-River Cable is complete (typically a few months). The cofferdams are designed to largely contain dredged river sediments within its perimeter to facilitate the jet plow junction and cable pulling through the HDD conduit at the landfall locations. Approximately 6,500 cubic yards of sediment will be dredged from each cofferdam using mechanical dredging methods to expose the in-water end of the borehole. Disposal of the dredged material from within both Temporary Cofferdams will be arranged with landfills licensed for the type of material involved. The Temporary Cofferdams will remain in place for the duration of the In-River Cable installation. The location of the cofferdams will be marked to warn vessels of the Temporary Cofferdam's presence below the water surface. After installation of the In-River Transmission Cable is complete, the Temporary Cofferdams will be removed. After cofferdam removal is complete, the dredged areas within the Temporary Cofferdam will be backfilled with imported clean backfill material to restore the riverbed to preconstruction grade.

The project installation activities will comply with applicable agency "time of year" restrictions to avoid potential project impacts to aquatic and benthic resources. In-River work is scheduled to occur from August through November to avoid in-water work during sensitive bird nesting and fish spawning and nursery periods in this area of the Hudson River. Given the anticipated time of year restrictions and the need for certain installation activities to occur uninterrupted (e.g., HDDs and jetting), it is projected that cable installation activities will occur twenty four hours per day/seven days per week in most areas, with nighttime shutdowns occurring only in select sensitive receptor areas, during the allowable work window. This will require that nighttime lighting be used. To the extent possible, directed lighting will be employed to minimize lighting of areas outside of the workspace. The continuous construction schedule will also result in the operation of heavy machinery and equipment (e.g., generators, water pumps, and vessel engines) during day and night activities. Certain activities may be limited to daytime periods depending

upon noise sensitivity of nearby areas. The installation of the In-River Cable via jet plow embedment is anticipated to take approximately 4 months to complete.

In general, potential impacts to EFH and species with designated EFH from installation of the In-River Transmission Cable will be temporary and localized in nature, resulting from both direct and indirect sediment disturbance. Sediment disturbance will be limited to the extent practicable through the use of low impact jet plow embedment. Likewise, horizontal directional drilling (HDD) and installation of temporary cofferdams at the northern and southern landfalls will help contain sediments suspended by dredging operations, minimizing suspended sediment and turbidity effects in nearshore habitats.

A description of the potential environmental impacts to EFH and EFH species associated with the installation and operation of the West Point project is described in detail in the following sections.

3.1.1 Direct Impacts

3.1.1.1 Benthic Habitat

Impacts to the benthic habitat in the Project Area during construction will be minimized by the use of temporary cofferdams and HDD at the northern and southern landfalls and jet plow embedment for the In-River Transmission Cable. These methods minimize disturbance to the benthic and surrounding environment when compared with other installation techniques, reducing impact to finfish lifestages that utilize the area as habitat and a source of benthic invertebrate prey.

Transition of the In-River Transmission Cable to the upland portions at both the northern and southern landfall will be achieved using HDD within temporary cofferdams. Each temporary cofferdam is expected to be 300 ft long, by 70 ft wide, by 10 ft deep, with an estimated dredged volume of approximately 6500 cubic yards each. During cofferdam construction, mobile fish and invertebrate species are expected to avoid the disturbed areas and relocate to similar nearby habitat. After installation of the In-River Transmission Cable is complete, the temporary cofferdams at both landfalls will be removed. The dredged area within the temporary cofferdams will be backfilled with imported clean backfill material to restore the riverbed to preconstruction grade. As benthic invertebrates rapidly recolonize the backfilled material, fish are expected to return to utilize the habitat.

The In-River Transmission cable will be installed by jet plow embedment, which fluidizes the sediments within the embedment trench, thereby allowing the cable to settle under its own weight. Compared to traditional dredging, jet plow embedment reduces the direct impact to the riverbed, the temporary increase in suspended sediments from construction, and the subsequent deposition of sediments outside the immediate cable trench. As the jet plow is towed along the riverbed, the plow's skids and the stinger blade will directly disturb the sediments. The width of direct disturbance to benthic communities due to jet plow embedment is expected to be 18-24 inches. The cable will either be buried a minimum of 8 feet below present river bottom (15 feet below authorized depth within the Federal Navigation Channel) along the majority of the route or armored by low profile (< 1 foot) concrete mattresses at select crossings coinciding with chartered cables/pipelines. The concrete mattresses are typically 8 feet wide and approximately 9 inches thick. Once installed, the concrete mattresses will settle under their own weight into the riverbed and sediment will be naturally deposited over the mattresses. As a result, the potential impacts to benthic habitat from the In-River Transmission Cable installation activities will be localized and temporary.

While some direct mortality or injury to benthic organisms in the immediate path of jet plow and dredging activities is unavoidable, many benthic invertebrate species (prey for finfish) are capable of opportunistically recolonizing surrounding benthic sediments during such disturbances. Apart

from the direct mortality of benthic organisms in the immediate path of the jet plow and within the cofferdam locations, the temporarily elevated levels of TSS water column concentrations and rapid rates of sediment deposition experienced by benthic organisms in the area immediately adjacent to the jetted trench may be similar to conditions that routinely occur within this part of the Hudson River, particularly during spring high freshwater discharge conditions and large storm events. Recovery of the benthic community in areas directly impacted by the jet plow is expected to be rapid, given the narrow width of the impacted area compared to the large area of adjacent unimpacted habitat that will serve as a recruitment source for recolonization (Van Dolah et al. 1984, Tuck et al. 2000). Similarly, recolonization of backfilled dredged areas within the temporary cofferdams is expected to be rapid.

3.1.1.2 Finfish

Benthic egg and larval stages of EFH species that lie within the direct footprint of the In-River Cable or cofferdam dredging are expected to experience mortality since they lack mobility. EFH species with pelagic eggs and larvae will be less affected by temporary benthic disturbance since they are not as closely associated with the bottom; however, those in the immediate area of construction could experience some injury or mortality. As described in Section 2.3 and Table B of this EFH, the only species with designated EFH for eggs potentially present in the Project Area is windowpane flounder. Although windowpane flounder eggs could occur in the Project Area during the proposed jet plow installation period, they are pelagic and thus should be less affected by temporary benthic habitat disturbance.

Benthic larvae of winter flounder could be temporarily affected by jet plow installation or dredging, and have the potential to occur in the Project Area during construction activities in November. Pelagic larvae of Atlantic butterfish, red hake, winter flounder and windowpane flounder could also be present during the proposed August to November timeframe. Summer flounder larvae have the potential to be present in the Project Area during the proposed August to November timeframe; however, their presence is unlikely since they are rarely documented in the Hudson/Raritan estuary (Stone et al. 1994). These larvae should not be directly affected by in-water construction since they occur in the water column above the direct influence of the installation activities. Indirect impacts that could occur to these species and lifestages are discussed in Section 3.1.2 below.

Juvenile and adult species with designated EFH are not likely to become buried given their mobility and the limited nature of the sediment disturbance. Juvenile and adult species with designated EFH potentially present in the Project Area during the proposed in-water construction period include winter flounder, windowpane flounder, summer flounder, Atlantic butterfish, and bluefish. The flounder species are benthic, while butterfish and bluefish adults and juveniles are pelagic. In addition, summer flounder and windowpane flounder juveniles and adults are unlikely to occur in the Project Area since the salinity in the Project Area is lower than their preferred salinity range. Each of these species is highly mobile and individuals are expected to temporarily avoid areas disturbed by construction activities but return to the area as soon as the construction activity ceases. Therefore, direct mortality of juveniles and adults resulting from Project construction activities will be minimal.

Designated EFH exists within the Project Area for spawning adult windowpane flounder. While these adults may be present throughout the year, a peak in spawning coincides with construction activities planned for September. Construction activities at this time may affect the use of EFH within the impacted area, displacing spawning adults to surrounding habitat. Spawning during a second peak in May will not be impacted.

Table B. Seasonality of Benthic and Pelagic Lifestages of Species with Designated EFH Potentially Present in the Project Area

	Early Lifestages		Older Lifestages	
	Eggs	Larvae	Juveniles	Adults
Benthic Species				
Winter flounder	n/a	November – June _a	Year-round (YOY)	n/a
Windowpane flounder	n/a	n/a	Year-round*	Year-round; peak May and September*
Summer Flounder	n/a	n/a	March – December*	
Pelagic Species				
Atlantic butterfish	n/a	June – August	April – November	
Bluefish	n/a		May – October	
Red hake	n/a	May – December; peak September – October	n/a	
Winter flounder	n/a	November – June _a	n/a	
Windowpane flounder	February – November; peak May and October		n/a	
Summer Flounder	n/a	April – June and September – December**	n/a	

^a Larvae are initially planktonic but become increasingly bottom-oriented as metamorphosis approaches.

*Unlikely to occur in Project Area because the salinity in the Project Area is lower than the preferred salinity range of this species/lifestage,

**Unlikely to occur in Project Area because it is listed as rare in the ELMR Report (Stone et al. 1994).

3.1.2 Indirect Impacts

3.1.2.1 Total Suspended Sediments (TSS)

In-river construction activities that are expected to contribute to localized sediment resuspension include dredging, jet-plowing, vessel movements, and cofferdam construction. These activities will result in a temporary and localized increase in suspended sediment concentrations in the water column above ambient conditions in the areas surrounding construction activities. HDD will be used within cofferdams constructed at the two Landfall locations in order to minimize impacts at the shoreline and nearshore areas to the best extent practicable. In order to estimate the extent of potential impacts from sediment suspension generated by jet plow activities, numerical modeling using SSFATE was conducted to predict jet-plow induced suspended sediment transport and deposition associated with in-water jetting activities. A summary of the model results is presented in Exhibit 4, Sections 4.4 and 4.5. The complete modeling report is provided in Appendix 4C.

The model results show that the highest concentrations of jet-plow induced suspended sediment and deposition occur on the riverbed directly at the jetting heads of the jet plow device. Concentrations and deposition thicknesses are predicted to decrease rapidly with distance from the jet plow as well as in time as the plow advances along the In-River Cable Route. In terms of vertical distribution, suspended sediment concentrations > 200 mg/L are predicted to remain within the bottom 10 to 13 feet of the water column, and decrease rapidly to approximately 10 mg/L or less approximately 16 to 26 feet above the bottom (see Appendix 4C). In addition, the modeling indicates that the suspended sediment will settle out quickly and suspended sediment concentrations will return to ambient conditions within 24 hours after passage of the jet plow. Such increases in water column solids loads would be within the normal variation occurring in the Hudson River (see Exhibit 4, Section 4.5 for characterization of ambient sediment conditions).

Resuspension of sediments can have a range of impacts to fish depending on the magnitude and duration of the event, its spatial and temporal distribution, and species and lifestages being considered. Potentially lethal levels of sustained TSS concentrations vary widely among different species. Lethal effects of exposure to TSS in the Delaware River were demonstrated between concentrations of 580 to 700,000 mg/L depending on species, (580 mg/L for sensitive species and 1,000 mg/L as more typical) (Burton 1993). Common non-lethal impacts to finfish are the abrasion of gill membranes and respiration impairment, impairment of feeding, reduction in dissolved oxygen, inhibition of migratory movements, and mortality to early lifestages. A study conducted by NOAA concluded that TSS concentrations as low as 350 mg/L could block upstream migrations of various species (NOAA 2001). Fish, however, are mobile and generally able to avoid unsuitable environments, such as large increases in suspended sediment and noise (Clarke and Wilber 2000). Based on the results of the SSFATE model, increased suspended sediment concentrations (greater than 200 mg/l) are predicted to extend a maximum of 312 feet from the jet plow and occur for a duration of less than two hours. After 12 hours, the suspended sediment concentration above ambient is predicted to be below 10 mg/L. These TSS characteristics are well within established NYSDEC requirements for jet plow embedment methods in the Hudson River.

No substantial adverse impacts to juvenile or adult lifestages are expected from jet plow installation or limited cofferdam dredging since these lifestages are highly mobile and would have the ability to avoid the temporary area of disturbance during construction. Of the EFH species/lifestages listed in Table B, those with designated EFH for juvenile and/or adult lifestages that could be present in the Project Area during the construction period (August to November) include winter flounder, windowpane flounder, summer flounder, butterfish, and bluefish. The flounder species are benthic, while butterfish and bluefish adults and juveniles are pelagic. Summer flounder and windowpane flounder juvenile and adults are unlikely to occur in the Project Area since the salinity in the Project Area is lower than their preferred salinity range. The narrow area of sediment disturbance would limit the distance that the other fish with designated EFH need to relocate. Therefore, indirect disturbance from temporary elevated suspended sediment concentrations to these older lifestages will be minimal.

Egg and larval stage fish are more likely to be affected by low-level increases in suspended sediment; however, they also exhibit a wide suspended sediment tolerance range. Of the EFH species/lifestages listed in Table B, demersal larvae of winter flounder could be present in November and could be affected by temporary elevated levels of suspended sediment generated during jet plow embedment activities. No demersal eggs with designated EFH have the potential to occur in the Project Area. Other larval fish species with designated EFH that are pelagic in nature and may be present from August through November in the Project Area include butterfish, red hake, winter flounder, windowpane flounder, and summer flounder. However, summer

flounder larvae are unlikely to occur in the Project Area since they are rarely documented in the Hudson/Raritan estuary (Stone et al. 1994). Windowpane flounder also has EFH designated for the egg lifestage (pelagic) that has the potential to be present during the August to November in-water construction period.

If any of these few species with demersal larvae or pelagic eggs or larvae are present during in-water installation, they may experience indirect impacts from temporary elevated TSS concentrations. However, model results predict that the highest suspended sediment concentrations (greater than 200 mg/L) remain in the bottom 10 to 13 feet of the water column under all tide conditions and concentrations are predicted to decrease rapidly to approximately 10 mg/L or less approximately 16 to 26 feet above the bottom under all tide conditions. Therefore, many of the pelagic eggs and larvae that may be present in the water column along the In-River Cable Route would be expected to be above the indirect influence of the elevated suspended sediment concentrations. Any larvae that are affected may be temporarily displaced in the water column as a result of the limited disturbance associated with the jet plow. However, the overall area of habitat disturbed is likely insignificant in comparison to surrounding areas of larval habitat in the Hudson River. Further, NMFS has indicated that TSS concentrations below 100 mg/L are not likely to affect eggs and larvae—at least over short durations (AKRF 2012).

Predatory fish species, which may feed on the larvae, may also be temporarily displaced from the area as a result of the same short term disturbance during construction activities. Limited motility in the latter stages of larval development may actually help facilitate disturbance avoidance, and thus allow these individuals to remove themselves from areas of disturbance.

Given the natural variation of suspended sediments in the Hudson River under ambient conditions and the limited area over which suspended sediment would be increased, the resuspension of bottom sediment that would result from construction of the Project would not result in adverse impacts to finfish species and lifestages with designated EFH.

3.1.2.2 Sedimentation

Deposition of the sediment suspended in the water column during jet plow embedment and cofferdam dredging occurs over time as the sediment particles settle through the water column to the riverbed. The SSFATE model was used to predict the cumulative suspended sediment deposition thickness resulting from jetting of the In-River Cable as described in Exhibit 4, Section 4.4. The model predicts that a cumulative suspended sediment deposition greater 2 mm (0.08 in) thick on the riverbed resulting from jetting of the In-River Cable extends up to 300 feet to either side of the centerline of the In-River Cable Route and covers an area of approximately 227 acres. Deposition thicknesses greater than 2 mm generally fall along the path of the operating jet plow and will provide sediment cover for the installed cable.

Resettling sediments during construction activities can potentially bury any demersal eggs or larvae that are within the zone of deposition in the Project Area. However, as previously stated, of the species listed in Table B, winter flounder (larvae only) is the only species with designated EFH that has the potential for demersal early lifestages to occur in the Project Area at the time of jet plow embedment activities (August – November). Any winter flounder larvae in the immediate vicinity of the jet plow or cofferdam dredging area would experience mortality and others may experience localized increases in physical abrasion or burial. However, the area affected by jet plow embedment and cofferdam dredging is small when compared to the surrounding habitat of the Hudson River. Therefore, the Project will not result in population-level effects. Burial of older lifestages of demersal fish is not expected because the amount of sediment displaced is

minimized by the jet plow embedment and also because construction activity will facilitate avoidance behavior in fish before sediments are settled.

3.1.2.3 Effect of Sediment Contaminants

The use of jet plow embedment will greatly limit the amount of sediment and contaminants introduced into the water column. The sediment potentially disturbed by jet plow embedment of the cable has been impacted by various chemical constituents, in most cases, at concentrations comparable to existing surface sediment. The suspended sediment plumes generated by the jetting process are predicted to dissipate rapidly after passage of the jetting device and potential impacts to surface water will likely be indistinguishable from that potentially resulting from existing surface sediment.

In order to minimize impacts to sediment quality at the shoreline and nearshore areas to the best extent practicable, HDD will be used at the two landfall locations. Further, sediments from within the temporary cofferdams established at the two landfall locations will be removed by mechanical dredging and disposed of at a suitable upland facility.

Overall, on the basis of these findings, the suspension of sediments induced by jet plow embedment of the In-River Cable is concluded to result in localized and temporary impacts to sediment quality, which pose a temporary and minimal risk to environmental receptors, including EFH and EFH species, within the Project Area when compared with the risks posed by their continuous interaction with existing sediments in the Hudson River.

3.1.2.4 Effects of Accidental Spill

During the installation of the cables, several vessels, including tugs, barges, cranes, and workboats, will be employed. Each of these vessels contains fuels, hydraulic fluid, oil, and potentially other hazardous materials that could be accidentally released to the water. A SPCC plan will be developed and employed throughout the life of the Project and spill procedures will be implemented in the case of a spill, to limit the impacts. With proper training and implementation, the likelihood of a spill is small, and the impact would be minor.

3.1.2.5 Effects of Possible Bentonite Release

A possible indirect impact to EFH during HDD operations could occur if bentonite (drilling fluid) is released and not contained during construction. To address a possible bentonite release, the HDD operation will be designed to include a drilling fluid fracture or overburden breakout monitoring program to minimize the potential of drilling fluid breakout into the waters of the Hudson River. The details of this program will be provided post-certification in the EM&CP. The Project will use bentonite drilling fluids that will gel or coagulate upon contact with saline or brackish water to minimize potential impacts. In the unlikely event of a fluid release, the bentonite fluid density and composition will cause it to remain as a cohesive mass on the riverbed, which can be quickly cleaned up and removed by diver-operated vacuum equipment, further minimizing any long-term impacts to EFH.

3.1.2.6 Acoustical Impacts

Underwater sound of certain levels and frequencies are known to affect fish behavior but specific effects vary with fish species and the existing hydroacoustic environment. The hearing frequency of the majority of fish ranges from 20 to 1,000 Hz, with best hearing sensitivity from 100 to 400 Hz (Popper et al. 2003, Bass and Ladich 2008, Popper and Schilt 2008). Overall there is a decreasing range of effects at greater distances from the source. For those very close to the source, effects may range from mortality to behavioral changes. As the distance to the source increases, mortality becomes less likely, but physiological and behavioral effects may still exist.

Aside from distance from the source, the nature of effects will depend on factors such as fish hearing sensitivity, sound level, rise time of the signal, duration of the signal, signal intensity, and the motivation level of the fish (Richardson et al. 1995).

The level of a sound in water is typically expressed in terms of decibels (dB relative to 1 micro-Pascal [μPa]). Interim criteria have been established for the acoustic levels at which there could be potential onset of physiological effects to fish (Stadler and Woodbury 2009). Studies suggest that there is not likely to be any adverse behavioral response from any fish species at sound levels as low as 150 dB re 1 μPa . Further, NMFS employs a 150 dB re 1 μPa rms criterion for assessing the effects of pile driving at several West Coast projects (CADOT 2009).

Underwater noise generated during construction activities has the potential to cause physical damage and displace/disrupt foraging and migratory activities of adult and juvenile fish within the study area. The installation of the In-River Cable as well as cofferdam construction and dredging will result in a certain level of noise from limited pile driving (cofferdam installation), service vessels and equipment that may temporarily result in fish species avoiding the construction area; however, underwater noise from construction activities will be short-term and impacts to finfish will be minimal. Aside from the limited pile driving, these noise levels are similar to noise levels from existing vessel traffic to which fish are routinely exposed. Overall, expected impacts to EFH designated species from underwater noise will be negligible.

3.2 Operational Impacts

3.2.1 In-River Transmission Cable

Finfish and EFH is not expected to be directly impacted by the In-River Cable during normal operation. The In-River Cable will be buried a minimum of 8 feet below present bottom and will not create a physical barrier that could interfere with fish migration or use of existing habitats or nursery areas. Therefore, EFH designated finfish and EFH would not be directly impacted during the normal operation of the In-River Cable. There will also be no adverse impacts to invertebrate or plankton prey species of fish (indirect impact) during the normal operation of the In-River Cable.

Operation of the In-River Cable will generate both magnetic and electric field emissions. The intensity of the electromagnetic field created by the cable is a direct function of voltage, although separation between the cables and burial depth also influences field strength. In industry standard High Voltage DC (HVDC) cables, the materials are sufficient to contain the directly emitted electric field, but the magnetic field cannot be fully shielded (Gill and Bartlett 2010). The predicted magnetic field for these cables is strongest directly over the cables and decreases rapidly with vertical and horizontal distance from the cables (Normandeau et al. 2011). Species that travel near the riverbed and species that feed on or near the bottom would have greater exposure to the magnetic field than those swimming or feeding higher in the water column. Most of the fish species with EFH in the project area are pelagic and are therefore unlikely to sense the EMF. Benthic species with EFH designations in the Project Area are limited to winter and windowpane flounder and rarely summer flounder (Table B). These species may experience some sensory interference from the In-River Cable. While there is evidence that many fish species, particularly benthic elasmobranchs, are able to sense the magnetic field generated by the cables, the response is not predictable and does not appear detrimental (Gill et al. 2009).

The In-River Cable will also generate a limited amount of heat that would be absorbed by, and dissipated into, the sediment surrounding the In-River Cable. The riverbed temperature at 10 cm (4 inches) below the river bottom is expected to increase less than 1° Celsius during operation of the In-River Cable. The temperature of the sediment at the riverbed (sediment-water interface) and within the water column is expected to remain unchanged by operation of the In-River Cable.

Hence, potential impacts to EFH and EFH-designated species from electromagnetic/thermal emissions during the normal operation of the In-River Cable are expected to be negligible as a result of the pelagic lifestyle of most species and the eight foot burial depth of the cable.

3.3 Summary of Impacts

Potential impacts discussed in Sections 3.1 through 3.2 above that may affect the benthic and pelagic fish species with designated EFH in the Project Area are summarized in Tables B and C. In order to assess impacts more efficiently, target species were grouped into four categories: early lifestages (eggs and larvae) of benthic or pelagic species and older lifestages (juveniles and adults) of benthic or pelagic species (Table B). Since potential impacts to all species is highly dependent on the time of year that Project activities occur, this table also describes the potential season(s) when these lifestages may be present in the Project Area. Potential impacts to species with designated EFH in the Project Area are further described in Table C. Species in this table are grouped into the four categories described above for comparison. Table C describes the level of impact to each category using the NEPA definitions of impact levels and provides a brief description of the potential impact. As can be seen in the Attachment, all Project impacts are expected to be minor or negligible.

4.0 CONCLUSION

The Project has been sited and designed and will be operated and maintained in a manner that will avoid and minimize impacts to aquatic resources, including impacts to EFH to the extent practicable. Potential impacts have been minimized through route selection; use of low impact HDD and jet plow embedment; and burying the cable system to limit potential damage from exterior factors, such as anchor strikes. Generally, the potential impacts are limited to temporary, localized, impacts associated with construction activities.

As demonstrated in this EFH assessment, egg and larval stage fish represent the most vulnerable communities in any marine or aquatic environment, including the Hudson River. As described in Section 2, only winter flounder larvae, butterfish larvae, red hake larvae and windowpane flounder eggs and larvae have designated EFH in the Project Area that could be present during the proposed August through November in-water construction timeframe. However, butterfish larvae, red hake larvae, winter flounder larvae and windowpane flounder eggs and larvae are pelagic and thus should be less affected by temporary benthic habitat disturbance. Summer flounder larvae may be present, however they are documented as rare in the mixing and seawater zones of the Hudson River/Raritan Bay estuary. Indirect impacts from Project construction to these species/lifestages are expected to be short-term and localized as described in Section 3.2.

Table C. Potential Impacts to Benthic and Pelagic Lifestages of Species with Designated EFH Potentially Present in the Project Area

Potential Impact	Level of Impact to Lifestages*				Description
	Benthic Early	Pelagic Early	Benthic Older	Pelagic Older	
Temporary finfish/benthic habitat loss (jet plow embedment of cables and vessel positioning activities)	MODERATE	NEGLIGIBLE	MODERATE		Greatest impacts to benthic eggs and larvae if present during construction. Pelagic eggs and larvae less affected. Spawning adult windowpane flounder may be impacted. Mortality and/or dispersal of benthic prey for fish may temporarily disrupt feeding for some benthic juvenile and adult fish. Temporary habitat impact will be localized to the jet plow track; therefore, sufficient habitat and food base is expected to be available for benthic juvenile and adult fish species in areas adjacent to the Project Area. Disturbed benthic habitat is expected to be recolonized by benthic organisms quickly and the affected area is expected to return to previous levels of abundance and diversity within one to three years.
Temporary finfish/benthic habitat loss (nearshore HDD installation, cofferdam installation, and minor dredging within cofferdam)	MODERATE	NEGLIGIBLE	MINOR	NEGLIGIBLE	Greatest impact to benthic eggs and larvae if present during construction. Other impacts minor and temporary since activity is limited and contained. Temporary cofferdam will be removed and backfilled after jet plow embedment is complete, thus reestablishing habitat. Disturbed benthic habitat is expected to be recolonized by benthic organisms quickly and the affected area is expected to return to previous levels of abundance and diversity within one to three years.
Mortality/Injury/Displacement	MODERATE	MINOR	MINOR	NEGLIGIBLE	Benthic early lifestages most affected if present during construction. Pelagic eggs and larvae less susceptible. Those in direct path may experience some limited injury/mortality. No measurable impacts expected to adult or juvenile pelagic finfish since these lifestages are mobile and can move away from disturbances associated with construction. Adult and juvenile benthic finfish in direct path of bottom disturbance may experience some direct injury/mortality, but they too should be able to move away. Displacement of juvenile and adult finfish expected to be temporary and localized.

Table C. continued

Potential Impact	Level of Impact to Lifestages*				Description
	Benthic Early	Pelagic Early	Benthic Older	Pelagic Older	
Elevated TSS levels (jet plow embedment of cables and limited dredging in temporary cofferdam).	MINOR	MINOR	NEGLIGIBLE	NEGLIGIBLE	Benthic early lifestages most affected, may experience mortality or injury through burial or smothering in immediate Project Area. Pelagic eggs and larvae may be temporarily affected/displaced. Benthic and pelagic adults and juveniles are mobile and capable of moving away from disturbed areas and elevated TSS. Little direct impact expected to adults and juveniles; however, indirect impacts may occur due to impairment of their ability to navigate, forage or find shelter. Impacts and impairment should be temporary and fish are expected to rapidly return to the area. Sediments disturbed during construction are expected to settle quickly and sediment suspension from HDD operations extremely minimal since these activities will be contained within cofferdam.
Water quality impacts from suspension of contaminants	MINOR	MINOR	MINOR	MINOR	Benthic early life stages most affected, if present during construction. The use of jet plow embedment will greatly limit the amount of sediment and contaminants introduced into the water column. The suspended sediment plumes generated by the jetting process are predicted to dissipate rapidly after embedment activities cease and potential impacts to surface water will likely be indistinguishable from that potentially resulting from existing surface sediment.
Acoustical Impacts	NEGLIGIBLE	NEGLIGIBLE	MINOR	MINOR	Disturbance due to underwater noise may impact older finfish species causing them to avoid the impacted area. Fishes are expected to return to the area once construction activities and associated noises cease. Impacts to early lifestages are not expected.
Bentonite Release	MINOR	NEGLIGIBLE	MINOR	NEGLIGIBLE	Minimal impact with protection measures in place (see Exhibit E-3 of the Article VII Application).

Level of Impact to Lifestages*					
Potential Impact	Benthic Early	Pelagic Early	Benthic Older	Pelagic Older	Description
Electromagnetic/ Thermal	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	Negligible impact to benthic life stages due to electromagnetic and thermal fields generated by operation of the In-River Transmission Cable. The electric field will be contained by outfitting the cable with a metal sheath. The magnetic field will be limited by burying the cable a minimum of 8 feet below the surface of the sediment within the river. A limited amount of heat will dissipate into the sediment and water column surrounding the cable. Benthic species that reside near the riverbed may sense the magnetic and thermal fields generated by the cable, but no measurable impacts are anticipated.

*Level of Impact Definitions

Negligible - No measurable impacts

Minor - Most impacts to the affected resource could be avoided with proper mitigation; if impacts occur, the affected resource will recover completely without any mitigation once the impacting agent is eliminated.

Moderate - Impacts to the affected resource are unavoidable; the viability of the affected resource is not threatened although some impacts may be irreversible, OR; the affected resource would recover completely if proper mitigation is applied during the life of the project or proper remedial action is taken once the impacting agent is eliminated.

Major - Impacts to affected resource are unavoidable; the viability of the affected resource may be threatened, AND; the affected resource would not fully recover even if proper mitigation is applied during the life of the project or remedial action is taken once the impacting agent is eliminated.

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