Final

ESSENTIAL FISH HABITAT

KNOWLEDGE GAINED DURING THE HARBOR DEEPENDING PROJECT

PARTS I AND II

SEPTEMBER 2013

U.S. ARMY CORPS OF ENGINEERS

NEW YORK DISTRICT

26 Federal Plaza

New York, New York 1027

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Executive Summary

Essential fish habitat (EFH) is defined under section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (Public Law 94-265), as amended by the Sustainable Fisheries Act (SFA) of 1996 (Public Law 104-267), as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." EFH designations emphasize the importance of habitat protection to healthy fisheries and serve to protect and conserve the habitats of marine and estuarine finfish, mollusks, and crustaceans. Under the EFH definition, necessary habitat is that which is required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem.

During the planning and execution of in-water construction projects including dredging, beach nourishment, jetty repair, Federal and state regulatory agencies recommend management practices such as dredging windows (also known as environmental windows) to protect sensitive biological resources. Ideally, management practices balance the risk of detrimental effects against the need to conduct dredging and placing in a safe and cost effective manner as well as addressing beneficial uses and placement of dredge material. Management practices should be designed to reduce or avoid risk of detrimental effects based on knowledge of the likelihood of exposure to project-induced perturbation as well as the tolerance thresholds of the species of concern. Planning and execution of these projects therefore requires coordination between the U.S. Army Corps of Engineers (USACE) and the National Oceanographic and Atmospheric Administration (NOAA), as well as among other project sponsors and appropriate state agencies. This document is intended to facilitate that coordination by compiling the most up-to-date information, with special reference to New York/New Jersey Harbor (NY/NJ Harbor) and adjacent coastal waters within the jurisdiction of the New York District (NYD) of the USACE.

The purpose of this EFH document is two-fold. Part I addresses the re-evaluation of the EFH assessment for the Harbor Deepening Project and associated maintenance dredging within the Harbor, in compliance with Section 305(b)(2) of the MSFCMA, as amended by the SFA of 1996 (Public Law 104-267). Part I consists of multiple sections which provide the reader with background materials including a basic description of the HDP and the identification of potential impacts on EFH species. A history of the NYD's EFH consultation process throughout the HDP is given, and the EFH managed species are identified. Consultation with NOAA led to a prioritization of concerns for species viewed to be especially vulnerable to project-related impacts. In particular, knowledge gaps pertaining to the early life history stages and spawning habitat of winter flounder (*Pseudopleuronectes americanus*) became the focus of long-term study.

In addition, it presents the findings of EFH assessments for over fourteen managed species. Each assessment includes a compilation of historical and new data sources, and summarizes results of HDP studies that describe distribution patterns of EFH species within the NY/NJ Harbor. An updated characterization of benthic habitats within the harbor is given, as well as a summary of multiple suspended sediment plume studies associated with various dredging activities. Supplemental information relevant to EFH assessments are provided in appendices to Part I, including examples of beneficial uses of dredged material. The collective fundamental information presented in Part I can be used to support informed project management decisions.

Part II is a summary of existing and readily available data on aquatic biological resources within the New York Bight (i.e. South Shore of Long Island, New York and along the New Jersey Coast within USACE-NYD boundaries. It focuses on summarizing existing fisheries data (i.e. species abundance and spatial and temporal distribution) in order to support informed decisions regarding project activities that could occur within the New York Bight for all New York District Civil Works (coastal storm damage reduction, flood risk management and ecosystem restoration projects) and Operations (maintenance dredging) missions. Part II of this assessment also supports the sustainability objectives of NYD dredging programs, including beneficial uses of dredged material and emergency activities associated with Flood Control and Coastal Emergencies (FCCE) Act, PL 84-99 which authorizes the USACE to repair previously constructed projects after a large event like Hurricane Sandy.

Taking an approach similar to Part I, the reader is first given a description of the area of interest, then provided with a list of EFH managed species. Acknowledging that NYD projects are largely confined to relatively shallow inshore and near shore Continental Shelf waters, Part II places an emphasis on EFH species likely to be encountered at beach nourishment sites, offshore borrow areas, and navigable inlets and bays. Sources of data relevant to EFH assessments are given, including a review of the results of published studies sponsored by NYD associated with the extensive monitoring of past beach nourishment activities. Supplemental content includes identification of existing environmental windows, a prominent engineering project management practice.

As is the case for Part I content, Part II also compiles basic data in support of robust EFH assessments. The approach stresses the need for a full understanding of both habitat requirements of key species and the probability of impacts during the conduct of engineering projects. The latter requires a fundamental knowledge of the equipment and processes entailed, including types of dredge plants and operational conditions. This document adopts a proactive approach toward assessing the risk of potential impacts by encouraging the fullest use of available data.

Introduction

Essential fish habitat (EFH) is defined under section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (Public Law 94-265), as amended by the Sustainable Fisheries Act (SFA) of 1996 (Public Law 104-267), as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The SFA requires that EFH be identified for those species actively managed under Federal fishery management plans (FMPs). This includes species managed by the eight regional Fishery Management Councils (FMCs), established under the MSFCMA, as well as those managed by National Marine Fisheries Service (NMFS) under FMPs developed by the Secretary of Commerce.

EFH designations emphasize the importance of habitat protection to healthy fisheries and serve to protect and conserve the habitats of marine and estuarine finfish, mollusks, and crustaceans. EFH embodies key physical, chemical, and biological attributes of both the water column and the underlying substrate, including sediment, hard bottom, and other submerged structures that support survival and growth of designated species. Under the EFH definition, necessary habitat is that which is required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. EFH may be designated for the complete life cycle of a species, including spawning, feeding, and growth to maturity, or may be specific for each life stage (egg, larval, juvenile, adult, and spawning adult).

For in-water construction projects including dredging, beach nourishment, jetty repair, placement of rock for reefs and removal of material from borrow areas, Federal and state regulatory agencies recommend management practices such as dredging windows (also known as environmental windows) to protect sensitive biological resources (i.e. finfish, shellfish, sea turtles, and marine mammals). Ideally, management practices should balance the risk of potential impacts against the need to conduct dredging and placing in a safe and cost effective manner as well as addressing beneficial uses and placement of dredge material. Management practices should be designed to reduce or avoid risk of detrimental effects based on knowledge of the likelihood of exposure to project-induced perturbation as well as the tolerance thresholds of the species of concern. At the dredging site, exposures depend on site-specific conditions including depth, substrate type, and prevailing hydrodynamics with consideration of the specific dredge plant being used (Wilber and Clarke 2007). Exposures of organisms to suspended sediments, turbidity, underwater sound, or hydraulic entrainment will differ based upon many factors. For example, mechanical dredging in silty sediments will induce very different exposures to suspended sediments than will hydraulic dredging in sandy sediments, with many possible scenarios between these alternatives. The probability of encountering a dredge will also differ depending upon the behavior of the organism of concern, as mediated by its position in the water column. Likewise, the duration of exposure will be influenced by attraction to, indifference to, or avoidance of sensory cues or stimuli produced by a given dredge. Similar factors will affect exposures of organisms at the fill site for beach nourishment. Rather than the presence of a dredge, here the method of discharging and handling fill material to achieve the designed beach profile will determine the spatial and temporal scales of disturbance (Wilber et al. 2003a, 2003b, 2007).

Choice and application of appropriate management practices requires knowledge of the life history and habitat requirements of managed species to determine if a conflict with EFH mandates could occur. First, what is the probability that a species of concern would encounter the specific project construction activity, such as an operating dredge or beach discharge? Second, if an encounter does occur, what would the duration of exposure be, given the organism's mobility (e.g., sessile, passive drifter, active swimmer) and the spatial scale of the perturbation. Finally, if the tolerance levels of that species are known or can be estimated, then the potential impacts can be assessed and the need for a restrictive management practice or mitigation measure evaluated. Each assessment and determination of risk is built upon a basic understanding of the occurrences of selected species in the given project areas which is discussed in this report.

The purpose of this EFH document is two-fold. Part I addresses the re-evaluation of the EFH assessment for the Harbor Deepening Project and associated maintenance dredging within the Harbor, in compliance with Section 305(b)(2) of the MSFCMA, as amended by the SFA of 1996 (Public Law 104-267). Part II is a summary of existing and readily available data on aquatic biological resources within the New York Bight (i.e. South Shore of Long Island, New York and along the New Jersey Coast within U.S. Army Corps of Engineers New York District (USACE) boundaries). The following sections focus on summarizing existing fisheries data (i.e. species abundance and spatial and temporal distribution) in order to support informed decisions regarding project activities that could occur within this area for the remaining HDP activities and associated maintenance dredging projects within the Harbor.

PART I

1. HDP Project and Program Description

The USACE-NYD congressionally authorized Harbor Deepening Project (HDP) is under construction and nearing completion (Figure 1). The HDP is a multi-year Federal channel deepening program focused on improving Harbor navigation and safety while minimizing impacts to existing habitats and fishery resources. Once the HDP is completed, there will be a shift in dredging activity from construction to maintenance. Maintenance dredging is anticipated to be conducted in those contract areas that experience shoaling due to the hydrodynamics in the NY/NJ Harbor. The maintenance schedule will be determined by both need and availability of funds. Knowledge gained during monitoring activities associated with the HDP will assist state resource managers in making informed decisions on how best to maintain the navigation infrastructure while protecting fishery resources.

Environmental compliance documents under the National Environmental Policy Act (NEPA) have been completed for the HDP within NY/NJ Harbor, including the Feasibility Report (Final Environmental Impact Statement) for New York and New Jersey Harbor Navigation Study (USACE–NYD 1999) and the Environmental Assessment on Consolidated Implementation of the New York and New Jersey Harbor Deepening Project (USACE–NYD 2004). A subsequent Environmental Assessment was developed in 2007 for the Newark Bay Study Area (Newark Bay and parts of Arthur Kill) to evaluate potential impacts on the U.S. Environmental Protection Agency Remedial Investigation and Feasibility Study (USACE-NYD 2007). The Recommended Plan in the 1999 Final Environmental Impact Statement (USACE-NYD 1999) consisted of deepening the main shipping channels within the Harbor to 50 feet (52 feet in rock or otherwise hard material). This project was authorized for construction by Congress in §101(a)(2) of the Water Resources Development Act of 16 2000 (Public Law No. 106-541, December 11, 2000).

In 2001, the National Marine Fisheries Service (NMFS) - Northeast Region - issued a conservation recommendation (CR) letter (NMFS 2001) regarding potential impacts of the HDP on federally managed EFH species. The potential project impacts identified in the letter included the re-deposition of sediment suspended during dredging, physical removal of bottom habitat, entrainment of eggs and larvae in dredging equipment, and loss of EFH function. Specifically, the 2001 CR letter identified winter flounder as a species "that will be most affected by the deepening, or are representative of other federally managed species." To mitigate these potential project impacts, NMFS recommended seasonal dredging constraints for some navigation channels based on location, sediment characteristics, and the temporal use of the project area by early life stage (eggs and larvae) winter flounder. In addition, USACE-NYD initiated several multi-year biological sampling programs as a type of mitigation and to inform decision makers.

Due to a lack of data concerning use of the Harbor by key species at the time, NMFS employed "a very conservative, risk-adverse approach." However, NMFS encouraged USACE-NYD to "revisit the consultation process during the pre and actual construction phases of the project if the information affects the basis for NMFS conservation recommendations (50 CFR

600.920(k))", including if "altered or new information becomes available regarding ESA or EFH issues."

In 2010, USACE-NYD published a report based on the multiple year Aquatic Biological Survey (ABS) data and analyses for the period 2002-2010 that focused on winter flounder early life stage utilization of the Harbor (USACE-NYD 2010). The findings published in the Early Life Stage Application Report provided strong evidence consistent with existing literature that navigation channels are not used as spawning habitat by winter flounder (USACE-NYD 2010). In addition, the multiple-year ABS data dataset has been used to better define the timing of winter flounder spawning activity and distributions of early life stages (eggs and larvae) in the Harbor. In coordination with the regulating states of New York and New Jersey as well as NMFS, these results have been used to refine existing dredge windows associated with the HDP.

Based on the extensive ABS dataset and other monitoring programs associated with the HDP, USACE-NYD would like to revisit the consultation process regarding seasonal dredging restrictions as they pertain to existing and future construction contracts for the HDP and future maintenance projects once the HDP is complete. A summary of the status of the HDP project can be found in Table 1.

Based on the latest scientific data from these studies the project related impacts identified in the 2001 CR letter may have limited application as they pertain to winter flounder EFH within the Harbor.

2. HDP Area/Site Description

The New York and New Jersey Harbor is located at the apex of the New York Bight. It serves as the port for the greater metropolitan New York area, providing maritime access to shipping terminals via a network of dredged and maintained channels and anchorages (Figure 1). The Harbor exists within the larger confines of the Hudson-Raritan estuary, a diverse and significant habitat complex strongly influenced by tidal action and the mixing of seawater and freshwater drainage (USFWS 1997). The Harbor portion of the estuary covers approximately 298 square miles of surface water (USACE 1999a) and includes for this assessment the bi-state waters of Newark Bay, Arthur Kill, Kill Van Kull, Lower New York Bay, and Upper New York Bay.

The Harbor is characterized by a network of interconnected navigation channels of a range of authorized depths down to 50 feet (ft) and surrounding shoals and shallow flats (Figure 2). The Lower Bay portion of the Harbor complex is comprised of extensive shallow flats with scattered areas of deeper waters, including borrow areas and pits. The relatively shallow bottoms exclusive of the navigation channels cover 77 percent of the total area (38 percent is <15 ft and 39 percent is 15 – 25 ft deep), whereas the Upper Bay is comprised predominantly of deep water (67 percent is >25 ft deep) and Newark Bay is dominated by shallow flats (67 percent is <15 ft deep). The Kill Van Kull and Arthur Kill are relatively narrow waterways dominated by major shipping channels. In the Upper Bay and Newark Bay, navigation channels and berthing areas comprise approximately 35 percent and 22 percent respectively of the total available substrate. The shoals and shallow flats of the Lower Bay represent approximately 152 million square meters (m^2) (91 percent of the total area in the Lower Bay), nearly 29 m^2 in the Upper Bay (65 percent), and nearly 12 m^2 in Newark Bay (78 percent). Thus the Lower Bay provides a large majority of the total shoal and shallow water acreage in the Harbor. Additionally the shallow waters of the Lower Bay are more expansive and unfragmented in comparison to other Harbor areas.

Estuarine benthic communities such as are found in NY/NJ Harbor are characterized by high levels of temporal and spatial variability. This variability is caused by the interplay of many natural factors and human influences on estuarine environments. Despite this variability, a general pattern of benthic community distribution exists that is related to substrate type. Silt- and sand-dominated substrates both occur in areas scattered throughout the Harbor. Both have distinctive benthic communities depending on the relative amounts of silt and sand and organic matter. In 2011, USACE conducted a benthic survey throughout the NY/NJ Harbor to characterize the surficial sediments found at 38 historic ABS[1] transect locations. Results included grain size and TOC content of the surficial sediments of channels and surrounding shallow areas. These data describe physical characteristics of the ABS Stations/Transects and locations of winter flounder collections (Wilber et al. 2013).

Composition of surficial sediments of the NY/NJ Harbor areas varied among sites. The Lower Bay consisted primarily of sandy substrates, whereas the majority of the Upper Bay was transitional ranging from silt to gravelly sand, the Kill Van Kull was dominated by silts, and the

[1] Throughout the survey, a standard set of approximately 26 sampling locations have been used, but some adjustments have been made from year to year to accommodate HDP construction and changes in station bathymetry. These standard 26 are used for overall data analysis.

Arthur Kill and Newark Bay areas were dominated by silty sediments. Total Organic Carbon values ranged from 0.07 percent to 5.5 percent, with lowest values occurring at the Lower Bay transects and the highest values at transect locations in the Arthur Kill, followed by Newark Bay and Port Jersey. In general, the lower values were associated with sandy sediments and the higher values with silts and clays. In general, a contrast exists between the Lower Bay where sandy substrates dominate, and the Upper Bay and Newark Bay, which are subject to sedimentation of fine-grained materials and consequently are dominated by soft substrates.

Benthic macroinvertebrate communities in the Harbor consist of diverse assemblages of small aquatic invertebrates which live burrowed into (i.e. infauna) or in contact with the bottom surface (i.e. epifauna), such as worms, mollusks, and amphipods (Pearce 1974). Benthic communities play an important role in the Harbor by providing winter flounder with structural habitat as well as a forage base. The majority of taxa identified in grab samples collected during USACE Harbor-wide Benthic Recovery Program in 2005 and 2009 were nematodes, annelids (oligochaetes and polychaetes), arthropods, and mollusks (bivalves and gastropods). These taxa vary considerably in the Harbor with respect to occurrence and abundance both seasonally and spatially (Iocco et al. 2000, BVA 1998, Cerrato et al. 1989, Steimle and Caracciolo-Ward 1989, Gandarillas and Brinkhuis 1981, Dean 1975). These reports provide benthic community data describing the ABS Stations/Transects and Dredging Contract Areas.

3. Potential Impacts from HDP Dredging

Based on the 2001 Conservation Recommendation, potential impacts from the HDP include:

- Physical disturbance and re-suspended sediments/re-deposition of suspended sediments (short-term direct and indirect impacts including potential burial and/or release of contaminants)
- Entrainment of early life stages (eggs and larvae) as a form of short-term direct impact due primarily due to hydraulic dredging and capture of eggs and possibly larvae in the dredge
- Loss of EFH function (i.e. loss of habitat) as a long-term indirect impact due to increased sedimentation and/or changes in depths, currents, substrate types, and/or in-water structures that reduce or eliminate the suitability of habitat for EFH-managed species.

Direct Impacts

Direct impacts are defined as those impacts that directly affect EFH or cause mortality. These impacts include physical alterations to the habitat of a particular species. Potential direct impacts to EFH species within the project area include the entrainment of demersal eggs and larvae by hydraulic dredges, changes to and/or removal of EFH habitat, localized changes in water column depth, bathymetry, hydrodynamics, and sedimentation rates, the temporary and localized impacts from other construction activities (i.e., water disturbance, noise and vibrations), and short-term changes to water quality conditions typically associated with dredging operations including the re-suspension of sediments in the water column.

Indirect Impacts

Indirect impacts are defined as those impacts that indirectly affect the well-being of a particular species. These impacts include activities that cause the loss of forage species. The primary indirect impact to EFH species during Harbor deepening activities is the disturbance of benthic and epibenthic forage communities. Several of the EFH species are demersal, or benthic feeders (i.e. red hake and winter flounder), that may experience a change in feeding efficiency for some period of time during and immediately following construction activities.

Cumulative Impacts

Cumulative impacts are defined as those impacts to EFH resulting from the ongoing activities of a particular project or from the activities of multiple projects in an area. These impacts represent the cumulative effects that can result from individually minor but collectively significant actions taking place over a period of time in a particular habitat.

Short-term cumulative impacts are related to dredging operations associated with the HDP and/or other permitted projects that are ongoing concurrently within the Harbor area. These short-term cumulative impacts to EFH would be a combination of disturbances associated with each project. Long-term cumulative impacts would be limited to localized changes in water column depth, bathymetric contours, hydrodynamics, and sedimentation rates.

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4. EFH Consultation History of HDP

USACE-NYD routinely coordinates with the states (New Jersey Department of Environmental Protection (NJDEP) and New York State Department of Environmental Conservation (NYSDEC)) and NMFS regarding EFH consultation through Water Quality Certificate process and through technical memorandums and meetings to provide updates on annual biological monitoring programs. In addition, USACE-NYD presents the results of winter flounder investigations at technical symposia such as the bi-annual NMFS sponsored flatfish conferences to continue technical outreach to regulatory agencies. A concerted effort is also being made to publish results of HDP studies in peer-reviewed scientific literature so that both the public and the scientific community can benefit from knowledge gained and lessons learned.

USACE-NYD coordinated with the New England Fisheries Management Council on the proposed winter flounder egg and larvae EFH re-designation from the current depth of 5 and 6 meters (16 and 20 ft) for eggs and larvae, respectively, to a depth of 20 meters (66 ft) as it would have impacted existing and future regional navigation channel maintenance and improvement projects. Coordination included the sharing of available ABS data and the invitation to attend a regional Fishery Management Council Habitat Plan Development Team (HPDT) meeting to present the latest ABS results relevant to the proposed re-designation. Based upon technical evidence gathered during collective HDP studies, and extensive coordination with appropriate state and Federal partners, a decision was reached by the Atlantic States Marine Fisheries Commission not to re-designate EFH within NY/NJ Harbor by inclusion of Federal channels.

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5. EFH Managed Species

EFH designations are defined for specific life stages based on occurrence in tidal freshwater, estuarine (brackish salinity zone), and marine (seawater salinity zone) water. Table 2 provides a summary of those species for which EFH has been designated in the HDP project area. A total of 19 federally managed species with EFH designations have been identified in the project area. Of these species, only winter flounder, windowpane flounder, scup and the three coastal migratory pelagics (king mackerel, Spanish mackerel and cobia) were identified for each stage of their life cycle: eggs, larvae, juveniles and adults. Winter flounder and windowpane flounder have an additional EFH designation for spawning adults. Appendix 1 provides a Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species.

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6. Essential Fish Habitat Assessment

6.1 Application of Data Sources within the Harbor

The seasonal timing and spatial distribution of each EFH species within the NY/NJ Harbor is characterized herein based on data from two major biological monitoring studies: the ABS and the Migratory Finfish Survey (MFS). Relative monthly abundances in the Harbor for each EFH life history stage are depicted through a color-coded classification scheme that ranges from "not present" to "highly abundant" (Table 3). This classification scheme is adapted from NOAA's Estuarine Living Marine Resources (ELMR) program and summarizes quantitative data to indicate both seasonal peaks in abundance and relative abundances among species. For instance a classification of "rare" indicates a species was collected in a particular month, but infrequently, whereas the "highly abundant" classification indicates the species was frequently collected in abundances totaling hundreds or thousands of individuals. Spatial distribution and abundance maps (Figures 3 – 20) depict the distributions of EFH life stages with "common," "abundant," or "highly abundant" density characterizations in the long-term bottom trawl (2002–2010) and epibenthic ichthyoplankton (2002–2011) components of the ABS sampling program.

In addition, other data sources were reviewed for characterizations of sediment type and benthic communities (Figures 21 and 22) for inclusion in the impact analysis as briefly summarized below.

6.2 Harbor Data Sources

The Aquatic Biological Survey (USACE 2010a, USACE 2012a). The USACE–NYD conducted extensive aquatic biological surveys of the Harbor in conjunction with the Harbor Deepening Project. Between 1999 and 2011, USACE conducted the yearly Aquatic Biological Survey to determine the seasonal distributions of demersal fish throughout NY/NJ Harbor. Adults and juveniles were sampled using a 30-foot bottom otter trawl and eggs and larvae were sampled with an epibenthic sled. Sampling was consistently conducted twice a month from January to June at approximately 26 stations throughout the Harbor (additional stations were added to satisfy sampling objectives). The sampling protocol was standardized in 2002 and data collected from 2002 to 2010 (2011 for eggs and larvae) are used in this document to illustrate the seasonal occurrences and spatial distributions of all life stages (eggs, larvae, juveniles, and adults) of federally managed species throughout the Harbor.

The Migratory Finfish Study (USACE 2012b). In 2006 and 2011, the USACE-NYD sampled throughout the harbor to determine the distributions and abundances of migratory finfish. Sampling was conducted at 26 fixed locations between April and May 2006 and between August and November 2006 using both bottom and mid-water trawls. In 2011, sampling was conducted from April to November with a mid-water trawl (USACE 2012b). In addition, 2012 data are currently being analyzed and 2013 data are being collected. At the end of the 2013 survey, a summary report will be developed summarizing the entire data collection effort.

The Hudson-Raritan Estuary Survey (Wilk et al. 1998). Bottom trawl sampling was conducted monthly in the Hudson-Raritan Estuary from 1992 to 1997 to provide data on the distributions and abundances of 26 fish and megainvertebrate species.

Benthic Habitats of New York/New Jersey Harbor (Iocco et al. 2000, USACE 2011b). Sediment profile imagery (SPI) and grab sampling were used to characterize benthic habitats in New York/New Jersey Harbor in June and October 1995. A habitat classification system based on sediment type was applied and observed faunal assemblages and habitat classes were identified and mapped in a geographic information system (GIS) for each survey (Iocco et al. 2000). Information on benthic habitat composition is also available from 2005 and 2009 in the Kill Van Kull Channel, Ambrose Channel, and Anchorage Channel (USACE 2011b) and 2012 in the Anchorage Channel, Elizabeth Channel and Newark Bay Channel (USACE 2013).

Total Suspended Sediment (TSS) Monitoring in the Harbor (USACE 2002, USACE 2009, USACE 2010b, USACE 2011a, USACE 2013). The USACE Harbor-wide Water Quality/Total Suspended Sediments (WQ/TSS) Monitoring Program documented the extent of suspended sediment plumes generated by ship traffic and harbor deepening operations. Ambient TSS concentrations have been measured in Newark Bay, the Kill van Kull, the Arthur Kill and Port Jersey Terminal. TSS measurements were also made after a storm event, following the passage of an ocean-going container ship, and both up-current and down-current of active dredging activities.

6.3 EFH Species Distribution and Abundance within NY/NJ Harbor

Butterfish (*Peprilus tricanthus*). Juvenile and adult butterfish were rarely collected during the winter ABS surveys, becoming more common in the spring and abundant in the late summer and fall (Table 3). Butterfish were collected in both bottom and mid-water trawls and were more abundant near the bottom in non-channel areas (USACE 2007). Butterfish were collected most frequently in the Lower Bay, followed by Newark Bay, with very low collections in Upper Bay and Arthur Kill (USACE 2007). Size data indicate young-of-year and yearlings comprise the peak summer and early fall catches. Bottom trawl surveys conducted in the mid-1990s also did not catch butterfish in the Lower Bay in the winter and reported peak abundances during the summer (Wilk et al. 1998).

Atlantic herring (*Clupea harengus*). Atlantic herring larvae were present, but only rarely from February to June during ABS epibenthic ichthyoplankton sampling (Table 3). Juveniles were captured in bottom trawls during ABS sampling. In the winter, juveniles were not collected at most stations and when present, were collected at low abundances throughout the harbor. Peak juvenile abundances occurred in April and May (Table 1), with the highest spring collections at non-channel stations in Newark Bay and in Upper Bay near Port Jersey (Fig. 3). Juveniles were not collected from June to September in the harbor in either the bottom or mid-water trawls of the MFS and were present in low abundances in October and November (Table 3). This seasonal pattern of occurrence in the harbor is consistent with distributions observed in the mid-1990s during the Hudson-Raritan Estuary Trawl Survey (Wilk et al. 1998), in which juveniles were most common in winter and spring, sometimes present at the mouth of the estuary in the summer, and were rare in the fall. Adults were most abundant in the winter in ABS bottom trawl sampling (Table 3) and were concentrated on the eastern side of the harbor, with only two adults collected in Arthur Kill, none in Newark Bay, and few on the western side of the Lower and Upper Bays (Fig. 4).

Atlantic Mackerel (*Scomber scombrus*). Atlantic mackerel were not collected within the Harbor in either the ABS or MFS sampling efforts.

Black Sea Bass (*Centropristus striata*). Juvenile black sea bass were collected at very low densities in the Harbor throughout the year, becoming more common in the fall (Table 3). Adults were rarely collected within the harbor regardless of season (Table 3). This seasonal pattern of occurrence in the harbor is consistent with that observed in the mid-1990s during the Hudson-Raritan Estuary Trawl Survey in which only juveniles were collected and they were most abundant in the fall (Wilk et al. 1998). Because the abundances of both juvenile and adult black sea bass were low within the harbor, distribution maps were not created for this species.

Bluefish (*Pomatomus saltatrix*). Juvenile bluefish were not collected within the harbor during the winter and were present, but rare, in the spring (Table 3). Likewise, juvenile bluefish were not collected in the harbor in the mid-1990s during the Hudson-Raritan Estuary Trawl Survey (Wilk et al. 1998). Juveniles were collected in slightly higher abundances in bottom than mid-water trawl sampling in 2006 (USACE 2007), with peak abundances in the late summer early fall (Table 3). The majority of fish collected were young-of-year juveniles, which were more common at non-channel than channel stations and present in higher abundances in Newark Bay and Lower Bay than in Arthur Kill and Upper Bay. Adults were collected, but rare in the spring during ABS surveys (Table 3) and were also present, but rare in the Hudson-Raritan Estuary Trawl Survey (Wilk et al. 1998). Because the abundances of both juvenile and adult bluefish were low within the harbor, harborwide distribution maps were not created for this species.

Red hake (*Urophycis chuss*). Red hake larvae were not collected in any epibenthic ichthyoplankton sampling conducted over 10 years from January through June 2002–2011 (Table 3). Juvenile red hake were abundant in bottom trawls from January through April and were present in the harbor at lower abundances in May and June (Table 3). Juveniles were most abundant in channels in the Upper Bay and Newark Bay areas in both the winter (Figure 5) and spring (Figure 6). The strong preference for channels was also observed in the bottom trawl surveys conducted in the Lower Bay in the mid-1990s (Wilk et al. 1998). Adult red hake were present in the Harbor, but were rare in abundance (Table 3).

Scup (*Stenotomus chrysops*). Scup eggs and larvae were not collected within the harbor in the epibenthic ichthyoplankton sampling conducted over ten years from January through June (Table 3). Juveniles were more abundant in bottom than mid-water trawl samples (USACE 2007) and were abundant from May through August (Table 3), with highest occurrences in the Lower and Upper Bay areas (Figure 7). Abundances were highest at non-channel stations in the Upper Bay and at a single channel station in the Lower Bay (Figure 7). The seasonal and spatial occurrences of scup in the Lower Bay in the mid-1990s were similar to that observed in the ABS study with fish collected at both channel and non-channel stations (Wilk et al. 1998).

Summer flounder (*Paralichthys dentatus*). Summer flounder larvae were present, but rare, from January through May in the Harbor and were not collected in June in any year of sampling (Table 3). Juveniles were collected in the Harbor in all months of sampling with the exception of September, whereas adults were not collected in the Harbor in September and November (Table 3). Adult densities were highest in the late spring and were concentrated in the Arthur Kill/Newark Bay and Upper Bay areas at both channel and non-channel stations (Figure 8). In sampling conducted in the mid-1990s (Wilk et al. 1998), summer flounder were most abundant in the Raritan Bay portion of the Hudson-Raritan Estuary at both channel and non-channels stations. The ABS sampling program did not have many stations in this area.

Windowpane flounder (*Scophthalmus aquosus*). Windowpane flounder eggs were collected in the Harbor in high abundances in May and June (Table 3) and were distributed widely throughout channel and non-channel stations in the Lower and Upper Bays (Figure 9). Eggs were not commonly collected in the Arthur Kill and Newark Bay areas (Figure 9). Windowpane flounder larvae were abundant in May and June in the Harbor (Table 3) and exhibited a distribution in the Lower and Upper Bays that was similar to that of eggs, with rare collections in the Arthur Kill and Newark Bay areas (Figure 10). Juvenile windowpane flounder were more widely distributed throughout the harbor and were more common at channel stations in the Arthur Kill, Newark Bay, and Upper Bay areas of the harbor in both the winter (Figure 11) and spring (Figure 12). Adult windowpane flounder were common in the spring and most abundant in the Upper Bay area (Figure 13). Bottom trawl sampling in the Lower Bay in the mid-1990s revealed the highest collections of windowpane flounder in channel areas (Wilk et al. 1998).

Winter flounder (*Pseudopleuronectes americanus*). Winter flounder eggs were common in the Harbor in January, becoming abundant in February and March and decreasing in abundance in April (Table 3). Winter flounder eggs were most common at non-channel stations in the Lower and Upper Bay areas in the winter (Figure 14) and in the Lower Bay in the spring (Figure 15). Eggs were rarely collected in the Arthur Kill and Newark Bay areas (Figures 14 and 15). Egg collections at channel stations were more common in years with strong spring tides and prolonged cold winters, both of which increase the probability of transport from shallow spawning sites via increased vertical mixing and prolonged residence time due to delayed development, respectively (USACE 2010a). Winter flounder larval abundances peaked in April (Table 3) and were concentrated primarily in the Lower Bay at both channel and non-channel stations, with lower densities in the Upper Bay and very low occurrences in the Arthur Kill and Newark Bay areas (Figure 16). Juvenile winter flounder were abundant from January through June and were also collected throughout the fall (Table 3). Juveniles were collected in the Arthur Kill, Newark Bay, and Upper Bay areas, primarily at channel stations in both the winter (Figure 17) and spring (Figure 18). Winter flounder adults were concentrated in the channels of the Upper and Lower Bays both in the winter (Figure 19) and spring (Figure 20). There were very few adults collected in the Arthur Kill and Newark Bay areas. Collections of adult winter flounder in aggregations during April, the critical post-spawning feeding period, occurred only in the Upper and Lower Bays in areas close to clam, mussel and ampeliscid amphipod beds (USACE 2012a). Spatial distributions of juveniles and adults in the Lower Bay during ABS sampling were similar to that observed in the mid-1990s, with highest abundances at channel locations (Wilk et al. 1998).

Little skate (*Leucoraja erinacea*). Little skate juveniles were collected in the Harbor in the winter and early spring, but were rare. Adults were present throughout the winter and spring with highest abundances observed in January and April. In the mid-1990s, little skate were common from the fall through the spring in both channel and non-channel areas of the Lower Bay (Wilk et al. 1998).

Clearnose skate (*Raja eglanteria*). Clearnose skate juveniles were present, but rare throughout the winter and spring (Table 1). Adult clearnose skate were collected in low numbers only in the winter. In the mid-1990s, clearnose skate were also rare in the winter and spring, with higher abundances in the summer (Wilk et al. 2998).

Winter skate (*Leucoraja ocellata*). Winter skate were present in low abundances from January through May and adults were collected only in March and April (Table 1). Winter skate were most abundant in winter in the mid-1990s (Wilk et al. 1998).

Other EFH species. Other EFH species listed for the New York/New Jersey Harbor, but not collected at any time or any lifestage in ABS or MFS sampling include king mackerel, cobia, sand tiger shark, dusky shark, and sandbar shark. MFS mid-water trawls in August of 2006 collected two Spanish mackerel at an Arthur Kill/Kill Van Kull channel station and one cobia at an Upper Bay channel station. Winter skate, little skate, and clearnose skate are present in the area and have been collected in low numbers in the Lower Bay.

6.4 Benthic Habitat Characterizations within the Harbor

Benthic habitats within the Harbor have been studied for decades and related to the continuum of disturbance conditions that result from industrial pollution and eutrophication within the Harbor. Using SPI images and benthic grab sampling, Iocco et al. (2000) surveyed benthic habitats in the Lower Bay, Newark Bay and Upper Bay (as well as areas outside of the HDP project area, Flushing Bay, Bowery Bay and Jamaica Bay) and used a GIS format to map the distribution of major benthic habitat types in these areas. These habitat types included shellfish beds, amphipod tube mats, and both sand and silt substrates. This study found patchy distributions of habitat classes within each bay that varied seasonally in location. Shellbeds were stable in location, whereas ampeliscid amphipod mats varied spatially.

The Lower Bay was comprised primarily of sandy sediments and extensive patches of shellfish and ampeliscid habitat (Figure 21). Ampeliscid habitat was most prevalent near Raritan Bay, whereas shellfish habitat was common near the channels. Bacterial mats, which are indicative of anoxic degraded habitat, were not observed in Lower Bay, even in borrow pits of similar bathymetry to pits in Jamaica Bay where bacterial mats were found.

Newark Bay benthic habitats were comprised primarily of muddy substrate with few infauna, dominated by opportunistic polychaetes (Figure 22). Species abundances were lower in the fall than in the summer and spring, which probably reflected spring larval recruitment.

Upper Bay benthic habitats were characterized by multiple occurrences of mussel and clam shellfish beds, generally near channels. These shellfish beds were temporally stable. Silty sediments with pollution tolerant species were prevalent along the shoreline (Figure 22).

Benthic communities within channels have been monitored at both baseline (pre-dredging) and post-dredging time periods at the following areas Ambrose Channel, Anchorage Channel, Newark Bay Channel, Elizabeth Channel and Kill Van Kull Channel within the Harbor (USACE 2011a and USACE 2013). Ambrose Channel sediments were comprised primarily of sand and did not change between pre- and post-dredging surveys. Post dredging, the benthic community was dominated by polychaetes and amphipods. Pollution tolerant species comprised less than 10 percent of the taxonomic assemblage in both years of sampling. In Anchorage Channel, pollution tolerant species increased from approximately 17 percent in pre-dredging surveys to 29 percent of the assemblage in the post-dredging survey and sediments were primarily silt/clay. Sediment composition in the Kill Van Kull Channel changed appreciably between the pre- and post-dredging surveys, from predominantly fine grained sediments to sediments with much coarser fractions, such as sand, rock, gravel and cobble. Pollution tolerant species comprised roughly 18 percent of all organisms in the post-dredging samples, which doubled that observed during pre-dredging monitoring. Anchorage Channel contract areas S-AN-2 and S-AN-1b experienced significant increases in average density between 2005 and 2012. The increases were driven by opportunistic colonizing polchaetes of the families Capitellidae and Spionidae.

Average benthic macroinvertebrate density increased significantly from 2005 to 2012 in the Elizabeth Channel resulting from large collections of annelids (96% of the total organisms collected in 2012). These consisted largely of opportunistic species such as capitellids, and to a lesser extent *Cossura longocirrata* and Oligochaeta.

Benthic macroinvertebrate indices within the Newark Bay S-NB-1 contract area were fairly consistent between the baseline condition observed in 2005 compared to 2012. Although average benthic density decreased in 2012, measures of diversity and evenness were consistent between sampling events (<1 percent decrease), indicating a comparatively stable community.

6.5 Total Suspended Sediment Studies within the Harbor

In the 2001 CR, redeposition of sediment suspended during the dredging was identified as a concern for potential impacts on aquatic communities and EFH species. This included short-term and indirect impacts such as potential burial and smothering of early life stages. At that time research had indicated that resuspended sediments plumes could extend more than 500 meters from the dredge site and residual plumes could remain resuspended in the water column for hours.

TSS within the harbor have been monitored with relation to dredging activities to address the concern that suspended sediment plumes may block the migratory pathways of anadromous fish, and to address the potential impacts identified in the 2001 CR including burial and smothering of early life stages. The USACE Harbor-wide WQ/TSS Monitoring Program has documented the extent of plumes generated by ship traffic and harbor deepening operations. Comparisons of TSS values measured near the passage of cargo ships, following storm events, and near active dredging operations revealed that cargo ships had prominent effects on localized TSS levels (USACE 2002), exceeding those attributed to dredging operations in terms of spatial extent. Results of several ship traffic TSS surveys in Newark Bay and a typical bucket dredging operation in the Kill Van Kull were published in Clarke et al. (2007a) and Clarke et al. (2007b).

Ambient TSS in the Newark Bay-Arthur Kill system and Upper Harbor were similar to TSS ranges in other northeastern estuaries with an overall near-bottom average of 15 milligrams/liter (mg/L) (USACE 2002). In some cases, turning ships within Newark Bay created TSS concentrations that were two orders of magnitude greater than ambient TSS concentrations. Site-specific factors such as sediment type and current conditions strongly influence plume size with larger plumes in areas with finer sediment grains size and stronger currents. For instance, in the Upper Bay, where sediments are sand/silt, TSS concentrations were typically 200 mg/L or less within 500 meters of the dredge and were equal to ambient conditions within 1,000 meters of the dredge (USACE 2011a). In Newark Bay, where sediments are silt/clay, TSS plumes as high as 200 mg/L occurred within 75 meters of the dredge, with rapid dissipation to less than 100 mg/L 150 meters down current from the dredge (USACE 2009). The results of the TSS surveys in these waterbodies have consistently shown that resuspended sediment plumes rapidly descended to the bottom of the navigation channel with no evidence of plume excursion beyond the channel side slopes onto the adjacent flats.

Biological impacts of suspended sediments on aquatic organisms historically were studied based on testing TSS concentrations without including durations of exposure as a factor. In addition, salmonids were a common target organism and impacts to estuarine fishes were not commonly studied (Wilber and Clarke 2001). Of the EFH species listed for the NYD project area, only juvenile bluefish were tested in experiments that recorded both TSS concentration and exposure duration data and results indicated 100 percent mortality at a TSS level of 800 mg/L for one day (Sherk et al. 1974, Wilber and Clarke 2001). As measured in multiple TSS surveys in the Harbor (e.g., Clarke et al. 2007b), plumes generated by dredging projects produce TSS concentrations above several hundred mg/L only within a few meters of the source. Concentration gradients within dredge plumes decrease exponentially with increasing time and distance from the dredge. Within most of the volume of dredge plumes TSS concentrations fall within the range regularly produced by the passage of storms (Bohlen 1980, Sosnowski 1984, Tramontano and Bohlen 1984). The fact that plumes have been demonstrated to remain within navigation channel side slopes in NY/NJ Harbor also indicates that exposures to plumes would be of relatively short duration for most EFH species.

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7. EFH species assessment

7.1 Butterfish (*Peprilus tricanthus*)

EFH has been identified within the Harbor for the larval, juvenile and adult life stages of Atlantic butterfish. Early life stages of butterfish have not been collected as part of the ABS surveys; therefore, no potential impacts are expected on these life stages.

Potential project related impacts to EFH and juveniles and adults, would be more likely to occur from late spring through fall (May through November). Because juveniles and adults prefer open and near bottom waters, potential direct impacts to Atlantic butterfish is limited to temporary disturbances within the water column. These impacts are localized and include increased turbidity within the water column. Recent sampling, however, has shown that the suspended sediment plumes associated with dredging in the Harbor follows a pattern of rapid gradient decay and settlement with the maximum spatial extent of plumes limited to the lower water column and seldom measuring more than 70 meters (230 feet) across at substantial concentrations (USACE 2010).

Indirect impacts are those resulting from the temporary loss of forage organisms and/or forage habitat and the alteration of existing habitat related to the deepening of the channels. Because Atlantic butterfish juveniles feed primarily on ctenophores and macro-zooplankton and adults on mollusks, the potential indirect impacts associated with the loss of forage species are minimal as other habitat outside of the immediate construction area is available.

Cumulative impacts are also expected to be negligible because of the species' mobility and available habitat throughout the Harbor. Therefore, no more than minimal direct impacts on Atlantic butterfish EFH are anticipated as a result of the ongoing HDP and future maintenance within the Harbor.

7.2 Atlantic herring (*Clupea harengus)*

EFH has been identified within the Harbor estuary for the larval, juvenile and adult life stages of Atlantic herring. Atlantic herring is a pelagic species that is only seasonally abundant within the project area. Potential impacts to EFH will therefore be limited to the late winter and spring (February through May), when migrating juveniles and adults are common to the estuary.

Because larvae, juveniles and adults are pelagic, potential direct impacts to Atlantic herring EFH will be limited to temporary disturbances within the water column such as bucket hoisting operations. These impacts are localized and may include increased turbidity by settling sediments within the water column. Recent sampling, however, has shown that the suspended sediment plumes associated with dredging in the Harbor estuary follows a pattern of rapid gradient decay and settlement with the maximum spatial extent of plumes limited to the lower water column and seldom measuring more than 70 meters (230 feet) across at substantial concentrations (USACE 2010).

Since this species feeds within the water column, turbidity resulting from dredging activities may have some short-term impact on feeding success. However, the exposed individuals are likely to move to adjacent waters where feeding will be less problematic during dredging operations.

These impacts will be further minimized whenever possible through BMPs as well as through seasonal restrictions.

Indirect impacts are those resulting from the temporary loss of forage organisms and/or forage habitat and the alteration of existing habitat related to the deepening of the channels. Because Atlantic herring are planktivorous and feed primarily on zooplankton, the indirect impacts associated with the loss of forage species are expected to be minimal as there is other viable habitat and food sources available outside of the construction area.

Cumulative impacts are also expected to be negligible because of the species' mobility and the availability of other EFH throughout the Harbor. Therefore, no more than minimal direct, indirect and cumulative impacts on Atlantic herring EFH are anticipated as a result of the ongoing HDP and future maintenance within the Harbor.

7.3 Atlantic Mackerel *(Scomber scombrus).*

EFH has been identified within the Harbor estuary for juveniles and adults. Atlantic mackerel were not collected within the Harbor and they are generally not expected to occur in the vicinity of dredged channels. Therefore, no potential direct, indirect and cumulative impacts to Atlantic mackerel EFH are anticipated as a result of the ongoing HDP and future maintenance within the Harbor.

7.4 Black Sea Bass (*Centropristus striata*)

EFH has been identified within the Harbor estuary for the juvenile and adult black sea bass life stages. Because juveniles and adults are demersal and occur near bottom in structured habitat such as reefs, they are generally not expected to occur in the vicinity of dredged channels. Therefore, no potential direct and indirect impacts to black sea bass EFH are anticipated.

Cumulative impacts are also expected to be negligible because of the species' mobility, occurrence in structured habitat, and the availability of EFH throughout the Harbor in areas outside of channels. Therefore, no direct, indirect and cumulative impacts on black sea bass EFH are anticipated as a result of the ongoing HDP and future maintenance within the Harbor.

7.5 Bluefish (*Pomatomus saltatrix*)

EFH has been identified within the Harbor for the juvenile and adult life stages of bluefish. Pelagic juvenile and adult bluefish are seasonally present within the HDP project area from late spring to early fall (May to September) with juveniles common in some years and adults usually rare/uncommon. Yearly fluctuations in abundances are possibly related to year class strength, prey abundance and physical conditions. The seasonal occurrence and pelagic behavior of bluefish greatly limits any potential impacts due to ongoing HDP construction and future maintenance activities. Juveniles and adults are pelagic, therefore, potential direct impacts to bluefish EFH will be limited to temporary disturbances of increased turbidity. Recent sampling, however, has shown that the suspended sediment plumes associated with dredging in the Harbor follows a pattern of rapid gradient decay and settlement with the maximum spatial extent of plumes limited to the lower water column and seldom measuring more than 70 meters (230 feet) across at substantial concentrations (USACE 2010).

7.6 Red hake (*Urophycis chuss*)

EFH has been identified within the Harbor for the egg, larval, juvenile and adult life stages of red hake. Red hake eggs and larvae were not collected in epibenthic ichthyoplankton sampling conducted over 10 years from January through June (Table 3). Because red hake eggs and larvae are pelagic, and spawning typically occurs offshore (Able and Fahay 1998;2010), they have not been collected within the project area during recent USACE sampling efforts (USACE 2011). Therefore, no direct impacts are expected to red hake egg and larvae EFH.

Potential direct impacts to juvenile and adult EFH are limited to the short-term disruption of bottom habitat during dredging activities. Spatial distribution and relative/seasonal abundance data from previous studies suggest that both juvenile and adult red hake are seasonally present within the HDP project area from winter to spring (January to June). Any potential impact is seasonally limited during juvenile and adult inshore migrations.

Potential indirect impacts to red hake EFH will be limited to the disturbance and temporary loss of benthic species included in the juvenile and adult diets. Indirect impacts to EFH, however, would be short-term and localized to areas of dredging since red hake are able to forage for prey in areas outside of areas impacted by dredging activities.

Cumulative impacts are expected to be minimal because red hake eggs and larvae are pelagic and juveniles and adults typically forage outside of the navigation channels.

7.7 Scup (*Stenotomus chrysops*)

EFH has been identified within the Harbor for the egg, larval, juvenile and adult life stages of scup. Scup eggs and larvae were not collected within the harbor in the epibenthic ichthyoplankton sampling conducted over ten years from January through June (Table 3). Therefore, no potential direct, indirect and cumulative impacts are anticipated to eggs and larvae.

Potential short-term impacts to juvenile and adult scup EFH are related to the temporary disruption of bottom and, to a lesser extent, water column habitats during HDP and maintenance activities. These impacts will continue to be localized and confined to the immediate dredging area and include increased turbidity and disruption/burial of substrate by settling sediments. Recent sampling, however, has shown that the suspended sediment plumes associated with dredging in the Harbor follows a pattern of rapid gradient decay and settlement with the maximum spatial extent of plumes limited to the lower water column and seldom measuring more than 70 meters (230 feet) across at substantial concentrations (USACE 2010).

Most of the project area, however, remains available for foraging and growth and scup will take advantage of the undisturbed habitat elsewhere in the Harbor. Potential impacts to EFH is restricted to May through October, when adults and juveniles are most common.

Potential indirect impacts to scup EFH will continue to be limited to the disturbance and temporary loss of benthic species included in the juvenile and adult diets. Indirect impacts to EFH will also be short-term and localized to areas of construction and dredging. Scup will be able to forage for prey in areas outside of that impacted by these activities.

Cumulative impacts are also expected to be negligible because of the species' mobility, seasonal occurrences, and the availability of other EFH throughout the Harbor. Therefore, minimal direct, indirect and cumulative impacts on scup EFH are anticipated as a result of the ongoing HDP and future maintenance within the Harbor.

7.8 Summer flounder (*Paralichthys dentatus*)

EFH has been identified within the Harbor for the larval, juvenile and adult life stages of summer flounder. Summer flounder larvae were present, but rare, from January through May in the Harbor and were not collected in June in any year of sampling (Table 3). Juveniles were collected in the Harbor in all months of sampling with the exception of September, whereas adults were not collected in the Harbor in September and November (Table 3). Adult densities were highest in the late spring and were concentrated in the Arthur Kill/Newark Bay and Upper Bay areas at both channel and non-channel stations (Figure 8).

Potential direct impacts to summer flounder EFH from the project include the temporary disruption and direct loss of summer flounder larvae and juvenile life stage habitat. Changes in bathymetry are limited to the channels and the side slope areas and will therefore minimally impact shallow/non-channel areas during the HDP. However, these impacts would not occur during future maintenance dredging. Short-term impacts would include increased turbidity associated with dredging activities. Recent surveys have shown that the suspended sediment plumes associated with dredging in the Harbor exhibit a pattern of rapid gradient decay and settlement with the maximum spatial extent of plumes limited to the lower water column and seldom measuring more than 70 meters (230 feet) across at substantial concentrations (USACE-NYD 2010).

Potential indirect impacts to summer flounder EFH include the removal and/or burial of benthic and epibenthic forage species habitat and the disruption and loss of forage species through increased turbidity and sediment re-suspension during dredging and the exclusion of some forage fish from the project area during construction. These indirect impacts are short-term as finfish prey species will return to the area immediately and benthic communities will begin to re-establish themselves within a few months following construction (Wilber and Clarke 2007). Moreover, adult summer flounder are opportunistic feeders and prey on a variety of on fish including sand lance, bay anchovy, and other flatfish (Klein-MacPhee 2002), while juveniles forage on sand shrimp and small fish. The loss of forage habitat would likely cause summer flounder to relocate to other feeding habitats within the Harbor since the total aquatic habitat area impacted during the construction phase is a small fraction of the total estuary available to summer flounder. The majority of this disturbed habitat has undergone natural re-colonization from contiguous areas shortly after the construction phase and return to the same productivity levels as currently exists with larval infauna and epifauna representing the first generation of re-colonization to settle on the new substrate.

Potential cumulative impacts of Harbor deepening activities will continue to be avoided and minimized whenever possible through integration of a variety of best management practices that include the use of the most efficient and environmentally compatible dredging equipment and operating practices. Moreover, dredging activities associated with the ongoing HDP will occur primarily within the existing boundaries of channels with minimal loss of shallow water EFH. Shallow water habitat has been created and enhanced through various USACE projects.

7.9 Windowpane flounder (*Scophthalmus aquosus*)

EFH has been identified within the Harbor for the egg, larval, juvenile and adult life stages of windowpane flounder. Windowpane flounder eggs and larvae were collected in epibenthic ichthyoplankton sampling conducted over 10 years from January through June (Table 3). Eggs were first collected in April and larvae in May. Juvenile and adult windowpane flounder are present throughout the year with the lowest abundance during the summer within the HDP area.

Potential direct impacts to windowpane flounder EFH include the temporary disruption of nursery EFH during deepening dredging operations. Windowpane flounder spawning may occur within the project area during the spring and early summer months. However, direct impacts to egg and larval stages are minimal because prevailing tidal currents will transport most eggs and larvae away from the project site. Spawning adults should be able to locate other suitable habitat within the estuary.

Potential indirect impacts to windowpane flounder EFH are related to bottom habitat disturbance and the potential temporary loss of forage organisms in the immediate vicinity of dredging. Impacts to windowpane flounder EFH would be short-term since natural sedimentation and subsequent re-colonization by benthic invertebrates and other prey are expected to occur within six months to several years depending on sediment characteristics and the scale, timing and frequency of disturbance (Wilber and Clarke 2007). A significant portion of the windowpane flounder's prey is pelagic. In-water construction activity would induce temporary avoidance behavior in most of these prey species. The resulting impact on windowpane flounder would be the need to follow their prey to other suitable habitats.

No long-term, direct, indirect or cumulative impacts on windowpane flounder are anticipated as a result of the ongoing HDP because impacts to spawning and nursery EFH will be short-term and impacts to benthic habitat are temporary, allowing for re-colonization. Lastly, shallow water habitat has been created and enhanced through various USACE-sponsored programs.

7.10 Winter flounder (*Pseudopleuronectes americanus*)

Potential direct impacts to winter flounder EFH from the HDP project include the temporary disruption and direct loss of winter flounder spawning and early life stage habitat due to any required widening of the navigation channels. The permanent loss of habitat would not be associated with maintenance dredging. Potential short-term impacts include increased turbidity and sediment re-suspension associated with dredging activities, the direct loss of eggs and larvae due to physical removal, exposure of eggs and larvae to suspended or deposited sediments due to re-suspension and transport of sediments (Berry et al. 2011).

Results of the long-term ABS sampling (2002–2010) that focused on winter flounder early life stage utilization of the Harbor provide strong evidence consistent with existing literature that navigation channels are not high value spawning habitat (USACE 2010, Wilber et al. 2013). In addition, the robust dataset has been used to better define the timing of winter flounder spawning activity in the Harbor, and thus, refine existing dredge windows associated with the HDP. In addition, Harbor-wide TSS surveys demonstrated that the lateral extent of the TSS plumes was confined to the channel basins and suspended sediments rapidly decayed from the dredge platform, thereby minimizing any potential impacts to shallow water habitats.

Entrainment during dredging or physical injury to juvenile and adult winter flounder is considered possible, yet improbable, as these stages are highly mobile and capable of avoiding the adverse impacts associated with the physical modification of the benthic substrate. Changes in bathymetry is limited to the channels and the side slope areas for the ongoing HDP and therefore minimally impacting shallow/non-channel winter flounder spawning EFH.

Potential indirect impacts to winter flounder EFH would include the removal and/or burial of benthic and epibenthic forage species habitat and the disruption and loss of forage species through increased turbidity and sediment re-suspension during dredging, and the exclusion of some forage fish from the project area during construction. These indirect impacts are expected to be short-term as finfish prey species will return to the area and benthic communities will begin to re-establish themselves within a few months following construction (Wilber and Clarke 2001, 2007). Moreover, adult winter flounder are opportunistic feeders and the loss of forage habitat would cause winter flounder to locate to other feeding habitats within the Harbor since the total aquatic habitat area impacted during the construction phase is a small fraction of the total estuary available to winter flounder. The majority of this disturbed habitat is expected to undergo natural re-colonization from contiguous areas shortly after the construction phase and return to the same productivity levels as currently exists with larval infauna and epifauna representing the first generation of re-colonization to settle on the new substrate.

Potential cumulative impacts of ongoing HDP activities have been avoided and minimized whenever possible through integration of a variety of BMPs that include the use of the most efficient and environmentally compatible dredging equipment and operating practices as well as the use of dredge windows and blasting restrictions that protect the spawning and nursery habitat of winter flounder EFH. Moreover, dredging activities associated with the HDP and maintenance dredging did and will continue to occur primarily within the linear framework of existing channels with minimal loss of shallow water nursery EFH. Lastly, shallow water habitat has been created and enhanced through various USACE-sponsored programs described in further detail in Section 9.

7.11 Little skate (*Raja erinacea*)

EFH has been identified within the Harbor for the juvenile and adult life stages of little skate. Juvenile little skate were collected at very low densities in the Harbor from late fall through spring, adults were slightly more common than juveniles (Table 3). Juveniles were collected during winter and spring in low abundances (rare). Adults were common in January, April and November (Table 3).

Because little skate are collected in relatively low abundance within the estuary and because they are limited to the higher salinity zones of the Lower and Upper Bays, no more than minimal direct impacts are anticipated as a result of ongoing HDP activities and future maintenance dredging. Potential indirect impacts to little skate EFH are related to direct impacts to benthic prey resources. These indirect impacts are temporary and limited to the area of bottom disturbance. The potential loss of prey resources within the construction area may induce individual skates to relocate to alternative foraging areas. Given the limited extent of the impact area and the relatively low abundance of little skates in the project area, no direct, long-term indirect or cumulative impacts are anticipated as a result of the ongoing HDP and future maintenance.

7.12 Clearnose skate (*Raja eglanteria*)

EFH has been identified within the Harbor for the juvenile and adult life stages of clearnose skate. Since 2002 clearnose skate were collected during the ABS bottom trawl sampling primarily from channel stations in the Lower Bay and Upper Bay. Because typically less than 20 individuals were collected in any given year, no more than minimal direct impacts are anticipated as a result of ongoing HDP and maintenance dredging activities. Potential indirect impacts to clearnose skate EFH are related to impacts to benthic prey resources. These indirect impacts are temporary and limited to the area of bottom disturbance. The potential loss of prey resources within the construction area may induce individual skates to relocate to alternative foraging areas. Given the limited extent of the impact area and the low abundance of clearnose skates in the project area, no direct, long-term, indirect impacts or cumulative impacts are anticipated as a result of the ongoing HDP and future maintenance.

7.13 Winter skate (*Leucorja ocellata*)

EFH has been identified within the Harbor for the juvenile and adult life stages of winter skate. Winter skate are occasionally (0 to 11/year) collected in the HDP and these occurred primarily in the channel stations of the Lower Bay and Upper Bay. No more than minimal direct impacts are therefore anticipated as a result of ongoing HDP and future maintenance activities. Potential indirect impacts to winter skate EFH are related to direct impacts to benthic prey resources. These indirect impacts are temporary and limited to the area of bottom disturbance. The potential loss of prey resources within the construction area may induce individual skates to relocate to alternative foraging areas. Given the limited extent of the impact area and the relatively low abundance of winter skates in the project area, no long-term, direct, indirect and cumulative impacts are anticipated as a result of the ongoing HDP and future maintenance.

7.14 Other EFH species

There are five other EFH-managed species in the HDP (Atlantic mackerel, king mackerel, sand tiger shark, dusky shark, and sandbar shark), none of which have been collected in the HDP during the ABS or MFS surveys (Table 3). Another two EFH managed species were very rarely collected in the HDP (two Spanish mackerel were collected in a mid-water trawl at an Arthur Kill/Kill Van Kull channel station in August of 2006, and one cobia was collected at an Upper Bay channel station).

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8. Assessment Summary

Direct impacts include all physical and environmental alterations to the useable habitat for each species. The potential direct impacts to EFH associated with dredging both HDP construction and future maintenance is limited primarily to demersal fish species, including winter flounder, windowpane flounder, summer flounder and red hake. Water quality impacts to EFH due to project in-water activities is limited to changes in turbidity levels and suspended solids in the immediate dredging area. Potential increases in suspended solids and turbidity can be minimized by using best management practices, such as specific equipment type, required by the state-issued water quality certificate for each contract area. Moreover, recent surveys have shown that the suspended sediment plumes associated with dredging in the Harbor follow a pattern of rapid gradient decay and settlement with the maximum spatial extent of plumes limited to the lower water column and seldom measuring more than 70 meters (230 feet) across at substantial concentrations (USACE 2010).

Juveniles and adults that use the project area will actively avoid most in-water work areas opting for other appropriate habitat within the NY/NJ Harbor. It is anticipated that most of the direct impacts would be associated with short-term effects. These temporary effects would result in the exclusion of the fish species from the project area due to increased turbidity, water disturbance, noise and vibrations. These effects would be very spatially limited to local waters and benthic habitat and would cause mobile organisms to move to other habitat. This avoidance behavior would occur only in those areas where active dredging is underway.

For the remaining HDP contract areas and for future maintenance dredging, no blasting will be conducted except for the S-AK-3 contract areas which are currently under construction. Therefore, potential impacts to EFH from blasting are limited and temporary.

Changes in water depth and bathymetry would result in long-term impacts, since both channel and shoal areas will have been excavated during the HDP. Channels and other deep water areas serve an important role in the estuary for several EFH species including winter flounder and red hake. Maintained navigational channels have been a long-term baseline condition in the Harbor and the HDP would represent only a minor incremental change to an already established habitat type. The widening of channels during the HDP and the removal of shallow habitat in selected areas, could potentially have more direct impact but would be mitigated by other habitat enhancement projects in the Harbor as well as the more subtle benefits of deepening such as the creation of more deepwater areas and the removal of sediment contamination.

Other potential direct impacts from the HDP include changes in underlying substrate. Impacts to sediment type would result from the removal of fine-grained sand and mud from channel areas. Sediment removal impacts would be realized most in areas requiring channel excavation (Arthur Kill Channel, Kill Van Kull Channel, and Newark Bay Entrance Channel). Only minor impacts to sediment type would occur in other project areas, since sediment type below existing bottom sediments is expected to be similar to the bottom sediments.

The primary indirect impact to EFH species from the HDP and future maintenance dredging is the effect of construction activities on benthic communities in the project area. Many of the listed finfish are demersal, or benthic feeders, which may experience a reduction in feeding efficiency for some period of time during and immediately following dredging. Indirect impacts are those that impact forage species in the form of displacement, temporary loss of forage species habitat and/or temporary loss of forage species individuals. The potential indirect impacts for EFH would be related to bottom habitat disturbance and the potential loss of forage organisms in the immediate vicinity of dredging. However, the remaining HDP contract areas and the future maintenance areas are a small percentage of the overall NY/NJ Harbor and mobile fish species will be able to forage in areas adjacent to the project area.

Based on previous studies, the re-establishment of benthic communities varies between six months to a year after the project's completion depending on substrate type (USACE 2007c, Wilber and Clarke 2007). Thus no long-term indirect impacts are expected as a result of the HDP and future maintenance dredging.

Because the HDP and future maintenance project area (i.e. NY/NJ Harbor) is densely populated and heavily industrialized, the potential for a variety of ongoing and future activities to cumulatively affect EFH-managed species does exist. Other permitted and pending projects located within the project area have been authorized by permits issued under the USACE's Permits Program for the Clean Water Act Section 404 and Section 10 of the Rivers and Harbors Act of 1899. Some of these applicants have already completed some dredging; others have not begun or scheduled the work. Other than the Port Authority and USACE, the permitted and pending work typically represents maintenance around pier areas and includes dredging, pier rehabilitation, and pier maintenance, rehabilitation of wave breaks, bridge abutment rehabilitation, and wharf reinforcements. Additional and updated information regarding specific permit actions is available on the USACE web page at http://www.nan.usace.army.mil/Missions/Regulatory/RegulatoryPublicNotices/tabid/4166/Year/2013/Page/3/Default.aspx . Relevant environmental documents and the Statement of Findings or Record of Decision containing these evaluations are also available from the USACE.

Short-term cumulative impacts would be related to dredging associated with other permitted or maintenance projects that are ongoing concurrently within the Harbor. Impacts to EFH would be the combined effect on EFH related to avoidance of turbidity and temporary loss of benthic communities in the dredged areas. However, the impact to EFH in the project area is only a small percentage of the total EFH that exists in the Harbor for any one of the managed species.

Specifically, in response to cumulative impacts, mobile life stages are expected to find acceptable habitat elsewhere within the Harbor beyond the localized dredging plumes. Early life stages that are pelagic and planktonic will be carried through areas of dredging by tidal currents resulting in little effect on them. The life stages that would be most susceptible to the deepening and future maintenance dredging are eggs and larvae. Eggs are demersal and adhesive for a short period following fertilization; larvae are largely passive drifters with limited capabilities to move within the water column. The magnitude of cumulative impacts from this and other projects would be directly related to work occurring in specific areas that EFH species had used as spawning grounds the past winter and spring, and then only if the eggs and/or larvae were still present.

9. Habitat Enhancement, Beneficial Use and Mitigation

The USACE has been conducting several large-scale environmental programs in the NY/NJ Harbor that focus on improving shallow, aquatic habitat through the beneficial use of dredged material. These habitat enhancement, beneficial use and mitigation projects will yield water quality improvements, which will enhance inter-tidal and sub-tidal habitat functions, contribute to increased production of benthic assemblages, shellfish and finfish populations, and subsequent increases in resident and migratory fish species that rely on the Harbor. Example projects are highlighted below and in Appendix 2:

- Multi-year biological sampling programs: In response to NMFS consultations, USACE-NYD agreed that as part of mitigation for the HDP, they would conduct long-term aquatic biological sampling programs to collect spatial and temporal data on aquatic species in NY/NJ Harbor.
- Port Jersey Project: As part of the Port Jersey Deepening and Navigation Safety Improvement Project, the USACE–NYD, instituted a Habitat Enhancement Project (HEP or Project) which utilizes clean subsurface sediments (e.g., sand and glacial till) dredged from the Port Jersey Federal Navigation Channel to re-establish shallow depth habitat within a portion of the adjacent, but no longer used, Military Ocean Terminal Bayonne (MOTBY). This beneficial use of dredged material was designed to fill in a large section of the MOTBY channel and re-establish continuity with the adjacent shoals from which the original MOTBY channel was cut. During an existing conditions study, the MOTBY channel bottom was found to offer little in the way of habitat variation and supported low biological diversity. The HEP was designed to bury and replace the unconsolidated, low-quality mud and silt bottom sediments with clean, coarse glacial till. The shallower post-construction depth of the channel has the potential to improve water quality via more effective circulation and flushing. These enhancements provide higher quality benthic habitat capable of supporting a greater diversity of estuarine organisms in comparison to previous conditions. The habitat improvements are expected to benefit many estuarine and marine species including the commercially important winter flounder (*Pseudopleuronectes americanus*).
- The HDP removed a considerable amount of regulated sediments from the Harbor.
- Rock material from the HDP has been used to create large-scale artificial reefs within NY and NJ waters.
- Another HDP benefit has been a reduction in nitrous oxide emissions due to improved air quality conformance and retrofitting ferries within the Harbor with more efficient power plants.
- Under USACE's Continuing Authorities Program (CAP), the New York City Department of Environmental Protection (NYCDEP) and NYSDEC requested assistance in implementing one or more restoration projects. A feasibility report titled Jamaica Bay Marsh Islands, Jamaica Bay, NY, Integrated Ecosystem Restoration Report, Environmental Assessment and Finding of No Significant Impact was approved in 2006, recommending restoration of three marsh islands: Yellow Bar Hassock, Elders Point

East, and Elders Point West. Restoration of the Jamaica Bay Marsh Islands involves using dredged material to restore island elevation and replanting salt marsh vegetation.

- Construction of the Elders Point East marsh island took place in 2006-2007 and Elders Point West in 2009-2010 restoring approximately 80 acres of marshland. The Engineering Documentation Report for Yellow Bar Hassock and the Amendment to the Project Cooperation Agreement for the NY&NJ Harbor Deepening Project were both approved by the Assistant Secretary of the Army in June and September 2011, respectively.
- Yellow Bar Hassock was constructed through the beneficial use of dredged material from the New York & New Jersey Harbor Navigation Project per Section 207 authority in cooperation with The Port Authority of New York & New Jersey, the non-Federal sponsor. The NYSDEC and NYCDEP funded the local share (35 percent) of the Yellow Bar marsh restoration project.
- Approximately 44 acres of salt marsh habitat were restored at Yellow Bar Hassock via placement of ~375,000 cubic yards of sand from Ambrose Channel. The 44 acres of marsh is comprised of approximately 14 acres of transplanted low marsh plant hummocks, 21,859 newly planted high marsh transition plants and 17,175 high marsh plants and more than 330 pounds of dispersed seed.
- Ambrose Channel sand was also beneficially used in September and October 2012 to restore an additional 30 acres of marsh islands at Black Wall (155,000 cubic yards of sand, 20.5 acres) and Rulers Bar (95,000 cubic yards of sand – 9.8 acres). Black Wall and Rulers Bar Marsh Islands were constructed as part of the USACE Beneficial Use Program along with USACE partners NYCDEP, NYSDEC, and The Port Authority of New York and New Jersey. The NYSDEC and NYCDEP paid 100 percent of the costs associated with sand placement.
- The marsh island restoration efforts are being monitored and are providing valuable data on the most effective future restoration options. This program also has significant implications for the future success of restoration activities from beneficially using sand from the Operations and Maintenance (O&M) Program.

- The NYD is also exploring the benefits of restoring underwater borrow pits in Norton Basin and Little Bay to increase flushing and improve water quality in the bay.

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Tables

Table 1: Harbor Deepening Contract Areas and Status June 2013

Water Body	Contract Area	Status
Newark Bay	S-NB-1	Completed
	S-NB-2	Completed
	S-E-1	Completed
Arthur Kill	S-AK-1	Completed
	S-AK-2	Ongoing
	S-AK-3	Currently in Construction
	S-SR-1	Awarded July 2013; construction anticipated to begin Fall 2013
	S-SR-2	To be awarded by the end of September 2013; construction anticipated to begin late 2013
	S-UC-1	Advertise and award dependent upon FY14 & FY14 appropriations
Kill van Kull	S-KVK-1	Completed
	S-KVK-2	Completed
	S-KVK-5	Completed
Upper Bay	PJ- 3	Completed
	PJ-4	Completed
	S-AN-1a	Completed
	S-AN-2	Completed
Lower bay	S-AN-1b/S-AM-2b	Completed
	S-AM-1a	Completed
	S-AM-2a	Completed
	S-AM-3a	Completed
	S-AM-3b	Completed

Table 2: EFH Designated Species within the HDP Project Area

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
red hake (Urophycis chuss)		M,S	M,S	M,S	
winter flounder (Pseudopleuronectes americanus)	M,S	M,S	M,S	M,S	M,S
windowpane flounder (Scophthalmus aquosus)	M,S	M,S	M,S	M,S	M,S
Atlantic sea herring (Clupea harengus)		M,S	M,S	M,S	
bluefish (Pomatomus saltatrix)			M,S	M,S	
Atlantic butterfish (Peprilus triacanthus)		M	M,S	M,S	
Atlantic mackerel (Scomber scombrus)			S	S	
summer flounder (Paralichthys dentatus)		F,M,S	M,S	M,S	
scup (Stenotomus chrysops)	S	S	S	S	
black sea bass (Centropristus striata)			M,S	M,S	
king mackerel (Scomberomorus cavalla)	X	X	X	X	
Spanish mackerel (Scomberomorus maculatus)	X	X	X	X	
cobia (Rachycentron canadum)	X	X	X	X	
clearnose skate (Raja eglanteria)			X	X	
little skate (Leucoraja erinacea)			X	X	
winter skate (Leucoraja ocellata)			X	X	
dusky shark (Carcharhinus obscurus)			X (neonate)		
sand tiger shark (Odontaspis taurus)			X (neonate)		
sandbar shark (Carcharinus plumbeus)			X (neonate)	X	

Source: National Marine Fisheries Service (2013) http://www.nero.noaa.gov/hcd/ny3.html Hudson River/Raritan, Sandy Hook Bays/New York/New Jersey Harbor Estuary. As well as 10' x 10 ' grids 40307400 and 40407400

Legend:

S = Includes the seawater salinity zone (salinity ≥ 25.0 ppt)

M = Includes mixing water / brackish salinity zone (0.5 ppt < salinity < 25.0 ppt)

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

X = Designated EFH but no salinity zone specified

Table 3. The highest mean CPUE (number per ten-minute tow) observed in any study EFH life stages within the harbor collected in United States Army Corps of Engineers New York District biological monitoring studies.

EFH species that were not collected within the harbor are not included in the table. Bottom sampling was not conducted in July. [a]Color coding indicates the relative monthly abundance of each life stage and is a modification of the classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Harbor Sampling Mixing (brackish) / Seawater (LB, UB)												
					MFS mid-water trawl 2006 and 2011							
									MFS bottom trawl 2006			
		ABS bottom trawl 2002-2010										
		ABS epibenthic sled 2002-2011										
Species	**Life stage**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**
Atlantic Butterfish	Juvenile											
	Adult											
Atlantic herring	Larvae											
	Juvenile											
	Adult											
Black sea bass	Juvenile											
	Adult											
Bluefish	Juvenile											
	Adult											
Red hake	Larvae											
	Juvenile											
	Adult											
Scup	Eggs											
	Larvae											
	Juvenile											
	Adult											
Summer Flounder	Larvae											
	Juvenile											
	Adult											
Windowpane Flounder	Eggs											
	Larvae											
	Juvenile											
	Adult											

Harbor Sampling Mixing (brackish) / Seawater (LB, UB)												
					MFS mid-water trawl 2006 and 2011							
									MFS bottom trawl 2006			
		ABS bottom trawl 2002-2010										
		ABS epibenthic sled 2002-2011										
Species	**Life stage**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**
Winter Flounder	Eggs	Common	Abundant	Abundant	Common	Not present	Not present	No information available	No information available	No information available	No information available	No information available
	Larvae	Rare	Common	Abundant	Highly abundant	Abundant	Common	No information available	No information available	No information available	No information available	No information available
	Juvenile	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant	No information available	Common	Common	Common	Common
	Adult	Rare	Rare	Rare	Common	Common	Rare	No information available	Rare	Not present	Rare	Rare
Little skate	Juvenile	Rare	Rare	Rare	Rare	Rare	Not present	No information available	Not present	Not present	Not present	Not present
	Adult	Common	Rare	Rare	Common	Rare	Rare	No information available	Not present	Not present	Not present	Common
Clearnose skate	Juvenile	Rare	Rare	Rare	Rare	Rare	Rare	No information available	Not present	Not present	Not present	Not present
	Adult	Rare	Rare	Rare	Not present	Not present	Not present	No information available	Not present	Not present	Not present	Not present
Winter skate	Juvenile	Rare	Rare	Rare	Rare	Rare	Not present	No information available	Not present	Not present	Not present	Not present
	Adult	Not present	Not present	Rare	Rare	Not present	Not present	No information available	Not present	Not present	Not present	Not present

Legend:

(white)	No information available	Ichthyoplankton or bottom trawl sampling not conducted.
(green)	Not present	Life stage not collected.
(light blue)	Rare	Life stage is present, but not frequently encountered.
(medium blue)	Common	Life stage is frequently encountered, but not in large numbers.
(blue)	Abundant	Life stage is often encountered in substantial numbers.
(dark blue)	Highly abundant	Life stage is consistently encountered in substantial numbers.

Figures

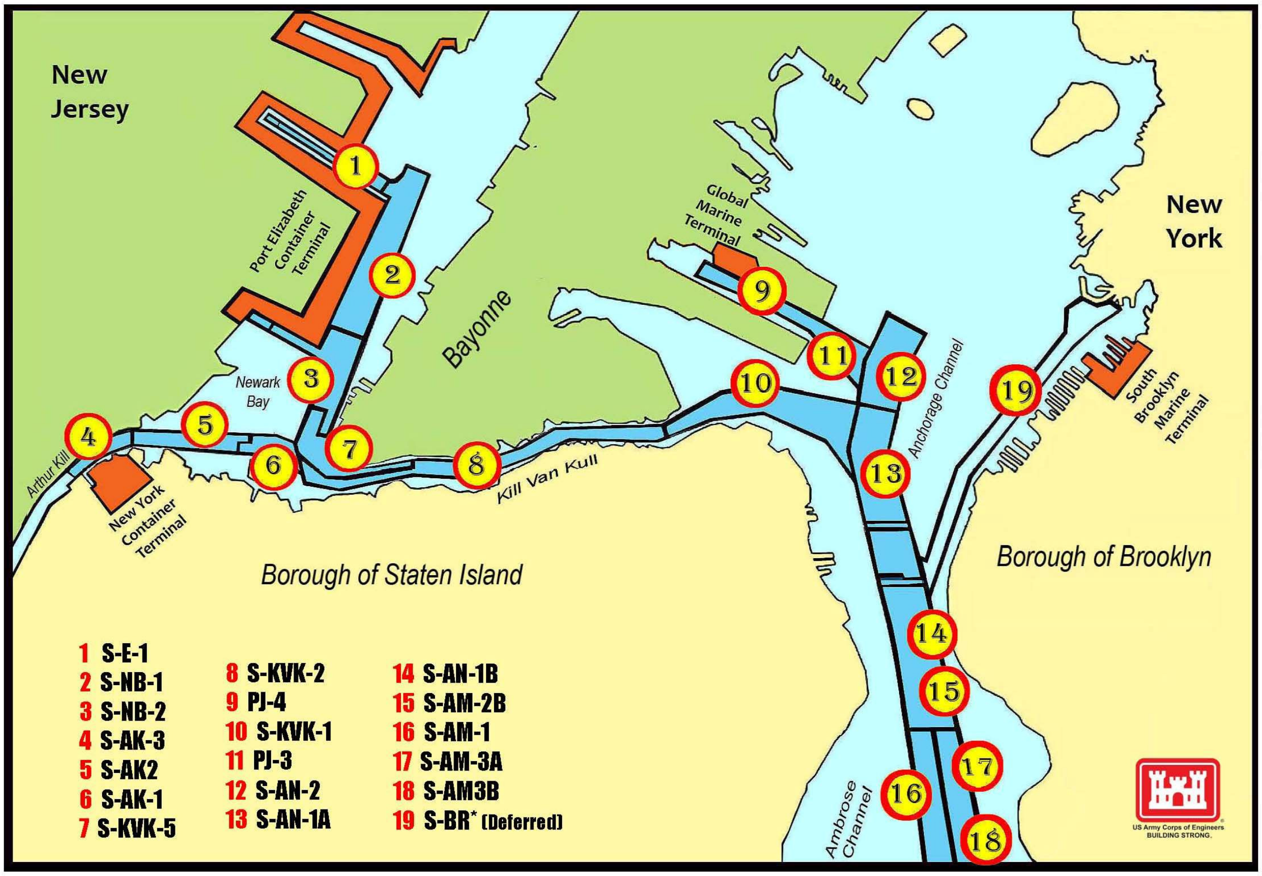


Figure 1. New York & New Jersey Harbor Deepening Contract Areas

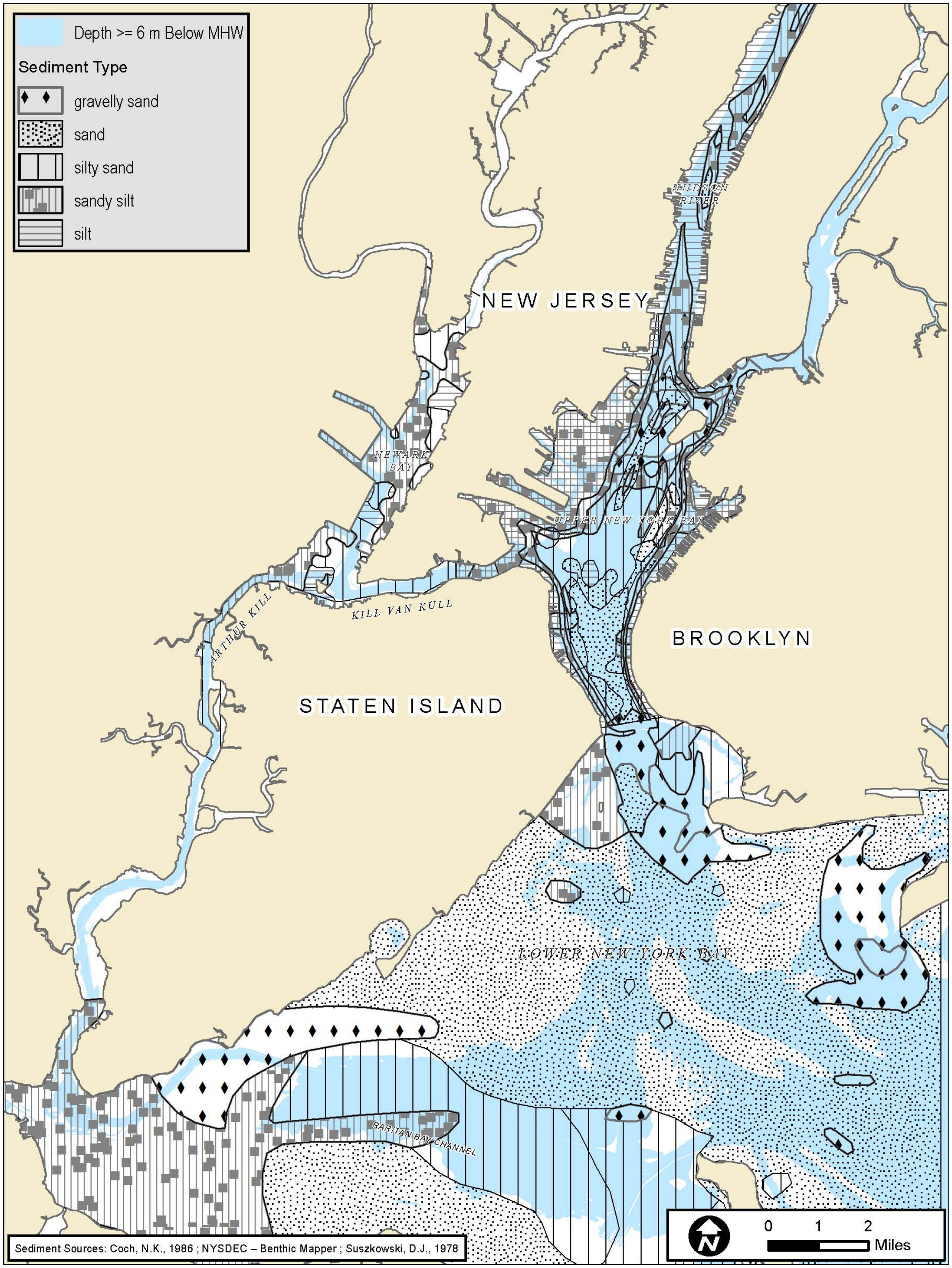


Figure 2. Summary of water depth and surficial sediments in New York & New Jersey Harbor

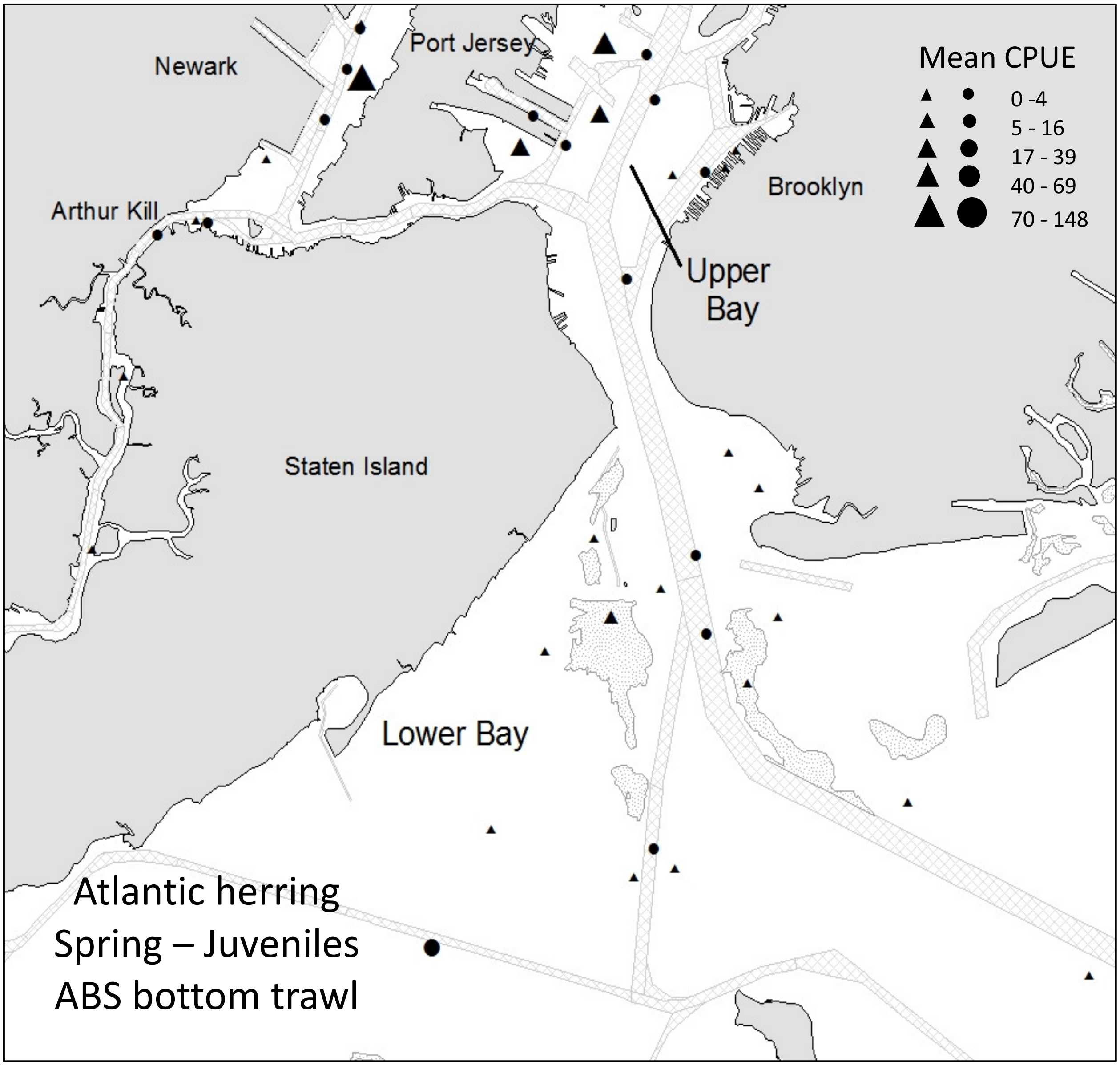


Figure 3. Atlantic herring spring (April – June) distribution and abundance for juveniles in ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow. Circles and triangles depict channel and non-channel stations, respectively.

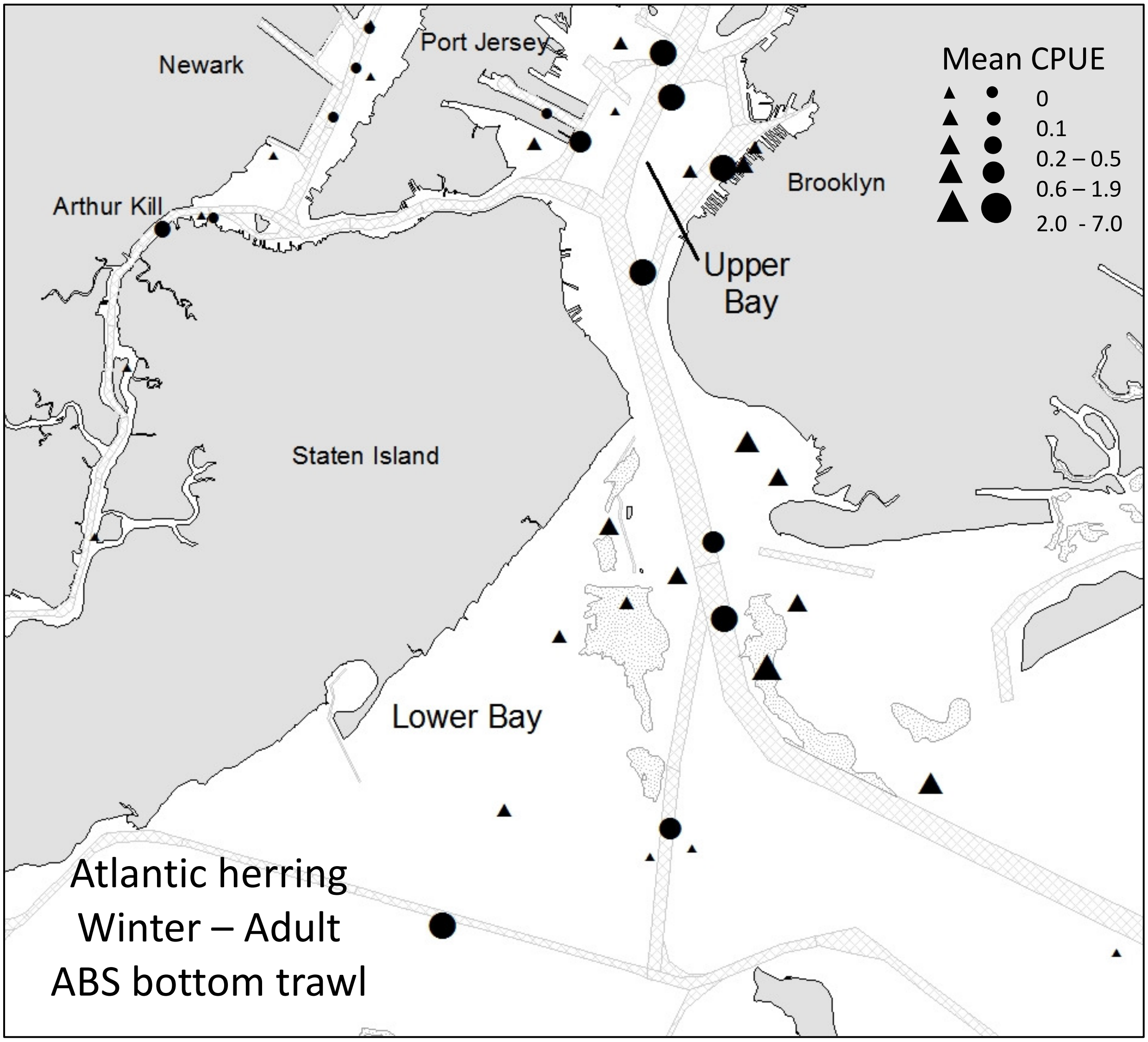


Figure 4. Atlantic herring winter (January – March) distribution and abundance for adults in ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow. Circles and triangles depict channel and non-channel stations, respectively.

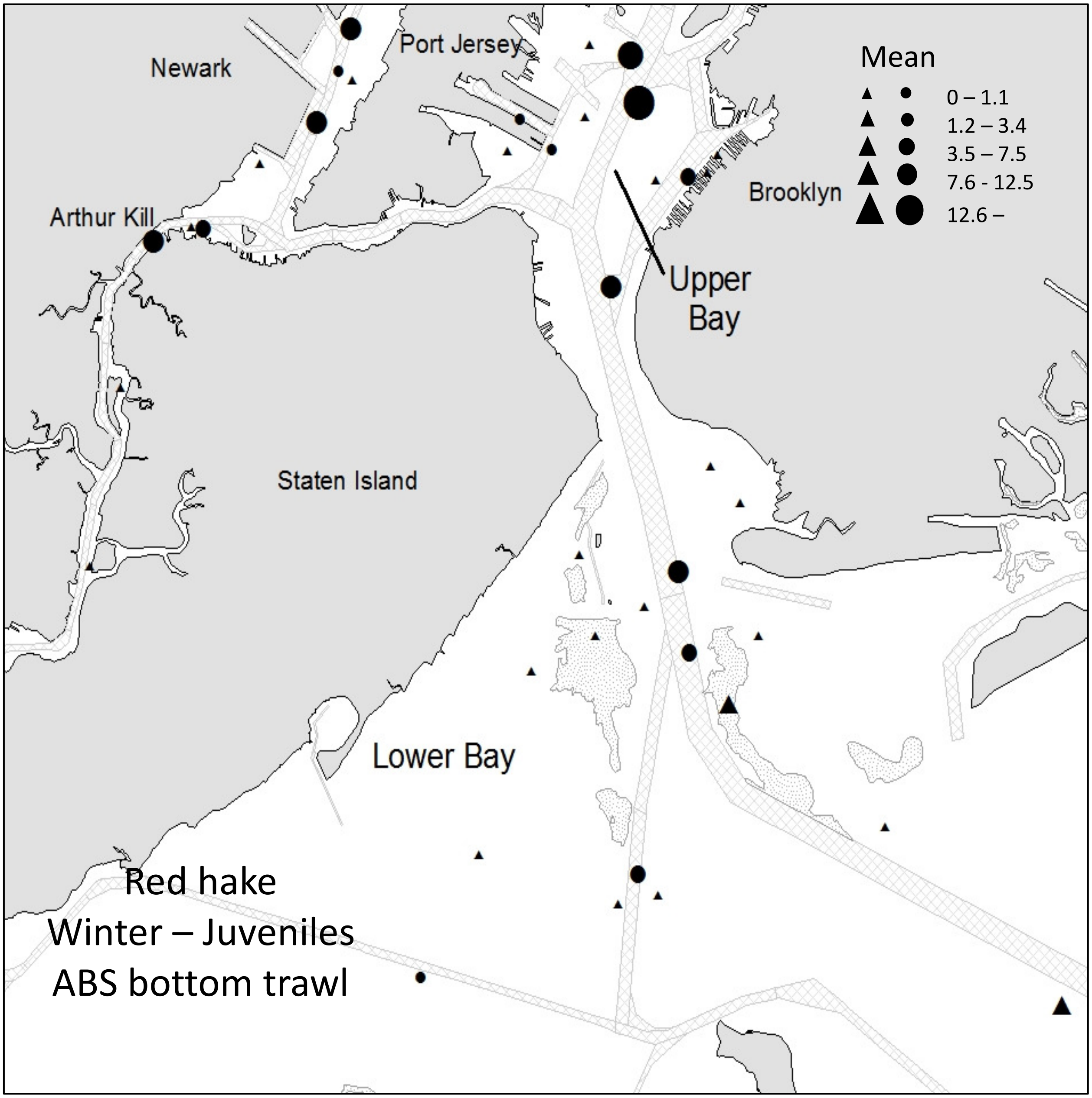


Figure 5. Red hake juvenile distribution and abundance in winter (January – March) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow. Circles and triangles depict channel and non-channel stations, respectively.

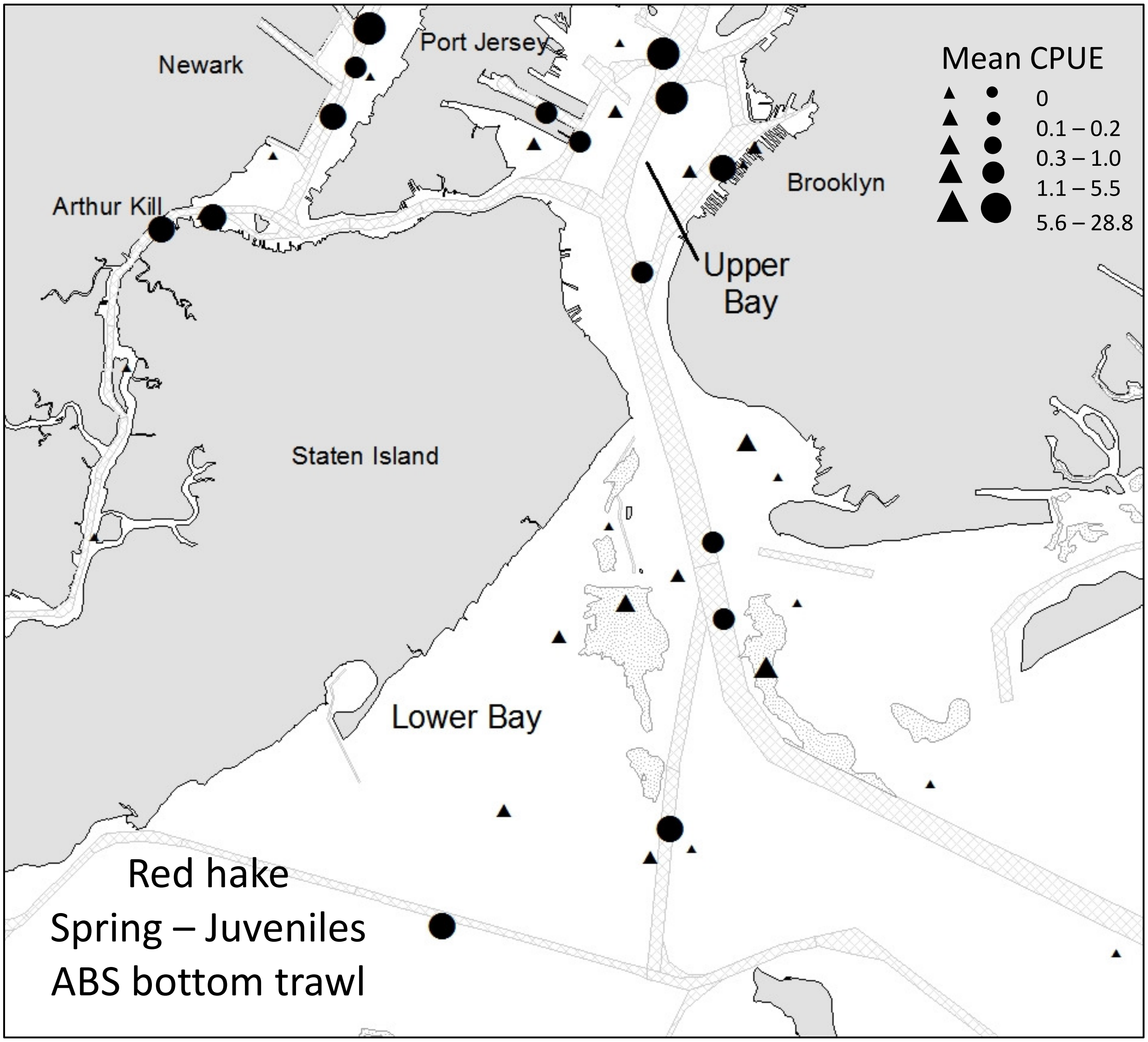


Figure 6. Red hake juvenile distribution and abundance in spring (April – June) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

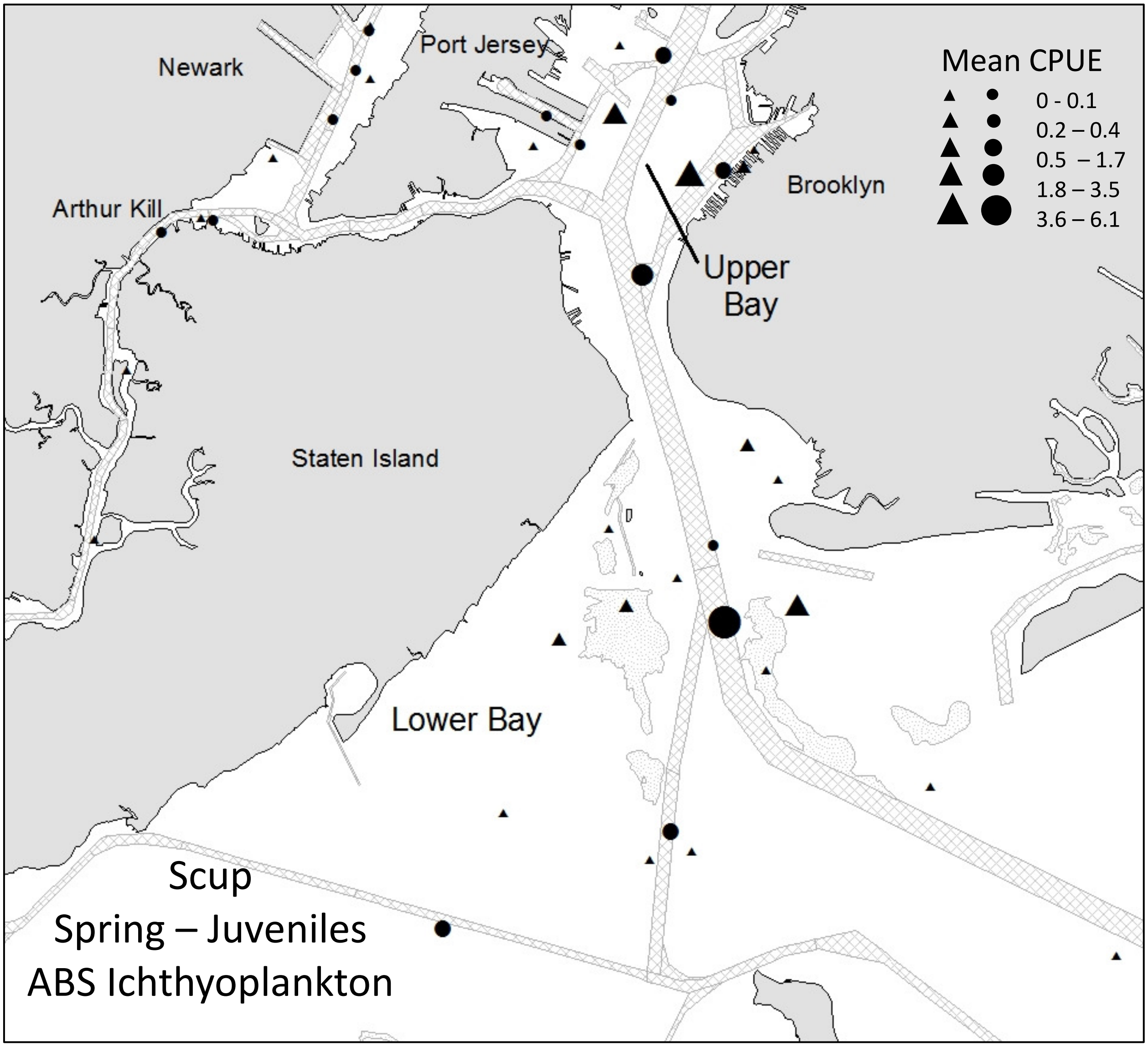


Figure 7. Scup juvenile distribution and abundance in spring (April – June) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

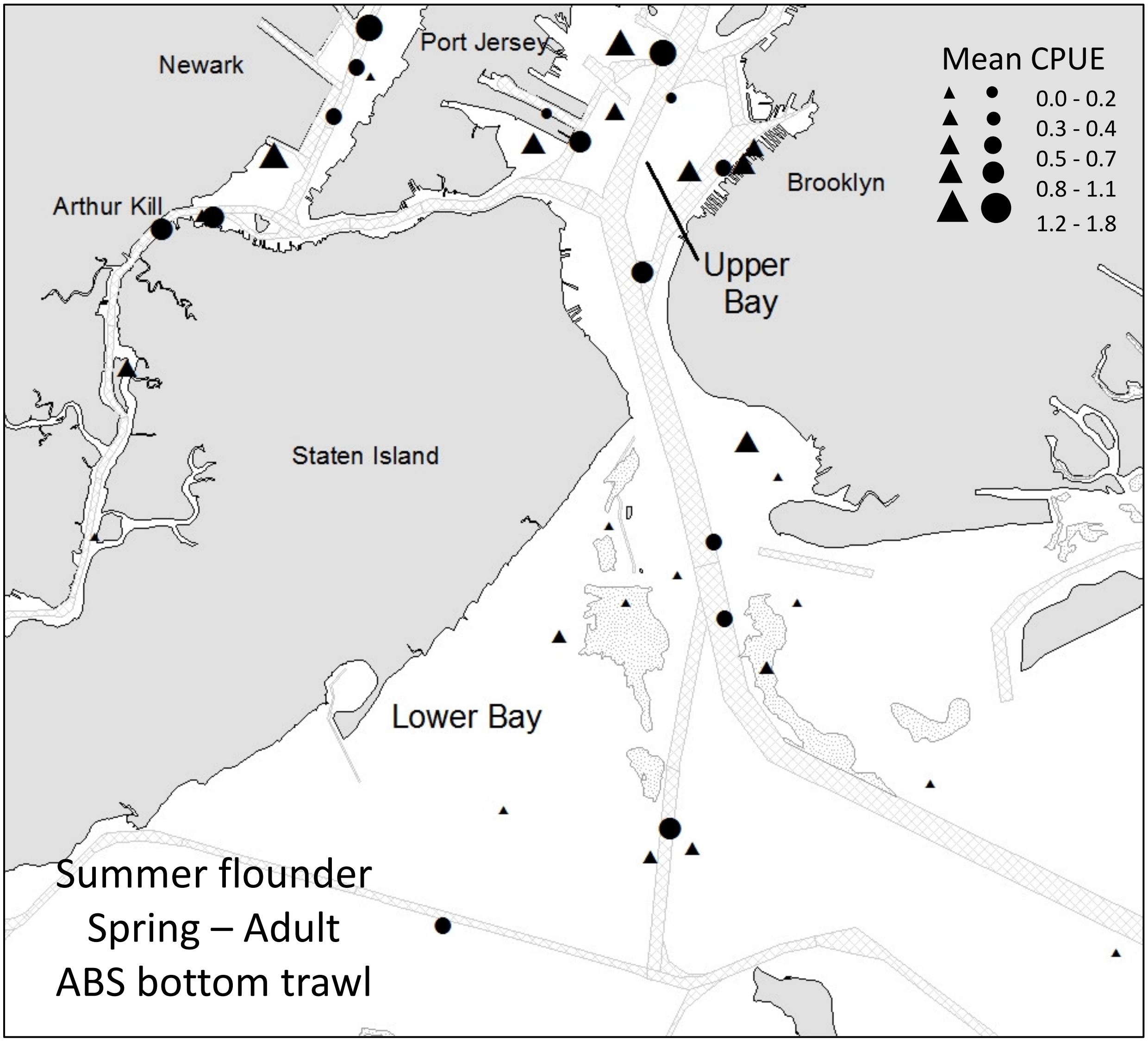


Figure 8. Summer flounder adult distribution and abundance in spring (April – June) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

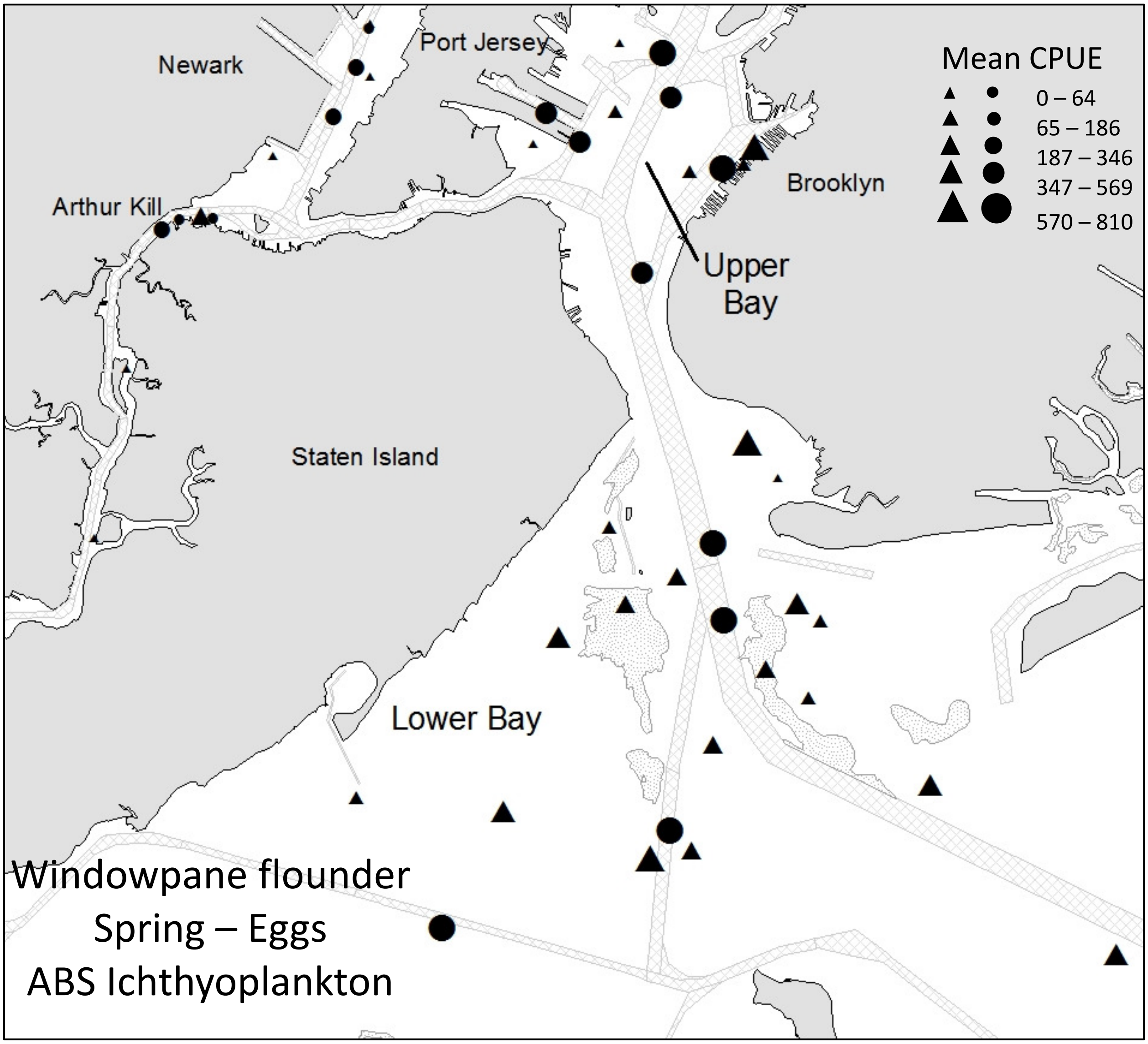


Figure 9. Windowpane flounder egg abundance in spring (April – June) ABS ichthyoplankton samples from 2002 to 2011. Catch per unit effort (CPUE) represents the number of eggs collected per 10-minute tow.

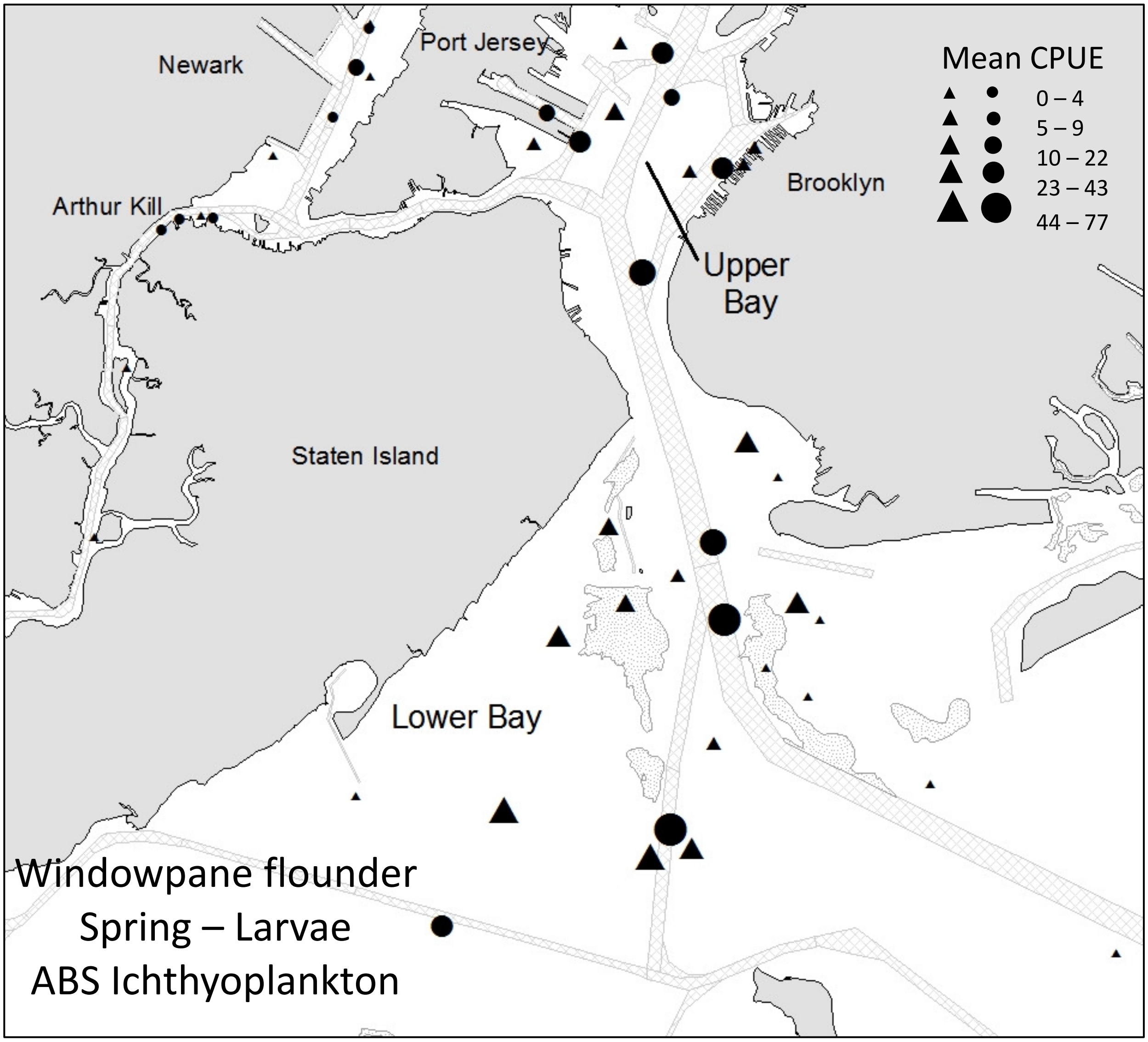


Figure 10. Windowpane flounder larval abundance in spring (April – June) ABS ichthyoplankton samples from 2002 to 2011. Catch per unit effort (CPUE) represents the number of larvae collected per 10-minute tow.

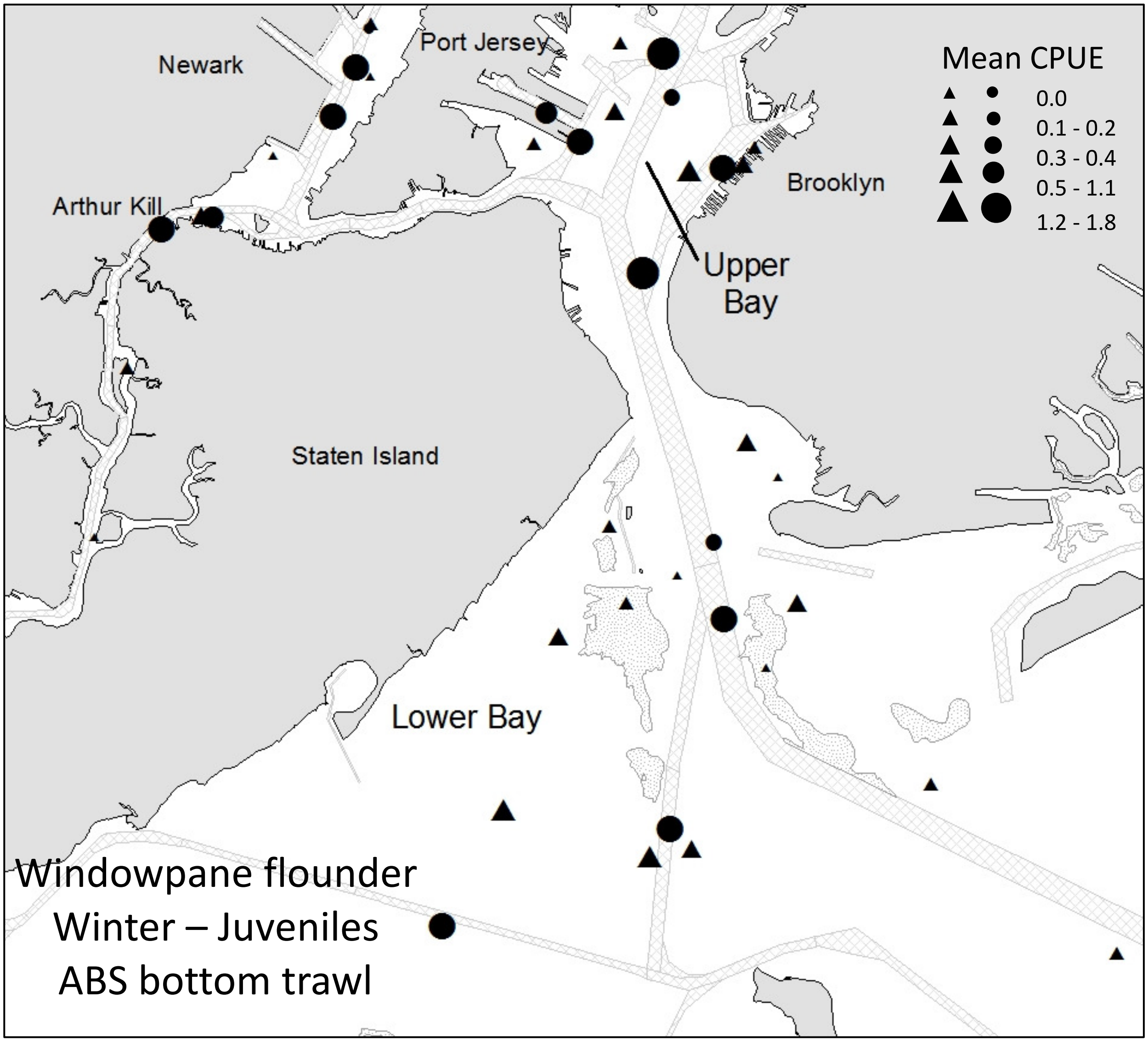


Figure 11. Windowpane flounder juvenile distribution and abundance in winter (January – March) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

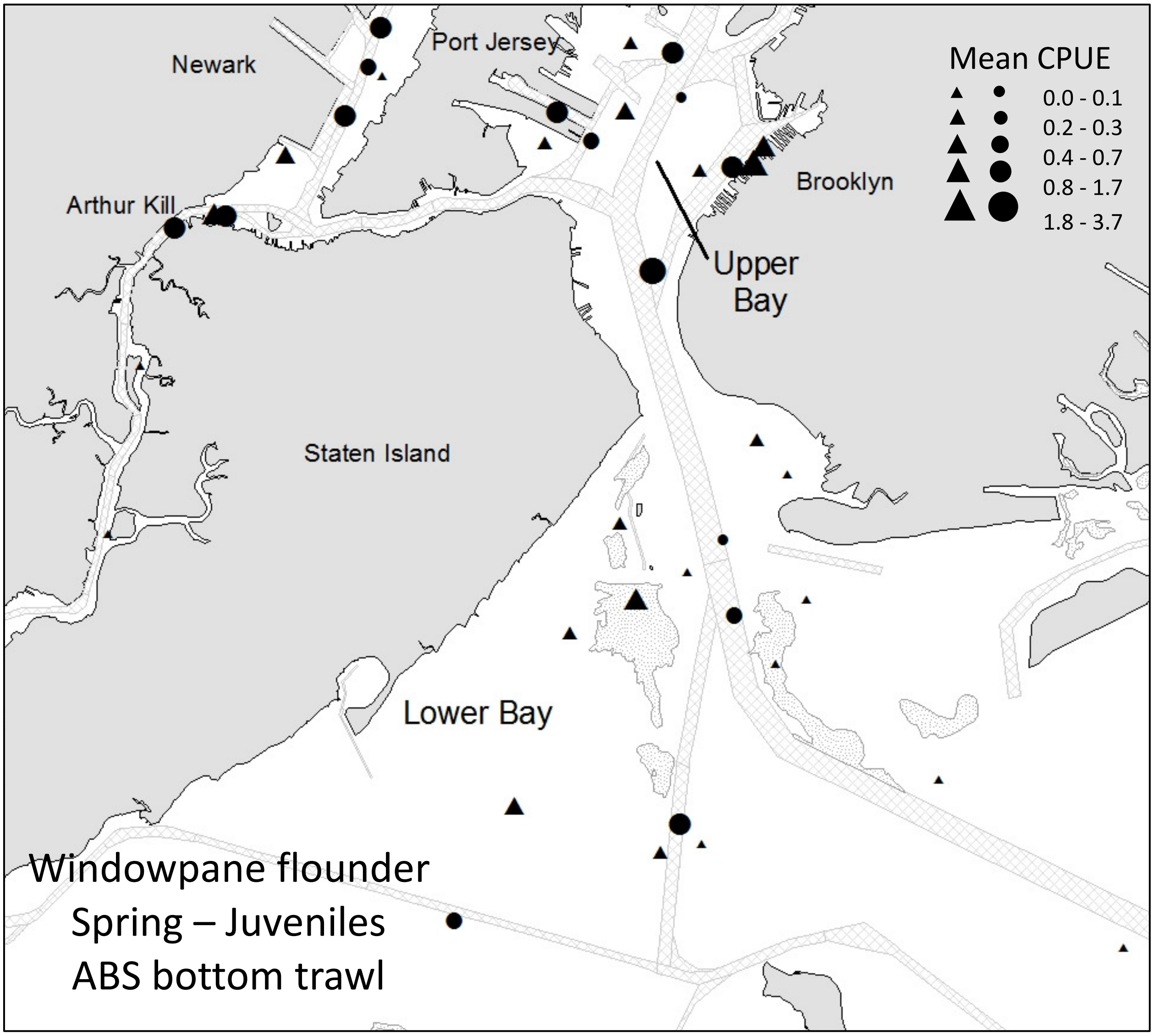


Figure 12. Windowpane flounder juvenile abundance in spring (April – June) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

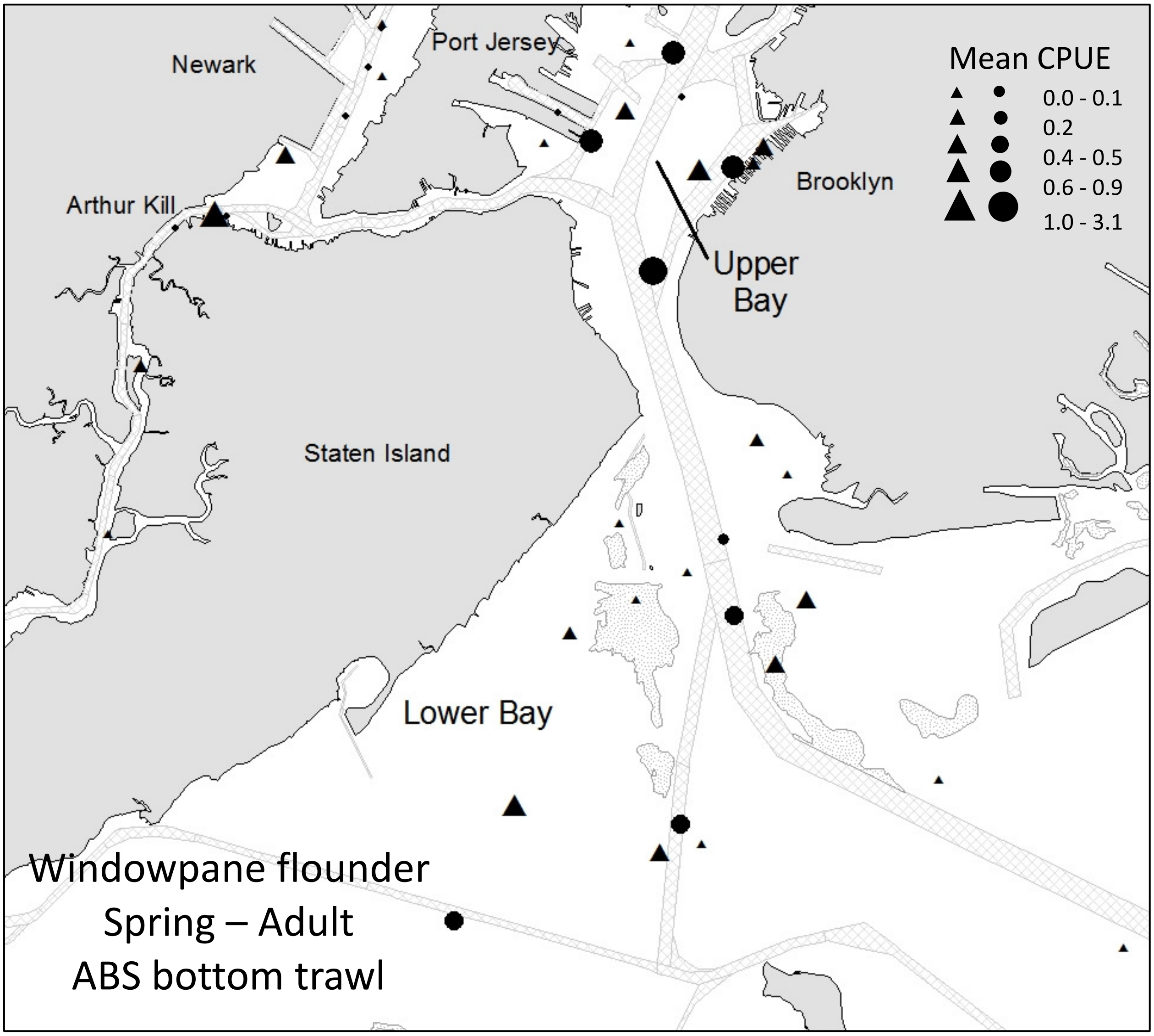


Figure 13. Windowpane flounder adult distribution and abundance in spring (April – June) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

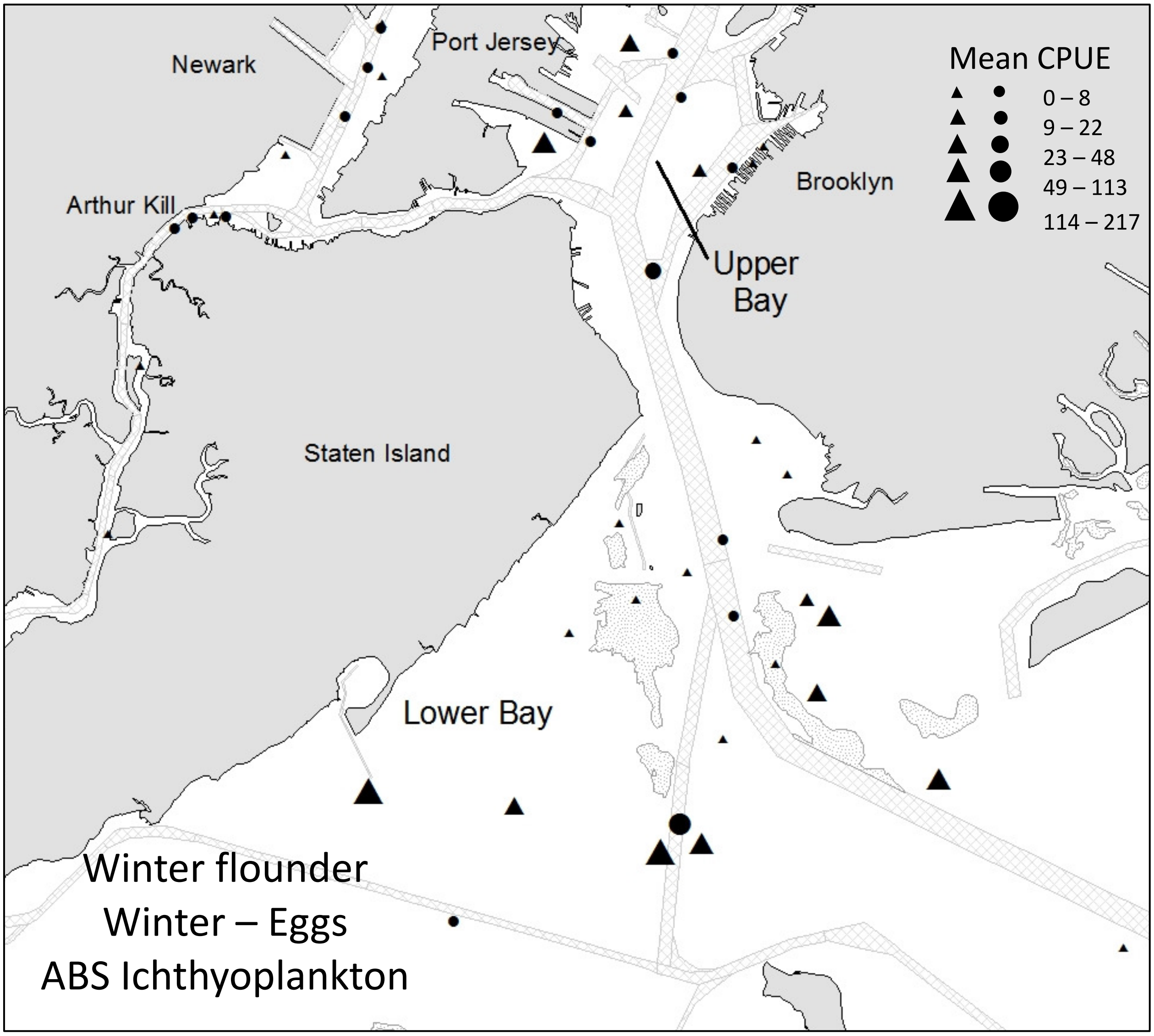


Figure 14. Winter flounder egg distribution and abundance in winter (January – March) ABS ichthyoplankton samples from 2002 to 2011. Catch per unit effort (CPUE) represents the number of eggs collected per 10-minute tow.

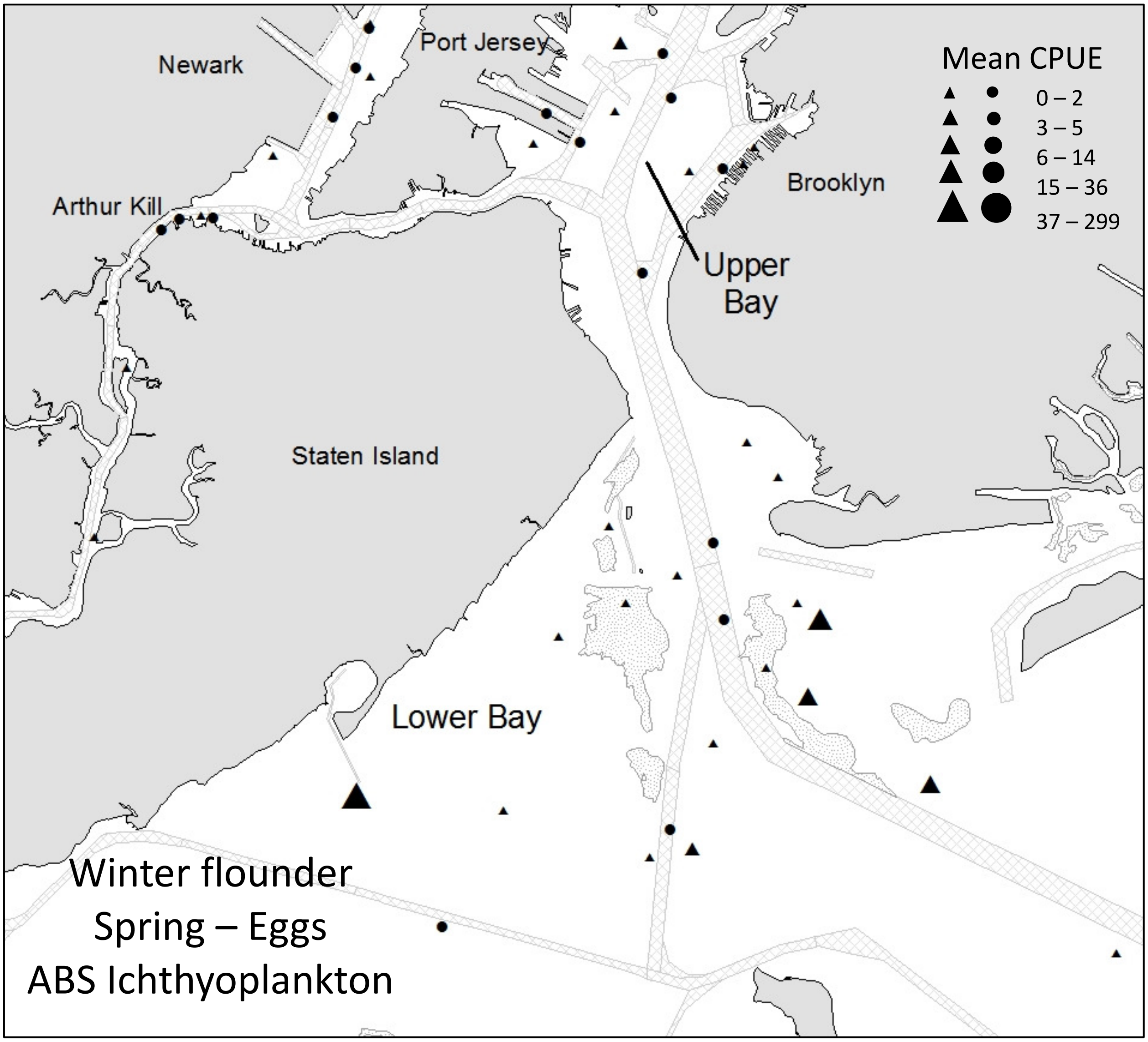


Figure 15. Winter flounder egg distribution and abundance in spring (April – June) ABS ichthyoplankton samples from 2002 to 2011. Catch per unit effort (CPUE) represents the number of eggs collected per 10-minute tow.

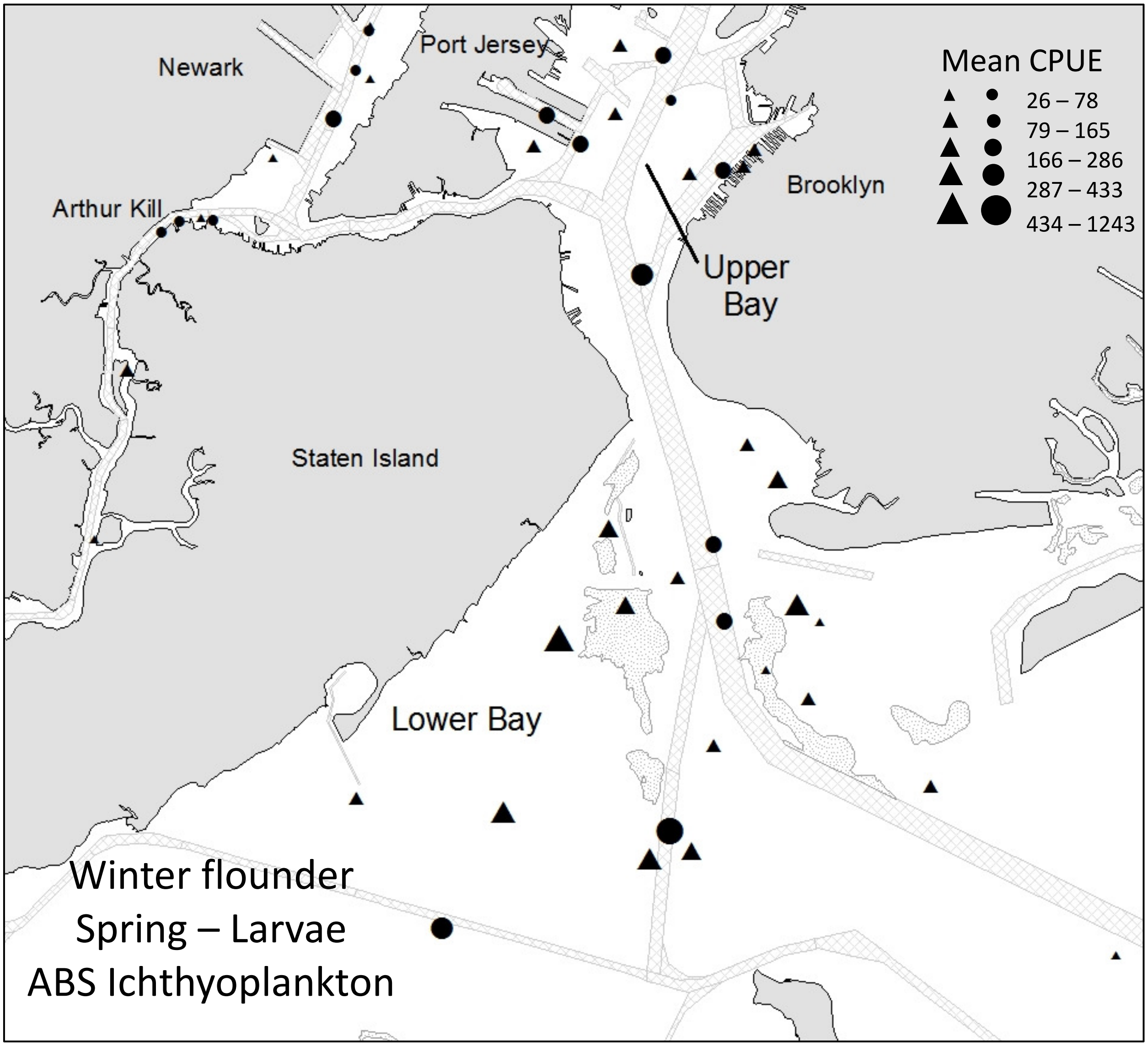


Figure 16. Winter flounder larval distribution and abundance in spring (April – June) ABS ichthyoplankton samples from 2002 to 2011. Catch per unit effort (CPUE) represents the number of eggs collected per 10-minute tow.

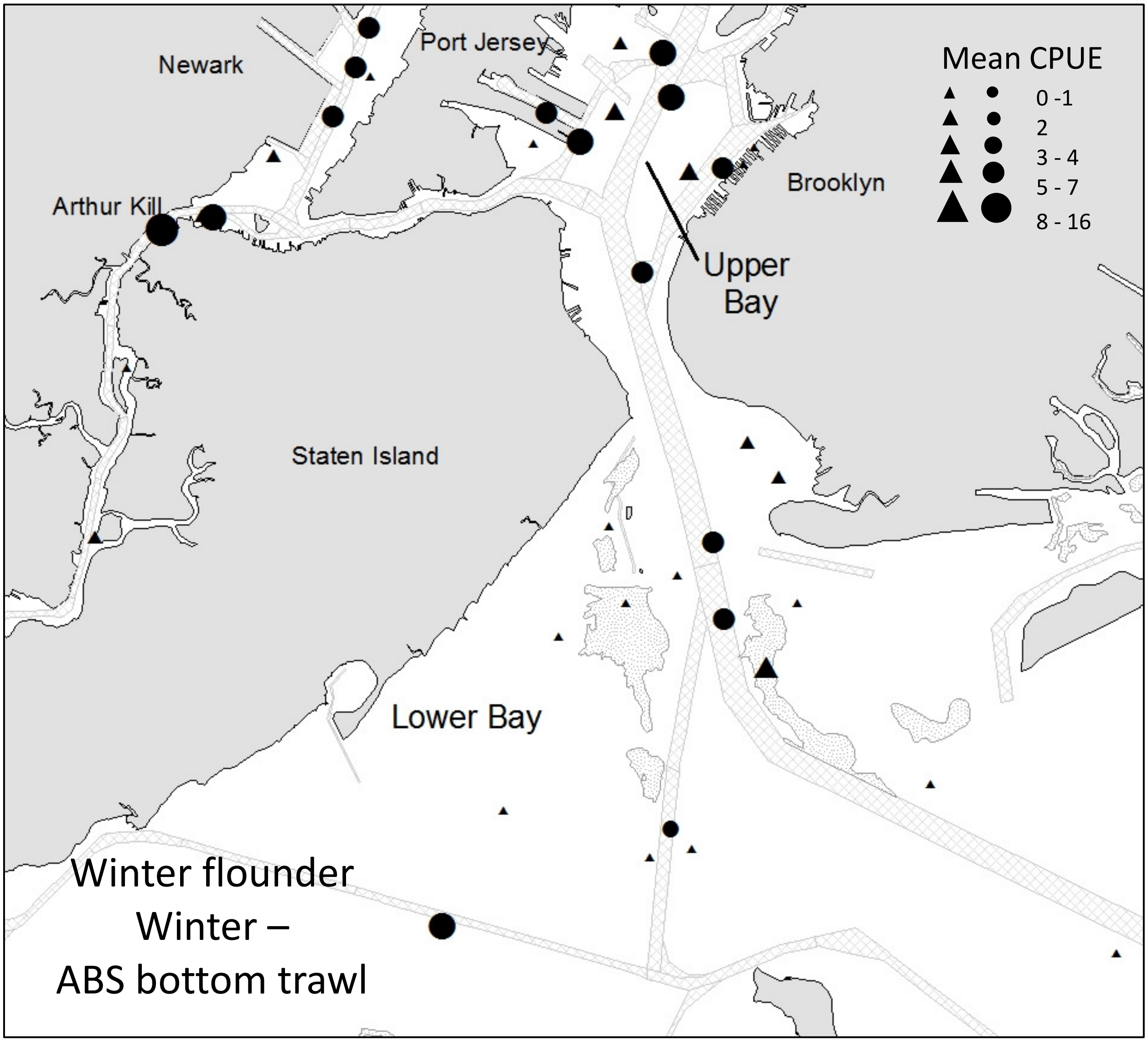


Figure 17. Winter flounder juvenile distribution and abundance in winter (January –March) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

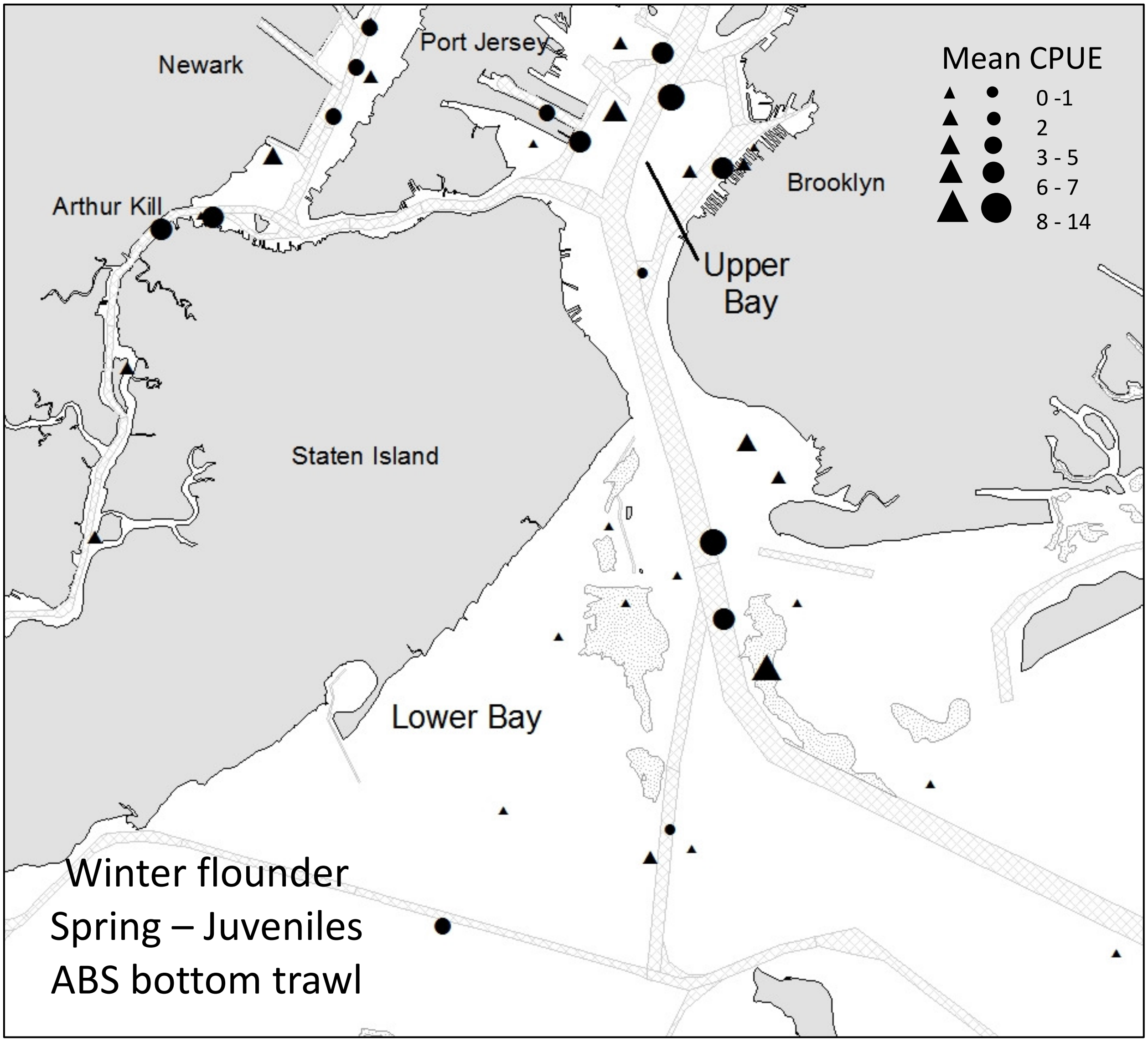


Figure 18. Winter flounder juvenile distribution and abundance in spring (April – June) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

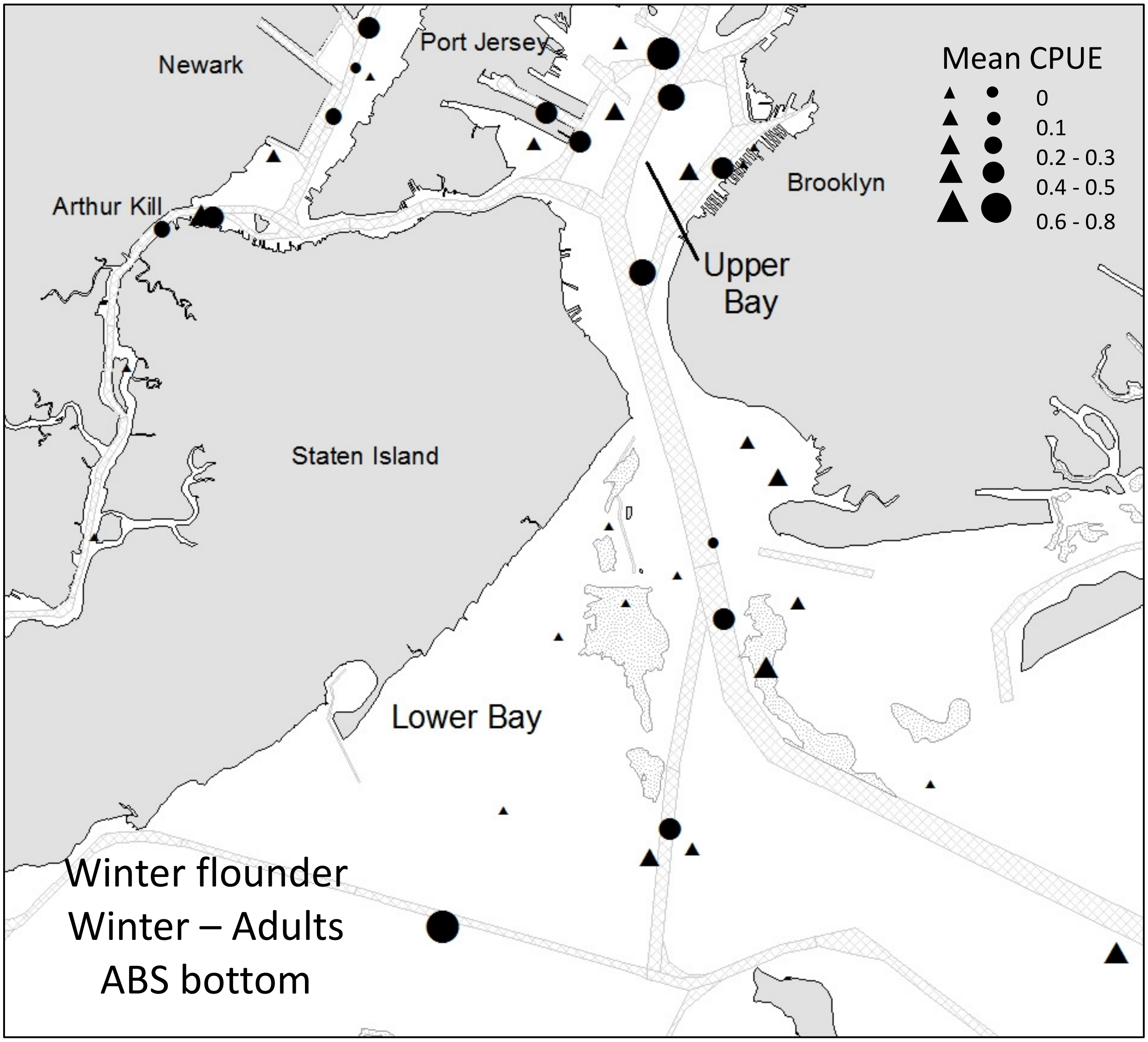


Figure 19. Winter flounder adult distribution and abundance in winter (January –March) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

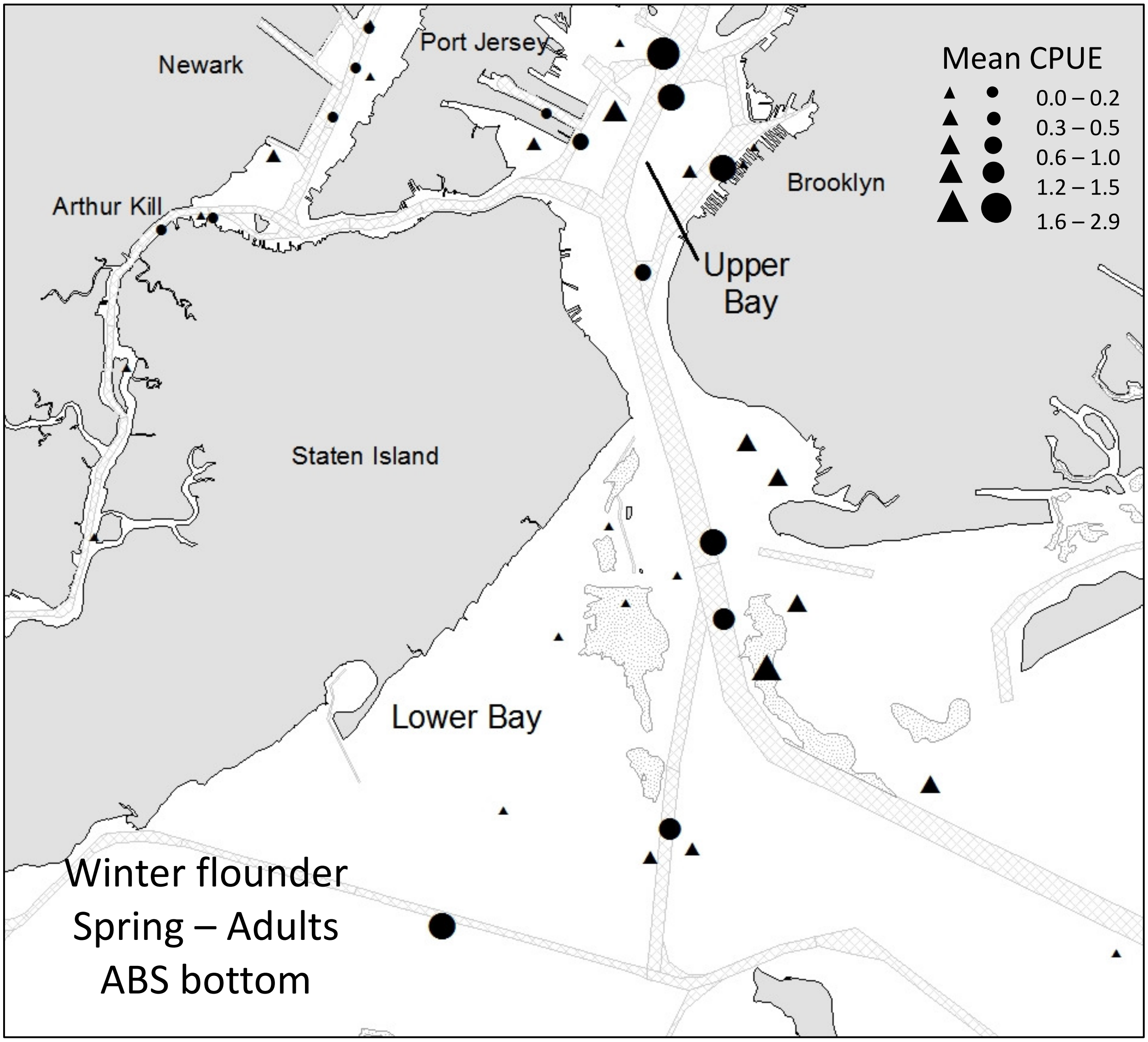


Figure 20. Winter flounder adult distribution and abundance in spring (April – June) ABS bottom trawl samples from 2002 to 2010. Catch per unit effort (CPUE) represents the number of fish collected per 10-minute tow.

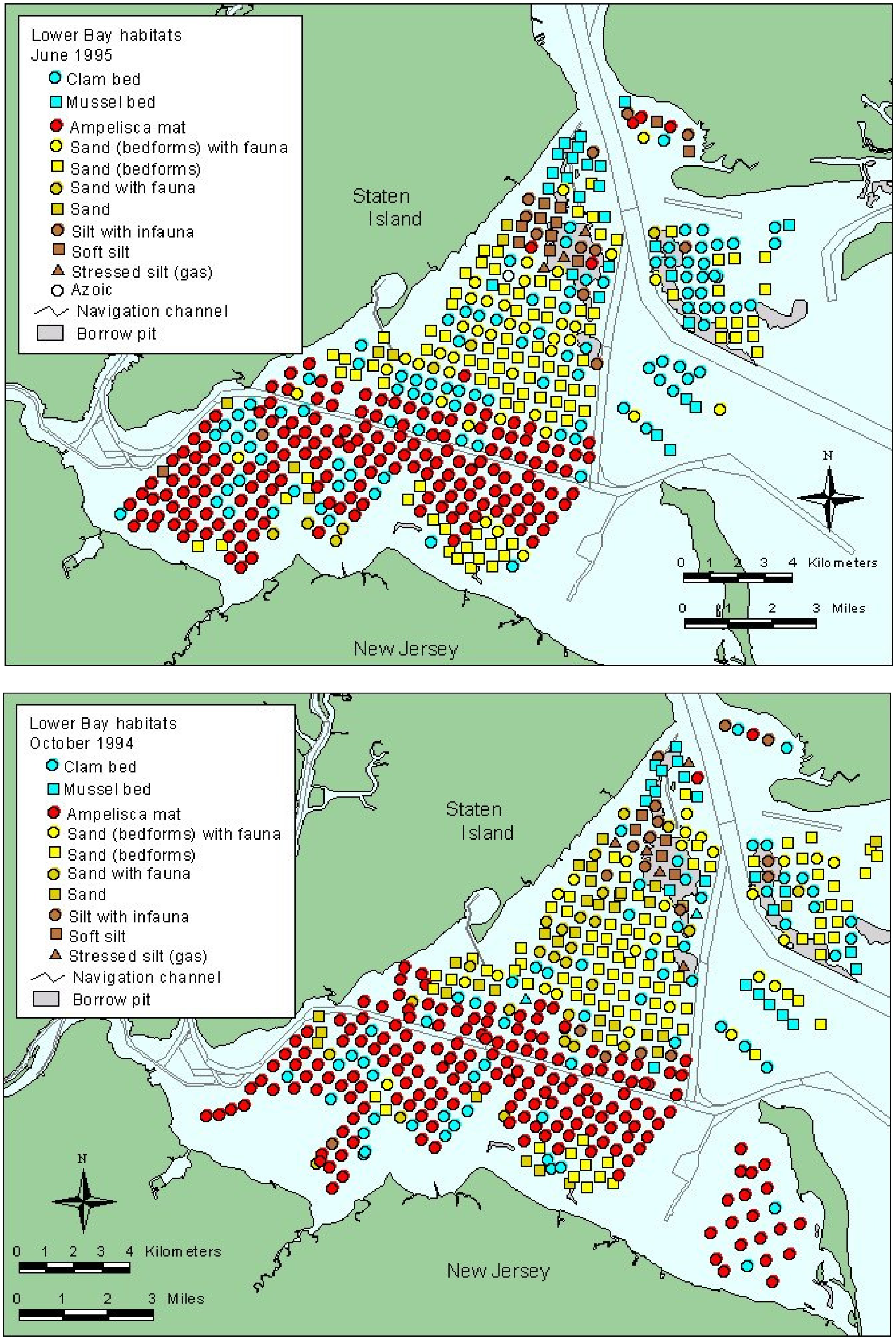


Figure 21. Summary of Benthic Habitat in Lower Bay of New York/ New Jersey Harbor

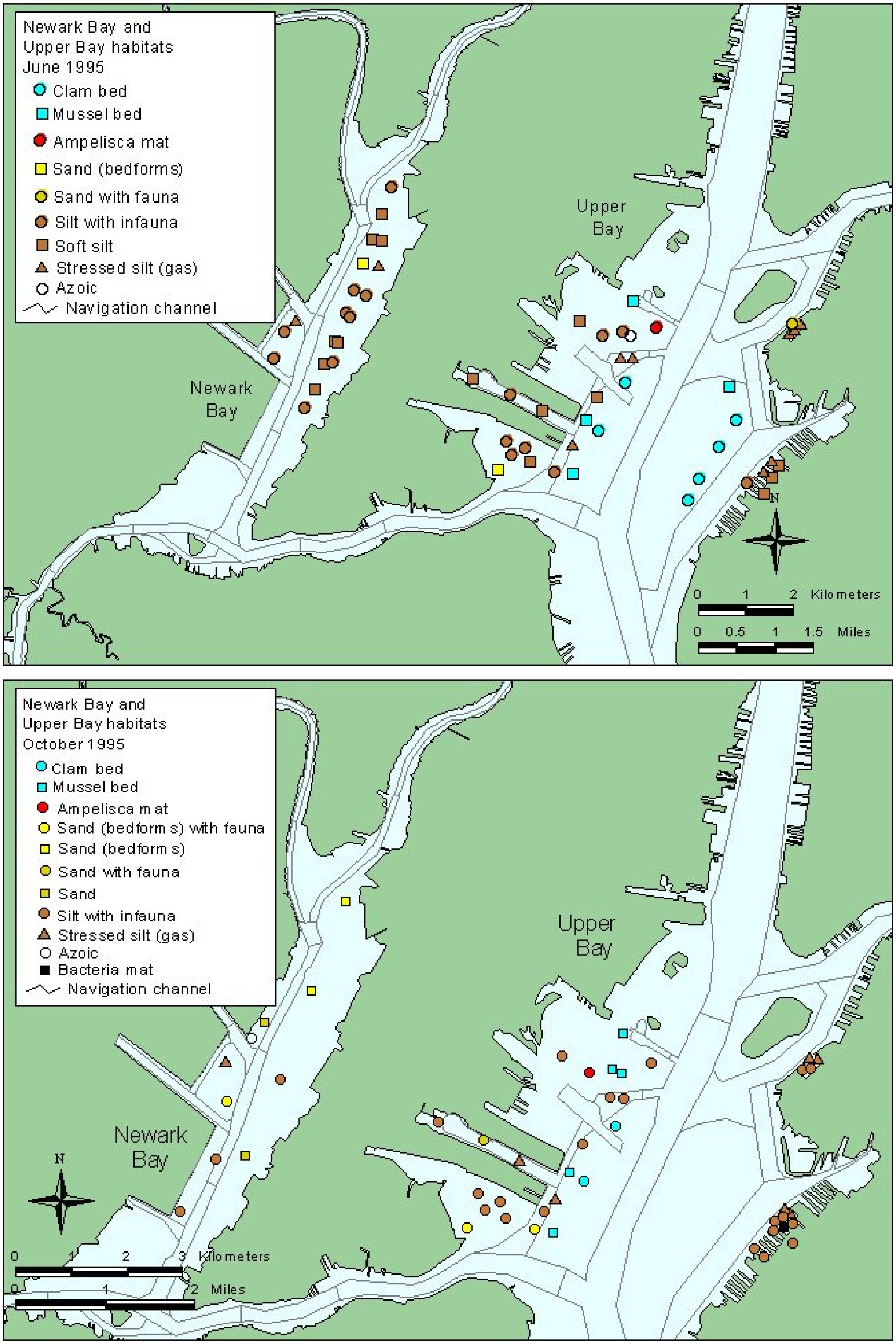


Figure 22. Summary of Benthic Habitat in Newark and Upper Bay of New York/ New Jersey Harbor

Appendix 1. Summary of Essential Fish Habitat and General Habitat Parameters for Selected Federally Managed Species

Species	Life Stage	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Atlantic herring	Eggs	<15	32 - 33	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble, shell fragments & aquatic macrophytes.	Eggs adhere to bottom forming extensive beds. Eggs most often found in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots (Egg beds can range from 4500 to 10,000 Km2 on GB. Eggs susceptible to suffocation from high densities and siltation)
	Larvae	<16	32	50 - 90	Between August and April, peaks from Sept. - Nov.	Pelagic waters	
	Juveniles	<10	26 - 32	15-135		Pelagic waters and bottom habitats	
	Adults	<10	>28	20-130		Pelagic waters and bottom habitats	(major prey: zooplankton)
	Spawning Adults	<15	32 - 33	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, also on aquatic macrophytes	Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots
Red hake	Eggs	<10	< 25		May to November, peaks in June and July	Surface waters of inner continental shelf	
	Larvae	<19	>0.5	<200	May to December, peaks in Sept. and October	Surface waters	(newly settled larvae need shelter, including live sea scallps, also use floating or mid-water objects for shelter)
	Juveniles	<16	31 - 33	<100		Bottom habitats with substrate of shell fragments, including areas with an abundance of live scallops	
	Adults	<12	33 - 34	10-130		Bottom habitats in depressions with a substrate of sand and mud	(major prey: fish and crustaceans)

Species	Life Stage	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	<10	>25	<100	May to November, peaks in June and July	Bottom habitats in depressions with a substrate of sand and mud	
Window-pane flounder	Eggs	<20		<70	February to November, peaks May and October in middle Atlantic July - August on GB	Surface waters	
	Larvae	<20		<70	February to November, peaks May and October in middle Atlantic July - August on GB	Pelagic waters	
	Juveniles	<25	5.5 - 36	1 - 100		Bottom habitats with substrate of mud or fine grained sand	
	Adults	<26.8	5.5 - 36	1 - 75		Bottom habitats with substrate of mud or fine grained sand	(major prey: polychaetes, small crustaceans, mysids, small fish)
	Spawning Adults	<21	5.5 - 36	1 - 75	February - December, peak in May in middle Atlantic	Bottom habitats with substrate of mud or fine grained sand	
Winter flounder	Eggs	<10	10 - 30	<5	February to June, peak in April on GB	Bottom habitats with a substrate of sand, muddy sand, mud, and gravel	* On GB, eggs are generally found in water temp < 8EC, and < 90m deep.
	Larvae	<15	4 - 30	<6	March to July, peaks in April and May on GB	Pelagic and bottom waters	* On GB, larvae are generally found in water temp < 8EC, and < 90m deep.
	Juveniles (age 1+)	<25	10 - 30	1 - 50		Bottom habitats with a substrate of mud or fine grained sand	* Young-of-year exist where water temp <28, depths 0.1 - 10m, salinities 5 - 33 (major prey: amphipods, copepods, polychaetes, bivalve siphons)
	Adults	<25	15 - 33	1 - 100		Bottom habitats including estuaries with substrate of mud, sand, gravel	(major prey: amphipods, polychaetes, bivalve siphons, crustaceans)

Species	Life Stage	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	<15	5.5 - 36	<6*	February to June	Bottom habitats including estuaries with substrate of mud, sand, gravel	*except on GB where they spawn as deep as 80m
Atlantic mackerel	Eggs	5-23	(18 - >30)	0 - 15		Pelagic waters	(peak spawning in salinities >30ppt)
	Larvae	6-22	(>30)	10-130		Pelagic waters	
	Juveniles	4 - 22	(>25)	0 - 320		Pelagic waters	
	Adults	4 - 16	(>25)	0 - 380		Pelagic waters	(opportunistic feeding: can filter feed or select individual prey. Major prey: crustaceans, pelagic mullosks, polychaetes, squid, fish)
Black sea bass	Eggs			0 - 200	May to October	Water column of coastal Mid-Atlantic Bight and Buzzards Bay	
	Larvae	(11-26)	(30 - 35)	(<100)	(May - Nov, peak Jun - Jul)	Habitats for transforming (to juveniles) larvae are near coastal areas and into marine parts of estuaries between Virginia and NY. When larvae become demersal, found on structured inshore habitat such as sponge beds.	
	Juveniles	>6	>18	(1 - 38)	Found in coastal areas (Apr -Dec , peak Jun - Nov) between VA and MA, but winter offshore from NJ and south; Estuaries in summer and spring	Rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, offshore clam beds and shell patches may be used during wintering	(YOY use salt marsh edges and channels; high habitat fidelity)
	Adults	>6	(>20)	(20- 50)	Wintering adults (Nov. to April) offshore, south of NY to NC Inshore, estuaries from May to October	Structured habitats (natural & man-made) sand and shell substrates preferred	(spawn in coastal bays but not estuaries; change sex to males with growth; prey: benthic and near bottom inverts, small fish, squid)

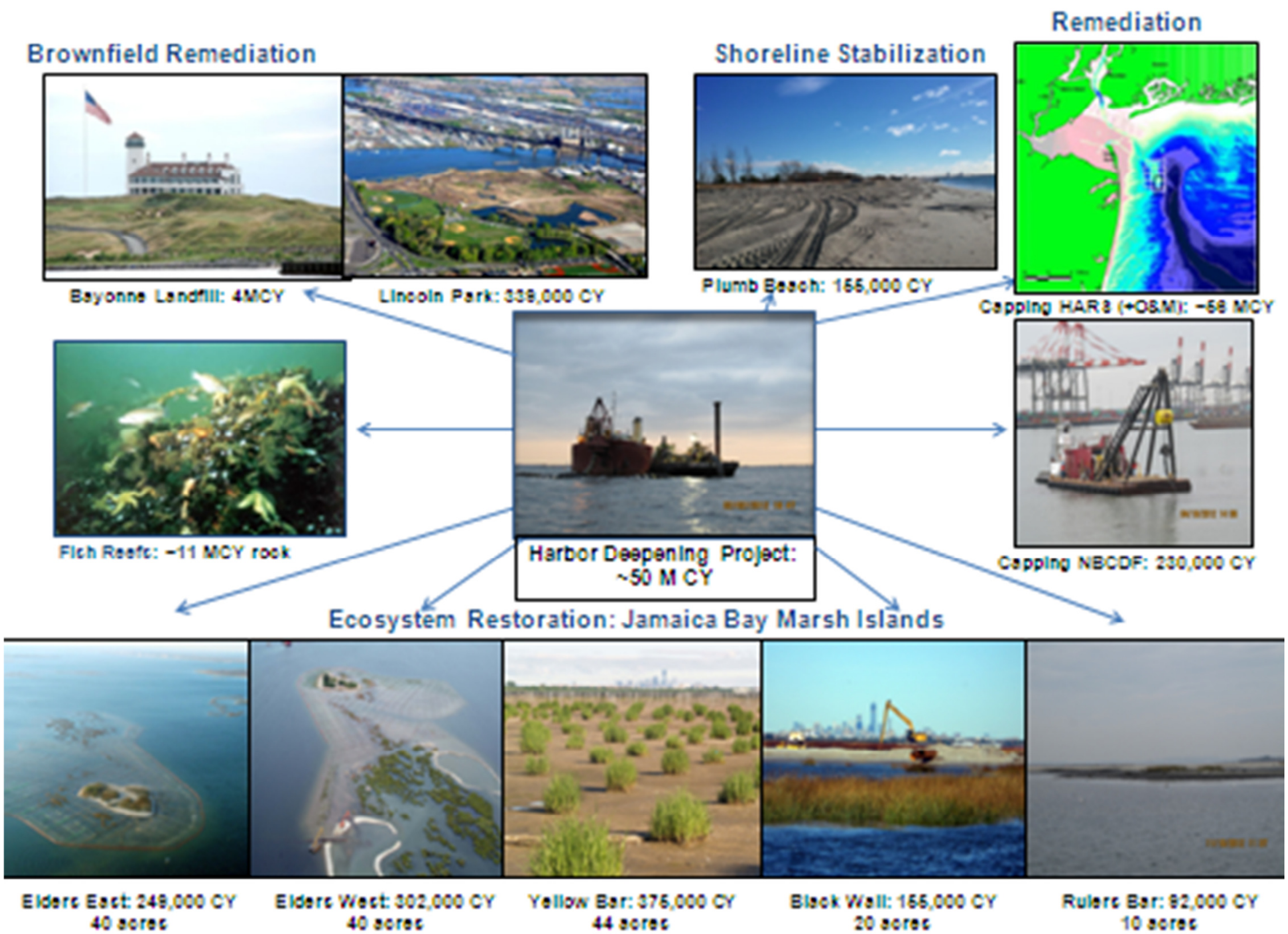
Species	Life Stage	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Bluefish	Eggs	>18	>31ppt	Mid-shelf depths	April to August	Pelagic waters	*No EFH designation inshore
	Larvae	>18	>30ppt	>15	April to September	Pelagic waters	No EFH designation inshore for larvae
	Juveniles	(19-24)	(23 - 36) freshwat er zone in Albemarie Sound		North Atlantic estuaries from June to October Mid-Atlantic estuaries from May to October South Atlantic estuaries from March to December	Pelagic waters	(use estuaries as nursery areas; can intrude into areas with salinities as low as 3 ppt)
	Adults	(14-16)	>25ppt		North Atlantic estuaries from June to October Mid-Atlantic estuaries from April to October South Atlantic estuaries from May to January	Pelagic waters	Highly migratory (major prey: fish)
Butterfish	Eggs	11 - 17	(25 - 33)	0-1829	(spring and summer)	Pelagic waters	
	Larvae	9 - 19	(6.4 - 37)	10-1829	(summer and fall)	Pelagic waters	
	Juveniles	3 - 28	(3 - 37)	10-365 (most <120)	(winter - shelf spring to fall - estuaries)	Pelagic waters (larger individuals found over sandy and muddy substrates)	(pelagic schooling - smaller individuals associated with floating objects including jellyfish)
	Adults	3 - 28	(4 - 26)	10-365 (most <120)	(winter - shelf summer to fall - estuaries)	Pelagic waters (schools form over sandy, sandy-silt and muddy substrates)	(common in inshore areas and surf zone; prey: planktonic, thaliacians, squid, copepods)

Species	Life Stage	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Scup	Eggs	13 - 23	>15	(<30)	May - August	Pelagic waters in estuaries	
	Larvae	13 - 23	>15	(<20)	May - September	Pelagic waters in estuaries	
	Juveniles	>7	>15	(0 - 38)	Spring and summer in estuaries and bays	Dermersal waters north of Cape Hatteras and Inshore on various sands, mud, mussel, and eelgrass bed type substrates	
	Adults	>7	>15	(2 -185)	Wintering adults (November April) are usually offshore, south of NY to NC	Dermersal waters north of Cape Hatteras and Inshore estuaries (various substrate types)	(spawn < 30m during inshore migration - May - Aug; prey: small benthic inverts)
Summer flounder	Eggs			30-70 fall; 110 winter; 9-30 spring	October to May	Pelagic waters , heaviest concentrations within 9miles of shore off NJ and NY	
	Larvae	(9 - 12)	(23-33) Fresh in Hudson R. Raritan Bay area	10-70	mid-Atlantic Bight from Sept. to Feb.; Southern part from Nov. to May at depths 9-30m	Pelagic waters, larvae most abundant 19 83km from shore; Southern areas 12 - 52 miles from shore	(high use of tidal creeks and creek mouths)
	Juveniles	>11	10 -30 Fresh in Narrag. Bay, Albem/ Pamlico Sound, & St. Johns R.	(0.5-5) in estuary		Demersal waters, muddy substrate but prefer mostly sand; found in the lower estuaries in flats, channels, salt marsh creeks, and eelgrass beds	HAPC - All native species of macroalgae, seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations, within adult and juvenile EFH. (Major prey: mysid shrimp)

Species	Life Stage	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Adults		Fresh in Albemarie Sound, Pamlico Sound, & St. Johns R.	(0 - 25)	Inhabit shallow coastal and estuarine waters during warmer months and move offshore on outer Continental Shelf at depths of 150m in colder months	Demersal waters and estuaries	HAPC - All native species of macroalgae, seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations, within adult and juvenile EFH. (Major prey: fish, shrimp, squid, polychaetes)
Spanish mackerel		>20	>30			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf	All coastal inlets
						break but from the Gulf Stream shoreward;	
Cobia		>20	>25			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; high salinity bays, estuaries, seagrass habitat.	All coastal inlets
King mackerel		>20	>30			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward;	All coastal inlets

This table was compiled by NMFS Northeast Regional Office, Habitat Conservation Division. All information presented is part of the Regional Fishery Management Council's EFH designations except for that contained within ( ) which is provided as important additional ecological information. Definitions: GOME - Gulf of Maine; GB - George's Bank; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year Please note: This Table does not contain EFH info on Highly Migratory Species (sharks, tunas, billfish)

Appendix 2 . Beneficial Use of Dredged Material Examples



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Final

ESSENTIAL FISH HABITAT

KNOWLEDGE GAINED DURING THE HARBOR DEEPENDING PROJECT

PART II

SEPTEMBER 2013

U.S. ARMY CORPS OF ENGINEERS

NEW YORK DISTRICT

26 Federal Plaza

New York, New York 1027

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PART II

Introduction

Essential fish habitat (EFH) is defined under section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (Public Law 94-265), as amended by the Sustainable Fisheries Act (SFA) of 1996 (Public Law 104-267), as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The SFA requires that EFH be identified for those species actively managed under Federal fishery management plans (FMPs). This includes species managed by the eight regional Fishery Management Councils (FMCs), established under the MSFCMA, as well as those managed by National Marine Fisheries Service (NMFS) under FMPs developed by the Secretary of Commerce.

EFH designations emphasize the importance of habitat protection to healthy fisheries and serve to protect and conserve the habitats of marine and estuarine finfish, mollusks, and crustaceans. EFH embodies key physical, chemical, and biological attributes of both the water column and the underlying substrate, including sediment, hard bottom, and other submerged structures that support survival and growth of designated species. Under the EFH definition, necessary habitat is that which is required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. EFH may be designated for the complete life cycle of a species, including spawning, feeding, and growth to maturity, or may be specific for each life stage (egg, larval, juvenile, adult, and spawning adult).

For in-water construction projects including dredging, beach nourishment, jetty repair, in water placement of maintenance dredge material (in NJ waters only), placement of rock for reefs and removal of material from borrow areas, Federal and state regulatory agencies recommend management practices such as dredging windows (also known as environmental windows) to protect sensitive biological resources (i.e. finfish, shellfish, sea turtles, and marine mammals). Ideally, management practices should balance the risk of potential impacts against the need to conduct dredging and filling in a safe and cost effective manner as well as addressing beneficial uses and placement of dredge material. Existing windows for maintenance dredging projects along the South Shore of Long Island and for civil works Coastal Storm Damage Reduction projects in New York and New Jersey are summarized in Tables 1a through 1c, respectively.

Choice and application of appropriate management practices requires knowledge of the life history and habitat requirements of managed species to determine if a conflict with EFH mandates could occur. First, what is the probability that a species of concern would encounter the specific project construction activity, such as an operating dredge or beach discharge? Second, if an encounter does occur, what would the duration of exposure be, given the organism's mobility (e.g., sessile, passive drifter, active swimmer) and the spatial scale of the perturbation. Finally, if the tolerance levels of that species are known or can be estimated, then the potential impacts can be assessed and the need for a restrictive management practice or mitigation measure evaluated. Each assessment and determination of risk is built upon a basic understanding of the occurrences of selected species in the given project areas which is discussed in this report.

The purpose of Part II of this EFH document is to summarize existing and readily available data on aquatic biological resources within the New York Bight (i.e. South Shore of Long Island, New York and along the New Jersey Coast within U.S. Army Corps of Engineers New York District (USACE) boundaries). This section focuses on existing fisheries data (i.e. species abundance and spatial and temporal distribution) in order to support informed decisions regarding project activities that could occur within this area for all New York District Civil Works (coastal storm damage reduction, flood risk management and ecosystem restoration projects) and Operations (maintenance dredging) missions and the sustainability objectives of District dredging programs, including beneficial uses of dredged material and emergency activities associated with Flood Control and Coastal Emergencies (FCCE) Act, PL 84-99 which authorizes the USACE to repair previously constructed projects after a large event like Hurricane Sandy.

1. Site Description

The southern coast of Long Island is approximately 190 kilometers (km) long and marks the southern terminus of late Pleistocene glacial advance in eastern North America. The South Shore of Long Island is compromised of dynamically changing beaches comprised of sand and gravel but can be divided into two distinct regions based on physical characteristics of the coast (Tanksi 2007). From Coney Island to Southampton, the shore is composed of five barrier islands: Coney Island, Long Beach, Jones Beach, Fire Island and Westhampton. Separating the barrier islands are tidal inlets that connect the bays with the ocean. These tidal inlets (Rockaway, East Rockaway, Jones, Fire Island, Moriches and Shinnecock) are dredged to maintain navigation (Tanksi 2007). Moving east past Southampton, the coastline is comprised of sandy beaches (Tanksi 2007).

The outer coast of New Jersey is approximately 210 km long and lies south of the extent of the most recent glacial advance. The New Jersey coastline is oriented almost perpendicular to the South Shore of Long Island, forming a wedge-shaped region known as the New York Bight within the northern Middle Atlantic Bight.. Coastal features include bluffs, headlands, and barrier spits and islands that are punctuated by inlets, allowing for the exchange of sediment and water between estuaries and the continental shelf, primarily as a function of tide (USACE 2004a).

Coastal habitat maps (Appendix 1) provide depth and sediment information for the potential USACE-NYD project areas from Manasquan, New Jersey to Montauk, New York. Depth is provided in 3 contours (-5.4 meters [m], -10 m, and -20 m below mean lower low water (MLLW)) and sediment types includes clay, silt, clayey silt/silty clay, sand silt clay / sandy clay / sandy silt, clayey sand / silty sand, sand, and gravel.

Most of the sediment along the coast consists of sands with gravelly areas. In the coastal bays sediment types vary between sands and silty sands with patches of finer sediments. Water depths within many of the bays south and east of the Harbor are generally less than 17 feet (5.4 m) below MLLW. The coastline gradually slopes from the New Jersey and Long Island beaches to 17 feet (5.4 m) below MLLW approximately .25 to .5 miles from the shoreline to 32 feet (10 m) approximately 1 to 2 miles from shore. Approximately 3 to 5 miles from the Long Island shore, the water depths are 65 feet (20 m) below MLLW, off New Jersey the 65 foot (20 m) depth contour is generally further from shore. For purposes of this report “nearshore” waters are defined as extending seaward to a depth of 30 feet (9 m). The dominant sediment type is sand with some patchy spots of gravel and fine grain silts and clays (Appendix 1).

Waves, particularly those associated with storm events, can play an important role in shaping the New York Bight as they redistribute sediments and impact benthic habitat. The storms can move sediments along the shore, scouring some areas and depositing sediment in others. This re-distribution of sediment related to erosion and storms often leads to a need for beach nourishment projects. Beach nourishment within New York and New Jersey differs based on if it is a Civil Works project versus an Operations project. Civil Works projects include deepening and Coastal Storm Damage Reduction Projects. For these projects material is dredged from a borrow area and for Operations Projects the material is dredged from federal channels to maintain authorized depths. The material is then placed in predetermined profiles along designated shorelines (onshore or nearshore). Numerous sand and aggregate borrow areas lie off of the coasts of New Jersey and New York. In 2010, as part of the Long Island Coastal Planning Project, the USACE conducted an inventory of suitable borrow areas (USACE 2010). Offshore borrow areas have been designated to meet the volume needs for potential storm reduction, a type of civil work project.

2. EFH Managed Species

EFH designations are structured by species and specific life history stages. Appendix 2 provides a summary of those species for which EFH has been designated within the New York Bight based upon a grid of 26 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm). The potential USACE-NYD project area includes approximately 26 cells that are summarized in this report based on geography and similar species in Appendix 2. A total of 39 federally managed species with EFH designations have been identified in the study area. Of these species, fourteen species (winter flounder, windowpane flounder, scup, whiting, red hake, bluefish, summer flounder, Atlantic butterfish, Atlantic mackerel, yellowtail flounder, Atlantic sea scallop, king mackerel, Spanish mackerel and cobia) have EFH designations for the following life history stages: egg, larval, juvenile and adult. Winter flounder and windowpane flounder have additional EFH designations for spawning adults. Appendix 3 provides a Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species.

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3. Essential Fish Habitat Species

3.1 Applicable Data Sources

The New York Bight has been extensively studied over the last two decades, including numerous studies sponsored by the USACE (Figure 1). For example, a comprehensive feasibility-level reformulation study of the Hurricane and Storm Damage Reduction Project for the south shore of Long Island, New York, from Fire Island Inlet to Montauk Point (FIMP) provides substantial relevant EFH data. Previously, the results of the Biological Monitoring Program for the Atlantic Coasts of New Jersey, Sea Bright to Manasquan Inlet Beach Erosion Project (Burlas et al. 2001) represented one of the most comprehensive investigations of potential impacts ever conducted in the region (e.g., Wilber et al. 2003a, 2003b, 2006, Able et al. 2010). Other studies included NOAA-NMFS 1982–2003 surveys of fish distribution in the New York Bight/Mid-Atlantic Bight (Grosslein and Azarovitz 1982, Able and Brown 2007); ichthyoplankton studies in the Mid-Atlantic Bight from 1977–1987 (Sibunka and Silverman 1984, 1989, Morse et al. 1987, Berrien and Sibunka 1999); tucker trawl, beam trawl, trap net, seine, otter trawl catch surveys in coastal areas of New Jersey (Able and Fahay 2010); fish community of the Lower New York Harbor from February 1985 to March 1986 (Woodhead and McCafferty 1986); seasonal distribution of fish and megainvertebrates in the Hudson-Raritan Estuary January 1992 to December 1997 (Wilk et al. 1998); 1983 inventory of fish in the Hudson River from Bayonne to Piermont (NJDEP 1984).

The relative abundances of EFH species expected to occur in the surf zone habitats of northern New Jersey and southern New York are characterized in Table 2 using the color-coded classification scheme that ranges from "not present" to "highly abundant." This classification scheme is adapted from NOAA's Estuarine Living Marine Resources (ELMR) program and summarizes quantitative data to indicate both seasonal peaks in abundance and relative abundances among species. For instance a classification of "rare" indicates a species was collected in a particular month, but infrequently, whereas the "highly abundant" classification indicates the species was collected in abundances totaling hundreds or thousands of individuals. Monthly abundances in nearshore (primarily in or near borrow pits) habitat are characterized for each species for each monitoring study (Appendix 4) and summarized across all species in nearshore habitat in Table 3. The Table 3 summary depicts the highest abundance estimate observed for any month across all monitoring studies to provide a conservative estimate of the seasonal timing of nearshore habitat use.

3.2 Surf Zone and Nearshore Habitat Data Sources

- Finfish in Surf zone habitat – Through the Biological Monitoring Program for the Atlantic Coast of New Jersey (Burlas et al. 2001, Wilber et al. 2003a, 2003b, Able et al. 2010), the USACE and others conducted several monitoring studies in the surf zone habitat. Surf zone habitat in northern New Jersey was sampled by beach seine from August to October from 1995 to 1999 to monitor potential impacts on surf zone fishes of a large beach nourishment project. Active nourishment began in 1997. Sampling was conducted every two weeks at 28 stations that spanned approximately 15 km of shoreline. The timing of sampling coincided with the occurrences of transient species that move into the area in the fall. Detailed analyses of surf zone fish assemblages are reported in

Wilber et al. (2003a) and the response of surf zone fish to an active beach replenishment operation are reported in Wilber et al. (2003b). Ichthyoplankton was sampled monthly in surf zone and nearshore habitats from May to July from 1995 to 1999. Temporal and spatial patterns of distribution, abundance, size, stage, and species composition are reported for fish larvae in Able et al. (2010).

- Finfish in nearshore habitats – The USACE and others conducted several monitoring studies in nearshore habitat that included bottom trawl surveys to characterize finfish communities in or near borrow areas. The locations of these studies are depicted in Fig. 2 and include northern New Jersey (Byrnes et al. 2004), East Rockaway (USACE 2008a), and from Fire Island to Montauk Point (EEA 2002, USACE 2004a, 2008b). In addition, fish collected by trap in rocky habitat during monitoring for the Ambrose obstruction project have been reported (USACE 2010c).
- Benthic habitat – Benthic invertebrates in nearshore habitats are an important source of prey for commercially and ecologically important finfish and crustacean species and have been sampled in conjunction with the use of nearshore habitat as borrow areas to provide sand for beach replenishment projects (EEA 2001, NEA 2001, USACE 2004a, USACE 2004b, USACE 2008a). In northern New Jersey, borrow areas were selected from bathymetric high points so that the extraction of sand would not create a depression, which could create depositional areas that would collect fine sediments and slow benthic recovery rates or alter the type of recovered benthic assemblage (Burlas et al. 2001).
- Borrow Areas - USACE has conducted a number of studies of potential borrow areas under the Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York, Storm Damage Reduction Reformulation Study (USACE 2004a, and 2004b). From 1999 to 2002, several environmental surveys were conducted to collect data on existing physical conditions and biological communities at these areas. In general, based on the extensive cores and grain size sampling conducted to characterize the sand, the dominant sediment type at these areas is sand and type of material was consistent among borrow areas (USACE 2004a)
- Total suspended sediments (TSS) in surf zone and nearshore habitat – TSS was monitored for two beach replenishment activities in northern New Jersey (Wilber et al. 2006). This represents one of very few published studies examining the spatial scales of beach discharge plumes and to document plume and ambient TSS concentrations. Light penetration has been measured by Secchi disk (EEA 2002, USACE 2004a) and a multi-parameter datasonde (USACE 2008a), which measures turbidity in nephelometric turbidity units (NTU).

4. EFH Species in Surf Zone and Nearshore Habitats

Surf zone habitat within the study area extending from Manasquan Inlet, New Jersey to Montauk, New York is homogeneous in many respects, including wave climate and sediment type. Subtle differences can be found with respect to hydrodynamic circulation, influence of the Hudson River plume, the presence of groins and jetties, and the orientation of individual inlets to the Atlantic Ocean. In terms of taxonomic groups and functional groups (e.g., planktivores, benthivores, piscivores, etc.), fish assemblages throughout the area are representative of a typical northwest Atlantic temperate assemblage. Few differences should exist in overall assemblage structure within the boundaries of the study area, although some distinctions might be found for species near the northern or southern limits of their range. Some differences might also be seen in the timing of species occurrences at various locations in the study area. A summary of each EFH-managed species is presented below including what is known of their spatial and temporal occurrences, along with a tabular representation of their seasonal abundance by life history stage.

Atlantic butterfish (*Peprilus tricanthus*). Juvenile butterfish were present, but rare, in surf zone sampling from August to October on the northern New Jersey shoreline (Table 2). In nearshore habitat on the south shore of Long Island, juvenile butterfish were highly abundant from May to November (Table 3, Appendix 4a), represented 80–90 percent of the fish collected in some summer months, and were among the numerically dominant finfish captured each year (2004–2008; USACE 2008b).

Atlantic herring (*Clupea harengus*). Atlantic herring larvae were not collected in ichthyoplankton samples from either the surf zone or nearshore habitats in northern New Jersey (Burlas et al. 2001, Able et al. 2010). Juveniles were present, but rare, in surf zone sampling in northern New Jersey from August to October (Table 2). In nearshore habitat, where sampling was conducted on or near borrow areas, juvenile abundances were highest in the late summer and December (Table 3, Appendix 4b). Adult Atlantic herring were not collected in the surf zone and were abundant in nearshore trawl surveys only in December (Table 3. Appendix 4b). The occurrence of Atlantic herring in nearshore habitat is consistent with their preference for higher salinities (26 – 32 psu).

Atlantic mackerel (*Scomber scombrus*). Juvenile Atlantic mackerel were present, but rare, in the surf zone of northern New Jersey in August and were not collected in September or October (Table 2). Juveniles were sporadically collected in low abundances in nearshore sampling on the south shore of Long Island (Table 3, Appendix 4c). Adult Atlantic mackerel were not collected in the surf zone (Table 2) and were collected at low abundances in nearshore sampling in March, April, and December (Table 3, Appendix 4c).

Black sea bass (*Centropristus striata*). Juvenile and adult black sea bass were not collected in the surf zone of northern New Jersey (Table 2). Juveniles were collected in nearshore habitat from April through November, with highest abundances in April, July, August, and November (Table 3, Appendix 4d). Adult black sea bass were collected from April through September in nearshore habitat. Juveniles and adults were common in fish trap sampling in September at the entrance to Ambrose channel in Lower Bay where gravel to boulder size rocks caused an obstruction to navigation (Appendix 4d). Adults are generally associated with structurally complex habitats such as rocky reefs, cobble and rock fields, and mussel beds with summer habitat on the nearshore continental shelf (Drohan et al. 2007), which is consistent with their higher abundances in sampling at the Ambrose channel obstruction.

Bluefish (*Pomatomus saltatrix*). Juvenile bluefish were highly abundant in surf zone habitat in northern New Jersey from August through October (Table 2). Size frequency distributions suggest these juveniles result from both spring and summer spawned cohorts (Wilber et al. 2003a). Bluefish were significantly more abundant at reference areas than at sites near an active beach nourishment operation, suggesting an avoidance response to the disturbance (Wilber et al. 2003b). Adult bluefish were not collected in the surf zone (Table 2). Juveniles were collected from August to November in nearshore habitat and were most abundant from August to October (Table 3, Appendix 4e). Adults were collected in very low abundances in nearshore habitat in June and September.

Red hake (*Urophycis chuss*). Red hake larvae were present, but rare, in surf zone plankton tows in July and juvenile and adults were not collected in the surf zone of northern New Jersey (Table 2). Red hake larvae were also sampled at very low abundances in nearshore habitat in the late summer (Able et al. 2010). The rare occurrences of eggs and larvae in the surf zone and nearshore habitat reflect that they are more commonly collected in habitats with lower salinities (e.g., < 25 psu). Juvenile red hake were highly abundant from November through April in the nearshore habitat west of Shinnecock Inlet (Appendix 4f) and were present at lower abundance throughout the summer and early fall (Table 3, Appendix 4f). The high abundances of juvenile red hake in nearshore habitat is consistent with the high salinity (31-33 psu) preference for this life stage. Red hake in the adult size range were collected in only one study conducted near Shinnecock Inlet and this collection occurred in April.

Scup (*Stenotomus chrysops*). Scup were not collected in the surf zone habitat of northern New Jersey (Table 2). Juvenile and adult scup were highly abundant in nearshore habitat on or near borrow areas during the summer and early fall (Table 3, Appendix 4g). In nearshore habitat, scup were present, but rare from November through January and not collected in February and March.

Summer flounder (*Paralichthys dentatus*). Summer flounder larvae were not collected in the surf zone of northern New Jersey, however, juveniles and adults were present, but rare, in August and September beach seine samples (Table 2). Juveniles were not commonly collected in nearshore bottom trawl surveys (Appendix 4h). Adult summer flounder were collected in all monitoring studies that used bottom trawls and were present from April through January and abundant from April through November (Table 3, Appendix 4h). The high abundances from late spring to early fall is consistent with their known distribution in shallow coastal and estuarine water during warmer months.

Windowpane flounder (*Scophthalmus aquosus*). Windowpane flounder larvae were highly abundant in the surf zone of northern New Jersey in May and June (Table 2). Juvenile windowpane flounder were present, but rare, in the surf zone in August and September and were not present in October, whereas adults were present, but rare in September in the surf zone (Table 2). Juvenile and adult windowpane flounder were collected throughout the year in nearshore habitat (Table 3, Appendix 4i). High abundances were observed in May and from July through December (Table 3, Appendix 4i).

Winter flounder (*Pseudopleuronectes americanus*). Winter flounder larvae were collected in surf zone habitat in northern New Jersey in May and were not collected in June or July (Table 2). Juveniles were present, but rare, in the surf zone in August and were not collected in September or October. Adult winter flounder were not collected in the surf zone habitat. Juvenile and adult winter flounder were collected in all months in nearshore habitat, with highest abundances occurring in April, May and December (Table 3, Appendix 4j).

Pollock *(Pollachius virens).* Pollock were not collected in the surf zone habitat in northern New Jersey. Pollock were uncommon in monitoring studies on the south shore of Long Island, but were collected sporadically in the spring and summer and in December (Appendix 4r).

Ocean pout (*Macrozoarces americanus*). Ocean pout were not collected in the surf zone habitat in northern New Jersey. Ocean pout were collected from February to April and in December on the south shore of Long Island in very low abundances (Appendix 4q).

Goosefish (*Lophius americanus*). Goosefish were not collected in the surf zone habitat in northern New Jersey. Goosefish were uncommon in all sampling on the south shore of Long Island and were sporadically collected in April, June, July, November, and December (Appendix 4p).

Longfin squid (*Loligo pealeii*). Longfin squid were not collected in the surf zone habitat in northern New Jersey. Longfin squid were highly abundant in the summer Rockaway borrow area sampling (Table 3, Appendix 4m), comprising as much as 7 percent of the total catch in some years. High summer abundances were also observed in bottom trawl sampling in the lower bay area of the harbor in the mid-1990s (Wilk et al. 1998).

Winter skate (*Leucoraja ocellata*). Winter skate were not collected in the surf zone habitat in northern New Jersey. Winter skate were present in all months during the three years of sampling borrow areas on the south shore of Long Island, with high abundances in the spring and fall (Appendix 4n).

Surf clam (*Spisula solidissima*). In August and September, surf clams were sampled along the south shore of Long Island at eight borrow areas (USACE 2002b). Results indicate the borrow areas had very small to no localized surf clam populations with the exception of Borrow Area 2AD off Fire Island Pines and portions of borrow area WOSI. At these locations, dense surf clam populations were sampled. In other monitoring studies on the south shore of Long Island, surf clams were collected incidentally in trawls year-round and were collected in high abundances in grab samples near the Rockaway borrow area (Appendix 4o). The New York State Department of Environmental Conservation conducted surf clam assessment surveys in 1992, 1993, 1994, 1996, 2000 and 2002 (Davidson and Linehan 2003)

Ocean quahog (*Artica islandica*). Ocean quahog were collected incidentally in several trawl surveys on the south shore of Long Island, but in low abundances (Appendix 4s). Their abundances were high in grab samples collected in June near the Rockaway borrow area.

Other EFH species listed in NOAA's 10 x 10 minute lat/long square coordinates that were not collected in the biological surveys reviewed were Atlantic cod, Atlantic salmon, whiting, yellowtail flounder, king mackerel, Spanish mackerel, cobia, sand tiger shark, dusky shark, sandbar shark, blue shark, shortfin mako shark, skipjack tuna, bluefin tuna, common thresher shark, white shark, and tiger shark.

4.1 Benthic Habitat Characterizations in Nearshore Habitat

Sampling conducted from Fire Island to Montauk Point, Long Island, New York indicated that the numerical abundances of benthic macroinvertebrates were consistent among borrow areas and seasons (USACE 2004b). South shore of Long Island benthic communities were more similar to those of New Jersey than to those near the Rockaways, which was attributed to differences in the physical and chemical features of the respective areas. Shallow (less than 16 meters depth) borrow areas had lower benthic invertebrate abundances than deeper borrow areas with the highest abundances found at borrow areas with a mean depth of 18 meters. Both shallow and deep borrow areas were dominated by arthropods, annelids, and archiannelids, with more annelids in deeper borrow areas (EEA 2001). The benthic community in the Coney Island borrow area in 2000 was dominated by small blue mussels, polychaete worms, amphipods and mud crabs (NEA 2001).

Offshore borrow areas in northern New Jersey were numerically dominated by polychaetes and amphipods and biomass was dominated by sand dollars (Burlas et al. 2001). Abundance, biomass, and species composition were similar to that observed in monitoring studies conducted on the southern shore of Long Island. More detailed information on benthic assemblages at each borrow area monitored by the USACE is available in the respective project reports.

4.2 TSS Characterizations in Surf Zone and Nearshore Habitat

TSS sampling was conducted in the swash, surf, and nearshore zones near the discharge pipe and at reference areas in conjunction with a beach replenishment project in northern New Jersey (Burlas et al. 2001, Wilber et al. 2006). TSS concentrations were relatively high (from 50 to almost 600 milligrams/liter [mg/L]) in the swash zone at two sites of active discharge compared to reference areas (generally less than 20 mg/L). Elevated TSS concentrations in the swash zone were limited to within 400 m of the discharge pipe. Surf zone concentrations were somewhat elevated at the point of discharge at one of the two active nourishment sites, but were otherwise near background levels, and nearshore TSS concentrations showed no response to discharges (Wilber et al. 2006). TSS concentrations measured immediately following the passage of severe storms greatly exceeded those at active discharge sites, although it was observed that the history of prior nourishment at a site affected the measured concentrations (Wilber et al. 2006).

Water quality monitoring at borrow areas included measures of water clarity, but no measures of suspended sediment concentrations. Although turbidity (NTU) and suspended sediment concentrations (TSS) can be calibrated within aquatic systems, in the absence of this calibration, NTU data are of limited usefulness in predicting potential biological impacts from suspended sediment plumes. Turbidity measures at borrow areas exhibited a wide range of values (0 to 83 NTU), with highest measures associated with sampling over areas with muddy substrate (USACE 2008a). Studies that directly measure TSS concentrations in the vicinity of dredging plumes in nearshore environments are needed to better understand the potential for detrimental impacts to marine organisms.

5. Summary

There are a number of existing storm damage reduction and maintenance dredging projects that are currently in place or under consideration for the nearshore coastal areas of southern New York and northern New Jersey. This document is intended to serve as a reference to aid in decisions related to management and implementation of the following project types and activities:

- Navigation dredging
  - Mechanical (open and closed buckets), including environmental bucket
  - Hydraulic Pipeline Cutterhead
  - Hydraulic Hopper
- Jetty repair
- Beach nourishment
  - placement of material onshore for maintenance and civil works projects
  - in-water placement of maintenance material (in NJ waters only)
  - removal of material from borrow areas (Hydraulic Pipeline Cutterhead and Hydraulic Hopper dredges)
- Placement of rock material at artificial reef sites

Constructions and Maintenance of navigation channel dredging is accomplished by two major categories of conventional dredging equipment: mechanical and hydraulic. Mechanical dredges include bucket (also known as clamshell or grab) dredges and backhoe (or excavator) dredges. Hydraulic dredges, referring to their use of water to form sediment-water slurries in the excavation process, include pipeline cutterhead dredges and hopper dredges. As their name implies, bucket dredges basically consist of a derrick on a floating platform or barge that uses a bucket with opposing "jaws" to penetrate the sediment bed and remove sediment with minimal disruption of the sediment matrix. Backhoe dredges work in a similar manner but use an articulated arm rather than a winch-driven hoist to lower and raise the attached bucket. In contrast, both types of hydraulic dredges entrain water to disaggregate the sediment bed matrix for pumping to either a pipeline discharge or into a hopper. In the case of a cutterhead a rotating cutter, fitted with replaceable cutting teeth for digging into the sediment, physically swings laterally back and forth in an arc into the sediment face while pumps take in water to dislodge the sediment. Dragheads on hopper dredges function somewhat differently by pumping in water while being pulled forward across the surface of the sediment bed. Choice of dredge type for a given project is heavily influenced by economics, potential environmental impacts, dredging area and sediment type. Navigation dredging within the interior portions of NY/NJ Harbor is generally accomplished with mechanical dredges. Cutterhead dredges have most frequently been used where sediments consist primarily of sands, as in the case of coastal inlets. Hopper dredges, which are essentially self-propelled ocean going vessels, have been used to maintain the Ambrose Channel which connects deeper ocean waters to the harbor's network of interior channels.

For maintenance sand placement and beach nourishment activities, the sand material is dredged from an offshore borrow area located approximately 2 to 6 miles offshore. Beach nourishment in New York and New Jersey is typically accomplished using hydraulic dredges described above and then the material is pumped to the project site.

For jetty repair/construction activities, the stone required is typically purchased from a nearby rock quarry and typically involves both on land and in-water activities. Depending on the project/site conditions, the stones can be trucked or barged to the project site. The stone is then placed using a variety of heavy equipment including cranes. If the stone is brought in on land, stones will be trucked in from the staging area to the jetty. A bulldozer is typically used for grading and placement of the smaller bedding stones.

Dredge windows (i.e. period during which dredging is not allowed) applied to dredging and beach nourishment projects have historically been based on subjective information and perceptions of the scales of disturbances posed by typical dredging operations (National Research Council 2001). Windows that are truly protective and balanced with the need to conduct dredging and beach nourishment in a cost-effective manner should be based on data to perform a risk assessment of the impacts associated with these projects. A determination of overlap in timing of the needed dredging and beach nourishment and occupation of surf zone or nearshore waters by an EFH species can generally be based on existing information and has historically resulted in establishing recommended dredge windows. The next step requires consideration of the probability that the species would be exposed to the project's perturbation. For example, as indicated above, juvenile bluefish, highly active swimmers, appear readily capable of avoiding discharge plumes. The avoidance response is likely driven by their reliance on optical cues for foraging rather than an intolerance of moderate TSS concentrations. Therefore, although the beach discharge plumes might occur while bluefish are present in the study area, the probability of an encounter with a plume that would result in a biologically meaningful exposure would be exceedingly low. In tandem with existing knowledge of the limited spatial scales of beach discharge plumes on open beaches, a summary finding that application of restrictive management practices to protect bluefish from TSS and turbidity related impacts is unnecessary might be justified. One caveat might concern dredging in spatially confined inlets or when the material contains high fractions of fine sediments (which normally would not be considered compatible for nourishment purposes).

Tables 4 and 5 are provided to facilitate assessment of EFH concerns for individual projects. Given the broad span of environmental settings within the total coverage area, the different means whereby coastal engineering projects are executed, and the diverse assemblage of EFH species that may occur at any location, it is useful to focus on the most probable impacts on appropriate species. Table 4 flows from the general areas of coverage (i.e. coastal, inlet, and estuary), through the types of engineering projects that may occur in each area, through the choices in equipment to perform a given project, to the categories of impacts associated with each choice of equipment. Although not an exhaustive list of possible impacts, these categories are intended to capture the major ways in which species and project interactions occur. In general, the environmental impacts that are associated with beach nourishment projects, dredging and in-water construction are direct impacts to demersal species, benthic infaunal species and nesting species at the borrow/dredging area and at the placement site. Indirect impacts are associated with temporary impacts to food source and potential increases in turbidity.

Cumulative impacts could be associated with modifying the bottom topography which could change hydrodynamics, sediment transport and water quality at borrow areas.

The listed categories of impacts include entrainment, resuspended sediment, sedimentation, underwater noise, habitat alteration, and impaired foraging. Entrainment refers to removal of organisms by hydraulic dredges (hopper and cutterhead), which use pumps to intake slurries of sediment and water (Reine and Clarke 1998).

Resuspended sediment refers to effects of exposure to plumes of sediment released to the water column during the dredging process (Wilber and Clarke 2001). The temporal and spatial scales of plumes differ dependent on the specific type of equipment used and conditions at the project site. Concerns for exposures would be heightened if the project entailed handling of contaminated sediments. However, the large majority of coastal engineering projects do not involve regulated sediments. Required testing procedures would identify problematic contaminants, if present, and trigger further regulatory scrutiny. For the purposes of this document an assumption is made that plumes are comprised of clean sediments.

Sedimentation as an impact category treats concerns that resuspended sediments would settle in sufficient quantities to cause detrimental effects (Wilber et al. 2005). Historically, sedimentation concerns have focused on sedentary organisms such as bivalve mollusks.

Underwater noise is a relatively new category of concern which addresses the fact that many aquatic organisms use sound as a sensory modality important in predator and prey detection as well as intraspecific communication (Clarke et al. 2002).

Habitat alteration represents an important category of impact if the project results in a long-term or permanent shift in habitat attribute, such as a shift from sand to silt-dominated substrate. Impaired foraging as a category of impact can be manifested in several ways. For example, suspended sediment plumes can affect the ability of visual predators to detect prey. Likewise, physical disturbance of the substrate can result in reduced availability of benthos during recovery periods of months or longer (Wilber and Clarke 2007, 2009).

Identification of appropriate categories of potential impact is the initial step in assessing effects on designated EFH species. The next step involves identification of the species that would, based upon distribution and life history characteristics, have a high probability of occurring within the area of influence of a given project. Table 5 assists in determining which species would potentially be at risk. Table 5 lists the currently designated EFH species with summary information on their respective life history stages that could potentially occur at a given project site. For the majority of species links to appropriate EFH source documents, which contain detailed information on distribution, habitat preferences, and environmental requirements, are provided. Summaries of information on habitat preferences are then shown and potential impacts identified. The contents of the table are organized with respect to priority species based upon a tiered approach. That is, designated EFH fish species most likely to be present at project sites are listed first. These species are known to be locally abundant and/or have strong affinities for the habitats in which coastal engineering projects take place. Designated EFH macroinvertebrates are then listed separately. The third grouping of designated EFH species consists of widely ranging but less abundant species. Finally, consistent with NOAA's treatment of "highly migratory species such as bluefin tuna, Table 5 then lists species that rarely venture into inshore waters. This group also includes multiple species of sharks for which detailed distribution data are lacking.

NOAA does provide source documents (see Table 5) giving very useful summaries of spatial and seasonal distributions, life histories, and habitat requirements for some but not all EFH species likely to occur in the project area. For example, the NOAA Habitat Protection website (www.habitat.noaa.gov/protection/efh/habitatmapper.html) provides access to an EFH Mapper tool, which can be used to display known occurrences of various life history stages of multiple EFH species. However, comparable data are not given for all EFH species, especially those classified by NOAA as "highly migratory" (www.nero.noaa.gov/hcd/). These species include most sharks and tunas. Active links to alternative NOAA EFH data sites (www.nero.noaa.gov/hcd/list.htm and www.nero.noaa.gov/hcd/efhtables.pdf) are provided to the extent possible in Table 5. Beyond awareness that the highly migratory species may occur in the project area, only subjective assumptions can be made about what specific categories of impact are relevant. Therefore a "Not Applicable (= NA)" category is assigned. In addition, three EFH species (cobia, king mackerel, and Spanish mackerel) are denoted by NOAA to be stragglers in the project area from their primary centers of abundance in the South Atlantic region. The above sources of EFH data should be checked periodically for updated and more comprehensive information.

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Tables

Table 1a. Dredging Windows for Maintenance Projects along South Shore of Long Island

Placement	State	Waterway	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Beach (pipeline)	NY (2013)	Long Island Intracoastal Waterway				With the exception of the May-June 2010 dredging event authorized herein, there shall be no dredging b/t the dates Jan 15-Sept 30 each year in order to protect **spawning finfish**, including the **winter flounder**, **shellfish** and **nesting shorebirds**. This restriction does not preclude the required earthwork and other construction necessary to prepare the diked deposition areas (East Inlet Island & Cupsogue Beach County Park) and the set up of the dredged material discharge pipe system for the May-June 2010 dredging events.								
								With the exception of the 2010 dredging event authorized herein, there shall be no excavation, grading or machinery operation on East Inlet Island and the ocean beach at Cupsogue County Park b/t the dates April 1 and Aug 31 each year in order to protect **nesting shorebirds**.						
								Dredging and material placement activities on the beach are prohibited b/t the dates April 1 and Sept 30 in order to protect **spawning finfish**, **shellfish** and/or **spawning finfish**.						
Beach (pipeline)	NY (2004)	East Rockaway Inlet									Dredging is prohibited b/t June 1-Sept 30 of each year to protect **spawning shellfish** and/or **spawning finfish**.			

Placement	State	Waterway	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Beach (pipeline)	NY (2008)	Lake Montauk Inlet				Dredging and material placement are prohibited b/t the dates Jan 15-Sept 30 each year to protect the spawning and early life stages of **finfish** and **shellfish**.								
Beach (pipeline)	NY (2009)	Shinnecock Inlet						No work which involves operation of machinery, redistribution of sand, grading, regrading, excavation or other physical disturbance is authorized from April 1-Aug 31 for **piping plover**.						
						Dredging is prohibited b/t Jan 15 and May 15 to protect spawning and early life stages of **winter flounder**.								
								Dredging is prohibited b/t June 1 and Sept. 30 to protect spawning and early life stages of **shellfish** and **finfish**.						

Table 1b. Dredge Windows for New York State/Federal Protected Species for Coastal Projects

Species	Ocean/Bay (open water)	Inlet+	Saltmarsh+	Intertidal +	Upper Beach	Comments
Piping Plover				4/1- 8/31 Placement Foraging FED/FWS NYSDEC	4/1-8/31 Placement Nesting FED/FWS NYSDEC	Window enforcement (Permit) may depend on recent present -absence history
Least Tern	Dredging * Foraging FED/FWS NYSDEC	Dredging * *Foraging* *FED/FWS NYSDEC*			4/1- 8/31 Placement Nesting FED/FWS NYSDEC	Window enforcement (Permit) may depend on recent present/absence history. *Possible secondary impacts, however no window is in place
Roseate Tern	Dredging* Foraging FED/FWS NYSDEC	Dredging* Foraging FED/FWS NYSDEC			4/1- 8/31 Placement Nesting FED/FWS NYSDEC	Window enforcement (Permit) based on recent present -absence history *May cause secondary impacts, however no window is in place
Winter Flounder	1/15-5/15 Dredge /Placement Spawning FED/NMFS	1/15-5/15 Dredge /Placement Spawning FED/NMFS	6/1-9/30 Dredge /Placement Nursery FED/NMFS	6/1-9/30 Dredge /Placement Nursery FED/NMFS		Existing windows are presently depth dependent, 15' or less. However, up to 60' may be enacted. By NMFS/EFH

Horseshoe Crab	5/1-6/30 Dredge /Placement Spawning NPS - FINS		5/1-6/30 Dredge/ Placement Spawning NPS - FINS	5/1-6/30 Dredge/ Placement Spawning NPS - FINS		Window only applies to Fire Island National Sea Shore. Relates to migratory Shore birds preying on HS crab eggs.
Sea Turtles	5/1 - 11/30 Hopper Dredge Forage/Resting Observer required on board FED/NOAA NYSDEC	5/1 - 11/30 Hopper Dredge Forage/Resting Observer required on board FED/NOAA NYSDEC			Nesting does not occur north of Delaware	Only Hopper Dredges are affected. Likelihood of turtle presence tied to depth and current. LI inlets generally considered unlikely due to strong currents
Sea Beach Amaranth (Plant)					5/15-10/15 Placement FED/FWS NYSDEC	
Shellfish, Lobster, Surf Clams	6/1-9/30 Dredging/ Placement NYSDEC					This general window is dependent on specific location and prior knowledge of presence on site.
+ Established Window Duration Action Causing Impact Species/Activity Impacted Responsible Regulatory Agency						

Table 1c. Dredge Windows for New Jersey State/Federal Protected Species for Coastal Projects

Species	Ocean/Bay (open water)	Inlet+	Saltmarsh+	Intertidal +	Upper Beach	Comments
Piping Plover				3/15- 8/15 Placement Foraging FED/FWS NJDEP	3/15-8/15 Placement Nesting FED/FWS NJDEP	Window enforcement (Permit) may depend on recent present -absence history
Plover Plover	Dredging * Foraging FED/FWS NJDEP	Dredging * *Foraging* *FED/FWS NJDEP*			3/15- 8/15 Placement Nesting FED/FWS NJDEP	Window enforcement (Permit) may depend on recent present/absence history. *Possible secondary impacts, however no window is in place
Plover Plover	Dredging* Foraging FED/FWS NJDEP	Dredging* Foraging FED/FWS NJDEP			3/15- 8/15 Placement Nesting FED/FWS NJDEP	Window enforcement (Permit) based on recent present - absence history *May cause secondary impacts, however no window is in place
Plover Plover	1/15-5/15	1/15-5/15	6/1-9/30	6/1-9/30		Existing windows are presently depth dependent, 15' or less. However, up to 60' may be enacted. By NMFS/EFH

	Dredge /Placement Spawning FED/NMFS NJDEP	Dredge /Placement Spawning FED/NMFS NJDEP	Dredge /Placement Nursery FED/NMFS NJDEP	Dredge /Placement Nursery FED/NMFS NJDEP		
Plover Plover	5/1 - 11/30 Hopper Dredge Forage/Resting Observer required on board FED/NOAA NJDEP	5/1 - 11/30 Hopper Dredge Forage/Resting Observer required on board FED/NOAA NJDEP			Nesting does not occur north of Delaware	Only Hopper Dredges are affected. Likelihood of turtle presence tied to depth and current.
Sea Beach Amaranth (Plant)					5/15-10/15 Placement FED/FWS NJDEP	

+

Established Window Duration
Action Causing Impact
Species/Activity Impacted

Responsible Regulatory Agency

Table 2. Compilation of all EFH species collected in surf zone beach seine (Burlas et al. 2001, Wilber et al. 2003) and plankton tow (Able et al. 2010) surveys conducted in northern New Jersey. The highest abundance categorization observed for each month is depicted.

Species	Life stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Atlantic Butterfish	Juvenile												
	Adult												
Atlantic herring	Juvenile												
	Adult												
Atlantic mackerel	Juvenile												
	Adult												
Black sea bass	Juvenile												
	Adult												
Bluefish	Juvenile												
	Adult												
Red hake	Larvae												
	Juvenile												
	Adult												
Scup	Eggs												
	Larvae												
	Juvenile												
	Adult												
Summer flounder	Larvae												
	Juvenile												
	Adult												
Windowpane flounder	Eggs												
	Larvae												
	Juvenile												
	Adult												
Winter flounder	Eggs												
	Larvae												
	Juvenile												
	Adult												
Little skate	Juvenile												
	Adult												

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No information available	Surf zone sampling not conducted.
Not present	Life stage not collected.
Rare	Life stage is present, but not frequently encountered.
Common	Life stage is frequently encountered, but not in large numbers.
Abundant	Life stage is often encountered in substantial numbers.
Highly abundant	Life stage is consistently encountered in substantial numbers.

Table 3. Compilation of all EFH species collected in nearshore bottom trawl surveys (data sources depicted in Fig. 22) and nearshore ichthyoplankton sampling (Burlas et al. 2001; Able et al. 2010). The highest abundance characterization observed for each species (see Appendix 4) in each month is depicted.

Species	Life stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Atlantic Butterfish	Juvenile	Common	Rare	Rare	Rare	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Rare
	Adult	Common	Rare	Rare	Rare	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Rare
Atlantic herring	Juvenile	Rare	Rare	Common	Rare	Common	Rare	Abundant	Abundant	Rare	Not present	Rare	Abundant
	Adult	Rare	Rare	Common	Rare	Common	Not present	Rare	Abundant	Rare	Not present	Rare	Abundant
Atlantic mackerel	Juvenile	Not present	Not present	Rare	Not present	Not present	Rare	Rare	Not present	Not present	Not present	Not present	Rare
	Adult	Not present	Not present	Rare	Rare	Not present	Rare	Rare	Not present	Not present	Not present	Not present	Rare
Black sea bass	Juvenile	Not present	Not present	Not present	Abundant	Rare	Rare	Abundant	Common	Rare	Rare	Common	Not present
	Adult	Not present	Not present	Not present	Abundant	Rare	Rare	Abundant	Common	Rare	Rare	Common	Not present
Bluefish	Juvenile	Not present	Not present	Not present	Not present	Not present	Rare	Rare	Abundant	Highly abundant	Abundant	Rare	Not present
	Adult	Not present	Not present	Not present	Not present	Not present	Rare	Rare	Abundant	Abundant	Abundant	Rare	Not present
Red hake	Larvae	No information available	No information available	No information available	No information available	Not present	Not present	Rare	No information available	No information available	No information available	No information available	No information available
	Juvenile	Highly abundant	Common	Highly abundant	Highly abundant	Common	Common	Common	Rare	Rare	Rare	Highly abundant	Highly abundant
	Adult	Highly abundant	Common	Abundant	Highly abundant	Common	Common	Common	Rare	Rare	Rare	Highly abundant	Highly abundant
Scup	Eggs	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available
	Larvae	No information available	No information available	No information available	No information available	Not present	Not present	Not present	No information available	No information available	No information available	No information available	No information available
	Juvenile	Rare	Not present	Not present	Rare	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Rare	Not present
	Adult	Rare	Not present	Not present	Rare	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Rare	Not present
Summer flounder	Larvae	No information available	No information available	No information available	No information available	Not present	Not present	Not present	No information available	No information available	No information available	No information available	No information available
	Juvenile	Rare	Not present	Not present	Abundant	Common	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant	Common
	Adult	Rare	Not present	Not present	Abundant	Common	Abundant	Abundant	Abundant	Abundant	Abundant	Abundant	Common
Windowpane flounder	Eggs	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available
	Larvae	No information available	No information available	No information available	No information available	Highly abundant	Highly abundant	Rare	No information available	No information available	No information available	No information available	No information available
	Juvenile	Common	Rare	Common	Abundant	Highly abundant	Abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant
	Adult	Common	Rare	Common	Abundant	Highly abundant	Abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant
Winter flounder	Eggs	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available	No information available
	Larvae	No information available	No information available	No information available	No information available	Common	Not present	Not present	No information available	No information available	No information available	No information available	No information available
	Juvenile	Common	Common	Common	Abundant	Highly abundant	Common	Common	Rare	Rare	Rare	Common	Abundant
	Adult	Common	Common	Common	Abundant	Highly abundant	Common	Common	Not present	Not present	Rare	Common	Abundant
Clearnose skate	Juvenile	Not present	Not present	Not present	Not present	Highly abundant	Common	Abundant	Common	Common	Rare	Rare	Not present
	Adult	Not present	Not present	Rare	Rare	Highly abundant	Common	Abundant	Common	Common	Rare	Rare	Not present
Little skate	Juvenile	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Abundant	Highly abundant	Highly abundant
	Adult	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Highly abundant	Abundant	Highly abundant	Highly abundant

No information available	Bottom trawl sampling not conducted.
Not present	Life stage not collected.
Rare	Life stage is present, but not frequently encountered.
Common	Life stage is frequently encountered, but not in large numbers.
Abundant	Life stage is often encountered in substantial numbers.
Highly abundant	Life stage is consistently encountered in substantial numbers.

Table 4. Categories of potential impact associated with coastal engineering projects.

AREA	LOCATION	ACTIVITY	EQUIPMENT	POTENTIAL EFH IMPACT
COASTAL OFFSHORE	BORROW AREA	DREDGING TO OBTAIN MATERIAL FOR BEACH NOURISHMENT	HOPPER DREDGE	ENTRAINMENT
				SEDIMENT RESUSPENSION
				UNDERWATER NOISE
				HABITAT ALTERATION
				IMPAIRED FORAGING
			CUTTERHEAD DREDGE	ENTRAINMENT
				SEDIMENT RESUSPENSION
				UNDERWATER NOISE
				HABITAT ALTERATION
				IMPAIRED FORAGING
	NAVIGATION ENTRANCE CHANNEL	DREDGING TO MAINTAIN NAVIGABLE DEPTH	HOPPER DREDGE	ENTRAINMENT
				SEDIMENT RESUSPENSION
				UNDERWATER NOISE
COASTAL INSHORE	INLET	DREDGING TO MAINTAIN NAVIGABLE DEPTH	HOPPER DREDGE	ENTRAINMENT
				SEDIMENT RESUSPENSION
				UNDERWATER NOISE
			CUTTERHEAD DREDGE	ENTRAINMENT
				SEDIMENT RESUSPENSION
				UNDERWATER NOISE
			BUCKET DREDGE	SEDIMENT RESUSPENSION
				UNDERWATER NOISE
		JETTY REPAIR OR CONSTRUCTION	BARGE WITH CRANE	UNDERWATER NOISE
				HABITAT ALTERATION
	SHORELINE	DREDGED MATERIAL PLACEMENT FOR BEACH NOURISHMENT	PIPELINE DISCHARGE	SEDIMENT RESUSPENSION
				SEDIMENTATION
				IMPAIRED FORAGING
		GROIN REPAIR OR CONSTRUCTION	BARGE WITH CRANE	UNDERWATER NOISE
				HABITAT ALTERATION
ESTUARY	BAY	DREDGING TO MAINTAIN NAVIGABLE DEPTH	HOPPER DREDGE	ENTRAINMENT
				SEDIMENT RESUSPENSION
				UNDERWATER NOISE
			CUTTERHEAD DREDGE	ENTRAINMENT
				SEDIMENT RESUSPENSION
				UNDERWATER NOISE
			BUCKET DREDGE	SEDIMENT RESUSPENSION
				UNDERWATER NOISE
		DREDGED MATERIAL PLACEMENT	PIPELINE DISCHARGE	SEDIMENT RESUSPENSION
				SEDIMENTATION
				HABITAT ALTERATION
				IMPAIRED FORAGING

Table 5. Identities of key EFH species and life history stages (1E = egg, L = larva, J = juvenile, A = adult) potentially affected by project-related impacts (2EN = entrainment, SR = sediment resuspension, SD = sedimentation, UN = underwater noise, HA = habitat alteration, IF = impaired foraging, NA = not applicable).

Designated Species and Life Stage[1], All Grids Combined (NOAA Source Document)	Species Designation by Grid	Life History Strategy	Occurrence in Surf and Inshore Zones	Habitat Preference	Potential Impact Type[2]	Factors That Influence Impacts
EFH FISH SPECIES MOST LIKELY TO OCCUR AT PROJECT SITES						
Spiny dogfish J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm203/tm203.pdf)	1-7	Benthic	Yes	Various substrates in estuaries and continental shelf waters.	EN, SR, HA	Highly mobile. May congregate at inlets.
Barndoor skate J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm173/tm173.pdf)		Benthic	Yes	Mud, sand, and gravel bottoms.	EN, SR, HA, IF	Bottom oriented. May use borrow areas.
Little skate J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm175/tm175.pdf)	1-7	Benthic	Yes	Sand or gravel bottoms.	EN, SR, HA, IF	Bottom oriented. May use borrow areas.
Winter skate J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm179/tm179.pdf)	1-7	Benthic	Yes	Sand and gravel bottoms.	EN, SR, HA, IF	Bottom oriented. May use borrow areas.
Clearnose skate J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm174/tm174.pdf)	1-7	Benthic	Yes	Soft bottoms.	EN, SR, HA, IF	Bottom oriented. May use borrow areas.
Atlantic herring L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm192/tm192.pdf)	1-7	Pelagic	Yes	Coastal pelagic.	SR, UN	Migratory schooling species.
Red hake E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm133/tm133.pdf)	1-6	Benthic	Yes	Eggs buoyant. Juveniles prefer shell fragments and scallop beds. Adults prefer depressions with sand and mud.	EN, HA	Generally found in deep water during winter, inshore as water warms.
Silver hake (Whiting) E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm186/tm186.pdf)	1-7	Benthic	Yes	Sand and pebble bottoms, occasionally mud during day, off bottom at night. Spawn inshore, eggs buoyant.	EN, HA	Can be abundant inshore in proximity to project sites.
Goosefish (locally Monkfish) E, L, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm127/tm127.pdf)	3-7	Benthic	Yes	Substrates with sand/shell mix, algae covered rocks, hard sand, gravel or mud.	HA	More abundant offshore, but can occur in estuaries.
Black sea bass L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm200/tm200.pdf)	1-7	Benthic	Yes	Submerged structure, rock piles throughout project area. Juveniles common in high salinity portion of estuaries. Eggs buoyant.	SR, HA	Occurs in inshore waters, but prefers structurally complex habitats of rock fields, reefs and mussel beds. Not abundant in sand substrates.
Bluefish E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm144/tm144.pdf)	1-7	Pelagic	Yes	Coastal pelagic including surf zone and throughout inshore waters.	SR, IF	Visual feeder. Avoids plumes.

Designated Species and Life Stage[1], All Grids Combined (NOAA Source Document)	Species Designation by Grid	Life History Strategy	Occurrence in Surf and Inshore Zones	Habitat Preference	Potential Impact Type[2]	Factors That Influence Impacts
Scup E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm149/tm149.pdf)	1-7	Benthic	Yes	Juveniles prefer mud, mussel beds, submerged aquatic vegetation. Adults prefer submerged structure.	EN, SR, HA	Abundant in inshore waters and borrow areas in spring and summer, moving offshore in fall and winter.
Ocean pout E, L, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm129/tm129.pdf)	3-6	Benthic	Yes	Smooth bottom near rocks or algae where they dig depressions.	EN, SR, HA	Occurs in low abundance in inshore waters. Prefers firm substrate in rocky areas to dig depressions.
Atlantic mackerel E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm141/tm141.pdf)	1-5	Pelagic	Yes	Coastal pelagic, but does not enter estuaries.	SR	Highly mobile. Occurs in schools.
Butterfish E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm145/tm145.pdf)	1-7	Pelagic	Yes	Coastal pelagic, but prefer sandy bottoms.	SR	Schools may venture inshore.
Windowpane flounder E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm137/tm137.pdf)	1-7	Benthic	Yes	Prefer sand but will occupy soft bottoms.	HA, SD, IF	Bottom oriented. Preys on epifauna.
Summer flounder E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm151/tm151.pdf)	1-7	Benthic	Yes	Mud to sand bottoms.	HA, SD, IF	Bottom oriented. Preys on epifauna, squid and fishes.
Winter flounder E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm138/tm138.pdf)	1-7	Benthic	Yes	Prefer muddy sand but will occupy mixed bottoms.	HA, SD, IF	Bottom oriented. Preys on infauna and epifauna, crops bivalve siphons.
MACROINVERTEBRATE EFH SPECIES						
Atlantic sea scallop E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm189/tm189.pdf)	5	Benthic	Yes	Substrates of cobble, shell hash, gravelly sand or sand.	SD, SR	Habitat preference is for cobble, shells, gravelly sand.
Longfin inshore squid J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm146/tm146.pdf)	1-7	Benthic/ Pelagic	Yes	Locally abundant, Rockaway borrow area.	EN, SR	Highly mobile.
Northern shortfin squid J (http://nefsc.noaa.gov/nefsc/publications/tm/tm191/tm191.pdf)	1-7	Benthic/ Pelagic	Yes	Locally abundant, Rockaway borrow area.	EN, SR	Highly mobile.
Atlantic surf clam J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm142/tm142.pdf)	1-7	Benthic	Yes	To depth of three feet in medium to coarse sand and gravel, also silty to fine sand, but not mud.	SD, SR	Abundant locally in borrow areas; very abundant near Rockaway borrow area.
Ocean quahog J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm146/tm146.pdf)	1-7	Benthic	Yes	To depth of 3 feet in medium to fine sand, also silty sand and sandy mud.	SD, SR	Occurs incidentally along L.I. south shore, but very abundant at Rockaway borrow area.
EFH SPECIES RARELY OCCURRING IN THE PROJECT AREAS						
Thorny skate J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm178/tm178.pdf)		Benthic	Rare	Wide variety of bottom types.	HA, IF	Generally deeper than 18 m. Most abundant below 50 m.
Rosette skate J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm176/tm176.pdf)		Benthic	Rare	Soft bottoms.	HA, IF	Generally deeper than 74 m.

Designated Species and Life Stage[1], All Grids Combined (NOAA Source Document)	Species Designation by Grid	Life History Strategy	Occurrence in Surf and Inshore Zones	Habitat Preference	Potential Impact Type[2]	Factors That Influence Impacts
Smooth skate J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm177/tm177.pdf)		Benthic	Rare	Wide variety of bottom types.	HA, IF	Generally deeper than 110 m.
Atlantic salmon J, A (Collette and Klein-MacPhee 2002)	3, 4, 5	Pelagic	Rare	Juveniles in rivers, smolts and adults oceanic, pelagic.	SR, UN	Low. Juveniles in rivers; smolts and adults wide-ranging pelagic.
Atlantic cod A (http://nefsc.noaa.gov/nefsc/publications/tm/tm124/tm124.pdf)	7	Benthic	Rare	Deep-water bottom habitats with gravel, cobble and rock.	NA	Generally not found in inshore waters.
Haddock L (http://nefsc.noaa.gov/nefsc/publications/tm/tm196/tm196.pdf)	3-6	Benthic	Rare	Substrates with pebble, gravel or gravelly sand.	SR	Abundance very low in project area; preference is for deeper waters.
Pollock J (http://nefsc.noaa.gov/nefsc/publications/tm/tm131/tm131.pdf)	3	Benthic	Occasional	Juveniles in sand, mud, rocks with aquatic vegetation. Adults prefer hard bottoms.	EN, HA	Occurs in low abundance in most inshore waters sampled. Adults prefer hard bottom, generally in deep water.
Redfish (http://nefsc.noaa.gov/nefsc/publications/tm/tm132/tm132.pdf)	1-7	Benthic	Rare	Bottoms of silt, mud or hard substrate.	NA	Generally not found in inshore waters.
Tilefish (http://nefsc.noaa.gov/nefsc/publications/tm/tm152/tm152.pdf)		Benthic	No	Excavates burrows.	NA	Generally not found shallower than 80 m.
Witch flounder E, L (Collette and Klein-MacPhee 2002)	4, 5, 6	Benthic	No	Does not occur in inshore waters.	HA, IF	Generally not found shallower than 90 m.
American plaice J, A (Collette and Klein-MacPhee 2002)		Benthic	Rare	Mixed mud and sand bottoms.	HA, IF	Generally not found in inshore waters.
Yellowtail flounder E, L, J, A (http://nefsc.noaa.gov/nefsc/publications/tm/tm180/tm180.pdf)	4-7	Benthic	Occasional	Mixed mud and sand bottoms.	HA, IF	Generally not found in inshore waters.
DESIGNATED EFH SPECIES WITH HIGHLY MIGRATORY PELAGIC DISTRIBUTIONS						
Sand tiger shark L (www.nero.noaa.gov/hcd/sandtiger.htm)	1-7	Pelagic	Yes	Migratory	NA	Insufficient data.
Sandbar shark L, J, A (www.nero.noaa.gov/hcd/sandbarshark.htm)	1-7	Pelagic	Yes	Migratory	NA	Insufficient data.
Dusky shark L, J, A (www.nero.noaa.gov/hcd/duskyshark.htm)	2-7	Pelagic	Yes	Migratory	NA	Insufficient data.
Blue shark L, J, A	3-7	Pelagic	Yes	Migratory	NA	Insufficient data.
Shortfin mako shark L, J, A (www.nero.noaa.gov/hcd/shortfinmako.htm)	3-7	Pelagic	No	Migratory	NA	Insufficient data.
Tiger shark L, J (www.nero.noaa.gov/hcd/tigershark.htm)	3-7	Pelagic	Yes	Migratory	NA	Insufficient data.

Designated Species and Life Stage[1], All Grids Combined (NOAA Source Document)	Species Designation by Grid	Life History Strategy	Occurrence in Surf and Inshore Zones	Habitat Preference	Potential Impact Type[2]	Factors That Influence Impacts
White shark J (www.nero.noaa.gov/hcd/whiteshark.htm)	4,5,6	Pelagic	Yes	Migratory	NA	Insufficient data.
Basking shark J (www.nero.noaa.gov/hcd/baskingshark.htm)	6	Pelagic	No	Migratory, but occurs on south shore of Long Island.	NA	Insufficient data.
Albacore tuna A (www.nero.noaa.gov/hcd/albacore.htm)		Pelagic	Yes	Migratory, but does occur in New Jersey inshore waters.	NA	Insufficient data.
Skipjack tuna A (www.nero.noaa.gov/hcd/skipjack.htm)	3-7	Pelagic	No	Migratory	NA	Insufficient data.
Bluefin tuna J, A (www.nero.noaa.gov/hcd/bluefin.htm)	4-7	Pelagic	No	Migratory	NA	Insufficient data.
Yellowfin tuna J, A (www.nero.noaa.gov/hcd/yellowfin.htm)	6	Pelagic	No	Migratory	NA	Insufficient data.
PRIMARILY SOUTH ATLANTIC EFH SPECIES						
King mackerel E, L, J, A (www.nero.noaa.gov/hcd/mackcobia.htm)	1-7	Pelagic	No	Migratory	NA	Insufficient data.
Spanish mackerel E, L, J, A (www.nero.noaa.gov/hcd/mackcobia.htm)	1-7	Pelagic	No	Migratory	NA	Insufficient data.
Cobia E, L, J, A (www.nero.noaa.gov/hcd/mackcobia.htm)	1-7	Pelagic	No	Migratory	NA	Insufficient data.

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Figures

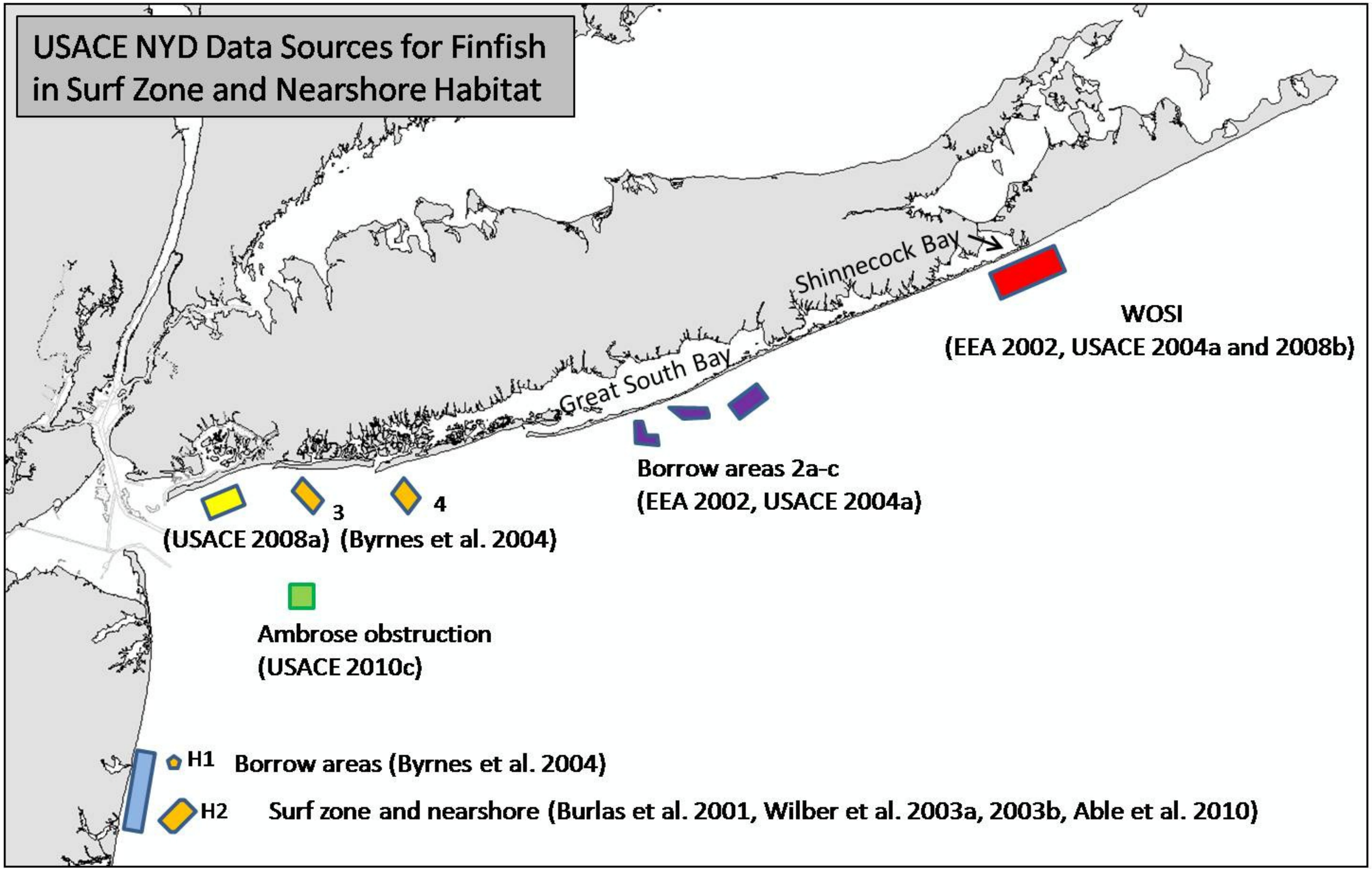

Figure 1. Locations of USACE finfish monitoring in surfzone and nearshore habitat in northern New Jersey and on the southern shore of Long Island, New York.

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Appendix 1: Coastal Habitat Maps: Summary of Surficial Sediment Sampling and Bathymetry

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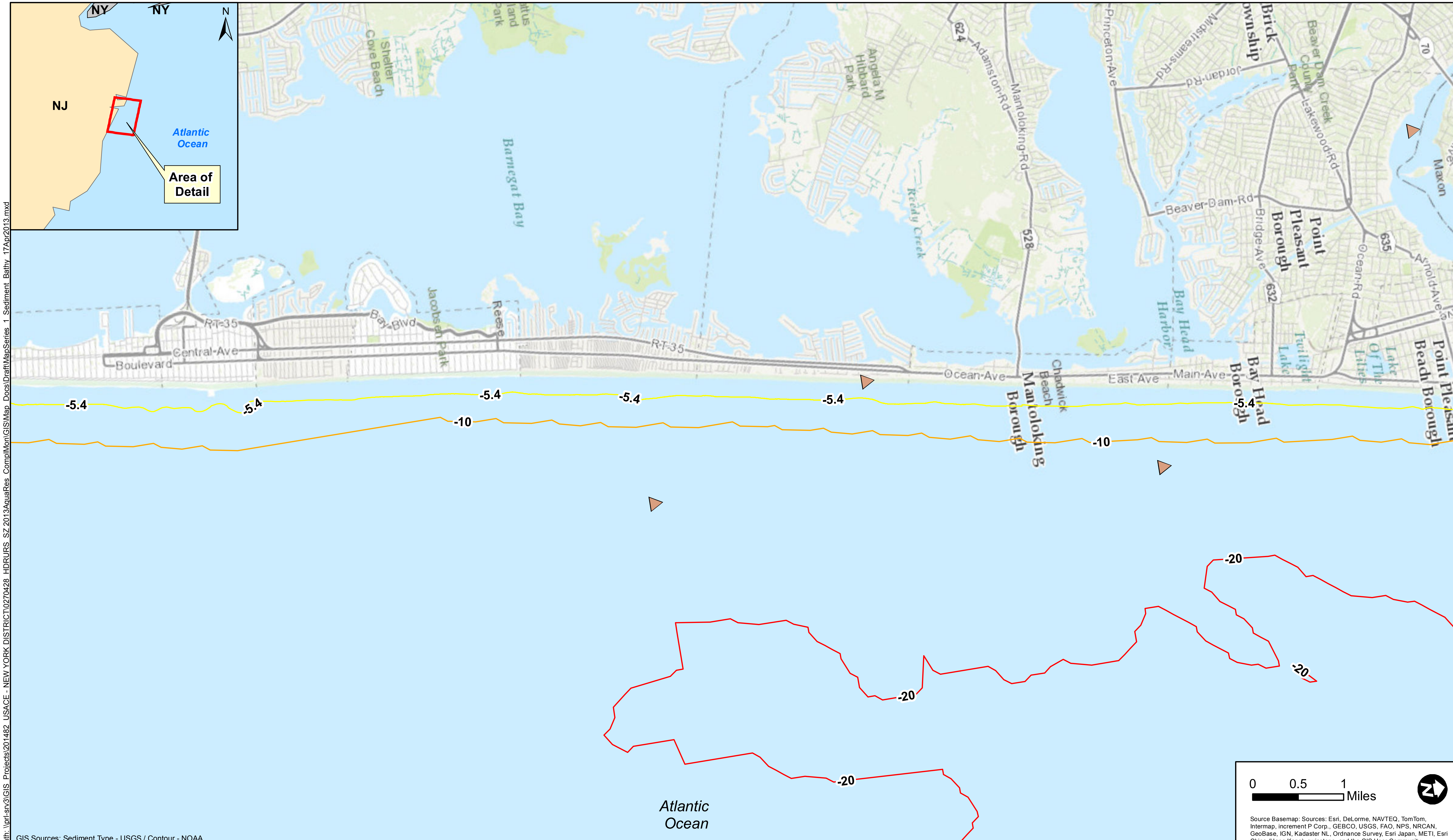

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Appendix 1
Coastal Habitat Maps: Summary of Surficial Sediment Sampling and Bathymetry

Contours in Meter
- -5.4
- -10
- -20

Sediment Type
- UNKNOWN
- CLAY
- CLAYEY SAND
- CLAYEY SILT
- GRAVEL
- GRAVELLY SEDIMENT
- SAND
- SAND SILT CLAY
- SANDY CLAY
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- SEDIMENT
- SILT
- SILTY CLAY
- SILTY SAND

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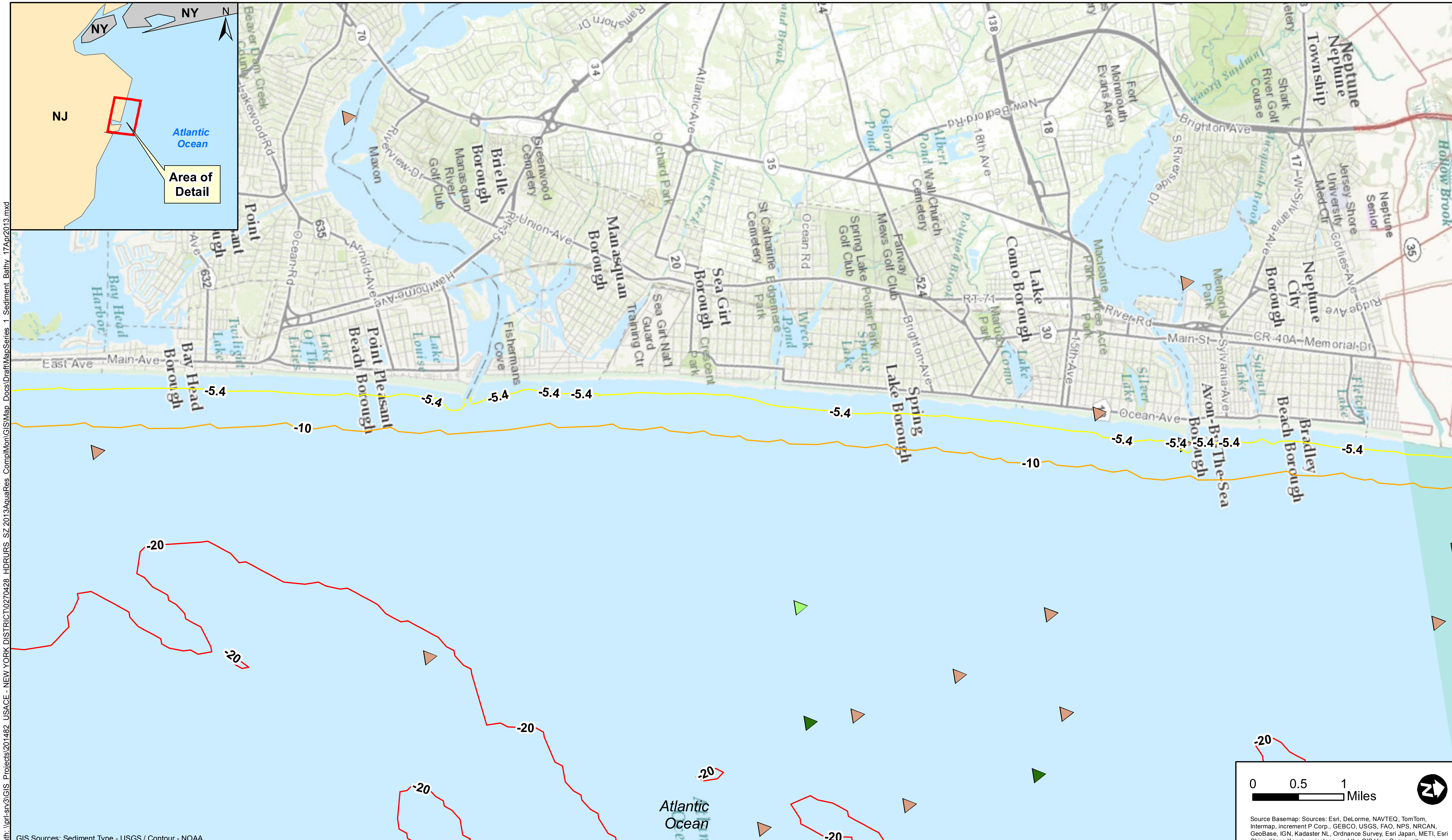

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- SILT
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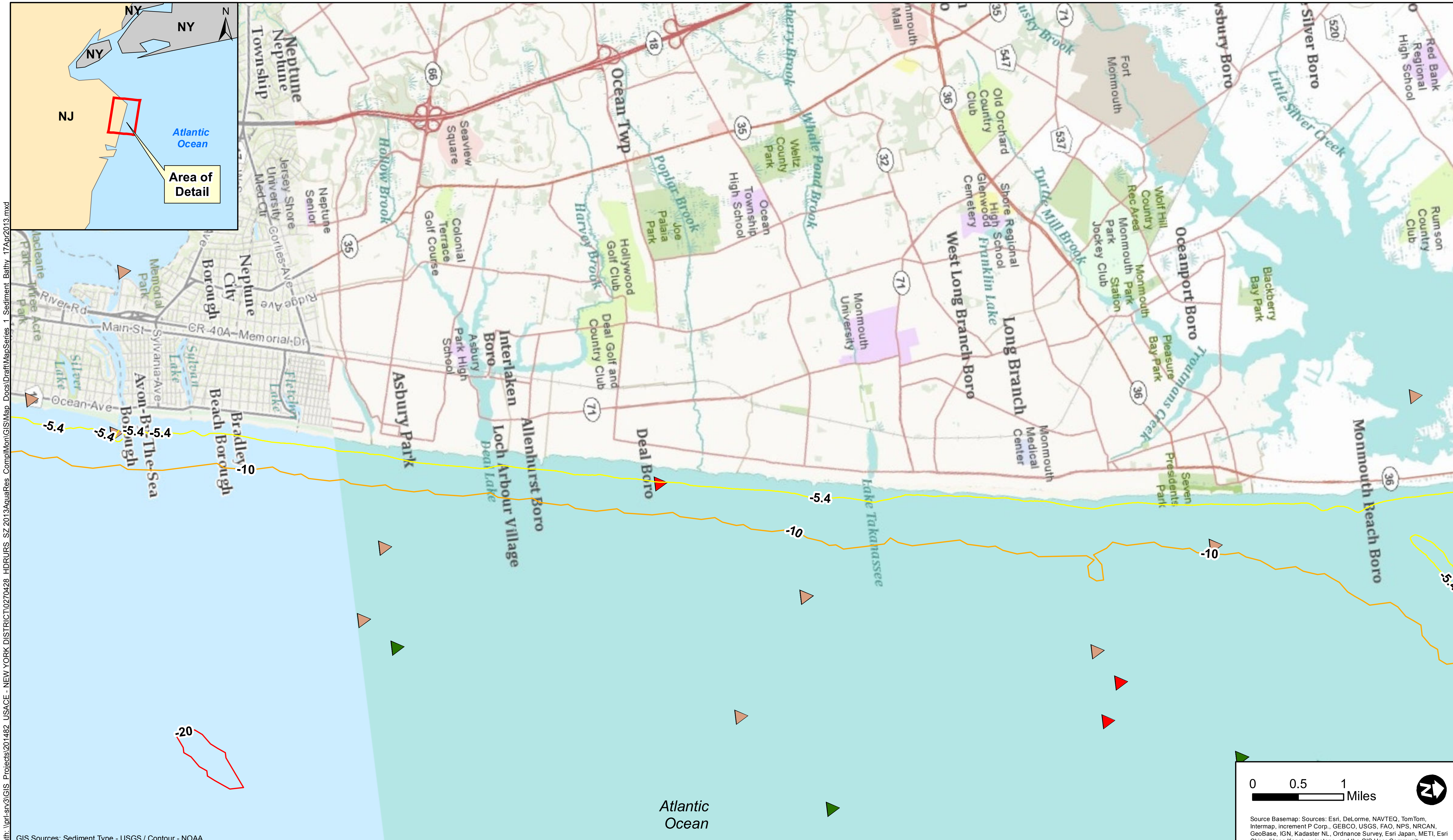

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- -20

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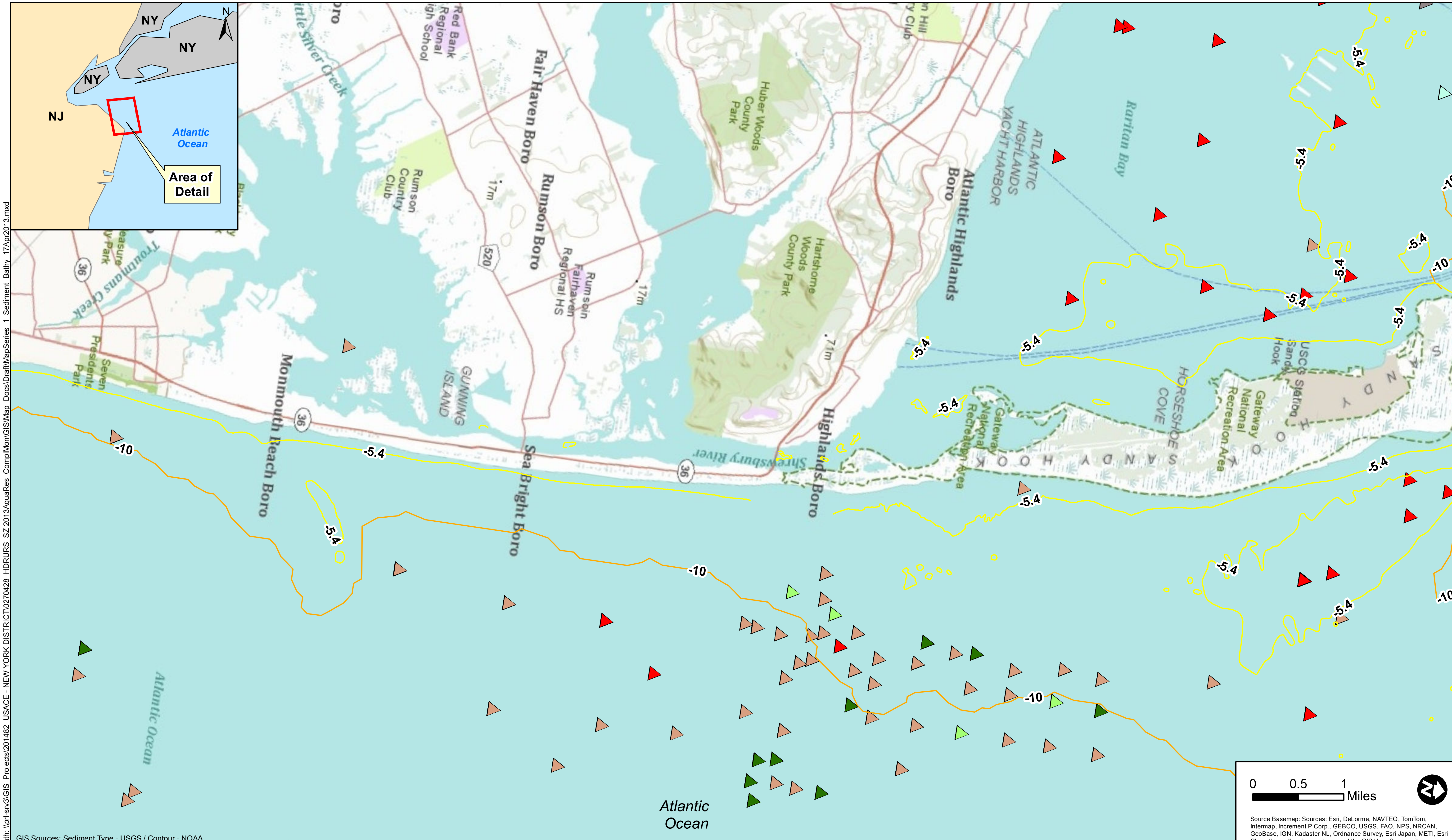

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Sediment Type
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- SILTY CLAY
- SILTY SAND

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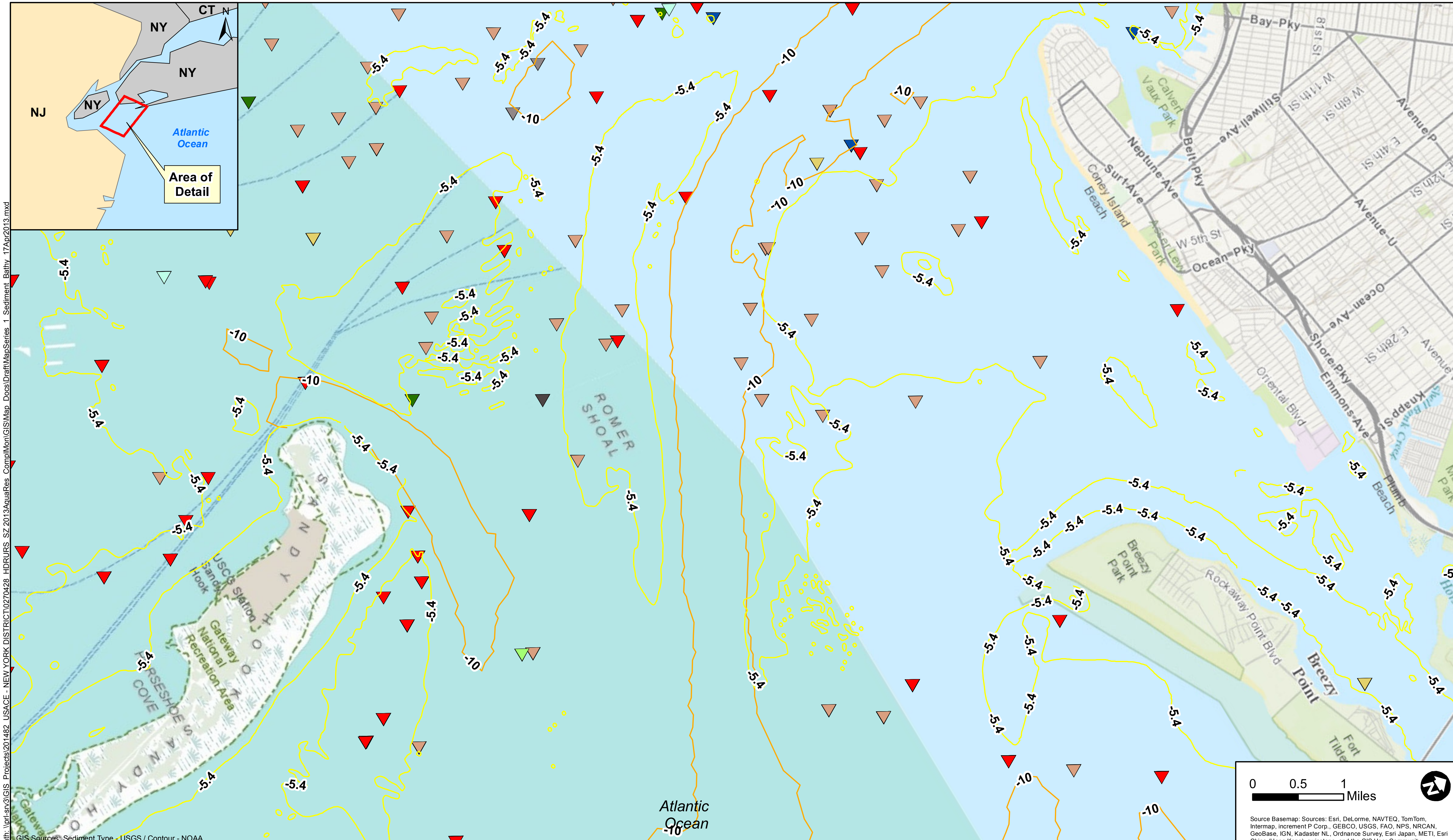

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Sediment Type
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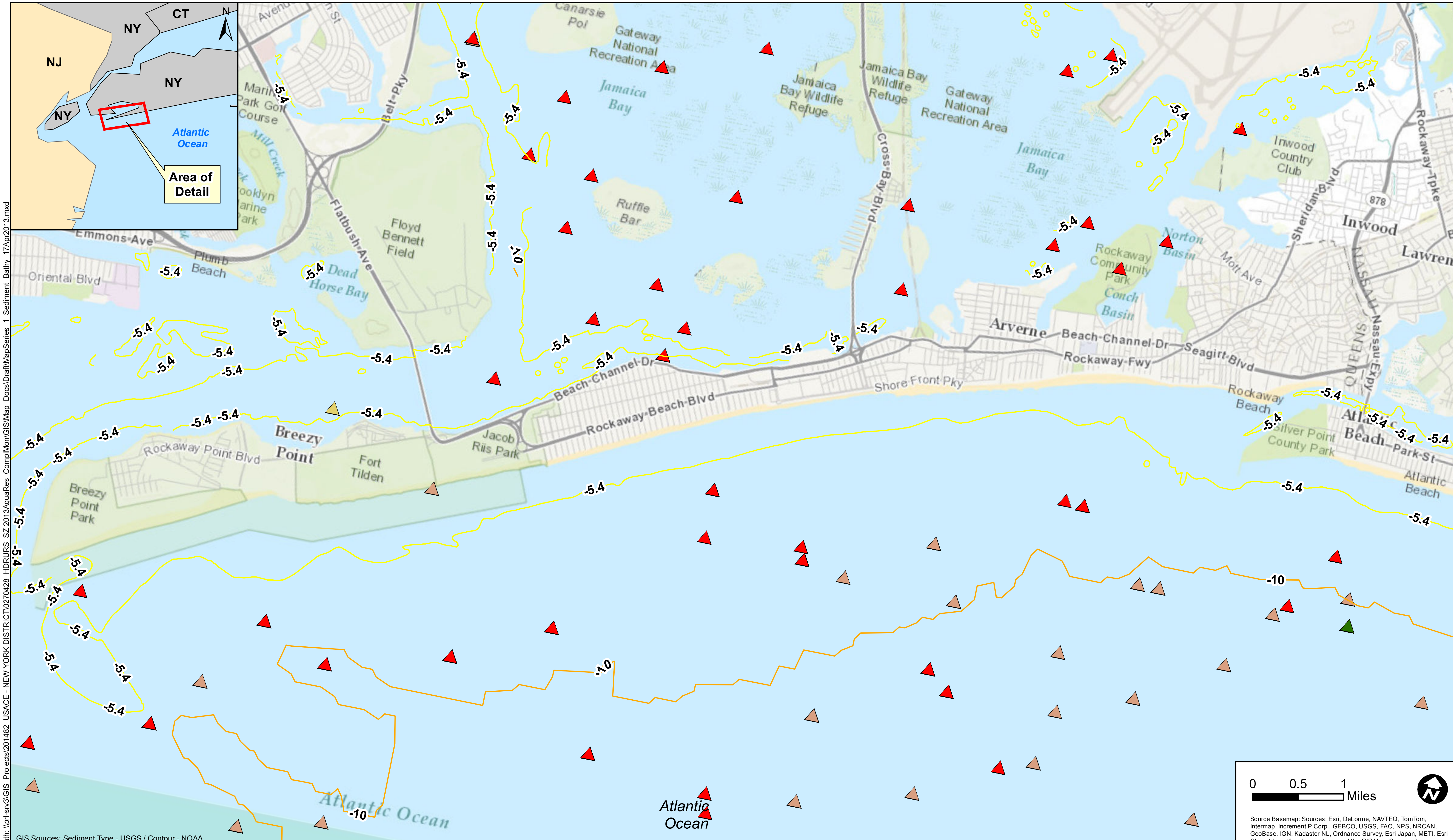

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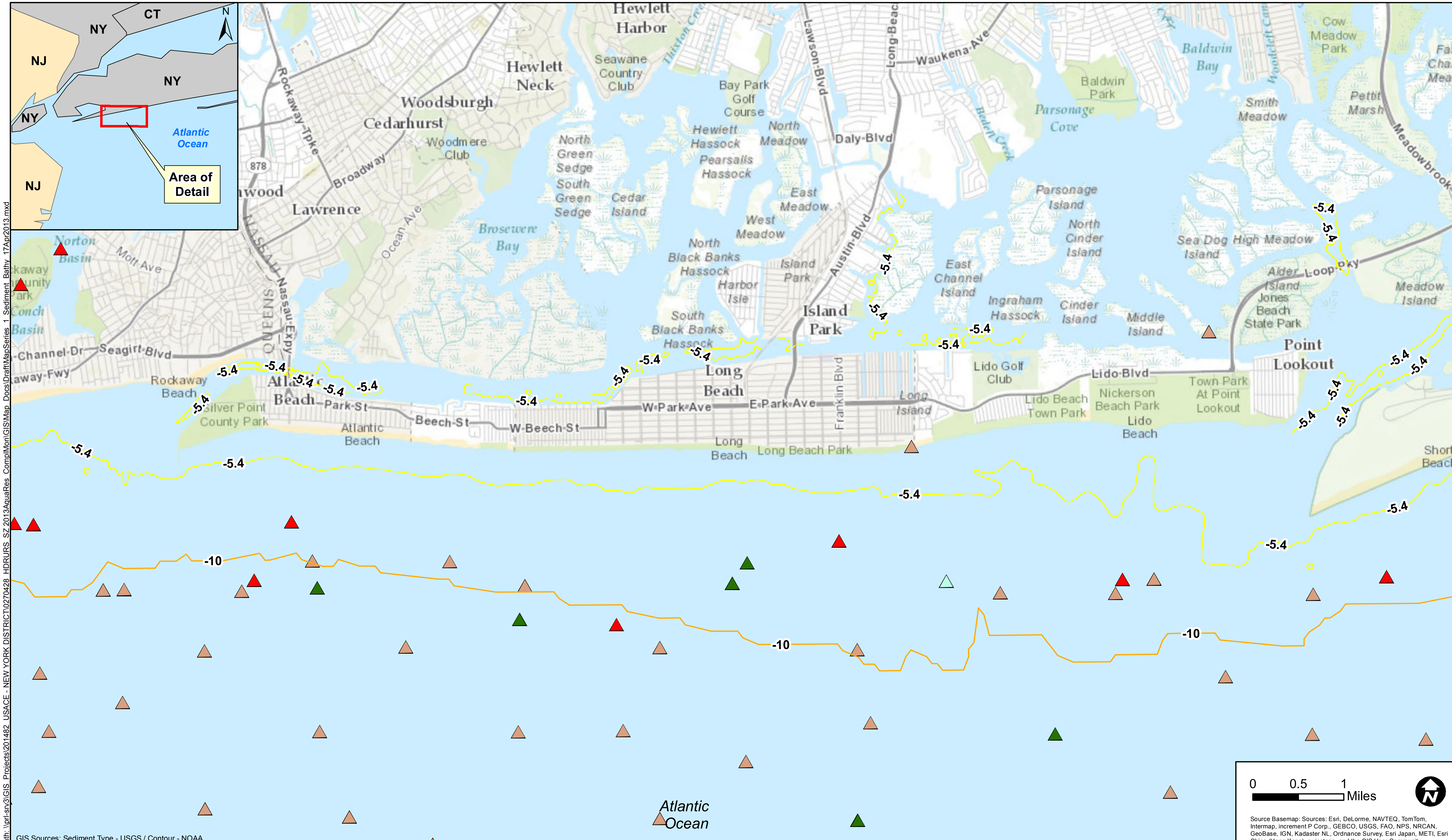

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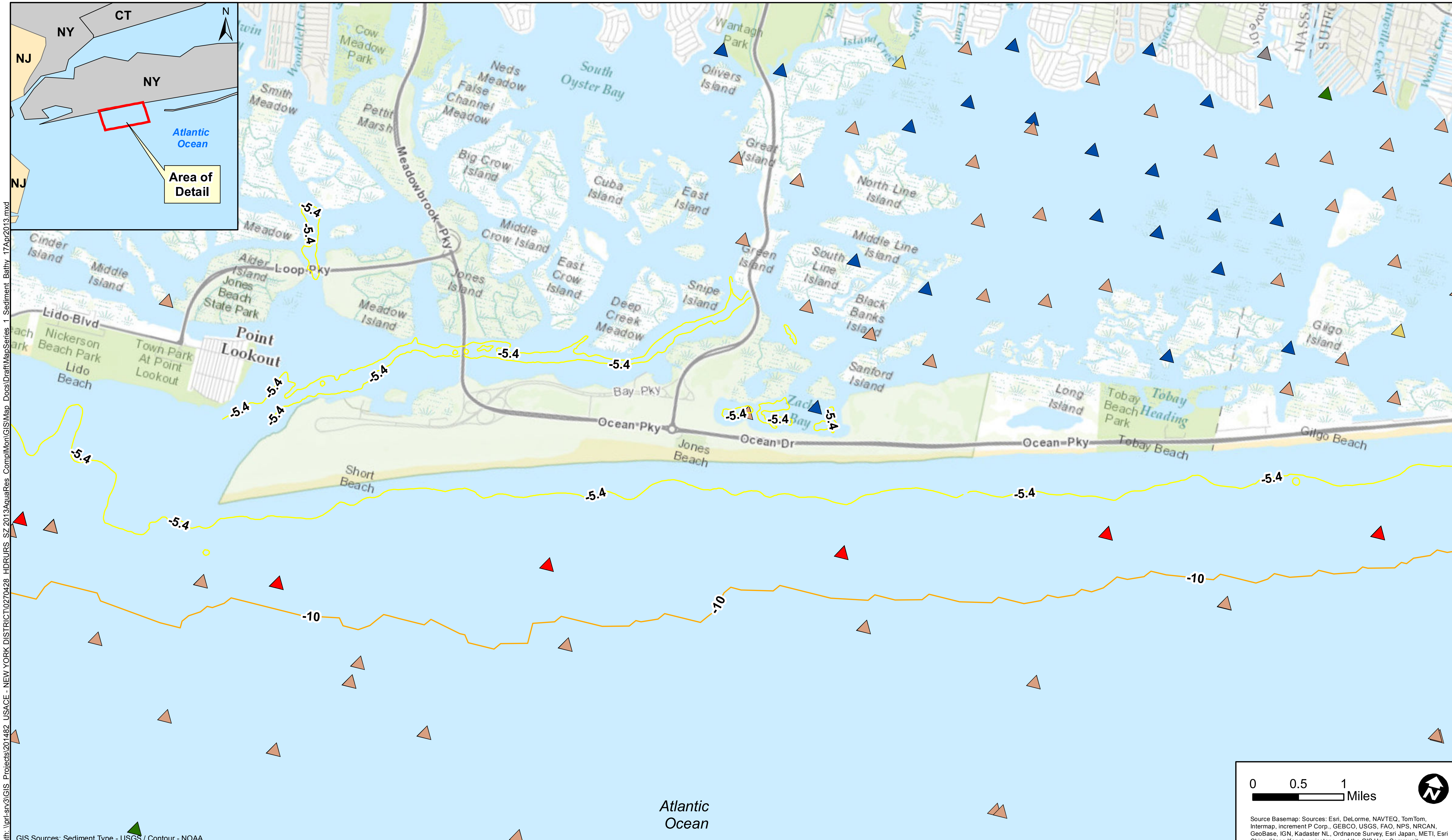

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Sediment Type
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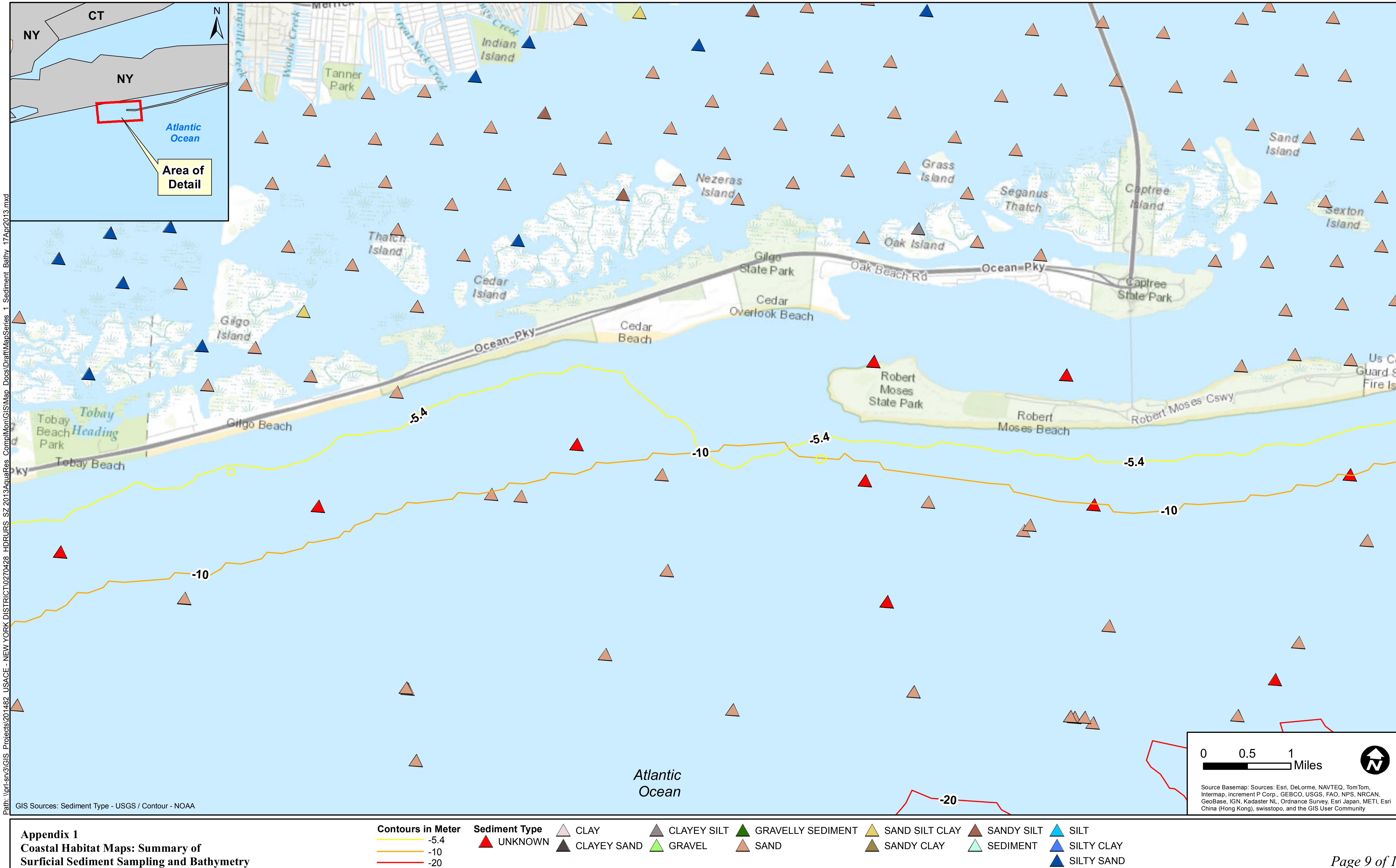

Appendix 1
Coastal Habitat Maps: Summary of Surficial Sediment Sampling and Bathymetry

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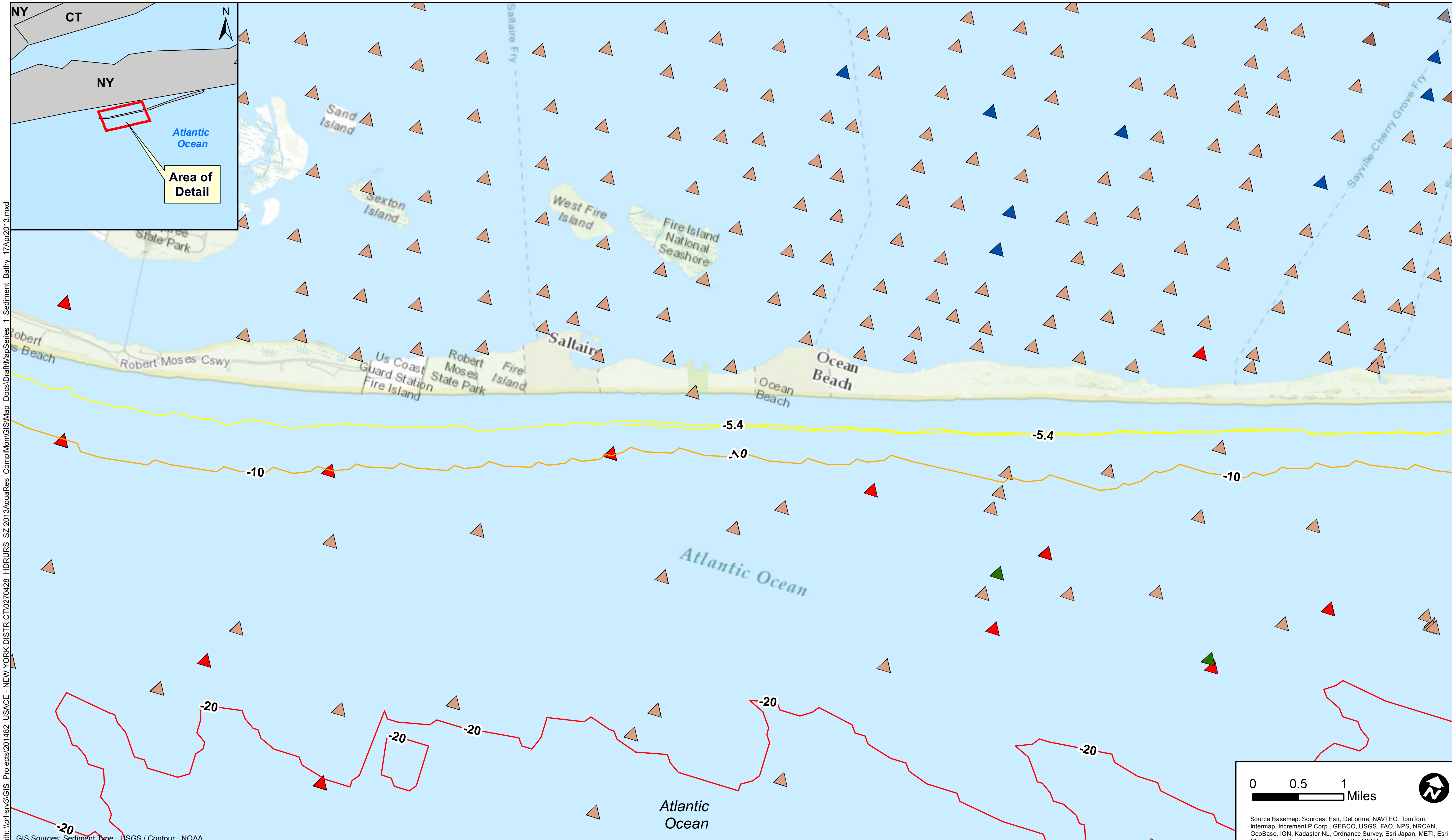

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Contours in Meter
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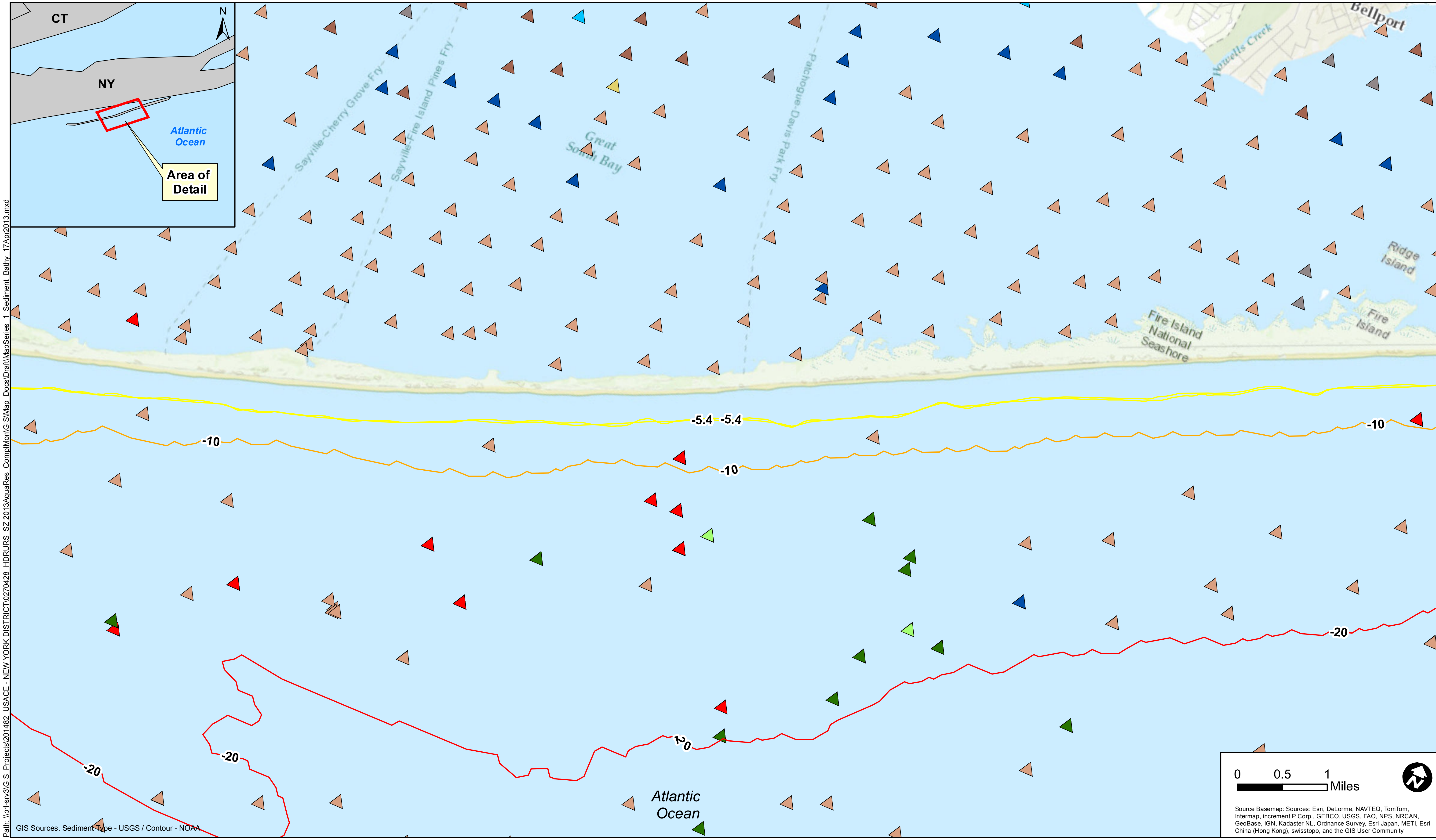

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Sediment Type
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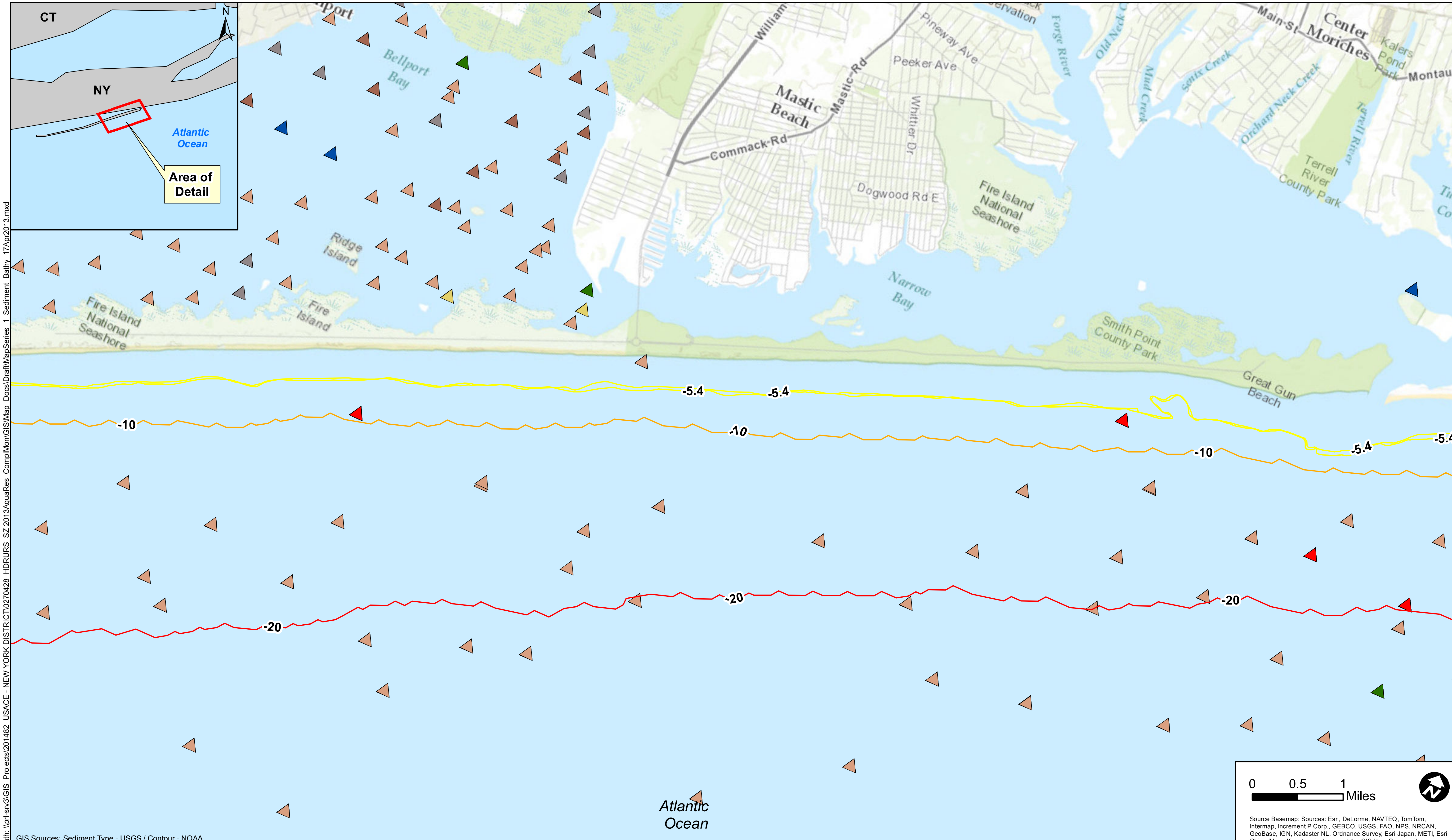

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Sediment Type
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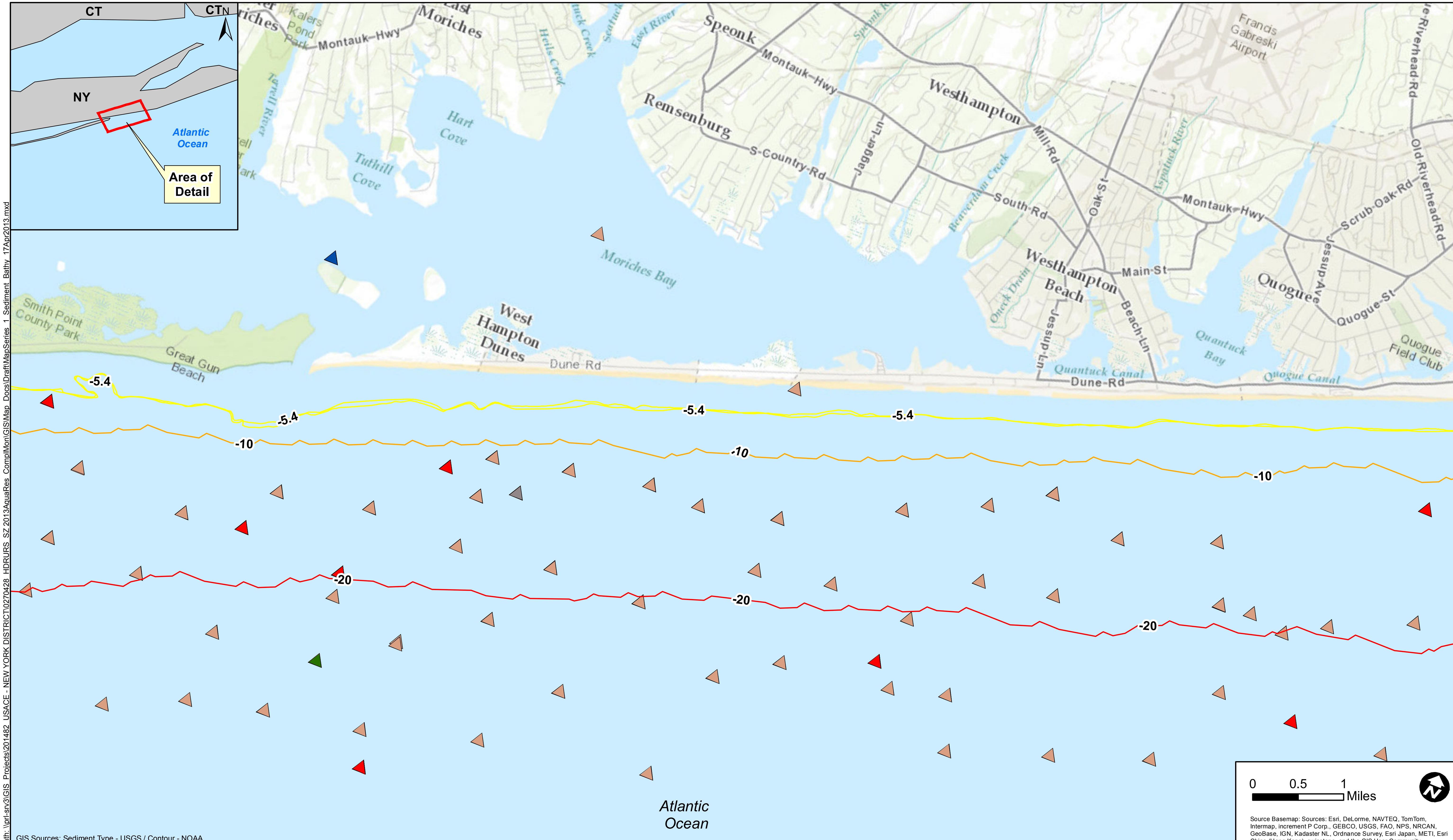

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Sediment Type
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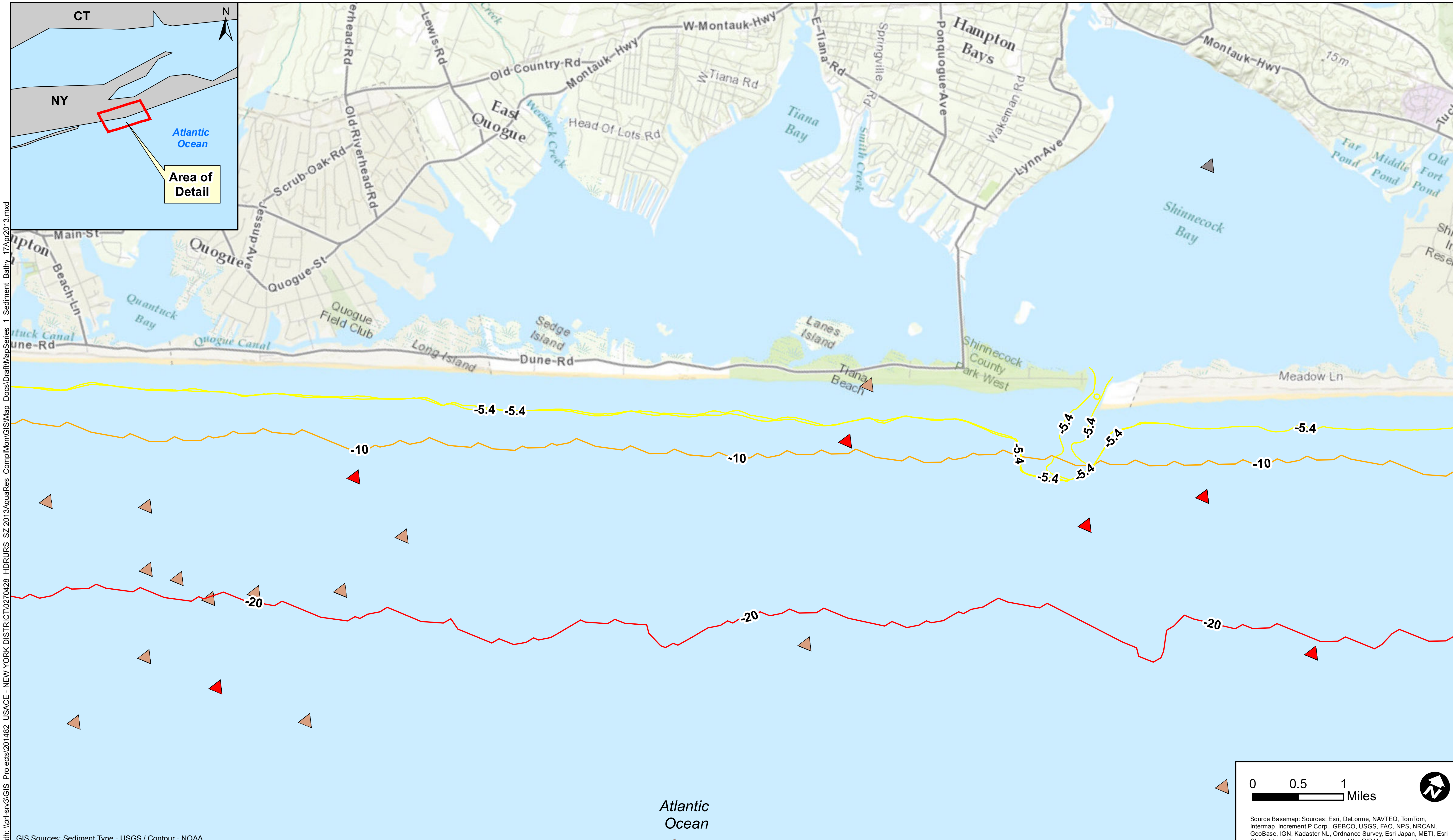

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Sediment Type
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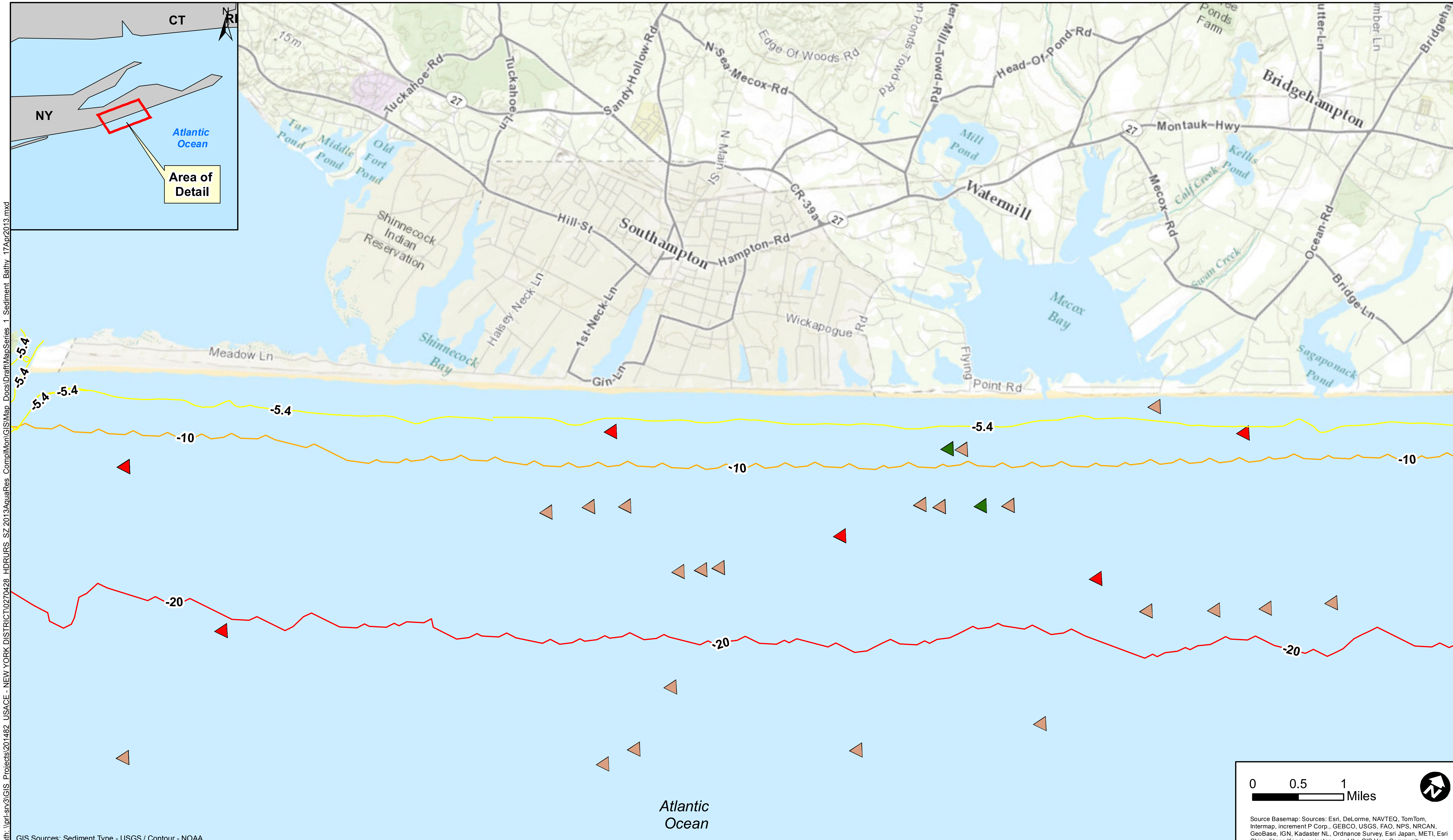

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Sediment Type
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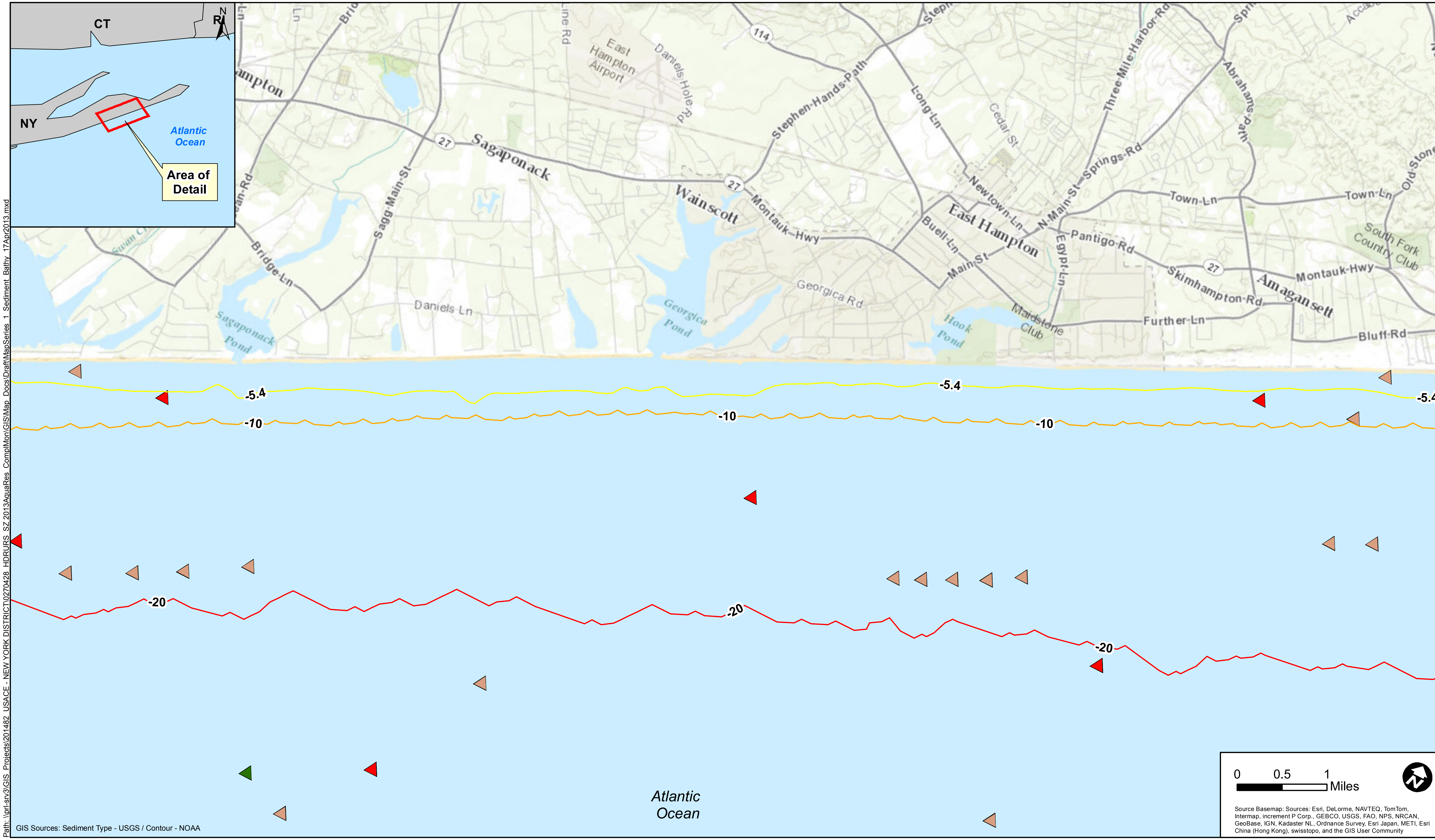

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Contours in Meter
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Sediment Type
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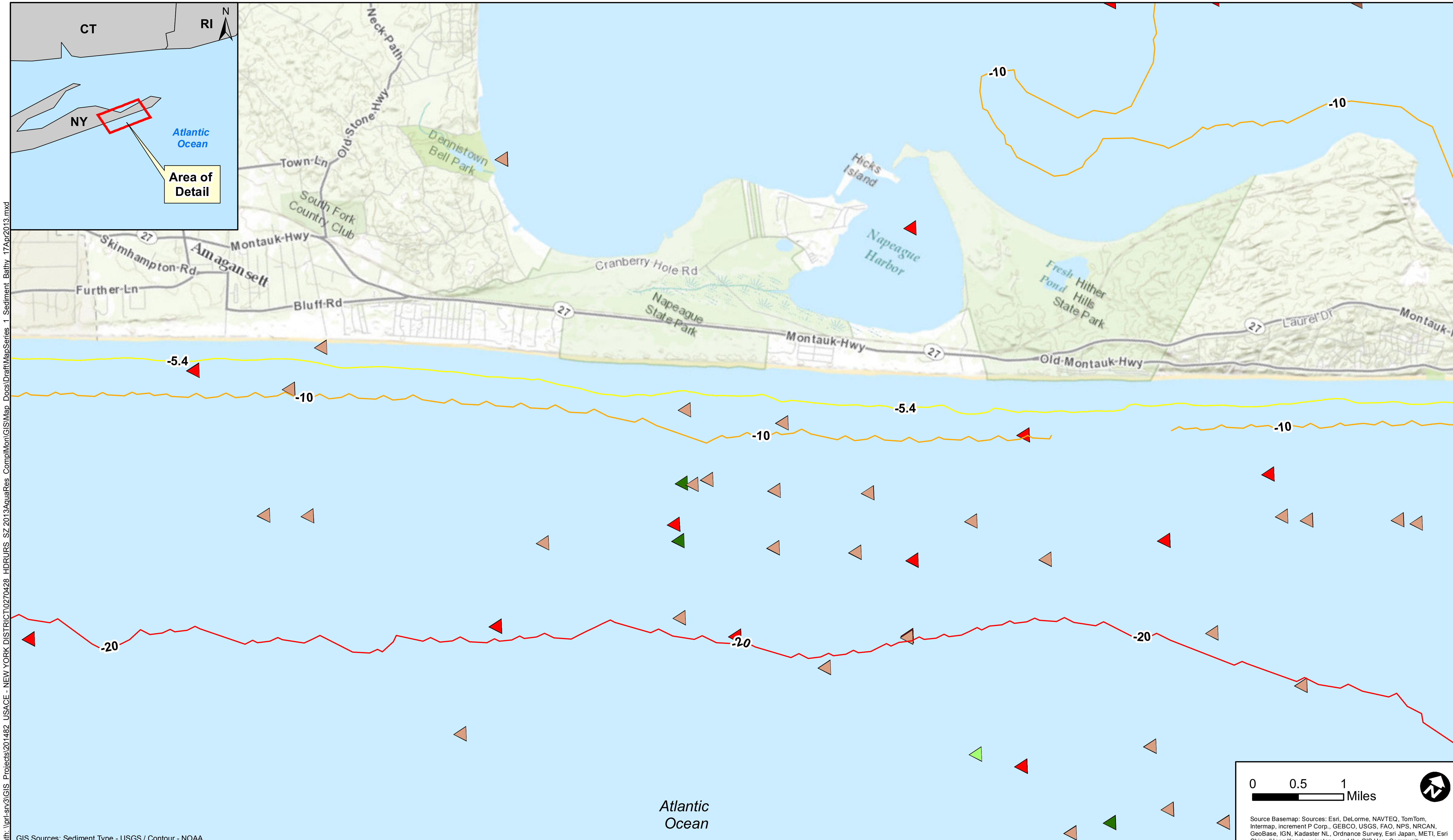

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Contours in Meter
-5.4
-10
-20

Sediment Type
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CLAY
CLAYEY SAND
CLAYEY SILT
GRAVEL
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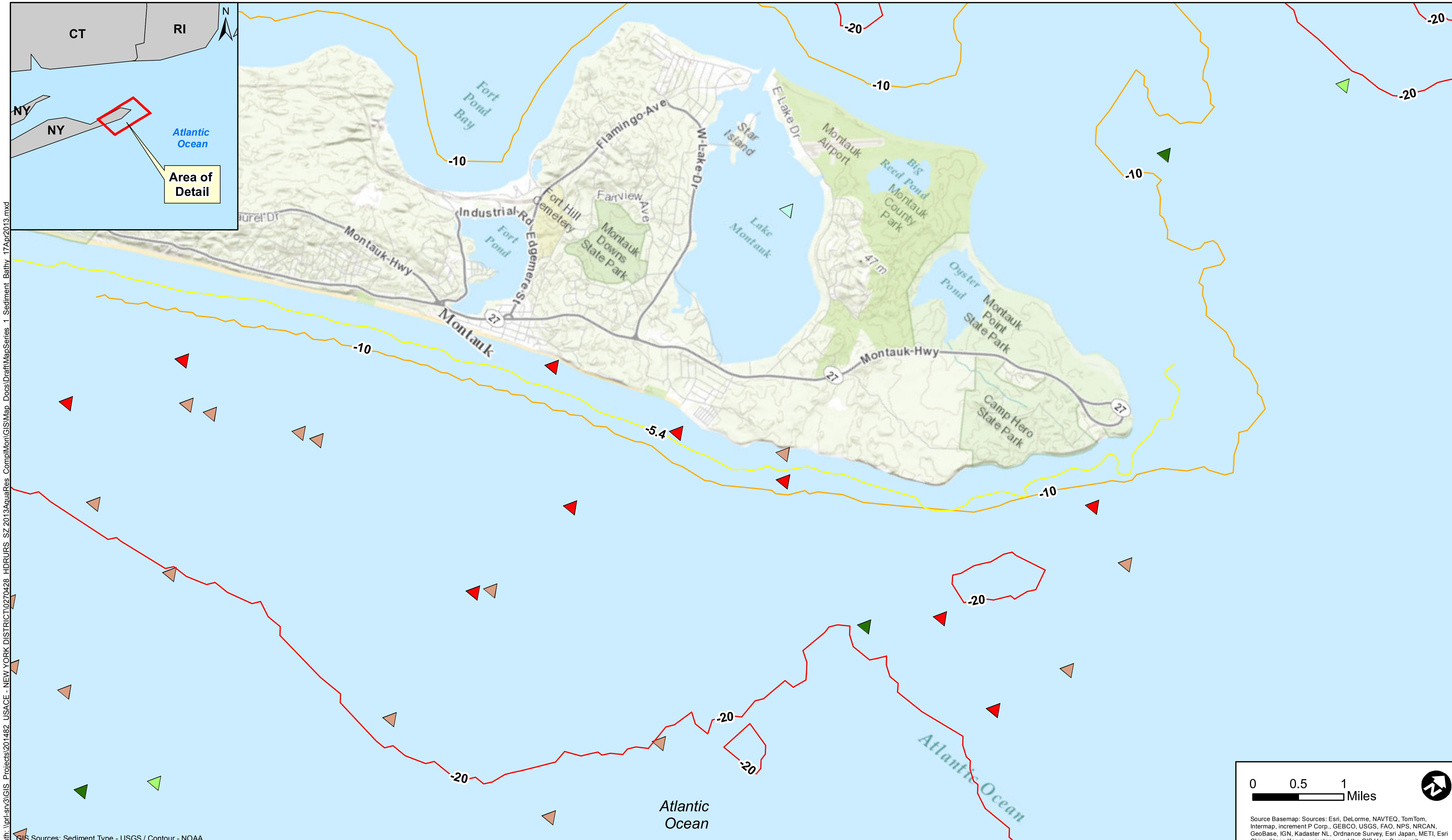

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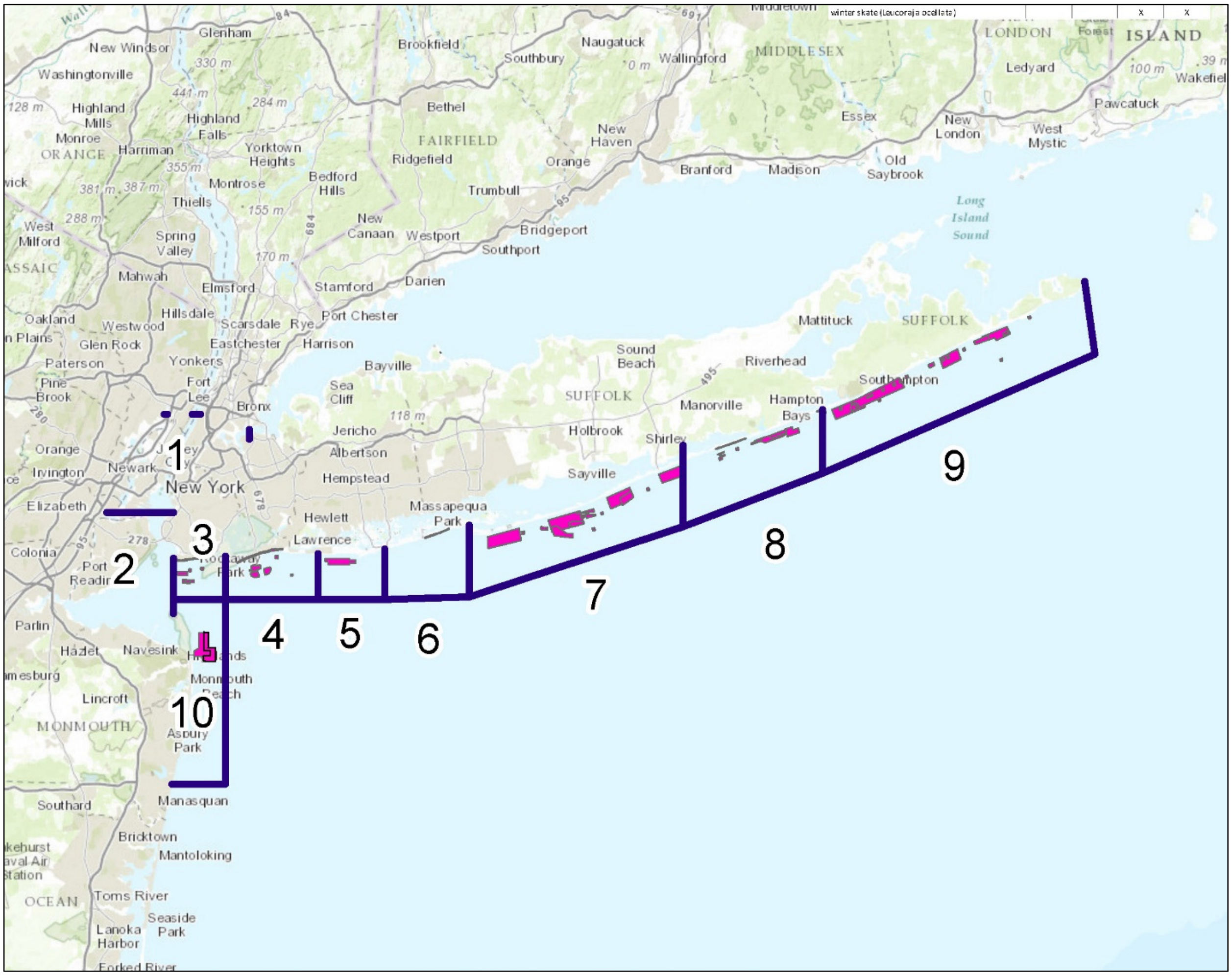
Appendix 2: Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species



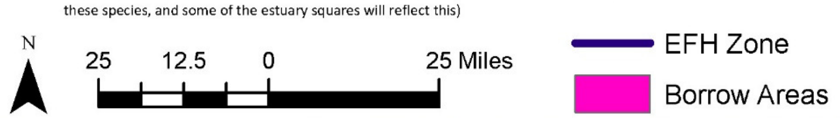
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

Essential Fish Habitat

The notation "n/a" in the tables indicates some of the species either have no data available on the designated life stages, or those life stages are not present in the species' reproductive cycle.

These species are:

- redfish, which have no eggs (larvae born already hatched);
- long finned squid, short finned squid, surf clam, and ocean quahog which are referred to as pre-recruits and recruits (this corresponds with juveniles and adults in the tables);
- spiny dogfish, which have no eggs or larvae (juveniles born live);
- scup and black sea bass, for which there is insufficient data for the life stages listed, and no EFH designation has been made as of yet (some estuary data is available for all the life stages of these species, and some of the estuary squares will reflect this)



GRID # 1				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*		X	X	X
Atlantic mackerel *(Scomber scombrus)*			X	X
Atlantic sea herring *(Clupea harengus)*		X	X	X
black sea bass *(Centropristis striata)*	n/a		X	X
bluefish *(Pomatomus saltatrix)*			X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X	X	
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a		
ocean quahog *(Artica islandica)*	n/a	n/a		
red hake *(Urophycis chuss)*	X	X	X	X
redfish *(Sebastes fasciatus)*	n/a			
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X		X
scup *(Stenotomus chrysops)*	X	X	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*		X	X	X
surf clam *(Spisula solidissima)*	n/a	n/a		
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
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GRID # 2				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*		X	X	X
Atlantic mackerel *(Scomber scombrus)*			X	X
Atlantic sea herring *(Clupea harengus)*		X	X	X
black sea bass *(Centropristis striata)*	n/a		X	X
bluefish *(Pomatomus saltatrix)*			X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X	X	
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a		
ocean quahog *(Artica islandica)*	n/a	n/a		
red hake *(Urophycis chuss)*	X	X	X	X
redfish *(Sebastes fasciatus)*	n/a			
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	X	X	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*		X	X	X
surf clam *(Spisula solidissima)*	n/a	n/a		
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
40307400
40207410
40207400
40307410

GRID # 3				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*		X	X	X
Atlantic mackerel *(Scomber scombrus)*			X	X
Atlantic sea herring *(Clupea harengus)*			X	X
black sea bass *(Centropristis striata)*	n/a		X	X
bluefish *(Pomatomus saltatrix)*			X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X		
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a		
monkfish *(Lophius americanus)*	X	X		
ocean quahog *(Artica islandica)*	n/a	n/a		
red hake *(Urophycis chuss)*	X	X	X	
redfish *(Sebastes fasciatus)*	n/a			
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	X	X	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*		X	X	X
surf clam *(Spisula solidissima)*	n/a	n/a		
whiting *(Merluccius bilinearis)*	X	X	X	
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
40307350

GRID # 4				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
Atlantic salmon *(Salmo salar)*				X
Atlantic sea herring *(Clupea harengus)*				X
black sea bass *(Centropristis striata)*	n/a		X	
blue shark *(Prionace glauca)*				X
bluefish *(Pomatomus saltatrix)*			X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X		
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a		
monkfish *(Lophius americanus)*	X	X		X
ocean quahog *(Artica islandica)*	n/a	n/a		
pollock *(Pollachius virens)*			X	
red hake *(Urophycis chuss)*	X	X	X	
redfish *(Sebastes fasciatus)*	n/a			
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	n/a	n/a	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*			X	X
surf clam *(Spisula solidissima)*	n/a	n/a		
tiger shark *(Galeocerdo cuvieri)*		X		
whiting *(Merluccius bilinearis)*	X	X	X	
windowpane flounder *(Scophthalmus aquosus)*			X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
40307340

GRID # 5				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
Atlantic salmon *(Salmo salar)*				X
Atlantic sea herring *(Clupea harengus)*			X	X
black sea bass *(Centropristis striata)*	n/a		X	X
blue shark *(Prionace glauca)*				X
bluefish *(Pomatomus saltatrix)*			X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X		
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a	X	
monkfish *(Lophius americanus)*	X	X		
ocean quahog *(Artica islandica)*	n/a	n/a		
pollock *(Pollachius virens)*			X	
red hake *(Urophycis chuss)*	X	X	X	
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	n/a	n/a	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*			X	X
surf clam *(Spisula solidissima)*	n/a	n/a		
tiger shark *(Galeocerdo cuvieri)*		X		
whiting *(Merluccius bilinearis)*	X	X	X	
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
40307330

GRID # 6				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
Atlantic salmon *(Salmo salar)*				X
Atlantic sea herring *(Clupea harengus)*			X	X
black sea bass *(Centropristis striata)*	n/a			X
blue shark (*Prionace glauca)*				X
bluefish *(Pomatomus saltatrix)*			X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X	X	
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a	X	
monkfish *(Lophius americanus)*	X	X		
ocean pout *(Macrozoarces americanus)*	X	X		X
ocean quahog *(Artica islandica)*	n/a	n/a		
pollock *(Pollachius virens)*			X	
red hake *(Urophycis chuss)*	X	X	X	
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	n/a	n/a	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
shortfin mako shark *(Isurus oxyrinchus)*			X	
skipjack tuna *(Katsuwonus pelamis)*				X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*			X	X
surf clam *(Spisula solidissima)*	n/a	n/a	X	X
tiger shark *(Galeocerdo cuvieri)*		X		
whiting *(Merluccius bilinearis)*	X	X	X	
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
40307320

GRID # 7				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
Atlantic salmon *(Salmo salar)*				X
Atlantic sea herring *(Clupea harengus)*			X	X
black sea bass *(Centropristis striata)*	n/a	X	X	X
blue shark (*Prionace glauca)*		X	X	X
bluefin tuna *(Thunnus thynnus)*			X	X
bluefish *(Pomatomus saltatrix)*			X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
common thresher shark *(Alopias vulpinus)*		X	X	X
dusky shark *(Carcharhinus obscurus)*		X	X	
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a	X	
monkfish *(Lophius americanus)*	X	X		
ocean pout *(Macrozoarces americanus)*	X	X		X
ocean quahog *(Artica islandica)*	n/a	n/a	X	X
pollock *(Pollachius virens)*			X	
red hake *(Urophycis chuss)*	X	X	X	
redfish *(Sebastes fasciatus)*	n/a			
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	n/a	n/a	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
shortfin mako shark *(Isurus oxyrinchus)*		X	X	X
skipjack tuna *(Katsuwonus pelamis)*				X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*	X	X	X	X
surf clam *(Spisula solidissima)*	n/a	n/a	X	X
tiger shark *(Galeocerdo cuvieri)*		X	X	
white shark *(Carcharodon carcharias)*			X	
whiting *(Merluccius bilinearis)*	X	X	X	
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X
yellowtail flounder *(Limanda ferruginea)*	X			X

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
40407240
40407250
40307300
40307250
40307310

GRID # 8				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
American plaice *(Hippoglossoides platessoides)*				
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic cod *(Gadus morhua)*				
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
Atlantic salmon *(Salmo salar)*				X
Atlantic sea herring *(Clupea harengus)*		X	X	
Atlantic sea scallop *(Placopecten magellanicus)*				
black sea bass *(Centropristis striata)*	n/a			X
blue shark (*Prionace glauca)*		X		X
bluefin tuna *(Thunnus thynnus)*			X	X
bluefish *(Pomatomus saltatrix)*			X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X	X	
haddock *(Melanogrammus aeglefinus)*		X		
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a		
monkfish *(Lophius americanus)*	X	X		
ocean pout *(Macrozoarces americanus)*	X	X		X
ocean quahog *(Artica islandica)*	n/a	n/a		
pollock *(Pollachius virens)*				
red hake *(Urophycis chuss)*	X	X	X	
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	n/a	n/a	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
shortfin mako shark *(Isurus oxyrinchus)*		X	X	
skipjack tuna *(Katsuwonus pelamis)*				X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*	X	X	X	X
surf clam *(Spisula solidissima)*	n/a	n/a		
tiger shark *(Galeocerdo cuvieri)*		X	X	
tilefish *(Lopholatilus chamaeleonticeps)*				
white shark *(Carcharodon carcharias)*			X	
whiting *(Merluccius bilinearis)*	X	X	X	
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X

GRID # 8				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
winter skate (Leucoraja ocellata)			X	X
witch flounder *(Glyptocephalus cynoglossus)*	X			
yellowtail flounder *(Limanda ferruginea)*	X	X		

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
40407220
40407230
40407240

GRID # 9				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*	X	X	X	X
Atlantic salmon *(Salmo salar)*			X	X
Atlantic sea herring *(Clupea harengus)*		X	X	X
basking shark *(Cetorhinus maximus)*			X	
black sea bass *(Centropristis striata)*	n/a		X	X
blue shark (*Prionace glauca)*		X	X	X
bluefin tuna *(Thunnus thynnus)*			X	X
bluefish *(Pomatomus saltatrix)*	X	X	X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
common thresher shark *(Alopias vulpinus)*		X	X	X
dusky shark *(Carcharhinus obscurus)*		X	X	
haddock *(Melanogrammus aeglefinus)*		X		
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a	X	X
monkfish *(Lophius americanus)*	X	X		
ocean pout *(Macrozoarces americanus)*	X	X		X
ocean quahog *(Artica islandica)*	n/a	n/a	X	X
pollock *(Pollachius virens)*			X	
red hake *(Urophycis chuss)*	X	X	X	
redfish *(Sebastes fasciatus)*	n/a			
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	X	X	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a	X	
shortfin mako shark *(Isurus oxyrinchus)*		X	X	X
skipjack tuna *(Katsuwonus pelamis)*				X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a	X	X
summer flounder *(Paralichthys dentatus)*	X	X	X	X
surf clam *(Spisula solidissima)*	n/a	n/a	X	X
tiger shark *(Galeocerdo cuvieri)*		X	X	
white shark *(Carcharodon carcharias)*			X	
whiting *(Merluccius bilinearis)*	X	X	X	X
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X

GRID # 9				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
witch flounder *(Glyptocephalus cynoglossus)*	X	X		
yellowfin tuna *(Thunnus albacares)*			X	X
yellowtail flounder *(Limanda ferruginea)*	X	X	X	X

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
41007150
40507150
40507200
40507210
40507220

GRID # 10				
Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Atlantic butterfish *(Peprilus triacanthus)*			X	
Atlantic cod *(Gadus morhua)*				X
Atlantic sea herring *(Clupea harengus)*			X	X
black sea bass *(Centropristis striata)*	n/a	X	X	X
blue shark (*Prionace glauca)*		X		
bluefin tuna *(Thunnus thynnus)*			X	
bluefish *(Pomatomus saltatrix)*	X	X	X	X
clearnose skate (Raja eglanteria)			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X	X	
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
little skate (Raja erinacea)			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a		
monkfish *(Lophius americanus)*	X	X		
ocean quahog *(Artica islandica)*	n/a	n/a		X
red hake *(Urophycis chuss)*	X	X	X	X
sand tiger shark *(Carcharias taurus)*		X		
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
scup *(Stenotomus chrysops)*	n/a	n/a	X	X
short finned squid *(Illex illecebrosus)*	n/a	n/a		
shortfin mako shark *(Isurus oxyrinchus)*		X	X	
skipjack tuna *(Katsuwonus pelamis)*				X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
summer flounder *(Paralichthys dentatus)*	X	X	X	X
surf clam *(Spisula solidissima)*	n/a	n/a	X	X
tiger shark *(Galeocerdo cuvieri)*		X	X	
whiting *(Merluccius bilinearis)*	X	X	X	X
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
winter skate (Leucoraja ocellata)			X	X
witch flounder *(Glyptocephalus cynoglossus)*	X	X		
yellowtail flounder *(Limanda ferruginea)*	X	X		

This Table was developed using the following 10 x 10 minute lat/long cells consistent with NOAA EFH maps (http://www.nero.noaa.gov/hcd/STATES4/ConnNYNJ.htm).
40207350
40107350
40007350
40007400

Appendix 3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Atlantic cod	Eggs	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Casco Bay, Saco Bay, Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<12	32 - 33 (10 - 35)	<110	Begins in fall, peaks in winter and spring	Surface Waters	
	Larvae	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Penobscot Bay; Sheepscot R., Casco Bay, Saco Bay, Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<10	32 - 33	30-70	Spring	Pelagic waters	
	Juveniles	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<20	30 - 35	25 - 75		Bottom habitats with a substrate of cobble or gravel	HAPC - An area approximate of 300sq. nautical miles along the northern edge of GB and the Hague line containing gravel cobble substrate.
	Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<10	(29 - 34)	10-150		Bottom habitats with a substrate of rocks, pebbles, or gravel	(Major prey: fish crustaceans, decapods, amphipods)
	Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and following estuaries: Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Mass Bay, Boston Harbor, Cape Cod Bay, MA	<10	(10 - 35)	10-150	spawn during fall, winter, and early spring	Bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel	
Atlantic herring	Eggs	GOME, GB and following estuaries: Englishman/ Machias Bay, Casco Bay,& Cape Cod Bay	<15	32 - 33	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble, shell fragments & aquatic macrophytes. .	Eggs adhere to bottom forming extensive beds. Eggs most often found in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots (Egg beds can range from 4500 to 10,000 Km2 on GB. Eggs susceptible to suffocation from high densities and siltation)
	Larvae	GOME, GB, Southern NE and following estuaries: Passamaquoddy Bay to Cape Cod Bay, Narragansett Bay, & Hudson R./ Raritan Bay	<16	32	50 - 90	Between August and April, peaks from Sept. - Nov.	Pelagic waters	
	Juveniles	GOME, GB, Southern NE and Middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay to Delaware Bay	<10	26 - 32	15-135		Pelagic waters and bottom habitats	
	Adults	GOME, GB, southern NE and middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay to Delaware Bay; & Chesapeake Bay	<10	>28	20-130		Pelagic waters and bottom habitats	(major prey: zooplankton)
	Spawning Adults	GOME, GB, southern NE and middle Atlantic south to Delaware Bay and Englishman/ Machias Bay Estuary	<15	32 - 33	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, also on aquatic macrophytes	Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots
Atlantic salmon	Eggs	Rivers from CT to Maine: Connecticut, Pawcatuck, Merrimack, Cocheco, Saco, Androscoggin, Presumpscot, Kennebec,	<10	Fresh water	30-31 cm	Between October and April	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	need clean well-oxygenated freshwater
	Larvae	Sheepscot, Ducktrap, Union, Penobscot, Narraguagus, Machias, East Machias, Pleasant, St. Croix, Denny's, Passagassawaukeag Aroostook, Lamprey, Boyden, Orland Rivers,	<10	Fresh water		Between March and June for alevins/fry	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	
	Juveniles	and the Turk, Hobart & Patten Streams; and the following estuaries for juveniles and adults: Passamaquoddy Bay to Muscongus Bay; Casco Bay to Wells Harbor; Mass Bay, Long Island Sound, Gardiners Bay to Great South Bay.	<25	Fresh water to Oceanic	10- 61 cm		Bottom habitats of shallow gravel/cobble riffles interspersed with deeper riffles and pools in rivers and estuaries Water velocities between 30 - 92cm/sec	As they grow, parr transform into smolts. Atlantic salmon smolts require access downstream to the ocean. Upon entering the ocean, post-smolts become pelagic and range from Long Island Sound north to the Labrador Sea.

Species	Life Stage	Geographic Area	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Adults	All aquatic habitats in the watersheds of the above listed rivers, including all tributaries to the extent that they are currently or were historically accessible for salmon migration.	<22.8	Fresh water to Oceanic			Oceanic adult Atlantic salmon are primarily pelagic and range from waters of the continental shelf off southern NE north throughout the GOME Dissolved oxygen above 5ppm for migratory pathway.	HAPC - Eleven rivers in Maine includes: St. Croix, Denny's, East Machias, Machias, Pleasant, Turk stream, Narraguagus, Penobscot, Ducktrap, Sheepscot, and Kennebec River.
	Spawning Adults		<10	Fresh water	30- 61 cm	October and November	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	Water velocity around 61cm per second
Atlantic sea scallop	Eggs	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay	<17			May through October Peaks in May and June in middle Atlantic area, and in Sept. and Oct. on GB and GOME	Bottom habitats	Eggs remain on sea floor until they develop into the first free-swimming larval stage.
	Larvae	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay	<18	16.9 - 30			Pelagic waters and bottom habitats with a substrate of gravelly sand, shell fragments, pebbles, or on various red algae, hydroids, amphipod tubes and bryozoans	
	Juveniles	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Great Bay, Mass Bay, and Cape Cod Bay	<15		18-110		Bottom habitats with a substrate of cobble, shells, and silt	(prey: filter feeders on phytoplankton; preferred substrates are associated with low concentrations of inorganics for optimal feeding)
	Adults	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Great Bay, Mass Bay, and Cape Cod Bay	<21	>16.5	18-110		Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand	
	Spawning Adults	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay	<16	>16.5	18-110	May through October, peaks in May and June in middle Atlantic area, and in Sept. and Oct. on GB and in GOME	Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand	
Haddock	Eggs	GB southwest to Nantucket Shoals and coastal areas of GOME and the following estuaries: Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<10	34 - 36	50 - 90	March to May, peak in April	Surface waters	
	Larvae	GB southwest to the middle Atlantic south to Delaware Bay and the following estuaries: Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay, and Narragansett Bay	<14	34 - 36	30 - 90	January to July, peak in April and May	Surface waters	
	Juveniles	GB, GOME, middle Atlantic south to Delaware Bay	<11	31.5 - 34	35-100		Bottom habitats with a substrate of pebble gravel	
	Adults	GB and eastern side of Nantucket Shoals, throughout GOME, *additional area of Nantucket Shoals, and Great South Channel	<7	31.5 - 35	40-150		Bottom habitats with a substrate of broken ground, pebbles, smooth hard sand, and smooth areas between rocky patches	*additional area more accurately reflects historic patterns of distribution and abundance
	Spawning Adults	GB, Nantucket Shoals, Great South Channel, throughout GOME	<6	31.5 - 34	40-150	January to June	Bottom habitats with a substrate of pebble gravel or gravelly sand	
Monkfish (Goosefish)	Eggs	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras, North Carolina	<18		15- 1000	March to September	Surface waters	(eggs contained in long mucus veils that float near or at the surface)
	Larvae	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras, North Carolina	15		25-1000	March to September	Pelagic waters	
	Juveniles	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, all areas of GOME	<13	29.9-36.7	25-200		Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	
	Adults	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, outer perimeter of GB, all areas of GOME	<15	29.9-36.7	25-200		Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	(Major prey: fish, shrimp, squid, crustaceans, mollusks)

Species	Life Stage	Geographic Area	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, outer perimeter of GB, all areas of GOME	<13	29.9-36.7	25-200	February to August	Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	
Ocean pout	Eggs	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay and Cape Cod Bay	<10	32-34	<50	Late fall and winter	Bottom habitats, generally hard bottom sheltered nests, holes, or crevices where they are guarded by parents	(eggs are laid in gelatinous masses and take 2-3 months to develop
	Larvae	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay and Cape Cod Bay	<10	>25	<50	Late fall to spring	Bottom habitats in close proximity to hard bottom nesting areas	
	Juveniles	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor and Cape Cod Bay	<14	>25	<80		Bottom habitats, often smooth bottom near rocks or algae	
	Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor and Cape Cod Bay	<15	32 - 34	<110		Bottom habitats. (Dig depressions in soft sediments which are then used by other species)	(major prey: mollusks, crustaceans, echinoderms, sand dollars)
	Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, and Cape Cod Bay	<10	32 - 34	<50	Late summer to early winter, peaks in Sept. and October	Bottom habitats with a hard bottom substrate, including artificial reefs and shipwrecks	(internal fertilization)
Pollock	Eggs	GOME, GB and the following estuaries: Great Bay to Boston Harbor	<17	32 - 32.8	30-270	October to June, peaks in November to February	Pelagic waters	
	Larvae	GOME, GB and the following estuaries: Passamaquoddy Bay, Sheepscot R., Great Bay to Cape Cod Bay	<17		10-250	September to July, peaks from Dec. to February	Pelagic waters	(migrate inshore as they grow)
	Juveniles	GOME, GB and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Waquoit Bay; Long Island Sound, Great South Bay	<18	29 - 32	0 - 250		Bottom habitats with aquatic vegetation or a substrate of sand, mud or rocks	(Intertidal zone may be important nursery area. Juveniles present in shallow intertidal zone at all tide stages throughout summer. Subtidal marsh creeks such as Little Egg Harbor, NJ are also seasonally important as nursery)
	Adults	GOME, GB, southern NE, and middle Atlantic south to New Jersey and the following estuaries: Passamaquoddy Bay, Damariscotta R., Mass Bay, Cape Cod Bay, Long Island Sound	<14	31 - 34	15-365		Hard bottom habitats including artificial reefs	(major prey: crustaceans, fish, mollusks)
	Spawning Adults	GOME, southern NE, and middle Atlantic south to New Jersey includes Mass Bay	<8	32 - 32.8	15-365	September to April, peaks December to February	Bottom habitats with a substrate of hard, stony, or rocky bottom includes artificial reefs	
Red hake	Eggs	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras	<10	< 25		May to November, peaks in June and July	Surface waters of inner continental shelf	
	Larvae	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and following estuaries: Sheepscot R., Mass Bay to Cape Cod Bay; Buzzards Bay, Narragansett Bay & Hudson R./ Raritan Bay	<19	>0.5	<200	May to December, peaks in Sept. and October	Surface waters	(newly settled larvae need shelter, including live sea scallps, also use floating or mid-water objects for shelter)
	Juveniles	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./ Raritan Bay, & Chesapeake Bay	<16	31 - 33	<100		Bottom habitats with substrate of shell fragments, including areas with an abundance of live scallops	
	Adults	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./ Raritan, Delaware Bay, & Chesapeake Bay	<12	33 - 34	10-130		Bottom habitats in depressions with a substrate of sand and mud	(major prey: fish and crustaceans)
	Spawning Adults	GOME, southern edge of GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and following estuaries: Sheepscott R., Mass Bay, Cape Cod Bay, Buzzards Bay, & Narragansett Bay	<10	>25	<100	May to November, peaks in June and July	Bottom habitats in depressions with a substrate of sand and mud	
Redfish	Eggs	No EFH identification or description for this life history stage						Redfish are ovoviviparous (live bearers)
	Larvae	GOME, southern GB	<15		50-270	March to October, peak in August	Pelagic waters	
	Juveniles	GOME, southern edge of GB	<13	31 - 34	25-400		Bottom habitats with a substrate of silt, mud, or hard bottom	
	Adults	GOME, southern edge of GB	<13	31 - 34	50-350		Bottom habitats with a substrate of silt, mud, or hard bottom	
	Spawning Adults	GOME, southern edge of GB	<13	31 - 34	5 -350	April to August	Bottom habitats with a substrate of silt, mud, or hard bottom	copulation occurs between Oct-Jan. Fertilization is delayed until Feb-Apr
Whiting (Silver hake)	Eggs	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Merrimack R. to Cape Cod Bay	<20		50-150	All year, peaks June to October	Surface waters	
	Larvae	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Mass Bay to Cape Cod Bay	<20		50-130	All year, peaks July to September	Surface waters	

Species	Life Stage	Geographic Area	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juveniles	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass Bay to Cape Cod Bay	<21	>20	20-270		Bottom habitats of all substrate types	
	Adults	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass Bay to Cape Cod Bay	<22		30-325		Bottom habitats of all substrate types	
	Spawning Adults	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Mass Bay and Cape Cod Bay	<13		30-325		Bottom habitats of all substrate types	
Windowpane flounder	Eggs	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<20		<70	February to November, peaks May and October in middle Atlantic July - August on GB	Surface waters	
	Larvae	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<20		<70	February to November, peaks May and October in middle Atlantic July - August on GB	Pelagic waters	
	Juveniles	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Chesapeake Bay	<25	5.5 - 36	1 - 100		Bottom habitats with substrate of mud or fine grained sand	
	Adults	GOME, GB, southern NE, middle Atlantic south to Virginia - NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Chesapeake Bay	<26.8	5.5 - 36	1 - 75		Bottom habitats with substrate of mud or fine grained sand	(major prey: polychaetes, small crustaceans, mysids, small fish)
	Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Virginia -NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<21	5.5 - 36	1 - 75	February - December, peak in May in middle Atlantic	Bottom habitats with substrate of mud or fine grained sand	
Winter flounder	Eggs	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<10	10 - 30	<5	February to June, peak in April on GB	Bottom habitats with a substrate of sand, muddy sand, mud, and gravel	* On GB, eggs are generally found in water temp < 8EC, and < 90m deep.
	Larvae	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<15	4 - 30	<6	March to July, peaks in April and May on GB	Pelagic and bottom waters	* On GB, larvae are generally found in water temp < 8EC, and < 90m deep.
	Juveniles (age 1+)	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	<25	10 - 30	1 - 50		Bottom habitats with a substrate of mud or fine grained sand	* Young-of-year exist where water temp <28, depths 0.1 - 10m, salinities 5 - 33 (major prey: amphipods, copepods, polychaetes, bivalve siphons)
	Adults	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	<25	15 - 33	1 - 100		Bottom habitats including estuaries with substrate of mud, sand, gravel	(major prey: amphipods, polychaetes, bivalve siphons, crustaceans)
	Spawning Adults	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<15	5.5 - 36	<6*	February to June	Bottom habitats including estuaries with substrate of mud, sand, gravel	*except on GB where they spawn as deep as 80m
Witch flounder	Eggs	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras	<13	High	Deep	March to October	Surface waters	
	Larvae	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras	<13	High	Deep	March to November, peaks in May - July	Surface waters to 250m	
	Juveniles	GOME, outer continental shelf from GB south to Cape Hatteras	<13	34 - 36	50-450 to 1500m		Bottom habitats with fine-grained substrate	(the upper slope is nursery area; major prey: crustaceans, polychaetes, mollusks)
	Adults	GOME, outer continental shelf from GB south to Chesapeake Bay	<13	32 - 36	25-300		Bottom habitats with fine-grained substrate	(major prey: polychaetes, echinoderms, crustaceans, mollusks, squid)
	Spawning Adults	GOME, outer continental shelf from GB south to Chesapeake Bay	<15	32 - 36	25-360	March to November, peaks in May-August	Bottom habitats with fine-grained substrate	
Yellowtail flounder	Eggs	GB, Mass Bay, Cape Cod Bay, southern NE continental shelf south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Cape Cod Bay	<15	32.4 33.5	30 - 90	Mid-March to July, peaks in April to June in southern NE	Surface waters	
	Larvae	GB, Mass Bay, Cape Cod Bay, southern NE continental shelf, middle Atlantic south to Chesapeake Bay and the following estuaries: Passamaquoddy Bay to Cape Cod Bay	<17	32.4 33.5	10 - 90	March to April in New York bight; May to July in south NE and southeastern GB	Surface waters	(largely an oceanic nursery)
	Juveniles	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass Bay to Cape Cod Bay	<15	32.4 33.5	20 - 50		Bottom habitats with substrate of sand or sand and mud	
	Adults	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass Bay to Cape Cod Bay	<15	32.4 -33.5	20 - 50		Bottom habitats with substrate of sand or sand and mud	(major prey: annelids, arthropods, mollusks)
	Spawning Adults	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Mass Bay to Cape Cod Bay	<17	32.4 33.5	10-125		Bottom habitats with substrate of sand or sand and mud	
Atlantic mackerel	Eggs	Continental Shelf from Maine through Cape Hatteras, NC also includes estuaries from Great Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay and Great South Bay	5-23	(18 - >30)	0 - 15		Pelagic waters	(peak spawning in salinities >30ppt)
	Larvae	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Great Bay to Cape Cod Bay; Narragansett Bay to Long Island Sound; Gardiners Bay and Great South Bay	6-22	(>30)	10-130		Pelagic waters	

Species	Life Stage	Geographic Area	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juveniles	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Passamaquoddy Bay; Penobscot Bay to Saco Bay; Great Bay; Mass Bay to Cape Cod Bay; Narragansett Bay, Long Island Bay; Gardiners Bay to Hudson R./ Raritan Bay	4 - 22	(>25)	0 - 320		Pelagic waters	
	Adults	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Passamaquoddy Bay to Saco Bay; Mass Bay to Long Island Bay; Gardiners Bay to Hudson R./ Raritan Bay	4 - 16	(>25)	0 - 380		Pelagic waters	(opportunistic feeding: can filter feed or select individual prey. Major prey: crustaceans, pelagic mullosks, polychaetes, squid, fish)
Black sea bass	Eggs	Continental Shelf and estuaries from southern NE to North Carolina, also includes Buzzards Bay			0 - 200	May to October	Water column of coastal Mid-Atlantic Bight and Buzzards Bay	
	Larvae	Pelagic waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes Buzzards Bay	(1126)	(30 - 35)	(<100)	(May - Nov, peak Jun - Jul)	Habitats for transforming (to juveniles) larvae are near coastal areas and into marine parts of estuaries between Virginia and NY. When larvae become demersal, found on structured inshore habitat such as sponge beds.	
	Juveniles	Demersal waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes estuaries from Buzzards Bay to Long Island Sound; Gardiners Bay, Barnegat Bay to Chesapeake Bay; Tangier/ Pocomoke Sound and James River	>6	>18	(1 - 38)	Found in coastal areas (Apr -Dec , peak Jun - Nov) between VA and MA, but winter offshore from NJ and south; Estuaries in summer and spring	Rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, offshore clam beds and shell patches may be used during wintering	(YOY use salt marsh edges and channels; high habitat fidelity)
	Adults	Demersal waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes estuaries: Buzzards Bay, Narragansett Bay, Gardiners Bay, Great South Bay, Barnegat Bay to Chesapeake Bay; Tangier/ Pocomoke Sound and James River	>6	(>20)	(20- 50)	Wintering adults (Nov. to April) offshore, south of NY to NC Inshore, estuaries from May to October	Structured habitats (natural & man-made) sand and shell substrates preferred	(spawn in coastal bays but not estuaries; change sex to males with growth; prey: benthic and near bottom inverts, small fish, squid)
Bluefish	Eggs	North of Cape Hatteras, found over Continental Shelf from Montauk Point, NY south to Cape Hatteras, South of Cape Hatteras, found over Continental Shelf through Key West, Florida	>18	>31ppt	Mid-shelf depths	April to August	Pelagic waters	*No EFH designation inshore
	Larvae	North of Cape Hatteras, found over Continental Shelf from Montauk Point, NY south to Cape Hatteras, South of Cape Hatteras, found over Continental Shelf through Key West, Florida, the slope sea and Gulf Stream between latitudes 29N and 40N; includes the following estuaries: Narragansett Bay	>18	>30ppt	>15	April to September	Pelagic waters	No EFH designation inshore for larvae
	Juveniles	North of Cape Hatteras, found over Continental Shelf from Nantucket Island, MA south to Cape Hatteras,South of Cape Hatteras, found over Continental Shelf through Key West, Florida, the slope sea and Gulf Stream between latitudes 29N and 40N also includes estuaries between Penobscot Bay to Great Bay; Mass Bay to James R.; Albemarie Sound to St. Johns River, FL	(1924)	(23 - 36) freshwat er zone in Albemarie Sound		North Atlantic estuaries from June to October Mid-Atlantic estuaries from May to October South Atlantic estuaries from March to December	Pelagic waters	(use estuaries as nursery areas; can intrude into areas with salinities as low as 3 ppt)
	Adults	North of Cape Hatteras, found over Continental Shelf from Cape Cod Bay, MA south to Cape Hatteras,South of Cape Hatteras, found over Continental Shelf through Key West, Florida also includes estuaries between Penobscot Bay to Great Bay; Mass Bay to James R.; Albemarie Sound to Pamilco/ Pungo R., Bougue Sound, Cape Fear R., St. Helena Sound, Broad R., St. Johns R., & Indian R.	(14-16)	>25ppt		North Atlantic estuaries from June to October Mid-Atlantic estuaries from April to October South Atlantic estuaries from May to January	Pelagic waters	Highly migratory (major prey: fish)
Butterfish	Eggs	Over Continental shelf from GOME through Cape Hatteras, NC,also in estuaries from Mass Bay to Long Island Sound; Gardiners Bay, Great South Bay, and Chesapeake Bay	11 - 17	(25 - 33)	0-1829	(spring and summer)	Pelagic waters	
	Larvae	Over Continental shelf from GOME through Cape Hatteras, NC,also in estuaries from Boston Harbor, Waquoit Bay to Long Island Sound; Gardiners Bay to Hudson R./ Raritan Bay; Delaware Bay and Chesapeake Bay	9 - 19	(6.4 - 37)	10-1829	(summer and fall)	Pelagic waters	
	Juveniles	Over Continental shelf from GOME through Cape Hatteras, NC also in estuaries from Mass Bay, Cape Cod Bay to Delaware Inland Bays; Chesapeake Bay, York R. and James R.	3 - 28	(3 - 37)	10-365 (most <120)	(winter - shelf spring to fall - estuaries)	Pelagic waters (larger individuals found over sandy and muddy substrates)	(pelagic schooling - smaller individuals associated with floating objects including jellyfish)
	Adults	Over Continental shelf from GOME through Cape Hatteras, NC,also in estuaries from Mass Bay, Cape Cod Bay to Hudson R./ Raritan Bay; Delaware Bay and Inland Bays; York R. and James R.	3 - 28	(4 - 26)	10-365 (most <120)	(winter - shelf summer to fall - estuaries)	Pelagic waters (schools form over sandy, sandy-silt and muddy substrates)	(common in inshore areas and surf zone; prey: planktonic, thaliacians, squid, copepods)
Ocean quahog	Juveniles	Eastern edge of GB and GOME throughout the Atlantic EEZ	<18	(>25)	8-245		Throughout substrate to a depth of 3ft within federal waters, occurs progressively further offshore between Cape Cod and Cape Hatteras	(medium to fine grained sands, sandy mud, silty sand)
	Adults	Eastern edge of GB and GOME throughout the Atlantic EEZ	<18	(>25)	8 -245	(spawn May-Dec with several peaks)	Throughout substrate to a depth of 3ft within federal waters, occurs progressively further offshore between Cape Cod and Cape Hatteras	(medium to fine grained sands, sandy mud, silty sand; earliest age of maturity 7 yrs, avg 13 yrs; suspension feeders on phytoplankton)
Scup	Eggs	Southern NE to coastal Virginia includes the following estuaries: Waquoit Bay to Long Island Sound; Gardiners Bay, Hudson R./ Raritan Bay	13 - 23	>15	(<30)	May - August	Pelagic waters in estuaries	
	Larvae	Southern NE to coastal Virginia includes the following estuaries: Waquoit Bay to Long Island Sound; Gardiners Bay, Hudson R./ Raritan Bay	13 - 23	>15	(<20)	May - September	Pelagic waters in estuaries	

Species	Life Stage	Geographic Area	Temp (°C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juveniles	The Continental Shelf from GOME to Cape Hatteras, NC includes the following estuaries: Mass Bay, Cape Cod Bay to Long Island Sound; Gardiners Bay to Delaware Inland Bays; & Chesapeake Bay	>7	>15	(0 - 38)	Spring and summer in estuaries and bays	Dermersal waters north of Cape Hatteras and Inshore on various sands, mud, mussel, and eelgrass bed type substrates	
	Adults	The Continental Shelf from GOME to Cape Hatteras, NC includes the following estuaries: Cape Cod Bay to Long Island Sound; Gardiners Bay to Hudson R./ Raritan Bay; Delaware Bay & Inland Bays; & Chesapeake Bay	>7	>15	(2 -185)	Wintering adults (November April) are usually offshore, south of NY to NC	Dermersal waters north of Cape Hatteras and Inshore estuaries (various substrate types)	(spawn < 30m during inshore migration - May - Aug; prey: small benthic inverts)
Spiny Dogfish	Juveniles	GOME through Cape Hatteras, NC across the Continental Shelf; Continental Shelf waters South of Cape Hatteras, NC through Florida; also includes estuaries from Passamaquaddy Bay to Saco Bay; Mass Bay & Cape Cod Bay	3 - 28		10-390		Continental Shelf waters and estuaries	
	Adults	GOME through Cape Hatteras, NC across the Continental Shelf;Continental Shelf waters South of Cape Hatteras, NC through Florida; also includes estuaries from Passamaquaddy Bay to Saco Bay; Mass Bay & Cape Cod Bay	3 - 28	(30 - 32)	10-450		Continental Shelf waters and estuaries	(major prey: crabs, eels, small fish)
Summer flounder	Eggs	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida			30-70 fall; 110 winter; 9-30 spring	October to May	Pelagic waters , heaviest concentrations within 9miles of shore off NJ and NY	
	Larvae	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Waquoit Bay to Narragansett Bay; Hudson River/ Raritan Bay; Barnegat Bay, Chesapeake Bay, Rappahannock R., York R., James R., Albemarie Sound, Pamlico Sound, Neuse R. to Indian R.	(9 - 12)	(23-33) Fresh in Hudson R. Raritan Bay area	10-70	mid-Atlantic Bight from Sept. to Feb.; Southern part from Nov. to May at depths 9-30m	Pelagic waters, larvae most abundant 19 83km from shore; Southern areas 12 - 52 miles from shore	(high use of tidal creeks and creek mouths)
	Juveniles	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Waquoit Bay to James R.; Albemarie Sound to Indian R.	>11	10 -30 Fresh in Narrag. Bay, Albem/ Pamlico Sound, & St. Johns R.	(0.5-5) in estuary		Demersal waters, muddy substrate but prefer mostly sand; found in the lower estuaries in flats, channels, salt marsh creeks, and eelgrass beds	HAPC - All native species of macroalgae, seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations, within adult and juvenile EFH. (Major prey: mysid shrimp)
	Adults	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Buzzards Bay, Narragansett Bay, Conn. R. to James R.; Albemarie Sound to Broad R.; St. Johns R., & Indian R.		Fresh in Albemarie Sound, Pamlico Sound, & St. Johns R	(0 - 25)	Inhabit shallow coastal and estuarine waters during warmer months and move offshore on outer Continental Shelf at depths of 150m in colder months	Demersal waters and estuaries	HAPC - All native species of macroalgae, seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations, within adult and juvenile EFH. (Major prey: fish, shrimp, squid, polychaetes)
Surf clams	Juveniles	Eastern edge of GB and the GOME throughout Atlantic EEZ	(2-30)		0 -60 , low density beyond 38		Throughout substrate to a depth of three feet within federal waters. (Burrow in med. To coarse sand and gravel substrates. Also found in silty to fine sand, not in mud)	
	Adults	Eastern edge of GB and the GOME throughout Atlantic EEZ	(2-30)		0 -60 , low density beyond 38	(spawn-summer to fall at 19 30 oC)	Throughout substrate to a depth of three feet within federal waters	
	Juveniles	US Canadian Boundary to VA/NC boundary (shelf break, submarine canyon walls and flanks; GB to Cape Hatteras)	8 - 18	(33 - 36)	76-365	(All year; may leave GB in winter)	Rough bottom, small burrows, and sheltered areas. (Substrate - rocky, stiff clay, human debris)	(Tilefish are shelter-seeking and habitat limited). HAPC is substrate between the 76 and 365m isobath, from U.S. / Canadian Boundary to the Virginia / North Carolina boundary within statistical areas 616 and 537 (intersection of isobaths east of Cape May, NJ and south of Provincetown, MA)
	Adults	US Canadian Boundary to VA/NC boundary (shelf break, submarine canyon walls and flanks; GB to Cape Hatteras)	8 - 18	(33 - 36)	76-365	(All year; may leave GB in winter)	Rough bottom, small burrows, and sheltered areas. (Substrate - rocky exposed ledges, stiff clay)	HAPC is substrate between the 250 and 1200 ft isobath, from U.S. / Canadian Boundary to the Virginia / North Carolina boundary within statistical areas 616 and 537 (intersection of isobaths east of Cape May, NJ and south of Provincetown, MA) (prey: crustaceans, fish, decapods, benthic epifauna)
Spanish mackerel		South Atlantic and Mid-Atlantic Bights	>20	>30			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward;	All coastal inlets
Cobia		South Atlantic and Mid-Atlantic Bights	>20	>25			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; high salinity bays, estuaries, seagrass habitat.	All coastal inlets
King mackerel		South Atlantic and Mid-Atlantic Bights	>20	>30			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward;	All coastal inlets

Appendix 4: Monthly Abundances in Nearshore Habitat Characterized for Each Species for Each Monitoring Study

Appendix 4a. Monthly occurrence of juvenile and adult butterfish in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Atlantic butterfish (*Peprilus tricanthus*)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)						X			X			
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)						X	X	X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004a)				Juv Adult	Juv Adult	Juv	Juv	Juv	Juv	Juv	Juv	Juv
West of Shinnecock Inlet (WOSI) (USACE 2004a)				Adult	Juv Adult	Juv	Juv	Juv	Juv	Juv Adult	Juv Adult	
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X	X	X	X	X	X	X	X

(white)	No information available	Bottom trawl sampling not conducted.
(green)	Not present	Life stage not collected.
(light blue)	Rare	Life stage is present, but not frequently encountered.
(blue)	Common	Life stage is frequently encountered, but not in large numbers.

	Abundant	Life stage is often encountered in substantial numbers.
	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4b. Monthly occurrence of juvenile and adult Atlantic herring in United States Army Corps of Engineers New York District biological monitoring studies conducted in nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Nearshore Sampling Seawater	Atlantic herring (*Clupea harengus*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)							X					
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)	Adult	Adult	Juv Adult									Juv Adult
West of Shinnecock Inlet (WOSI) (USACE 2004)	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv	Juv	Juv					Juv Adult
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X		X	X	X		X	X

	No information available	Bottom trawl sampling not conducted.
	Not present	Life stage not collected.
	Rare	Life stage is present, but not frequently encountered.
	Common	Life stage is frequently encountered, but not in large numbers.
	Abundant	Life stage is often encountered in substantial numbers.
	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4c. Monthly occurrence of juvenile and adult Atlantic mackerel in United States Army Corps of Engineers New York District biological monitoring studies conducted in nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Nearshore Sampling Seawater	Atlantic mackerel (*Scomber scombrus*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)						Not present			Not present			
Ambrose obstruction (USACE 2010c)									Not present			
Rockaway borrow area (USACE 2008a)						Not present	Not present	Not present	X (Rare)			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)	Not present	Not present	Juv Adult (Rare)	Not present	Not present	Not present	Not present	Not present	Not present	Not present	Not present	Not present
West of Shinnecock Inlet (WOSI) (USACE 2004)	Not present	Not present	Not present	Adult (Rare)	Not present	Not present	Not present	Not present	Not present	Not present	Not present	Juv Adult (Rare)
West of Shinnecock Inlet (WOSI) (USACE 2008b)	Not present	Not present	Not present	Not present	Not present	X (Rare)	X (Rare)	Not present	Not present	Not present	Not present	Not present

White	No information available	Bottom trawl sampling not conducted.
Green	Not present	Life stage not collected.
Light blue	Rare	Life stage is present, but not frequently encountered.
Medium blue	Common	Life stage is frequently encountered, but not in large numbers.
Blue	Abundant	Life stage is often encountered in substantial numbers.
Dark blue	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4d. Monthly occurrence of juvenile and adult black sea bass in United States Army Corps of Engineers New York District biological monitoring studies conducted in nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Nearshore Sampling Seawater	Black sea bass (*Centropristus striata*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)									X			
Ambrose obstruction (USACE 2010c)									Juv Adult			
Rockaway borrow area (USACE 2008a)												
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)				Juv	Juv Adult	Juv Adult	Juv					
West of Shinnecock Inlet (WOSI) (USACE 2004)				Juv Adult	Juv Adult	Juv Adult	Juv Adult		Adult	Juv		
West of Shinnecock Inlet (WOSI) (USACE 2008b)				X	X		X	X	X	X	X	

White	No information available	Bottom trawl sampling not conducted.
Green	Not present	Life stage not collected.
Light blue	Rare	Life stage is present, but not frequently encountered.
Medium blue	Common	Life stage is frequently encountered, but not in large numbers.
Blue	Abundant	Life stage is often encountered in substantial numbers.
Dark blue	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4e. Monthly occurrence of juvenile and adult bluefish in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Bluefish (*Pomatomus saltatrix*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)								X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)						Adul t			Juv Adul t		Juv	
West of Shinnecock Inlet (WOSI) (USACE 2004)								Juv	Juv	Juv		
West of Shinnecock Inlet (WOSI) (USACE 2008b)						X	X	X	X	X	X	

	No information available	Bottom trawl sampling not conducted.
	Not present	Life stage not collected.
	Rare	Life stage is present, but not frequently encountered.
	Common	Life stage is frequently encountered, but not in large numbers.
	Abundant	Life stage is often encountered in substantial numbers.
	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4f. Monthly occurrence of juvenile and adult red hake in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Red hake (*Urophycis chuss*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)							X					
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)	Juv	Juv										Juv
West of Shinnecock Inlet (WOSI) (USACE 2004)			Juv	Juv Adul t					Juv		Juv	Juv
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X	X	X	X	X	X	X	X

	No information available	Bottom trawl sampling not conducted.
	Not present	Life stage not collected.
	Rare	Life stage is present, but not frequently encountered.
	Common	Life stage is frequently encountered, but not in large numbers.
	Abundant	Life stage is often encountered in substantial numbers.
	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4g. Monthly occurrence of juvenile and adult scup in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Scup (*Stenotomus chrysops*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)						X			X			
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)						X	X	X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)				Juv Adult	Juv Adult	Juv	Juv	Juv	Juv	Juv		Adult
West of Shinnecock Inlet (WOSI) (USACE 2004)				Adult	Juv Adult	Juv Adult	Juv	Juv	Juv Adult	Juv Adult	Adult	
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X			X	X	X	X	X	X	X	X	

(white)	No information available	Bottom trawl sampling not conducted.
(green)	Not present	Life stage not collected.
(light blue)	Rare	Life stage is present, but not frequently encountered.
(medium blue)	Common	Life stage is frequently encountered, but not in large numbers.
(blue)	Abundant	Life stage is often encountered in substantial numbers.
(dark navy)	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4h. Monthly occurrence of juvenile and adult summer flounder in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Summer flounder (*Paralicthys dentatus*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)						X			X			
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)						X	X	X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)	Adult			Adult	Adult	Adult	Adult	Adult	Adult	Adult	Adult	
West of Shinnecock Inlet (WOSI) (USACE 2004)				Adult	Adult	Adult	Adult	Adult	Juv Adult	Adult	Adult	Adult
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X			X	X	X	X	X	X	X	X	X

(white)	No information available	Bottom trawl sampling not conducted.
(green)	Not present	Life stage not collected.
(light blue)	Rare	Life stage is present, but not frequently encountered.
(medium blue)	Common	Life stage is frequently encountered, but not in large numbers.
(blue)	Abundant	Life stage is often encountered in substantial numbers.
(dark blue)	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4i. Monthly occurrence of juvenile and adult windowpane flounder in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Windowpane flounder (*Scopthalmus aquosus*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)						X						
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)						X	X	X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Adult	Adult	Adult	Adult	Adult	Juv Adult	Adult	Juv Adult
West of Shinnecock Inlet (WOSI) (USACE 2004)	Adult	Juv	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X	X	X	X	X	X	X	X

	No information available	Bottom trawl sampling not conducted.
	Not present	Life stage not collected.
	Rare	Life stage is present, but not frequently encountered.
	Common	Life stage is frequently encountered, but not in large numbers.
	Abundant	Life stage is often encountered in substantial numbers.
	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4j. Monthly occurrence of juvenile and adult winter flounder in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Winter flounder (*Pseudopleuronectes americanus*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)							X					
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult		Juv				Juv Adult
West of Shinnecock Inlet (WOSI) (USACE 2004)	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult	Juv Adult		Juv	Juv Adult	Juv Adult	Juv Adult
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X	X	X			X	X	X

No information available	Bottom trawl sampling not conducted.
Not present	Life stage not collected.
Rare	Life stage is present, but not frequently encountered.
Common	Life stage is frequently encountered, but not in large numbers.
Abundant	Life stage is often encountered in substantial numbers.
Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4k. Monthly occurrence of juvenile and adult clearnose skate in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	**Clearnose skate (*Raja eglanteria*)**											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)						X			X			
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)							X	X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)					Juv Adult		Juv Adult	Juv Adult	Adult		Adult	
West of Shinnecock Inlet (WOSI) (USACE 2004)			Adult	Adult		Juv Adult	Juv	Juv Adult	Juv Adult			
West of Shinnecock Inlet (WOSI) (USACE 2008b)					X	X	X	X	X	X	X	

(white)	No information available	Bottom trawl sampling not conducted.
(green)	Not present	Life stage not collected.
(light blue)	Rare	Life stage is present, but not frequently encountered.
(medium blue)	Common	Life stage is frequently encountered, but not in large numbers.
(blue)	Abundant	Life stage is often encountered in substantial numbers.
(dark blue)	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4l. Monthly occurrence of juvenile and adult little skate in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	**Little skate (*Leucoraja erinacea*)**											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)									Juv			
Rockaway borrow area (USACE 2008a)						X	X	X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004)												
West of Shinnecock Inlet (WOSI) (USACE 2004)												
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X	X	X	X	X	X	X	X

(white)	No information available	Bottom trawl sampling not conducted.
(green)	Not present	Life stage not collected.
(light blue)	Rare	Life stage is present, but not frequently encountered.
(blue)	Common	Life stage is frequently encountered, but not in large numbers.
(medium blue)	Abundant	Life stage is often encountered in substantial numbers.
(dark blue)	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4m. Monthly occurrence of juvenile and adult longfin squid in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Longfin squid (*Loligo pealeii*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)						X	X	X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004a)												
West of Shinnecock Inlet (WOSI) (USACE 2004a)												
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X	X	X	X	X	X	X	X

	No information available	Bottom trawl sampling not conducted.
	Not present	Life stage not collected.
	Rare	Life stage is present, but not frequently encountered.
	Common	Life stage is frequently encountered, but not in large numbers.
	Abundant	Life stage is often encountered in substantial numbers.
	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4n. Monthly occurrence of juvenile and adult winter skate in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Winter skate (*Leucoraja ocellata*)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)						X	X	X	X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004a)												
West of Shinnecock Inlet (WOSI) (USACE 2004a)												
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X	X	X	X	X	X	X	X

No information available	Bottom trawl sampling not conducted.
Not present	Life stage not collected.
Rare	Life stage is present, but not frequently encountered.
Common	Life stage is frequently encountered, but not in large numbers.
Abundant	Life stage is often encountered in substantial numbers.
Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4o. Monthly occurrence of juvenile and adult surf clam in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	**Surf clam (*Spisula solidissima*)**											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)						X			X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004a)						X		X				X
West of Shinnecock Inlet (WOSI) (USACE 2004a)	X	X	X	X	X	X	X	X		X	X	X
West of Shinnecock Inlet (WOSI) (USACE 2008b)	X	X	X	X	X	X	X	X	X	X	X	X

	No information available	Bottom trawl sampling not conducted.
	Not present	Life stage not collected.
	Rare	Life stage is present, but not frequently encountered.
	Common	Life stage is frequently encountered, but not in large numbers.
	Abundant	Life stage is often encountered in substantial numbers.
	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4p. Monthly occurrence of juvenile and adult ocean quahog in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Ocean quahog (*Artica islandica*)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)						X			X			
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004a)								X				
West of Shinnecock Inlet (WOSI) (USACE 2004a)												
West of Shinnecock Inlet (WOSI) (USACE 2008b)				X								

No information available	Bottom trawl sampling not conducted.
Not present	Life stage not collected.
Rare	Life stage is present, but not frequently encountered.
Common	Life stage is frequently encountered, but not in large numbers.
Abundant	Life stage is often encountered in substantial numbers.
Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4q. Monthly occurrence of juvenile and adult goosefish in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Goosefish (*Lophius americanus*)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)												
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004a)												X
West of Shinnecock Inlet (WOSI) (USACE 2004a)				X			X					X
West of Shinnecock Inlet (WOSI) (USACE 2008b)						X					X	

(white)	No information available	Bottom trawl sampling not conducted.
(green)	Not present	Life stage not collected.
(light blue)	Rare	Life stage is present, but not frequently encountered.
(blue)	Common	Life stage is frequently encountered, but not in large numbers.
(medium blue)	Abundant	Life stage is often encountered in substantial numbers.
(dark blue)	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4r. Monthly occurrence of juvenile and adult ocean pout in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program.

Surf Zone / Nearshore Sampling Seawater	Ocean pout (*Macrozoarces americanus*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)												
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004a)		X	X	X								
West of Shinnecock Inlet (WOSI) (USACE 2004a)			X	X								X
West of Shinnecock Inlet (WOSI) (USACE 2008b)				X								

	No information available	Bottom trawl sampling not conducted.
	Not present	Life stage not collected.
	Rare	Life stage is present, but not frequently encountered.
	Common	Life stage is frequently encountered, but not in large numbers.
	Abundant	Life stage is often encountered in substantial numbers.
	Highly abundant	Life stage is consistently encountered in substantial numbers.

Appendix 4s. Monthly occurrence of juvenile and adult pollock in United States Army Corps of Engineers New York District biological monitoring studies conducted in surf zone and nearshore habitat of northern New Jersey and southern New York. If size data were available, the life stage (juvenile or adult) is indicated. Otherwise, an X indicates individuals of unknown size were collected. [a]Color coding indicates the relative monthly abundance based on a modified classification scheme used in NOAA's Estuarine Living Marine Resources (ELMR) program

Surf Zone / Nearshore Sampling Seawater	Pollock (*Pollachius virens*)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northern NJ surf zone (Burlas 2001; Wilber et al. 2003)												
Borrow areas in northern NJ (H1, H2) and southern NY (3, 4; Byrnes et al. 2004)												
Ambrose obstruction (USACE 2010c)												
Rockaway borrow area (USACE 2008a)												
Great South Bay borrow areas – 2A, 2B, 2C (USACE 2004a)							X					
West of Shinnecock Inlet (WOSI) (USACE 2004a)			X		X		X					X
West of Shinnecock Inlet (WOSI) (USACE 2008b)			X	X		X						

(white)	No information available	Bottom trawl sampling not conducted.
(green)	Not present	Life stage not collected.
(light blue)	Rare	Life stage is present, but not frequently encountered.
(blue)	Common	Life stage is frequently encountered, but not in large numbers.
(medium blue)	Abundant	Life stage is often encountered in substantial numbers.
(dark blue)	Highly abundant	Life stage is consistently encountered in substantial numbers.

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Appendix 5: EFH DOCUMENT USERS GUIDE

1. Introduction

There are two types of EFH consultations, abbreviated and expanded. The type of consultation necessary depends upon the magnitude of the potential adverse effect on EFH. Abbreviated consultations are used when a proposed project will have less than substantial adverse impact on EFH. Expanded consultations are used when the adverse impact on EFH may be substantial. In either case, both levels of consultation require application of the best available knowledge to ensure that EFH aspects of a given project are fully addressed. Both levels of consultation require the following information:

- A description of the proposed action.
- An analysis of the potential adverse effect(s) of the action on EFH and managed species.
- The federal agency's conclusions regarding the effects of the action on EFH and the managed species. The agency's findings after careful review of available information will usually determine the type of consultation. Examples of agency determinations are as follows: A) no adverse effect to EFH (no consultation required); B) minimal adverse effect or less than substantial adverse effect to EFH (abbreviated consultation can be conducted); or C) substantial adverse effect to EFH (expanded consultation required).
- Proposed mitigation, if applicable.

This EFH document is a tool that can be used for the following:

- Preparation for initial project planning meetings
- Coordination with Federal and State agencies
- Supporting material for development of EFH Assessments
- Evaluating the need for establishing dredging windows and identifying appropriate start-end dates for the window

In brief, this document is a summary of existing and readily available data on aquatic biological resources within the New York Bight (i.e. South Shore of Long Island, New York and along the New Jersey Coast within U.S. Army Corps of Engineers New York District (USACE) boundaries). It focuses on existing fisheries data (i.e. species abundance and spatial and temporal distributions) in support of informed decisions regarding project activities that could occur within this area for all New York District Civil Works (coastal storm damage reduction, flood risk management and ecosystem restoration projects) and Operations (maintenance dredging) missions. It also promotes sustainability objectives of District dredging programs, including beneficial uses of dredged material and emergency activities associated with Flood Control and Coastal Emergencies (FCCE) Act, PL 84-99, which authorizes the USACE to repair previously constructed projects after large events like Hurricane Sandy. In addition, this document can be used to begin consultation with NOAA in a programmatic EFH manner as this document identifies a generic approach that is relevant to similar actions that are applicable to multiple project scenarios within broad geographic boundaries.

In the case of an Abbreviated Consultation, the reader is referred to appropriate sections of this document Parts I and II depending on specific details of a given project. Provided that the description of the project (i.e. location, basic equipment, and proposed schedule) and review of managed species do not lead to a finding of substantial risk of detrimental impact, appropriate documentation fulfilling the Abbreviated Consultation can be generated. Particular attention should be given to:

1. Project descriptions for the HDP/ Future Maintenance project area (Part I, Section 1, Table 1, Figure 1) and coastal waters of the NY/NJ Bight (Part II, Section 1, Figure 1)
2. Existing EFH conditions for the HDP/ Future Maintenance project area (Part I, Section 2) and coastal waters of the NY/NJ Bight (Part II, Section 1)
3. EFH species for the HDP/ Future Maintenance project area (Part I, Section 5) and coastal waters of the NY/NJ Bight (Part II, Section 3)
4. EFH impacts assessment for the HDP/ Future Maintenance project area (Part I, Sections 6 and 7) and coastal waters of the NY/NJ Bight (Part II, Section 4)
5. Conclusions for the HDP/ Future Maintenance project area (Part I, Section 8) and coastal waters of the NY/NJ Bight (Part II, Section 5)

In cases where an Expanded Consultation has been justified, the reader is referred to additional sources of information that should be taken into consideration. For example, a comprehensive review should be undertaken of appropriate EFH source documents pertaining to life history requirements of managed species with occurrences likely to coincide with necessary project activities. In tandem with a refined determination of the species likely at risk, the assessment should include a detailed review of what types of impact would be associated with the specific activity. Not all species that could occur at a project site would be subject to equal levels of risk.

2. Reference Tools

This EFH document, rather than replacing existing materials conventionally used for EFH assessments, serves as a supplement to facilitate satisfying EFH mandates by connecting the reader to the most up to date relevant information. Content therefore includes a compilation and summary of existing studies and EFH species. This information can feed directly into project NEPA documents and other regulatory and planning documents. The application of appropriate management practices requires knowledge of the life history and habitat requirements of managed species to determine if a conflict with EFH mandates could occur. The following tools can be used when coordinating with regulatory agencies:

- Part I Tables 2 and 3 and Part II Tables 2 and 3: Compilation of Existing Studies and EFH species monthly abundance. These tables can be used to quickly assess the presence and absence of EFH species in the respective project areas
- Part II Table 4: Summary of potential impacts by project area (i.e. bays, inlets), project activity (i.e. dredging), equipment and potential impacts.

- Part II Table 5: Lists the currently designated EFH species with summary information on their respective life history stages that could potentially occur at a given project site. For the majority of species links to appropriate EFH source documents, which contain detailed information on distribution, habitat preferences, and environmental requirements, are provided. Summaries of information on habitat preferences are then shown and potential impacts identified. The contents of the table are organized with respect to priority species based upon a tiered approach. That is, designated EFH fish species most likely to be present at project sites are listed first.
- Part II Appendix 2: Summary of EFH Grids. This Appendix distills 26 10' x 10' grids to 10 areas based on potential projects and EFH species. When a potential project comes up one can quickly identify what EFH species will need to be addressed.
- Part II Appendix 3: Summary of EFH Species Habitat Parameters
- Part II Appendix 4: Summary of Species Monthly Occurrence. These tables can be used to quickly assess the presence and absence of EFH species in the project area

The key benefit of these tools is that the information is readily available in summary tables and can be used to develop meeting materials and EFH assessments quickly.

3. An Example of Work Flow

Consider a hypothetical project scenario that arises in the early planning stages. Maintenance dredging of a coastal inlet has been authorized and funds appropriated, triggering the need for EFH consultation. Historically, the inlet has been maintained using a medium capacity pipeline cutterhead dredge. The inlet channel generally shoals as a consequence of winter storms, so that the most economical time to remove the shoals would occur in early spring. This leads to:

(Step 1) compilation of general project information to be shared with the appropriate regulatory agencies during initial coordination meetings.

Step 2. A review of the EFH Grid (Appendix 2) is conducted to determine what EFH species occur in the area. In this hypothetical example, it was determined that winter flounder, based on compiled data (Appendix 4j), are likely to be present moving through the inlet as juveniles or adults to spawning habitat in bay waters. Depending on the duration of the dredging, early life history stages could also be present.

Step 3. A review of the project area conditions and equipment requirements is conducted. In this example, the cutterhead dredge will be working in a shallow draft channel and pumping the sediment to a down-drift site on the adjacent ocean beach for placement purposes. The reader refers to the categorization of potential impacts in Part II, Table 4. The project occurs in the Coastal Inshore Area, at an Inlet Location, with a Dredging Activity to be performed by a Hydraulic Cutterhead Dredge. For this set of project descriptors Entrainment, Sediment Resuspension, and Underwater Noise are identified as categories of potential impact. Each category of impact can then be assessed by referral to the most up to date available data on that impact related to that target species. In this example, recognizing that winter flounder are bottom oriented, entrainment by hydraulic inflows could be a concern. Likewise, juveniles and adults could be exposed to dredge plumes and underwater noise during their movement through the inlet.

Step 4. A review of the Species Monthly occurrence tables (in Appendix 4j) would reveal that winter flounder juveniles and adults can be common to abundant in coastal nearshore and inlet waters in spring.

Step 5. The reader would then refer to Part II, Table 5, which would confirm that winter flounder would be present at that project location in both surf zone and nearshore waters. The table identifies muddy sand and mixed substrates as preferred habitats of winter flounder, which could be checked against available sediment core data for the project. In this hypothetical example, the dredge would be removing sands with low fine content, suitable for beach placement. The table also indicates that, based on existing information, key concerns for winter flounder include Habitat Alteration, Sedimentation, and Impaired Foraging. Note that these categories of impact do not overlap with those identified in Table 4 as of greatest concern for coastal inlet dredging. Therefore the risk of detrimental impact on this species would be low.

It should be noted that concerns for particular impacts may be re-prioritized during early coordination meetings. In this hypothetical case for example, although no published evidence exists of hydraulic entrainment of winter flounder of any life history stage, a more detailed examination may be requested. This task would necessitate a more thorough examination of the project conditions.

Step 6. The EFH Assessment documentation would make use of summary tables for describing direct, indirect and cumulative impacts to select species and develop proposed mitigation options if necessary.