

**Portal Bridge Capacity Enhancement Project
Hudson County, New Jersey
Essential Fish Habitat Assessment**

A. INTRODUCTION

Essential fish habitat (EFH) is defined under the Magnuson-Stevens Fishery Conservation Management Act (16 USC §§ 1801 to 1883), as amended by the Sustainable Fisheries Act (SFA) of 1996, as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” “Waters” include aquatic areas and their physical, chemical and biological properties that are used by fish. “Substrate” includes sediment, hard bottom, structures, and associated biological communities that are under the water column. Waters and substrates necessary for fish spawning, breeding, feeding or growth to maturity—covering all stages within the life cycle of a particular species—refers to those habitats required to support a sustainable fishery and a particular species’ contribution to a healthy ecosystem (50 CFR 600.10).

Section 303(a)(7) of the Magnuson-Stevens Act requires that the eight Regional Fishery Management Councils (RFMC) describe and identify EFH for each Federally managed species, and minimize adverse impacts from fishing activities on EFH. Section 305(b)(2)-(4) of the Magnuson-Stevens Act outlines the process for providing the National Marine Fisheries Service (NMFS) within the National Oceanic and Atmospheric Administration (NOAA), and the RFMC with the opportunity to comment on activities proposed by Federal agencies that have the potential to adversely impact EFH areas. Federal agencies are required to consult with NMFS (using existing consultation processes for NEPA, the Endangered Species Act, or the Fish and Wildlife Coordination Act) on any action that they authorize, fund, or undertake that may adversely impact EFH.

Adverse effects to EFH, as defined in 50 CFR 600.910(A) include any impact that reduces the quality and/or quantity of EFH. Adverse effects may include:

- Direct impacts such as physical disruption or the release of contaminants;
- Indirect impacts such as the loss of prey, reduction in the fecundity (number of offspring produced) of a managed species; and
- Site-specific or habitat-wide impacts that may include individual, cumulative, or synergetic consequences of a Federal action.

An EFH assessment of a Federal action that may adversely affect EFH must contain:

- A description of the proposed project;
- An analysis of the effects, including cumulative effects, on EFH, the managed species and associated species such as major prey species, and the life history stages that may be affected;

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- The agency's conclusions regarding the effects of the action on EFH; and
- Proposed mitigation, if applicable (50 CFR 600.920(g)).

The following sections describe:

- The project actions that have potential to affect aquatic resources at the Portal Bridge Capacity Enhancement Project (the proposed project);
- Existing water and sediment quality within the tidal Hackensack River, where the project is located;
- Potential impacts to aquatic biota and habitat that may result from the proposed project activities;
- The species for which EFH has been identified near the proposed project and potential impacts to their habitats; and
- Potential impacts to one non-EFH species, shortnose sturgeon, a federal and state-listed endangered species, and four species of marine turtles with the potential to occur in the vicinity of the project as seasonal transients.

B. PROJECT DESCRIPTION

OVERVIEW

The project involves the reconstruction and or augmentation of Amtrak's Portal Bridge, an approximately 961-foot railroad bridge spanning the Hackensack River and associated wetlands. A detailed description of project Alternatives is provided in Chapter 3, "Project Alternatives."

SITE DESCRIPTION

The existing project area extends along Amtrak's northeast corridor from the east bank of the Passaic River in Newark, NJ to Secaucus Junction in Secaucus, NJ (Figure 3-1). The project area is approximately bounded by the city of Newark, NJ to the west, the New Jersey Turnpike's Eastern Spur to the north, Secaucus, NJ to the east, and the Morris and Essex rail lines to the south. This project area encompasses the maximum area of project disturbance for all project alternatives.

SURFACE WATER RESOURCES IN THE PROJECT AREA

The Hackensack River is the most prominent ecological feature in the project area. The river is approximately 45 mi (72 km) long, flowing through New York and New Jersey, and ultimately discharging into Newark Bay (a sub-estuary of New York Harbor). The Hackensack watershed includes part of the New York City suburban area west of the lower Hudson River, which it roughly parallels, and is separated from it by the New Jersey Palisades. The river flows through and drains the New Jersey Meadowlands. The lower river, which is navigable as far as the community of Hackensack, is heavily industrialized and forms a commercial extension of Newark Bay.

WATER QUALITY

Surface Water Quality Standards for New Jersey Waters are designated in N.J.A.C. 7:9 B. The Surface Water Quality Standards establish the designated uses to be achieved and specify the

water quality criteria necessary to protect the State's waters. Designated uses include potable water, propagation of fish and wildlife, recreation, agricultural and industrial supplies, and navigation. These are reflected in use classifications assigned to specific waters. The Hackensack River is designated Use Class SE2. In all SE2 waters, the designated uses are:

- Maintenance, migration and propagation of the natural and established biota;
- Migration of diadromous fish;
- Maintenance of wildlife;
- Secondary contact recreation; and
- Any other reasonable uses.

Tidal tributaries in the project area are designated Use Class FW2-NT/SE2. The FW2 general surface water classification is applied to those fresh waters that are not designated as FW1 or pineland waters. The NT designation indicates that the tributaries are not trout waters, and the SE2 designation is defined above. In all FW2 waters the designated uses are:

- Maintenance, migration and propagation of the natural and established biota;
- Primary and secondary contact recreation;
- Industrial and agricultural water supply;
- Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
- Any other reasonable uses.

As of 2006, the Hackensack River in the project area was in non-attainment of Surface Water Quality Standards for New Jersey Waters for aquatic life (general) and for fish consumption. Waters below the Amtrak Portal Bridge are in full attainment for industrial water supply. Insufficient data exist to designate attainment status for the Hackensack River near the project area for primary and secondary contact recreation, drinking water supply, or agricultural water supply (NJDEP 2006).¹

SEDIMENT QUALITY

The New York Harbor Estuary and its tributaries have had a long history of industrialization along its shores. This legacy of pollution continues to affect water quality as pollutants residing mostly in the sediments are dissolved and redistributed. This is an important point; in a tidally mixed water body, water exchange with the Atlantic Ocean tends to dilute waterborne contaminants, but the historically degraded sediments continue to provide new contaminants that affect water quality. Thus, the water quality of the system is coupled tightly to the quality of sediments, but can also be affected by other sources (e.g., industrial discharges).

Many area sediments contain low concentrations of contaminants such as heavy metals, PCB's, PAHs, and other organic compounds. Sediments nearest former (or active) industrial sites may

¹ New Jersey Department of Environmental Protection (NJDEP). New Jersey Integrated Water Quality Monitoring and Assessment Report. Trenton, NJ. December 2006.

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exhibit much higher local concentrations, and can result in localized areas of high contaminant concentrations colloquially as “hot spots”. Landfills (either active or closed) abut many of the region’s waterways, and also may leach contaminants into the waters. In addition, many former wetlands throughout the region have been filled with a mixture of materials including municipal waste and incinerator ash. Lastly, combined sewer outfalls (CSOs) can contribute significantly to regional pollution by introducing fecal coliform bacteria, floatable debris, and other contaminants.

Recent sediment quality investigations near the project area have revealed the presence of a number of contaminants present in Hackensack Meadowlands sediments, including chromium, lead, arsenic, mercury, 4,4’-DDE (a pesticide), flouranthane, pyrene, anthracene, and many others (Barrett and McBrien 2007).¹ Other investigators have identified a similar suite of contaminants, all within a few river miles of the project site (e.g., Weis et al. 2004,² Sorensen et al. 2007,³ Bonnevie et al. 1993⁴).

C. EFH DESIGNATIONS

Table 1 lists the species for which Essential Fish Habitat has been designated in the estuary of Hudson River / Raritan Bay / Sandy Hook Bays in New York and New Jersey, The proposed action is located within the mixing zone (M) of the estuary (<http://www.nero.noaa.gov/hcd/salinityzones.pdf>).

Freshwater Zone (F), Mixing zone (M), Saltwater Zone (S)

Table 1

| Species | Eggs | Larvae | Juveniles | Adults | Spawning Adults |
|---|------|--------|-----------|--------|-----------------|
| Red hake (<i>Urophycis chuss</i>) | | M,S | M,S | M,S | |
| Winter flounder (<i>Pleuronectes americanus</i>) | M,S | M,S | M,S | M,S | M,S |
| Windowpane flounder (<i>Scopthalmus aquosus</i>) | M,S | M,S | M,S | M,S | M,S |
| Atlantic herring (<i>Clupea harengus</i>) | | 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 | |
| Black sea bass (<i>Centropristus 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>) | | | X | X | |
| Little skate (<i>Leucoraja erinacea</i>) | | | | | |
| Winter skate (<i>Leucoraja ocellata</i>) | | | | | |

¹ Barrett, K.R., and M.A. McBrien. Chemical and biological assessment of an urban, estuarine marsh in northeastern New Jersey, USA. Environ. Monit. Assess. 124:63-88. 2007.

² Weis, J.S., J. Skurnick, and P. Weis. Studies of a contaminated brackish marsh in the Hackensack Meadowlands of Northeastern New Jersey: benthic communities and metal contamination. Marine Pollution Bulletin 49:1025-1035. 2004.

³ Sorensen, M.T., J.M. Conder, P.C. Fuchsman, L.B. Martello, R.J. Wenning. Using a Sediment Quality Triad Approach to Evaluate Benthic Toxicity in the Lower Hackensack River, New Jersey. Arch. Environ. Contam. Toxicol. 53, 36-49. 2007.

⁴ Bonnevie, N.L., R.J. Wenning, S.L. Huntly, and H. Bedbury. Distribution of Inorganic Compounds in Sediments from Three Waterways in Northern New Jersey. Bull. Environ. Contam. Toxicol. 51:672-680. 1993.

D. POTENTIAL IMPACTS TO EFH

GENERAL DISCUSSION OF AQUATIC IMPACTS TO WATER QUALITY AND AQUATIC BIOTA FROM THE PROPOSED PROJECT

CONSTRUCTION

In-water project elements necessary to support the build Alternatives, such as pile installation, have the potential to result in temporary adverse impacts to fish and macroinvertebrates due to the following:

- increases in suspended sediment;
- noise associated with pile driving; and
- loss of benthic habitat within pile footprints

The project site spans the Hackensack River, and would be strongly influenced by tidal currents. Any temporary sediment resuspension associated with pile driving would be localized (rather than widespread) to the project site. This sediment would be expected to dissipate shortly after the completion of the sediment disturbing activity and would not be expected to result in significant adverse impacts to water quality or aquatic biota. Sediments throughout the Harbor Estuary contain contaminants. While Hackensack River sediments have been found to contain contaminants at concentrations that may pose a risk to some benthic macroinvertebrates, the tidal currents within the project area should dissipate these sediments such that redeposition within or outside the project area would not be expected to adversely affect benthic macroinvertebrates or bottom fish. Furthermore, sediment resuspension will be mitigated against through the use of silt curtains or other appropriate technologies during the period of disturbance.

Life stages of estuarine-dependent and anadromous fish species, bivalves and other macroinvertebrates generally are tolerant of elevated suspended sediment concentrations and have evolved behavioral and physiological mechanisms for dealing with variable concentrations of suspended sediment (Birtwell et al. 1987,¹ Dunford 1975,² Levy and Northcote 1982,³ and Gregory 1990 in Nightingale and Simenstad 2001,⁴ LaSalle et al. 1991⁵). Fish are mobile and

¹ Birtwell, I.K., M.D. Nassichuk, H. Beune, and M. Gang. Deas Slough, Fraser River Estuary, British Columbia: General description and some aquatic characteristics. Can. Fish. Mar. Serv. Man. Rep. No. 1464. 1987.

² Dunford, W.E. Space and food utilization by salmonids in marsh habitats of the Fraser River estuary. University of British Columbia. 1975.

³ Levy, D.A., and T.G. Northcote. Juvenile salmon residency in a marsh area of the Fraser River estuary. *Can. J. Fish. Aquat. Sci.* 39:270-276. 1982.

⁴ Nightingale, B, and C.A. Simenstad, University of Washington. Dredging Activities: Marine Issues. White Paper, Research Project T1803, Task 35. Prepared by the Washington State Transportation Center (TRAC), University of Washington. Prepared for Washington State Transportation Commission, Department of Transportation and in cooperation with the US Department of Transportation, Federal highway Administration. 2001.

⁵ LaSalle, M.W., D.G. Clarke, J. Homziak, J.D. Lunz, and T.J. Fredette. A framework for assessing the need for seasonal restrictions on dredging and disposal operations. Department of the Army,

generally avoid unsuitable conditions such as increased suspended sediment and noise (Clarke and Wilber 2000¹). While a localized increase in suspended sediment may cause fish to temporarily avoid the area where bottom disturbing activities are occurring, the affected area would be expected to be small. Similar nearby suitable habitats would be available for use by fish to avoid the area being disturbed. Many estuarine fish species also have the ability to expel materials that may clog their gills when they return to cleaner, less sediment-laden waters. The shellfish species found in the Hackensack River are necessarily adapted to naturally turbid estuarine conditions and can tolerate short-term exposures by closing valves or reducing pumping activity. Mobile benthic invertebrates that occur in estuaries have been found to be tolerant of extremely elevated suspended sediment concentrations. In studies of the tolerance of crustaceans exposed to suspended sediments for up to two weeks, nearly all mortality was caused by the full-time exposure to high suspended sediment concentrations (greater than 10,000 mg/L) (Clarke and Wilber 2000²), which would not occur from the in-water work associated with the proposed project (except perhaps extremely locally). Therefore, temporary increases in suspended sediment resulting from in-water construction activities would not be expected to result in significant adverse impacts to fish and mobile benthic macroinvertebrates.

The installation of in-water bridge supports (i.e. caissons and/or piers) is expected to be accomplished by drilling into the bottom rather than through the use of impact pile driving. Caisson drilling radiates significantly less noise into the aquatic environment than pile driving. Nevertheless, because the effects of impact pile driving on living marine resources are comparatively well studied, the possible effects of the noise of pile driving is assessed in this EFH. It is important to note that this assessment overstates the effects of project-specific construction elements, and is therefore conservative.

Pile driving can produce underwater sound pressure waves that can affect fish, with the type and intensity of sounds varying with factors such as the type and size of the pile, firmness of the substrate, depth of water, and the type and size of the pile driver. Larger piles and firmer substrate require greater energy to drive the pile resulting in higher sound pressure levels (SPL). Hollow steel piles appear to produce higher SPLs than similarly sized wood or concrete piles (Hastings and Popper 2005³). Sound attenuates more rapidly in shallow waters than in deep waters (Rogers and Cox 1988 in Hanson et al. 2003⁴). SPLs generated by the driving of hollow steel piles with impact hammers can reach levels that can injure fish (Hanson et al. 2003), and may not generate sound in the frequencies that elicits avoidance behavior in fish. Impact hammers generate short pulses of sound with little of the sound energy occurring in the infrasound frequencies, the sound frequencies that have been shown to elicit an avoidance

Environmental laboratory, Waterways Experiment Station, Corps of Engineers, Vicksburg, Mississippi. 1991.

¹ Clarke, D.G., and D.H. Wilber. Assessment of potential impacts of dredging operations due to sediment resuspension. DOER Technical Notes Collection (ERDC TN-DOER-E9), US Army Engineer Research and Development Center, Vicksburg, MS. 2000.

² Clarke and Wilbur. 2000

³ Hastings, M.C., and A.N. Popper. Effects of Sound on Fish. California Department of Transportation. Contract No. 43A0139, Task Order 1. Sacramento, CA. 2005.

⁴ Hanson, J, M. Helvey, and R. Strach (eds.). Non-Fishing Impacts to Essential Fish Habitat and Recommended Conservation Measures. National Marine Fisheries Service. 2003.

response in fish (Enger et al. 1993,¹ Knudsen et al. 1994, and Sand et al. 2000 in Hanson et al. 2003). Therefore, fish have been observed exhibiting an initial startle response to the first few strikes of an impact hammer, after which fish may remain in an area with potentially harmful sound levels (Dolat 1997,² NMFS 2001 in Hanson et al. 2003). While there is little data available on the SPL required to injure fish, fish with swim bladders and smaller fish have been shown to be more vulnerable (Hanson et al. 2003).

In-water construction is expected to last eight months for each bridge. Because the length of time for drilling each shaft is expected to be short and the tidal flux through the project area is high, individual fish would not be expected to be exposed to potentially dangerous SPLs long enough to result in mortality. Because the tidal flux through the project area is high, individual fish would not be expected to be exposed to potentially dangerous SPLs long enough to result in mortality. Furthermore, underwater sound radiated by pile driving will largely be confined and attenuated by the Hackensack River itself, significantly limiting potential impacts to regional fish populations. Lastly, in-water construction activities will not be conducted during the period identified as anadromous fish spawning period by regulatory authorities (typically April through June). Therefore, the pile driving that would occur as a result of the proposed project would not be expected to result in significant adverse impacts to aquatic biota.

The installation of piles would result in the direct loss of some benthic macroinvertebrates and benthic habitat associated with those organisms that are unable to move from the area of activity. The permanent loss of benthic macroinvertebrates within the piling footprints would not significantly impact the food supply for fish foraging in the area. Lastly, the new piles will provide additional attachment sites for algae and sessile invertebrates and some structures may provide suitable refuge to fish.

In summary, during construction of the in-water project elements for the project Alternatives, temporary increases in suspended sediment, noise generated by pile driving, and alterations to bottom habitat and benthic macroinvertebrates would not be expected to result in significant adverse impacts to aquatic biota of the Hackensack River.

OPERATION

The operation of the Portal Bridge(s) would not be expected to result in significant adverse impacts to water quality, and, therefore, would not be expected to result in significant adverse impacts to fish or benthic macroinvertebrates. The bridges would involve increasing the area of overwater coverage and the associated shading of aquatic habitat within the project site. It has been suggested that shading of estuarine habitats can result in decreased light levels which can lower productivity of primary producers and adversely affect invertebrates, and fish that use these areas particularly with respect to use as foraging habitat (Able et al. 1995,³ Able et al. 2006¹). The

¹ Enger, P.S., H.E. Karlsen, F.R. Knudsen, and O. Sand. Detection and reaction of fish to infrasound. *Fish Behavior in Relation to Fishing Operations*, pp. 108-112, ICES marine science symposia. Copenhagen vol. 196. 1993.

² Dolat, S.W. Acoustic measurements during the Baldwin Bridge demolition (final, dated March 14, 1997). Prepared for White Oak Construction by Sonalysts, Inc, Waterford, CT. 34 p. plus appendices. 1997.

³ Able, K.W., A.L. Studholme, and J.P. Manderson. Habitat quality in the New York/New Jersey Harbor Estuary: An evaluation of pier effects on fishes. Final Report. Hudson River Foundation, New York, NY. 1995.

amount of additional over-water shading for each alternative is discussed below. However, given the changing daily and seasonal angles of solar illumination, light would be expected to reach the water under these structures during portions of the day, reducing potential impacts to aquatic biota due to shading. Additionally, the generally high turbidities on the Hackensack River limit any effect of the additional shading to the first few feet of the water column – benthic communities would be relatively unaffected by the increase in shaded habitat. Lastly, because the tidal currents under the bridge(s) are strong and the bridge structure(s) are comparatively narrow, phytoplankton would be expected to move through the project site quickly and would not be expected to be adversely impacted by shading from the proposed project.

ASSESSMENT OF EFH SPECIES

An analysis of EFH for each fish species and life stage listed in Table 1—including the likelihood that the species would occupy the project area—is summarized below.

RED HAKE (UROPHYCIS CHUSS)

Red Hake is a bottom-dwelling fish that lives on sand and mud bottoms along the continental shelf from southern Nova Scotia to North Carolina (concentrated from the southwestern part of the Georges Banks to New Jersey). Spawning adults and eggs are common in marine portions of most coastal bays between Rhode Island and Massachusetts. Spawning occurs from May to June in the New York Bight (Steimle et al 1999a²). The Hackensack River is within an area designated as EFH for larval, juvenile, and adult red hake.

Larval red hake are free floating and occur in the middle and outer continental shelf. They are most common in water temperatures from 11 to 19°C (52-66°F) and depths from 10 to 200 m (33-660 ft). Recently metamorphosed juveniles remain pelagic (i.e. in the water column) for approximately two months, during which time they achieve growth up to 25-30 mm (1.0-1.2 in) in total length. Shelter/structure is a critical habitat requirement for juvenile red hake. In the autumn, juveniles descend from the water column to the bottom and seek sheltering habitat in depressions in the sea floor. Juvenile settlement usually occurs in October and November. Older juveniles use scallop shells, mussel beds, moon snail egg collars, and other available structure until their second autumn when they move inshore to waters less than 55 m (180 ft) in depth. They typically remain inshore until the temperature reaches 4°C (39°F), at which point they migrate offshore to overwinter (USACOE 2000,³ Steimle et al. 1999a).

Woodhead (1990⁴) describes red hake as a common resident of the New York Harbor system. In the Harbor Estuary, the distribution of red hake is influenced by salinity, water temperature, and dissolved oxygen. Juvenile red hake were collected when salinity was greater than 22 ppt and at

¹ Able, K.W., J.T. Duffy-Anderson. In *The Hudson River Estuary*. J.S. Levinton and J.R. Waldman eds. Cambridge University Press. pp.428-440. 2006.

² Steimle, F.W., W.W. Morse, P.L. Berrien, and D.L. Johnson. *Essential Fish Habitat Source Document: Red Hake, *Urophycis chuss* Life History and Habitat Characteristics*. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 133, <http://www.nefsc.nmfs.gov/nefsc/habitat/efh/> - list. 1999a.

³ USACOE. *Memorandum for the Record: Statement of Findings and Environmental Assessment for Application Number 1998-00290-Y3 by the Hudson River Park Trust*. CENAN-OP-RE. 2000.

⁴ Woodhead, P.M. *The Fish Community of New York Harbor: Spatial and temporal Distribution of major Species*. Report to the New York - New Jersey Harbor Estuary Program, New York, NY. 1990.

depths from 5 to 50 m (16-164 ft) deep. Collections tapered off when salinity reached greater than 28 ppt. Adult red hake prefer temperatures from 2 to 22°C (36-72°F), salinity ranging from 20 to 33 ppt and depths greater than 25 m (82 ft) deep. In Middle Atlantic Bight, red hake occur most often in coastal waters in the spring and autumn, moving offshore to avoid warm summer temperatures. Additionally, red hake have been reported to be sensitive to dissolved oxygen levels and within the Harbor Estuary they preferred dissolved concentrations of 6 mg/L or more (Steimle et al. 1999a).

Juvenile and adult red hake have the potential to occur in the deeper waters in the vicinity of the Hackensack, but may be limited by occasional low DO concentrations and when salinity levels are low. The area of the proposed project represents a small portion of the EFH for this species. The southern stock of red hake (the stock that occurs within the Hackensack River) is not currently considered overfished (defined as the stock size being below a prescribed biomass threshold) (NMFS 2004,¹ 2005²). Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Water quality during operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

WINTER FLOUNDER (PSEUDOPLEURONECTES AMERICANUS)

Winter flounder typically are found from Labrador to North Carolina, but are most common in estuaries from the Gulf of St. Lawrence to the Chesapeake Bay (Bigelow and Schroeder 1953,³ Heimbuch et al. 1994,⁴ USACOE 2000). This fairly small, thick flatfish is abundant in the Harbor Estuary, where it is a resident, but may move upriver into fresh water (Heimbuch et al. 1994). It spawns during the winter and early spring, typically at night in shallow, inshore estuarine waters with sandy bottoms. Woodhead (1990) reports spawning to occur mostly in the Lower New York Bay and the New York Bight. The Hackensack River is within an area designated as EFH for eggs, larval, juvenile, adult, and spawning adult winter flounder.

Winter flounder have negatively buoyant eggs that clump together and sink following fertilization (Heimbuch et al. 1994, USACOE 2000). Optimal egg hatching occurs at 3°C (37°F) and in salinity ranging from 15 to 25 ppt. Winter flounder larvae develop to juveniles within the estuarine systems. In March, April and May, winter flounder larvae can be found in the Upper New York Bay near the bottom (Heimbuch et al. 1994).

For the first summer, young-of-year winter flounder remain in the shallow waters (0.1-10 m [0.2-33 ft] in depth) of bays and estuaries where temperatures are generally less than 28°C (82°F) and salinities range from 5-33 ppt. Juveniles often occupy areas with sand and/or mud

¹ NMFS. Annual Report to Congress on the Status of U.S. fisheries—2003, U.S. Dept. Commerce, NOAA, National Marine Fisheries Service, Silver Spring, MD. 2004.

² NMFS. Annual Report to Congress on the Status of US fisheries—2004, U.S. Dept. Commerce, NOAA, National Marine Fisheries Service, Silver Spring, MD. 2005.

³ Bigelow, H.B., and W.C. Schroeder. Fishes of the Gulf of Maine. Fishery Bulletin of the Fish and Wildlife Service Volume 53. 1953.

⁴ Heimbuch, D., S. Cairns, D. Logan, S. Janicki, J. Seibel, D. Wade, M. Langan, and N. Mehrotra. Distribution Patterns of Eight Key Species of Hudson River Fish. Coastal Environmental Services, Inc. Linthicum, MD. Prepared for the Hudson River Foundation, New York, NY. 1994.

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substrates. Juveniles beyond their first year have also been found to overwinter in estuaries at temperatures less than 25°C (77°F), salinities from 10-30 ppt, and depths from 1-5 m (3-16 ft) (Pereira et al. 1999¹). However, in some studies, wintertime juvenile catches generally increased outside of the estuary while at the same time decreasing within the estuary, suggesting that juveniles migrate out of the estuary in the winter (Pearcy 1962,² Warfel and Merriman 1944,³ and Richards 1963 in Pereira et al. 1999).

Adult winter flounder prefer depths of 20 to 48 m (66-158 ft) and are commonly associated with mud, sand, pebble, or gravel bottoms (USACOE 2000). Adults generally leave the Harbor Estuary in the summer as water temperatures increase, returning in the autumn (Woodhead 1990). Winter flounder will live close to shore, swimming in shallow water to feed. Adults tend to move to deeper water when water temperatures increase in the summer or decrease in the autumn and winter (Heimbuch et al. 1994). NMFS Northeast Fisheries Science Center (NEFSC) trawls within the New York Harbor Estuary found adult winter flounder at temperatures between 4°C and 12°C (39-54°F) and salinities as low as 15 ppt, although most were found at salinities greater than 22 ppt. The bulk of the adult catch occurred in water depths of 25 m (82 ft) or less in the spring (during and just after spawning) and 25 m or deeper in the autumn (prior to spawning) (Pereira et al. 1999).

All stages of this demersal fish have the potential to occur within the project area. Juveniles feed on a variety of worms and small crustaceans, switching to mostly mollusks as they grow. Adults eat small invertebrates and fish. Because they are sight feeders, increased turbidity can interfere with feeding success (USACOE 2000). Within the Hackensack River, young-of-the-year may occur from early April through December. Yearling winter flounder may occur from late May to December. Catches of winter flounder in the Harbor Estuary off Manhattan have been reported to be highest from May through June (Woodhead 1990). Older winter flounder have been found in the Harbor Estuary from late May to September (Heimbuch et al. 1994).

While winter flounder are found throughout the Harbor Estuary, this species is currently experiencing high fishing rates that are in excess of natural production (annual exploitation rates from 55 to 70 percent). The Southern New England/Mid-Atlantic stock unit (which includes the New York population), is considered to be overfished. A rebuilding program is being implemented by the Secretary of Commerce (NMFS 2004, 2005). The 2001 exploitation rate was 37 percent (ASMFC 2002)⁴, and the target exploitation rate for rebuilding winter flounder stocks in 10 years with a 50% probability is 24% (ASMFC 2005⁵). Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate

¹ Pereira, J.J., R. Goldberg, J.J. Ziskowski, P.L. Berrien, W.W. Morse, and D.L. Johnson. Essential Fish Habitat Source Document: Winter Flounder, *Pseudopleuronectes americanus*, Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 138, <http://www.nefsc.nmfs.gov/nefsc/habitat/efh/> - list. 1999.

² Pearcy, W.G. Ecology of an estuarine population of winter flounder, *Pseudopleuronectes americanus* (Walbaum). Parts I-IV. *Bull. Bingham Oceanogr. Collect.* 18(1):5-78. 1962.

³ Warfel, H.E., and D. Merriman. Studies on the marine resources of southern New England. *Bull Bingham Oceanogr. Collect.* 9:1-91. 1944.

⁴ Atlantic States Marine Fisheries Commission (ASMFC). Review of the Atlantic States Marine Fisheries Commission Fishery Management Plan for Winter Flounder (*Pseudopleuronectes americanus*) for 2002

⁵ ASMFC. Press Release - ASMFC Winter Flounder Board Approves State Implementation Plans. http://www.asmfc.org/press_releases/2005/pr09WinterFlounder.pdf. 2005.

area of the activity. Water quality during operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

WINDOWPANE (SCOPHTHALMUS AQUOSUS)

Windowpane, also called sand flounder, is found from the Gulf of St. Lawrence to South Carolina and maximally abundant in the New York Bight. Windowpanes are generally found offshore on sandy bottoms in water between 80 m deep (262 ft) and close inshore in estuaries just below the mean low water mark. They migrate inshore into shallow shoal waters in the summer and early autumn as water temperatures increase, and migrate offshore during the winter and early spring months when temperatures decrease. Windowpanes spawn within the mid-Atlantic Bight from April to December in bottom waters, with temperatures ranging from 8.5 to 13.5°C (47-56°F). Spawning peaks occur in May and then again in the autumn in the southern portion of the Bight (USACOE 2000). The Hackensack River is within an area designated as EFH for eggs, larval, juvenile, adult, and spawning adult windowpane.

The eggs and larvae are found predominately in the estuaries and coastal shelf water for the spring spawning period, and in the coastal shelf waters alone for those eggs spawned in the autumn. Windowpane eggs are buoyant, and can be found in the water column at temperatures of 5-20°C (41-68°F), specifically at 4-16°C (39-61°F) in spring (March through May), 10-16°C (50-61°F) in summer (June through August), and 14-20°C (57-68°F) in autumn (September through November), and within depths less than 70 m (230 ft) (Chang et al. 1999¹). Larvae are free swimming, and typically are found in the areas of the estuaries where salinity ranges from 18 to 30 ppt in the spring and on the continental shelf in the autumn. Juvenile windowpanes were found year-round in both the shelf waters and inshore during a recent study of the New York Harbor Estuary (Chang et al. 1999). In this study, juvenile fish were fairly evenly distributed but seemed to prefer the deeper channels in the winter and summer. They were most abundant where bottom water temperatures ranged from 5 to 23°C (41-73°F), depths ranged from 7 to 17 m (23-56 ft), salinities ranged from 22 to 30 ppt, and dissolved oxygen concentrations ranged from 7 to 11 mg/L. Similarly, adults were fairly evenly distributed year-round, preferring deeper channels in the summer months. Adults were collected in bottom waters where temperatures ranged from 0 to 23°C (32-73°F), depths were less than 25 m (82 ft), salinity ranged from 15 to 33 ppt, and dissolved oxygen ranged from 2 to 13 mg/L (USACOE 2000).

All life stages of windowpane have the potential to occur within the vicinity of the Hackensack River. The southern New England/Middle Atlantic windowpane stock is currently considered to be overfished. A stock rebuilding program is currently under review by the Secretary of Commerce (NMFS 2004, 2005). As with winter flounder, this species is widely distributed throughout the Harbor Estuary. Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Water quality during operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

¹ Chang, S., P.L. Berrien, D.L. Johnson, and W.W. Morse. Essential Fish Habitat Source Document: Windowpane, *Scophthalmus aquosus*, Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 137, <http://www.nefsc.nmfs.gov/nefsc/habitat/efh/> - list. 1999.

ATLANTIC HERRING (CLUPEA HARENGUS)

Atlantic herring is a planktivorous marine species that occurs throughout the Northwestern Atlantic waters from Greenland to North Carolina. They are most abundant north of Cape Cod and relatively scarce in waters south of New Jersey (USACOE 2000). Atlantic herring rarely move into fresh water (Smith 1985¹). Juvenile and adult herring undergo complex north-south migrations and inshore-offshore migration for feeding, spawning, and overwintering. They spawn once a year in late August through November in the coastal ocean waters of the Gulf of Maine and Georges Banks. This species never spawns in brackish water. Post-spawn, the adults migrate to the New York Bight to overwinter from December to April. The autumn migration to overwintering areas is done in tight schools while the spring migration to spawning areas is much more dispersed. Fish that pass through the mid-Atlantic Bight are typically four years of age or older (USACOE 2000). The Hackensack is within an area designated as EFH for larval, juvenile, and adult Atlantic herring.

Larval herring are free-floating, and for autumn-spawned fish this stage can last 4 to 8 months. A fraction of those hatched remain at the spawning site, while others may drift in ocean currents, reaching eastern Long Island Sound. In the Gulf of Maine, larvae occur at temperatures ranging from 9 to 16°C (48-61°F), and a salinity of 32 ppt. During post-metamorphosis, which occurs through April and May, juveniles form large schools and move into shallow waters. Large schools of juveniles have been found in Connecticut and southern Massachusetts in May and June. In the summer and autumn, juveniles move out of the nearshore waters to overwinter in deep bays or near the bottom in offshore areas. Within Long Island Sound, springtime abundances have been reported as being highest at temperatures ranging from 9 to 10°C (48-50°F), depths ranging from 10 to 30 m (33-98 ft), and salinity ranging from 25 to 28 ppt. Within the New York Harbor Estuary, catches of herring were highest at temperatures ranging from 3 to 6°C (37-43°F) and in the deeper portions of the estuary (USACOE 2000). Juveniles in the NEFSC bottom trawl surveys of the New York Harbor Estuary were found to prefer temperatures at 2-16°C (36-61°F) and 12-22°C (54-72°F), and were most abundant at 4-6°C (40-43°F) and 15-18°C (59-64°F). Juveniles are commonly found at depths ranging from 30-135 m (98-443 ft) which varied seasonally (depths increasing with the summer months) (Reid et al. 1999).

On average, males and females mature at about 25-27 cm (10-11 in). In the NEFSC bottom trawl surveys, adults collected were most abundant at 3-6°C (37-43°F) at depths ranging from 4.5 to 13.5 m (14 to 44 ft). Preferred salinities for the Atlantic herring are greater than 28 ppt (Reid et al. 1999). Juveniles and adults perform diel and semi-diel vertical migrations in response to daily photoperiods and variations in turbidity. Being sensitive to light intensity, activity is highest after sunrise and just before sunset, when the herring will avoid the surface during daylight to avoid predators (Reid et al. 1999²).

¹ Smith, C.L. The Inland Fishes of New York State. The New York State Department of Environmental Conservation. 1985.

² Reid, R.N., L.M. Cargnelli, S.J. Griesbach, D.B. Packer, D.L. Johnson, C.A. Zetlin, W.W. Morse, P.L. Berrien. Essential Fish Habitat Source Document: Atlantic Herring, *Clupea harengus* Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 126, <http://www.nefsc.nmfs.gov/nefsc/habitat/efh/> - list. 1999.

No spawning would occur within the Hackensack River, nor would larvae be likely to occur there. Juvenile and adult Atlantic herring could occur within the Hackensack River in low numbers because of salinity and depth preferences. The Atlantic herring stock complex in the northeastern United States is considered underutilized with the exception of the portion in the Gulf of Maine (Reid et al. 1999) and is not overfished (NMFS 2004, 2005). Further, because this species' stock is coastwide, the fraction of the population that may occur within the project area would be extremely small. Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Water quality during operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

BLUEFISH (POMATOMUS SALTATRIX)

Bluefish is a carnivorous marine species that occurs in temperate and tropical waters on the continental shelf and in estuarine habitats around the world. In North America, bluefish live along most of the Atlantic coastal waters from Nova Scotia south, around the tip of Florida, and along the Gulf Coast to Mexico. Bluefish migrate between summering and wintering grounds, generally traveling in groups of fish of similar sizes and loosely aggregated with other groups. They generally migrate north in the spring and summer and south in the autumn and winter. Along the North Atlantic, summering waters are centered in the New York Bight, southern New England and northern sections of the North Carolina coastline. Wintering grounds are found in the southeastern parts of the Florida coast. Juvenile and adult bluefish travel far up estuarine waters (where salinity may be less than 10 ppt) while eggs and larvae are largely restricted to marine habitats (USACOE 2000). The Hackensack River is within an area designated as EFH for juvenile and adult bluefish.

There are two spawning stocks along the U.S. Atlantic coast—a south Atlantic spring spawn, and mid-Atlantic summer spawn. The fish spawning in the spring migrate to the Gulf Stream/coastal shelf interface between northern Florida and Cape Hatteras in April and May. Post-spring spawn, smaller bluefish drift westward while the larger fish slowly migrate north along the shelf and west into mid-Atlantic bays and estuaries including the New York Harbor Estuary where they remain until autumn. Summer-spawning fish migrate to the mid-Atlantic from Cape Cod to Cape Hatteras in June through August. Summer post-spawn fish head towards the mid-Atlantic shores and are particularly abundant in Long Island Sound (USACOE 2000, Fahay et al. 1999¹). Juveniles from the spring spawn drift north in the early summer and enter the important nursery habitats in estuaries and bays along the mid-Atlantic coast in June. Summer-spawned fish enter the estuaries in mid- to late-summer (Buckel et al. 1999²). All spent fish and juveniles migrate to the wintering grounds in the autumn (USACOE 2000).

¹ Fahay, M.P., P.L. Berrien, D.L. Johnson, and W.W. Morse. Essential Fish Habitat Source Document: Bluefish, *Pomatomus saltatrix* Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 144, <http://www.nefsc.nmfs.gov/nefsc/habitat/efh/-list>. 1999.

² Buckel, J.A., D.O. Conover, N.D. Steinberg, and K.A. Mckown. Impact of age-0 bluefish (*Pomatomus saltatrix*) predation on age-0 fishes in the Hudson River estuary: evidence for density-dependent loss of juvenile striped bass (*Morone saxatilis*). *Canadian Journal of Fisheries and Aquatic Sciences* 56:275-287. 1999.

Juveniles in the Mid-Atlantic Bight inhabit inshore estuaries from May to October, preferring temperatures between 15 and 30°C (59-86°F), and salinities between 23 and 33 ppt. Although juvenile and adult bluefish are moderately euryhaline, they occasionally will ascend well into estuaries where salinities may be less than 3 ppt. Juveniles use estuaries as nursery areas, and can be found over sand, mud, silt, or clay substrates as well as in *Spartina* marshes or *Fucus* beds. Bluefish juveniles are sensitive to changes in temperature; thermal boundaries apparently serve as important cues to juvenile migration off shore in the winter season (Fahay et al. 1999).

Adult bluefish are pelagic and highly migratory with a seasonal occurrence in Mid-Atlantic estuaries from April to October. They prefer temperatures from 14-16°C (57-61°F) but can tolerate temperatures from 11.8-30.4°C (35-87°F) and salinities greater than 25 ppt. Adult bluefish are not uncommon in bays and larger estuaries, as well as in coastal waters (Bigelow and Schroeder 1953, Olla and Studholme 1971 in Fahay et al. 1999).

Within the Harbor Estuary, juvenile and adult bluefish may occur in the late spring through autumn. No spawning would occur within the project area. Historically, bluefish was categorized as overfished—the stock size was below the minimum threshold set for this species—and a rebuilding program has been implemented. However, recent estimates of fishing mortality suggest that the rebuilding program, state-by-state quota system, and recreational harvest limit have been successful and that overfishing is no longer occurring. (MAFMC 2002,¹ NMFS 2003, 2004, 2005). Water quality changes during construction of the Proposed Project would be minimal and temporary, limited to the immediate area of the activity. Water quality during operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

ATLANTIC BUTTERFISH (PEPRILUS TRIACANTHUS)

Butterfish occur from Newfoundland to Florida and are most abundant between southern New England and Cape Hatteras. It has been suggested that two populations of butterfish exist. One population appears largely restricted to shoals (less than 20 m [66 ft]) south of Cape Hatteras, and another mainly north of Hatteras that occurs in shoals and possibly some deeper waters along of the shelf. Throughout its range, butterfish are found over the entire shelf, inshore and offshore. Cooling temperatures associated with late autumn trigger a migration offshore to the edges of the shelf where waters are warm. Butterfish require 10°C (50°F) for survival. This species spawns from June to August in inshore waters generally less than 30 m (98 ft) deep. Peak egg production is in late June and early July off Long Island Sound. Studies performed in the Hudson-Raritan Estuary noted that butterfish comprised less than 1% of total catches of fish (USACOE 2000). The Hackensack River is within an area designated as EFH for larval, juvenile, and adult butterfish.

Newly hatched larvae are between 2 and 16 mm (0.1-0.6 in) in length. Larvae are found at the surface and often in the shelter of the tentacles of large jellyfish. The latter tend to be more nektonic (freely swimming) than planktonic (passively drifting with currents) when between 10 and 15 mm (0.4-0.6 in) long. Larvae are found at temperatures ranging from 7-26°C (45-79°F),

¹ Mid-Atlantic Fishery Management Council (MAFMC). Council Management, A Quiet Success Story. Council Newsletter, Summer 2002

although most abundant at 9-19°C (48-66°F), and at depths less than 120 m (394 ft) (Cross et al. 1999).

At 6 mm (0.24 in), larval body depth has increased substantially in proportion to length. At 15 mm (0.6 in), the fins are differentiated and the young fish takes on the general appearance of the adult. Adult butterfish can range from 120 to 305 mm (4.7-12 in) long. Both juveniles and adults have similar habitat characteristics. Both are eurythermal and euryhaline and are common often near the surface in sheltered bays and estuaries during the spring to autumn months. In the Hudson-Raritan trawl survey, juveniles and adults were found at depths from 3-23 m (10-75 ft), salinities from 19-32 ppt, and dissolved oxygen from 3-10 mg/L. Juvenile and adult butterfish also often prefer sandy and muddy substrates, and temperatures from 3-28°C (37-82°F) (Cross et al. 1999¹).

Occasional adult and juvenile butterfish have the potential to occur within the project area. Spawning would not occur within the project area. Woodhead (1990) reports butterfish to be a common transient in the New York Harbor in the summer. Atlantic butterfish prefer sandy bottoms, but are not closely associated with the bottom when inshore during the summer. They may stay close to the bottom during the day and move into the water column at night (Smith 1985). Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

SUMMER FLOUNDER (PARALICHTHYS DENTATUS)

Summer flounder prefer the estuarine and shelf waters of the Atlantic Ocean and are found between Nova Scotia and southeastern Florida. They are most abundant from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina. Summer flounder usually appear in the inshore waters of the New York Bight in April, continuing inshore in May and June, and reach their peak abundance in July and August. Spawning takes place in the New York Bight in nearshore waters outside estuarine systems in September to October. Spawning occurs in surface water temperatures of 7-14°C (45-57°F), with peak activity occurring around 10-12°C (50-54°F) (Packer et al. 1999²). The Hackensack River is within an area designated as EFH for larval, juvenile, and adult summer flounder.

Larvae occur in water from 0 to 22°C (32-72°F) and are transported to estuarine nurseries by currents. Juvenile summer flounder are well adapted to the temperature and salinity ranges present in estuarine habitats. They are distributed throughout the estuary prior to late summer and are more concentrated in sea grass beds (as opposed to tidal marshes) in the late summer and early autumn (USACOE 2000). Planktonic larvae (2-13 mm [0.08-0.5 in]) have been found in temperatures ranging from 0-23°C (32-73°F), but are most abundant between 9°C and 17°C (48-

¹ Cross, J.N., C.A. Zetlin, P.L. Berrien, D.L. Johnson, and C. McBride. Essential Fish Habitat Source Document: Butterfish, *Peprilus triacanthus* Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 145, <http://www.nefsc.nmfs.gov/nefsc/habitat/efh/> - list. 1999.

² Packer, D.B., S.J. Griesbach, P.L. Berrien, C.A. Zetlin, D.L. Johnson, and W.W. Morse. Essential Fish Habitat Source Document: Summer Flounder, *Paralichthys dentatus*, Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 151, <http://www.nefsc.nmfs.gov/nefsc/habitat/efh/> - list. 1999.

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63°F). Salinity preference within the New Jersey area for this species was found between 20-30 ppt. In the Mid -Atlantic Bight, larvae were found at depths from 10-70 m (33-230 ft). Greater densities of young fish were found in or near inlets (Packer et al. 1999).

Young summer flounder move into shallow estuaries (i.e. 0.5-5.0 m [1.6-16 ft] in depth) using these areas as nursery habitat in the autumn, summer, and spring months. Juvenile summer are able to withstand a wider range of temperatures (greater than 11°C [52°F]) and salinities from 10-30 ppt than many species, and have evolved this tolerance to exploit estuarine nursery areas. Juveniles can be found on mud and sand substrates in flats, channels, salt marsh creeks, and eelgrass beds (Packer et al. 1999).

Adult summer flounder feed both in the shelf waters and estuaries and are more active in the daylight hours; they generally feed by sight (USACOE 2000). Adults are found to grow to lengths ranging from 25-71 cm (10-28 in). They inhabit sand substrates at depths up to 25 m (82 ft), at temperatures ranging from 9-26°C (48-79°F) in the autumn, 4-13°C (39-55°F) in the winter, 2-20°C (36-72°F) in the spring, and 9-27°C (48-81°F) in the summer. Salinity is known to have a minor effect on distribution as compared to substrate preference (Packer et al. 1999).

Spawning of summer flounder would not occur in the vicinity of the proposed project. Summer flounder have been collected in areas of the Upper Bay, primarily in the summer (USACOE 1999¹). In 2002, the stock was considered overfished and was in the 8th year of a 10-year rebuilding program (NMFS 2003, MAFMC 2002). The latest stock assessment for summer flounder indicates that management measures have been successful. The resource is no longer overfished although overfishing is currently occurring (NMFS 2005). Summer flounder biomass is estimated to be above the threshold point for the first time since this species was placed under the joint management of the ASMFC and the MAFMC. The ASMFC and MAFMC have recommended increasing the total allowable landing limits to 28.2 million pounds in 2004 (compared to 23 million pounds in 2003) (ASMFC 2003). Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Water quality during operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

BLACK SEA BASS (CENTROPRISTUS STRIATA)

Black sea bass is a marine species that occurs from Cape Cod, Massachusetts to Cape Canaveral, Florida. The fishery is divided into two populations: one major population north of Cape Hatteras, North Carolina, and one in southern waters. The northern population migrates seasonally: shoreward and north in the spring and offshore and south in the autumn. In the autumn, older fish move offshore sooner and overwinter in deeper waters (73 to 163 m [240-535 ft]) than young-of-the-year fish (56 to 110 m [184-361 ft]). Black sea bass can tolerate temperatures as low as 6°C (43°F) but are most abundant in off-shore waters warmer than 9°C (48°F) between 20 to 60 m (66-197 ft) deep (USACOE 2000). During the spring migration, adults move to spawning grounds and juveniles move into estuaries. For the northern population, spawning generally takes place in the summer, in water 18 to 45 m deep from the Chesapeake

¹ USACOE. New York and New Jersey Harbor Navigation Study. Draft Environmental Impact Statement. 1999.

Bay to Montauk Point, New York. The Hackensack River is within an area designated as EFH for juvenile and adult black sea bass.

Larvae develop for the most part in continental shelf waters and are most abundant in the southern portion of the Middle Atlantic Bight. Larvae quickly become bottom dwellers and move into estuaries. Those young-of-year fish in estuaries occupy bottom habitats with shells, amphipod tubes, and rubble, and have been observed on inshore jetties in late May to early June. In the Hudson River, young-of-the-year have been captured in both open water and interpier areas. Juvenile sea bass occur in the saline portions of estuaries from Massachusetts to Florida starting with the initial spring migration until late autumn and are commonly found around jetties, piers, wrecks, and bottom areas with shells (USACOE 2000). They appear to prefer hard bottom (Bigelow and Schroeder 1953).

Juveniles settle in estuaries and the inner continental shelf growing up to 19 cm (7.5 in). Young-of-the-year black sea bass inhabit estuarine areas in the Mid-Atlantic Bight at depths from 1-38 m (3-125 ft) from July to September. They prefer structured bottoms, shell patch substrates and often find shelter around manmade structures. Juveniles can be found in water temperatures ranging from 6-30°C (43-86°F) and salinities ranging from 8-38 ppt (but most preferring 18-20 ppt). The young-of-the-year are migratory during some portions of the first year. They migrate out of the estuaries and away from inner continental shelf nursery areas during the autumn as water temperatures drop (Steimle et al. 1999b). Adult black sea bass prefer similar habitat conditions as that of the juvenile and perform similar migratory patterns. Adults also tend to seek shelter around manmade structures (Steimle et al. 1999b¹).

Black sea bass are bottom feeders, consuming crabs, shrimp, mollusks, small fish, and squid. Woodhead (1990) describes black sea bass as a common summer transient in the New York Harbor. Individuals have been collected in the New York Harbor and the Hackensack River (Smith 1985). Young-of-the-year have been collected in the lower Hudson River off Manhattan from mid-July to September (Able et al. 1995), and have the potential to occur within the project area. The USACOE collected low numbers of individuals in trawls conducted within the Port Jersey area from October 1998 through November 1999 (USACOE 1999).

While previously considered overfished, management efforts have been successful in rebuilding the stock and it is no longer considered overfished and overfishing is not occurring (ASMFC 2003, NMFS 2004, 2005). The ASMFC and MAFMC recently recommended increasing the total allowable landing limit for black sea bass from 6.8 million pounds in 2003 to 8.0 million pounds in 2004 (ASMFC 2003). Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

¹ Steimle, F.W., C.A. Zetlin, P.L. Berrien, and S. Chang. Essential Fish Habitat Source Document: Black Sea Bass, *Centropristis striata* Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 143, <http://www.nefsc.nmfs.gov/nefsc/habitat/efh/-list>. 1999b.

KING MACKEREL (SCOMBEROMORUS CAVALLA)

King mackerel is a marine species that inhabits Atlantic coastal waters from the Gulf of Maine to Rio de Janeiro, Brazil, including the Gulf of Mexico. There may be two distinct populations of king mackerel. One group migrates from waters near Cape Canaveral, Florida south to the Gulf of Mexico, making it there by spring and continuing along the western Florida continental shelf throughout the summer. A second group migrates to waters off the coast of the Carolinas in the summer, after spending the spring in the waters of southern Florida, and continues on in the autumn to the northern extent of the range. The Hackensack River is within an area designated as EFH for eggs, larval, juvenile, and adult king mackerel.

Overall, temperature appears to be the major factor governing the distribution of the species. The northern extent of its common range is near Block Island, Rhode Island, near the 20°C (68°F) isotherm and the 18-meter (59 ft) contour. King mackerel spawn in the northern Gulf of Mexico and southern Atlantic coast. Larvae have been collected from May to October, with a peak in September. In the south Atlantic, larvae have been collected at the surface with salinities ranging from 30 to 37 ppt and temperatures from 22 to 28°C (70-81°F). Adults are normally found in water with salinity ranging from 32 to 36 ppt (USACOE 2000).

King mackerel would likely occur only as rare transient individuals within the Hackensack River. The proposed project would not result in adverse impacts to the EFH for this species.

SPANISH MACKEREL (SCOMBEROMORUS MACULATUS)

Spanish mackerel is a marine species that can occur in the Atlantic Ocean from the Gulf of Maine to the Yucatan Peninsula. The Hackensack River is within an area designated as EFH for eggs, larval, juvenile, and adult Spanish mackerel. This species occurs most commonly between the Chesapeake Bay and the northern Gulf of Mexico from spring through autumn, and then over-winters in the waters of south Florida. Spanish mackerel spawn in the northern extent of their range (along the northern Gulf Coast and along the Atlantic Coast). Spawning begins in mid-June in the Chesapeake Bay and in late September off Long Island, New York. Temperature is an important factor in the timing of spawning and few spawn in temperatures below 26°C (79°F). Spanish mackerel apparently spawn at night. Studies indicate that Spanish mackerel spawn over the Inner Continental Shelf in water 12-34 m (39-112 ft) deep.

Spanish mackerel eggs are pelagic and about 1 mm in diameter. Hatching takes place after about 25 hours at a temperature of 26°C. Most larvae have been collected in coastal waters of the Gulf of Mexico and the east coast of the United States. Juvenile Spanish mackerel can use low salinity estuaries (~12.8 to 19.7 ppt) as nurseries and also tend to stay close inshore in open beach waters (USACOE 2000).

Overall, temperature and salinity are indicated as the major factors governing the distribution of this species. The northern extent of their common range is near Block Island, Rhode Island, near the 20°C (68°F) isotherm and the 18 meter contour. During warm years, they can be found as far north as Massachusetts. They prefer water from 21 to 27°C (70-81°F) and are rarely found in waters cooler than 18°C (64°F). Adult Spanish mackerel generally avoid freshwater or low salinity (less than 32 ppt) areas such as the mouths of rivers (USACOE 2000).

Because this is a marine species that prefers higher salinity waters, only occasional juvenile individuals are likely to occur within the Hackensack River. The resource is not overfished and

overfishing is not occurring (NMFS 2004, 2005). Therefore, the proposed project would not result in adverse impacts to the EFH for this species.

COBIA (RACHYCENTRON CANADUM)

Cobia are large, migratory, coastal pelagic fish of the monotypic family Rachycentridae. In the western Atlantic Ocean, cobia occur from Massachusetts to Argentina, but are most common along the south Atlantic coast of the United States and in the northern Gulf of Mexico. In the eastern Gulf, cobia migrate from wintering grounds off south Florida into northeastern Gulf waters during early spring. They occur off their northwest Florida, Alabama, Mississippi, and southeast Louisiana wintering grounds in the fall. Some cobia overwinter in the northern Gulf at depths of 100 to 125 m (328 to 410 feet). The Hackensack River is within an area designated as EFH for eggs, larval, juvenile and adult cobia.

Information on the life history of cobia from the Gulf and the Atlantic Coast of the United States is limited. Essential fish habitat for coastal migratory pelagic species such as 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, but from the Gulf Stream shoreward, including areas inhabited by the brown alga *Sargassum*. For cobia, essential fish habitat also includes high salinity bays, estuaries, and seagrass habitat. The Gulf Stream is an essential fish habitat because it provides a mechanism to disperse coastal migratory pelagic larvae. Preferred temperatures are greater than 20°C and salinities are greater than 25 ppt.

Cobia are likely to occur only as rare transient individuals within the vicinity of the proposed project due to its coastal migrations, pelagic nature, and salinity requirements. The resource is not overfished and overfishing is not occurring (NMFS 2004, 2005). Therefore, the proposed project would not result in adverse impacts to the EFH for this species.

CLEARNOSE SKATE (RAJA EGLANTERIA)

The clearnose skate occurs along the Atlantic coast from the Nova Scotian Shelf to northeastern Florida and in the northern Gulf of Mexico from Texas to Florida. It is considered a southern species that is rare in the northern part of its range (Packer et al. 2003a). The Hackensack River is within an area designated as EFH for juvenile and adult clearnose skates. North of Cape Hatteras, clearnose skates move inshore and northward along the continental shelf during the spring and early summer and offshore and southward during autumn and early winter. This species occurs off of New Jersey and New York from late April to May and October to November (Packer et al. 2003a¹).

In winter, juveniles are concentrated from the Delmarva Peninsula south to Cape Hatteras out to the 200 m contour. In spring they concentrate inshore from the Delaware Bay south to Cape Hatteras. In summer they occur inshore from the New Jersey coast to around Cape Hatteras with a limited presence off Cape Cod. In Hudson-Raritan Estuary bottom trawls, the largest numbers were found in the summer, particularly in and near channels and south of Coney Island. Small numbers were collected in the spring and autumn, with very few collected in the winter. The

¹ Packer, D.B., C.A. Zetlin, and J.J. Vitaliano. Essential Fish Habitat Source Document: Clearnose Skate, *Raja eglantaria*, Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE-174. 2003a.

distribution of adults in Hudson-Raritan Estuary trawls was similar to that of the juveniles (Packer et al. 2003a).

This skate is found on soft bottoms along the continental shelf but will also occur on rocky or gravelly bottoms. It is most abundant at depths less than 111 meters (364 ft). The Hudson-Raritan trawls found juveniles most abundant at depths of 5-7 m (16-23 ft) and temperatures between 13 and 24°C (55-75°F). Adults were most abundant at depths of 5-8 m (16-26 ft) and temperatures between 9 and 24°C (48-75°F). In this survey, clearnose skates were found at salinities ranging from 22 to 32 ppt (Packer et al. 2003a).

Clearnose skates may occur in the Hackensack River in spring and autumn, although the larger population of this southern species is concentrated around the Delmarva Peninsula and further south. The northeastern clearnose skate stock is not overfished and but it is not known if overfishing of this stock is currently occurring (NMFS 2005). Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Water quality during operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

LITTLE SKATE (LEUCORAJA ERINACEA)

Little skates occur from Nova Scotia to Cape Hatteras and are possibly one of the most dominant demersal (bottom-dwelling) species in the northwest Atlantic. The center of abundance is in the northern portion of the Mid-Atlantic Bight and on George's Bank, where it is found year-round. Little skates do not undertake extensive migrations but do move onshore and offshore with the seasons—generally to shallow waters in the spring and deeper waters in winter (Packer et al. 2003b¹). The Hackensack River is within an area designated as EFH for juvenile and adult little skates.

Little skates are generally found on sandy or gravelly bottoms but can also be found on muddy bottoms. This species is generally found in the Hudson-Raritan Estuary when temperatures are less than about 16-18°C (61-64°F). Juvenile little skates are generally absent from the Hudson-Raritan Estuary during summer months and well distributed throughout in the spring, autumn, and winter. Those that have been collected in the estuary in the summer during trawl surveys were generally found in the deeper, warmer waters of channels. Juveniles were generally found at depths between 4 and 24 m (13-79 ft) and salinities between 17 and 35 ppt (but most at ≥ 25 ppt).

Few adults were collected during the Hudson-Raritan Estuary surveys (conducted 1992-1997). Temperatures where this species was collected ranged from 1 to 17°C (34-63°F), depths from 5 to 16 m (16-52 ft), and salinities from 18 to 32 ppt (but most at ≥ 25 ppt). Only two adults were collected during the summer.

Based on NEFSC trawls, juvenile little skates have the potential to occur in the Hackensack River in the autumn through the spring while adults occur less commonly. Water quality changes during construction of the Proposed Project would be minimal and temporary, limited to the immediate area of the activity. Water quality during operation of the proposed project would not

¹ Packer, D.B., C.A. Zetlin, and J.J. Vitaliano. Essential Fish Habitat Source Document: Little Skate, *Leucoraja erinacea*, Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE-175. 2003b.

be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

WINTER SKATE (LEUCORAJA OCCELATA)

The winter skate occurs from the south coast of Newfoundland and the southern Gulf of St. Lawrence to Cape Hatteras. Its center of abundance is on Georges Bank and in the northern portion of the Mid-Atlantic Bight. It is often second in abundance to the little skate (*Leucoraja erinacea*), and immature winter skates are often confused with immature little skates (Packer et al. 2003c¹). The Hackensack River is within an area designated as EFH for juvenile and adult winter skates.

This skate is found most often on sandy or gravelly bottoms but can also be found on muddy bottoms. It is most abundant at depths less than 111 meters (364 ft). During surveys of the Hudson-Raritan Estuary, juvenile winter skates were generally absent during the summer and well distributed in winter, spring, and autumn. This species was most abundant in winter. Those individuals present in the summer were generally found in deeper channel waters. Juveniles are found in warmer waters during the spring and autumn (most at 6 to 9°C and 5 to 17°C, respectively) than winter (mostly in 0 to 7°C), and remain mostly around depths of 5 to 8 meters (16-26 feet) during those seasons. Salinities ranged from 15 to 34 ppt, but most were found between 23 and 32 ppt. Very few adults were collected in these surveys (conducted 1992-1997). Too few were found to determine their habitat preferences.

Juvenile and adult winter skates have the potential to occur within the vicinity of the Hackensack River. Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Water quality during operation of the proposed project would not be expected to change from the existing condition. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

E. POTENTIAL IMPACTS TO ENDANGERED SPECIES

SHORTNOSE STURGEON

The federally-listed and state-listed endangered shortnose sturgeon is an anadromous bottom-feeding fish that can be found throughout the greater Hudson River Estuary system. These fish spawn, develop, and overwinter in the mid-Hudson River well up-estuary of the project site (NYSDEC 2003²). Shortnose sturgeon spend most of their lives in the estuary and prefer colder, deeper waters for all lifestages. Individuals are only expected to in the vicinity of Portal Bridge as rare transient individuals while traveling to or from spawning, nursery and overwintering areas in the Hudson River Estuary.

Although larvae can be found in brackish areas of the Hudson River, juveniles (fish ranging from 2 to 8 years old) are predominately confined to freshwater reaches above the downstream saline area. The primary summer habitat for shortnose sturgeon in the middle section of the

¹ Packer, D.B., C.A. Zetlin, and J.J. Vitaliano. Essential Fish Habitat Source Document: Winter Skate, *Leucoraja ocellata*, Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE-179. 2003c.

² New York State Department of Environmental Conservation (DEC). NYSDEC, Endangered Species Unit, Shortnose Sturgeon Fact Sheet, NYSDEC Internet website, www.dec.state.ny.us/website/dfwmt/wildlife/endspec/shnostur.html 2003.

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Hudson River (far from the Project area) is the deep river channel (13 to 42 meters deep, 43 to 138 feet). The river channel downstream of this middle estuary area is 18 to 48 meters deep (59 to 157 feet) (Peterson and Bain 2002). Shortnose sturgeon are not known to occur in the Hackensack River in recent times. Therefore, the proposed project would not result in significant adverse impacts to this species.

MARINE TURTLES

Four species of marine turtles, all state and federally listed, can occur in New York Harbor and its tributaries. Juvenile Kemp's ridley (*Lepidochelys kempii*) and large loggerhead (*Caretta caretta*) turtles regularly enter the New York Harbor and bays in the summer and fall. The other two species, green sea turtle (*Chelonia mydas*) and leatherback sea turtle (*Dermochelys coriacea*), are usually restricted to the higher salinity areas of the Harbor. However, these four turtle species mostly inhabit Long Island Sound and Peconic and Southern Bays to the northeast, and Raritan and Barnegat Bays to the south. They neither nest in the New York Harbor Estuary, nor reside there year-round (Morreale and Standora 1995¹). Turtles leaving Long Island Sound for the winter usually do so by heading east to the Atlantic Ocean before turning south (Standora et al. 1990²). These species are not known to occur in the Hackensack River. Therefore, the proposed project would not result in significant adverse impacts to this species. *

¹ Morreale, S.J. and E.A. Standora. Occurrence, movement, and behavior of the Kemp's ridley and other sea turtles in New York waters. Final Report April 1988 – March 1993 for the New York State Department of Wildlife Conservation Return a Gift to Wildlife Program. Contract #C001984. 70 pp. 1993.

² Standora, E.A., S.J. Morreale, R.D. Thompson and V.J. Burke. Telemetric monitoring of diving behavior and movements of juvenile Kemp's ridleys. Page 133 in T. H. Richardson, J.I. Richardson and M. Donnelly, compilers. Proceedings of the tenth annual workshop on sea turtle conservation and biology. NOAA Technical Memorandum. NMFS-SEFC-278. 1990.