ESSENTIAL FISH HABITAT ASSESSMENT
FOR NEWARK BAY MAINTENANCE DREDGING;
NEWARK BAY – PORT NEWARK CHANNEL, PORT NEWARK PIERHEAD CHANNEL, & PORT ELIZABETH CHANNEL OF NEWARK BAY, HACKENSACK & PASSAIC RIVERS FEDERAL NAVIGATION PROJECT

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A. INTRODUCTION

In compliance with Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (1996 amendments), the New York District, U.S. Army Corps of Engineers, is providing this assessment of the potential effects of maintenance dredging of the Federal Navigation Project at Newark Bay - Port Newark Channel, Port Newark Pierhead Channel, and Port Elizabeth Channel of Newark Bay, Hackensack & Passaic Rivers Federal Navigation Channels, N.J on essential fish habitats.

The following assessment addresses the physical effects of dredging at Newark Bay, including a description of the physical habitat, the listed managed species, including specific life stages, and associated major prey species. Based on the potential for adverse effects on designated species Essential Fish Habitat (EFH), recommendations are made for best management practices, which minimize the potential effects and the need for seasonal restrictions on dredging.

B. PROJECT AUTHORIZATION, DESCRIPTION, AND PROPOSED ACTION

1. Federal Project Authorization

The Newark Bay Channels were authorized by the Rivers and Harbors Acts of 1922 and subsequently modified on 1943, 1954, 1964, 1966, 1975 and 1985. The Newark Bay Channels includes the following channels:

a. A main channel, including widenings and maneuvering areas, 40 ft deep, 700 ft wide to the branch channel at Port Newark, thence 500 ft wide, to a turning basin at the junction of the Hackensack and Passaic River channels, length about 4.7 miles.
b. A branch channel at Port Newark (Port Newark Branch Channel), 800 ft wide, leading to an inshore channel, 400 ft wide, total length 1.6 miles. The depth of the channel is 40 ft up to 1 mile into the channel at which point the project depth becomes 35 ft until the channel’s termination.
c. A pierhead channel (Port Newark Pierhead Channel) 200 ft wide, between the Port Newark and Elizabeth branch channels, length 4,100 ft.
d. A branch channel (Elizabeth Channel) 45 ft deep, 500 ft wide and 1.4 miles long.
e. A pierhead channel (Port Elizabeth Pierhead Channel) 40 ft deep, 290 ft wide, between Elizabeth and South Elizabeth branch channels, length 1.1miles.
f. A branch channel (South Elizabeth Channel) 40 ft deep, 290 ft wide and 0.6 miles long.

2. Federal Project Description

The Newark Bay Federal Navigation Channel consists of a main channel 700 ft wide to the branch channel, to Port Newark, thence 500 ft wide to a turning basin 1,300 ft long and 900 ft wide at the junction of the Hackensack and Passaic River channels. The main channel is about 4.7 miles long. There is a combined bend cutoff and maneuvering area at the south side of the junction with the Elizabeth branch channel. At the Kill Van Kull and Port Newark channels, a widening of bends exists. At Port Newark there is a branch channel 800 ft wide leading to an inshore channel 400 ft wide with a total length of about 1.6 miles. A 200 ft wide, 4,100 ft long, pierhead channel exists along the east bulkhead between the Port Newark and Elizabeth branch channels. At the Elizabeth Marine Terminal there is a branch about 1.4 miles long and 500 ft wide.

3. Description of Planned Action

Maintenance dredging of portions of Newark Bay Federal Navigation Project was last performed in 2002 with 68,510 cubic yards (CY) removed from the select shoals of the Port Newark Branch and the Main channel. The material was placed at the OENJ site, an approved, state of New Jersey permitted upland site. Dredging of the Port Newark Channel, Port Newark Pierhead Channel, and Port Elizabeth Channel is proposed during the current dredging cycle. The proposed maintenance dredging would involve the removal of between 400,000 and 550,000 CY of material to –40 feet Mean Low Water (MLW) in Port Newark Channel and Port Newark Pierhead Channel, and –45 feet MLW in Port Elizabeth Channel, with 2 feet allowable overdepth. The dredged material from this dredging cycle will be placed at a state approved and permitted upland placement site(s) provided by the Port Authority, the project co-sponsor. The proposed dredging for this cycle would not occur before October 2005 and is expected to require no greater than approximately one hundred sixty five (165) days.

The purpose of the proposed dredging is to maintain the authorized project dimensions, thereby assuring safe and economical use of the Newark Bay Federal Navigation Channel by shipping interests. Maintenance dredging of a channel is generally accomplished by a clamshell dredge with an environmental bucket, or other similar plant.

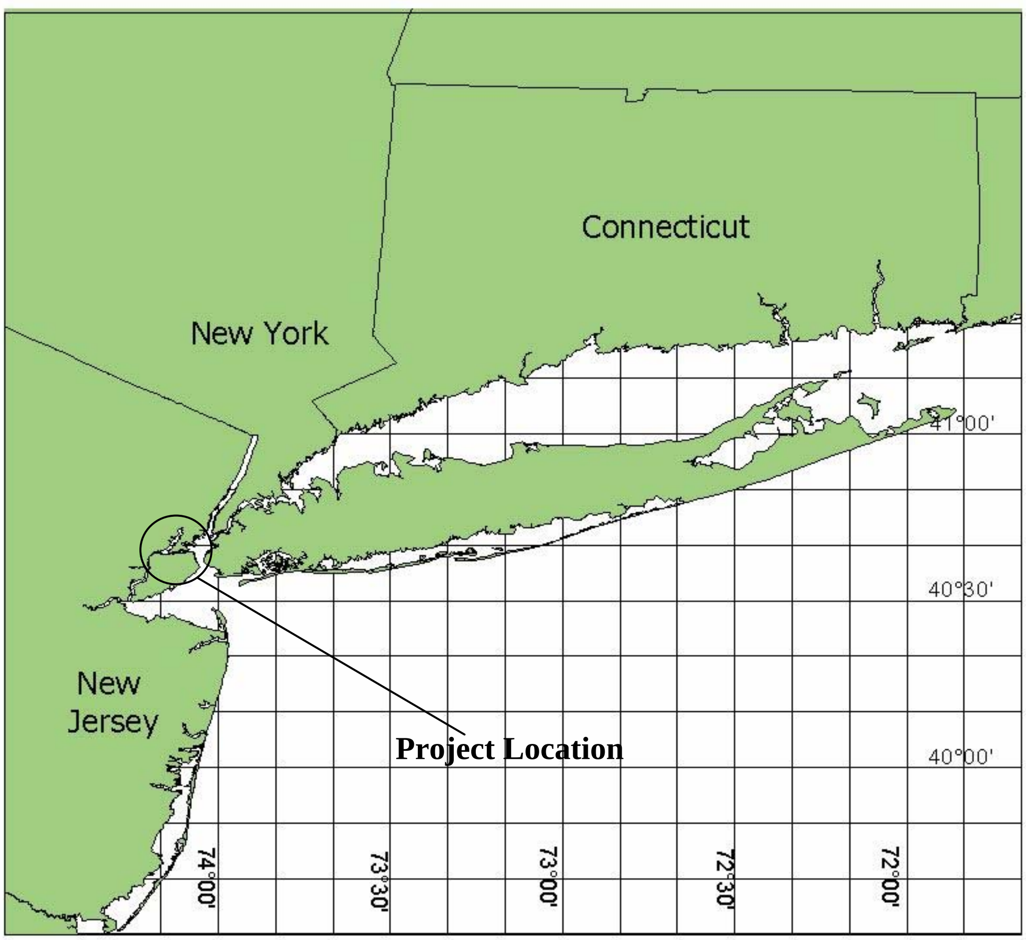
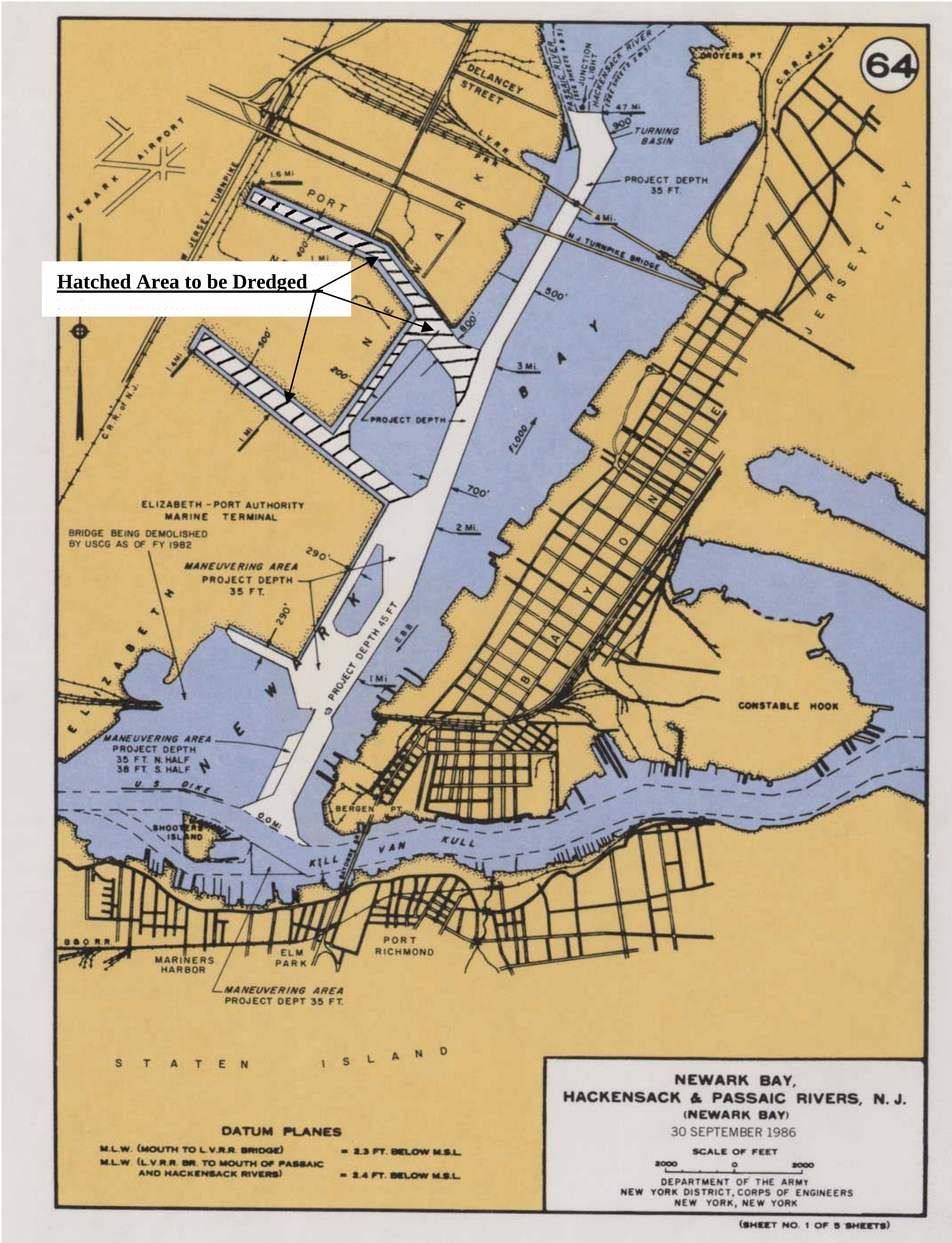


FIGURE 1



Hatched Area to be Dredged
64
NEWARK BAY,
HACKENSACK & PASSAIC RIVERS, N. J.
(NEWARK BAY)
30 SEPTEMBER 1986
SCALE OF FEET
2000 0 2000
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
NEW YORK, NEW YORK
(SHEET NO. 1 OF 5 SHEETS)
DATUM PLANES
M.L.W. (MOUTH TO L.V.R.R. BRIDGE) = 2.3 FT. BELOW M.S.L.
M.L.W. (L.V.R.R. BR. TO MOUTH OF PASSAIC AND HACKENSACK RIVERS) = 2.4 FT. BELOW M.S.L.
STATEN ISLAND
ELIZABETH - PORT AUTHORITY
MARINE TERMINAL
BRIDGE BEING DEMOLISHED
BY USCG AS OF FY 1982
MANEUVERING AREA
PROJECT DEPTH
35 FT.
MANEUVERING AREA
PROJECT DEPTH
35 FT. N. HALF
38 FT. S. HALF
MANEUVERING AREA
PROJECT DEPT 35 FT.
PROJECT DEPTH 45 FT
PROJECT DEPTH
PROJECT DEPTH
35 FT.
TURNING
BASIN
N.J. TURNPIKE BRIDGE
CONSTABLE HOOK
BERGEN PT.
SHOOTERS
ISLAND
MARINERS
HARBOR
ELM
PARK
PORT
RICHMOND
KILL VAN KULL
U. S. DIKE
NEWARK BAY
PORT NEWARK
ELIZABETH
BAYONNE
JERSEY CITY
NEWARK AIRPORT
NEW JERSEY TURNPIKE
DELANCEY STREET
DROYERS PT.
C.R.R. of N.J.
B & O R.R.
FLOOD
EBB

FIGURE 2

C. DESCRIPTION OF STUDY AREA

Newark Bay is rectangular, approximately 5.5 miles (8.9 km) long, varying in width from 0.6 to 1.2 miles, with the widest section of the Bay opposite Port Newark and the narrowest section opposite Port Elizabeth. With the exception of the maintained shipping channels, turning basins, and docking facilities, Newark Bay is very shallow, with extensive shallow areas found throughout the eastern half. Newark Bay may be divided longitudinally into four reaches: (1) South Reach, the southern section of the Bay corresponding to the area between the Arthur Kill/Kill Van Kull to the south and South Elizabeth Channel to the north (South Elizabeth Channel being the southern access channel to Port Elizabeth); (2) Middle Reach, the Bay area in front of Ports Elizabeth and Newark (location of the constructed Newark Bay Combined Disposal Facility [NBCDF], extending from South Elizabeth Channel north to Port Newark Channel; (3) North Reach, extending from Port Newark Channel to a point approximately 3,000 ft. north of the CSX railroad bridge; and (4) the northern area, consisting of the Kearny Point Reach (corresponding to the area around the mouth of the Passaic River), and the Droyers Point Reach (corresponding to the area around the mouth of the Hackensack River) (USACE-NYD 1998).

In the Middle Reach, the Port Elizabeth piece extends to the Navigation Channel, with water depth maintained at approximately 45 ft. by dredging. A narrow ship channel is maintained at the Port Newark pierhead. The large shallow area between the Port Newark Pierhead Channel and the Navigation Channel (where water depth ranges from 1 to 5 ft. MLW) corresponds to Area 1 in the developed NBCDF site 1S. The eastern side of Newark Bay, included in the Middle and North Reaches, is an extensive shallows area with water depths ranging from 1 to 11 ft. MLW. The presence of the Federal Navigation Channel along the western side of the Bay in the North Reach results in limited shallows along the Newark shore in this area. Area 2 is located due east of Port Newark, which is itself located north of the Port Newark Channel.

D. ANALYSIS OF EFFECTS ON EFH

1. Habitat Characteristics – Newark Bay Channel Maintenance Dredging Site

Newark Bay and its shoreline have been modified extensively by dredging, filling, and commercial operations since the mid-1800s (Crawford et al. 1994). The Bayonne, or eastern, side of Newark Bay is characterized by varied industrial complexes near the Hackensack River and the Kill Van Kull. Residential areas, school campuses, parks, and light industry are present over most of the remainder of the shoreline. The Bay's western shore is dominated by the extensive container-ship facilities of the Elizabeth Marine Terminal and Port Newark. Small, isolated vegetated or emergent wetland areas are found on the western shore of the Bay north and south of Port Newark and Elizabeth Marine Terminal. Most of the remainder of Newark Bay is designated as either “estuarine, subtidal, open water substrate unknown” or “estuarine, intertidal flat” (USACE-NYD 1998).

Hydrologic Characteristic

As is true for most of the New York and New Jersey Harbor Estuary Complex, the aquatic resources of Newark Bay are impacted by a variety of inorganic and organic materials. These materials are released from numerous sources, including municipal and commercial discharges, nonpoint sources, combined sewer overflows (CSO), and accidental spills. Although some of these contaminants are considered relatively nonreactive, most have a strong affinity to sediments and fine-grained particles. Largely the sediment suspension, deposition, and transport processes in Newark Bay govern the accumulation, movement, and transport pathways for these substances.

The Hudson River is the largest river entering the Harbor, with a mean annual flow on the order of 14,000 cubic feet per second (cfs) as estimated from USGS stream flow data at Green Island. Other major tributaries include the Passaic and the Hackensack rivers, which enter Newark Bay approximately one mile north of Port Newark. Annual mean flows in the Passaic and Hackensack are approximately 1,100 cfs and 100 cfs, respectively.

Numerous wastewater treatment plants (STPs) and combined sewer overflows (CSOs) contribute freshwater (in addition to pollutant loads) to the system. The contribution of these sources is small compared to the river input during average conditions, but may be similar to the rivers under low runoff conditions in some areas (Jay and Bowman 1975, Hydroqual 1991).

Region	Salinity Minimum	Salinity Average	Salinity Maximum
Newark Bay	13.6 ppt	19.7 ppt	23.6 ppt

Newark Bay is a partially stratified estuary in which salinity at the surface is typically lower than salinity on the bottom. Measurements in the estuary indicate that for Upper New York Bay, differences in salinity between the surface and bottom of the water column can be nearly 10 parts per thousand (ppt) during periods of high Hudson River flows. Salinity differences are on the order of 1-3 ppt during other times of the year. A similar pattern occurs in northern reaches of Newark Bay, with large differences in water column salinity when the Passaic and Hackensack Rivers are near peak discharge. Mixing in the southern portion of Newark Bay and the Kills creates surface-to-bottom salinity differences of approximately 1-3 ppt throughout the year.

Geologic Properties

Based on borings and laboratory test data published by PANYNJ (1996) and USACE (1996, 1997b), and on recent borings performed by Battelle under contract to USACE, the stratigraphy at Newark Bay is as follows:

(1) Black organic silt - This stratum of very soft to soft organic sediments extends from approximately 5 to 18 ft MLW;
(2) Sand - A layer of loose to medium sand about 12 ft thick underlies the organic silt, extending from about 18 to 30 ft MLW;
(3) Stiff clay and silt - A 45- to 60-ft thick layer of stiff clay and silt or varved silt and clay underlies the sand, from a depth of about 30 ft MLW to the top of rock;
(4) Bedrock - Rock at Newark Bay is red Shale.

Newark Bay sedimentology reflects the deposition of sediments from river input at the northern end and tidal input at the southern end. Sediments within Newark Bay tend to be a fine-grained combination of silts, clays and sands with larger-grained materials present in the southern end of the Bay due to materials introduced by tidal activity.

<u>Biota</u>

Finfish

The finfish community in the Hudson/Raritan Estuary system is typical of large coastal estuaries and inshore waterways located along the Mid-Atlantic Bight. It supports a variety of estuarine, marine, and anadromous fish species. Situated in the transition zone between northern cold-water (boreal) species and temperate (warm-water) species, New York Bight and the New York and New Jersey Harbor Estuary act as a spawning ground, migratory pathway and a nursery/foraging area for a variety of fish species.

Many of the species that are seasonally abundant in the project area are transient or migratory species, moving through the project area to upstream spawning grounds or entering the area on a seasonal basis from nearby ocean waters. These include estuarine migratory species that depend on the estuary primarily as a nursery, or as a forage area for juveniles or adults.

Striped bass are among those species that rely on the estuary as a nursery and forage area for juveniles and adults. Species that frequent the harbor during similar life history stages include both marine and estuarine predators such as winter flounder, bluefish, and summer flounder. These fish migrate in and out of the estuary on a seasonal basis depending on spawning area (estuarine vs. marine) and period (winter vs. summer).

Relatively few species are year-round residents in the project area. Estuarine residents tolerate the naturally wide range and abrupt changes in salinity from tidal freshwater to marine environments (0.5 to 30 ppt). These species generally begin spawning in late spring and continue throughout most of the summer, following general onshore and offshore seasonal movement patterns (i.e., onshore in spring and summer, offshore to deeper waters in fall and winter). Most life stages of these species may be found in the estuary throughout the year. These species provide an important forage base for larger predatory species.

Previous biological investigations have characterized the seasonal distribution and composition of the fish community in various habitats and areas of the Harbor estuary. Fish sampling was conducted in the Arthur Kill, Kill Van Kull, and Newark Bay in 1984-1985 (USACE 1985) and from April 1995 to March 1996 (LMS 1996). Sampling specific to Newark Bay was conducted in 1987-1988 (Will and Houston 1989) and from May 1993 to April 1994 (NMFS 1994).

The fish sampling programs described above provide an inventory of fish species that may occur in the project area (Table 1). The list shows the occurrence of 42 species from the lower Hackensack River through Newark Bay, the Arthur Kill/Kill Van Kull, Raritan-Sandy Hook Bays, and Lower New York Bay. Most species listed might be expected to occur in the project area, excluding some freshwater species that represent unique or uncharacteristic catches. A limited number of species dominate the fish community, with the vast majority of species occurring in very low numbers. Many of the marine species are semitropical forms that move north along the Atlantic coast during summer.

Table 1
Inventory of Fish Species Collected from Sampling Programs Conducted in the Project Area, 1993-1994 and 1995-1996

Species	Common Name	1993-1994 (a)	1995-1996 (b)
Raja erinacea	Little skate	X	
Acipenser oxyrhyncus	Atlantic sturgeon	X	
Anguilla rostrata	American eel	X	
Conger oceanicus	Conger eel	X	
Alosa aestivalis	Blueback herring	X	X
Alosa pseudoharengus	Alewife	X	X
Alosa sapidissima	American shad	X	X
Brevoortia tyrannus	Atlantic menhaden	X	
Clupea harengus	Atlantic herring	X	X
Dorosoma epedianum	Gizzard shad	X	X
Engraulidae	Anchovies		
Anchoa mitchilli	Bay anchovy	X	X
Anchoa hepsetus	Striped anchovy		X
Osmerus mordax	Rainbow smelt	X	
Microgadus tomcod	Atlantic tomcod	X	X
Urophycis chuss	Red hake	X	
Urophycis regia	Spotted hake	X	X
Fundulus majalis	Striped killifish	X	
Menidia menidia	Atlantic silverside	X	X
Gasterosteus aculeatus	Threespine stickleback	X	
Hippocampus erectus	Lined seahorse	X	
Syngnathus fuscus	Northern pipefish		X
Myoxocephalus aenaeus	Grubby		X
Morone americana	White perch	X	X
Morone saxatilis	Striped bass	X	X
Pomatomus saltatrix	Bluefish		X

Table 1
Inventory of Fish Species Collected from Sampling Programs Conducted in the Project Area, 1993-1994 and 1995-1996

Species	Common Name	1993-1994 (a)	1995-1996 (b)
Caranx hippos	Crevalle jack	X	X
Stenotomus chrysops	Scup	X	X
Cynoscion regalis	Weakfish	X	X
Leiostomus xanthurus	Spot	X	X
Menticirrhus saxatilis	Northern kingfish	X	X
Bairdiella chryosura	Silver perch	X	
Micropogon undulatas	Atlantic croaker		X
Tautoga onitis	Tautog	X	
Tautogolabrus adspersus	Cunner	X	X
Pholis gunnellus	Rock gunnel	X	
Scomber japonicus	Chub mackerel	X	
Peprilus triacanthus	Butterfish	X	X
Etropus microstomus	Smallmouth flounder	X	
Paralichthys dentatus	Summer flounder	X	X
Pseudopluronectes americanus	Winter flounder	X	X

(a) Lawler, Matusky & Skelly Engineers LLP (LMS). 1996. Newark Bay Biological Monitoring Program April 1995-March 1996. Report prepared for the Port Authority of NY/NJ

(b) National Marine Fisheries Service. Undated. Results of a Biological and Hydrological Characterization of Newark Bay, New Jersey, May 1993-April 1994

In order to describe the species composition and relative abundance of fishes in shoal areas of Newark Bay, trawl samples were collected there from April 1995 to March 1996 (LMS 1996). Four shoal areas in Newark Bay were sampled to provide information on the fish community in shoal water. Species collected from the shoal stations were dominated by relatively few species. Eight species - bay anchovy, striped bass, winter flounder, windowpane, Atlantic silverside, summer flounder, northern pipefish, and white perch - accounted for at least 1% of the total catch at a station. Most species occurred infrequently, and in very low numbers during the 12-month long study. However, there was a consistent seasonal pattern for fishes among the shoal stations. Fish were relatively abundant from April through October, but much less abundant from November through March. During the period when fish were most abundant only four species - striped bass, winter flounder, summer flounder, and bay anchovy - occurred during each month.

NMFS undertook a major fish-sampling program in Newark Bay as part of an evaluation of a flood control project for the Passaic River Basin (NMFS 1994). This study provides additional information on habitat preference of species, e.g., channel vs. shoal areas. Monthly fish sampling was conducted from May 1993 through April 1994. Juvenile and adult fish were sampled with bottom trawls and gill nets. Larval fish were sampled with plankton nets of two different mesh sizes.

Twenty-eight species of fish were collected with a bottom trawl from seven shoal stations on the east side (relative to main channel) of Newark Bay in 1993-1994. Six species—striped bass, winter flounder, bay anchovy, Atlantic herring, Atlantic tomcod, and Atlantic silverside—accounted for 1% or more of the total number collected at the shoal stations combined.

The seasonal occurrence of fishes on the shoals in Newark Bay was similar to that observed in the 1995-1996 (LMS 1996) sampling program. Fish were more abundant from May through October in 1993-1994, with very low numbers from January through April. There was low to moderate abundance in November and December. The 1995-1996 study showed a very similar seasonal pattern, with slightly fewer fish in November and December and more fish in April.

TABLE 2
Seasonal Abundance at Channel Stations in Newark Bay, 1993 – 1994

Species	Season	Species	Season
Alewife	Fall	Spotted hake	May and June
Gizzard shad	Fall and Winter	White perch	Late Fall and Winter
Bay anchovy	Summer	Striped bass	November to April
Rainbow smelt	Winter	Weakfish	August to October
Atlantic tomcod	Summer	Summer flounder	Summer

Benthos

The community of aquatic invertebrates attached to, resting on, or living in the bottom sediments is called the benthos (Odum 1971). Many benthic species are filter feeders of suspended particulate matter, or deposit feeders of soft organic sediments. These organisms, such as worms, bivalves, and shrimps, are an important food resource for fish. Since the benthos is mostly composed of sessile or relatively immobile invertebrates that cannot easily avoid intolerable conditions, the composition of the benthic community reflects prevailing habitat conditions. The substrate type, such as soft sediments, well-sorted sands, rocky outcrops, or manmade structures (pilings or jetties), is the habitat component that is generally most influential on species composition and distribution. Other factors that affect the composition and relative abundance of the benthos are physical parameters, such as currents, wave action and disturbance, water column physical parameters (dissolved oxygen, salinity, and temperature), and life history factors, which are primarily related to reproduction. Therefore, the dependence of the benthic community on bottom sediments for food and shelter makes benthos analysis an important consideration in the evaluation of a dredging project.

Coch (1986) found that the rivers at the northern end and the Lower and Upper Bay at the southern end influenced Newark Bay sediment patterns. There was an input of sandy-clayey silt from the northwest by the Passaic River and clayey-silty sand from the northeast by the

Hackensack River. Sandy-clayey silt underlay the central part of the Bay, grading southward into clayey-silty sand and sandy-clayey silt where it connects with the Arthur Kill and the Kill Van Kull. Tidal interchange with the Lower and Upper Bay through the Arthur Kill and Kill Van Kull results in coarser sediments in the southern portion of the Bay.

Benthic fauna of Newark Bay were surveyed during 1985, with samples collected at 30 stations throughout the western and southern half of Newark Bay (the northern limit was Port Newark) and the Kill Van Kull in the vicinity of Shooters Island (USACE-NYD 1987). Benthic sampling included an equal number of sampling stations from shallow-water (7-18 ft) and deeper-water (33-40 ft) stations. In general, greater numbers of organisms and species were recorded during the summer sampling program, with a significant difference (α= 0.5) noted for the shallow-water-depth stations.

Overall benthic organism abundance in Newark Bay was classified as moderate. The Newark Bay benthic community was dominated by polychaete worms, which are habitat generalists and exhibit high tolerance to environmentally stressful conditions such as low DO levels. Two polychaete worms, *Streblospio benedicti* and *Sabellaria vulgaris*, and the soft shell clam, *Mya arenaria,* were dominant during both the spring and summer periods. Three polychaete worm species, *Scolecolepides viridis*, *Nereis succinea*, and *Polydora ligni*, were dominant in the spring, being replaced by *Spio setosa* (polychaete), *Balanus improvisus* (barnacle), and *Molgula manhattensis* (tunicate) during the summer. There was a high degree of variability in individual species abundance levels between the shallow- and deep-water stations; however, no significant difference was detected in abundance or species representation between the two habitat types. Physical and chemical parameters measured during these studies included water temperature, salinity, and DO. All three parameters were similar at the shallow- and deep-water stations, and it was concluded that none of the three was limiting to the development of the benthic community. Stations characterized by finer-grained sediments in the center of the Bay exhibited lower species numbers and lower overall abundance.

Twenty-five stations (eighteen channel stations and seven shallow-water stations) located in the northern and central sections of Newark Bay were sampled for benthic macroinvertebrates during 1993 and 1994 (NOAA 1994). Bottom sediments at the northern end of the Bay in the vicinity of the mouth of the Passaic River consisted primarily of soft, black, silty clay; north of the two bridges the bottom sediments were soft, with varying amounts of gravel, shell, sand, silt, and clay. South of the bridges the bottom sediments in both the channel and shoal stations were light, soft silt and clay, with some shell fragments. As noted for the benthic study conducted during 1985, the benthos at both shallow-water and channel stations were similar in species composition (dominated by polychaete worms) and exhibited similar seasonal abundance patterns. It was determined that the Newark Bay benthic community had lower overall abundance and lower species diversity when compared to the benthos of Upper New York Bay.

Lawler, Matusky & Skelly Engineers LLP (LMS) conducted a Newark Bay benthic sampling program for PANYNJ from April 1995 through March 1996 (LMS 1996). Seven stations were sampled: five of the stations were in Newark Bay and included stations in the immediate vicinity of the proposed Newark Bay Combined Disposal Facility (NBCDF) site. Polychaetes dominated the benthos collected at the Newark Bay stations. Six species of polychaete worms were among the ten most abundant species identified in the Bay samples. The dominant species collected was the polychaete worm *Scoloplos* sp., which accounted for 28.5% of the total. The five other polychaetes ranked in the top 10 were *S. benedicti* (rank = 2, 23.7% of the total), the family

Paraonidae (rank = 4, 7.0% of the total), the family Phyllodocidae (rank = 8, 1.7% of the total), *Glycera* sp. (rank = 9, 1.7% of the total), and *P. ligni* (rank = 10, 1.6% of the total). The other species rounding out the top 10 by abundance included two bivalves, *Mulinia lateralis* (rank = 3, 15.4% of the total), and *M. arenaria* (rank = 6, 4.4% of the total); the estuarine isopod *Cyathura polita* (rank = 5, 5.8% of the total); and the cumacean *Oxyurostylis smithii* (rank = 7, 1.9% of the total). Species composition and abundance patterns were similar among the five Newark Bay stations (LMS 1996).

Overall, the moderate organism abundance and generally low species diversity in the benthos suggest that Newark Bay is a stressed environment that restricts the development of the benthic community (USACE-NYD 1987).

2. Effects on Physical Habitat – Newark Bay Channel Maintenance Dredging Site

Maintenance dredging of the Newark Bay Channel is proposed by the Corps. The maintenance dredging, which is scheduled from 1 October 2005 to 31 March 2006, is part of an ongoing maintenance program. The physical effects of dredging would be the removal of existing sediments to deepen the project area to design depths as shown in Figure 1. Due to both the dynamics and the nature of the sediments (finer grained sediments), there should be (1) negligible loss in the benthic invertebrate community as the substrate returns to a typical condition, and (2) a minor localized increase in turbidity due to the use of a clamshell dredge or similar plant. The depths in the work area would remain within the same depth range that has been present for over fifty years. The substrate of the channel would show little or no change subsequent to maintenance dredging. Pre-dredging conditions are further insured by immediate re-deposition of similar sediments. Noise generated by the project would be typical of the normal traffic of commercial and recreation vessels using Newark Bay and Newark Bay Channel.

3. Effects on Managed Species

a. EFH Species Listed for the Project Area

The managed species with EFH designations as noted in the summarization of major estuaries, bays, and rivers comprised of the Hudson River, Raritan / Sandy Hook Bays, New York / New Jersey, which contains the project domain, are listed in Table 2 by life stages. Among the listed species, 16 species of fish could occur in the designated area based on its broad distributional boundaries (NMFS 1999). Table 3 summarizes their general habitat parameters by life stage.

b. Potential EFH Impacts – Dredging

The following subsections provide a species by species assessment for the species identified below. However, for all species, the impacts during construction would be minimal and temporary for the following reasons:

- Typically turbidity associated with dredging will reach background levels within an hour or less after dredging stops, dependent upon the composition of the material being dredged. Tidal currents run parallel to the channel, thereby minimizing the chance of sediments being deposited on contiguous flats. Conditions set forth in the New Jersey State Department of Environmental Protection Water Quality Certificate ensure continued water quality.
- The temporal constraints of the project preclude any long-term disturbance, including persistent turbidity.

- Bodily injury or entrainment of species in the Newark Bay Channel may occur as a result of failure to flee the dredge area. However, the likelihood of this scenario occurring is unlikely due to several factors: 1) The generally small contact footprint of the clam shell dredge, characteristically up to a 12 foot by 14 foot area; 2) Dredging is accomplished in a sequential manner, resulting in continuous dredging in one zone, rather than random operations, increasing the chance of escape; and 3) Noise from vessels repetitively working in one area with the relatively shallow waters of the Newark Bay Channel will further increase the chance of flight from the area. Therefore, given the wide distribution of EFH species and the given population density at the Newark Bay Channel, the possibility of dredge contact or entrainment during dredging is minimal.
- Newark Bay Channel is bordered by well-trafficked, relatively shallow waterways, used by both recreational and commercial vessels. The disturbance created by the daily operations during the maintenance dredging should have no greater impact.
- After completion of the Newark Bay Channel maintenance dredging, the exposed substrate should present benthic habitat of no less quality than previously exposed substrate.

For all species and respective EFHs, the impacts during maintenance dredging will be minimal. Best management practices will be used to minimize potential effects, precluding the need for mitigation or seasonal restrictions.

4. EFH-Designated Species Feeding Habits and Habitat Assessments

Although dredging may affect feeding success of EFH species, this will be a temporary occurrence in a relatively small area. Turbidity may impact sight feeding, but affected species will undoubtedly flee to neighboring waters where feeding will be less problematic. In other cases, dredging may change primary diets, but should minimally impact feeding success. Therefore, no more than minimal impact to feeding success should occur to EFH species.

<u>Species by Species Feeding Habits for the Identified Species / Life Stages</u>

Red Hake Juveniles feed at night on small benthic and pelagic crustaceans, including larval and small decapods, shrimp and crabs, mysids, euphausids, and amphipods (Stiemle *et al.*, 1999a). Amphipods, small decapods (i.e., *Crangon* shrimp), and polychaetes are important prey in the middle Atlantic Bight, but dominant prey can change seasonally and include copepods and chaetognaths (Bowman *et al.*, 1987). Adult and juvenile red hake prey upon crustaceans, but also consume a variety of demersal and pelagic fish and squid (Stiemle *et al.*, 1999a). Although polychaetes are a dominant prey for red hake, prey are varied and impact to feeding success would be minimal.

Winter Flounder Winter flounder are omnivorous or opportunistic feeders consuming a wide variety of prey. According to Pearcy (1962), metamorphosing and recently metamorphosed larvae feed on copepods and harpacticoids while young-of-the-year and one-year-old juveniles gradually feed more and more on amphipods and polychaetes. They also feed on bivalve siphons, Crangon shrimp, and sand dollars (Pereira *et al.*, 1999). The amphipod *Ampelisca abdita* made up the majority of the diet of young flounder in Jamaica Bay, NY (Franz and Tanacredi, 1992). Winter flounder (11-70 cm) caught in NMFS trawl surveys between 1973 and 1990 were feeding primarily on polychaetes (>50% total prey volume in stomachs) and less so on amphipods (10-30%) (Pereira et al., 1999). Juvenile and adult winter flounder are sight feeders, using their dorsal fins to raise their heads off the bottom (Olla *et al.*, 1969). Although dredging may affect feeding success of adults, this will be a temporary occurrence in a relatively small area. Turbidity may impact sight feeding, but adults will undoubtedly flee to neighboring waters where feeding will be less problematic. For these opportunistic feeders, dredging may change their primary diet, but should minimally impact their feeding success. Therefore, no more than minimal impact to feeding success should occur to this opportunistic feeding species.

Windowpane Flounder Like summer flounder, windowpane flounder have larger mouths than winter flounder and feed primarily on small crustaceans (e.g., mysids and decapod shrimps), also fish larvae (red hakes, tomcod, other flounder) (Chang *et al*., 1999). The mysid *Neomysis Americana* was a majority prey item in Long Island Sound and hake, herring, sand lance, and silversides were found in stomachs of windowpane flounder caught off of Woods Hole, MA (Bigelow and Schroeder, 1953). Although dredging may affect feeding success of adults, this will be a temporary occurrence in a relatively small area. Turbidity may impact sight feeding, but adults will undoubtedly flee to neighboring waters where feeding will be less problematic. Dredging may change their primary diet, but should minimally impact their feeding success. Therefore, no more than minimal impact to feeding success should occur to winter flounder.

Atlantic Sea Herring Juvenile Atlantic sea herring, like adults, are planktivorous and feed on a wide variety of species, including some fish larvae (Reid *et al*., 1999). Since this species feeds in the water column, turbidity resulting from dredging activities may have some impact on feeding success. However, the present population is likely to travel to adjacent waters where feeding will be less problematic during dredging operations. Therefore, no more than minimal impact to feeding success should occur to Atlantic sea herring.

Bluefish Bluefish are mostly pisciverous, but may also eat crustaceans and polychaetes (Fahay *et al*., 1999). Juveniles and adults generally consume whatever prey are available. Juvenile bluefish in Sandy Hook Bay in 1981, 1983, and 1984 consumed a variety of polychaete, crustacean, and fish prey (Friedland *et al*., 1988). Fish first appear in the diets of juveniles at lengths of 30 mm, and by 40 mm they are the major food item (Fahay *et al*., 1999). Soon after this shift in diet, juveniles migrate inshore to occupy near shore estuarine habitats (Marks and Conover, 1993). In terms of biomass and frequency of occurrence, opossums shrimp, grass shrimp, bay anchovy, striped killifish, and Atlantic silversides dominated the diet. At least 70 species of fish have been found in bluefish stomachs. Invertebrates eaten by bluefish also include shrimp, lobster, squid, crab, annelid worms, and surf clams. Turbidity may impact sight feeding, but the species will undoubtedly flee to neighboring waters where feeding will be less problematic. For these opportunistic feeders, dredging may change their primary diet, but should minimally impact their feeding success. Therefore, no more than minimal impact to feeding success should occur to this opportunistic feeding species.

Atlantic Butterfish Butterfish feed mainly on planktonic prey, including thaliaceans, squids, copepods, amphipods and decapods, coelenterates (primarily hydrozoans), polychaetes (primarily Tomopteridae and Goniadidae), small fishes and ctenophores (Cross *et al*., 1999). Since this species feeds in the water column, turbidity resulting from dredging activities may have some impact on feeding success. However, the present population is likely to travel to adjacent waters where feeding will be less problematic during dredging operations. Therefore, no more than minimal impact to feeding success should occur to Atlantic butterfish.

Atlantic Mackeral Atlantic Mackeral are opportunistic feeders. They feed on plankton via filter feeding, zooplankton, copepods, fish larvae, amphipods, mysid shrimp and pelagic mollusks.

Turbidity may impact sight feeding, but the species will undoubtedly flee to neighboring waters where feeding will be less problematic. For these opportunistic feeders, dredging may change their primary diet, but should minimally impact their feeding success. Therefore, no more than minimal impact to feeding success should occur to this opportunistic feeding species.

Summer Flounder Adult summer flounder are aggressive opportunistic feeders that feed chiefly on fish and crustaceans: windowpane flounder, winter flounder, northern pipefish, Atlantic menhaden, bay anchovy, red hake, silver hake, scup, Atlantic silversides, American sand lance, bluefish, weakfish, mummichog, rock crabs, squid, shrimp, small bivalve and gastropod mollusks, small crustaceans, marine worms, and sand dollars (Packer *et al*., 1999). Differences in diet between habitats and locations may be due to prey availability. Festa (1979) reported that at least seven species of fish make up 74% of the diet volume of 25-65 cm summer flounder in the Little Egg Harbor, NJ; the remainder was mostly brachyuran crabs, mainly blue crabs. At Hereford Inlet near Cape May, NJ, summer flounder measuring 200-400 mm fed mostly on sand shrimp, mysids, and fish (Allen *et al*., 1978). In Delaware Bay, Smith and Daiber (1977) reported that adults (< 45 cm) fed on invertebrates while larger (> 45 cm) adults consumed mostly fish. Similar shifts in diet from invertebrates to fish have been observed for larger adults in Virginia and South Carolina. Smaller adult summer flounder that occupy nearshore waters could be expected to feed primarily on invertebrates. Early juvenile summer flounder examined in North Carolina (Burke 1991; 1995) were active infaunal predators feeding primarily on spionid polychaetes, but this has not been reported for larger juveniles or adults. Although dredging may affect feeding success, this will be a temporary occurrence in a relatively small area. Turbidity may impact sight feeding, but the present population will undoubtedly flee to neighboring waters where feeding will be less problematic. Dredging may change their primary diet, but should minimally impact their feeding success. Therefore, no more than minimal impact to feeding success should occur to summer flounder.

Scup Juveniles prey on polychaetes, copepods, small mollusks and hydroids. Adult scup are benthic feeders (Steimle et al., in review). They primarily feed on a variety of prey such as amphipods, zooplankton, polychaetes, mollusks, small squid, sand dollars, and small fish (Goode 1884, Nichols and Breder 1927; Hildebrand and Schroeder 1928; Bigelow and Schroeder 1953; Oviatt and Nixon 1973; Maurer and Bowman 1975; Morse 1978; Sedberry 1983). Although dredging may affect feeding success, this will be a temporary occurrence in a relatively small area. Turbidity may impact sight feeding, but the present population will undoubtedly flee to neighboring waters where feeding will be less problematic. Dredging may change their primary diet, but should minimally impact their feeding success. Therefore, no more than minimal impact to feeding success should occur to scup.

Black Sea Bass Juveniles prey on small benthic crustaceans (isopods, amphipods, small crabs, sand shrimp, copepods) and other epi- or semi-benthic estuarine/coastal taxa such as mysids or smaller fish (Steimle *et al*., 1999c). Kimmel (1973) reported a dietary shift with juvenile growth in Virginia, from mysids and amphipods at 3-9 cm SL to xanthid and other crabs, mysids, and polychaetes for 9-15 cm SL sub-adults. Festa (1979) reported various crabs (lady, blue, and mud) and caridean shrimp as major diet components in a central New Jersey estuary. Allen *et al.* (1973) reported that small bait fish (anchovies and silversides) became most evident in the diets of southern New Jersey coastal/estuarine black sea bass between 11 and 18 cm, although crustaceans were still the predominant prey taxon. While still in their nearshore summer habitat, adults continued to feed on a variety of infaunal and epibenthic invertebrates (especially crustaceans, including small lobsters) and on pelagic squid and small fish. Although dredging may affect feeding success, this will be a temporary occurrence in a relatively small area. Turbidity may impact sight feeding, but the present population will undoubtedly flee to neighboring waters where feeding will be less problematic. Dredging may change their primary diet, but should minimally impact their feeding success. Therefore, no more than minimal impact to feeding success should occur to black sea bass.

King Mackerel / Spanish Mackerel Both species are primarily pelagic carnivores. Stomach contents of juvenile Spanish and king mackerel from Florida and the Gulf of Mexico revealed that both species were piscivores, but king mackerel showed a greater preference for invertebrates (Godcharles and Murphy, 1986). Squid was the major invertebrate for both species. Since these species feed in the water column, turbidity resulting from dredging activities may have some impact on feeding success. However, the present population is likely to travel to adjacent waters where feeding will be less problematic during dredging operations. Therefore, no more than minimal impact to feeding success should occur to king mackerel or spanish mackerel.

Clearnose Skate The diet of the clearnose skate consists of polychaetes, amphipods, mysid shrimp, crab, squid, bivalves and small fish. Although dredging may affect feeding success, this will be a temporary occurrence in a relatively small area. Turbidity may impact sight feeding, but the present population will undoubtedly flee to neighboring waters where feeding will be less problematic. Therefore, no more than minimal impact to feeding success should occur to clearnose skate.

Little Skate The most important prey item to little skate are decapod crustaceans, amphipods and polychaetes. Although dredging may affect feeding success, this will be a temporary occurrence in a relatively small area. Turbidity may impact sight feeding, but the present population will undoubtedly flee to neighboring waters where feeding will be less problematic. Therefore, no more than minimal impact to feeding success should occur to little skate.

Winter Skate Winter skate generally feed on polychaetes, amphipods, decapods, isopods, bivalves, squid, crab and fishes. Polychaetes and amphipods are the predominant prey. Although dredging activities may affect the feeding success, this will be a temporary occurrence in a relatively small area. Additionally the wide range of prey increases the potential for feeding success. Therefore, no more than minimal impact to feeding success should occur to winter skate.

Species by Species EFH Assessment for the Identified Species / Life Stages

Red Hake EFH is designated within the estuary complex for larvae, juveniles and adults of this species. EFH for larvae is surface waters with surface temperatures below 19 °C. Larvae, which peak in June and July are typically found in surface waters, and would receive minimal impact as a result of the physical act of dredging, other than a short-term increase in turbidity. The EFH for juveniles is bottom habitats with substrates of shell fragments, while adults are associated with depressions in sand or mud substrates. Although the substrate is suitable for adults, salinities in Newark Bay Channel are generally lower than those customary to juvenile and adult red hake EFH. Accordingly, these habitat parameters indicate that no more than minimal impact on red hake or red hake EFH for the designated life stages is anticipated as a result of the proposed project.

Winter Flounder EFH is designated within the estuary complex for all life stages of the winter flounder. The eggs of the winter flounder are typically found at depths of less than five meters in bottom habitats in a broad range of salinity (10–30 ‰), with seasonal abundance from January to May. The larvae of the winter flounder are typically found at depths of less than six meters in pelagic and bottom waters in a broad range of salinity (10–30 ‰), with seasonal abundance from March to July. The habitat depth preference precludes any impact to winter flounder larvae or winter flounder larvae EFH. The EFH for juveniles and adults includes bottom habitats of mud or fine-grained sand substrate in waters ranging from 0.1 to 100 meters in depth, with juveniles preferring sandy coves. Spawning adults are typically associated with similar substrates in less than 6 meters of water. In contrast, the majority of the Newark Bay Channel project is scheduled for a maintenance depth of 40 feet, precluding spawning adults from the area. Although the EFH for this species' juveniles and adults may encompass part of the project area, the habitat will rapidly recover. Additionally, the prospect of injury or capture by the dredge bucket is unlikely. Therefore, no more than minimal impact on all life stages of winter flounder or winter flounder EFH is anticipated as a result of the proposed project.

Windowpane Flounder EFH is designated within the estuary complex for all life stages of windowpane flounder. Eggs are found in surface waters with water temperatures of less than 20 °C and water depths less than 70 meters. Larvae are found in pelagic waters of similar water depths and temperatures. Juveniles and adults prefer bottom habitats of mud or fine-grained sand at depths of 1 to 75 meters (adults) or 100meters (juveniles). Seasonal occurrences are generally from February to November, with peaks in May and October in the middle Atlantic for eggs and larvae, and a seasonal occurrence and peak for spawning adults of February to December and May, respectively. The dredge project encompasses only a small interval of the spawning season and is not scheduled during peak period of May.

Although this EFH may encompass part of the project area for juveniles and adults, the habitat will rapidly recover. Additionally, the prospect of injury or capture by the dredge bucket is unlikely. Therefore, no more than minimal impact on all life stages of the windowpane flounder or windowpane EFH is anticipated as a result of the proposed project.

American Plaice EFH is designated within the estuary complex for American plaice larvae, juveniles and adults. According to the NMFS (personal communication, Rusanowsky, 2000), the American plaices designation in this area is anomalous and need not be evaluated as part of an assessment for this region.

Atlantic Sea Herring EFH is designated within the estuary complex for Atlantic sea herring larvae, juveniles, and adults. Larvae of this species generally prefer salinities around 32‰ and are found in pelagic waters with depths from 50 to 90 meters, typically precluding them from the project area. Juvenile and adult life stages of Atlantic herring prefer higher salinities (26-32 ‰) and tend to avoid brackish water. Additionally, juveniles and adults (including spawning adults) are typically found at depths greater than 15 meters (~50 feet), deeper than the project depth of 40 feet. Although this EFH may encompass part of the project area, designated Atlantic sea herring life stages should not be present at Newark Bay Channel. Therefore, no more than minimal impact on Atlantic sea herring or Atlantic sea herring EFH is anticipated as a result of the proposed project.

Bluefish EFH is designated within the estuary complex for bluefish juveniles and adults. EFH for this species is mostly pelagic waters over the Continental Shelf, including all major estuaries. Juveniles are generally abundant from May through October in the mid-Atlantic estuaries.

Bluefish adults are highly migratory and are generally found in salinities greater than 25‰, precluding adults from Upper New York Bay during the better part of the year.

Although this EFH may encompass part of the project area for juveniles and adults, the habitat will rapidly recover. Additionally, the prospect of injury or capture by the dredge bucket is unlikely. Therefore, no more than minimal impact on bluefish juveniles and adults or bluefish EFH is anticipated as a result of the proposed project.

Atlantic Butterfish EFH is designated within the estuary complex for Atlantic butterfish larvae, juveniles and adults. EFH is the pelagic waters over the Continental Shelf and the estuaries from Passamaquaddy Bay, Maine to James River, Virginia. Generally, butterfish larvae are collected in depths (33-6000 feet) greater than project depth. Although this EFH may encompass part of the project area, the habitat will rapidly recover. Additionally, the prospect of injury or capture by the dredge bucket is unlikely. Therefore, no more than minimal impact on Atlantic butterfish or Atlantic butterfish EFH is anticipated as a result of the proposed project.

Summer Flounder EFH is designated within the estuary complex for summer flounder larvae, juveniles and adults. EFH for larvae of this species is mostly pelagic waters over the Continental Shelf. Summer flounder larvae are frequently found in the northern part of the mid-Atlantic Bight from September to February and are most abundant in nearshore waters at depths (10-70 meters), which is generally greater than project depth. EFH for juveniles and adults is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), estuaries and salinity zones. Juveniles may be found over muddy substrate but appear to prefer mostly sand. The project substrate is dominated by silt and clay. Adults inhabit shallow coastal and estuarine waters during warmer months and move offshore on the outer Continental Shelf at depths of 500 feet in colder months. Both juveniles and adults may be found associated with eelgrass beds where it is used as both a nursery and “hunting blind”. Due to the preference of larvae for deeper water and the preference of juveniles for a sandy substrate, no more than minimal impact on summer flounder larvae and juveniles or their EFH is anticipated. Although this EFH may encompass part of the project area, there is a lack of sub-aqueous vegetation on the shoals and the habitat will rapidly recover. Additionally, adult summer flounder may be present during the proposed project; however, the prospect of injury or capture by the dredge bucket is unlikely. Therefore, no more than minimal impact on summer flounder or summer flounder EFH is associated with this project.

Black Sea Bass EFH is designated within the estuary complex for black sea bass juveniles and adults. EFH for the juveniles and adults of this species is predominantly demersal waters over the Continental Shelf from the shore to the EEZ. They may also overwinter offshore in sandy-shelly areas. In considerably lesser numbers, juveniles may be found in association with rough bottom, and shellfish and eelgrass beds. Although the EFH for this species’ juveniles and adults may encompass part of the project area, the habitat will rapidly recover. Additionally, the prospect of injury or capture by the dredge bucket is unlikely. Therefore, no more than minimal impact on black sea bass or black sea bass EFH is associated with this project.

King Mackerel EFH is designated within the estuary complex for all life stages of the king mackerel. EFH for this species is the South Atlantic and mid-Atlantic Bights. King mackerel prefer offshore waters to the edge of the Continental Shelf and along the edge of the Gulf Stream around sandy shoals, offshore bars, high profile rock bottoms, barrier island ocean-side waters and coastal inlets. EFH for this species is primarily located in the South Atlantic and not customarily encountered in the project area. Due to this, no more than minimal impact on King mackerel or King mackerel EFH is anticipated as a result of the proposed project.

Spanish Mackerel EFH is designated within the estuary complex for all life stages of the Spanish mackerel. EFH for this species is the South Atlantic and mid-Atlantic Bights. Spanish mackerel prefer offshore waters to the edge of the Continental Shelf and along the edge of the Gulf Stream around sandy shoals, offshore bars, high profile rock bottoms, barrier island ocean-side waters and coastal inlets. EFH for this species is primarily located in the South Atlantic and not customarily encountered in the project area. Due to this, no more than minimal impact on Spanish mackerel or Spanish mackerel EFH is anticipated as a result of the proposed project.

Cobia EFH is designated within the estuary complex for all life stages of the cobia. EFH for this species is the South Atlantic and mid-Atlantic Bights. Cobia prefer coastal waters to the edge of the Continental Shelf and along the edge of the Gulf Stream around sandy shoals, offshore bars, high profile rock bottoms, barrier island ocean-side waters and coastal inlets. EFH for cobia has also been designated within high salinity bays, estuaries and sea grass habitat. Due to the preferred sandy and high salinity habitat of this species, no more than minimal impact on cobia or cobia EFH is anticipated as a result of the proposed project.

Atlantic mackerel EFH is designated within the project area grid for Atlantic mackerel juveniles and adults. EFH for this species is mostly pelagic waters over the Continental Shelf, although they may be found in estuarine seawater zones. Due to the preference of Atlantic mackerel for higher salinities, no more than minimal impact on Atlantic mackerel EFH is anticipated as a result of the proposed project.

Scup EFH is designated within the project area grid for all life stages of scup. EFH for this species' eggs is the seawater zone in Raritan Bay, and larval EFH is nearshore waters with salinities greater than 15 ‰. Various sand, mud, mussel, and eelgrass bed substrates comprise the EFH for juveniles. Demersal waters over the Continental Shelf and saline waters of Raritan Bay are designated EFH for adult scup. Due to: (1) the widespread distribution of scup, (2) an absence of sub-aquatic vegetation resulting in a poor nursery habitat with minimal food sources and inadequate protection from predation for larvae, and (3) the preference of scup for saline waters, no more than minimal impact on scup EFH is anticipated as a result of the proposed project.

Little Skate EFH is designated within the project area grid for little skate juveniles and adults. They are broadly distributed from Nova Scotia to Cape Hatteras. Juveniles and adults mostly prefer sand or gravelly bottoms but some mud also. During the spring they move into shallow water and during winter head into deeper water.

Although this EFH may encompass part of the project area, the little skate is widely distributed and the habitat will rapidly recover. Additionally, juveniles and adults may be found at depths ranging from less than 27 feet and up to 1152 feet which is quite broad when compared to the project depth. Therefore, no more than minimal impact on juvenile and adult winter skate is anticipated as a result of the proposed project.

Winter Skate EFH is designated within the project area grid for winter skate juveniles and adults. They are broadly distributed from Newfoundland to Cape Hatteras. Juveniles mostly prefer sand, gravel bottoms and some mud substrate.

Although this EFH may encompass part of the project area, the winter skate is widely distributed and the habitat will rapidly recover. Additionally, juveniles and adults are typically found at depths greater than 93 feet which is much deeper than the project depth. Therefore no more than minimal impact on juvenile and adult winter skate is anticipated as a result of the proposed project.

Clearnose Skate EFH is designated within the project area grid for clearnose skate juveniles and adults. They are broadly distributed along the eastern United States from Nova Scotia to Northeastern Florida. Juveniles and adults are most abundant in the summer months and less abundant in the cooler months of fall, winter and spring. Bigelow and Schroeder (1953b) reported clearnose skate occurring off New Jersey and New York from late April-May to October-November. Clearnose skate prefer soft bottom habitats but can also be found in rocky or gravelly bottoms. According to a 1992-1997 NEFSC trawl survey of the Hudson-Raritan estuary, juveniles and adults mostly occur in depths of 5–8 meters during the fall.
Although this EFH may encompass part of the project area, the clearnose skate is broadly distributed along the eastern United States and the habitat will rapidly recover. The dredge project does not coincide with the peak abundance of the summer months. Therefore, no more than minimal impact on all life stages of the clearnose skate EFH is anticipated as a result of the proposed project.

F. EFFECTS ON ENDANGERED SPECIES

<u>Marine Mammals</u>

Three endangered marine mammals have been identified by NMFS as occurring within the project area. These include the northern right whale, the humpback whale, and the finback whale (NMFS 1999). These species are migratory, using the Harbor in transit to other habitat areas, or have been recorded in the Lower New York Bay area, although some individuals have been documented as far up the Hudson River as the Troy Dam.

There is no recent documentation of these species in Newark Bay. Therefore, no direct or indirect impacts to marine mammals are expected as a result of maintenance dredging operations.

<u>Marine Turtles</u>

The disturbance of macroinvertebrate habitat in the channel bottoms would indirectly impact marine turtles, since they feed on organisms such as crabs and some mollusks that inhabit these areas. However, these effects would be only temporary since these habitats are expected to return to pre-existing conditions over time. In the interim, marine turtles would tend to leave or avoid these less desirable areas. In addition, an on-going study of marine turtle occurrence in the Harbor has documented little recent evidence of marine turtle presence in the New York and New Jersey Harbor. The very low occurrence of marine turtles will result in a very low impact potential related to maintenance dredging operations.

<u>Fish</u>

The shortnose sturgeon has shown a preference for deep channel areas and has been documented in the New York and New Jersey Harbor in the past. However, its preference for less saline waters typically keeps the species further up the Hudson River. No shortnose sturgeons were collected during the 12-month Harbor-wide sampling program conducted for the Harbor

Navigation Study (USACE, 1999). Therefore, no direct impacts to shortnose sturgeon are projected as a result of scheduled maintenance dredging operations.

G. EFFECTS on EFH and Designated Species

1. Direct Impacts

- The most obvious direct impact will be the loss of the benthic community associated with the shoals. This will have an immediate, albeit temporary, minimal effect on the feeding success of those species dependent upon benthic invertebrates. By dredging within a linear framework, impact will be minimized spatially and temporally.
- The Corps has determined that entrainment or physical injury of designated species is possible yet improbable and, therefore, will have minimal impact on designated species or their EFH.
- Although increased turbidity and contaminant concentrations may occur in the water column during dredging operations, these effects are typically short-lived (less than one hour). Additionally, designated species may take refuge in neighboring water.

2. Indirect Impacts

- Minor changes in bathymetry may occur, but not enough to create noticeable changes in the physical oceanography. Furthermore, the bathymetric changes resulting from dredging should not measurably alter the relationship of the benthic community with the photic zone.

3. Cumulative Impacts

- Recolonization of the benthic community will occur through: 1) benthic infauna that were not entrained during dredging operations, 2) migration of juvenile and adult infauna from contiguous areas, and 3) larval infauna that settle on the new substrate.

G. CONCLUSIONS

Based on the foregoing, the Corps of Engineers, New York District, concludes that there would be no more than minimal impact to designated species or designated species' EFHs listed in Table 2. Dredging efforts at Newark Bay should be conducted without the need for seasonal restrictions or mitigation measures to protect habitat or individual species.

Table 2 Summary of Essential Fish Habitat (EFH) Designations

Name of Estuary/ Bay/ River: Hudson River / Raritan / Sandy Hook Bays, New York/ New Jersey

SPECIES	EGGS	LARVAE	JUVENILES	ADULTS	SPAWNING ADULTS
Atlantic salmon (Salmo salar)					
Atlantic cod (Gadus morhua)					
haddock (Melanogrammus aeglefinus)					
pollock (Pollachius virens)					
whiting (Merluccius bilinearis)					
offshore hake (Merluccius albidus)					
red hake (Urophycis chuss)		M,S	M,S	M,S	
white hake (Urophycis tenuis)					
witch flounder (Glyptocephalus cynoglossus)					
winter flounder (Pseudopluronectes americanus)	M,S	M,S	M,S	M,S	M,S
yellowtail flounder (Pleuronectes ferruginea)					
windowpane flounder (Scopthalmus aquosus)	M,S	M,S	M,S	M,S	M,S
American plaice (Hippoglossoides platessoides)		M,S	M,S	M,S	
ocean pout (Macrozoarces americanus)					
Atlantic halibut (Hippoglossus hippoglossus)					
Atlantic sea scallop (Placopecten magellanicus)					
Atlantic sea herring (Clupea harengus)		M,S	M,S	M,S	
monkfish (Lophius americanus)					
bluefish (Pomatomus saltatrix)			M,S	M,S	
long finned squid (Loligo pealei)	n/a (1)	n/a			
short finned squid (Illex illecebrosus)	n/a (1)	n/a			
Atlantic butterfish (Peprilus triacanthus)		M	M,S	M,S	
Atlantic mackerel (Scomber scombrus)			S	S	
summer flounder (Paralicthys dentatus)		F,M,S	M,S	M,S	
scup (Stenotomus chrysops)	S	S	S	S	
black sea bass (Centropristus striata)			M,S	M,S	
surf clam (Spisula solidissima)	n/a (1)	n/a			
ocean quahog (Artica islandica)	n/a (1)	n/a			
spiny dogfish (Squalus acanthias)	n/a (2)	n/a			
tilefish (Lopholatilus chamaeleonticeps)					
king mackerel (Scomberomorus cavalla)	X	X	X	X	
Spanish mackerel (Scomberomorus maculatus)	X	X	X	X	
cobia (Rachycentron canadum)	X	X	X	X	

SHADING INDICATES THAT EFH HAS BEEN DESIGNATED WITHIN THE GRID FOR A GIVEN SPECIES AND LIFE STAGE.

1. Long finned squid, short finned squid, surf clams, and ocean quahog are referred to as pre-recruits and recruits, which corresponds with juveniles and adults in the table.
2. Spiny dogfish have no eggs or larvae – juveniles are born live.

Table 3 NEWARK BAY CHANNEL MAINTENANCE DREDGING
Summary of General Habitat Parameters

SPECIES	Life Stage/ Maturity Stage	EFH General Habitat Parameters				
		Water Temp. (°C)	Salinity (‰)	Water Depth (m)	Seasonal Occurrence / Abundance	Comments
Red hake *(Urophycis chuss)*	Larvae	< 19 (3)	> 0.5	< 200iso	MAY – DEC Peak JUN - JUL	Surface waters over the Continental Shelf from Gulf of Maine to Cape Hatteras, including Raritan Bay
	Juveniles	< 16	31 – 33	< 100		Bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops over the Continental Shelf from the Gulf of Maine to Cape Hatteras, including Raritan Bay
	Adults	< 12	33 – 34	10 – 130		Bottom habitats in depressions with a substrate of sand and mud over the Continental Shelf to Cape Hatteras, including Raritan Bay
Winter Flounder *(Pseudoplurонectes americanus)*	Eggs	< 10	10 - 30	< 5	FEB – JUN	Bottom habitats with a substrate of sand-mud and gravel, Although sandy bottoms are preferred; inshore areas of the Middle Atlantic to DE, including Raritan Bay
	Larvae	< 15 (3)	4 - 30	< 6	MAR – JUL	Pelagic and bottom waters off middle Atlantic south to DE, including Raritan Bay
	Juveniles (4)	< 28	5 - 33	0.1-10		Preferred bottom habitats of sandy coves, inshore waters of middle Atlantic to DE, including Raritan Bay
	Juveniles (5)	< 25	10 –3 0	1-50		Bottom habitats with mud or fine-grained sand substrate, inshore waters of middle Atlantic to DE, including Raritan Bay
	Adults	< 25	15 - 33	1-100		Bottom habitats with mud, sand, or gravel substrate, inshore waters of middle Atlantic to DE, including Raritan Bay
	Spawning Adults	< 15	5.5 - 36	< 6	FEB – JUN (spawning)	Bottom habitats with mud, sand, or gravel substrate; inshore waters of middle Atlantic to DE, including Raritan Bay Spawning occurs at night.
Windowpane Flounder *(Scopthalmus aquosus)*	Eggs	< 20 (3)		< 70	FEB – NOV peak MAY & OCT	Planktonic, surface waters from mid Atlantic to Cape Hatteras, NC
	Larvae	< 20 (3)		< 70	FEB – NOV peak MAY & OCT	Planktonic, surface waters from mid Atlantic to Cape Hatteras, NC
	Juveniles	< 25	5.5 – 36	1 – 100		Bottom habitats with fine sandy substrate, from middle Atlantic to Cape Hatteras, NC
	Adults	< 26.8	5.5 – 36	1 – 75		Bottom habitats with fine sandy substrate, from middle Atlantic to NC – VA border.
	Spawning Adults	< 21	5.5-36	1 – 75	FEB – DEC peak MAY	Bottom habitats with fine sandy substrate, from middle Atlantic to NC – VA border. Spawning occurs in the evening or at night.

SPECIES	Life Stage/ Maturity Stage	EFH General Habitat Parameters				
		Water Temp. (°C)	Salinity (‰)	Water Depth (m)	Seasonal Occurrence / Abundance	Comments
American plaice *(Hippoglossoides platessoides)*	Larvae	--	--	--	--	--
	Juveniles	--	--	--	--	--
	Adults	--	--	--	--	--
Atlantic sea herring *(Clupea harengus)*	Larvae	< 16	32	50 – 90	AUG – APR peak SEP – NOV	Pelagic waters in the Gulf of Maine, Georges Bank and southern New England.
	Juveniles	< 10	26 – 32	15 – 135		Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras.
	Adults	< 10	> 28	20 – 130		
Bluefish *(Pomatomus saltatrix)*	Juveniles		M, S (6)		MAY – OCT	Mostly pelagic waters over the Continental Shelf from the coast to the EEZ (7) from Nantucket Island, MA to Cape Hatteras, NC including all major estuaries.
	Adults		> 25			Mostly pelagic waters over continental shelf, from the coast to the EEZ, from Cape Cod Bay, MA to Cape Hatteras, NC including all major estuaries; highly migratory, and distribution varies seasonally and according to individual size.
Atlantic Butterfish *(Peprilus triacanthus)*	Larvae	9 - 19	M, S	10 - 1829		EFH is pelagic waters over the Continental Shelf, from coastal waters to EEZ, from the Gulf of Maine to Cape Hatteras, NC. EFH is also mixing and/or seawater portions of estuaries from Passamaquady Bay, Maine to James River, Virginia.
	Juveniles	3 - 28	M, S	10 - 366		
	Adults	3 - 28	M, S	10 - 366		
Summer Flounder *(Paralicthys dentatus)*	Larvae		M, S	10 - 70	SEP – FEB	Pelagic waters over the Continental Shelf from the Gulf of Maine to Cape Hatteras, NC. Abundant nearshore (19-83 km from shore).
	Juveniles	> 3	10-30			Demersal waters over Continental Shelf, from coastal waters to EEZ, from Gulf of Maine to Cape Hatteras, including Raritan Bay; may be found over muddy substrate but prefer mostly sand.
	Adults		M, S			Demersal waters over Continental Shelf, from coastal waters to EEZ, from Gulf of Maine to Cape Hatteras, including Raritan Bay. Inhabit shallow, coastal waters during warmer months and move offshore on the outer Continental Shelf, at depths of 500 ft., in colder months.
Scup *(Stenotomus chrysops)*	Eggs	7 – 23	> 15 (6)		MAY – AUG	Estuaries from southern New England to coastal Virginia, found in seawater zone of Raritan Bay
	Larvae	7 – 23	> 15 (6)		MAY – SEP	EFH is nearshore waters and estuaries from New England to coastal Virginia, including seawater zones in Raritan Bay
	Juveniles	> 7	>15 (6)	3 - 5	SPRING / SUMMER (8)	EFH is demersal waters over the Continental Shelf including seawater zones in eastern LI Sound; found in association with various sand, mud, mussel and eelgrass bed substrates.
	Adults	> 7	S (2)		NOV – APR	Demersal waters over the Continental Shelf from the coast to the EEZ; from the Gulf of Maine to Cape Hatteras, NC, including Raritan Bay (seawater zone)

SPECIES	Life Stage/ Maturity Stage	EFH General Habitat Parameters: Water Temp. (°C)	Salinity ($^0/_{00}$)	Water Depth (m)	Seasonal Occurrence / Abundance	Comments
Black Sea Bass *(Centropristus striata)*	Juveniles	> 6	> 18		SPRING / SUMMER (9)	Demersal waters over the Continental Shelf; found in association with rough bottom, shellfish and eelgrass beds and man-made structures in sandy-shelly areas. Offshore clam beds and shell patches may be used for wintering (NJ and south).
	Adults	> 6	M, S			Demersal waters over the Continental Shelf. Wintering adults (Nov – Apr) are usually offshore south of NY to NC. Structured habitats (natural and man-made), sand and shell are the preferred substrate. Inshore, EFH is estuaries from May to October.
King Mackerel (10) *(Scomberomorus cavalla)*	Eggs		M, S		MAY – JUN	Coastal pelagic species
	Larvae	22 - 31	M, S		JUL - NOV	Found from Rio de Janeiro to the Gulf of Maine, EFH
	Juveniles		M, S		APR - OCT	includes sandy shoals offshore, high profile rocky bottom and
	Adults		M, S		APR - OCT	barrier island ocean-side waters from surf zone to shelf break.
Spanish Mackerel (10) *(Scomberomorus maculatus)*	Eggs		M, S		MAY - JUN	Coastal pelagic species.
	Larvae		M, S		JUL - NOV	Found from Yucatan to the Gulf of Maine, EFH includes sandy
	Juveniles		M, S		APR - OCT	shoals offshore, high profile rocky bottom, and barrier island
	Adults		M, S		APR - OCT	ocean-side waters; from the surf zone to the shelf break.
Cobia (10) *(Rachycentron canadum)*	Eggs		> 23			Coastal pelagic species; found along eastern seaboard, EFH
	Larvae		>27.8			sandy shoals offshore, high profile rocky bottom, and
	Juveniles	19 - 30	M, S		MAY - OCT	barrier island ocean-side waters; from the surf zone to EEZ.
	Adults		M, S		MAY - OCT	Spawning occurs nearshore in higher saline water, preferably >23 $^0/_{00}$
Sandbar Shark *(Charcharinus plumbeuss)*	Larvae	> 21	> 22			EFH for neonates/early juveniles (< 90 cm) is shallow coastal waters from Montauk, Long Island to Cape Canaveral, FL.
	Adults					EFH for adults (180 cm) is shallow coastal areas from the coast to the 50 m isobath from Nantucket, MA to Miami, FL. Habitat areas of particular concern have been identified in shallow areas and the mouth of Great Bay, NJ, lower and middle Delaware Bay, lower Chesapeake Bay, and on the Outer Banks, NC.

(1) The EFH designation for this species includes the seawater zone (S) where salinity > 25.0 $^0/_{00}$.
(2) These values represent sea surface temperatures.
(3) Young-of-the-year juveniles.
(4) Age +1 year juveniles
(5) Juveniles are found in Mid-Atlantic estuaries in mixing (M) and (S) seawater zones.
(6) EEZ = Exclusive Economic Zone
(7) Generally found in estuaries and bays between VA and MA during his period.
(8) During this time period wintering adults are usually offshore south of NY to NC.
(9) Juvenile black sea bass are found in estuaries in the spring and summer.
(10) Coastal migratory species

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