APPENDIX L.2

NATURAL RESOURCES—
FEDERAL TRANSIT ADMINISTRATION /
METROPOLITAN TRANSPORTATION AUTHORITY
SECOND AVENUE SUBWAY, NEW YORK, NEW YORK
ESSENTIAL FISH HABITAT ASSESSMENT

Appendix L.2: Essential Fish Habitat Assessment

A. PROJECT DESCRIPTION

As described in detail in Chapter 2, "Project Alternatives," the project has been refined since issuance of the SDEIS. Of particular importance to this chapter are the withdrawal of any activities at Coney Island (Coney Island Yard expansion site), and withdrawal of the 129th Street barge site. Therefore, text previously including those two sites has been eliminated from this FEIS, and this appendix now focuses only on the proposed Pier 6 barge site on the East River in Lower Manhattan.

The East River is relatively close to the Second Avenue Subway alignment at several locations, providing the opportunity to transport spoils and other materials to and from Manhattan by barge. To take advantage of waterborne transportation opportunities, riverfront sites were explored along most of Manhattan's East Side. The site near Pier 6 on the East River in Lower Manhattan stands out as potentially viable. See Figure L-2.1.

By minimizing truck traffic, barge transport would generally create the fewest street-level impacts. Spoils and other materials from the Second Avenue Subway project could be transported to and from the barge site by:

- An underground conveyance system connecting the Second Avenue shaft sites with the East River;
- A covered above-ground conveyor system; or
- Trucks from the Second Avenue shaft sites.

The barge site would require three barge cranes to be located next to the bulkhead as shown in Figure L-2.2. These cranes would be used to load spoils and other materials on or off the barges. If underground conveyors are used to transport spoils, a shaft would also have to be located near the bulkhead on the land side. Approximately 12 barge trips would be made from the barge site every day. In addition, approximately three additional barges could be moored in the vicinity to store materials. This additional storage space would be needed because the land between the East River and the FDR Drive is narrow.

The following sections describe activities associated with the construction of the barge facility. Coordination with the U.S. Army Corps of Engineers (ACOE), National Marine Fisheries Service (NMFS) and other agencies would occur as part of the permitting process to determine the most appropriate seasons and timeframes for in-water construction, based on other projects within the New York Harbor area.

BARGE SITE IN LOWER MANHATTAN

In Lower Manhattan, the proposed barge site is located at Pier 6 on the East River, the site near Coenties Slip recently used to remove debris from the World Trade Center site. Tunnel spoils would be removed from a shaft at the southern terminus of the Second Avenue Subway alignment on Water Street near

Coenties Slip and potentially conveyed to the Pier 6 barge site, where they would be removed by barge. A docking facility for several barges would be operated at Pier 6. Materials could be transported to the barge site by a conveyor system or by trucks. The shaft on Water Street could be used for inserting the tunnel boring machine, which would then excavate a tunnel northward toward Houston Street.

The proposed barging facility near Pier 6 would include the placement of three barge cranes that would be fixed in the water for the duration of construction at this site, which could last for up to 10 years, depending on the construction option. One crane barge (approximately 240 feet long and 70 feet wide) is proposed adjacent to the existing bulkhead for storage to allow vehicles to drive over the water for loading and unloading. Two crane barges (120 feet by 60 feet) placed to the north and east of this storage barge would be used to load and unload materials to and from the vehicles. Piles would be used to secure the crane barges. Up to four hopper barges, two approximately 260 feet by 50 feet and two approximately 200 feet by 50 feet, would be temporarily moored near the crane barges. Because these four barges would be used for transporting materials to and from the site, they would move frequently; only one or two barges would be located at the construction site at any one time. In contrast, the crane barges (storage and crane barges) would remain as fixed platform coverage for the duration of the construction period.

EAST RIVER

The East River is a tidal strait connecting New York Harbor with the western end of Long Island Sound. It is approximately 16 miles long and generally ranges from 600 to 4,000 feet wide. Water depth in the navigation channel is maintained at 40 feet below MLW from the Battery to the former Brooklyn Navy Yard, and 35 feet at MLW from that point to the Throgs Neck Bridge. In reality, the channel is much deeper in places than the maintained depth, reaching up to 100 feet deep in areas just north of Hell Gate.

Circulation and salinity structure is largely determined by conditions in the Harbor and Sound. The East River fish, benthic, and plankton communities are strongly influenced by the composition and abundance of these communities in adjacent water bodies. The reach of the East River between Roosevelt Island and Wards Island, known as Hell Gate, is noted for its strong tidal currents. The flood current sets eastward and the ebb sets westward. Direction and velocity of the currents are affected by strong winds, which may increase or diminish the periods of flood and ebb. Current velocities are rapid in the East River—maximum velocities in the lower River reach 5 knots. Current speeds in the upper East River are not as great because it is wider and more of its tidal prism is exchanged with the Harbor than with the Sound.

The mean tidal range is considerable—approximately 1.3 meters (4.26 feet) at the Battery increasing to 2.2 meters (7.2 feet) at Willets Point. The phase of the tide at Willets Point lags the Battery by about 3 hours. This phase difference (and the difference in resulting water elevations between the Battery and Willets Point) is chiefly responsible for the rapid tidal currents in this water body. Tidal excursion distances vary between 16 and 21 kilometers (9.9 to 13 miles) in the upper East River.

Water Quality Overview

New York City Department of Environmental Protection (NYCDEP) currently collects water quality monitoring data from 14 sites in the Inner Harbor area, which encompasses the proposed Pier 6 barge site in the Lower East River as well as the Hudson River, the Narrows, and the Kill van Kull-Arthur Kill system. The closest sampling site to the proposed Pier 6 barge site is located on the west side of the river off of East 23rd Street. Summer temperatures in 2001 in the East River near the project site at the East 23rd Street sampling station ranged from 20 to 24°C (68 to 75.2°F), and salinity ranged from 23 to 26.5 parts per thousand (ppt). Differences in water quality measurements between surface waters 0.91 to 1.8 meters (3 to 6 feet) and bottom waters 11.9 to 15.9 meters (39 to 52 feet) were slight (NYCDEP, 2001).

The East River is classified as a Class I water by NYCDEP. The dissolved oxygen (DO) standard for Class I waters is 4.0 mg/L. As mentioned previously, although water quality conditions in the estuary have improved considerably over the past two decades, violations of the "never less than" DO standard are still recorded. Summer DO values recorded at the East 23rd Street sampling station ranged from 2.5 to 5.3 mg/L for surface waters and 2.2 to 5.0 for bottom waters. DO concentrations were below the 4.0 mg/L standard in 3 of 15 surface water samples and 5 of 15 bottom water samples in 2001 (NYCDEP, 2001).

Fecal coliform concentrations for the Lower East River ranged from 8 to 1,020 MF/L in 2001 and complied with the standard for best-use classifications for fishing (2,000 MF/L). Past data show that the Inner Harbor area is prone to short-term fluctuations in water quality, particularly episodic increases in fecal coliform following rainstorms. The Inner Harbor shows the least year-to-year chlorophyll *a* variation and lowest summertime average (5 µg/L average in 2001), although trends have shown a slight increase in chlorophyll *a* concentration in the 1990's relative to the value concentrations measured in the 1980's. In 2001 chlorophyll *a* concentrations at the East 23rd Street sampling station ranged from 1.2 to 9.6 µg/L, with 13 of 15 samples below 5 µg/L (NYCDEP, 2001).

Sediments Overview

The lower East River primarily has a hard, rock bottom consisting of gravel, cobble, rocks, and boulders covered with a shallow layer of sediment, usually ranging from less than 2 inches and occasionally up to 12 inches thick in the channel area. Sediment samples collected at the Pier 6 site were primarily silt and clay with some sand (EEA, 2002). Studies indicate that the lack of soft sediments is most likely attributable to the high current velocities that maintain particulate matter in suspension (PAS, 1985). In addition, elevated concentrations of several heavy metals and methylene chloride in East River sediments were measured over the period between 1980 and 1982 as part of the Newtown Creek 301 (n) application (Hazen and Sawyer, 1983). Results of sampling at Pier 6 in June 2002 indicate that sediment concentrations of contaminants exceed NYSDEC guidance levels for some SVOCs and heavy metals (EEA, 2002).

B. ESSENTIAL FISH HABITAT DESIGNATIONS

PIER 6 SITE

The Pier 6 study area on the East River is within a portion of the Hudson River estuary Essential Fish Habitat (EFH) that is situated in the NOAA/NMFS 10' x 10' square with coordinates (North) 40°50.0' N, (East) 74°00.0' W, (South) 40°40.0' N, (West) 74°10.0' W, which includes Atlantic Ocean waters within the square affecting the following: the Hudson River and Bay from Guttenberg, NJ, south to Jersey City, NJ, including the Global Marine Terminal and the Military Ocean Terminal, Bayonne, NJ, Hoboken, NJ, Weehawken, NJ, Union City, NJ, Ellis Island, Liberty Island, Governors Island, the tip of Red Hook Pt. on the west tip of Brooklyn, NY, and Newark Bay. The area of the East River containing the Pier 6 site has been identified as EFH for 15 species of fish. The species and life stages for the East River are shown below in Table L.2-1.

Table L.2-1
Essential Fish Habitat Designated Species for the East River

Species	Eggs	Larvae	Juveniles	Adults
Red hake (*Urophycis chuss*)		X	X	X
Winter flounder (*Pleuronectes americanus*)	X	X	X	X
Windowpane flounder (*Scopthalmus aquosus*)	X	X	X	X
Atlantic herring (*Clupea harengus*)		X	X	X
Bluefish (*Pomatomus saltatrix*)			X	X
Atlantic butterfish (*Peprilus triacanthus*)		X	X	X
Atlantic mackerel (*Scomber scombrus*)			X	X
Summer flounder (*Paralicthys dentatus*)		X	X	X
Scup (*Stenotomus chrysops*)	X	X	X	X
Black sea bass (*Centropristus striata*)	N/A		X	X
King mackerel (*Scomberomorus cavalla*)	X	X	X	X
Spanish mackerel (*Scomberomorus maculatus*)	X	X	X	X
Cobia (*Rachycentron canadum*)	X	X	X	X
Sand tiger shark (*Odontaspis Taurus*)		X		
Sandbar shark (*Charcharinus plumbeus*)		X		X
Source: National Marine Fisheries Service. "Summary of Essential Fish Habitat (EFH) Designation" posted on the internet at http://www.nero.noaa.gov/ro/STATES4/new_jersey/40407400.html.				

C. ANALYSIS OF EFFECT TO THE EFH

GENERAL DISCUSSION OF AQUATIC IMPACTS

PIER 6 AT THE EAST RIVER

As noted above, a barge facility is proposed at or near Pier 6. The current concept design of the barging facility involves the placement of three fixed barges, each supporting a crane, in the water for the duration of construction at this site, which could last for up to 7 years. In addition, up to four hopper barges would be temporarily moored near the barge cranes and used to transport construction spoils. No bulkhead repairs would be required, and only a small amount of dredging (approximately 3,500 cubic yards) may be required. Fixed platform coverage from the proposed crane barges is approximately 30,000 square feet.

Some localized water quality degradation would be expected to occur while the crane barges are anchored to the river bottom; this could last for approximately 3 to 6 months. It is likely that in-water placement of spud barges would require the use of pile driving equipment from the landside, which would cause resuspension of particulates and fine matter within the water column. However, the current velocities within the East River should disperse suspended material quickly. Additionally, the decrease in water quality should only be temporary and would be minimized using mitigation measures described below.

Barge facility operations are not likely to result in any significant long-term impacts to water quality within the East River. In addition, the potential above-ground conveyer system, which would transport material to the site, would be completely covered, and would minimize the release of materials or fines into the water or air.

Because the area around Pier 6 was recently dredged to accommodate transport of World Trade Center debris by barge, it is not anticipated that dredging would be required at the site, with the possible exception of a small amount of channel deepening at the southern edge of Pier 9 (if needed for safe barge operations). However, it may be necessary to conduct maintenance dredging if the area were to become resedimented. Maintenance dredging is expected to be minimal, approximately 3,500 cubic yards.

Potential benefits of the fixed barges are that their piles could provide additional temporary substrate for the invertebrate communities in the East River, increasing food sources for fish species, and may provide additional habitat for those species commonly associated with man-made structures, such as black sea bass.

PROPOSED MITIGATION

The Metropolitan Transportation Authority (MTA)/New York City Transit (NYCT) has previously worked successfully with natural resource issues, and have coordinated with regulatory agencies, such as the NYSDEC, to develop viable design options and mitigation for various projects. The MTA/NYCT will continue to work with regulatory agencies in developing the Second Avenue Subway project in order address and resolve natural resource issues.

Silt curtains would be used where appropriate (i.e., during dredging or shoreline construction activities) to reduce and control turbidity in the water column and to allow suspended solids to settle. These curtains could also capture floating debris during placement of crane barges within the waterways. Silt curtains would also be expected to minimize local water quality degradation from in-water construction. Additional mitigation measures would be implemented as identified during the permitting process by federal and state agencies. As part of the permitting processes, the Second Avenue Subway project would coordinate with the NYSDEC to identify appropriate mitigation for any temporary aquatic habitat impacts. All mitigation measures would be organized into the CEPP, which would be applied to all aspects of planned project construction and operation. This CEPP would be implemented through MTA/NYCT.

ASSESSMENT OF EFH SPECIES

An analysis of EFH for each fish species and life stage for the East River—including the likelihood that the species would occupy the project area, as shown in Table L.2-1—is summarized below.

RED HAKE

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). The East River is designated as EFH for larvae, juvenile, and adult red hake. 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., 1999a).

Red hake eggs are pelagic and range from the Middle Atlantic Bight to the Gulf of Maine. Eggs are found on the edge of the continental shelf during the cooler months and across the continental shelf during the warmer months. The characteristics of the habitat in which red hake eggs are commonly found are not well understood because red hake eggs co-occur with, and are indistinguishable from, the eggs of other hake species (Steimle et al., 1999a).

The typical habitat for red hake larvae is sea surface temperatures between 8 and 23°C (46 to 73°F), depths between 10 and 200 meters (33 to 660 feet), and salinities greater than 0.5 ppt. The larvae are most often observed from May through December, with peaks in September and October. Although larvae have been reported from the Hudson River Estuary, they are most abundant at the middle and outer continental shelf throughout the Middle Atlantic Bight (Steimle et al., 1999a). While red hake larvae do have the potential to occur in the East River, these individuals would be transient on the basis of habitat preferences, and the potential habitat modifications that would occur as a result of in-water construction would not significantly affect EFH for larvae.

Shelter is a critical habitat requirement for red hake. In the autumn, young juveniles descend from the water column to the bottom and seek sheltering habitat in depressions in the sea floor. Juveniles are found on shelly substrates, and prefer water temperatures below 16°C (61°F), depths of less than 100 meters (328 feet), and a salinity range of 31 to 33 ppt (Steimle et al., 1999a). This is a slightly lower temperature and greater salinity then is typical in the vicinity of the project site (NYCDEP, 2001). In the Hudson-Raritan Estuary red hake were collected at depths between 5 and 50 meters (16 to 164 feet) (Woodhead, 1990). Red hake are very sensitive to low DO (Steimle et al., 1999a). In particular, juveniles are sensitive to DO levels less than 4.2 mg/L, and would likely not tolerate summer minima conditions that occur occasionally in the East River.

Adults are found in bottom habitats of sand and mud, and they prefer water temperatures below 14°C (57°F), depths from 15 to 365 meters (50 to 1,200 feet), salinities between 31 and 34 ppt, and a more open water environment than the project areas. Red hake adults are sensitive to hypoxia, and prefer DO levels greater than 6 mg/L (Steimle et al., 1999a), and as noted for juveniles, may not tolerate summer minima conditions the project areas.

Adult red hake were collected during impingement studies at the Ravenswood plant on the Queens side of the East River (New York State Department of Transportation (NYSDOT), 2000). If present in the project areas, adults of this species are expected to be transient, likely during the spring and fall when DO is above 4.2 mg/L, prior to winter migrations to deeper waters. The project areas are likely at the upper portion of the geographic range for juveniles and adults and would constitute a small portion of the EFH for this species. Overfishing is not currently occurring for the southern stock of red hake, the stock that occurs within the New York/New Jersey Harbor (NMFS, 2002). No effects to EFH from the project are expected for any life stage of red hake.

WINTER FLOUNDER

Winter flounder can be found from Labrador to North Carolina but most commonly in estuaries from the Gulf of St. Lawrence to the Chesapeake Bay including the Lower Hudson (Heimbuch et al., 1994, ACOE, 2000). It is a fairly small, thick flatfish that is abundant in the Lower Hudson Estuary, where it is a resident, but may travel upriver into fresh water (Heimbuch et al., 1994). The East River is designated as EFH for eggs, larvae, juvenile, and adult winter flounder.

Habitat and environmental conditions in the East River are typical for all life stages of winter flounder. All life stages were collected during impingement and entrainment studies conducted in 1993-1994 at the Ravenswood plant on the Queens side of the East River (NYSDOT, 2000). All life stages are expected to occur at the Pier 6 site. Spawning adults and eggs are often observed from February to June, and larvae are observed from March to July. Eggs, juveniles, and adults prefer bottom habitats of mud or fine-grained sand, and larvae are found in both bottom habitats and in the water column (Heimbuch et al., 1994).

Winter flounder are particularly susceptible to pollution (Grosslein and Azarovitz 1982). The eggs are laid directly on the substrate and therefore any toxins in the sediment can affect their viability. This species' close association with sediments also potentially exposes the fish to sediment toxins. Grosslein and Azarovitz (1982) noted that few larvae survived in polluted estuaries, and that winter flounder were entirely absent from polluted sections of the New York/New Jersey Harbor. In particular, winter flounder experience increased mortality as a result of exposure to insecticides, especially DDT (Buckley, 1989).

Installation of piles for the crane barges and dredging would disturb substrate habitat and the water column. These activities could result in a temporary increase in turbidity, and a temporary adverse impact on the habitat for winter flounder because of this species' dependence on sight. However, this species has adapted to relatively harsh estuarine conditions and can avoid highly turbid conditions that are temporary in nature. Because the proposed action would occur over a maximum of approximately 6 months, water quality is expected to return to existing conditions following the construction of barge facilities. In addition, the intensity of construction during this period would vary, with periods of turbidity alternating with periods of limited activity. Due to current velocities within the East River dispersion of re-suspended sediments would likely occur quickly.

No significant adverse impacts are expected to occur from the limited amount of platform addition that would result from the barge operations at Pier 6. The limited size of the fixed barges, coupled with the limited amount of vertical intrusion into the river bottom, would allow fish to move through the underpier areas at the barge location. In addition, because the narrow dimensions of the proposed crane barges at the site reduces the amount of habitat affected by shading, proposed construction activities would not significantly alter the habitat used by fish. Shading by fixed barges may adversely affect some habitat but the project area constitutes a small portion of EFH for this species and would not adversely impact this fishery. Winter flounder are found throughout the Upper New York Harbor, Kill van Kull and Arthur Kill, and the southern New England-Middle Atlantic stocks of winter flounder are not considered over-exploited (NMFS, 2002). Project activities would not substantially alter the existing habitat at the in-water construction site. No impacts to EFH for winter flounder are anticipated from this project.

WINDOWPANE FLOUNDER

Windowpane flounder, also called sand flounder, is found from the Gulf of St. Lawrence to South Carolina and has its maximum abundance in the New York Bight. Windowpane flounder are generally found offshore on sandy bottoms in water between 50 and 80 meters (164 to 262 feet) deep, and close inshore in estuaries just below the mean low water mark. They migrate onshore in the shallow shoal water in the summer and early autumn as water temperatures increase, and migrate offshore during the winter and early spring months when temperatures decrease (Chang et al., 1999). Habitat and environmental conditions in the East River are typical for all life stages of windowpane flounder. The East River is designated as EFH for eggs, larvae, juvenile, and adult windowpane flounder. Windowpane flounder eggs, larvae, juveniles, and adults were collected during impingement and entrainment studies conducted in 1993-1994 at the Ravenswood plant on the Queens side of the East River (NYSDOT, 2000).

Windowpane flounder spawn within the mid-Atlantic Bight from April to December in the bottom waters with temperatures ranging from 8.5 to 13.5°C (47 to 56°F). Spawning peaks occur in May and then again in the autumn in the southern portion of the Bight (ACOE, 2000).

The buoyant eggs and larvae that settle to the bottom are found predominately in the estuaries and coastal shelf water for the spring spawned eggs, and in the coastal shelf waters alone for those eggs spawned in the autumn. Windowpane eggs are found floating in the water column at temperatures of 5 to 20°C (41 to 68°F), specifically at 4 to 16°C (39 to 61°F) in spring (March through May), 10 to 16°C (50 to 61°F) in summer (June through August), and 14 to 20°C (57 to 68°F) in autumn (September through November), and within depths less than 70 meters (229 feet) (Chang et al., 1999). Larvae are typically found in the area of the estuary where salinity ranges from 18 to 30 ppt in the spring, and on the shelf in the autumn. Juvenile windowpane flounder were found year round in both the shelf waters and in the Hudson-Raritan Estuary. Larvae are found at similar temperature and depth as the egg stage of this species, particularly at 3 to 14°C (37 to 57°F) in the spring, 10 to 17°C (50 to 63°F) in the summer, and 13 to 19°C (55 to 66°F) in the autumn (Chang et al., 1999).

Within the Hudson-Raritan estuary, 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 to 73°F), depths ranged from 7 to 17 meters (23 to 55.7 feet), 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 to 73°F), depths were less then 25 meters (82 feet), salinity ranged from 15 to 33 ppt, and dissolved oxygen ranged from 2 to 13 mg/L (ACOE, 2000).

As noted above for winter flounder, no significant adverse impacts are expected to occur from the limited amount of platform addition that would result from the barge operations at Pier 6 or from the installation of piles for the crane barges or dredging. Shading may affect some habitat but the barge areas constitute a small portion of EFH for this species. Project activities would not substantially alter the existing habitat at the construction site. The southern New England/Middle Atlantic stock is not currently considered to be overfished (NMFS, 2002) and should not be affected by any temporary changes associated with the project. Therefore, no impacts to EFH for windowpane flounder are anticipated from this project.

ATLANTIC HERRING

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 (ACOE, 2000). Atlantic herring rarely move into fresh water (Smith, 1985). 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 to November, in the coastal ocean waters of 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 (ACOE, 2000).

NOAA (Stone et al., 1994) indicates that larvae, juvenile, and adult Atlantic herring are common within the mixing zone portion of the Hudson River/Raritan Bay Estuary and are known to occur in the East River (NOAA, 2001). In addition, larvae and adult life stages of this species were collected during impingement studies at the nearby Ravenswood plant conducted in the East River 1993-1994 (NYSDOT, 2000). The East River is designated as EFH for larvae, juvenile, and adult Atlantic herring.

Larvae are generally found in pelagic waters with temperatures below 16 °C (60 °F), water depths from 50 to 90 meters (154 to 300 feet), and salinities of about 32 ppt. Larval Atlantic herring occur in the East River from April to June (NOAA, 2001).

Juveniles and adults prefer pelagic waters and bottom habitats with water temperatures below 10 °C (50 °F), at water depths of 15 to 135 meters (50 to 450 feet) and 10 to 130 meters (33 to 430 feet), respectively, and salinity ranges of over 26 ppt. Juveniles overwinter in deep bays. In the Hudson- Raritan estuary NEFSC bottom trawl surveys, adults collected were most abundant at 3 to 6°C (37 to 43°F) at depths ranging from 4.5 to 13.5 meters (14.7 to 44.2 feet). Preferred salinities for the Atlantic herring occur at 28 ppt and greater (Reid et al., 1999).

Juveniles and adults perform diel and semi-diel vertical migrations in response to daily photo periods and increased turbidity. Being sensitive to light intensity, activity is highest after sunrise and just before sunset where the herring will avoid the surface during daylight to avoid predators (Reid et al., 1999). Atlantic herring are pelagic (found within the water column). Because of this, individuals of this species are less likely to be affected by the in-water activities than bottom dwelling fish. The Atlantic herring stock complex in the northeastern United States is considered under-utilized with the exception of the portion in the Gulf of Maine (Reid et al., 1999) and is not overfished (NMFS, 2002). In addition, habitat areas affected by the Pier 6 site make up a small portion of EFH for this species and potential impacts to these areas would not adversely affect the Atlantic herring fishery. The fixed barges and pilings have the potential to provide additional substrate for invertebrate communities in the East River, increasing food sources for fish. Temporary increases turbidity and shading from the project are not expected to impact EFH for any life stage of Atlantic herring.

BLUEFISH

Bluefish is a carnivorous marine fish 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 (Fahay et al., 1999). The East River is designated as EFH for juvenile and adult bluefish.

Bluefish often migrate to estuaries in the summer months, between April (adults) or May (juveniles), and October. Juveniles in the Mid-Atlantic Bight inhabit inshore estuaries from May to October, preferring temperatures between 15 and 30°C (59°F to 86°F), and salinities between 23 to 33 ppt. Although juvenile (and adult) bluefish are moderately euryhaline, occasionally they will ascend well into estuaries where salinities may be less than 3 ppt. Juveniles use estuaries as nursery areas and can be found in sand, mud, silt, or clay substrates as well as *Spartina* or *Fucus* beds. Bluefish juveniles are sensitive to changes in temperature where thermal edges 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 to 16 °C (57.2°F to 60.8°F) but can tolerate temperatures from 11.8 to 30.4 °C (53.24°F to 86.72°F) and salinities greater than 25 ppt. Adult bluefish are not uncommon in bays and larger estuaries, as well as coastal waters (Fahay et al., 1999).

Juvenile bluefish may be abundant and adults are common within the mixing zone portion of the Hudson River/Raritan Bay Estuary (Stone et al., 1994). Juvenile and adult bluefish are known to occur in the East River from June to October (NOAA, 2001). Bluefish adults were collected during impingement studies conducted in 1993-1994 at the Ravenswood plant in the East River (NYSDOT, 2000).

Juveniles and adults are the stages of bluefish with the greatest potential to occur within the project area. No spawning would occur within the project area. Because this species is pelagic, occupying open water areas and not bottom habitat, potential impacts associated with temporary increases in turbidity would not be significant. Bluefish is currently categorized as overfished—the stock size is below the minimum threshold set for this species and a rebuilding program has been implemented (NMFS, 2002). 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). The temporary increases in turbidity and shading from the project are not expected to impact EFH for any life stage of bluefish.

ATLANTIC BUTTERFISH

Butterfish occur from Newfoundland to Florida and are most abundant between southern New England and Cape Hatteras, North Carolina. It has been suggested that two populations of butterfish exist. One population appears largely restricted to shoals (less than 20 meters [65 feet]) 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 spawning takes place chiefly from May through October in Mid-Atlantic Bight. The times and duration of spawning are closely associated with changes in surface temperatures (Cross et al., 1999). The East River is designated as EFH for larvae, juvenile, and adult Atlantic butterfish.

Larvae are found at the surface or in the shelter of the tentacles of large jellyfish, and are more nektonic than planktonic from 10 to 15 mm. Larvae are found at temperatures ranging from 7 to 26°C (44 to 78.8°F) (although most abundant at 9 to 19°C [148.2 to 66.2°F]), and at depths less than 120 meters (393.8 feet).

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 fall months. In the Hudson-Raritan trawl survey, juveniles and adults were found at depths from 3 to 23 meters (9.8 to 75 feet), salinities from 19 to 32 ppt, and DO from 3 to 10 mg/L. Juvenile and adult butterfish also often prefer sandy and muddy substrates, and temperatures from 3 to 28 °C (37.4°F to 82.4°F) (Cross et al., 1999).

Juvenile and adult butterfish have the potential to occur in the East River site. Larvae and adult butterfish were collected during impingement and entrainment studies conducted in 1993-1994 at the Ravenswood plant in the East River (NYSDOT, 2000). Studies performed in the Hudson-Raritan Estuary noted that butterfish make up less than 1 percent of total catches of fish (ACOE, 2000).

Woodhead (1990) reports butterfish to be a common transient to the New York Harbor in the summer. They 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 upward at night (Smith, 1985). Because this species is not closely associated with bottom habitats and can be found throughout the water column, individuals of this species are less likely to be affected by the in-water activities than more bottom dwelling fish. This species is found throughout the Upper Harbor and temporary increases in turbidity or shading would not adversely impact this fishery. Butterfish stock is not overfished or approaching an overfished condition (Cross et al., 1999, NMFS, 2002) and it is considered an underexploited fishery (Cross et al., 1999). This project is not expected to impact EFH for any life stage of butterfish.

ATLANTIC MACKEREL

Atlantic mackerel is a pelagic marine fish that occurs in the western North Atlantic from Labrador to North Carolina. It sustains fisheries from the Gulf of St. Lawrence and Nova Scotia to the Cape Hatteras area. There may be two populations: one occurring in the northern Atlantic and associated with the New England and Maritime Canadian coast, and another more southerly population inhabiting the mid-Atlantic coast. Both populations overwinter in the deep waters at the edge of the continental shelf, generally moving inshore (in a northeastern direction) during the spring, and reversing this migration in autumn. The southern population begins its spawning migration by moving inshore between the Delaware Bay and Cape Hatteras and in a northeastern direction along the coast. The timing of the migration and spawn is a result of warming water temperatures. The peak spawn for the southern population occurs off New Jersey and Long Island Sound in April and May. Most spawning occurs in the shoreward half of the shelf and in waters from 7 to 14°C (45 to 57°F) (with the peak being 10 to 12°C (50 to 54°F). By June there are schools of juveniles off Massachusetts, and they move into the Gulf of Maine by June and July where they remain for the summer (Studholme et al., 1999). The East River is designated EFH for juvenile and adult Atlantic mackerel.

In the Hudson-Raritan Estuary, juveniles are present from April to December, but are most common from April through June and October through November (ACOE, 2000). Juvenile transformation includes swimming and schooling behaviors starting at 30 to 50 mm, and closely resemble adults when about 1 year of age. In the Hudson-Raritan Bay estuary, juveniles are present in the spring and summer months preferring depths from 4.9 to 9.8 meters (16 to 32 feet), salinity ranges from 26 to 28.9 ppt, dissolved oxygen from 7.3 to 8.0 mg/L and temperatures from 17.6 to 21.7°C (64 to 71°F) (Studholme et al., 1999).

In the Hudson-Raritan Estuary adults are present from April through June and from September through December, most commonly from April to May and from October to November (ACOE, 2000). Adult Atlantic mackerel can range from 26 cm in their second year to about 40 cm in their sixth year. NEFSC trawl surveys show that adults are found in the spring at temperature ranges from 5 to 13°C (41 to 55°F) dispersed from 0 to 380 meters (0 to 1,246 feet) (most abundant at 160 to 170 meters [524 to 558 feet]), and in the summer at temperatures ranging from 4 to 14°C (39 to 57°F) at depths of 10 to 180 meters (32.8 to 590.5 feet) (abundant at 50 to 70 meters [164 to 229.6 feet]). Adults also prefer salinities of 25 ppt or greater (Studholme et al., 1999).

Juveniles and adults are the stages of Atlantic mackerel with the greatest potential to occur within the project areas, although most individuals are found in the Lower Harbor (Raritan Bay and Sandy Hook Bay) (Woodhead, 1991 in ACOE, 1999). Atlantic mackerel were rarely collected during trawls in the New York Harbor by ACOE from October 1998 through November 1999 (ACOE, 1999). Spawning would not occur within this area. Project activities would not substantially alter the existing habitat at any of the in-water construction sites. The fixed barges have the potential to provide additional substrate for invertebrate communities in the East River, increasing food sources for fish, and may provide shelter for some fish species. Because the habitat found within the project area in the Upper Harbor does not represent a significant portion of the EFH for this species, as evidenced by the low numbers of individuals that have been collected in this area, and because this species is pelagic (occupying open water areas and not bottom habitat) this project would not be expected to have significant adverse impacts on EFH for this species. The Atlantic mackerel fishery is no longer considered overfished and this stock is now considered underexploited (MAFMC, 2002; NMFS, 2002).

SUMMER FLOUNDER

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 during the warm summer months of July and August. Summer flounder move offshore for the winter season (Packer et al., 1999). The East River is designated as EFH for larvae, juvenile, and adult summer flounder.

Larvae occur in water from 0 to 22°C (32 to 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 New York-New Jersey Harbor 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 (ACOE, 2000). Planktonic larvae (2 to 13 mm) have been found in temperatures ranging from 0 to 23°C (32 to 73°F), but are most abundant between 9 and 17°C (48 to 63°F). Salinity preference within the New Jersey area for this species was found between 20 to 30 ppt. In the Mid-Atlantic Bight, larvae were found at depths from 10 to 70 meters (32.8 to 229.6 feet). Greater densities of young fish were found in or near inlets (Packer et al., 1999).

Young summer flounder move into shallow (found usually at 0.5 to 5.0 meters [1.6 to 16.4 feet] in depth) estuaries using them as nursery habitat in the autumn, summer, and spring months. Juvenile summer flounder are well adapted for estuarine life. They are able to withstand a wide range of temperatures (greater than 11°C (52°F)) and salinities from 10 to 30 ppt. 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 when they feed by sight (ACOE, 2000). Adults are found to grow to lengths ranging from 25 to 71 cm. Adults often feed in estuaries and shelf waters in the warmer months and are more active during daylight hours since summer flounder are primarily visual feeders. Adults inhabit sand substrates usually at depths up to 25 meters, at temperatures ranging from 9 to 26°C (48 to 79°F) in the autumn, 4 to 13°C (39 to 55°F) in the winter, 2 to 20°C (36 to 72°F) in the spring, and 9 to 27°C (48 to 81°F) in the summer. Salinity is known to have minimal effect on distribution in comparison to substrate preference (Packer et al., 1999).

Juvenile and adult summer flounder are known to occur within the East River (NOAA, 2001) and have the potential to occur within the Pier 6 project area. Summer flounder larvae and adults were collected during impingement and entrainment studies conducted at the Ravenswood plant in the East River in 1993-1994 (NYSDOT, 2000). Spawning would not occur in the Upper Harbor. Summer flounder have been collected within areas of the Upper Harbor, primarily in the summer (ACOE, 1999). As discussed with respect to the other flounder EFH, summer flounder is a bottom dwelling species and therefore has a potential to be affected by the temporary increases in turbidity and shading. As with winter flounder, any temporary changes associated with the project would not significantly impact this fishery since summer flounder are widely distributed in nearby habitats and the stock is not considered overfished provided it continues to rebuild as projected (NMFS, 2002; MAFMC, 2002).

SCUP

Scup is a marine fish that occurs primarily on the continental shelf from Cape Cod, Massachusetts to Cape Hatteras, North Carolina. It migrates extensively from inshore summer grounds to offshore winter grounds. Scup arrive in the waters off New Jersey and New York by early May. During the summer months, older fish (four years old or older) tend to stay in the inshore waters of the bays while the younger fish are found the more saline waters of estuaries such as the Hudson-Raritan Estuary. Spawning occurs in May through August with a peak in June and occurs principally in the estuaries of the New York and New Jersey. Juveniles grow quickly and migrate with the rest of the population to offshore wintering grounds starting in late October and are absent from inshore waters by the end of November (ACOE, 2000). The East River is designated as EFH for eggs, larval, juvenile, and adult scup.

Scup eggs are buoyant and are rather small (0.8 to 1.0 mm), hatching in about 2 to 3 days depending on temperature. Most were collected from May-August at depths less than 50 meters (164 feet) and at temperatures ranging from 11 to 23°C (52 to 73ºF) (Steimle et al., 1999c).

Newly hatched larvae are pelagic and approximately 2 mm long. In approximately three days, diagnostic characters of the species are evident and shortly afterwards the larvae abandon the pelagic phase and become bottom dwelling. They occur at water temperatures ranging from 14 to 22°C (57 to 72°F) and occupy more saline (23 to 33 ppt) portions of bays. They are often found within the water column at depths less than 50 meters (164 feet) (Steimle et al., 1999c).

Juveniles from 15 to 30 mm (up to 10 cm) are common during November. By the end of their first year they can reach up to 16 cm. Juveniles inhabit estuarine intertidal areas at depths of 5 to 12 meters (16.4 to 39.3 feet), particularly areas with sand and mud substrates or mussel and eelgrass beds. Juveniles prefer temperatures from about 9 to 27°C (48 to 81°F) and salinities greater than 15 ppt (Steimle et al., 1999c).

Scup males and females reach sexual maturity at age two and reach about 15.5 cm. From April to December, adults can be found inshore along silt, sand, and mud substrates at depths less than 30 meters (98.4 feet). Temperature preferences for the adult species range from 6 to 27°C (43 to 81°F) and salinities from 20 to 30 ppt are preferred (Steimle et al., 1999c).

Juvenile and adult scup are known to occur in the East River (NOAA, 2001) and have the potential to occur within the Pier 6 project area, primarily in the summer and autumn. No spawning would occur within the vicinity of the project area. Adults of the species were collected during impingement studies at the Ravenswood plant in the East River (NYSDOT, 2000). Although scup have been collected within the vicinity of the project area the EFH for this marine species is primarily in higher salinity areas (ACOE, 1999). Because juveniles and adults tend to occur toward the bottom, in-water construction activities have the potential to temporarily impact scup EFH during the summer and autumn. As with other bottom dwelling fish, temporary habitat changes associated with the project would not impact this fishery since these fish are widely distributed in nearby habitats and the project area constitutes a small portion of the EFH for this species. Furthermore, the preferred EFH would be south of this area. The rebuilding schedule and management measures implemented in 1996 have resulted in dramatic increase in scup abundance even though the stock is still considered overfished (MAFMC, 2002). The temporary loss of EFH within the vicinity of the barge site should not adversely impact the status of scup stock.

BLACK SEA BASS

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 above Cape Hatteras, North Carolina, and one below. The northern population migrates seasonally: inshore 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 meters (239.5 to 534 feet) than young-of-the-year fish (56 to 110 meters [193.7 to 360.8 feet]). 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) and between 20 to 60 meters (65.6 to 197 feet) deep (ACOE, 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 meters (59 to 147 feet) deep from the Chesapeake Bay to Montauk (Steimle et al., 1999b). The East River is 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 estuarine. Young-of-the-year (YOY) fish in estuaries occupy bottom habitats with shells, amphipod tubes, and deep channel rubble and have been noted to appear on inshore jetties in late May to early June. In the Hudson River, YOY have been captured in 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 (ACOE, 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. From July to September, YOY inhabit estuarine areas in the Mid-Atlantic Bight at depths from 1 to 38 meters. They prefer rough bottoms and shell patch substrates, and find shelter around manmade structures. Juveniles can be found in water temperatures ranging from 6 to 30°C (43 to 86°F) and salinities ranging from 8 to 38 ppt (but most prefer 18 to 20 ppt). The YOY are migratory during some portions of the first year. They migrate out of the estuary and away from inner continental shelf nursery areas during the autumn as water temperatures drop (Steimle et al., 1999b).

Adult black sea bass prefer habitats similar to juveniles and perform similar migratory patterns. Adults also find shelter around manmade structures (Steimle et al., 1999b). 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, and individuals have been collected in the New York Harbor and the Arthur Kill (Smith, 1985). YOY have been collected in the lower Hudson River off Manhattan from mid-July to September (Able et al., 1995).

NOAA (Stone et al., 1994) indicates that adult and juvenile black sea bass are rare in the mixing zone portion of the Hudson River/Raritan Bay Estuary, but are known to occur in the East River from April to November (NOAA, 2001) and, therefore, have the potential to occur within the Pier 6 project area. Adults were collected during the 1993-1994 impingement studies at the Ravenswood plant in the East River (NYSDOT, 2000). Black sea bass stock is currently considered overfished (NMFS, 2002) but the stock is rebuilding and in the sixth year of a ten year rebuilding plan. The temporary increases in turbidity and shading during the construction period of the project area should not affect the continued rebuilding of this stock. The fixed barges have the potential to provide additional substrate for invertebrate communities in the East River, increasing food sources, and to serve as shelter areas for some individuals. Therefore, no effects to EFH are expected for any life stage of black sea bass.

KING MACKEREL

King mackerel is a marine fish 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. Overall, temperature appears to be the major factor governing the distribution of the species. The northern extent of its range is near Block Island, Rhode Island, near the 20°C (68°F) isotherm and the 18-meter contour. The East River is designated as EFH for eggs, larvae, juvenile, and adult king mackerel.

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 to 81°F). Adults are normally found in water with salinity ranging from 32 to 36 ppt.

King mackerel would occur only as occasional transient individuals within the New York/New Jersey Harbor Estuary system, and would only be likely to occur in the Lower Harbor area where the salinities are higher. Therefore, EFH for this species would not be affected by this project.

SPANISH MACKEREL

Spanish mackerel is a marine species that can occur in the Atlantic Ocean from the Gulf of Maine to the Yucatan Peninsula. It is most common between the Chesapeake Bay and the northern Gulf of Mexico from spring through autumn, and then heads south to overwinter in the waters of south Florida. These populations spawn in the northern extent of their ranges (along the northern Gulf Coast and along the

Atlantic Coast). The East River is designated as EFH for eggs, larvae, juvenile, and adult Spanish mackerel.

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 to 34 meters (39.3 to 111.5 feet) 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 (78.8°F). 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 stay close inshore in open beach waters (ACOE, 2000).

Overall, temperature and salinity is indicated as the major factor governing the distribution of this species. The northern extent of their 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 to 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 (ACOE, 2000).

Because this is a marine species that prefers higher salinity waters, only occasional individuals are likely to occur within the project areas. Therefore, EFH for this species would not be affected by this project.

COBIA

Cobia are large, migratory, coastal pelagic fish of the monotypic family *Racycentriadae*. 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 typically migrate from wintering grounds off south Florida into northeastern Gulf waters during early spring. They occur off 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 meters (328 to 410 feet). The East River is designated as EFH for eggs, larvae, juvenile and adult Cobia.

Information on the life history of cobia from the Gulf and the Atlantic Coast of the United States is limited. EFH 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 *Sargassum.* For cobia, EFH 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 and salinities are greater than 25 ppt.

Cobia are likely to occur only as occasional transient individuals within the project area due to its coastal migrations, pelagic nature, and salinity requirements. No effects to EFH for this species are anticipated.

SAND TIGER SHARK

The sand tiger is a large, coastal species found in tropical and warm temperate waters throughout the world. It is often found in very shallow water (< 4 m). The East River is designated as EFH for sand tiger shark larvae (neonates).

Males mature between 190 to 195 cm total length (TL) or four to five years, and females at more than 220 cm TL or six years. The sand tiger has an extremely limited reproductive potential, producing only two young per litter. In North America, the sand tiger gives birth in March and April to two young that measure about 100 cm TL. Parturition is believed to occur in winter in the southern portions of its range, and the neonates migrate northward to summer nurseries. The nursery areas are the following Mid-Atlantic Bight estuaries: Chesapeake, Delaware, Sandy Hook, and Narragansett Bays, as well as coastal sounds.

The species congregates in coastal areas in large numbers during the mating season, and the species is limited in its fecundity with only two pups per litter often contributing to overfishing vulnerability. Embryos, being cannibalistic, consume other embryos until only one from each oviduct survives. Each pup grows to be quite large (up to 40 inches) before birth. Neonates, after birth, migrate northward in the summer to estuarine nursery areas (University of Delaware, 2001). The EFH for sand tiger sharks for neonate and early juveniles are the shallow coastal waters from Barnegat Inlet, New Jersey to Cape Canaveral, Florida to the 25-m isobath.

This species is not expected to occur within the New York/New Jersey Harbor Estuary except as occasional transient individuals. Therefore, it is unlikely that this species would be found in the project area and EFH for sand tiger shark would not be affected by the project.

SANDBAR SHARK

The sandbar shark is cosmopolitan in subtropical and warm temperate waters. It is a common species found in many coastal habitats. It is a bottom-dwelling species most common in 20 to 55 meters (65.6 to 180 feet) of water, but occasionally found at depths of about 200 meters (656 feet). The East River is designated as EFH for sandbar shark larvae (neonates).

The sandbar shark is a slow growing species. Both sexes reach maturity at about 180 cm TL. Estimates of age of maturity range from 15 to 16 years to 29 to 30 years, although 15 to 16 years is the commonly accepted age of maturity. Young are born at about 60 cm TL (smaller in the northern parts of the North American range) from March to July. Litters consist of one to 14 pups, with nine being the average. The gestation period lasts about a year and reproduction is biennial. In the United States, the sandbar shark uses estuarine nurseries in shallow coastal waters from Cape Canaveral, Florida, to the northern extent of the range at Great Bay, New Jersey (Merson and Pratt, 1997). Bays from Delaware to North Carolina are important nursery areas (Knickle, 2001).

Neonates have been captured in Delaware Bay in late June. Young-of-the-year are present in Delaware Bay until early October when the temperature falls below 21°C (69.8°F). Sandbar sharks were captured in varying salinities but no specimens were caught at salinities below 22 ppt. The EFH for sandbar shark neonates and early juveniles are shallow coastal areas; nursery areas in shallow coastal waters from Great Bay, New Jersey to Cape Canaveral, Florida, especially Delaware and Chesapeake Bays (seasonal summer); also shallow coastal waters up to a depth of 50 meters (164 feet) on the west coast of Florida and the Florida Keys. Neonates and early juveniles require salinity greater than 22 ppt and temperatures greater than 21°C (69.8°F).

This species is not expected to occur within the New York/New Jersey Harbor Estuary except as occasional transient individuals. Therefore, it is unlikely that this species would be found in the project area and EFH for sandbar shark will not be affected by the project.

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