Report on Three Fishery Resource Inventories of the Lower Hackensack River within The Hackensack Meadowlands District

New Jersey Sports and Exposition Authority
March 2019

REPORT ON THREE FISHERY RESOURCE INVENTORIES OF THE LOWER HACKENSACK RIVER WITHIN THE HACKENSACK MEADOWLANDS DISTRICT

New Jersey Sports & Exposition Authority

by

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March 2019

This Report is dedicated to the Memory of

JOHN R. QUINN

JULY 17, 1938 – MAY 25, 2012

Meadowlands Artist, Naturalist and Author

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX A
LIST OF 2013-2015 DATA TABLES

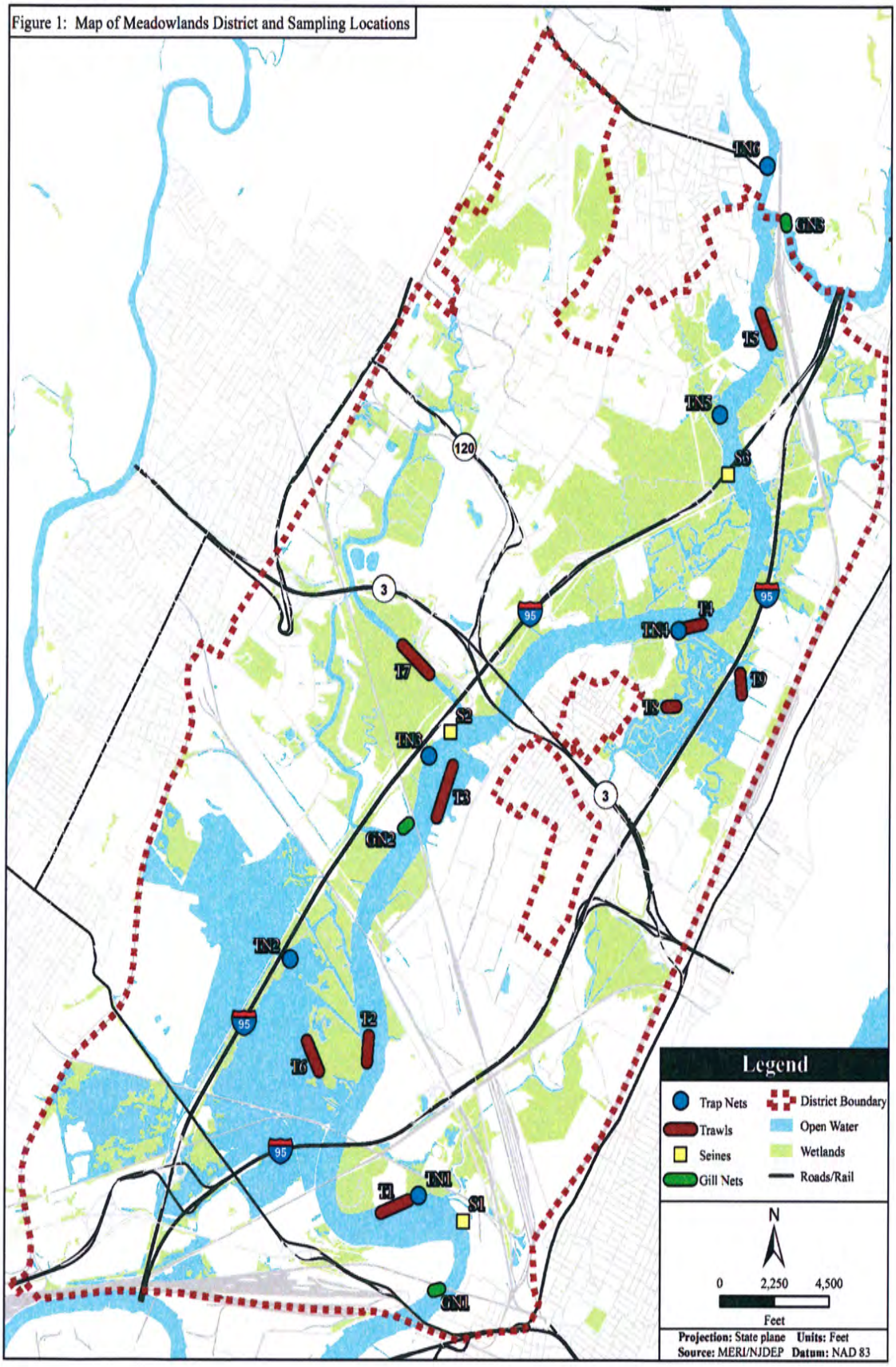
APPENDIX B
LIST OF 2001-2003 and 1987-1988 DATA TABLES

EXECUTIVE SUMMARY

In 2015, the New Jersey Sports & Exposition Authority (NJSEA) completed its third periodic two-year fishery resource inventory of the Hackensack River within the Hackensack Meadowlands District (HMD). The two previous surveys were conducted by the NJSEA's predecessor agencies, the New Jersey Meadowlands Commission (NJMC, during 2001-2003) and the Hackensack Meadowlands Development Commission (HMDC, during 1987-1988). These periodic two-year fisheries resource inventory surveys were initiated by the HMDC in 1987 to provide data for the Special Area Management Plan (SAMP), which was being developed at that time. The survey was periodically updated to inform the agency about changes to the fish community that have taken place over the last 30 years. The surveys were conducted using the same four different sampling gear types, and (with a few minor exceptions) collections were made at the same sampling locations established during the inaugural survey in 1987-1988 (Figure 1).

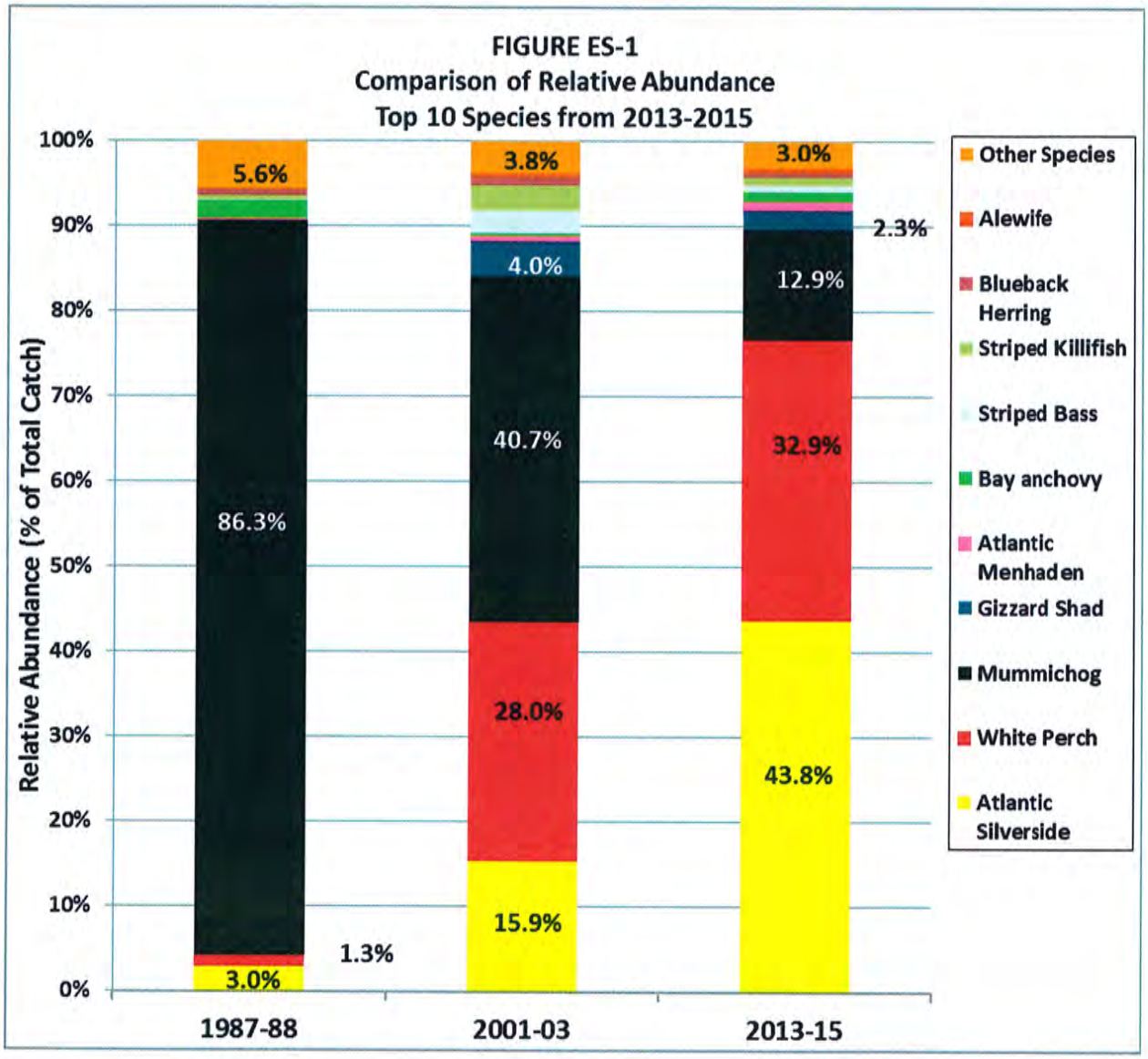
In the most recent survey, which was conducted seasonally between July 2013 and June 2015, a total of 22,860 fish were counted from 210 collections. A total bycatch of 349 blue crab, 76 Diamondback Terrapin, and two Snapping Turtle were also identified in these collections. The 10 numerically dominant species, which comprised 97% of the total catch, included: Atlantic Silverside (*Menidia menidia*) (43.8% of the total catch); White Perch (*Morone americana*) (32.9%); Mummichog (*Fundulus heteroclitus*) (12.9%); Gizzard Shad (*Dorosoma cepedianum*) (2.3%); Atlantic Menhaden (*Brevoortia tyrannus*) (1.1%); Bay Anchovy (*Anchoa mitchilli*) (1.0%); Striped Bass (*Morone saxatilis*) (0.9%); Striped Killifish (*Fundulus majalis*) (0.9%); Blueback Herring (*Alosa aestivalis*) (0.6%); and Alewife (*Alosa pseudoharengus*) (0.6%). When combined, the remaining 23 species collected made up the remaining 3% of the catch.

Figure 1: Map of Meadowlands District and Sampling Locations

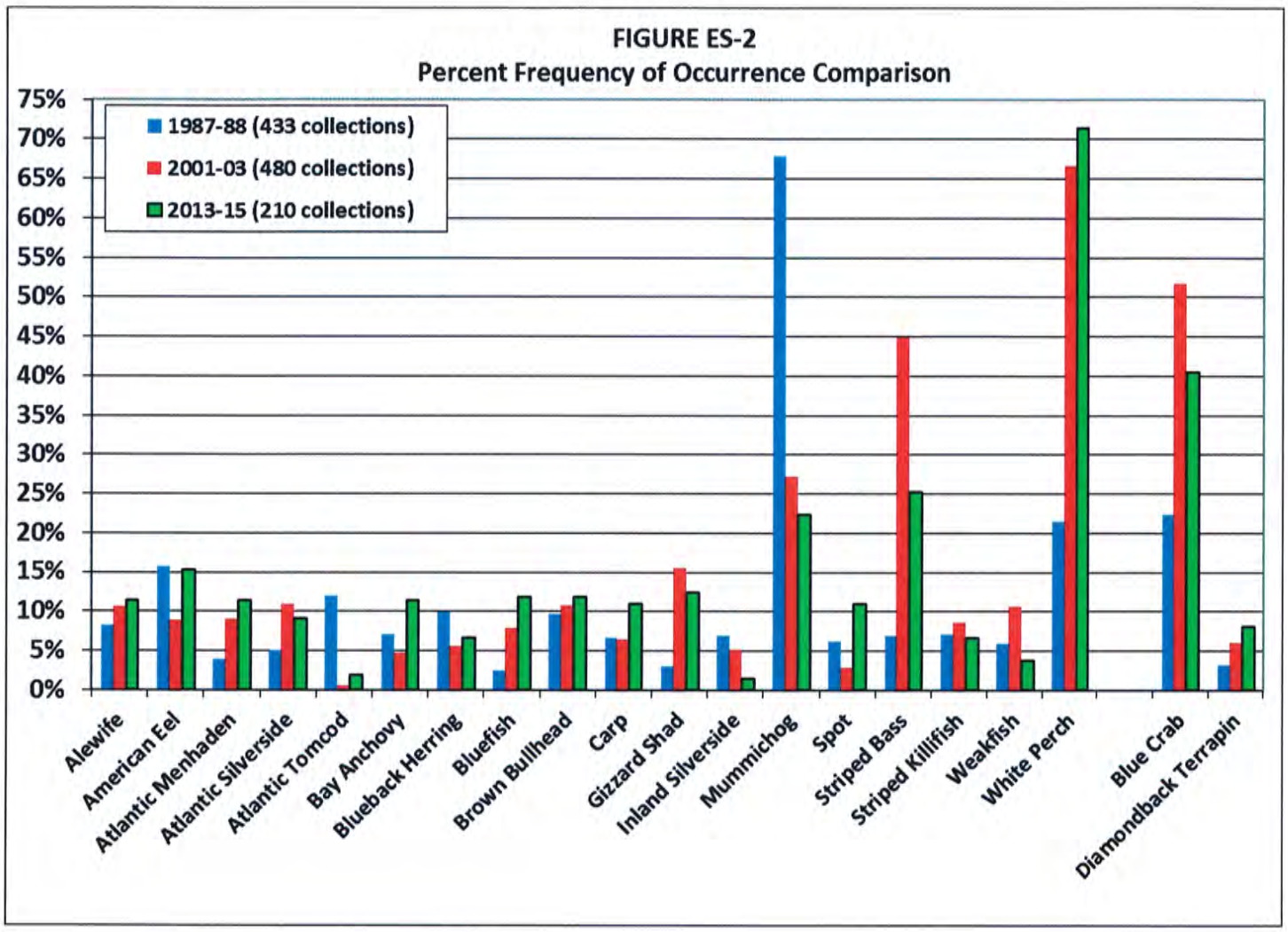


During the initial 1987-1988 survey (when collections were made monthly during the first year and seasonally during the second year), a total of 433 collections were made, which produced a total of 61,718 fish from 36 species. During the second periodic survey (2001-2003, when collections were also made monthly in the first year and seasonally in the second year), a total of 40,940 fish, representing 39 species were identified from 480 collections. Due to the differences in the number of collections made during each survey period, a chart showing the relative abundance of the 10 most abundant species collected during the 2013-2015 study compared to the previous two study periods is provided in Figure ES-1. This comparison reveals that the change in the community structure observed between the first two surveys has continued. The Mummichog was overwhelmingly dominant in 1987-1988, comprising just over 86% of all fish caught. Although the Mummichog remained the most abundant species in 2001-2003, it comprised only about 41% of all fish collected. During the 2013-2015 survey, the Mummichog was the third-most abundant species, making up only 13% of all fish collected. Other differences seen over time include the immense increase in the abundance of White Perch, which increased from 1.3% of the total catch during the 1987-1988 study to 28% during 2001-2003. In the 2013-2015 survey, White Perch comprised 33% of the total catch. The abundance of Atlantic Silverside increased from 3% to 16% to almost 44% of the total catch. The Gizzard Shad went from 0.1% to 4% in 2001-2003, but then dropped to 2.3% in 2013-2015. The Striped Bass increased from 0.1% in 1987-1988 to 3% in 2001-2003, and then decreased to 0.9% during the recent survey. These results show that while many of the same species still use the River, there is a more even distribution amongst the most common species. The River is no longer overwhelmingly dominated by the Mummichog (a pollution tolerant species) and the fish community has gained more desirable game species.

The improvements in the fish community seen over the 1987-1988 and the 2001-2003 surveys have been sustained, but no further improvements were seen in the most recent collections. It appears that the fish community in the Hackensack Meadowlands has reached a plateau.

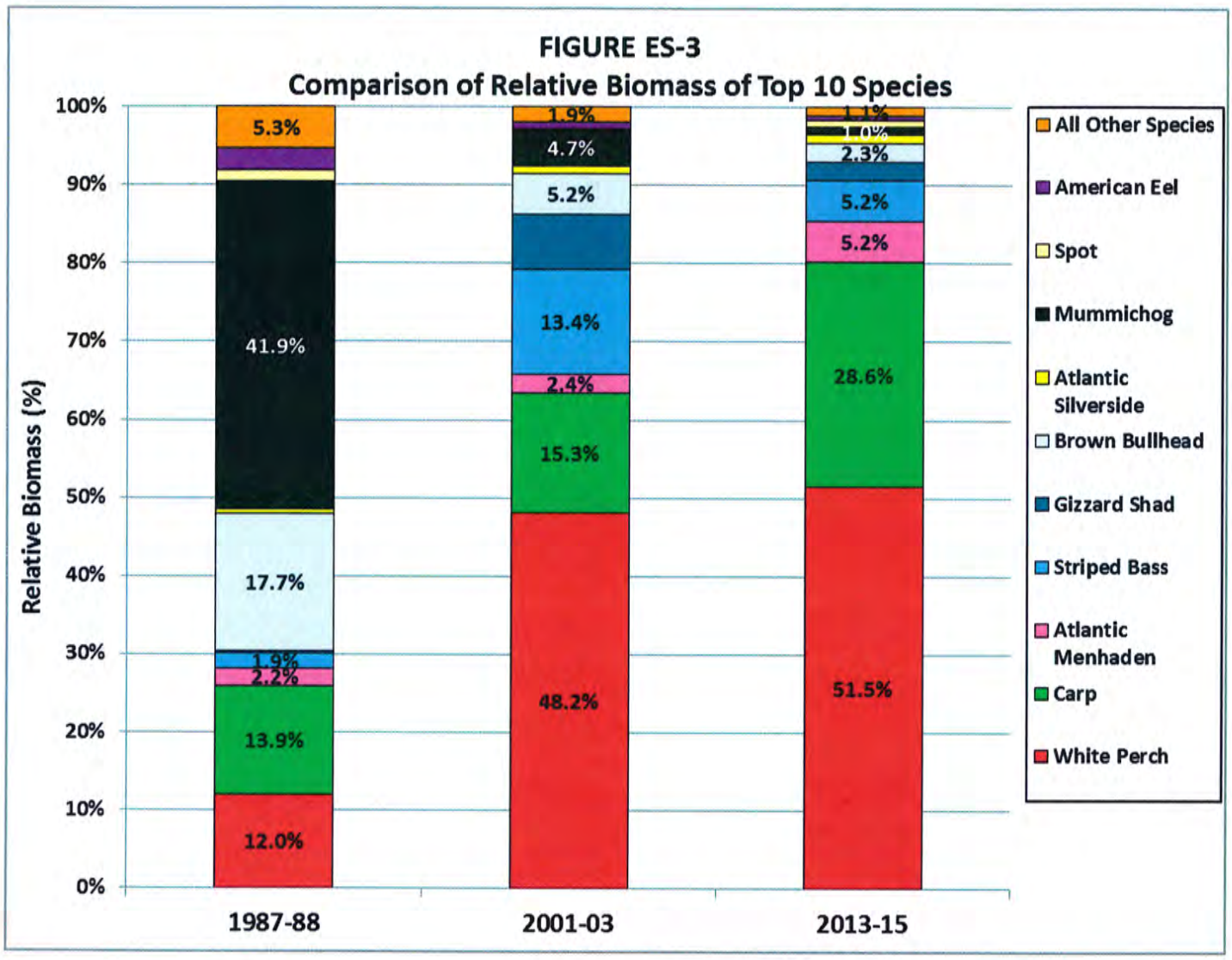


The frequency that each species was captured (i.e., the number of collections that yielded a particular species) during each of the three studies was also compared. Figure ES-2 shows the comparison of the percent frequency of occurrence of selected fish species (as well as blue crab and diamondback terrapin) for each survey period. As shown on this chart, six species (Alewife, Atlantic Menhaden, Bluefish, Brown Bullhead, Carp and White Perch) increased in frequency of occurrence during the second and the third collection periods. The most striking example is the White Perch, which was only captured in 93 of the 433 collections during the 1987-1988 study (a frequency of occurrence of 21.5%). In 2001-2003, White Perch were collected in 320 of the 480 collections (66.6%), while in the most recent survey White Perch were captured in 150 of the 210 collections (71.4%). The diamondback terrapin also showed an increase in percent frequency of occurrence over the three survey periods. Figure ES-2 also shows the decrease in the frequency of the Mummichog and the Inland Silverside across the three studies. Those two species had their highest percent frequency of occurrence during the 1987-1988 survey.

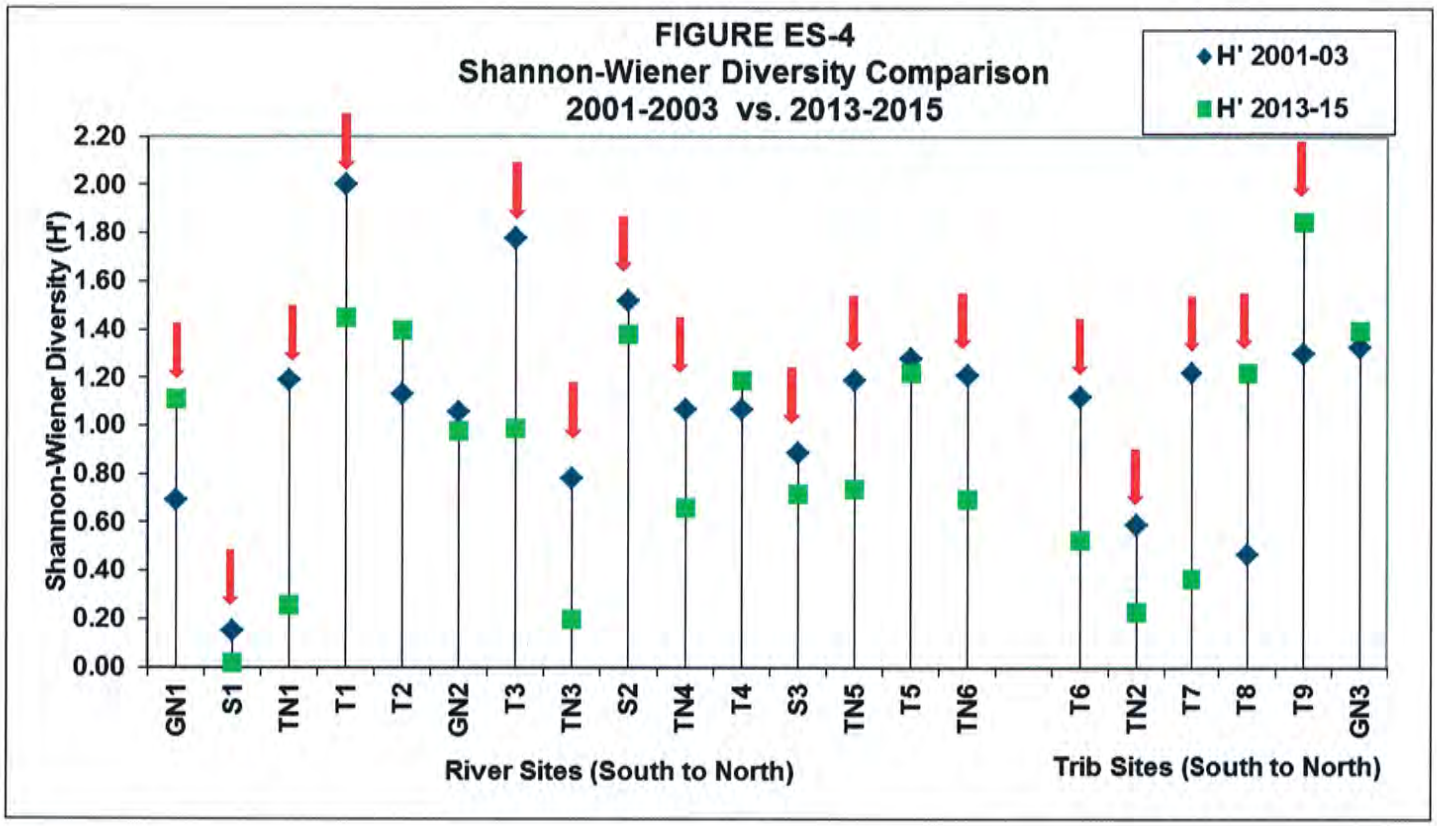


Another way to compare the data is to examine the total biomass (weight) of the species collected during each survey. Figure ES-3 shows a comparison of the relative biomass of the top ten species (by weight) collected during the 2013-2015 study to the previous two surveys. In 2013-2015 three species (White Perch, Carp and Atlantic Menhaden) comprised just over 85% of the total biomass. These three species also showed an increase in biomass over the three study periods. For example, during the 1987-1988 study, the White Perch comprised only 12% of total biomass, increasing to 48% during the 2001-2003 collections, and increasing to almost 52% of total biomass in 2013-2015. Conversely, the Mummichog and Brown Bullhead showed steady decreases in biomass over the three study periods. The Striped Bass, a highly sought after game fish, saw a large increase in biomass from 1.9% during the 1987-1988 collections to 13.4% of total biomass in 2001-2003. Striped Bass biomass then decreased to 5.2% during the recent survey.

FIGURE ES-3
Comparison of Relative Biomass of Top 10 Species



Another point of comparison that was examined was the diversity of the fish community. An index of diversity, the widely used Shannon-Wiener diversity index, was calculated for each of the 21 fishery sampling locations. A specialized t-test was used to statistically compare the 2013-2015 and 2001-2003 diversity indexes. This site-by-site comparison revealed that the Shannon-Wiener diversity index was significantly different between the two most recent surveys at 16 of our 21 sampling locations. For the 2013-2015 collections, only three sites had a significantly higher diversity index when compared to the 2001-2003 data. The diversity indexes calculated for five sites were not significantly different between the 2013-2015 and 2001-2003 collections. The remaining 13 sites had a significantly higher diversity index during the 2001-2003 collections. These differences are illustrated in Figure ES-4.



= significantly different

In summary, the perceived improvements in water quality, as evidenced by the improvements in the fish community within the Meadowlands between the 1987-1988 and 2001-2003 collections have been sustained, but seem to have reached a plateau. Some of the previous detriments to water quality in the Meadowlands, such as the heated discharges of once-through cooling water from three electric power generating facilities and the uncontrolled discharge of millions of gallons of leachate from orphaned landfills, have stopped. To noticeably improve water quality above the present level would likely entail extremely expensive projects such as upgrading sewage treatment plants that discharge their effluent into the Hackensack River to tertiary treatment, and allowing more freshwater to pass through/over the Oradell dam, thus restoring the River to a more natural flow regime. However, given the historical and present use of the upper Hackensack River as a source of drinking water supply for the communities of Bergen County, a return to a more natural flow pattern in the Hackensack River is extremely unlikely.

1.0 INTRODUCTION

In 1968, the NJ Legislature enacted the Hackensack Meadowlands Reclamation Act (N.J.S.A. 13:17-1 et. seq.), which created the Hackensack Meadowlands Development Commission (HMDC). The HMDC was given broad regulatory, administrative, and financial powers that directly affected the 14 municipalities in two counties that were included in the Hackensack Meadowlands District (HMD). The HMDC was given five mandates, chief among them were:

- To support orderly economic development in the Hackensack Meadowlands District;
- To plan for the disposal of all solid waste from the communities then dumping in the District; and
- To protect the delicate balance of nature.

Since the inception of the HMDC, the view of the Meadowlands District has changed. It is no longer considered a dumping ground and heavy industrial region. The Hackensack River (River) is no longer considered to be ecologically dead, and its marshes are no longer accepted as a good place to fill for development of commercial, industrial, and/or solid waste facilities. Instead, the River and its associated marshes are correctly viewed as an important urban estuary that provides ecologically valuable habitat, nursery, and refuge areas for many species of fish and wildlife. It is increasingly being used for scientific study and recreation. The most recent Master Plan for the Meadowlands (NJMC, 2004) recognizes that this estuary is worthy of protection, as it calls for the preservation of the District's remaining wetlands.

However, in the 1970's and 1980's increasing development pressures put many demands on the River and its tributaries. The HMDC realized that these pressures, which would result in the loss of even more wetlands, could affect the fisheries resources of the River. Due to a lack of data pertaining to this issue, in 1987 the HMDC initiated a two-year fishery study of the lower Hackensack River. The purpose of the study was to provide an inventory of the fishery resources within the boundaries of the HMD. The data was used to assess the fish populations that were using the River, and to determine the extent to which the River and its tributaries provided habitat and refuge for those species. That study served as an information resource for a programmatic Draft Environmental Impact Statement that was being prepared for the District (the Special Area Management Plan Draft EIS; US Environmental Protection Agency, 1995). The data from the 1987-88 study was presented in the HMDC's 1989 fishery resource inventory report (HMDC, 1989), which was frequently requested by the State and Federal resource agencies, environmental consultants and the public.

The HMDC, which was renamed the New Jersey Meadowlands Commission (NJMC) on August 29, 2001 (PL 2001, c.232) had always envisioned repeating the fishery inventory periodically to determine whether the fish community would respond to perceived water quality improvements that were occurring within the District. Therefore, in 2001, the NJMC began a second fishery resource inventory of the Hackensack River, the goal of which was to repeat the earlier study and compare the results. In 2013, ten years after the 2001-2003 fishery inventory study had concluded, the NJMC initiated a third round of periodic fisheries monitoring, with the goal of comparing the new data with the previous fisheries inventories. In February 2015, legislation was passed that consolidated the NJMC and the New Jersey Sports & Exposition Authority (NJSEA). Although the majority (74%) of the collections for the 2013-2015 study was conducted by the NJMC, this report is published under the aegis of the NJSEA, the surviving Meadowlands regulatory agency.

2.0 MATERIALS AND METHODS

A total of 21 sampling locations were established during the 1987-1988 fisheries study (HMDC, 1989). The locations were selected with the assistance of the New Jersey Department of Environmental Protection (NJDEP) Bureau of Marine Fisheries. Sites were selected based on their spatial distribution along the River (within the HMD) as well as the suitability of deploying and retrieving each of the gear types in order to sample subtidal and shallow inshore areas of the River. The gear types were selected to match what the NJDEP Bureau of Marine Fisheries used in making collections for other fisheries studies in estuarine waters around the State (e.g., see NJDEP, 1984). The same 21 locations were sampled during the 2001-2003 and 2013-2015 fisheries studies (Figure 1). Due to changes in site conditions during the intervening years, two sampling sites (T9 and TN1, described in Sections 2.4.1 and 2.4.2) were slightly relocated from their original 1987-1988 locations.

2.1 Sampling Gear

The four types of fishing gear used during this and the previous studies were similar, and are described in the following sections.

2.1.1 Trawl

A 16-foot otter trawl, (constructed using ¾-inch square body mesh, 5/8-inch square cod-end mesh, with a ¼-inch mesh cod-end liner) was towed for three minutes at approximately 2,400 rpm at nine sites. Two duplicate tows were made each time we sampled a trawl location. A 20-foot commercial Privateer outfitted with a 115 horsepower Yamaha four-stroke outboard motor was used to tow the trawls. The trawl was towed using ½ inch nylon ropes fastened to either side of the transom of the vessel. The trawl was deployed with the vessel in forward motion, with tension on the towropes and (in all but a very few cases) against the prevailing current. A minimum 5:1 ratio of towrope length to station depth was maintained. The trawl was deployed and retrieved by hand.

2.1.2 Seine

A 60-foot long by six foot high by ¼-inch mesh bag seine was fished at three sites. One end of the seine was held stationary on shore and the other end of the seine was walked out into the River to a depth of approximately four feet with the offshore end of the net being hauled in a semicircular arc about the shoreline. When the offshore end of the net was brought in to the shoreline, both ends of the net were hauled up onto the beach.

2.1.3 Gill Net

A 200-foot long by eight-foot high experimental sinking gill net made-up of four 50-foot panels of ¾-inch, 1¾-inch, 3½-inch, and 4-inch square mesh was fished at three locations. The gill nets were anchored using one (or sometimes two) cinder blocks attached to either end of the lead line. A large white and/or orange Styrofoam buoy (i.e., a crab pot marker) was attached to each cinder block via an appropriate length of ½ inch polydacron rope to mark the location of each end of the net. These buoy lines also served as a means of retrieving the nets, which were deployed and retrieved by hand. In order to limit damage to and/or loss of the gill nets, they were generally deployed during neap tides, when the

range of tidal fluctuations is smaller, with correspondingly lower tidal velocity. In almost all cases, the inshore (shallow) end of the net was deployed first, and the net was payed out as the boat moved in reverse at a very slow speed. The nets were usually set during a rising tide, so that the boat was moving upriver (in reverse) "with the current", rather than against it. The gill nets were retrieved the following day, after being left to fish for an approximately 24-hour set.

2.1.4 Trap Net

An Indiana Trap Net was fished at six sites. The net consisted of two rectangular steel frame braces each three feet high and six feet wide, and four 30-inch diameter steel hoops constructed using ½-inch square mesh. Each trap net also had a three foot high by 50-foot long leader (also constructed using ½-inch square mesh) affixed to the center of the first frame brace. The trap nets were deployed during neap tides, at or near the predicted time of low water. Each net was staked into the mud using three round wooden poles 1 5/8-inches in diameter and between 12 to 16 feet long, one at the free end of the leader and two at the first frame brace. In order to keep the net from being moved by the tidal currents, a cinder block was attached to the cod-end of the net. The nets were generally set as follows; the cod-end was tied securely and the net leader was checked to make sure it was not twisted. The boat was moved inshore over the mudflat (at or near the time of predicted low water) as far as possible (usually in approximately one to two feet of water) and the free end of the leader was staked into the mud. The boat was then slowly reversed, with the leader being payed out over the port side of the boat. As the leader was almost fully extended, the boat was turned and the remainder of the net dropped into the water so that the leader would be taut and perpendicular to the frames of the net, at which point the first frame brace of the leader was staked into the mud (usually in approximately two to five feet of water) using a pole on each side of the first frame. The boat was then slowly reversed until the second frame brace and the four hoops were pulled taut by means of a buoy line attached to the cod-end cinder block. While keeping the net taut, the cinder block was allowed to sink into the mud, thereby anchoring the cod-end. After an approximately 24-hour set, the nets were retrieved in the reverse order.

2.2 Sampling Frequency

As in the previous two studies the fish community was sampled over a two-year period. During the two previous studies, sampling was conducted monthly during the first year, and seasonally during the second year. In this third iteration, the NJMC's fishery inventory sampled the River only on a seasonal basis. A total of thirty fishery collections were made each season, beginning in the summer of 2013 (July through September). Fishery collections continued during autumn 2013 (October through December). No collections were made during the winter of 2013-2014, due to a malfunctioning boat motor. Fishery collections resumed during spring 2014 (April to June). The second year of sampling began in the summer of 2014 (July to September), and continued during autumn 2014 (October to December) and the winter of 2014-2015 (January 2014 to March 2015). A total of 210 fishery collections were made. Collections were made under NJDEP scientific collection permit number 1306 (during 2013), MFA-SCP No. 1410 (during 2014) and MFA-SCP No. 1528 (during 2015).

2.3 Water Quality Measurements

During each fishery collection water quality was measured using a Yellow Springs Instrument company (YSI) multi-parameter mini-sonde with a YSI data logger/display terminal. The following water quality parameters were measured: temperature, dissolved oxygen, specific conductance, conductivity, total dissolved solids (TDS), salinity, and pH. The mini-sonde was periodically calibrated according to the

manufacturer's specifications. Additionally, water clarity was measured at each sampling location using an 8-inch diameter Secchi disc. When sampling using active gear (i.e., the otter trawl and the seine), water quality measurements were taken just prior to the deployment of the gear. When sampling using passive gear (i.e., the gill and trap nets) the water quality measurements were made just prior to retrieving the nets. Water quality measurements from the surface and bottom were recorded during otter trawl and gill net collections. Samples of bottom water were collected approximately one foot off of the bottom using a 2.2 liter clear acrylic horizontal Alpha sampling bottle. Only surface measurements were recorded during the seine and trap net collections, owing to the very shallow water depths along the shoreline (generally one to four feet) encountered while fishing these two gear types.

2.4 Sampling Location Descriptions

Figure 1 shows the 21 sampling locations, each of which are described below. Any reference to river mile (RM) with regard to the position of each sampling location along either the main stem of the River or any of its tributaries has been scaled from nautical chart 12337 – Passaic and Hackensack Rivers (NOAA, 1984), and are expressed in nautical miles (one nautical mile is equal to 1.15 statute miles).

2.4.1 Trawls

Trawl 1 (T1) – was in the main stem of the Hackensack River. The downstream end of the trawl began at approximately river mile (RM) 3.7, approximately 300 yards upstream of the mouth of Penhorn Creek. The trawl began in the shallows near the mouth of a small-unnamed tidal creek, and continued out into deeper water adjacent to the Malanka Landfill. Based on a visual examination, the substrate at this location was hard-packed sand and hard mud. This site is located in Secaucus, Hudson County.

Trawl 2 (T2) – was located on the western side of the Hackensack River, upstream of the mouth of Sawmill Creek, at approximately RM 5.4. The shoreline consisted of saltmarsh cordgrass (*Spartina alterniflora*) along the edge of the River, which graded into a thin band of common reed (*Phragmites australis*), behind which was an extensive tidal marsh dominated by saltmarsh cordgrass. The substrate at T2 was hard clay and hard-packed sand. This site was located in Lyndhurst, Bergen County.

Trawl 3 (T3) – was located on the eastern side of the River, between the NJ Transit Bergen County Line railroad bridge and red nun buoy #18, at RM 7.0, in Secaucus, Hudson County. The downstream end of this trawl was just offshore from one of the protrusions of fill that supports a number of Harmon Cove town homes that front the River just upstream (i.e., north of) the railroad bridge. The substrate at T3 ranged from soft black mud to hard clay.

Trawl 4 (T4) – was located on the eastern side of the River, between the mouths of Mill and Cromakill Creeks, at RM 9.2 in Secaucus, Hudson County. The substrate at T4 consisted of mud, clay, and occasional rubble.

Trawl 5 (T5) – was located in the main stem of the River at approximately RM 11.4, adjacent to the Bergen County Utility Authority (BCUA) Little Ferry sewage treatment plant. The shallow end of this trawl began in Ridgefield, progressing towards the deep end in the middle of the River, which forms the boundary between Ridgefield and Little Ferry, Bergen County. The shoreline along either side of the River was either developed (i.e., the BCUA sewage plant), or was dominated by thick stands of *Phragmites*. The substrate at T5 was soft black mud.

Trawl 6 (T6) – was located in the Sawmill Creek Wildlife Management Area (WMA), in the center of Sawmill Creek, which forms the boundary between Kearny, Hudson County, and Lyndhurst, Bergen County. The lower end of the site was approximately 0.3 nautical miles upstream from the mouth of Sawmill Creek. The shoreline on either side of the creek consisted of a thin band of *Spartina alterniflora*, which graded into a thin band of *Phragmites* (along the natural creek bank levee), behind which was either an extensive area of mudflat/open water (depending on the level of the tide) south of the creek, or tidal *Spartina alterniflora* marsh (along the north side of the creek). The bottom of Sawmill Creek consisted of hard gray clay. There are no deposits of fine sediments in the trawl area due to the large amount of tidal flushing that occurs twice each day between the Sawmill Creek, its associated marshes, and the Hackensack River.

Trawl 7 (T7) – was located in Berry's Creek Canal, a man-made waterway that was dug by the Erie Railroad in 1911 in order to maintain navigability between the Hackensack River and upper Berry's Creek without having to build a drawbridge over Berry's Creek. The lower end of T7 was approximately 0.3 nautical miles above the mouth of the Canal. Both sides of Berry's Creek Canal were vegetated with thick stands of *Phragmites*. The substrate in the area of T7 was soft black mud that contained a large amount of *Phragmites* canes, leaves, and other organic debris (tree limbs, etc.). T7 was located in East Rutherford, Bergen County.

Trawl 8 (T8) – was located in Mill Creek, approximately 0.6 nautical miles from its mouth. The substrate at T8 was a mixture of hard clay, soft brown mud, live dark false mussel (*Mytilopsis leucophaeata*) also a hash of their shells, and *Phragmites* stalks along with leaves. In the area adjacent to T8, an approximately 140 acre former *Phragmites*-dominated marsh on the eastern side of Mill Creek was restored by the NJMC in 1999. The interior of this marsh consisted of large patches of *Spartina alterniflora*, mudflats/open water (depending on the level of the tide), and upland trails as well as islands created as part of the restoration project. Mudflats dominated the area directly adjacent to the creek. Portions of the mudflats were vegetated with small spikerush (*Eleochris parvula*), saltmarsh fleabane (*Pluchea odorata*), and horned pondweed (*Zannichellia palustris*). The western side of Mill Creek was not restored and consisted of a thick monoculture of *Phragmites*. During the 1987-1988 study, either side of Mill Creek consisted of *Phragmites* marsh, and there were no mudflats adjacent to Mill Creek. T8 was located in Secaucus, Hudson County.

Trawl 9 (T9) – was located in Cromakill Creek, approximately 0.4 nautical miles from its confluence with the Hackensack River (on the eastern side of the NJ Turnpike's eastern spur), in North Bergen, Hudson County. The substrate at T9 was soft black mud, which often contained *Phragmites* leaves and stems. On either side of the Cromakill Creek channel at T9 were mudflats/open water (depending on the tidal stage) with sparse clumps of saltmarsh cordgrass (*Spartina alterniflora)* and large areas of small spikerush (*Eleochris parvula*). During the 1987-1988 study, T9 was located further upstream, approximately 0.8 nautical miles from the mouth, on the straight reach just upstream of the two large meanders in the creek. During 1987-1988, both banks of the entire Cromakill Creek drainage were dominated by dense monocultures of *Phragmites*. The location of T9 was moved after the first collection of the 2001-2003 study (August 2001) due to the shallow depths found in the former area of T9 and the fact that Cromakill Creek was not accessible during high tide due to the low clearance of the NJ Turnpike's Eastern Spur bridge crossing of the creek. Due to this logistical problem, the "new" location of T9 was generally sampled on a falling tide, approximately two to three hours after high water.

2.4.2 Trap Nets

Trap Net 1 (TN1) – was located on a mudflat adjacent to the northern bank of the Hackensack River, at RM 3.7, approximately 250 yards upstream from the mouth of Penhorn Creek, in Secaucus, Hudson County. The leader of TN1 was generally set within approximately 20 to 30 feet of the river bank, which was dominated by *Phragmites*. Just downstream of TN1 was the mouth of the Hudson County Fish Creek, which bisects a small area of mixed *Spartina/Phragmites* marsh. The substrate in the area of TN1 consisted of soft black mud approximately one to three feet deep, underlain by hard clay. During 1987-1988, TN1 was set closer to the mouth of Penhorn Creek (at RM 3.6).

Trap Net 2 (TN2) – was located in the Sawmill Creek WMA, within a shallow tidal embayment/mudflat on the northern side of Sawmill Creek, approximately 1.1 nautical miles above the mouth of the creek, just downstream from the NJ Turnpike's Western Spur crossing of Sawmill Creek, in Lyndhurst, Bergen County. The substrate at TN2 was soft mud, underlain by hard clay. The shoreline at TN2 consisted of scattered clumps of *Spartina alterniflora*, behind which was a stand of *Phragmites* that extended to the NJ Turnpike.

Trap Net 3 (TN3) – was located on the western side of the Hackensack River, north of the NJ Transit Bergen Line railroad crossing in East Rutherford, Bergen County at approximate RM 7.1. TN3 was set just downstream of a drainage ditch that conveys tidal water underneath the adjacent NJ Turnpike's Western Spur (which eventually connects with the Bergen County Fish Creek, a tributary of Berry's Creek). The substrate at TN3 consisted of a one to three foot thick layer of soft mud, underlain by hard clay. The shoreline was dominated by a stand of *Phragmites*.

Trap Net 4 (TN4) – was located on the eastern shore of the Hackensack River, on the mudflat just upstream from (i.e., north of) the mouth of Mill Creek, at RM 9.2 in Secaucus, Hudson County. The substrate at TN4 was soft mud. The riverbank at TN4 was dominated by a dense stand of *Phragmites*, behind which was the Western Brackish Marsh, a former *Phragmites*-dominated marsh that in 1985-1986 was an early Meadowlands wetland mitigation site. A second effort at ecological enhancement of Western Brackish Marsh began in 2009. It now consists of open water channels, mudflats, emergent stands of vegetation dominated by *Spartina alterniflora*, and upland islands.

Trap Net 5 (TN5) – was located on the western shore of the River, on the mudflat just downstream from the mouth of the Losen Slote (formerly known as Eckel's Creek), at approximately RM 10.9, in South Hackensack, Bergen County. The substrate at TN5 was soft black mud, and the riverbank was dominated by a dense stand of *Phragmites*. On the western edge of this *Phragmites* stand is the Richard P. Kane Wetland Mitigation Bank. Between 2009 and 2011, an area of approximately 213 acres that was previously cut-off from tidal flow due to historic dikes and tide gates was reopened to tidal inundation. A 142 acre portion of the site was planted with *Spartina alterniflora*. The mitigation bank is now subject to daily tidal inundation which supports a large *Spartin*a marsh and mudflats.

Trap Net 6 (TN6) – was located on the western shore of the River, just upstream (north) of the U.S. Route 46 bridge crossing in Little Ferry, Bergen County. TN6 was approximately 12.5 RM from the mouth of the Hackensack River. The substrate at TN6 was soft black mud, the riverbank consisted of a thin band of *Phragmites* with a few small trees.

2.4.3 Gill Nets

Gill Net 1 (GN1) – was located on the western side of the River, just downstream from the NJ Transit Morristown Line railroad crossing (a.k.a. the Morris & Essex Line) of the lower Hackensack River, at RM 3.0, in Kearny, Hudson County. Due to the high velocity of the tidal currents that occur further offshore, GN1 was generally set close to the western shore of the River, in an eddy that forms below the railroad bridge. Also due to the large volume of water that passed this point in the River, GN1 was only fished during neap tides. The substrate at GN1 consisted of rubble, sand, soft mud, and hard clay. The shoreline was mainly riprap, although there was a thin band of *Spartina alterniflora* along the edge of the River. During the 2013-2015 study, in-water construction (i.e., new pilings and bridge piers) for a new State Route 7 bridge was ongoing, just downstream of the area where GN1 was set. This resulted in an extraordinary amount of tug boat and barge traffic in the area of GN1, which we suspect may have had an impact on the catch from this location.

Gill Net 2 (GN2) – was located on the western side of the River, just downstream from the NJ Transit Bergen Line railroad crossing, at RM 6.8 in Rutherford, Bergen County. The location of GN2 was adjacent to the Hackensack River frontage of the old Rutherford landfill. The inshore (shallow) end of the net was set approximately 60 feet upstream (north) from the mouth of Berry's Creek, and the net extended diagonally from the shoreline upstream (northward) out into deeper water, with care taken not to set the offshore end of the net too close to the navigation channel. GN2 was normally fished during neap tides. The shoreline was dominated by riprap that was placed along the face of the landfill circa 1990. The substrate at GN2 consisted of rubble, soft mud, clay, and in some areas, refuse that had at one time likely been contained within the landfill.

Gill Net 3 (GN3) – was located in Overpeck Creek, which forms the boundary between Ridgefield and Ridgefield Park, Bergen County. The inshore (shallow) end of the net was set approximately 60 to 80 feet upstream from the eastern or inner span of the two adjacent non-functional railroad drawbridges that cross the mouth of Overpeck Creek. The net was extended diagonally across the channel of Overpeck Creek. Due to the presence of the two non-functioning drawbridges across the mouth of the creek (New York, Susquehanna and Western drawbridge on the west and Penn Central/Conrail drawbridge on the east), we could only gain access during low water (from approximately two hours before to two hours after the time of low water). Therefore, all GN3 sets and retrievals were done around the predicted time of low water, generally during neap tides.

2.4.4 Seines

Seine 1 (S1) – was located on the eastern shore of the Hackensack River, in front of the Public Service Electric & Gas Company (PSE&G) Hudson Generating Station at RM 3.5, in Jersey City, Hudson County. Riprap and developed areas of the Generating Station dominated the shoreline. The substrate consisted of smaller pieces of riprap and other debris in a muddy sand matrix. The location where the seine hauls were made was approximately 250 feet upstream from the location of the Hudson Station's cooling water intake structure. This site was generally sampled at or near the predicted time of low water.

Seine 2 (S2) – was located on the western shore of the River, approximately 600 feet downstream from the mouth of Berry's Creek Canal, at RM 7.4 in East Rutherford, Bergen County. The shoreline is dominated by *Phragmites*, with a small patch of sandy beach between the *Phragmites* and the River.

The substrate at S2 grades from sand fill from the NJ Turnpike (high up on the shore), to sandy mud, to very soft mud in the subtidal portion of this area.

Seine 3 (S3) – was located on the western shore of the River, on the downstream (southern) side of the NJ Turnpike Western Spur crossing, in Carlstadt, Bergen County, at approximately RM 10.6. It is important to note that the location of S3 during the 2001-2003 study is the same as location S4 from the 1987-1988 fisheries study. The shoreline at S3 was dominated largely by bare sand and rock filled gabions (fill from the construction of the NJ Turnpike, which supports the overhead roadway crossing), with a stand of *Phragmites* at the downstream end of the site. As with S2, the substrate at site S3 grades from sand at the upper reaches of the intertidal zone, to sandy mud, to very soft thick black mud in the lower intertidal to subtidal zone. A wide mudflat that is exposed at this location during the time of mid to low water makes this site inaccessible during that portion of the tidal cycle. Therefore, S3 was normally sampled at or close to the predicted time of high water. Directly to the south and west of S3 was a channel that led directly to the mouth of Mudabock Creek (also known as the Blue Ditch), which is cut off from the River by an old earthen dike and tide gate. The wetland restoration at the nearby Richard P. Kane wetland mitigation bank has rerouted the mouth of Mudabock Creek, so that now some of the tidal waters which enters and leaves the mitigation bank (just north of site S3, on the northern side of the NJ Turnpike) is carried by the relocated Mudabock Creek, the "new" mouth of which enters the Hackensack River on the north side of the NJ Turnpike's crossing of the River.

2.5 Sample Processing

After each collection, all fish and the invertebrate bycatch were identified, sorted by species into separate buckets of water, then counted. With the exception of the blue crab (*Callinectes sapidus*) (all of which were counted), visual estimates of invertebrate bycatches were made. Occasionally large catches of Mummichog (*Fundulus heteroclitus*) and/or daggerblade grass shrimp (*Palaemon pugio*) were also estimated by sub-sampling, as follows; a calibrated cup was filled and the number of Mummichog from three cups were counted. We calculated the average number per cup and then multiplied by the total number of cups to arrive at an estimate of the number of that species for that collection. For fish, a representative sub-sample of 20 individuals of each species were weighed and measured in the field. Fish and blue crabs were measured to the nearest millimeter (total length for fishes, carapace width for blue crabs). Specimens were weighed using either an Ohaus CS-5000 portable electronic balance (5,000 gram capacity), a series of Pesola hanging scales (10 g, 30 g, 100 g, 300 g, 1,000 g capacity), or for large specimens such as Common Carp (*Cyprinus carpio*) and large Striped Bass (*Morone saxatilis*) a Pesola hand-held spring scale (10.0 kg capacity) was used. For invertebrates, only the blue crabs were measured and sexed. Incidental captures of Diamondback Terrapin (*Malaclemys t. terrapin*) and Snapping Turtles (*Chelydra s. sepentina*) were noted. Most of the fish collected were returned to the River. However, some were retained, either for further identification or as voucher specimens.

2.6 Data Analysis

2.6.1 Fishery Catch Analysis

All data related to each of the 2013-2015 fishery collections (date, time, location, gear, water quality data, number of each species captured, length and weight of specimens measured, etc.) were recorded directly onto pre-printed data forms on the boat, during the processing of each collection (Figure 2). The data were subsequently entered into computer spreadsheets to facilitate data summary, analysis, and

presentation. Tables containing detailed information for each of the 2013-2015 fishery collections (which include the time and date of collection, water quality data, tidal stage, number and size ranges of all fish, and the number of all incidental invertebrates and reptiles captured) are presented in an Appendix A.

One of the main goals of the 2013-2015 fishery resource inventory was to compare the results with those from the previous two studies. Since in the previous two surveys fisheries collections were made monthly during the first year, the monthly data from the first years collections had to be converted to be expressed on a seasonal basis. This was accomplished by examining the dates of collection for the monthly sampling and assigning those data to the season in which those sampling dates occurred. Then, the fish collection data were averaged to arrive at a "seasonal" abundance total for each species collected. We used the actual collection dates to assign each collection to its astronomical season in assigning the first year 2001-2002 data (August 2001 to September 2002) and 1987-1988 data (February 1987 to March 1988) to their appropriate "after-the-fact" season. In this manner, spring samples were represented by collections made from March 20 to June 20; collections made between June 21 and September 21 were assigned to summer; autumn collections were made between September 22 and December 20; and winter collection occurred between December 21 and March 19. In a perfect world this would result in using the fisheries collection data from three collections for each of the newly calculated seasonal averages for the 2001-2002 and 1987-1988 first year data. However, this was not always the case. For the 2001-2002 seasonal conversions, although all monthly collections were made during the first year of that study, some of the collection dates pushed some collections into the next season. For example, at seining location S3 the monthly collection for June was collected late in the month, on June 25th, which caused the average calculated for S3 in summer to be based on four collections. Similar situations occurred for some of the 2001-2002 gill net seasonal averages, but the seasonal averages for the 2001-2002 trawl and trap net all were based on three collections per season.

For the 1987-1988 data, calculations to convert the first year of monthly data into seasonal averages presented similar situations as described above for the 2001-2002 data. However, during the 1987-1988 survey, several collections were missed, resulting in no seasonal averages for several sites during winter (e.g., TN1, TN2, TN3 and TN6) and some seasonal averages were based on only one or two collections for certain seasons. All of the seasonal data averages calculated as described above to put all of the first year monthly data into a seasonal format for direct comparison to the 2013-2015 data are included in APPENDIX B. The data tables in Appendix B show the number of collections that were averaged to arrive at the seasonal values for each sampling location. The data shown in Appendix B are what was used to calculate the catch per unit effort values for each species.

2.6.2 Biomass Analysis

Biomass was calculated for every species collected during this study. The data used in the biomass analysis were collected by measuring total length and weight on up to 20 individuals of each species from each collection. If over 20 individuals of a species were collected in a single collection, a representative subsample of 20 was measured (the only exception to this method was that 180 Atlantic Silversides (*Menidia menidia*) were measured from the Summer 2014 collection at site S1). With this method, the percentage of the total catch measured varied widely between the species (as seen in Table 13). Species with a high abundance per occurrence generally had a lower percentage of the total catch measured, and less abundant or less frequently occurring species had a higher percentage measured and weighed. For each species, biomass was calculated by multiplying the average mass of those measured by that species' total abundance.

Biomass calculations for the 2001-2003 data were calculated in the same way as the data from this study. The methods for the 1987-1988 study differed due to the fact that weight data were not collected. To compute biomass, a log-transformed linear regression was computed using the 2001-2003 data, and this equation was used to estimate the weights of the fish collected during the 1987-1988 study. For a more detailed explanation of this method see Bragin et al. (2005).

2.6.3 Ecological Indices Analysis

In the simplest of terms, species diversity can be expressed as species richness (S), which is the number of species in the community. However, this simple measure fails to consider species evenness (the relative abundance of individuals across all species within the community). Consideration of the species richness weighted by species evenness gives a better measure, or index, of the species diversity of the community. We calculated two of the most commonly used indices to compare species diversity, Simpson's index (D) and the Shannon-Weiner Index (H'). Higher values of D and H' represent greater diversity. Both indices are calculated using the proportions (p_i) of individuals in the total sample (N_{total}) that are represented by a given species (i), so that

$$p_i = \frac{n_i}{N_{total}}$$

Simpson's index (D) gives little weight to rare species in comparison to the abundant species. This index has a range between 0 and (1-1/S). Simpson's index was calculated using the equation:

$$D = \frac{1}{\Sigma p_i^2}$$

The Shannon-Wiener index (H') takes into consideration species richness and evenness. The Shannon-Wiener index was calculated using the equation:

$$H' = -\Sigma p_i \ln(p_i)$$

Once H' was known, we used it to calculate an evenness index, Shannon's equitability (EH), using the equation:

$$E_H = \frac{H'}{H'_{max}} \text{ where } H'_{max} = \ln(s)$$

We then used Hutchenson's t-test (Hutchenson, 1970) to statistically compare the Shannon-Wiener indices calculated for the 2013-2015 (H'_1) to that calculated for the data collected during the 2001-2003 fisheries inventory (H'_2). Hutchenson's t-test is given as:

$$t = \frac{|H'_1 - H'_2|}{\sqrt{Var(H'_1) + Var(H'_2)}}$$

where

$$Var(H) = \frac{\Sigma p_i(\ln(p_i))^2 - (\Sigma p_i \ln(p_i))^2}{N} + \frac{S-1}{2N^2}$$

Standard deviation was calculated using the equation:

$$S_d = \sqrt{Var(H')}$$

The results of the Hutchenson's t-test were used to assess the significance of the differences in H' between the 2013-2015 data and the 2001-2003 data. This was done by comparing the calculated t-value to the critical t value for a two-tailed test found at both α=0.05 and α=0.01 with degrees of freedom (v) calculated with the following equation:

$$v = \frac{(Var(H_1') + Var(H_2'))^2}{(Var(H_1'))^2/N_1 + (Var(H_2'))^2/N_2}$$

Error bars were calculated as two standard deviations using the variance of the sample, and estimate significance at α=0.05

3.0 RESULTS

3.1 Fish Community

3.1.1 Overview

A phylogenetic listing of the fishes captured during the 2013-2015 collections is presented in Table 1, which lists the family, common name, and scientific name of each species (according to Page et al., 2013). In subsequent tables, the fish are only listed by common name. Table 1 also provides information on the pattern of utilization for each species (i.e., do they typically inhabit marine, estuarine, and/or fresh water, based on Able, 1999) and the gear types by which each species was captured. A total of 22 families were represented by 33 species that were identified during the 2013-2015 inventory.

A summary of the species composition, total along with relative abundance, and percent frequency of occurrence for fishes and selected bycatch (blue crab, Diamondback Terrapin and Snapping Turtle) captured by each gear type during the two-year study is presented (ranked by total abundance) in Table 2. Between July 2013 and June 2015 a total of 22,860 fish were counted in our 210 collections. A total bycatch of 349 blue crab, 76 Diamondback Terrapin, and two Snapping Turtle were also identified in these collections. The 10 numerically dominant species, which comprised 97% of the total catch, included: Atlantic Silverside (*Menidia menidia*) (43.8% of the total catch); White Perch (*Morone americana*) (32.9%); Mummichog (*Fundulus heteroclitus*) (12.9%); Gizzard Shad (*Dorosoma cepedianum*) (2.3%); Atlantic Menhaden (*Brevoortia tyrannus*) (1.1%); Bay Anchovy (*Anchoa mitchilli*) (1.0%); Striped Bass (*Morone saxatilis*) (0.9%); Striped Killifish (*Fundulus majalis*) (0.9%); Blueback Herring (*Alosa aestivalis*) (0.6%); and Alewife (*Alosa pseudoharengus*) (0.6%). When combined, the remaining 23 species collected made up the remaining 3% of the catch.

While the Atlantic Silverside was the most abundant species, this was due to one exceptional collection, a seine haul from location S1 during the summer of 2014, where 9,412 Atlantic Silverside were captured. This one seine collection captured 94% of all Atlantic Silversides that were counted in all of our 210 collections. While the Atlantic Silverside was the most abundant species, it was not the most frequently encountered species in our collections (Table 2). Atlantic Silverside occurred in only 9% of our collections. While second in terms of its abundance, the White Perch was the most frequently occurring species, captured in 71.4% of all collections (i.e., the White Perch was taken in 150 out of our 210 collections). The Striped Bass, which is closely related to the White Perch, was captured in 25% of our collections. Although the total number of Striped Bass collected was approximately 1/35th that of the White Perch, the Striped Bass was the second most frequently occurring species. The percent frequency data shows that Striped Bass were generally collected in low numbers in many (n=53) collections. The Mummichog was the third most frequently occurring species, captured in 22.4% of all collections. The percent frequency of occurrence also shows that although the number of Blueback Herring and Alewife collected were almost identical (138 vs. 137, respectively), the percent frequency of occurrence for Alewife (found in 11.4% of all collections) was almost double that of the Blueback Herring (6.7%).

Figure 3 shows the total number of fish collected during each season for the top ten species. The data from each season consisted of 30 fishery collections. The exceptional catch of Atlantic Silverside during summer 2014 stands out, as do the large numbers of White Perch taken in summer and autumn 2013, as well as spring and summer 2014. Large catches of Mummichog were taken in summer 2014 and spring 2015. Examination of the same data in a different way (Figure 4) shows the seasonal percent contribution, based on the total number of fish collected, of the 10 most abundant fish species. Figure 4 clearly shows the dominance of the White Perch, Atlantic Silverside (summer 2014), and Mummichog in our 2013-2015 collections.

An overview of the monthly occurrence for the 33 species identified during the current fishery resource inventory is provided in Table 3. Since the sampling during the 2013-2015 inventory was conducted seasonally, and no collections were made during the winter of 2013-14, the number of collections made each month is quite variable. For example, no collections were made during the month of February, while only three collections were made during December. The highest number of collections were made during May, n=45, followed by 44 collections made during October. Not surprisingly, these two months returned the two highest numbers of species, with 22 species captured during October and 19 species during May. Although we only made 17 collections during the July, this is when the highest number of fish specimens was collected (due to the exceptional catch of Atlantic Silverside at site S1 during July 2014).

Resident species such as the White Perch and Mummichog were collected during all months that collections were made. Common Carp were collected during all months except January and February (when no collections were made). Striped Bass were collected during nine months. In contrast, marine transients, such as the Atlantic Moonfish (*Selene setapinnis*), the Crevalle Jack (*Caranx hippos*), and a handful of other species were collected during only one month of the year. With the exception of the Winter Flounder (*Pseudopleuronectes americanus*), the species that were collected during only one month of the year were represented by only one specimen each. Other typically marine species, such as the Bluefish (*Pomatomus saltatrix*) and Weakfish (*Cynoscion regalis*), the young of which seek food and refuge from predators in the estuary, were collected during only a portion of the year. One Bluefish was collected during May, with the remainder collected from July through October. Few Weakfish were taken during the 2013-2015 survey, from July through October. As expected, collections made during

the winter months produced the fewest number of species, with only four species collected during January, eight species taken in December, and nine species collected during March (Table 3).

An overview of the spatial distribution of the 33 species collected is provided in Table 4, where all of the main stem river sampling locations are arranged by river mile, from our downstream-most site (GN1 at RM 3.0) to our upstream-most site (TN6 at RM 12.5). Collections made within tributary creeks have been segregated, in order to see at a glance which species are using which tributaries. Only one species, the White Perch, was collected at each of the 21 sampling locations. The Striped Bass was collected at 18 locations. Although less than 100 Bluefish were collected, they were captured at 16 of our 21 sampling locations. The Mummichog was collected at 15 locations, and the Spot (*Leiostomus xanthurus*) was collected at 14 locations. As shown in Table 4, the total number of species captured at each site ranged from a low of five (GN1) to a high of 15 at sites T4 and T7 (Berry's Creek Canal).

Overall, the seine hauls captured the highest number of fish (as shown in Table 2). This was primarily due to the one exceptional catch of 9,412 Atlantic Silverside at site S1 in the summer 2014 collection. The silversides captured in this one seine haul comprise 71% of all fish captured by seine during the two years of seasonal collections (and 41% of all fish captured during the entire study). High numbers of Mummichog also contributed to the large number of fish collected in the seine hauls. The trap nets captured a combined total of 4,352 fish from 23 species. The trawls captured fewer fish (3,414) compared to the trap nets, but produced the highest species richness (n=26) of the four gear types. The differences in catch between the gear types are directly related to the selectivity of the gear types used. For example, our gill nets were efficient at capturing medium to large sized fish swimming within eight feet of the river bottom (e.g., White Perch and Striped Bass), but did not capture any of the most abundant fishes in the estuary, the Atlantic Silverside and Mummichog, small fishes which typically frequents shallow inshore areas. The Mummichog and other small forage fish typically found in shallow, nearshore waters, such as Striped Killifish and Atlantic Silverside were effectively sampled by the seine. Therefore, summaries of our collection data by gear type are presented in the following paragraphs.

3.1.2 Trap Net Catch

A summary of the percent frequency of occurrence, relative abundance, mean number of fish per collection, and total catch per unit effort (CPUE – for trap nets the total number of fish caught/the total number of hours all trap nets were fished) for all of the trap net collections is presented in Table 5. Six species (White Perch, Mummichog, Blueback Herring, Alewife, Brown Bullhead (*Ameiurus nebulosus*), and Common Carp) comprised 98% of the total trap net catch. The White Perch was not only the most abundant fish caught by the trap net (87.1% of the total), it was also the most frequently occurring (captured in 88.1% of the 42 trap net sets). The Mummichog was second in abundance (3.2% of the trap net catch) and the second-most frequently occurring (in 45.2% of trap net collections). While the Striped Bass comprised only 0.37% of the total trap net catch, they were the third most frequently encountered species, taken in 26.2% of all trap net collections. The trap nets also collected blue crab (n=152), which occurred in 40.5% of all trap net collections, and it was the only gear in which the Diamondback Terrapin (n=76) or the Snapping Turtle (n=2) were collected.

A summary of the catch data (including all of the bycatch) for each trap net location is presented in Table 6. The total number of species collected at each trap net location ranged from 6 at TN1 to 13 at TN6. The total number of fish collected was lowest at TN1 (n=227), and increased moving upriver to TN5, where 1,312 fish were collected. Table 6 also shows that the number of blue crab and

Diamondback Terrapin generally decrease as you move upriver, which would be expected as the River's salinity decreases. Additionally, an extremely large number of amphipods were collected at TN6. Amphipods, a large component in the diet of Hackensack River White Perch (Weis, 2005) are considered an indicator species, as they are among the first taxa to disappear from benthic communities impacted by pollution and have been shown to be more sensitive to contaminated sediments than several other major invertebrate taxa (ASTM, 1990).

The CPUE for all species captured by trap net were calculated for each trap net location, and the CPUE for seven selected species (plus the other 16 species combined) is shown in Figure 5. The CPUE by trap net location was calculated as the total number of each species/total number of hours that the trap nets were fished at that location. As seen in Figure 5, White Perch dominated the catch at all trap net locations. TN5 had the highest CPUE, at 7.59 fish/hour. Blueback Herring, Alewife and Mummichog were notable additions to the CPUE at TN5. The second highest trap net CPUE was 7.13 fish/hour at TN6, where Mummichog and Brown Bullhead were the second and third most abundant species.

A temporal view of the CPUE for the selected species collected by trap net is represented in Figure 6, which shows that the highest CPUE was in autumn 2013 (6.97 fish/hour), closely followed by spring 2014 (6.61 fish/hour), and summer 2013 (5.94 fish/hour). During all seasons except winter 2014-2015, White Perch was the dominant component of the TN catch. Winter trap net collections, dominated by the Mummichog, had the lowest trap net CPUE (0.41 fish/hour).

3.1.3 Trawl Catch

A summary of all trawl collections is presented in Table 7. The following eight species (of the total of 26 species collected by trawl) made up 95% of the catch: White Perch, Bay Anchovy, Mummichog, Spot, Gizzard Shad, American Eel (*Anguilla rostrata*), Striped Bass, and Weakfish. White Perch were the most abundant species collected in the trawl and represented 74% of the total trawl catch. The Bay Anchovy comprised 6.2% of the trawl catch, followed by Mummichog (4.8%). The White Perch was captured in 65% of our 126 trawl hauls. Although the Striped Bass and American Eel each represented only 2% of the total trawl catch, they were tied for the second most frequently occurring species, each being taken in 20.6% of all trawl collections. The blue crab was captured in 42% of the trawl collections.

The catch data for each trawl location are summarized in Table 8. The total number of species captured by trawl ranged from seven at T6 (Sawmill Creek) to 15 at T4 and T7 (Berry's Creek Canal). The lowest total number of fish captured by trawl was in the lower River at T2 (n=63), and the highest total number of fish (due to large catches of White Perch) was collected at T7 (n=1,430). With the exception of site T8 (Mill Creek), the White Perch was the most abundant species captured at every other trawl location. Since the otter trawl is dragged along the bottom of the river, 21 species of invertebrates (the "bycatch") were also collected during the fishery collections. Table 8 also shows that large numbers of bay barnacle and dark false mussels were collected in Cromakill Creek at T9. These invertebrates were invariably attached to debris that came up in the net, such as rocks and/or pieces of wood. Location T5 produced large numbers of estuarine mud crabs (*Rhithropanopeus harrisii*). The blue crab was collected at all trawl locations. The bycatch at T6 (in Sawmill Creek) included three specimens of the not previously reported Oriental shrimp (*Palaemon macrodactylus*). Two specimens of the brown shrimp (*Penaeus aztecus*), which have also never been reported from the Hackensack Meadowlands, were collected at site T7 (in Berry's Creek Canal).

The CPUE (total number of fish captured/minute) for the eight most abundant species taken by trawl are shown by trawl location in Figure 7. The highest CPUE, at 34.05 fish/minute, was at T7 in Berry's Creek Canal, while the lowest was 1.50 fish/minute at location T2. In almost all cases, the trawl CPUE was dominated by White Perch. Exceptions were at T5, where Bay Anchovy contributed to the catch and at T8 where the Mummichog made up a large portion of the catch.

The CPUE expressed on a seasonal basis is shown in Figure 8. The highest seasonal CPUE for the trawl collections were during the summers of 2013 and 2014, where the CPUE were almost identical. Autumn of 2013 had the third highest trawl CPUE, followed by the autumn of 2014. The CPUE for trawls during the spring and winter seasons was low. The seasonal trawl CPUE was dominated by White Perch, with contributions of Spot in summer 2013, Bay Anchovy in autumn 2013 and 2014, and Mummichog during summer 2014.

3.1.4 Seine Catch

A total of sixteen species were captured by seine (Table 9). Four species comprised 99% of all fish taken by seine. As one might expect from gear that sampled shallow, inshore estuarine waters, Atlantic Silverside were the most abundant (75% of the total seine catch), followed by Mummichog (20%), White Perch (3%), and Striped Killifish (1.5%). Although the Atlantic Silverside was the most abundant species (due to the one exceptional catch at S1 during spring 2014), it occurred in only 57% of our seine collections. The Mummichog was captured in 81% of the 21 seine hauls. The highest species richness in the seine collections was recorded at S3 (n=11 species), while the seven seine collections at S1 produced the most fish (n=9,694) (Table 10). Again, the high total number of fish collected at S1 was due to the exceptional catch of Atlantic Silverside in summer 2014. If those 9,412 Atlantic Silverside were discounted, S3 would have produced the highest number of fish collected by seine.

The CPUE (total number of fish per seine haul) for the four most abundant species captured by seine are shown by location in Figure 9. At the lower river seine location (S1), Atlantic Silverside dominated the catch, while upriver at S3 the Mummichog was abundant. The CPUE at the mid-District seine location (S2) was more evenly split between Mummichog and White Perch. The high CPUE of the Atlantic Silverside evident in Figure 9 at location S1 is due to the exceptional catch of this species during the summer 2014 collection (see Table A-16 in Appendix A).

The monthly seine CPUE is shown in Figure 10, where the high catch of Atlantic Silverside during summer 2014 skews the scale of the graph. Also evident from this Figure is the large number of Mummichog taken during summer 2013, autumn 2014 and spring 2015, and the drop-off in catch during winter 2014-2015, where the low number of fish captured does not even register given the scale of this graph.

3.1.5 Gill Net Catch

The gill nets collected 15 species, the lowest species richness of any gear type sampled (Table 11). White Perch, Gizzard Shad, Atlantic Menhaden, Striped Bass and Common Carp made up 94% of the total gill net catch. White Perch were the most abundant species taken by gill net (45% of the total catch). Gizzard Shad comprised 24.3% of the catch, while Atlantic Menhaden (13%), Striped Bass (6.8%), and Common Carp (5%) were also relatively common. In addition to being the most abundant species, the White Perch was also the most frequently occurring (collected in 95% of all gill net sets). Although the Striped Bass only made up 6.8% of the total gill net catch, they were captured in 71% of

all gill net collections. Table 12 provides a summary of the catch for each gill net location. The gill net farthest downstream (GN1) captured the lowest number of fish (n=105). This may have been due to the high amount of the tug boat and barge traffic associated with the construction of the new Route 7 bridge pilings, just downstream from the location of GN1, which was ongoing during our two-year sampling period. The highest number of fish taken by gill net (n=960), and the highest species richness of any gill net location (n=11 species) was seen at the farthest upstream gill net site (GN3, in Overpeck Creek). All of the Gizzard Shad collected by gill net were taken at GN3, as were 91 of the total of 94 Common Carp collected in the gill nets. The highest number of Striped Bass taken by gill net was also at GN3. The blue crab was collected at each gill net location. The other incidental invertebrates shown on Table 12 captured during the gill net collections were either associated with debris that was pulled in with the nets, or, in the case of the two blue mussels (Mytilus edulis) were attached to a blue crab that was captured in GN2. Blue mussel had not been previously reported from the Hackensack Meadowlands.

The CPUE (total number of each species/total hours that each gill net was set) for the five most abundant species captured in the gill nets is shown by location in Figure 11. The trend of increasing CPUE as we moved upstream into the fresher portion of the River is evident here, as it was with the trap net catch. White Perch and Atlantic Menhaden composed the majority of the lower and mid-river gill net collections (GN1 and GN2, respectively). The Gizzard Shad was the most abundant species collected in Overpeck Creek at GN3 (see Table 12 and A-21).

The seasonal CPUE for the gill net collections are shown in Figure 12. The high CPUE of Gizzard Shad during summer 2013 and 2014 are due to the catch at GN3, the only gill net location where they were collected. The White Perch comprised the majority of the gill net catch during the other seasons.

3.2 Biomass

Section 2.6.2 describes how the biomass data were calculated. Table 13 provides a summary of the total number of fish collected, measured and weighed. That table also shows the minimum, maximum and average lengths and weights, as well as the total calculated biomass for all species collected during the 2013-2015 study. Since only 20 of each species recovered in each collection were weighed and measured, species collected in large numbers (e.g., Atlantic Silverside, White Perch, Mummichog) had the lowest number of individuals weighed/measured. For example, Table 13 shows that of the total of 7,512 White Perch collected, 1,884 (25.1%) were weighed/measured. Conversely, species captured in lower numbers (typically less than 20 per collection), had a much higher percentage that were weighed/measured. This is illustrated in Table 13 which shows that 84 of the total of 93 Brown Bullhead captured (90.3%) were weighed/measured.

The biomass distribution was very different from the abundance distribution during 2013-2015 (Figure 13). While the average size of the White Perch was not amongst the largest of the 33 species collected, the large number of White Perch captured (n=7,512) along with their average weight of 109.9 g made this species the largest contributor to the total biomass. White Perch comprised 51.5% of the total biomass (Table 13), while accounting for only 33% of the total abundance (Table 2, Figure 13). Common Carp had the highest average, maximum, and minimum weights. Because of their large size, Common Carp made up 28.6% of the biomass while representing only 0.6% of the total abundance. Atlantic Menhaden and Striped Bass each represented 5.22% of the total biomass, while contributing 1.1% and 0.9% to the total catch. Gizzard Shad comprised 2.4% of the biomass and 2.3% of the abundance. The aforementioned five species, which were the top five in terms of biomass, comprised 93.0% of the total biomass but only 37.8% of the total abundance. The diminutive Atlantic Silverside,

which made up 43.8% of the total abundance, made up just over 1% of the total biomass largely due to its low average weight of 1.8 grams. Fifteen species, many represented by only one specimen each, contributed 0.01% or less to the total biomass. The total calculated biomass of all 22,860 fish collected during the 2013-2015 survey was 1,601 kilograms (3,529.6 pounds).

3.3 Water Quality

The water quality data recorded during each collection is provided in Appendix A, Tables A-1 through A-21. The water quality data recorded during each fishery collection was organized so that spatial (Table 14) and seasonal (Table 15) trends could be examined. Brief summaries of the ranges in water quality parameters measured during the recent study are provided here. Overall, surface salinity ranged from a low of 0.40 $^{o}/_{oo}$ at GN3 in spring 2014 to 18.65 $^{o}/_{oo}$ at T1 during autumn 2013. Bottom salinity ranged from 1.15 $^{o}/_{oo}$ at T5 and GN3 in spring 2013 to 18.94 $^{o}/_{oo}$ at T1 in autumn 2013. Surface water temperatures ranged from -0.2 °C at TN4 during winter 2014-2015 (when the net was surrounded by ice on its retrieval) to 27.6 °C at S1 during summer 2014. Bottom water temperatures ranged from 2.6 °C at GN3 during winter 2014-2015 to 26.8 °C during summer 2014 (at site T3). Dissolved oxygen (DO) at the surface ranged from a low of 2.29 ppm at T7 during spring 2015 to 12.76 ppm at GN3 during summer 2014. A total of 144 surface DO measurements were made during the study, of which 21 (14.6%) were below the NJDEP water quality criteria of 4.0 ppm. Bottom water DO levels ranged from 1.30 ppm at GN3 during spring 2014 to 9.96 ppm at T8 during winter 2014-2015. A total of 84 bottom DO measurements were recorded, with 28.6% falling below the 4.0 ppm State criteria. Surface water pH measurements ranged from a low of 7.14 during autumn 2013 at T9 to a high of 8.87 at GN3 during winter 2014-2015. Bottom water pH measurements ranged from 7.16 at T9 (autumn 2013) to 8.64 at GN3 (winter 2014-2015). Secchi depths, a measure of water clarity, ranged from a low of 20 cm at our most upriver site TN6 (during spring 2015) to a high of 165 cm at T1 (autumn 2013).

To provide spatial trends, mean values for all surface and bottom salinity, temperature, pH, DO, and the Secchi depth were arranged by RM starting with the downstream-most site (GN1 at RM 3.0), ascending to the upstream-most site (TN6, near RM 12.5) (Table 14). For the purposes of examining the water quality data, sampling locations that were within tributaries (T6, TN2, T7, T8, T9, and GN3) were placed according to the order of where the tributary joined the river (e.g., the mouth of Sawmill Creek, where site T6 is located, is at RM 5.1) in Table 14.

The water quality data from the 12 sampling locations where both surface and bottom readings were obtained (i.e. trawl and gill net locations) were extracted from Table 14 and are shown graphically in Figure 14. As expected in an estuarine system, the highest average salinities occurred downriver (at GN1 and T1), and decreased moving upriver to GN3. The salinity chart within Figure 14 also shows that the average bottom salinities are generally slightly higher than the average surface salinities. Exceptions occur at sites T6 and T8, where the average surface and bottom salinities are almost identical. The chart showing average pH values within Figure 14 shows that, with the exception of the average bottom pH at site GN3, the pH values fell within a very narrow range, and the average surface pH was higher at the surface from site T2 all the way upriver. Average temperatures were slightly higher at the surface, except at sites GN1, T1, T3, and T9, where the average surface and bottom water temperatures were almost identical. The highest average temperatures were recorded at mid and up-river sites T3, T8, T4, and T5, while the lowest average temperature was recorded at GN3. The average Secchi depths (shown for all 21 sampling locations on Figure 14) show that water clarity was highest at the southernmost sampling location (GN1), and generally decreased as we moved upriver.

On a spatial basis, the average DO level fell below the NJDEP's water quality criteria for saline waters of 4.0 ppm at only one location – the average bottom value (3.9 ppm) for site T5 (see dissolved oxygen chart in Figure 14). However, the DO criteria are based on minimum, rather than average values. The percentage of individual seasonal surface DO measurements that were below the criteria ranged from 0% (at 11 sites – S1, TN1, TN2, TN3, TN4, TN5, TN6, T1, T2, T6, and GN3) to 43% at T4, T7, and T8. Seasonal bottom DO measurements below the criteria ranged from 0% at T1, T2, and T6 to 57% at T4 and T5. At several lower river sites (GN1, T1, T6 and T2), the average surface and bottom DO levels were the same. At the remainder of sites, the surface DO was only slightly higher than the bottom DO, except at sites T5 and GN3, where the difference was pronounced.

The water quality data were also examined on a temporal basis by calculating averages using the data from the seven seasonal collections performed at each of the 21 sampling locations (Table 15). Graphic representations of these data are presented in Figure 15. An examination of the average seasonal salinity chart (within Figure 15) shows that, averaged across the Meadowlands District, the lowest salinities during our study period occurred during the spring 2014 and the highest salinities were during autumn 2013. The average bottom water salinity was always slightly higher than the surface salinity, except during winter 2014-2015, when they were almost identical. The average monthly pH values were lowest during autumn 2013 and highest during winter 2014-2015. As expected, the average monthly water temperatures were lowest during the winter and highest during the summer. On a seasonal basis, the temperature chart shows that there was little difference between the average surface and bottom water temperatures. The average seasonal DO values were lowest during spring 2014, and were highest during winter 2014-2015. The average surface DO was always above the 4.0 ppm State criteria. However, the number of individual measurements that fell below the criteria ranged from 0% during autumn 2014 and winter 2014-2015 to 38.1% during spring 2014. The average bottom DO value dipped slightly below the State criteria (to 3.9 ppm) during spring 2014. Individual bottom DO measurements below the criteria ranged from 0% during autumn 2014 and winter 2014-2015, to 50% during spring 2014. In terms of water clarity, the average seasonal Secchi depths show that the River's clarity was highest during autumn 2013, and was lowest during summer 2013.

Based on the salinity, pH, temperature, and DO charts shown in Figure 15, it appears that the water column of the Hackensack River within the Meadowlands District is well mixed, rather than being stratified.

4.0 DISCUSSION

Since one of the main goals of the 2013-2015 fishery inventory was to compare the newly collected data to that collected by the HMDC/NJMC during the previous studies, this section will focus on that comparison. A direct comparison of the total abundance data (by gear type) from each of the three study periods for each species collected is presented in Table 16. During the 1987-1988 inventory, 433 collections produced 36 species and a total of 61,718 fish. The full complement of monthly collections in the first year and seasonal collections in the second year resulted in 480 collections during the 2001-2003 study, which yielded 40,490 fish from 39 species. During the 2013-2015 survey, when collections were made on a seasonal basis, 210 collections recovered a total of 22,860 fish from 33 species. Although we made many fewer collections in 2013-2015 than during either of the previous two surveys, eight species were collected in higher numbers than were captured during the 2001-2003 study. These included the Atlantic Silverside, Bay Anchovy, Common Carp, Hogchoker (*Trinectes maculatus*), Naked Goby (*Gobiosoma bosc*), Spot, Threespine Stickleback (*Gasterosteus aculeatus*), and Yellow Perch (*Perca flavescens*).

As shown in Table 16, six species were collected (in low numbers) during 1987-1988 that were not encountered during either the 2001-2003 or the 2013-2015 collections; Conger Eel (*Conger oceanus*), Rainbow Smelt (*Osmerus mordax*), Seaboard Goby (*Gobiosoma ginsburgi*), White Catfish (*Ameiurus catus*), Windowpane (*Scophthalmus aquosus*), and Golden Shiner (*Notemigonus crysoluecus*). There were six species that were collected during both the 1987-1988 and 2001-2003 surveys that were not seen in 2013-2015, namely the American Shad (*Alosa sapidissima*), Bluegill (*Lepomis macrochirus*), Goldfish (*Carassius auratus*), Green Sunfish (*Lepomis cyanellus*), Spotted Hake (*Urophycis regia*), and the Striped Mullet (*Mugil cephalus*). Four species were collected only during the 2001-2003 study; the Alligator Gar (*Atractosteus spatula*, undoubtedly an aquarium release), Largemouth Bass (*Micropterous salmoides*), Lookdown (*Selene vomer*), and the Striped Searobin (*Prionotus evolans*). Finally, we collected four species (each represented by only one specimen) during the 2013-2015 survey that were not encountered in any of the 913 collections made during the previous two surveys; Atlantic Moonfish, Freshwater Goby (*Ctenogobius shufeldti*), Northern Searobin (*Prionotus carolinus*), and the Oyster Toadfish (*Opsanus tau*). This brings the total number of species collected in the Hackensack Meadowlands by the HMDC/NJMC/NJSEA in 1,123 collections made during the three fisheries inventory studies to a grand total of 49.

Since the number of collections varied between the three surveys, the data in Table 16 were used to calculate the relative abundance of each species captured during the three surveys as a way to more equitably consider total abundance data. Figure 16 presents a comparison of the relative abundance of the 10 most abundant species collected during 2013-2015 versus their relative abundance during the previous two surveys. Between the 1987-1988 and 2001-2003 surveys, there was a large decrease in the abundance of Mummichog, and a large increase in the abundance of White Perch and Atlantic Silverside. These three species comprised 91% of all fish captured in 1987-1988, and 84% during the 2001-03 survey. During the 2013-2015 collections, this pattern continued, as the relative abundance of Mummichog decreased from 41% of all fish captured in 2001-2003 to 13% during the 2013-2015 study. This is likely due to the lower number of seine collections made during the 2013-2015 survey compared to the other years. The seine is the gear type most likely to capture Mummichog. The relative abundance of White Perch increased from 28% of the catch in 2001-2003 to 33% in the 2013-2015 collections. The abundance of Atlantic Silverside increased from 16% of the 2001-2003 catch to 44% of the 2013-2015 catch. This was due to the one exceptional seine haul collected at site S1 during summer 2014, as discussed in section 3.1.1. These three species comprised 90% of the total catch during the 2013-2015 study, and while this seems similar to the 91% that these three species comprised during the 1987-1988 study, a quick glance at Figure 16 reveals how the proportions of these three species has changed over the ensuing 28 years. Of the other species shown on Figure 16, the relative abundance of four species decreased from 2001-2003 to 2013-2015. These include the Gizzard Shad, which made up 4.0% of the 2001-2003 catch, but fell to 2.3% during the current survey; Striped Bass fell from 2.7% to 0.9%; Striped Killifish fell from 3.1% to 0.9%; and the Blueback Herring fell slightly from 0.9% to 0.6%. Species that increased in relative abundance compared to the 2001-2003 study were the Atlantic Menhaden (from 0.8% to 1.1%), Bay Anchovy (from 0.2% to 1.0%), and Alewife, which saw an increase from 0.3% in the 2001-2003 collections to 0.6% in the 2013-2015 collections.

The percent frequency with which each species was captured (i.e., the number of collections that yielded a particular species divided by the total number of collections made) during each of the three studies was also compared (Table 17). A close examination of Table 17 shows that of the 29 species collected in both the 2013-2015 and 2001-2003 surveys, 19 species had a higher percent frequency of occurrence in 2013-2015 compared to 2001-2003. The Spot showed the largest increase in frequency of occurrence

(+8.1% over that of 2001-2003), followed by the Bay Anchovy (+6.6%), the American Eel (+6.2%), White Perch (+4.7%) and Common Carp (+4.5%). Ten species occurred with less frequency in 2013-2015 when compared to the 2001-2003 collections. The Striped Bass showed the largest decline in frequency of occurrence (-19.8%), followed by Weakfish (-6.8%), Mummichog (-4.9%) and Inland Silverside (*Menidia beryllina*) (-3.8%). And while the Atlantic Silverside had the highest abundance during the 2013-2015 collections, its percent frequency of occurrence declined by 1.9% when compared to the 2001-2003 collections.

Figure 17 shows a comparison of the percent frequency of occurrence of selected fish species (as well as blue crab and Diamondback Terrapin) for all three study periods. Of the 13 fish species shown on this graph, four showed a trend of increasing percent frequency of occurrence between the 1987-1988, 2001-2003 and 2013-2015 collection periods (Alewife, Bluefish, Brown Bullhead, and White Perch). The Mummichog showed a decreasing trend in percent frequency of occurrence over the three study periods. Three species (American Eel, Blueback Herring, and Spot) had a higher percent frequency of occurrence during the 1987-1988 collections than in 2001-2003, but the frequency of occurrence went up during in the 2013-2015 collection. Conversely, the percent frequency of occurrence for four species (Atlantic Silverside, Gizzard Shad, Striped Bass, and Striped Killifish) rose between 1987-1988 and 2001-2003, and then fell during 2013-2015. The Diamondback Terrapin showed an increasing trend in frequency of occurrence over the three study periods. Although the terrapin was only collected in the trap nets during each study period, the percent frequency of occurrence values shown on Table 17 and in Figure 17 were calculated the same as for each fish species (i.e., using all of the fishery collections made during each survey period). Finally, the frequency of occurrence for the blue crab rose during the 2001-2003 collections, but decreased between 2001-2003 and 2013-2015.

Comparisons of the biomass data for each of the three study periods are shown in Figure 18. The upper chart presents the comparison of total biomass for the top ten species (when ranked by biomass using the 2013-2015 data). Given the disparity in the number of collections between the three studies, and in order to put the biomass comparison on an even footing, the biomass data for each time period were expressed as relative biomass (see lower chart on Figure 18). The relative biomass comparison shows that the relative biomass of the White Perch, Common Carp, Atlantic Menhaden, and Atlantic Silverside each increased over the three study periods. The Common Carp showed the largest increase in biomass (+13.3%) between 2001-2003 and 2013-2015. During the 2013-2015 study, the White Perch and Common Carp comprised 80% of the total biomass. It is interesting to note that the majority of the Common Carp (69%) captured in 2013-2015 were collected from Overpeck Creek (in GN3). The Common Carp were consistently the largest species of fish caught during each survey, hence their large contribution to the biomass when compared to the number caught. The Mummichog, Brown Bullhead and "all other species combined" exhibited a decreasing trend in relative biomass between the three study periods. The Striped Bass showed the largest decrease in relative biomass (-8.2%) between the 2001-2003 and 2013-2015 studies.

In order to examine the data from the three studies in greater detail, and to repeat the manner with which the 2013-2015 results were presented in Section 3, a comparison of the catch data from the three study periods are presented by gear type. Because of the disparity in the numbers of collections during each of the collection periods, the gear type comparisons were done using catch per unit effort (CPUE) data.

4.1 Comparison of Trap Net Collections

Table 18 presents a comparison of the percent frequency of occurrence, relative abundance, mean number collected per net set, total CPUE, and total abundance for all trap net collections made during the three study periods. Although the number of 2013-2015 TN collections were just under half of the number made during the 1987-1988 collections, and amounted to only 44% of the collections made in 2001-2003, two species (Alewife and Common Carp) were collected in higher numbers when compared to the 2001-2003 TN collections. The most abundant species collected by TN in 2013-2015, the White Perch, exhibited the highest total CPUE, mean number collected and relative abundance of all three study periods, while its percent frequency of occurrence was almost identical to that seen in the 2001-2003 TN collections. The second-most abundant species collected by TN in 2013-2015 (Mummichog) showed a continuing decline over the previous two collection periods, with the percent frequency of occurrence, relative abundance, mean number collected, and total CPUE falling from the highs in the 1987-1988 TN collections. Blueback Herring, Alewife, and Common Carp each had a higher percent frequency of occurrence, relative abundance, mean number per net, and total CPUE in 2013-2015 compared to 2001-2003. And while total CPUE's for Bluefish, Pumpkinseed and Yellow Perch were similarly low, the percent frequency of occurrence, relative abundance and mean number per net were higher in the 2013-2015 collections compared to 2001-2003. Finally, Atlantic Moonfish and Summer Flounder (*Paralichthys dentatus*) were collected by TN in 2013-2015, but not during the two previous surveys.

Figure 19 shows the CPUE and species richness (i.e., the total number of species collected, along the right axis) at each of the TN locations for five selected species (plus all other species combined) for all three study periods. In terms of species richness, Figure 19 shows that the 2013-2015 TN collections returned the lowest number of species of any of the three study periods at each TN location. This is due to the reduced sampling effort during the 2013-2015 surveys, when less than half the number of collections were made when compared to the 1987-1988 and 2001-2003 collection periods. Figure 19 also shows the decrease in CPUE for Mummichog collected by TN, and the increasing CPUE for White Perch over the three study periods, especially at the upriver sites TN5 and TN6.

4.2 Comparison of Trawl Collections

A comparison of the percent frequency of occurrence, relative abundance, mean number collected per trawl, total CPUE, and total abundance for all trawl collections is presented in Table 19. Despite making less than half of the trawl collections as were made during the 2001-2003 study, five species (Bay Anchovy, American Eel, Spot, Atlantic Silverside, and Threespine Stickleback) were collected in higher numbers by trawl in the 2013-2015 collections. Those five species also had a higher total CPUE, mean number per trawl, relative abundance, and percent frequency of occurrence compared to the 2001-2003 collections. Although slightly fewer White Perch were collected by trawl in 2013-2015 compared to 2001-2003, they had a higher total CPUE, mean number per trawl, relative abundance, and percent frequency of occurrence compared to either the 2001-2003 or 1987-1988 trawl collections. And while the relative abundance of Brown Bullhead, Atlantic Menhaden, Atlantic Tomcod (*Microgadus tomcod*), Summer Flounder, and Atlantic Croaker (*Micropogonais undulatus*) were lower in 2013-2015 than in 2001-2003, they all had a higher percent frequency of occurrence in 2013-2015. The species that showed lower percent frequency of occurrence, relative abundance, mean number per trawl and a lower total CPUE during 2013-2015 compared to 2001-03 included Striped Bass, Mummichog, Gizzard Shad,

Weakfish, Blueback Herring and Alewife. Four species collected in 2013-2015 by trawl had not been collected by trawl in the previous two surveys, including Oyster Toadfish, Freshwater Goby, Naked Goby, and Hogchoker.

Figure 20 shows the CPUE (left axis) and species richness (right axis) for each trawl location for six selected species (and all other species combined) for each survey period. In the main stem River trawls the CPUE at T1 was almost the same between 2013-2015 and 2001-2003, while at T2 and T5 the 2013-2015 CPUE was lower than in the 2001-2003 collections. The CPUE was higher in 2013-2015 compared to the 2001-2003 collections at T3 and T4. In the tributaries, the CPUE at T6 (Sawmill Creek) was almost identical in 2013-2015 and 2001-2003, with the White Perch being the main contributor in both collection periods. The CPUE was much higher in 2013-2015 compared to 2001-2003 at T7 (Berry's Creek Canal), mainly due to the large numbers of White Perch captured there in the 2013-2015 collections. However, the CPUE during 1987-1988 at T7 was the highest recorded by trawl of any of the three surveys, mainly due to the high numbers of Bay Anchovy captured in Berry's Creek Canal during the 1987-1988 collections. The CPUE at T8 was lower in 2013-2015 compared to 2001-2003, while 2013-2015 CPUE at T9 was a bit higher than in 2001-2003. The White Perch was the largest contributor to the total CPUE at all trawl locations (except at T8) during the 2013-2015 surveys (which is most evident at T3, T4 and especially T7). At T8, the Mummichog was the largest component of the 2013-2015 CPUE.

With regard to the total number of species collected at each of the trawl sites, in the main stem of the river the total number of species collected at T1 and T2 was lower in 2013-2015 than during either of the two previous surveys. At T3, the total number of species collected in 2013-2015 was the same as in 2001-2003. At T4 and T5 the total number of species collected in 2013-2015 was higher than in either of the previous two surveys. For the tributary trawl locations, T6, T7 and T8 produced a lower total number of species in 2013-2015 compared to 2001-2003, while at T9 the total number of species collected was identical in 2001-2003 and 2013-2015.

4.3 Comparison of Seine Collections

Comparisons of the percent frequency of occurrence, relative abundance, total CPUE, and total number of fish collected by seine during each of the three study periods are shown in Table 20. Although less than half the number of seine hauls were made in 2013-2015 compared to either of the other two study periods, more Atlantic Silversides were collected during the 2013-2015 survey (due to the exceptional seine haul at S1 in summer 2014, as discussed in Section 3.1.1). While this resulted in a greater total CPUE and relative abundance in the 2013-2015 collections than during either of the previous two collection periods, the percent frequency of occurrence of Atlantic Silverside was lower in 2013-2015 than in 2001-2003. Conversely, there were several species where the total CPUE and relative abundance were lower in 2013-2015 compared to 2001-2003, but showed a greater percent frequency of occurrence (e.g., Mummichog, Striped Killifish, White Perch, Crevalle Jack, Spot, and Alewife). All of the metrics shown on Table 20 were lower in 2013-2015 compared to 2001-2003 for the Inland Silverside and Striped Bass. For the Inland Silverside, this is due to the higher salinities measured at seine locations S2 and S3 over the years since the 1987-1988 collections were made. Three species were collected in the 2013-2015 seine collections that were not collected by seine in either of the previous two surveys; Threespine Stickleback, Yellow Perch, and Naked Goby.

Figure 21 presents a comparison of the CPUE for five selected species and the total number of species collected at each seine location for each of the three study periods. The total number of species

collected at S1 and S2 was lower in 2013-2015 when compared to either 1987-1988 or 2001-2003. At S3 the total number of species collected in 2013-2015 was higher than in either of the two earlier collection periods. The highest number of species collected by seine was 15, at S2 during the 2001-2003 collections. The CPUE at S1 increased over each of the previous collection periods, with the increases during the 2001-2003 and 2013-2015 collections attributable to large collections of Atlantic Silversides [especially during August 2001 and summer 2003 (August) and the one exceptional seine haul from summer 2014]. At S2 the CPUE decreased from its highest point during the 1987-1988 collections (when Mummichog dominated the catch) to its lowest level during the 2013-2015 collections. A similar situation is also seen at S3, where the Mummichog continues to dominate the catch, although the decrease in CPUE across the years at S3 is less pronounced.

4.4 Comparison of Gill Net Collections

Table 21 presents the comparisons of percent frequency, relative abundance, mean number of fish per net, total CPUE (total number of each species/total gill net sampling time), and total abundance for all gill net collections for each study period. Despite making only half the number of 1987-1988 gill net collections, and a bit under half of the number of 2001-2003 gill net collections, higher numbers of Gizzard Shad, Atlantic Menhaden, Common Carp, Bluefish, and Spot were collected by gill net during the 2013-2015 survey. All species collected by gill net in 2013-2015, except for two (Gizzard Shad and Black Crappie (*Pomoxis nigromaculatus*)) had a higher percent frequency of occurrence compared to the previous two surveys. Five species collected by gill net in 2013-2015 (White Perch, Striped Bass, Brown Bullhead, Black Crappie and Alewife) had lower relative abundances compared to 2001-2003. The mean number collected per gill net was higher in 2013-2015 compared to 2001-2003 for all species except two. These were the Brown Bullhead and Black Crappie, each of which was barely below the mean numbers seen in 2001-2003. Total CPUE was equivalent (Brown Bullhead) or higher in 2013-2015 for all other species collected by gill net when compared to the two previous survey periods. Finally, three species (Northern Searobin, Yellow Perch, and Hogchoker) that had not been collected by gill net in the previous two surveys were collected by gill net in 2013-2015.

Figure 22 shows the CPUE and species richness at each gill net location over the three study periods for five selected species (plus all other species combined). Species richness (total number of species collected) at GN1 in 2013-2015 was lower than either 1987-1988 or 2001-2003. At GN2, the total number of species collected in 2013-2015 was higher than in 2001-2003, but equal to that seen in the 1987-1988 collections. The highest species richness at any gill net site during any of the three study periods was at GN3 during the 2013-2015 collections, when 11 species were captured. The CPUE at GN3 during the 2013-2015 collection period was also the highest of any gill net site during the three study periods. The large numbers of Gizzard Shad and Common Carp (included in the "all other species" category on Figure 22) contributed to this distinction. The CPUE at GN2 was highest during the 2013-2015 collections, mainly due to the large numbers of White Perch and Atlantic Menhaden collected there. The CPUE at GN1 was lower during the 2013-2015 collections compared to 2001-2003, due to the lower numbers of White Perch collected in 2013-2015. The in-river bridge construction work that was ongoing during the 2013-2015 collection period may have also contributed to the lower CPUE seen at GN1.

4.5 Water Quality

The average values of the surface readings measured during all three study periods for salinity, temperature, DO, and Secchi depth are graphed by site (in ascending order, starting from our

downstream-most location) in Figure 23. The comparison of the average salinity for all 21 sampling locations for each study period (top panel in Figure 23) reveals a similar pattern during each survey. As expected in an estuarine system, the highest salinities were recorded at the downstream-most sampling locations (i.e., those closest to Newark Bay), with the average salinity falling as we moved upstream. With the exception of the average salinity at site GN3 (in Overpeck Creek), during 2013-2015, the average salinities were lowest during the 1987-1988 survey. The highest average salinities were observed during the 2001-2003 study, while the average salinities calculated using the 2013-2015 study were intermediate between those observed during 1987-1988 and 2001-2003 (except at site GN3).

The average surface temperature comparison is presented in the second panel on Figure 23. The range of average surface temperatures during the 2013-2015 study fell within the narrowest range (4.9° C) of the three time periods, which was closely followed by a range of 5.1° C for 2001-2003. Average surface temperatures were higher during the 1987-1988 study (when three power plants were discharging heated once-through cooling water into the River) which exhibited a range of 7.8° C across all sampling locations. However, the temperature data from the 1987-1988 study are skewed a bit to the high side, as seen by the temperature spikes at the trap net sites, as no trap net collections were made during December, January, or February during the 1987-1988 study. In fact, the opposite can be seen in the 2013-2015 average surface temperature data, where the lowest average temperatures were calculated for the trap net locations (which were sampled around the time of predicted low water). Some of the highest average surface temperatures during the 2013-2015 study were seen at GN1 and the main stem trawl locations, which were often sampled at or near high tide.

Comparisons of the average surface DO readings are presented in the third panel of Figure 23. In 2013-2015, we saw the highest average DO readings compared to the other two study periods at eight of our 21 sampling locations (TN1, T1, TN3, TN4, TN5, T5, GN3, and TN6). Since the trap net locations had the lowest average temperatures, and given the inverse relationship between water temperature and DO (the lower the water temperature, the more oxygen the water can hold), it is not surprising that the trap net sites had some of the highest DO readings in 2013-2015. The average surface DO was the lowest across the three study periods in 2013-2015 at three sites (GN1, GN2 and T3). The average surface DO in 2013-2015 was identical (or nearly so) to that calculated in 2001-2003 at two locations (T2 and T4), and at four locations compared to the 1987-1988 DO (T6, TN2, S2 and S3).

It is encouraging to note that, in 1987-1988, 77% of all surface DO readings (n=272) were above the regulatory criteria of 4 mg/l. The percentage of surface DO measurements above the State criteria rose to 85% (based on 330 measurements) during 2001-2003, and during the 2013-2015 study, 85.4% of all surface DO readings (n=144) were above 4 mg/l. A similar, although less dramatic improvement was noted in the bottom DO measurements between 1987-1988 and 2001-2003, when a total 70% of the bottom DO measurements (n=202) were above 4 mg/l during 1987-88. During 2001-03, the number of DO measurements above 4 mg/l rose to 77% (n=186 measurements). During the 2013-2015 study, 71.4% of all bottom DO measurements (n=84) were above the 4 mg/l criteria. When all 2013-2015 DO measurements (surface and bottom) are considered (n=228), 80.3% were above the 4 mg/l criteria.

The comparison of the average Secchi disk water clarity measurements are shown in the bottom panel on Figure 23. During the 2013-2015 study, water clarity was highest at GN1, our downstream-most sampling station, and the average water clarity was the lowest at our upstream-most site, TN6. This pattern of water clarity decreasing as one moves upriver comports with the pattern of decreasing clarity moving upstream seen in the 1987-1988 and 2001-2003 Secchi disk readings. In general, average water clarity was usually higher at most sampling locations (13 of 21) during the 2001-2003 study.

4.6 Analysis of Ecological Indices

To determine if any changes in the fish community were significant, as revealed by our collections, between the 2013-2015 and 2001-2003 surveys, the statistics of community structure calculated were analyzed using an adapted t-test to statistically compare the fish community data. We applied the t-test described in Section 2.6.3 to the paired data sets for each of the 21 sampling locations. The results of the ecological index calculations by individual site locations (grouped by gear type) are presented in Table 22. This site-by-site comparison revealed that the Shannon-Wiener diversity index was significantly different (at both the p=0.05 and 0.01 levels) at 16 of our 21 sampling locations. For the 2013-2015 collections, three sites had a significantly higher diversity index when compared to the 2001-2003 data (GN1, T8 [Mill Creek] and T9 [Cromakill Creek]). The diversity indexes calculated for five sites (GN2, GN3 [Overpeck Creek], T2, T4, and T5) were not significantly different between the 2013-2015 and 2001-2003 collections. The remaining 13 sites had a significantly higher diversity index during the 2001-2003 collections (T1, T3, T6 [Sawmill Creek], T7 [Berry's Creek Canal], and all six Trap Net and all three Seine locations).

4.7 Summary

The collections made during the NJMC/NJSEA's 2013-2015 fishery resource inventory represent the third survey of the fisheries resources within the Hackensack Meadowlands District over a 28 year period. The initial survey, done during 1987-1988 showed a fish community dominated by Mummichogs, with much smaller numbers of game fish such as White Perch, Striped Bass, Bluefish, and Weakfish. During the 1987-1988 study, the Mummichog was the most abundant species collected by seine (91% of the total seine catch), trap net (86%), and trawl (66%). No mummichogs were collected in the gill nets. The Atlantic Tomcod was the most abundant species captured by gill net in 1987-1988.

During the 2001-2003 survey, the Mummichog continued to be the most abundant species captured by seine (46% of total seine catch) and trap net (48% of total trap net catch), while in the trawls the White Perch was the most abundant species (58% of total trawl catch). The White Perch was also the most abundant species captured in the gill nets in 2001-2003 (58% of total gill net catch). In contrast to the 1987-1988 collections, the Atlantic Tomcod was not captured by gill net in 2001-2003. Only five Atlantic Tomcod were captured in 2001-2003, two by seine and three by trawl. While forage fish such as the Mummichog continued to be the most abundant species overall during the 2001-2003 collections, there was a marked increase in desirable game species such as the White Perch, Striped Bass, Weakfish, and Bluefish compared to the 1987-1988 collections. These differences were described in the NJMC's earlier fisheries survey report, which attributed some of the changes in the fish community between those two surveys to improved water quality conditions (Bragin et al., 2005).

During the most recent 2013-2015 collections, the forage fish Atlantic Silverside, Mummichog, and the White Perch continue to be a major component of the Hackensack Meadowlands ichthyofauna. During the 2013-2015 collections the White Perch was the most abundant species captured by gill net (45% of total gill net catch), trap net (87% of total trap net catch), and trawl (74% of total trawl catch). Overall, the White Perch was the second most abundant species collected in the 2013-2015 collections. The most abundant species collected in 2013-2015 was the Atlantic Silverside (75% of total seine catch and 44% of all fish collected – which was due to one exceptional seine haul at site S1 in summer 2014). The Mummichog was the second most abundant species captured by seine (20% of total seine catch). While

the forage fish are still a main component of the Hackensack River fish community, the White Perch continue (since 2001) to be the largest component of the game fish that inhabit the River.

Despite making fewer collections in 2013-2015 than during either of the two previous surveys, the relative abundance of Bluefish was higher than during either of the two previous surveys. The same is true for Alewife, American Eel, Atlantic Menhaden, Atlantic Silverside, Common Carp, Spot, White Perch and Yellow Perch.

In 1987-1988, the extreme abundance of the forage species (Mummichog, Atlantic and Inland Silversides) was due to the dearth of predatory game fish like the Striped Bass and Bluefish, which would tend to regulate the numbers of the prey species. The greater abundances of predator species revealed by the 2001-2003 collections seemed to reduce the numbers of the forage species, which appears to have continued into the 2013-2015 collections.

The perceived improvements in water quality within the Meadowlands between the 1987-1988 and 2001-2003 collections have been sustained, but seem to have reached a plateau. Some of the previous detriments to water quality in the Meadowlands, such as the heated discharges of once-through cooling water from three electric power generating facilities and the uncontrolled discharge of millions of gallons of leachate from orphaned landfills, have stopped. To noticeably improve water quality above the present level would likely entail extremely expensive projects such as upgrading sewage treatment plants that discharge their effluent into the Hackensack River to tertiary treatment, and allowing more freshwater to pass through/over the Oradell dam, thus restoring the River to a more natural flow regime. However, given the historical and present use of the upper Hackensack River as a source of drinking water supply for the communities of Bergen County, a return to a more natural flow pattern in the Hackensack River is extremely unlikely.

Large-scale improvements to the Meadowlands ecosystem that have occurred in the period between the 2001-2003 fishery surveys include four wetland restoration projects:

- The Secaucus High School Wetland Enhancement Site (2007) – 31 acres;
- The Richard P. Kane Wetland Mitigation Bank (2010-2012) – 217 acres;
- The Evergreen MRI Phase 3 Wetland Mitigation Bank (2012) – 51 acres; and
- The Global Industries Wetland Mitigation Project (2012) – 16 acres.

It is difficult to discern what improvements to the fish community of the Meadowlands have resulted from the restoration of these 315 acres of tidal wetlands. However, 284 of these restored acres were previously not tidal wetlands, as they sat behind old dikes and tide gates. Since 2012, these 284 acres have been reconnected to the River so that after a period of approximately 100 years, these marshes are once more open to the tide. Fishes, invertebrates, and other wildlife of the Meadowlands again have access to these restored marshes.

Since the majority of these wetland restoration projects were completed just one year before our 2013 collections commenced, it is unlikely that any improvements in the fish community would be discernable. Like the water quality in the River, which appears to have reached a plateau, so it seems with the fish community, which is very similar to that revealed by the 2001-2003 collections.

While the more current assessment of the fish community within the Meadowlands is similar to that revealed by the 2001-2003 collections, there were a few interesting observations made during the 2013-

2015 study which deserve special note. These include what is apparently the only New Jersey record of the Freshwater Goby (*Ctenogobius schufeltdi*). We collected one Freshwater Goby in Mill Creek, at site T8 on October 09, 2014 (Table A-17). Robbins and Ray (1986) list the range for this species as North Carolina to Southern Florida and Texas, from low salinity waters of bays and estuaries. According to Ross and Rhode (2004), the gobies have little economic value except in the aquarium trade. It is possible, though unlikely, that the one specimen recovered during our 2013-2015 collections was an aquarium release.

While the Sea Lamprey (*Petromyzon marinus*) has never been reported as being collected in the Hackensack River, we observed evidence of possible Sea Lamprey parasitism on a White Perch that was collected in a trap net during our spring 2014 collections. Figure 24 shows a photograph of the White Perch with what appears to be a scar from a lamprey that was collected on June 06, 2014 at TN3.

The other interesting specimens identified during the 2013-2015 survey were in the invertebrate by-catch. On November 5, 2014 two brown shrimp (*Penaeus aztecus*) were collected by trawl at site T7 (Berry's Creek Canal). While Gossner (1978) lists the northward range of the brown shrimp as Cape Cod, the brown shrimp has not been previously reported from the Hackensack Meadowlands. Three Oriental shrimp (*Paleaeomon macrodactylus*) were collected by trawl on May 4, 2015 at site T6. These non-native shrimp have not been reported from the Meadowlands, but have been found in Red Bank and Keyport, NJ.

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TABLES

TABLE 1
Phylogenetic Checklist of Fishes Captured Within the Hackensack Meadowlands District
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

Family	Scientific Name	Common Name	Pattern of Utilization*	Collected by			
				Trap Net	Seine	Trawl	Gill Net
Anguillidae	*Anguilla rostrata*	American Eel	D	X		X	
Engraulidae	*Anchoa mitchilli*	Bay Anchovy	E, M		X	X	
Clupeidae	*Alosa aestivalis*	Blueback Herring	D	X		X	X
	Alosa pseudoharengus	Alewife	D	X	X	X	X
	Brevoortia tyrannus	Atlantic Menhaden	D	X		X	X
	Dorosoma cepedianum	Gizzard Shad	D	X		X	X
Cyprinidae	*Cyprinus carpio*	Common Carp	F	X	X	X	X
Ictaluridae	*Ameiurus nebulosus*	Brown Bullhead	F	X		X	X
Gadidae	*Microgadus tomcod*	Atlantic Tomcod	D	X	X	X	X
Batrachoididae	*Opsanus tau*	Oyster Toadfish	E			X	
Atherinopsidae	*Menidia beryllina*	Inland Silverside	E, F		X		
	Menidia menidia	Atlantic Silverside	E, M	X	X	X	
Fundulidae	*Fundulus heteroclitus*	Mummichog	E	X	X	X	
	Fundulus majalis	Striped Killifish	E	X	X	X	
Gasterosteidae	*Gasterosteus aculeatus*	Threespine stickleback	E	X	X	X	
Syngnathidae	*Syngnathus fuscus*	Northern Pipefish	E	X		X	
Triglidae	*Prionotus carolinus*	Northern Searobin	M, E				X
Moronidae	*Morone americana*	White Perch	E, D	X	X	X	X
	Morone saxatilis	Striped Bass	D	X	X	X	X
Centrarchidae	*Lepomis gibbosus*	Pumpkinseed	F	X			
	Pomoxis nigromaculatus	Black Crappie	F	X			X
Percidae	*Perca flavescens*	Yellow Perch	F	X	X		X
Pomatomidae	*Pomatomus saltatrix*	Bluefish	M,E	X	X	X	X
Carangidae	*Caranx hippos*	Crevalle Jack	M		X		
	Selene setapinnis	Atlantic Moonfish	M	X			
Sciaenidae	*Cynoscion regalis*	Weakfish	E, M			X	
	Leiostomus xantharus	Spot	E, M	X	X	X	X
	Micropogonias undulatus	Atlantic Croaker	E, M			X	
Gobiidae	*Ctenogobius shufeldti*	Freshwater Goby	E, F			X	
	Gobiosoma bosc	Naked Goby	E		X	X	
Paralichthyidae	*Paralichthys dentatus*	Summer Flounder	M, E	X		X	
Pleuronectidae	*Pseudopleuronectes americanus*	Winter Flounder	M, E	X		X	
Achiridae	*Trinectes maculatus*	Hogchoker	E, M			X	X
		TOTAL NUMBER OF SPECIES		**23**	**16**	**26**	**15**

* NOTES: D=diadromous; E= estuarine; F=freshwater; M=marine. Source: Able, 1999.
Phyologenetic classification and names per Page, et al. 2013.

TABLE 2

Ranked Overall Species Composition, Total Abundance, Relative Abundance and Percent Frequency of Occurrence

NJMC/NJSEA Hackensack River Fisheries Inventory

July 2013 to June 2015

GEAR TYPE:	Trap Net	Seine	Trawl	Gill Net	Total Abundance (total #)	Relative Abundance (% of total)	Percent Frequency of Occurrence
Number of Collections:	**42**	**21**	**126**	**21**	**210**		
Atlantic Silverside	10	9,981	28		10,019	43.83%	9.05%
White Perch	3,792	374	2,525	821	7,512	32.86%	71.43%
Mummichog	140	2,638	163		2,941	12.87%	22.38%
Gizzard Shad	15		74	444	533	2.33%	12.38%
Atlantic Menhaden	5		15	237	257	1.12%	11.43%
Bay Anchovy		14	210		224	0.98%	11.43%
Striped Bass	16	1	69	125	211	0.92%	25.24%
Striped Killifish	2	196	1		199	0.87%	6.67%
Blueback Herring	131		4	3	138	0.60%	6.67%
Alewife	118	1	15	3	137	0.60%	11.43%
Common Carp	29	4	5	94	132	0.58%	10.95%
Spot	2	1	103	19	125	0.55%	10.95%
Bluefish	4	13	23	57	97	0.42%	11.90%
Brown Bullhead	60		28	5	93	0.41%	11.90%
American Eel	8		74		82	0.36%	15.24%
Yellow Perch	2	17		14	33	0.14%	2.38%
Weakfish			29		29	0.13%	3.81%
Hogchoker			23	2	25	0.11%	4.29%
Inland Silverside		19			19	0.08%	1.43%
Threespine Stickleback	1	2	11		14	0.06%	4.29%
Black Crappie	6			3	9	0.04%	1.43%
Northern Pipefish	2		4		6	0.03%	2.38%
Summer Flounder	3		2		5	0.02%	1.43%
Atlantic Tomcod	1	1	1	1	4	0.02%	1.90%
Winter Flounder	1		3		4	0.02%	1.43%
Pumpkinseed	3				3	0.01%	0.95%
Naked Goby		2	1		3	0.01%	1.43%
Oyster Toadfish			1		1	0.00%	0.48%
Northern Searobin				1	1	0.00%	0.48%
Crevalle Jack		1			1	0.00%	0.48%
Atlantic Moonfish	1				1	0.00%	0.48%
Atlantic Croaker			1		1	0.00%	0.48%
Freshwater Goby			1		1	0.00%	0.48%
Total # Collected	**4,352**	**13,265**	**3,414**	**1,829**	**22,860**	100.00%	
Total # of Taxa	**23**	**16**	**26**	**15**	**33**		
blue crab	152	15	127	55	**349**	--	40.50%
Diamondback Terrapin	76	0	0	0	**76**	--	8.09%
Snapping Turtle	2	0	0	0	**2**	--	0.48%

TABLE 3
Checklist of Temporal Species Occurrence
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

Month:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	# of
Number of Collections:	**6**	**0**	**24**	**6**	**45**	**9**	**17**	**19**	**24**	**44**	**13**	**3**	Months
American Eel			3	1	6		11	17	35	8	1		8
Blueback Herring			1	2	9			1		125			5
Alewife				6	1	1	36	70	2	21			7
Atlantic Menhaden				2	40	50	2	150		7	6		7
Gizzard Shad						1	3	440	15	63	9	2	7
Bay Anchovy					1		1		25	197			4
Common Carp			3	2	41	21	1	53	2	6	2	1	10
Brown Bullhead			4	28	36	3	10	2	5	5			8
Atlantic Tomcod	1				2							1	3
Oyster Toadfish							1						1
Mummichog	57		18	39	102	1,046	232	5	943	183	314	2	11
Striped Killifish			1		47	4	15		56	65	8	3	8
Inland Silverside									2	4	13		3
Atlantic Silverside					1		9,433		371	136	60	18	6
Threespine Stickleback			11	1	1	1							4
Northern Pipefish					3	1		1		1			4
Northern Searobin								1					1
White Perch	1		68	303	1,478	245	870	1,330	873	1,787	556	1	11
Striped Bass			1		18	9	5	101	48	24	3	2	9
Pumpkinseed							1			2			2
Black Crappie					1	2	6						3
Yellow Perch	2					25		6					3
Bluefish					1		12	58	23	3			5
Crevalle Jack									1				1
Atlantic Moonfish								1					1
Weakfish							1	3	24	1			4
Spot							1	20	100	4			4
Atlantic Croaker											1		1
Freshwater Goby										1			1
Naked Goby									2	1			2
Summer Flounder					1			3		1			3
Winter Flounder											4		1
Hogchoker					3	1			21				3
Total # of Fish:	**61**	**0**	**110**	**384**	**1,792**	**1,410**	**10,641**	**2,262**	**2,548**	**2,645**	**977**	**30**	**22,860**
Total # of species:	**4**	**0**	**9**	**9**	**19**	**14**	**18**	**18**	**18**	**22**	**12**	**8**	**33**

NOTES: denotes that only one specimen was captured during that month
denotes that more than one specimen was captured during that month (with total number captured)

TABLE 4
Checklist of Species Distribution by Site Location/Rivermile
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

	Hackensack River															Tributaries						Total # of Sites Collected
Sampling Location River Mile/ Tributary	**GN1 3.0**	**S1 3.5**	**TN1 3.6**	**T1 3.8**	**T2 5.4**	**GN2 6.8**	**T3 7.0**	**TN3 7.1**	**S2 7.4**	**TN4 9.2**	**T4 9.3**	**S3 10.6**	**TN5 10.9**	**T5 11.4**	**TN6 12.5**	**T6 SMC**	**TN2 SMC**	**T7 BCC**	**T8 MC**	**T9 CC**	**GN3 OC**	
American Eel				1	1		5	3			31		2	4	3			22	1	9		11
Blueback Herring				1						23	1		107	1	1					1	3	8
Alewife						3	1		1	21	4		81	6	16			2	2			10
Atlantic Menhaden	62					175	4	4		1						3		7		1		8
Gizzard Shad							24			2	18		1	4	7	8	5	7	2	11	444	12
Bay Anchovy				24	5		19		9		11	5		138		1		9	2	1		11
Common Carp						3		2				4	7	1	18		2			4	91	9
Brown Bullhead								1			4		6	13	52		1		10	1	5	9
Atlantic Tomcod		1						1										1			1	4
Oyster Toadfish				1																		1
Mummichog		13	5		1			1	157	18	1	2,468	24	3	85		7	1	151	6		15
Striped Killifish		2					1	2	91			103										5
Inland Silverside												19										1
Atlantic Silverside		9,667							47	4	1	267	6						26	1		8
Threespine Stickleback		1	1		8		1		1		1					1						7
Northern Pipefish			1	4				1														3
Northern Searobin						1																1
White Perch	27	3	216	36	38	513	276	539	240	392	372	131	1,071	181	1,053	131	521	1,342	86	63	281	21
Striped Bass	7			2	3	23	11	1		1	12	1	5	3	5	1	4	3	1	33	95	18
Pumpkinseed															3							1
Black Crappie															6						3	2
Yellow Perch												17			2						14	3
Bluefish	3	5			3	33	2		7		1	1	2	2	1		1	1	1	13	21	16
Crevalle Jack									1													1
Atlantic Moonfish																	1					1
Weakfish				2							12			1				14				4
Spot	6	1	1	1	3	11	12			1	30			4		3		15		35	2	14
Atlantic Croaker																		1				1
Freshwater Goby																			1			1
Naked Goby		1										1		1								3
Summer Flounder			3	1	1																	3
Winter Flounder								1										3				2
Hogchoker				2		2	3				16							2				5
Total # of Fish:	**105**	**9,694**	**227**	**75**	**63**	**764**	**359**	**556**	**554**	**463**	**515**	**3,017**	**1,312**	**362**	**1,252**	**148**	**542**	**1,430**	**283**	**179**	**960**	**22,860**
Total # of Species:	**5**	**9**	**6**	**11**	**9**	**9**	**12**	**11**	**9**	**9**	**15**	**11**	**11**	**14**	**13**	**7**	**8**	**15**	**11**	**13**	**11**	**33**

NOTES: denotes that only one specimen was captured at that location
denotes that more than one specimen was captured at that location (with total number captured)
SMC=Sawmill Creek, BCC=Berry's Creek Canal, MC=Mill Creek, CC=Cromakill Creek, OC=Overpeck Creek

TABLE 5
Ranked Species Composition for All Trap Net Collections
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

Gear Type: / Number Of Collections:	TRAP NET 42				
Species	**Percent Frequency of Occurrence**	**Relative Abundance (% of total)**	**Mean # / Trap Net**	**Total CPUE (# / hour)**	**Total Number Collected**
White Perch	88.1	87.13%	90.29	3.69	3,792
Mummichog	45.2	3.22%	3.33	0.14	140
Blueback Herring	19.1	3.01%	3.12	0.13	131
Alewife	23.8	2.71%	2.81	0.11	118
Brown Bullhead	16.7	1.38%	1.43	0.06	60
Common Carp	21.4	0.67%	0.69	0.03	29
Striped Bass	26.2	0.37%	0.38	0.02	16
Gizzard Shad	11.9	0.34%	0.36	0.01	15
Atlantic Silverside	4.8	0.23%	0.24	0.01	10
American Eel	14.3	0.18%	0.19	0.01	8
Black Crappie	2.4	0.14%	0.14	0.01	6
Atlantic Menhaden	9.5	0.11%	0.12	<0.01	5
Bluefish	9.5	0.09%	0.10	<0.01	4
Pumpkinseed	4.8	0.07%	0.07	<0.01	3
Summer Flounder	2.4	0.07%	0.07	<0.01	3
Striped Killifish	2.4	0.05%	0.05	<0.01	2
Yellow Perch	2.4	0.05%	0.05	<0.01	2
Northern Pipefish	4.8	0.05%	0.05	<0.01	2
Spot	4.8	0.05%	0.05	<0.01	2
Threespine Stickleback	2.4	0.02%	0.02	<0.01	1
Winter Flounder	2.4	0.02%	0.02	<0.01	1
Atlantic Tomcod	2.4	0.02%	0.02	<0.01	1
Atlantic Moonfish	2.4	0.02%	0.02	<0.01	1
Totals:		100.0%	103.62	4.24	4,352
Total Number of Taxa:					23
blue crab	40.5		3.62	0.15	152
Diamondback Terrapin	40.5		1.81	0.07	76
Snapping Turtle	2.4		0.05	<0.01	2

Percent Frequency of Occurrence = % of collections that captured each species
Relative Abundance = total # of the individual species/total # of fish collected
Total CPUE = total # of fish / total # of hours Trap Nets were fished

TABLE 6
Summary of Species Composition and Abundance by Trap Net Location
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

SITE:	TN1	TN2	TN3	TN4	TN5	TN6	
Approximate River Mile:	**3.6**	**SMC**	**7.1**	**9.2**	**10.9**	**12.5**	
Average Surface Salinity (ppt):	**12.5**	**11.1**	**8.0**	**6.7**	**5.0**	**4.0**	**TOTALS**
Number of Collections:	7	7	7	7	7	7	**42**
American Eel			3		2	3	8
Blueback Herring				23	107	1	131
Alewife				21	81	16	118
Atlantic Menhaden			4	1			5
Gizzard Shad		5		2	1	7	15
Common Carp		2	2		7	18	29
Brown Bullhead		1	1		6	52	60
Atlantic Tomcod			1				1
Mummichog	5	7	1	18	24	85	140
Striped Killifish			2				2
Atlantic Silverside				4	6		10
Threespine Stickleback	1						1
Northern Pipefish	1		1				2
White Perch	216	521	539	392	1,071	1,053	3,792
Striped Bass		4	1	1	5	5	16
Pumpkinseed						3	3
Black Crappie						6	6
Yellow Perch						2	2
Bluefish		1			2	1	4
Atlantic Moonfish		1					1
Spot	1			1			2
Summer Flounder	3						3
Winter Flounder			1				1
Total # of Fish:	**227**	**542**	**556**	**463**	**1,312**	**1,252**	**4,352**
Total # of Species:	**6**	**8**	**11**	**9**	**11**	**13**	**23**
INVERTEBRATES							
scuds		30	15	1,025	1,000	500,000	502,070
blue crab	24	41	54	12	12	11	154
comb jelly	1,000	300	200				1,500
white-fingered mud crab		16	3	28	8	5	60
isopod	5						5
REPTILES							
Diamondback Terrapin	30	16	8	21	1		76
Snapping Turtle						2	2

NOTES: SMC=Sawmill Creek (mouth at RM 5.1)

TABLE 7
Ranked Species Composition for All Trawl Collections
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

Gear Type: / **Number Of Collections:**	**TRAWL** / **126**				
Species	**Percent Frequency of Occurrence**	**Relative Abundance (% of total)**	**Mean # / Trawl**	**Total CPUE (# / minute)**	**Total Number Collected**
White Perch	65.1	73.96%	20.04	6.68	2,525
Bay Anchovy	16.7	6.15%	1.67	0.56	210
Mummichog	8.7	4.77%	1.29	0.43	163
Spot	12.7	3.02%	0.82	0.27	103
Gizzard Shad	12.7	2.17%	0.59	0.20	74
American Eel	20.6	2.17%	0.59	0.20	74
Striped Bass	20.6	2.02%	0.55	0.18	69
Weakfish	6.4	0.85%	0.23	0.08	29
Brown Bullhead	11.9	0.82%	0.22	0.07	28
Atlantic Silverside	4.0	0.82%	0.22	0.07	28
Bluefish	7.1	0.67%	0.18	0.06	23
Hogchoker	5.6	0.67%	0.18	0.06	23
Alewife	7.9	0.44%	0.12	0.04	15
Atlantic Menhaden	7.9	0.44%	0.12	0.04	15
Threespine Stickleback	4.8	0.32%	0.09	0.03	11
Common Carp	4.0	0.15%	0.04	0.01	5
Blueback Herring	3.2	0.12%	0.03	0.01	4
Northern Pipefish	2.4	0.12%	0.03	0.01	4
Winter Flounder	1.6	0.09%	0.02	0.01	3
Summer Flounder	1.6	0.06%	0.02	0.01	2
Atlantic Tomcod	0.8	0.03%	0.01	<0.01	1
Atlantic Croaker	0.8	0.03%	0.01	<0.01	1
Striped Killifish	0.8	0.03%	0.01	<0.01	1
Oyster Toadfish	0.8	0.03%	0.01	<0.01	1
Freshwater Goby	0.8	0.03%	0.01	<0.01	1
Naked Goby	0.8	0.03%	0.01	<0.01	1
Totals:		100.00%	27.10	9.04	3,414
Total Number of Taxa:					26
blue crab	42.1		1.01	0.34	127

Percent Frequency of Occurrence = % of collections that captured each species
Relative Abundance = total # of the individual species/total # of fish collected
Total CPUE = total # of fish / total # of minutes Trawls were fished

TABLE 8
Summary of Species Composition and Abundance by Trawl Location
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

SITE:	T1	T2	T3	T4	T5	T6	T7	T8	T9	
Approximate River Mile:	**3.8**	**5.4**	**7.0**	**9.3**	**11.4**	**SMC**	**BCC**	**MC**	**CC**	
Average Surface Salinity (ppt):	**14.8**	**12.3**	**10.2**	**7.8**	**5.0**	**12.3**	**7.9**	**7.2**	**6.7**	**TOTALS**
Number of Collections:	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**42**
American Eel	1	1	5	31	4		22	1	9	74
Blueback Herring	1			1	1				1	4
Alewife			1	4	6		2	2		15
Atlantic Menhaden			4			3	7		1	15
Gizzard Shad			24	18	4	8	7	2	11	74
Bay Anchovy	24	5	19	11	138	1	9	2	1	210
Common Carp					1				4	5
Brown Bullhead				4	13			10	1	28
Atlantic Tomcod							1			1
Oyster Toadfish	1									1
Mummichog		1		1	3		1	151	6	163
Striped Killifish			1							1
Atlantic Silverside				1				26	1	28
Threespine Stickleback		8	1	1		1				11
Northern Pipefish	4									4
White Perch	36	38	276	372	181	131	1,342	86	63	2,525
Striped Bass	2	3	11	12	3	1	3	1	33	69
Bluefish		3	2	1	2		1	1	13	23
Weakfish	2			12	1		14			29
Spot	1	3	12	30	4	3	15		35	103
Atlantic Croaker							1			1
Freshwater Goby								1		1
Naked Goby					1					1
Summer Flounder	1	1								2
Winter Flounder							3			3
Hogchoker	2		3	16			2			23
Total # of Fish:	**75**	**63**	**359**	**515**	**362**	**148**	**1,430**	**283**	**179**	**3,414**
Total # of Species:	**11**	**9**	**12**	**15**	**14**	**7**	**15**	**11**	**13**	**26**
INVERTEBRATES										
scuds	65	60	35	530	255	41	4,335	101	480	5,902
bay barnacle	3,705	1,500		8,530	7,050	365			100,210	121,360
blue crab	27	9	16	9	10	7	23	20	6	127
platform mussel	25			301	855				50,100	51,281
sand shrimp	20	16	2		2	3	4	3	2	52
American oyster	39	1				4				44
comb jelly	55	5				35				95
slender isopod									1	1
ribbed mussel	138	26		1		19				184
Baltic macoma clam			20				1			21
sea squirt	15									15
small surf clam									3	3
soft clam	1									1
Oriental shrimp						3				3
grass shrimp	13	5		6	11	2	35	1	30	103
brown shrimp							2			2
Atlantic rangia			5	14				4	1	24
white-fingered mud crab	18	30	52	351	1,309	41	152	27	510	2,490
common shore shrimp									2	2
brackish water fiddler crab		1								1

NOTES: SMC=Sawmill Creek (mouth at RM 5.1); BCC=Berry's Creek Canal (mouth at RM7.5);
MC=Mill Creek (mouth at RM 9.2); CC=Cromakill Creek (mouth at RM 9.4).

TABLE 9
Ranked Species Composition for All Seine Collections
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

Gear Type: / **Number Of Collections:**	**SEINE** / **21**			
Species	**Percent Frequency of Occurrence**	**Relative Abundance (% of total)**	**Total CPUE (Total # /# of hauls)**	**Total Number Collected**
Atlantic Silverside	57.1	75.24%	475.29	9,981
Mummichog	81.0	19.89%	125.62	2,638
White Perch	52.4	2.82%	17.81	374
Striped Killifish	57.1	1.48%	9.33	196
Inland Silverside	14.3	0.14%	0.90	19
Yellow Perch	4.8	0.13%	0.81	17
Bay Anchovy	14.3	0.11%	0.67	14
Bluefish	23.8	0.10%	0.62	13
Common Carp	4.8	0.03%	0.19	4
Threespine Stickleback	9.5	0.02%	0.10	2
Naked Goby	9.5	0.02%	0.10	2
Striped Bass	4.8	0.01%	0.05	1
Crevalle Jack	4.8	0.01%	0.05	1
Spot	4.8	0.01%	0.05	1
Alewife	4.8	0.01%	0.05	1
Atlantic Tomcod	4.8	0.01%	0.05	1
Totals:		100%	631.67	13,265
Total Number of Taxa:				16
blue crab	28.6		0.71	15

Percent Frequency of Occurrence = % of collections that captured each species
Relative Abundance = total # of the individual species/total # of fish collected
Total CPUE = total # of fish / total # of seine hauls

TABLE 10
Summary of Species Composition and Abundance by Seine Location
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

SITE:	S1	S2	S3	TOTALS
Approximate River Mile:	**3.5**	**7.4**	**10.6**	
Average Surface Salinity (ppt):	**12.8**	**11.8**	**7.2**	
Number of Collections:	**7**	**7**	**7**	**21**
Alewife		1		1
Bay Anchovy		9	5	14
Common Carp			4	4
Atlantic Tomcod	1			1
Mummichog	13	157	2,468	2,638
Striped Killifish	2	91	103	196
Inland Silverside			19	19
Atlantic Silverside	9,667	47	267	9,981
Threespine Stickleback	1	1		2
White Perch	3	240	131	374
Striped Bass			1	1
Yellow Perch			17	17
Bluefish	5	7	1	13
Crevalle Jack		1		1
Spot	1			1
Naked Goby	1		1	2
Total # of Fish:	**9,694**	**554**	**3,017**	**13,265**
Total # of Species:	**9**	**9**	**11**	**16**
INVERTEBRATES				
bay barnacle		200		200
blue crab	4	11		15
sand shrimp	12	2	2	16
Oriental shrimp		2		2
grass shrimp	63	496	3,181	3,740
white-fingered mud crab		1		1

TABLE 11
Ranked Species Composition for All Gill Net Collections
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

Gear Type: / **Number Of Collections:**	**GILL NET** / **21**				
Species	**Percent Frequency of Occurrence**	**Relative Abundance (% of total)**	**Mean # / Gill Net**	**Total CPUE (# / hour)**	**Total Number Collected**
White Perch	95.2	44.9%	39.10	1.63	821
Gizzard Shad	23.8	24.3%	21.14	0.88	444
Atlantic Menhaden	47.6	13.0%	11.29	0.47	237
Striped Bass	71.4	6.8%	5.95	0.25	125
Common Carp	38.1	5.1%	4.48	0.19	94
Bluefish	33.3	3.1%	2.71	0.11	57
Spot	19.1	1.0%	0.90	0.04	19
Yellow Perch	14.3	0.8%	0.67	0.03	14
Brown Bullhead	14.3	0.3%	0.24	0.01	5
Black Crappie	9.5	0.2%	0.14	0.01	3
Alewife	14.3	0.2%	0.14	0.01	3
Blueback Herring	9.5	0.2%	0.14	0.01	3
Hogchoker	9.5	0.1%	0.10	<0.01	2
Atlantic Tomcod	4.8	0.1%	0.05	<0.01	1
Northern Searobin	4.8	0.1%	0.05	<0.01	1
Totals:		100.0%	87.10	3.63	1,829
Total Number of Taxa:					15
blue crab	42.9		0.71	0.03	15

Percent Frequency of Occurrence = % of collections that captured each species
Relative Abundance = total # of the individual species/total # of fish collected
Total CPUE = total # of fish / total # of hours Gill Nets were fished

TABLE 12

Summary of Species Composition and Abundance by Gill Net Location

NJMC/NJSEA Hackensack River Fishery Resource Inventory

July 2013 to June 2015

SITE:	GN1	GN2	GN3	TOTALS
Approximate River Mile:	**3.0**	**6.8**	**OC**	
Average Surface Salinity (ppt):	**15.2**	**9.5**	**2.7**	
Number of Collections:	**7**	**7**	**7**	**21**
Blueback Herring			3	3
Alewife		3		3
Atlantic Menhaden	62	175		237
Gizzard Shad			444	444
Common Carp		3	91	94
Brown Bullhead			5	5
Atlantic Tomcod			1	1
Northern Searobin		1		1
White Perch	27	513	281	821
Striped Bass	7	23	95	125
Black Crappie			3	3
Yellow Perch			14	14
Bluefish	3	33	21	57
Spot	6	11	2	19
Hogchoker		2		2
Total # of Fish:	**105**	**764**	**960**	**1,829**
Total # of Species:	**5**	**9**	**11**	**15**
INVERTEBRATES				
scuds		40		40
bay barnacle	160	140		300
blue crab	9	32	14	55
American oyster	14	2		16
ribbed mussel	40			40
blue mussel		2		2
white-fingered mud crab	5	10	1	16
isopod	42			42

NOTES: OC=Overpeck Creek (mouth at RM 12.2)

TABLE 13
Summary of Length and Weight Data Used for Biomass Analysis
NJMC/NJSEA Hackensack River Fishery Resource Inventory
July 2013 to June 2015

Biomass Rank	Species	Total # Collected	Total # Measured	% Measured	Weight (grams)				Length (mm, total length)				Biomass (Kg)	% of Total Biomass	Cumulative Total %
					Min	Max	Avg	St. Dev	Min	Max	Avg	St. Dev			
1	White Perch	7,512	1,884	25.1	0.1	626	109.85	94.10	2.3	336	175.7	60.91	825.21	51.544	51.54
2	Common Carp	132	123	93.2	92	7800	3471.30	1929.98	167	813	569.5	156.56	458.21	28.621	80.16
3	Atlantic Menhaden	257	137	53.3	18	563	325.47	102.81	114	367	312.4	54.62	83.65	5.225	85.39
4	Striped Bass	211	144	68.2	9	6300	393.97	1021.46	105	838	249.7	140.77	83.13	5.192	90.58
5	Gizzard Shad	533	125	23.5	8	1752	73.38	194.05	82	518	168.1	55.02	39.11	2.443	93.02
6	Brown Bullhead	93	84	90.3	6	855	400.80	218.64	75	392	289.5	69.56	37.27	2.328	95.35
7	Atlantic Silverside	10,019	421	4.2	0	8	1.81	1.37	25	132	65.9	16.35	18.13	1.132	96.49
8	Mummichog	2,941	336	11.4	0.1	26	5.25	5.34	19	120	65.8	21.42	15.44	0.965	97.45
9	Spot	125	117	93.6	4.7	248	106.36	58.76	71	250	183.5	33.51	13.29	0.830	98.28
10	American Eel	82	81	98.8	0.1	822	117.32	137.23	57	680	343.5	130.23	9.62	0.601	98.88
11	Bluefish	97	82	84.5	6	614	62.06	73.82	84	414	178.2	42.78	6.02	0.376	99.26
12	Alewife	137	62	45.3	1.8	206	24.05	45.96	55	290	112.4	54.79	3.30	0.206	99.46
13	Blueback Herring	138	73	52.9	2	179	20.16	42.39	67	276	106.3	57.23	2.78	0.174	99.64
14	Striped Killifish	199	127	63.8	1.1	43	13.21	7.95	36	144	96.2	19.38	2.63	0.164	99.80
15	Yellow Perch	33	32	97.0	0.5	138	25.41	32.92	3.8	232	71.2	79.06	0.84	0.052	99.85
16	Summer Flounder	5	5	100.0	32	221	126.20	77.12	152	275	227.8	50.79	0.63	0.039	99.89
17	Hogchoker	25	24	96.0	6	74	24.88	15.01	66	153	103.8	20.25	0.62	0.039	99.93
18	Bay anchovy	224	125	55.8	0.05	6	1.09	1.13	15	89	50.6	16.93	0.24	0.015	99.95
19	Oyster Toadfish	1	1	100.0	166	166	166.00		200	200	200.0		0.17	0.010	99.96
20	Weakfish	29	29	100.0	0.4	32	5.65	6.52	33	156	77.1	26.05	0.16	0.010	99.97
21	Pumpkinseed	3	3	100.0	24	76	51.33	26.10	109	151	130.0	21.00	0.15	0.010	99.98
22	Atlantic Tomcod	4	4	100.0	0.2	53	24.75	28.19	29	190	109.5	85.25	0.10	0.006	99.98
22	Black Crappie	9	9	100.0	2	34	11.00	11.31	62	132	84.9	27.03	0.10	0.006	99.99
24	Winter Flounder	4	4	100.0	11	19	15.25	3.50	100	115	109.0	7.35	0.06	0.004	99.99
25	Threespine stickleback	14	13	92.9	0.1	3	2.24	0.91	23	70	58.7	11.65	0.03	0.002	100.00
26	Northern Searobin	1	1	100.0	30	30	30.00		151	151	151.0		0.03	0.002	100.00
27	Crevalle Jack	1	1	100.0	24	24	24.00		122	122	122.0		0.02	0.001	100.00
28	Inland Silverside	19	18	94.7	0.3	1.5	0.79	0.32	36	65	52.1	7.52	0.02	0.001	100.00
29	Northern Pipefish	6	6	100.0	0.2	1.4	0.83	0.48	72	176	128.3	37.28	0.01	<0.001	100.00
30	Naked Goby	3	3	100.0	0	0.8	0.73	0.12	36	42	39.7	3.21	0.002	<0.001	100.00
31	Atlantic Moonfish	1	1	100.0	1	1	1.00		52	52	52.0		0.001	<0.001	100.00
31	Freshwater Goby	1	1	100.0	1	1	1.00		41	41	41.0		0.001	<0.001	100.00
33	Atlantic Croaker	1	1	100.0	0.2	0.2	0.20		26	26	26.0		0.000	<0.001	100.00

TABLE 14
Average Surface and Bottom Salinity, Temperature, Dissolved Oxygen, pH and Secchi Depths - By River Mile
NMJC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

Approx		Surface Salinity (0/00)				Bottom Salinity (0/00)			
RM	Site	Min	AVG	Max	n	Min	AVG	Max	n
3.0	GN1	12.12	**15.2**	18.29	7	13.65	**15.5**	18.25	7
3.5	S1	7.07	**12.8**	17.01	7				0
3.7	TN1	8.02	**12.5**	17.02	7				0
3.7	T1	10.77	**14.8**	18.65	7	11.04	**15.3**	18.94	7
5.1	T6	6.00	**12.3**	16.68	7	6.03	**12.2**	17.67	7
5.2	TN2	6.57	**11.1**	15.61	7				0
5.4	T2	7.19	**12.3**	16.40	7	8.80	**13.0**	16.59	7
6.8	GN2	5.16	**9.5**	14.37	7	5.71	**10.2**	14.59	7
7.0	T3	5.48	**10.2**	15.05	7	5.99	**11.1**	15.45	7
7.1	TN3	3.79	**8.0**	13.80	7				0
7.4	S2	3.12	**11.8**	11.75	7				0
7.5	T7	3.57	**7.9**	12.05	7	5.00	**8.5**	12.26	7
9.2	TN4	2.99	**6.7**	9.44	6				0
9.2	T8	2.19	**7.2**	11.74	7	2.25	**7.4**	12.19	7
9.3	T4	1.99	**7.8**	13.43	7	1.98	**8.2**	14.20	7
9.4	T9	1.15	**6.7**	11.44	7	1.21	**7.0**	11.64	7
10.6	S3	1.68	**7.2**	11.17	7				0
10.9	TN5	1.72	**5.0**	7.84	6				0
11.4	T5	0.97	**5.0**	10.61	7	1.15	**5.7**	10.92	7
12.2	GN3	0.40	**2.7**	6.41	7	1.15	**3.5**	7.03	7
12.5	TN6	0.79	**4.0**	7.15	6				0

	Surface Temperature (C)				Bottom Temperature (C)			
Site	Min	AVG	Max	n	Min	AVG	Max	n
GN1	2.8	**17.7**	25.9	7	2.9	**17.6**	25.9	7
S1	3.6	**14.8**	27.6	7				0
TN1	0.9	**14.3**	26.9	7				0
T1	2.5	**16.3**	24.8	7	3.6	**16.3**	24.7	7
T6	3.7	**16.4**	26.5	7	3.6	**16.1**	25.8	7
TN2	0.1	**13.6**	26.3	7				0
T2	3.5	**17.4**	26.0	7	3.4	**17.1**	25.6	7
GN2	4.0	**18.0**	25.5	7	3.1	**17.7**	25.2	7
T3	4.5	**18.5**	26.8	7	3.9	**18.5**	26.8	7
TN3	0.7	**14.4**	26.3	7				0
S2	3.9	**14.8**	26.7	7				0
T7	3.7	**18.1**	27.0	7	3.7	**17.3**	25.7	7
TN4	-0.2	**13.7**	24.9	6				0
T8	5.2	**18.5**	25.5	7	4.9	**18.2**	25.4	7
T4	5.2	**18.5**	25.9	7	5.3	**18.1**	25.3	7
T9	4.3	**17.1**	24.6	7	4.4	**17.0**	24.7	7
S3	3.5	**17.6**	25.2	7				0
TN5	0.2	**14.2**	25.4	6				0
T5	5.6	**18.5**	25.9	7	5.7	**18.0**	25.1	7
GN3	2.8	**15.2**	25.5	7	2.6	**14.9**	24.2	7
TN6	1.3	**14.3**	25.9	6				

Approx		Surface pH				Bottom pH			
RM	Site	Min	AVG	Max	n	Min	AVG	Max	n
3.0	GN1	7.34	**7.7**	7.97	7	7.32	**7.7**	7.93	7
3.5	S1	7.46	**7.7**	8.00	7				0
3.7	TN1	7.55	**7.9**	8.31	7				0
3.7	T1	7.47	**7.8**	8.15	7	7.45	**7.8**	8.11	7
5.1	T6	7.38	**7.8**	8.40	7	7.43	**7.8**	8.28	7
5.2	TN2	7.49	**8.1**	8.47	7				0
5.4	T2	7.43	**7.8**	8.09	7	7.36	**7.7**	8.08	7
6.8	GN2	7.38	**7.7**	8.07	7	7.23	**7.6**	7.92	7
7.0	T3	7.34	**7.8**	8.28	7	7.34	**7.7**	8.19	7
7.1	TN3	7.40	**8.0**	8.19	7				0
7.4	S2	7.39	**7.7**	8.10	7				0
7.5	T7	7.33	**7.8**	8.19	7	7.25	**7.7**	8.09	7
9.2	TN4	7.40	**7.9**	8.06	6				0
9.2	T8	7.30	**7.8**	8.26	7	7.23	**7.6**	8.21	7
9.3	T4	7.24	**7.7**	8.16	7	7.18	**7.6**	8.07	7
9.4	T9	7.14	**7.8**	8.45	7	7.16	**7.7**	8.23	7
10.6	S3	7.29	**7.8**	8.37	7				0
10.9	TN5	7.58	**7.9**	8.12	6				0
11.4	T5	7.24	**7.8**	8.27	7	7.18	**7.6**	8.14	7
12.2	GN3	7.67	**8.3**	8.87	7	7.36	**7.8**	8.64	7
12.5	TN6	7.70	**8.0**	8.54	6				0

	Surface Dissolved Oxygen (ppm)				Bottom Dissolved Oxygen (ppm)			
Site	Min	AVG	Max	n	Min	AVG	Max	n
GN1	3.82	**6.0**	8.39	7	3.57	**6.0**	8.55	7
S1	4.71	**6.6**	9.22	7				0
TN1	5.30	**7.0**	10.60	7				0
T1	4.95	**6.6**	9.24	7	5.02	**6.7**	9.24	7
T6	4.22	**6.6**	9.73	7	4.77	**6.7**	9.69	7
TN2	6.05	**8.8**	12.29	7				0
T2	4.43	**6.0**	9.19	7	4.51	**6.0**	9.14	7
GN2	3.55	**5.0**	6.67	7	3.11	**4.6**	6.32	7
T3	3.69	**5.7**	9.31	7	3.61	**5.2**	9.32	7
TN3	4.75	**7.6**	9.81	7				0
S2	2.87	**5.6**	8.18	7				0
T7	2.29	**5.6**	9.04	7	2.86	**5.0**	8.64	7
TN4	4.66	**7.4**	11.40	6				0
T8	2.74	**5.4**	10.22	7	2.82	**4.9**	9.96	7
T4	2.78	**4.9**	7.35	7	2.81	**4.2**	7.18	7
T9	3.12	**5.4**	7.89	7	3.20	**5.2**	7.58	7
S3	3.09	**5.7**	9.36	7				0
TN5	5.80	**7.9**	10.62	6				0
T5	2.55	**6.0**	10.12	7	2.10	**3.9**	7.83	7
GN3	5.33	**9.7**	12.76	7	1.30	**5.4**	9.34	7
TN6	5.25	**8.5**	12.62	6				0

Approx		Secchi Disk Depths (cm)			
RM	Site	Min	AVG	Max	n
3.0	GN1	70	**122.1**	165	7
3.5	S1	65	**82.9**	100	7
3.7	TN1	75	**102.5**	140	7
3.7	T1	50	**94.3**	165	7
5.1	T6	50	**85.7**	115	7
5.2	TN2	35	**65.8**	95	7
5.4	T2	55	**78.6**	105	7
6.8	GN2	55	**79.3**	105	7
7.0	T3	50	**76.4**	100	7
7.1	TN3	40	**73.0**	105	7
7.4	S2	35	**57.9**	70	7
7.5	T7	45	**59.3**	80	7
9.2	TN4	25	**62.5**	80	7
9.2	T8	40	**58.6**	70	7
9.3	T4	40	**61.4**	75	7
9.4	T9	30	**49.3**	65	7
10.6	S3	45	**59.3**	75	7
10.9	TN5	30	**52.5**	65	7
11.4	T5	25	**54.3**	80	7
12.2	GN3	35	**56.4**	80	7
12.5	TN6	20	**42.5**	55	7

NOTES: 1) No bottom water quality data were collected at Seine or Trap Net locations.
2) Sampling locations from within tributaries (T6, TN2, T7, T8, T9 and GN3) were placed in the order of the location of the tributary mouth along the river.
3) No water quality data was collected during Summer 2013 at sites TN4, TN5, or TN6; therefore there are only 6 surface measurements for these locations.

TABLE 15

Average Seasonal Surface and Bottom Salinity, Temperature, Dissolved Oxygen, pH and Secchi Depths

NMJC/NJSEA Hackensack River Fishery Resource Inventory

Summer 2013 to Spring 2015

Seasonal Surface Salinity (0/00)								
Surf Sal	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**11.2**	**12.4**		**4.9**	**9.0**	**10.9**	**7.1**	**7.5**
Min	2.41	3.12		0.40	2.89	0.92	1.74	0.79
Max	16.43	18.65		12.12	18.29	15.08	14.15	15.66
n=	18	21	0	21	21	21	21	21

Seasonal Bottom Salinity (0/00) (No bottom measurements at TN & S locations)								
Bottom Sal	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**11.7**	**13.2**		**5.4**	**10.6**	**11.6**	**7.3**	**8.6**
Min	3.64	7.03		1.15	4.64	1.59	1.79	4.01
Max	17.67	18.94		13.65	18.25	15.60	14.57	15.59
n=	12	12	0	12	12	12	12	12

Seasonal Surface Temperature (C)								
Surf Temp	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**23.1**	**14.2**		**20.2**	**25.8**	**13.4**	**2.9**	**17.9**
Min	20.4	3.1		16.2	23.8	3.8	-0.2	13.1
Max	25.9	18.0		23.8	27.6	19.4	5.6	25.2
n=	18	21	0	21	21	21	21	21

Seasonal Bottom Temperature (C) (No bottom measurements at TN & S locations)								
Bottom Temp	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**23.1**	**16.0**		**19.5**	**25.1**	**14.5**	**3.9**	**18.4**
Min	20.1	4.3		15.5	23.7	4.7	2.6	13.4
Max	25.9	18.1		22.6	26.8	18.8	5.7	22.8
n=	12	12	0	12	12	12	12	12

Seasonal Surface Dissolved Oxygen (ppm)								
Surf DO	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**5.5**	**5.6**		**4.4**	**6.8**	**6.4**	**9.1**	**7.0**
Min	3.82	2.98		2.55	3.58	4.66	6.67	2.29
Max	11.16	9.60		7.43	12.76	9.14	10.60	12.62
n=	18	21	0	21	21	21	21	21

Seasonal Bottom Dissolved Oxygen (ppm) (No bottom measurements at TN & S locations)								
Bottom DO	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**4.4**	**4.7**		**3.9**	**4.6**	**6.2**	**8.5**	**4.9**
Min	3.11	2.76		1.30	2.10	4.46	5.53	2.86
Max	5.02	8.19		6.45	5.90	8.36	9.96	8.75
n=	12	12	0	12	12	12	12	12

Seasoanl Surface pH measurements								
Surf. pH	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**7.5**	**7.4**		**7.7**	**7.9**	**8.0**	**8.2**	**8.1**
Min	7.34	7.14		7.56	7.56	7.55	7.94	7.77
Max	8.54	7.70		8.07	8.74	8.45	8.87	8.54
n=	18	21	0	21	21	21	21	21

Seasoanl Bottom pH measurements (No bottom measurements at TN & S locations)								
Bottom pH	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**7.4**	**7.3**		**7.6**	**7.7**	**7.8**	**8.1**	**8.0**
Min	7.23	7.16		7.46	7.52	7.53	7.90	7.80
Max	7.48	7.53		7.63	8.05	8.05	8.64	8.11
n=	12	12	0	12	12	12	12	12

Seasonal Secchi Disk Depths (cm)								
Secchi	Summer 2013	Autumn 2013	Winter 2013-14	Spring 2014	Summer 2014	Autumn 2014	Winter 2014-15	Spring 2015
AVG	**50.3**	**83.3**		**72.6**	**58.1**	**76.9**	**74.8**	**74.3**
Min	25	50		40	25	50	45	20
Max	80	165		110	125	125	150	165
n=	21	21	0	21	21	21	21	21

NOTE: During Summer 2013 the water quality meter was not working at 3 sites, therefore there are only 18 surface readings.

TABLE 16

Summary of Abundance Data for All Collections

HMDC/NJMC/NJSEA Hackensack River Fishery Resource Inventory

February 1987 to December 1988, August 2001 to September 2003, and Summer 2013 to Spring 2015

Gear Type:	Gear Type:	GILL NET			SEINE			TRAP NET			TRAWL			TOTALS		
Collection Period:	Collection Period:	87/88	01/03	13/15	87/88	01/03	13/15	87/88	01/03	13/15	87/88	01/03	13/15	87/88	01/03	13/15
Total Number Of Collections:	Total Number Of Collections:	42	48	21	45	48	21	81	96	42	265	288	126	433	480	210
Common Name	Scientific Name															
Unidentified Clupeidae	*Alosa sp.*					1		1	1					1	2	
Alewife	*Alosa pseudoharengus*	6	5	**3**		3	**1**	46	52	**118**	57	78	**15**	109	138	**137**
Alligator Gar	*Atractosteus spatula*		1												1	
American Eel	*Anguilla rostrata*							79	42	**8**	77	50	**74**	156	92	**82**
American Shad	*Alosa sapidissima*							93	1		20	15		113	16	
Atlantic Croaker	*Micropogonias undulatus*											2	**1**		2	**1**
Atlantic Menhaden	*Brevoortia tyrannus*	97	115	**237**		35		4	144	**5**	5	26	**15**	106	320	**257**
Atlantic Moonfish	*Selene setapinnis*									**1**						**1**
Atlantic Silverside	*Menidia menidia*				1,821	6,278	**9,981**	5	58	**10**	25	7	**28**	1,851	6,343	**10,019**
Atlantic Tomcod	*Microgadus tomcod*	101		**1**		2	**1**	9		**1**	358	3	**1**	468	5	**4**
Bay Anchovy	*Anchoa mitchilli*				18	21	**14**	1	2		1,279	72	**210**	1,298	95	**224**
Black Crappie	*Pomoxis nigromaculatus*		7	**3**				9	93	**6**	1	2		10	102	**9**
Blueback Herring	*Alosa aestivalis*	4	4	**3**	5			232	240	**131**	179	127	**4**	420	371	**138**
Bluefish	*Pomatomus saltatrix*	1	33	**57**	3	18	**13**	9	6	**4**	4	49	**23**	17	106	**97**
Bluegill	*Lepomis macrochirus*							2	1		1			3	1	
Brown Bullhead	*Ameiurus nebulosus*	2	12	**5**				405	300	**60**	5	58	**28**	412	370	**93**
Common Carp	*Cyprinus carpio*	2	58	**94**	2	6	**4**	76	19	**29**		6	**5**	80	89	**132**
Conger Eel	*Conger oceanicus*										1			1		
Crevalle Jack	*Caranx hippos*				2	19	**1**	97	7		1	4		100	30	**1**
Freshwater Goby	*Ctenogobius shufeldti*												**1**			**1**
Gizzard Shad	*Dorosoma cepedianum*	37	411	**444**	6	23		19	1,011	**15**	14	198	**74**	76	1,643	**533**
Golden Shiner	*Notemigonis crysoleucas*	1						6			1			8		
Goldfish	*Carassius auratus*				1	1			33					1	34	
Green Sunfish	*Lepomis cyanellus*							13	1					13	1	
Hogchoker	*Trinectes maculatus*			**2**		2							**23**		2	**25**
Inland Silverside	*Menidia beryllina*				1,390	361	**19**		3		1	2		1,391	366	**19**
Largemouth Bass	*Micropterus salmoides*								5						5	
Lookdown	*Selene vomer*								1						1	
Mummichog	*Fundulus heteroclitus*				36,126	7,803	**2,638**	12,377	8,438	**140**	4,756	403	**163**	53,259	16,644	**2,941**
Naked Goby	*Gobiosoma bosc*						**2**					2	**1**		2	**3**
Northern Pipefish	*Sygnathus fuscus*				2	7		1		**2**	1	4	**4**	4	11	**6**
Northern Searobin	*Prionotus carolinus*			**1**												**1**
Oyster Toadfish	*Opsanus tau*												**1**			**1**
Pumpkinseed	*Lepomis gibbosus*				17			155	6	**3**	6	3		178	9	**3**
Rainbow Smelt	*Osmerus mordax*										1			1		
Seaboard Goby	*Gobiosoma ginsburgi*										1			1		
Spot	*Leiostomus xanthurus*	13	1	**19**		5	**1**	46		**2**	259	32	**103**	318	38	**125**
Spotted Hake	*Urophycis regia*							8	7		3	2		11	9	
Striped Bass	*Morone saxatilis*	26	158	**125**	6	70	**1**	35	339	**16**	18	556	**69**	85	1,123	**211**
Striped Killifish	*Fundulus majalis*	1			244	1,211	**196**	58	37	**2**	11	1	**1**	314	1,249	**199**
Striped Mullet	*Mugil cephalus*				1	6								1	6	
Striped Searobin	*Prionotus evolans*		1												1	
Summer Flounder	*Paralichthys dentatus*					1				**3**		3	**2**		4	**5**
Threespine Stickleback	*Gasterosteus aculeatus*						**2**		5	**1**		1	**11**		6	**14**
Weakfish	*Cynoscion regalis*		6		1			10	49		83	187	**29**	94	242	**29**
White Catfish	*Ameiurus catus*							1						1		
White Perch	*Morone americana*	54	1,102	**821**	10	1,196	**374**	663	6,533	**3,792**	47	2,620	**2,525**	774	11,451	**7,512**
Windowpane	*Scophthalmus aquosus*				1			1			1			3		
Winter Flounder	*Pseudopleuronectes americanus*	1			1	5		5	3	**1**	31	1	**3**	38	9	**4**
Yellow Perch	*Perca flavescens*			**14**			**17**	2	1	**2**				2	1	**33**
Total Number of Fish	**Total Number of Fish**	346	1,914	**1,829**	39,657	17,074	**13,265**	14,468	17,438	**4,352**	7,247	4,514	**3,414**	61,718	40,940	**22,860**
Total Number of Taxa	**Total Number of Taxa**	14	14	**15**	19	21	**16**	30	29	**23**	30	29	**26**	36	39	**33**
blue crab	*Callinectes sapidus*	60	216	**55**	18	102	**15**	154	1,092	**152**	202	721	**127**	434	2,131	**349**
Diamondback Terrapin	*Malaclemys terrapin*							66	126	**76**				66	126	**76**
Eastern Painted Turtle	*Chrysemys picta*							2						2		
Snapping Turtle	*Chelydra serpentina*							4	6	**2**		1		4	7	**2**

TABLE 17

Summary of Percent Frequency of Occurrence for All Collections

HMDC/NJMC/NJSEA Hackensack River Fishery Resource Inventory

Feb. 1987 - Dec. 1988, Aug. 2001 - Sep. 2003, and Summer 2013 to Spring 2015

Survey Period:	2013-15	2001-03	1987-88
Gear Type:	ALL GEAR	ALL GEAR	ALL GEAR
Total Number Of Collections:	210	480	433
	% Frequency	% Frequency	% Frequency
Unidentified Alosa/Clupeidae		0.4%	0.2%
Alewife	11.4%	10.6%	8.3%
Alligator Gar		0.2%	
American Eel	15.2%	9.0%	15.7%
American Shad		1.7%	2.5%
Atlantic Croaker	0.5%	0.4%	
Atlantic Menhaden	11.4%	9.2%	3.9%
Atlantic Moonfish	0.5%		
Atlantic Silverside	9.1%	11.0%	5.1%
Atlantic Tomcod	1.9%	0.6%	12.0%
Bay Anchovy	11.4%	4.8%	7.2%
Black Crappie	1.4%	4.4%	1.2%
Blueback Herring	6.7%	5.6%	9.9%
Bluefish	11.9%	7.9%	2.5%
Bluegill		0.2%	0.7%
Brown Bullhead	11.9%	10.8%	9.7%
Common Carp	11.0%	6.5%	6.7%
Conger Eel			0.2%
Crevalle Jack	0.5%	1.9%	1.8%
Freshwater Goby	0.5%		
Gizzard Shad	12.4%	15.6%	3.0%
Golden Shiner			1.2%
Goldfish		2.9%	0.2%
Green Sunfish		0.2%	2.1%
Hogchoker	4.3%	0.4%	
Inland Silverside	1.4%	5.2%	6.9%
Largemouth Bass		0.6%	
Lookdown		0.2%	
Mummichog	22.4%	27.3%	67.9%
Naked Goby	1.4%	0.2%	
Northern Pipefish	2.4%	1.7%	0.7%
Northern Searobin	0.5%		
Oyster Toadfish	0.5%		
Pumpkinseed	1.0%	1.3%	11.3%
Rainbow Smelt			0.2%
Seaboard Goby			0.2%
Spot	11.0%	2.9%	6.2%
Spotted Hake		1.0%	0.7%
Striped Bass	25.2%	45.0%	6.9%
Striped Killifish	6.7%	8.8%	7.2%
Striped Mullet		0.4%	0.2%
Striped Searobin		0.2%	
Summer Flounder	1.4%	0.6%	
Threespine Stickleback	4.3%	1.3%	
Weakfish	3.8%	10.6%	6.0%
White Catfish			0.2%
White Perch	71.4%	66.7%	21.5%
Windowpane			0.7%
Winter Flounder	1.4%	1.3%	3.7%
Yellow Bullhead			
Yellow Perch	2.4%	0.2%	0.2%
blue crab	40.5%	51.7%	22.4%
Diamondback Terrapin	8.1%	6.0%	3.2%
Snapping Turtle	0.5%	1.0%	0.5%

TABLE 18

Comparison of Percent Frequency of Occurrence, Relative Abundance, Mean #, Total CPUE and Total # For All Trap Net Collections

HMDC/NJMC/NJSEA Hackensack River Fishery Resource Inventory

2013- 2015; 2001-2003; and 1987-1988

Sampling Period:	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88
Number Of Collections:	42	96	81	42	96	81	42	96	81	42	96	81	42	96	81
	Percent Frequency of Occurrence			Relative Abundance (% of total)			Mean # / Trap Net			Total CPUE (# / hour)			Total Number Collected		
Mummichog	45.2	63.5	93.8	3.22%	48.4%	85.5%	3.33	87.90	152.80	0.14	3.57	6.51	140	8,438	12,377
White Perch	88.1	88.5	69.1	87.13%	37.5%	4.6%	90.29	68.05	8.19	3.69	2.77	0.35	3,792	6,533	663
Gizzard Shad	11.9	24.0	4.9	0.34%	5.8%	0.1%	0.36	10.53	0.23	0.01	0.43	0.01	15	1,011	19
Striped Bass	26.2	54.2	13.6	0.37%	1.9%	0.2%	0.38	3.53	0.43	0.02	0.14	0.02	16	339	35
Brown Bullhead	16.7	30.2	44.4	1.38%	1.7%	2.8%	1.43	3.13	5.00	0.06	0.13	0.21	60	300	405
Blueback Herring	19.1	12.5	25.9	3.01%	1.4%	1.6%	3.12	2.50	2.86	0.13	0.10	0.12	131	240	232
Atlantic Menhaden	9.5	9.4	2.5	0.11%	0.8%	0.0%	0.12	1.50	0.05	0.00	0.06	<0.01	5	144	4
Black Crappie	2.4	14.6	4.9	0.14%	0.5%	0.1%	0.14	0.97	0.11	0.01	0.04	<0.01	6	93	9
Atlantic Silverside	4.8	17.7	3.7	0.23%	0.3%	0.0%	0.24	0.60	0.06	0.01	0.02	<0.01	10	58	5
Alewife	23.8	14.6	18.5	2.71%	0.3%	0.3%	2.81	0.54	0.57	0.11	0.02	0.02	118	52	46
Weakfish		15.6	3.7		0.3%	0.1%		0.51	0.12		0.02	0.01		49	10
American Eel	14.3	21.9	29.6	0.18%	0.2%	0.5%	0.19	0.44	0.98	0.01	0.02	0.04	8	42	79
Striped Killifish	2.4	14.6	9.9	0.05%	0.2%	0.4%	0.05	0.39	0.72	<0.01	0.02	0.03	2	37	58
Goldfish		13.5			0.2%			0.34			0.01			33	
Common Carp	21.4	13.5	33.3	0.67%	0.1%	0.5%	0.69	0.20	0.94	0.03	<0.01	0.04	29	19	76
Crevalle Jack		6.3	7.4		0.04%	0.7%		0.07	1.20		<0.01	0.05		7	97
Spotted Hake		3.1	1.2		0.04%	0.1%		0.07	0.10		<0.01	<0.01		7	8
Bluefish	9.5	3.1	3.7	0.09%	0.03%	0.1%	0.10	0.06	0.11	<0.01	<0.01	<0.01	4	6	9
Pumpkinseed	4.8	4.2	46.9	0.07%	0.03%	1.1%	0.07	0.06	1.91	<0.01	<0.01	0.08	3	6	155
Largemouth Bass		3.1			0.03%			0.05			<0.01			5	
Threespine Stickleback	2.4	5.2		0.02%	0.03%		0.02	0.05		<0.01	<0.01		1	5	
Inland Silverside		3.1			0.02%			0.03			<0.01			3	
Winter Flounder	2.4	3.1	4.9	0.02%	0.02%	0.03%	0.02	0.03	0.06	<0.01	<0.01	<0.01	1	3	5
Bay Anchovy		1.0	1.2		0.01%	0.01%		0.02	0.01		<0.01	<0.01		2	1
Unid. Clupeidae		1.0	1.2		0.01%	0.01%		0.01	0.01		<0.01	<0.01		1	1
American Shad		1.0	6.2		0.01%	0.6%		0.01	1.15		<0.01	0.05		1	93
Bluegill		1.0	2.5		0.01%	0.01%		0.01	0.02		<0.01	<0.01		1	2
Green Sunfish		1.0	11.1		0.01%	0.1%		0.01	0.16		<0.01	0.01		1	13
Lookdown		1.0			0.01%			0.01			<0.01			1	
Yellow Perch	2.4	1.0	1.2	0.05%	0.01%	0.01%	0.05	0.01	0.02	<0.01	<0.01	<0.01	2	1	2
Atlantic Tomcod	2.4		3.7	0.02%		0.1%	0.02		0.11	<0.01		<0.01	1		9
Golden Shiner			3.7			0.04%			0.07			<0.01			6
Northern Pipefish	4.8		1.2	0.05%		0.01%	0.05		0.01	<0.01		<0.01	2		1
Spot	4.8		8.6	0.05%		0.3%	0.05		0.57	<0.01		0.02	2		46
White Catfish			1.2			0.01%			0.01			<0.01			1
Windowpane			1.2			0.01%			0.01			<0.01			1
Atlantic Moonfish	2.4			0.02%			0.02			<0.01			1		
Summer Flounder	2.4			0.07%			0.07			<0.01			3		
Totals:				100.0%	100.0%	100.0%	103.62	181.65	178.59	4.24	7.38	7.61	4,352	17,438	14,468
Total Number of Taxa:													23	29	30
blue crab	40.5	61.5	34.6				3.62	11.38	1.90	0.15	0.46	0.08	152	1,092	154
Diamondback Terrapin	40.5	30.2	17.3				1.81	1.31	0.81	0.07	0.05	0.03	76	126	66
Snapping Turtle	2.4	5.2	2.5				0.05	0.06	0.05	<0.01	<0.01	0.00	2	6	4

Total CPUE = total # of fish / total # of hours Trap Nets were fished

TABLE 19

Comparison of Percent Frequency of Occurrence, Relative Abundance, Mean #, Total CPUE and Total # For All Trawl Collections
HMDC/NJMC/NJSEA Hackensack River Fishery Resource Inventory
2013- 2015; 2001-2003; and 1987-1988

Sampling Period:	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88
Number Of Collections:	126	288	265	126	288	265	126	288	265	126	288	265	126	288	265
	Percent Frequency of Occurrence			Relative Abundance (% of total)			Mean # / Trawl			Total CPUE (# / minute)			Total Number Collected		
White Perch	65.1	59.4	7.5	73.96%	58.0%	0.6%	20.04	9.10	0.18	6.68	3.04	0.06	2,525	2,620	47
Striped Bass	20.6	40.3	4.2	2.02%	12.3%	0.2%	0.55	1.93	0.07	0.18	0.64	0.02	69	556	18
Mummichog	8.7	11.8	65.3	4.77%	8.9%	65.6%	1.29	1.40	17.95	0.43	0.47	5.94	163	403	4,756
Gizzard Shad	12.7	12.8	1.5	2.17%	4.4%	0.2%	0.59	0.69	0.05	0.20	0.23	0.02	74	198	14
Weakfish	6.4	10.8	8.3	0.85%	4.1%	1.1%	0.23	0.65	0.31	0.08	0.22	0.10	29	187	83
Blueback Herring	3.2	4.5	6.4	0.12%	2.8%	2.5%	0.03	0.44	0.68	0.01	0.15	0.22	4	127	179
Alewife	7.9	11.5	7.2	0.44%	1.7%	0.8%	0.12	0.27	0.22	0.04	0.09	0.07	15	78	57
Bay Anchovy	16.7	6.6	9.8	6.15%	1.6%	17.6%	1.67	0.25	4.83	0.56	0.08	1.60	210	72	1,279
Brown Bullhead	11.9	6.3	1.5	0.82%	1.3%	0.1%	0.22	0.20	0.02	0.07	0.07	0.01	28	58	5
American Eel	20.6	7.6	16.6	2.17%	1.1%	1.1%	0.59	0.17	0.29	0.20	0.06	0.10	74	50	77
Bluefish	7.1	8.0	. 1.5	0.67%	1.1%	0.1%	0.18	0.17	0.02	0.06	0.06	0.01	23	49	4
Spot	12.7	3.8	6.8	3.02%	0.7%	3.6%	0.82	0.11	0.98	0.27	0.04	0.32	103	32	259
Atlantic Menhaden	7.9	4.5	1.1	0.44%	0.6%	0.1%	0.12	0.09	0.02	0.04	0.03	0.01	15	26	5
American Shad		2.4	2.3		0.3%	0.3%		0.05	0.08		0.02	0.03		15	20
Atlantic Silverside	4.0	1.7	0.8	0.82%	0.2%	0.3%	0.22	0.02	0.09	0.07	0.01	0.03	28	7	25
Common Carp	4.0	1.7		0.15%	0.1%		0.04	0.02		0.01	0.01		5	6	
Crevalle Jack		0.7	0.4		0.1%	0.01%		0.01	<0.01		<0.01	<0.01		4	1
Northern Pipefish	2.4	1.4	0.4	0.12%	0.1%	0.01%	0.03	0.01	<0.01	0.01	<0.01	<0.01	4	4	1
Atlantic Tomcod	0.8	0.7	14.0	0.03%	0.1%	4.9%	0.01	0.01	1.35	<0.01	<0.01	0.45	1	3	358
Pumpkinseed		0.7	1.5		0.1%	0.1%		0.01	0.02		<0.01	0.01		3	6
Summer Flounder	1.6	0.7		0.06%	0.1%		0.02	0.01		0.01	<0.01		2	3	
Atlantic Croaker	0.8	0.7		0.03%	0.04%		0.01	0.01		<0.01	<0.01		1	2	
Black Crappie		0.7	0.4		0.04%	0.01%		0.01	<0.01		<0.01	<0.01		2	1
Inland Silverside		0.3	0.4		0.04%	0.01%		0.01	<0.01		<0.01	<0.01		2	1
Naked Goby		0.3			0.04%			0.01			<0.01			2	
Spotted Hake		0.7	0.8		0.04%	0.04%		0.01	0.01		<0.01	<0.01		2	3
Striped Killifish	0.8	0.3	2.6	0.03%	0.02%	0.2%	0.01	<0.01	0.04	<0.01	<0.01	0.01	1	1	11
Threespine Stickleback	4.8	0.3		0.32%	0.02%		0.09	<0.01		0.03	<0.01		11	1	
Winter Flounder	1.6	0.3	3.8	0.09%	0.02%	0.4%	0.02	<0.01	0.12	0.01	<0.01	0.04	3	1	31
Bluegill			0.4			0.01%			<0.01			<0.01			1
Conger Eel			0.4			0.01%			<0.01			<0.01			1
Golden Shiner			0.4			0.01%			<0.01			<0.01			1
Rainbow Smelt			0.4			0.01%			<0.01			<0.01			1
Seaboard Goby			0.4			0.01%			<0.01			<0.01			1
Windowpane			0.4			0.01%			<0.01			<0.01			1
Oyster Toadfish	0.8			0.03%			0.01			<0.01			1		
Freshwater Goby	0.8			0.03%			0.01			<0.01			1		
Naked Goby	0.8			0.03%			0.01			<0.01			1		
Hogchoker	5.6			0.67%			0.18			0.06			23		
Totals:				100.00%	100.0%	100.0%	27.10	15.67	27.37	9.04	5.23	9.05	3,414	4,514	7,247
Total Number of Taxa:													26	29	30
blue crab	42.1	52.8	20.0				1.01	2.50	0.76	0.34	0.84	0.25	127	721	202

Total CPUE = total # of fish / total # of minutes Trawls were fished

TABLE 20

Comparison of Percent Frequency of Occurrence, Relative Abundance, Total CPUE and Total # For All Seine Collections

HMDC/NJMC/NJSEA Hackensack River Fishery Resource Inventory

2013-2015; 2001-2003; and 1987-1988

Sampling Period:	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88
Number Of Collections:	21	48	45	21	48	45	21	48	45	21	48	45
	Percent Frequency of Occurrence			Relative Abundance (% of total)			Total CPUE (Total # /# of hauls)			Total Number Collected		
Mummichog	81.0	75.0	100.0	19.89%	45.7%	91.1%	125.62	162.56	802.80	2,638	7,803	36,126
Atlantic Silverside	57.1	64.6	37.8	75.24%	36.8%	4.6%	475.29	130.79	40.47	9,981	6,278	1,821
Striped Killifish	57.1	56.3	33.3	1.48%	7.1%	0.6%	9.33	25.23	5.42	196	1,211	244
White Perch	52.4	45.8	17.8	2.82%	7.0%	0.03%	17.81	24.92	0.22	374	1,196	10
Inland Silverside	14.3	43.8	64.4	0.14%	2.1%	3.5%	0.90	7.52	30.89	19	361	1,390
Striped Bass	4.8	29.2	6.7	0.01%	0.4%	0.02%	0.05	1.46	0.13	1	70	6
Atlantic Menhaden		12.5			0.2%			0.73			35	
Gizzard Shad		6.3	2.2		0.1%	0.02%		0.48	0.13		23	6
Bay Anchovy	14.3	6.3	8.9	0.11%	0.1%	0.05%	0.67	0.44	0.40	14	21	18
Crevalle Jack	4.8	2.1	2.2	0.01%	0.1%	0.01%	0.05	0.40	0.04	1	19	2
Bluefish	23.8	12.5	6.7	0.10%	0.1%	0.01%	0.62	0.38	0.07	13	18	3
Northern Pipefish		8.3	2.2		0.04%	0.01%		0.15	0.04		7	2
Common Carp	4.8	4.2	2.2	0.03%	0.04%	0.01%	0.19	0.13	0.04	4	6	2
Striped Mullet		4.2	2.2		0.04%	<0.01%		0.13	0.02		6	1
Spot	4.8	4.2		0.01%	0.03%		0.05	0.10		1	5	
Winter Flounder		4.2	2.2		0.03%	<0.01%		0.10	0.02		5	1
Alewife	4.8	2.1		0.01%	0.02%		0.05	0.06		1	3	
Atlantic Tomcod	4.8	2.1		0.01%	0.01%		0.05	0.04		1	2	
Hogchoker		4.2			0.01%			0.04			2	
Unidified Clupeidae		2.1			0.01%			0.02			1	
Goldfish		2.1	2.2		0.01%	<0.01%		0.02	0.02		1	1
Summer Flounder		2.1			0.01%			0.02			1	
Blueback Herring			4.4			0.01%			0.11			5
Pumpkinseed			15.6			0.04%			0.38			17
Weakfish			2.2			<0.01%			0.02			1
Windowpane			2.2			<0.01%			0.02			1
Threespine Stickleback	9.5			0.02%			0.10			2		
Yellow Perch	4.8			0.13%			0.81			17		
Naked Goby	9.5			0.02%			0.10			2		
Totals:				100%	100.0%	100.0%	631.67	355.71	881.27	13,265	17,074	39,657
Total Number of Taxa:										16	21	19
blue crab	28.6	39.6	13.3				0.71	2.13	0.40	15	102	18

Total CPUE = total # of fish / total # of seine hauls

TABLE 21

Comparison of Percent Frequency of Occurrence, Relative Abundance, Mean #, Total CPUE and Total # For All Gill Net Collections

HMDC/NJMC/NJSEA Hackensack River Fishery Resource Inventory

2013- 2015; 2001-2003; and 1987-1988

Sampling Period:	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88	2013-15	2001-03	1987-88
Number Of Collections:	21	48	42	21	48	42	21	48	42	21	48	42	21	48	42
	Percent Frequency of Occurrence			Relative Abundance (% of total)			Mean # / Gill Net			Total CPUE (# / hour)			Total Number Collected		
White Perch	95.2	87.5	21.4	44.9%	57.6%	15.6%	39.10	22.96	1.29	1.63	0.95	0.05	821	1,102	54
Gizzard Shad	23.8	25.0	9.5	24.3%	21.5%	10.7%	21.14	8.56	0.88	0.88	0.35	0.04	444	411	37
Striped Bass	71.4	70.8	11.9	6.8%	8.3%	7.5%	5.95	3.29	0.62	0.25	0.14	0.02	125	158	26
Atlantic Menhaden	47.6	33.3	28.6	13.0%	6.0%	28.0%	11.29	2.40	2.31	0.47	0.10	0.09	237	115	97
Common Carp	38.1	22.9	2.4	5.1%	3.0%	0.6%	4.48	1.21	0.05	0.19	0.05	<0.01	94	58	2
Bluefish	33.3	12.5	2.4	3.1%	1.7%	0.3%	2.71	0.69	0.02	0.11	0.03	<0.01	57	33	1
Brown Bullhead	14.3	10.4	4.8	0.3%	0.6%	0.6%	0.24	0.25	0.05	0.01	0.01	<0.01	5	12	2
Black Crappie	9.5	10.4		0.2%	0.4%		0.14	0.15		0.01	<0.01		3	7	
Weakfish		10.4			0.3%			0.13			<0.01			6	
Alewife	14.3	6.3	4.8	0.2%	0.3%	1.7%	0.14	0.10	0.14	0.01	<0.01	0.01	3	5	6
Blueback Herring	9.5	4.2	7.1	0.2%	0.2%	1.2%	0.14	0.08	0.10	0.01	<0.01	<0.01	3	4	4
Alligator Gar		2.1			0.1%			0.02			<0.01			1	
Spot	19.1	2.1	4.8	1.0%	0.1%	3.8%	0.90	0.02	0.31	0.04	<0.01	0.01	19	1	13
Striped Searobin		2.1			0.1%			0.02			<0.01			1	
Atlantic Tomcod	4.8		28.6	0.1%		29.2%	0.05		2.40	<0.01		0.10	1		101
Golden Shiner			2.4			0.3%			0.02			<0.01			1
Striped Killifish			2.4			0.3%			0.02			<0.01			1
Winter Flounder			2.4			0.3%			0.02			<0.01			1
Northern Searobin	4.8			0.1%			0.05			<0.01			1		
Yellow Perch	14.3			0.8%			0.67			0.03			14		
Hogchoker	9.5			0.1%			0.10			<0.01			2		
Totals:				100.0%	100.0%	100.0%	87.10	39.88	8.24	3.63	1.65	0.33	1,829	1,914	346
Total Number of Taxa:													15	14	14
blue crab	42.9	37.5	23.8				0.71	4.50	1.43	0.03	0.19	0.06	15	216	60

Total CPUE = total # of fish / total # of hours Gill Nets were fished

TABLE 22
Summary of Species Index Calculations by Individual Site Location
NJMC/NJSEA Hackensack River Fishery Resource Inventory
2013-2015 vs. 2001-2003

Site:	GN1	GN2	GN3	T1	T2	T3	T4	T5	T6	T7	T8	T9
# of Collections 2001-2003	**16**	**16**	**16**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
# of Collections 2013-2015	7	7	7	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**
# of Species 2001-2003	**8**	7	**10**	**13**	**12**	**12**	**14**	**12**	**11**	**17**	**14**	**13**
# of Species 2013-15	**5**	**9**	**11**	**11**	**9**	**12**	**15**	**14**	**7**	**15**	**11**	**13**
# of Fish 2001-2003	**216.33**	**272.99**	**390.16**	**79.83**	**212.66**	**325.00**	**340.98**	**475.97**	**170.81**	**291.00**	**400.62**	**180.65**
# of fish 2013-2015	**105**	**764**	**960**	**75**	**63**	**359**	**515**	**362**	**148**	**1,430**	**283**	**179**
INDEX												
$H'_{2001-2003}$	0.69	1.06	1.33	2.00	1.13	1.78	1.07	1.28	1.12	1.22	0.47	1.30
$H'_{2013-2015}$	1.11	0.98	1.40	1.45	1.40	0.99	1.19	1.22	0.53	0.37	1.22	1.85
$H'^{\wedge}2_{2001-2003}$	0.48	1.12	1.77	3.99	1.29	3.18	1.15	1.63	1.26	1.50	0.22	1.68
$H'^{\wedge}2_{2013-2015}$	1.22	0.95	1.95	2.11	1.96	0.97	1.41	1.50	0.28	0.13	1.49	3.44
$D_{2001-2003}$	1.51	2.04	2.97	5.34	2.16	4.58	1.96	2.77	2.32	1.85	1.21	2.75
$D_{2013-2015}$	2.36	1.97	3.13	2.95	2.54	1.66	1.88	2.52	1.27	1.13	2.58	4.77
$H'max_{2001-2003}$	2.08	1.95	2.20	2.56	2.48	2.48	2.64	2.48	2.40	2.83	2.64	2.56
$H'max_{2013-2015}$	1.61	2.20	2.40	2.40	2.20	2.48	2.71	2.64	1.95	2.71	2.40	2.56
$E_{2001-2003}$	0.33	0.54	0.61	0.78	0.46	0.72	0.41	0.51	0.47	0.43	0.18	0.51
$E_{2013-2015}$	0.69	0.44	0.58	0.61	0.64	0.40	0.44	0.46	0.27	0.13	0.51	0.72
Var	< 0.1	< 0.1	< 0.1	0.01	0.02	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Tstat	3.69	1.11	1.15	3.12	1.55	8.96	1.23	0.68	4.81	8.92	8.57	5.22
V (dof)	250.19	484.07	715.02	146.82	102.57	630.39	791.92	721.54	299.80	365.04	666.45	355.99
Significant at .05	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes
Significant at .01	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes

Site:	S1	S2	S3	TN1	TN2	TN3	TN4	TN5	TN6
# of Collections 2001-2003	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**
# of Collections 2013-2015	7	7	7	7	7	7	7	7	7
# of Species 2001-2003	**13**	**15**	**10**	**16**	**17**	**18**	**17**	**19**	**19**
# of Species 2013-15	**9**	**9**	**11**	**6**	**8**	**11**	**9**	**11**	**13**
# of Fish 2001-2003	**3,835.81**	**2,449.59**	**4,178.27**	**96.66**	**697.99**	**769.62**	**933.31**	**2,054.33**	**3,093.99**
# of fish 2013-2015	**9,694**	**554**	**3,017**	**227**	**542**	**556**	**463**	**1,312**	**1,252**
INDEX									
$H'_{2001-2003}$	0.15	1.52	0.89	1.19	0.59	0.78	1.07	1.19	1.21
$H'_{2013-2015}$	0.02	1.38	0.72	0.26	0.23	0.20	0.66	0.74	0.70
$H'^{\wedge}2_{2001-2003}$	0.02	2.31	0.78	1.41	0.35	0.60	1.13	1.41	1.46
$H'^{\wedge}2_{2013-2015}$	0.00	1.91	0.52	0.07	0.05	0.04	0.44	0.55	0.50
$D_{2001-2003}$	1.05	3.87	1.72	1.91	1.27	1.47	2.32	2.26	2.42
$D_{2013-2015}$	1.01	3.30	1.47	1.10	1.08	1.06	1.38	1.48	1.40
$H'max_{2001-2003}$	2.56	2.71	2.30	2.77	2.83	2.89	2.83	2.94	2.94
$H'max_{2013-2015}$	2.20	2.20	2.40	1.79	2.08	2.40	2.20	2.40	2.56
$E_{2001-2003}$	0.06	0.56	0.38	0.43	0.21	0.27	0.38	0.40	0.41
$E_{2013-2015}$	0.01	0.63	0.30	0.15	0.11	0.08	0.30	0.31	0.27
Var	1.62	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Tstat	8.98	3.67	6.10	5.64	5.54	9.06	6.10	10.38	12.13
V (dof)	4568.87	849.48	6322.57	131.14	1228.74	1325.46	836.65	2817.13	2026.38
Significant at .05	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Significant at .01	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

FIGURES

Figure 1: Map of Meadowlands District and Sampling Locations

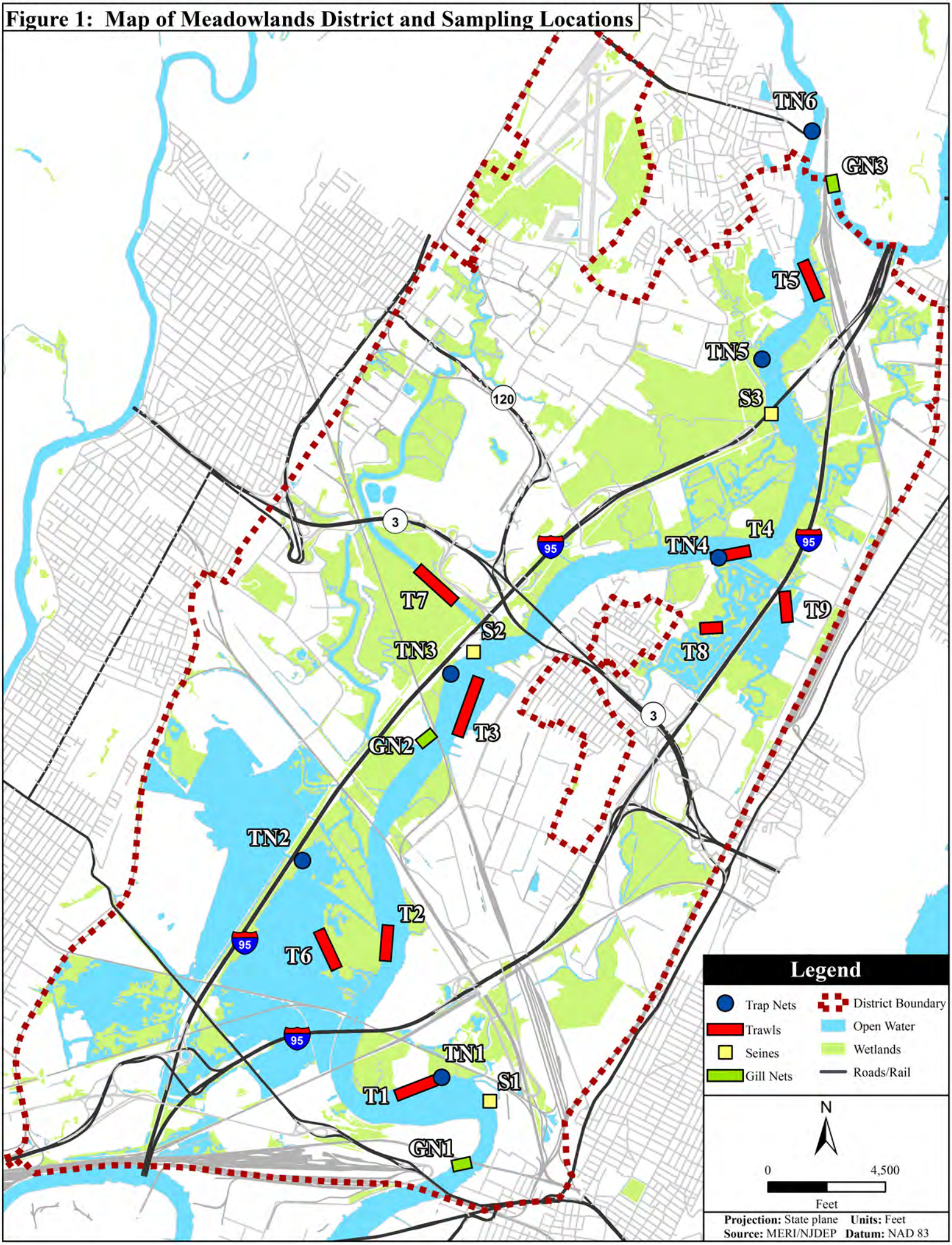

FIGURE 2
NJMC HACKENSACK RIVER
FISHERIES RESOURCE INVENTORY

Station/Location: _____

Collection No.: _____ Replicate No.: _____

Date/Time (Set): _____ Gear: _____
Date/Time(Retr.): _____

RPM: _____

Duration of tow/set: _____

Depth: _____

Tide: High
Low
Moon Phase: _____

Weather: wind: Calm, Breeezy, Windy, Other: _____
sea: Calm, Choppy, Rough, Other: _____
atmosphere: Clear, Overcast, Fog, Drizzle, Rain, Sleet, Snow, Other: _____

Temp. : air: _____
(^{0}C) surface: _____
bottom: _____

Crew: _____
Remarks: _____

D.O. surface: _____
(mg/L) bottom: _____

Cond : surface: _____
(umhos) bottom: _____

Salinity surface: _____
(0/00) bottom: _____

Turb: surface: _____
(NTU) bottom: _____

pH: surface: _____
bottom: _____

T.D.S.: surface: _____
bottom: _____

Tissue samples: _____

Redox : surface: _____
(mV) bottom: _____

Date proccessed: _____

Sorted by: _____

Secchi (cm): _____

Identified by: _____

Site:

CAPTURE DATA

#	Species											
		mm TL										
		grams										
		mm TL										
		grams										
		mm TL										
		grams										
		mm TL										
		grams										
		mm TL										
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Figure 3
Seasonal Abundance of the Top 10 Species

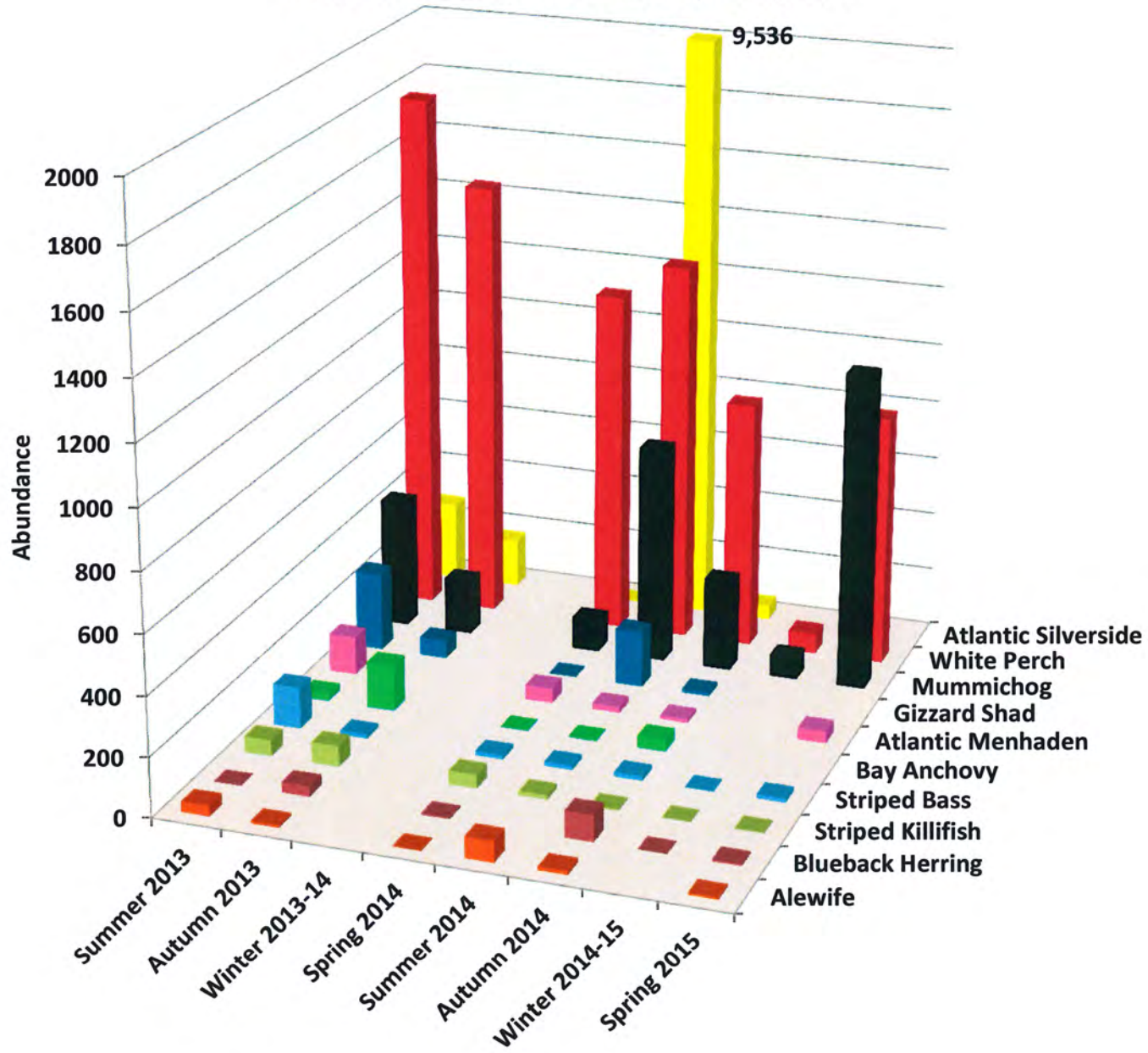


Figure 4
Seasonal Percent Contribution of the 10 Most Abundant Species

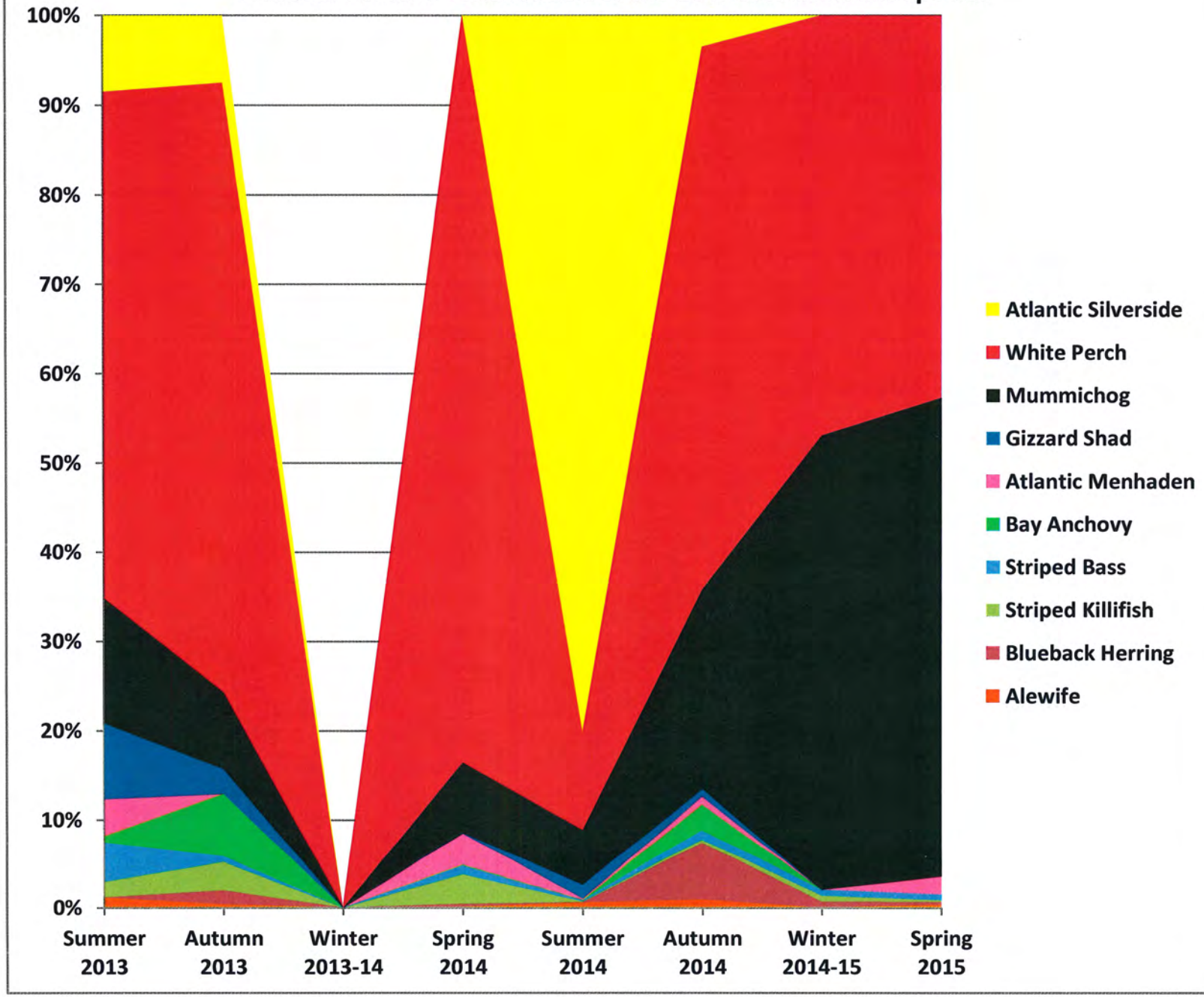


Figure 5
CPUE by Trap Net Location
2013 to 2015

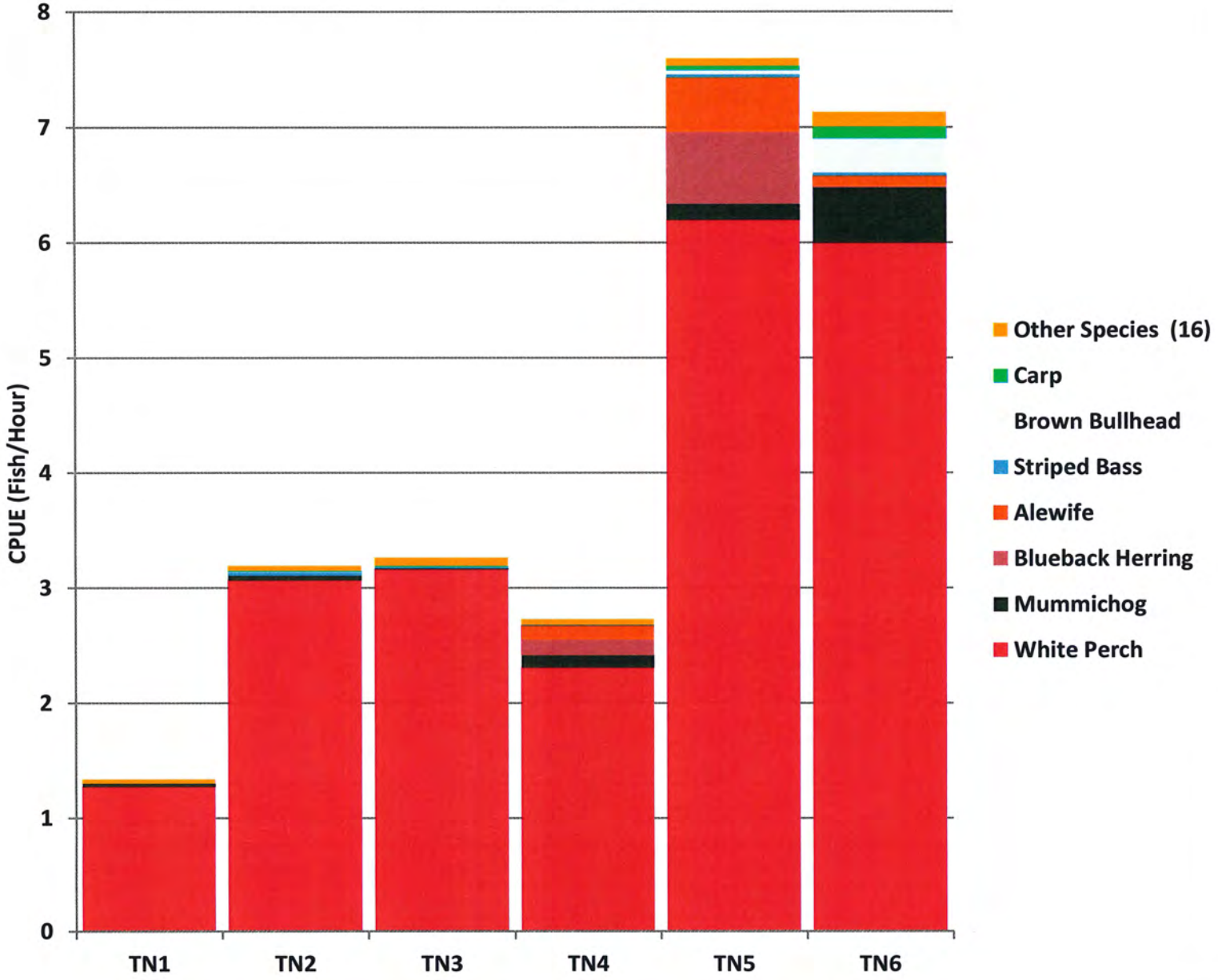


Figure 6
Seasonal Trap Net CPUE
Summer 2013 to Spring 2015

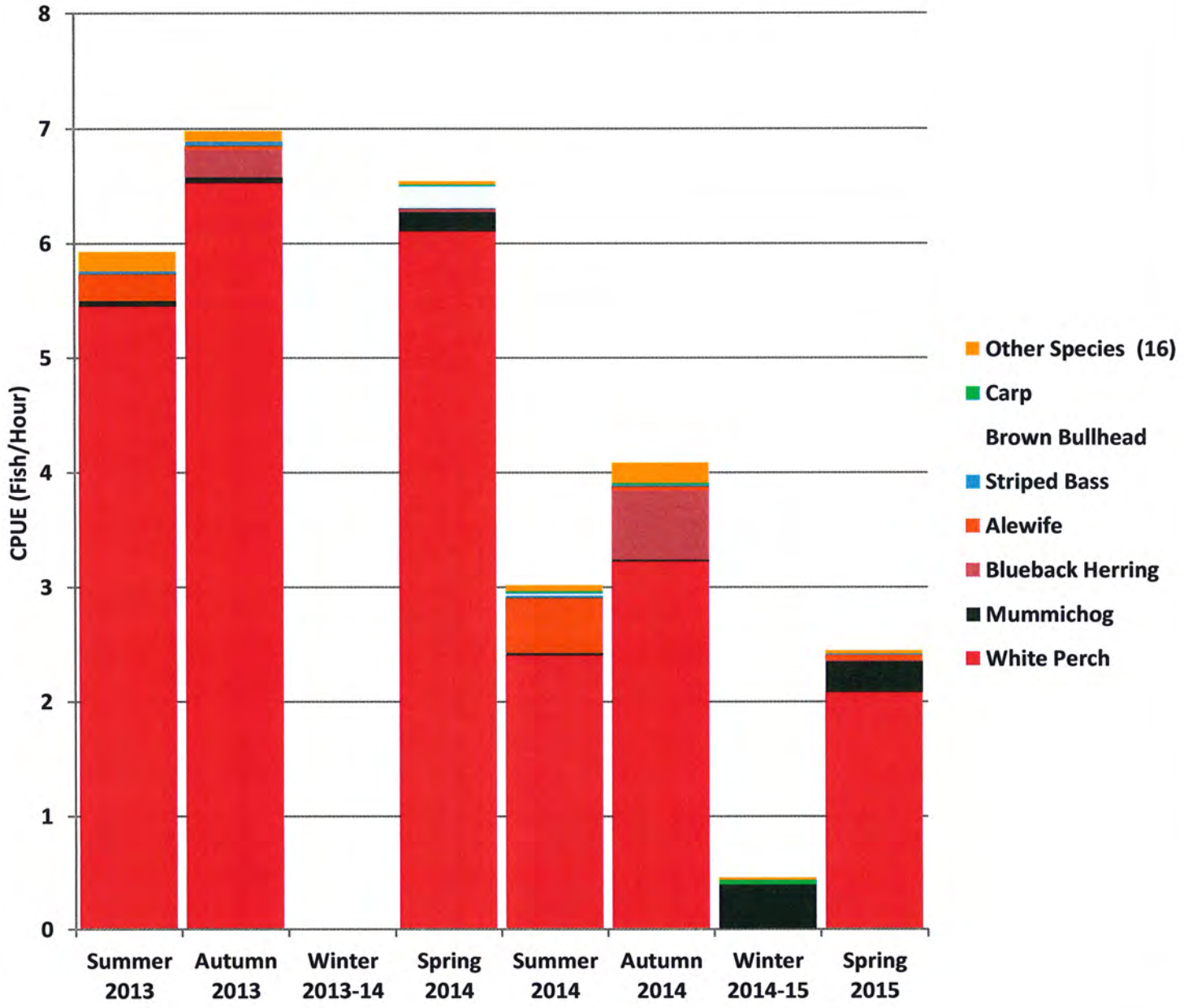


Figure 7
CPUE by Trawl Location
Summer 2013 to Spring 2015

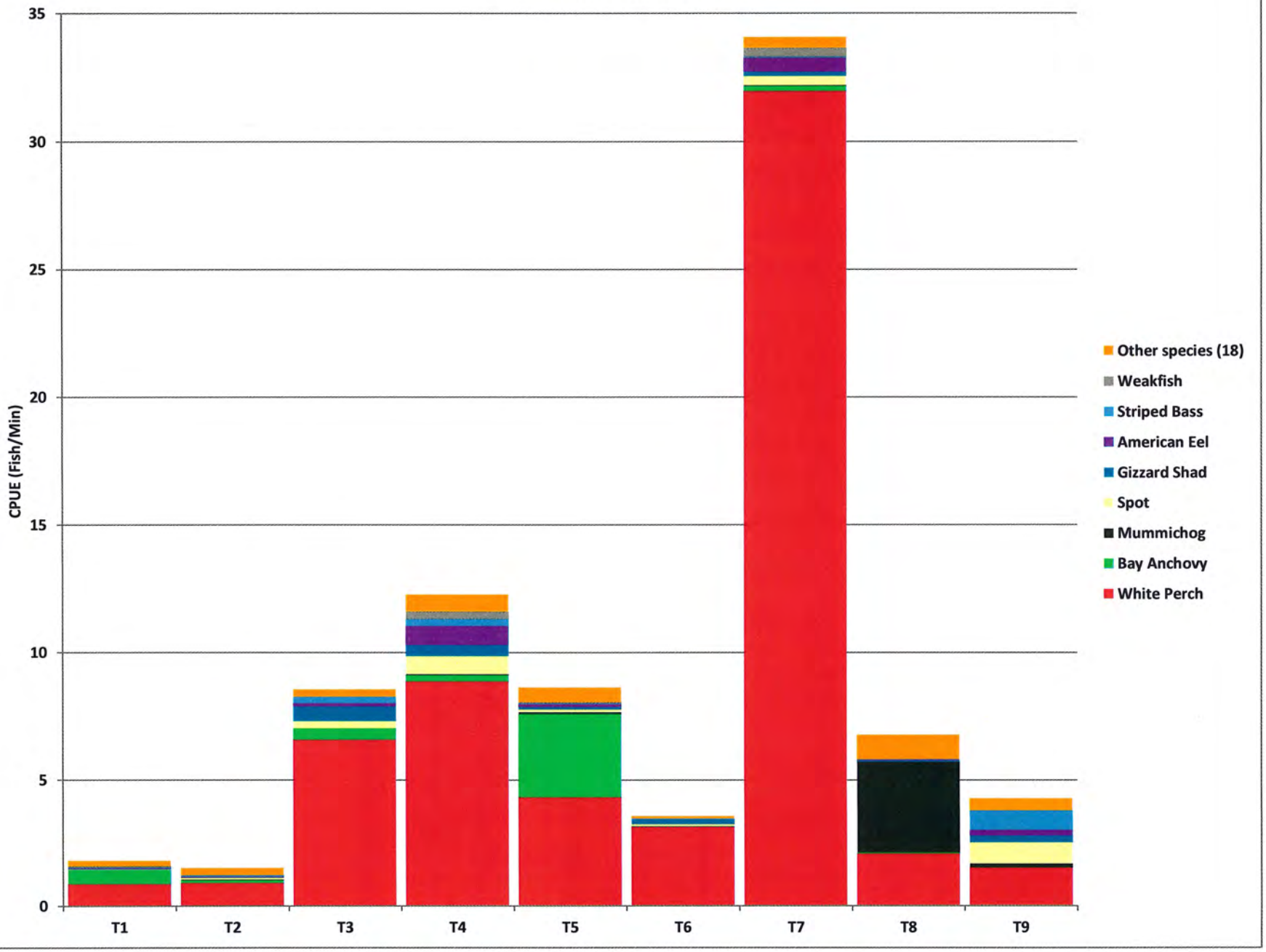


Figure 8
Seasonal Trawl CPUE
Summer 2013 to Spring 2015

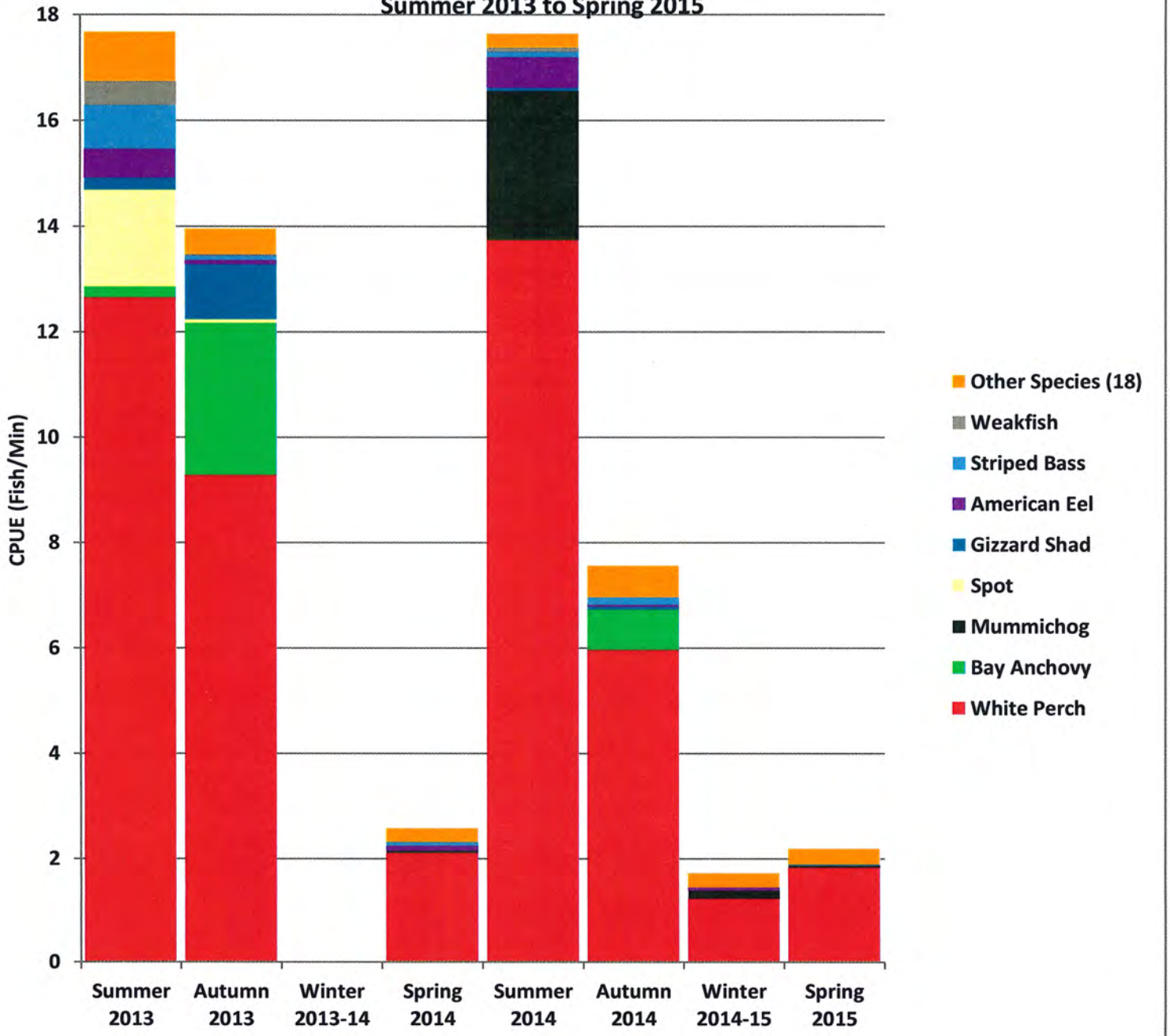


Figure 9
CPUE by Seine Location
Summer 2013 to Spring 2015

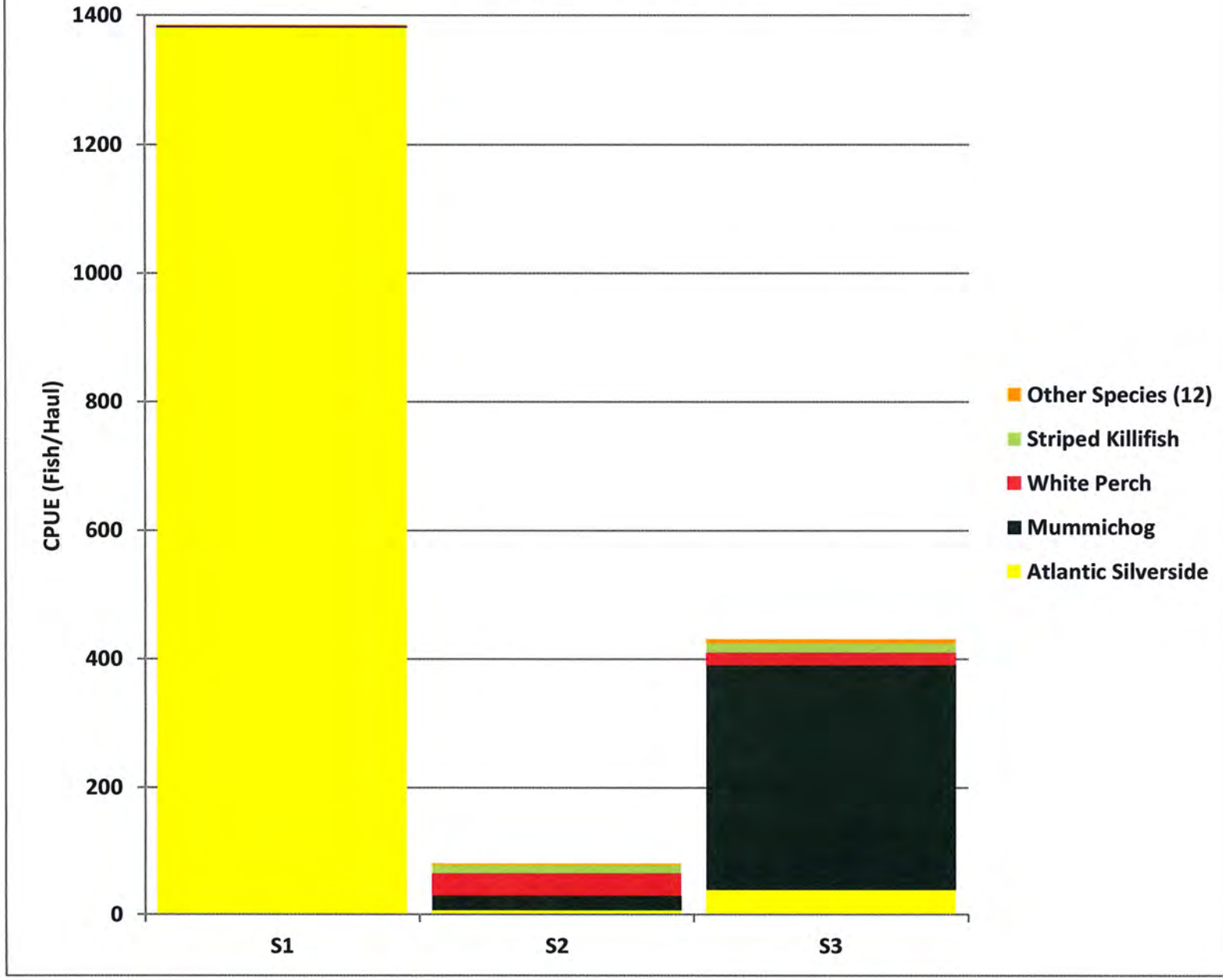


Figure 10
Seasonal Seine CPUE

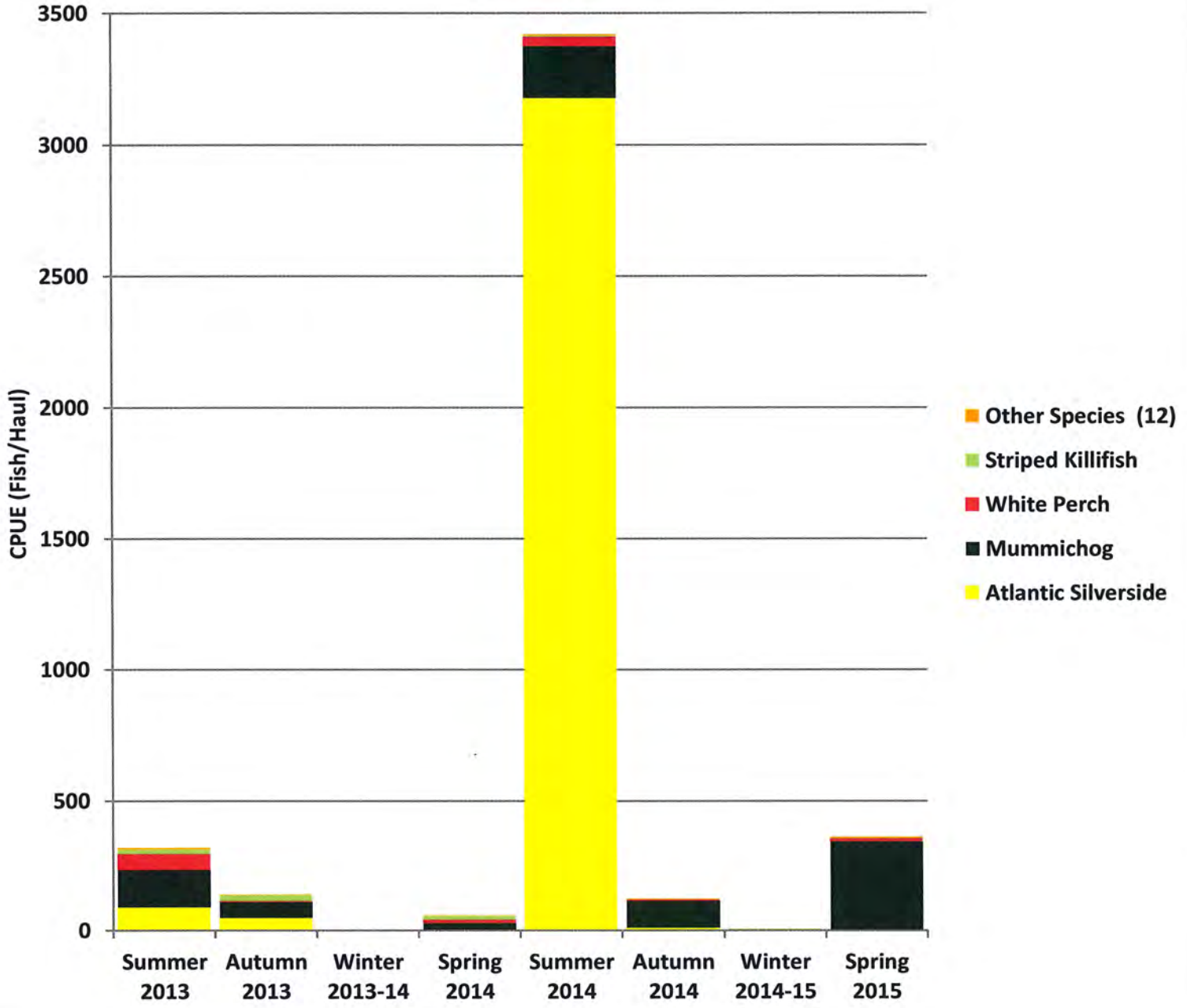


Figure 11
CPUE by Gill Net Location
Summer 2013 to Spring 2015

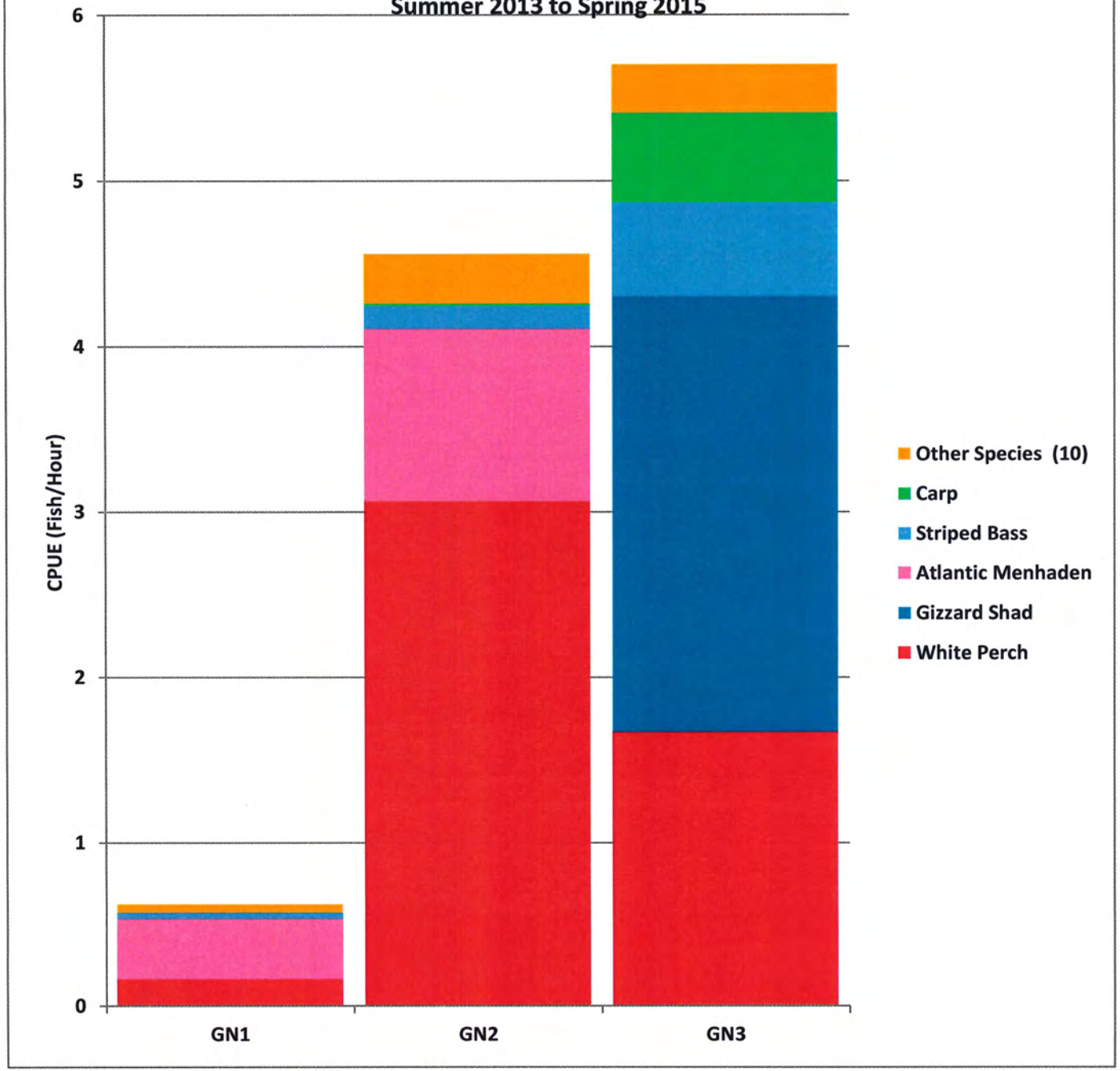


Figure 12
Seasonal Gill Net CPUE
Summer 2013 to Spring 2015

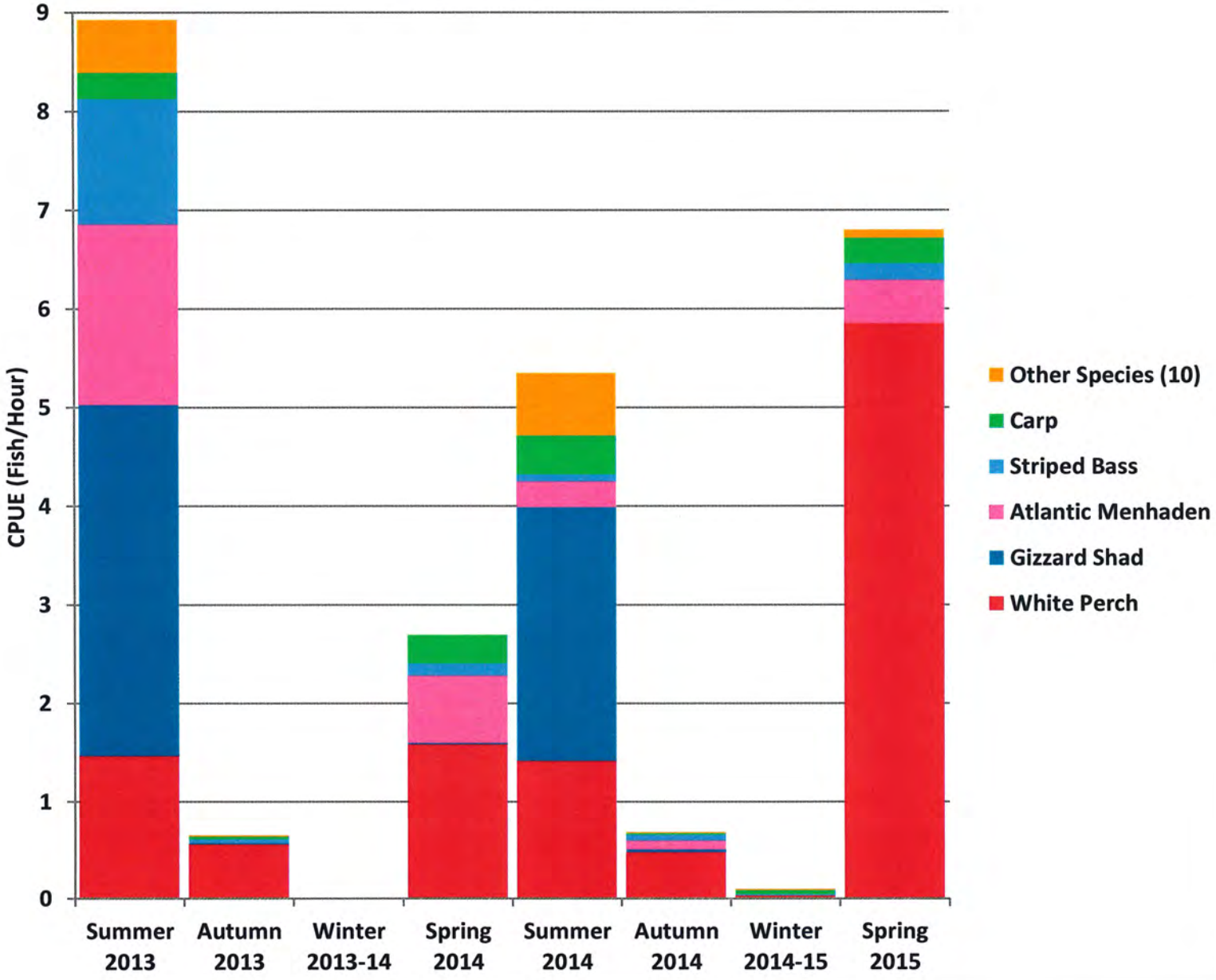


Figure 13
Relative Biomass vs Relative Abundance
Summer 2013 to Spring 2015

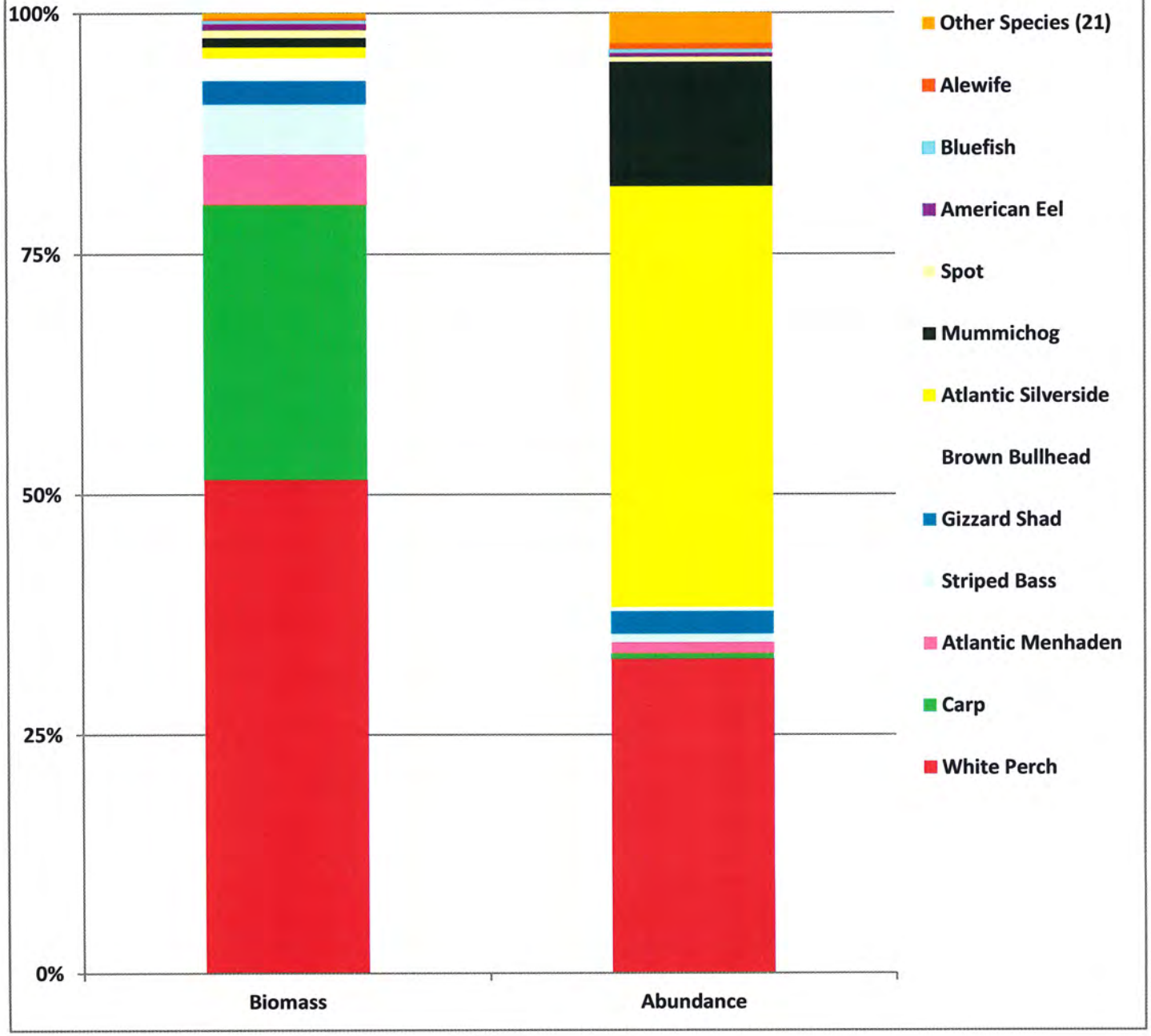
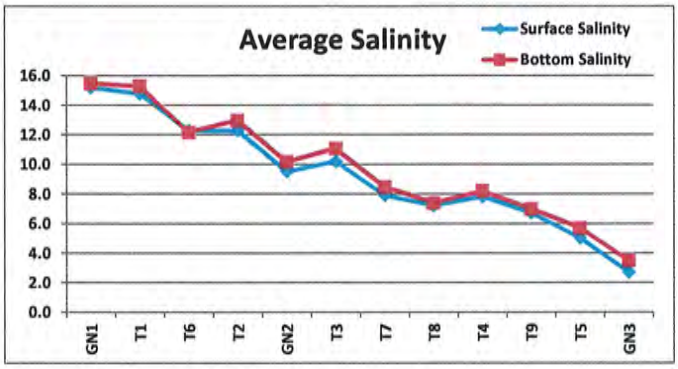
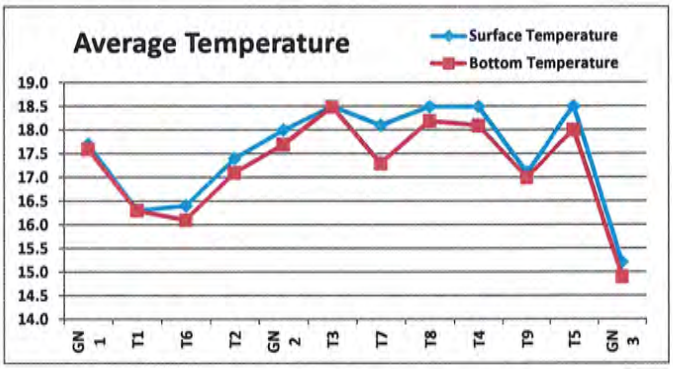
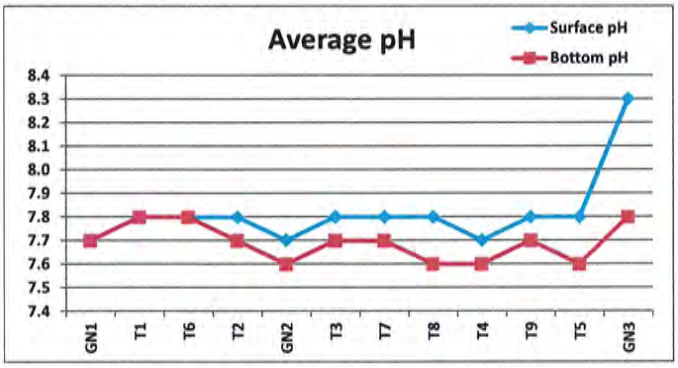
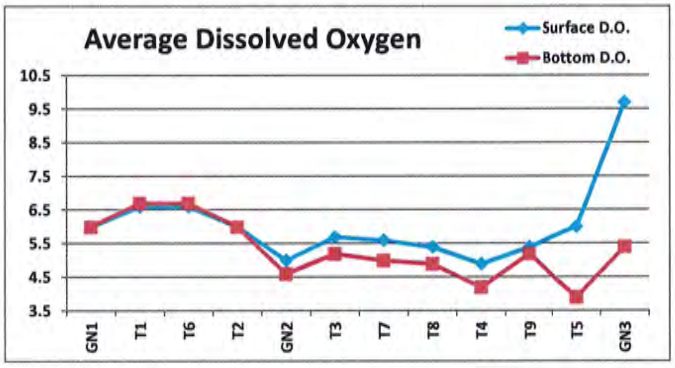


FIGURE 14
Water Quality Averages by Site Location
Summer 2013 to Spring 2015









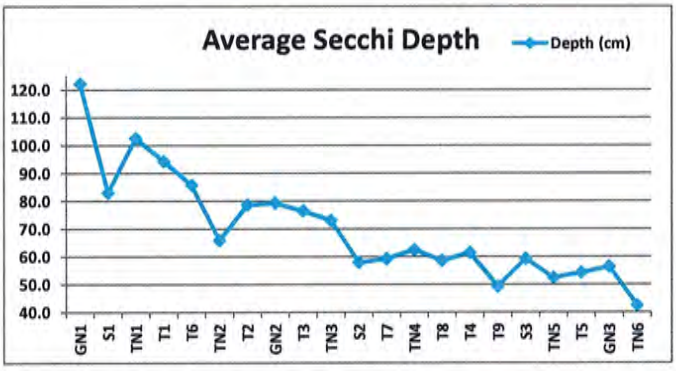
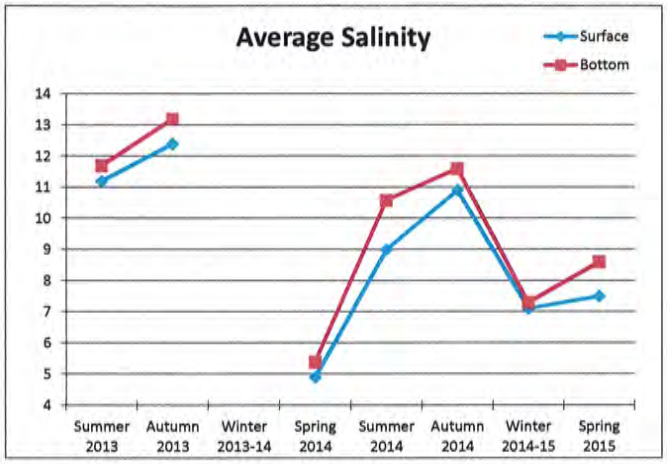
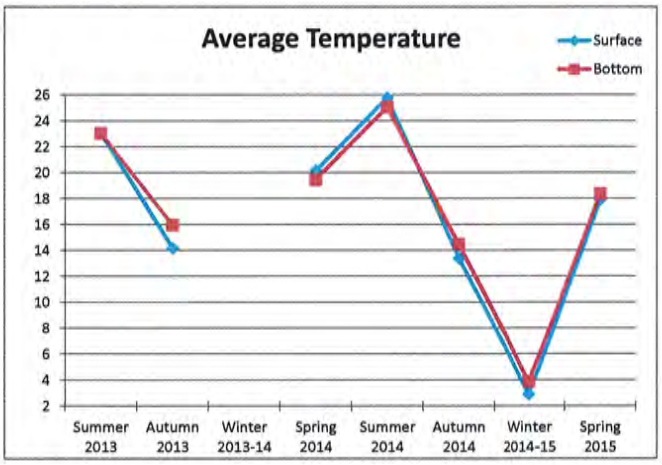
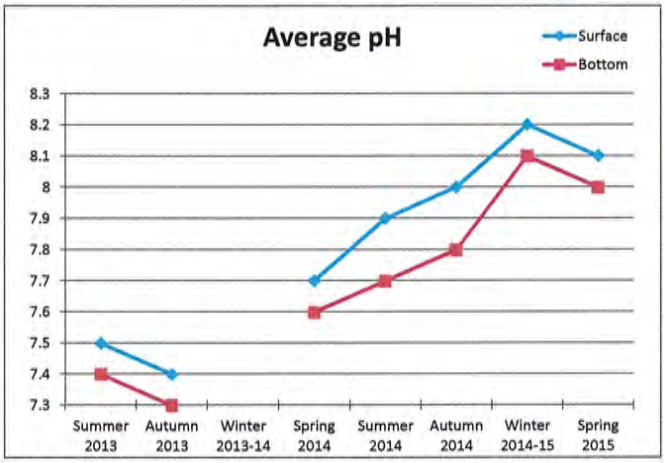
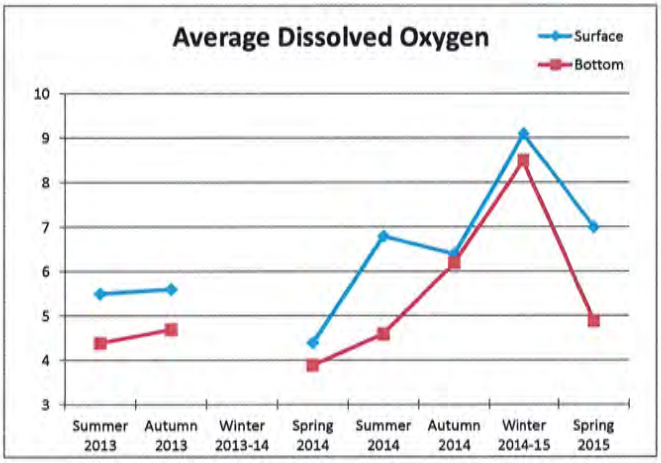


FIGURE 15
Water Quality Averages by Season
Summer 2013 to Spring 2015









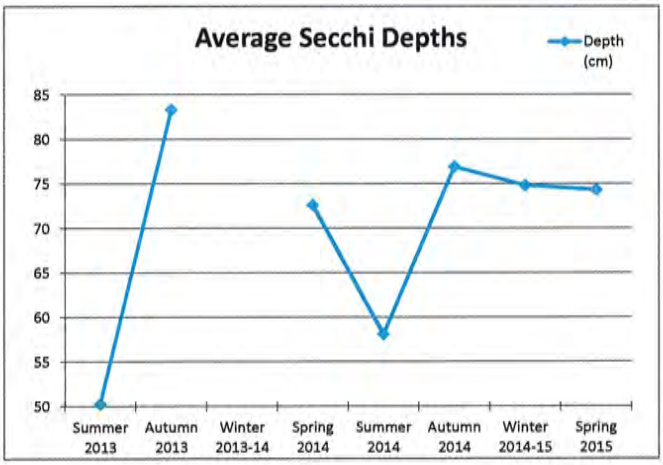


Figure 16
Comparison of Relative Abundance

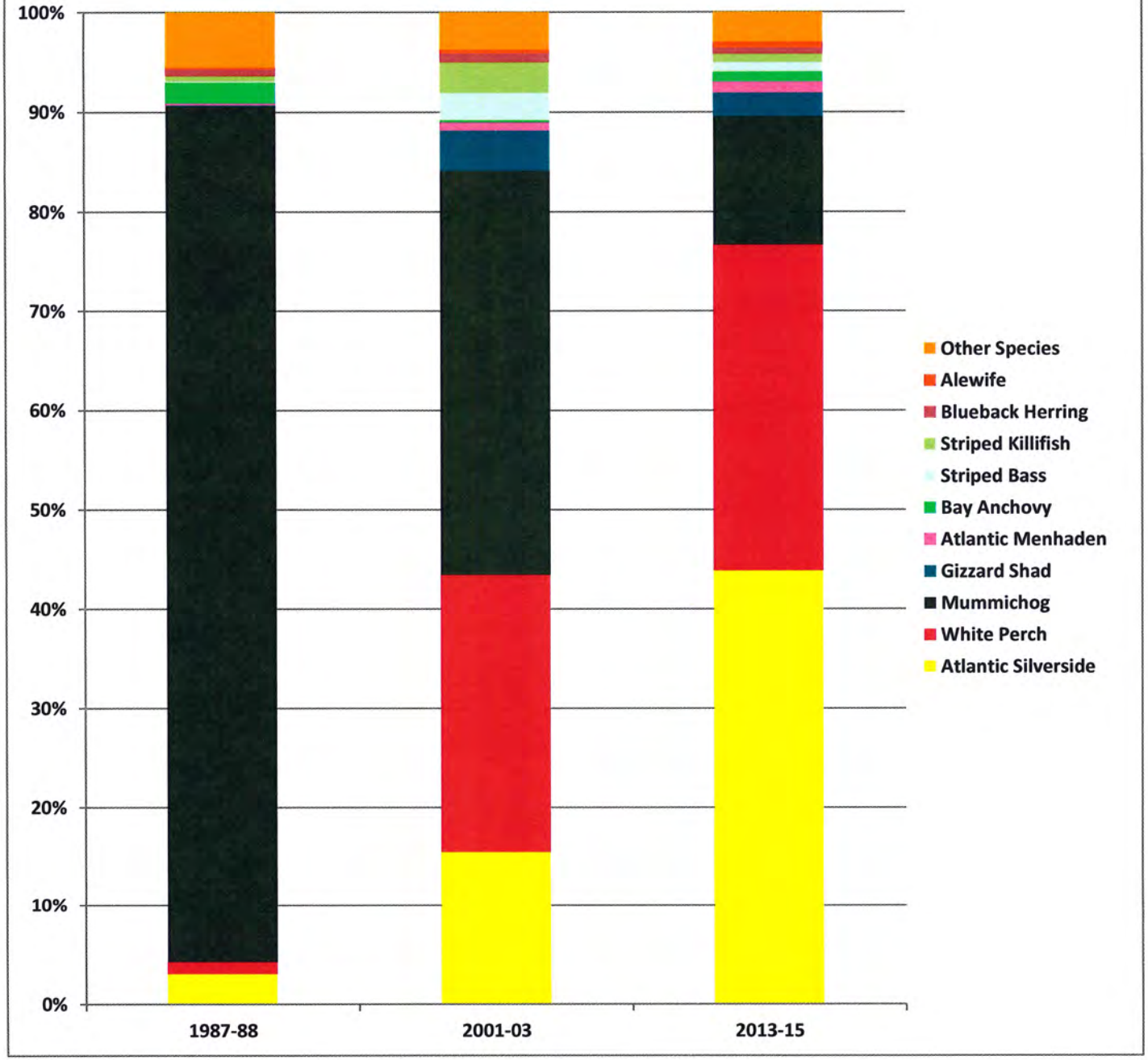


Figure 17
Comparison of Percent Frequency of Occurrence

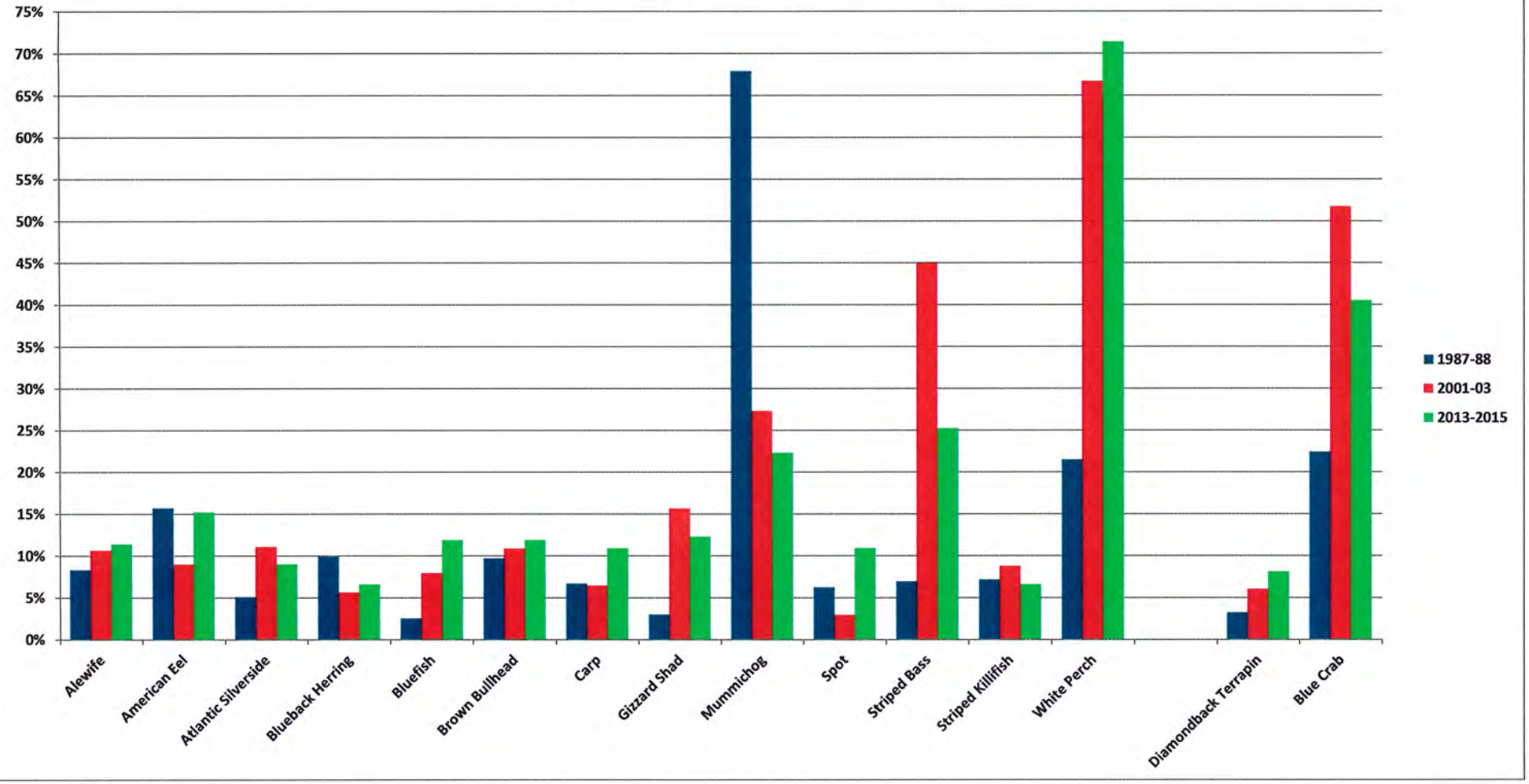
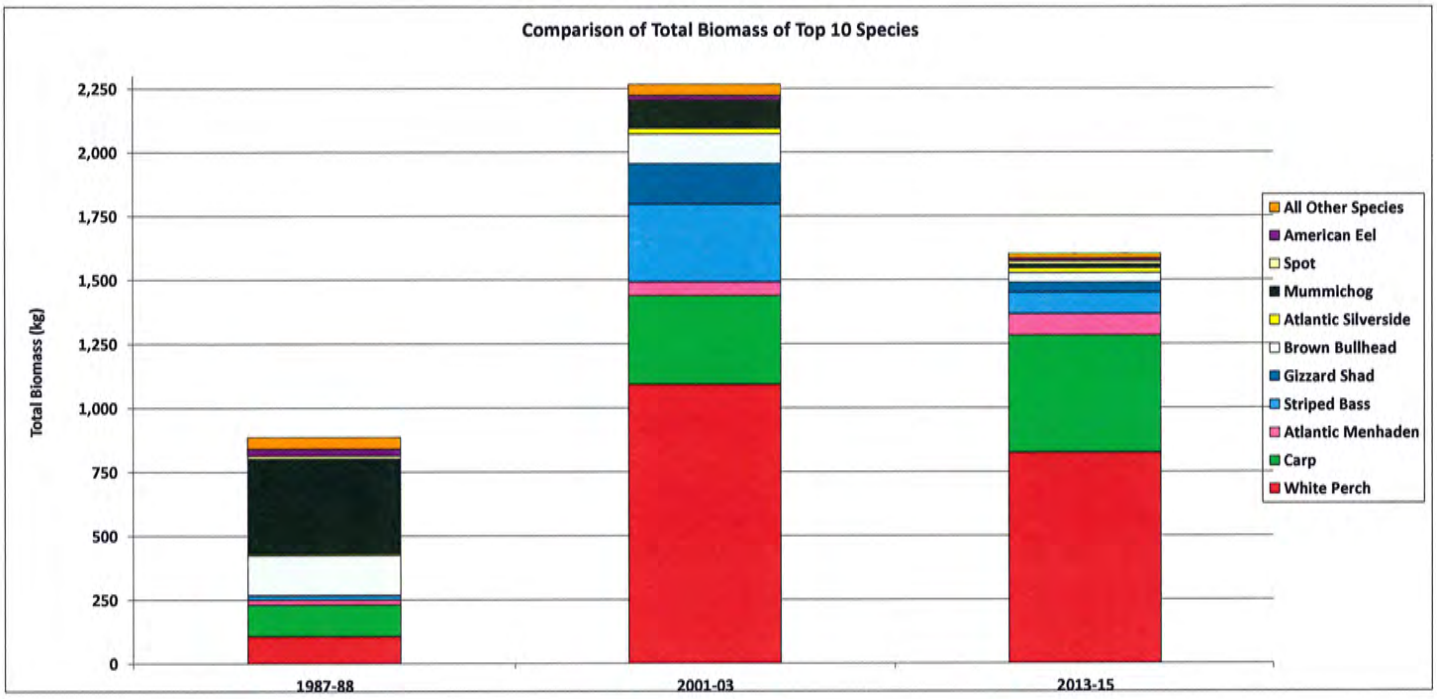


Figure 18


Comparison of Total Biomass of Top 10 Species
Total Biomass (kg)
2,250
2,000
1,750
1,500
1,250
1,000
750
500
250
0
1987-88
2001-03
2013-15
All Other Species
American Eel
Spot
Mummichog
Atlantic Silverside
Brown Bullhead
Gizzard Shad
Striped Bass
Atlantic Menhaden
Carp
White Perch

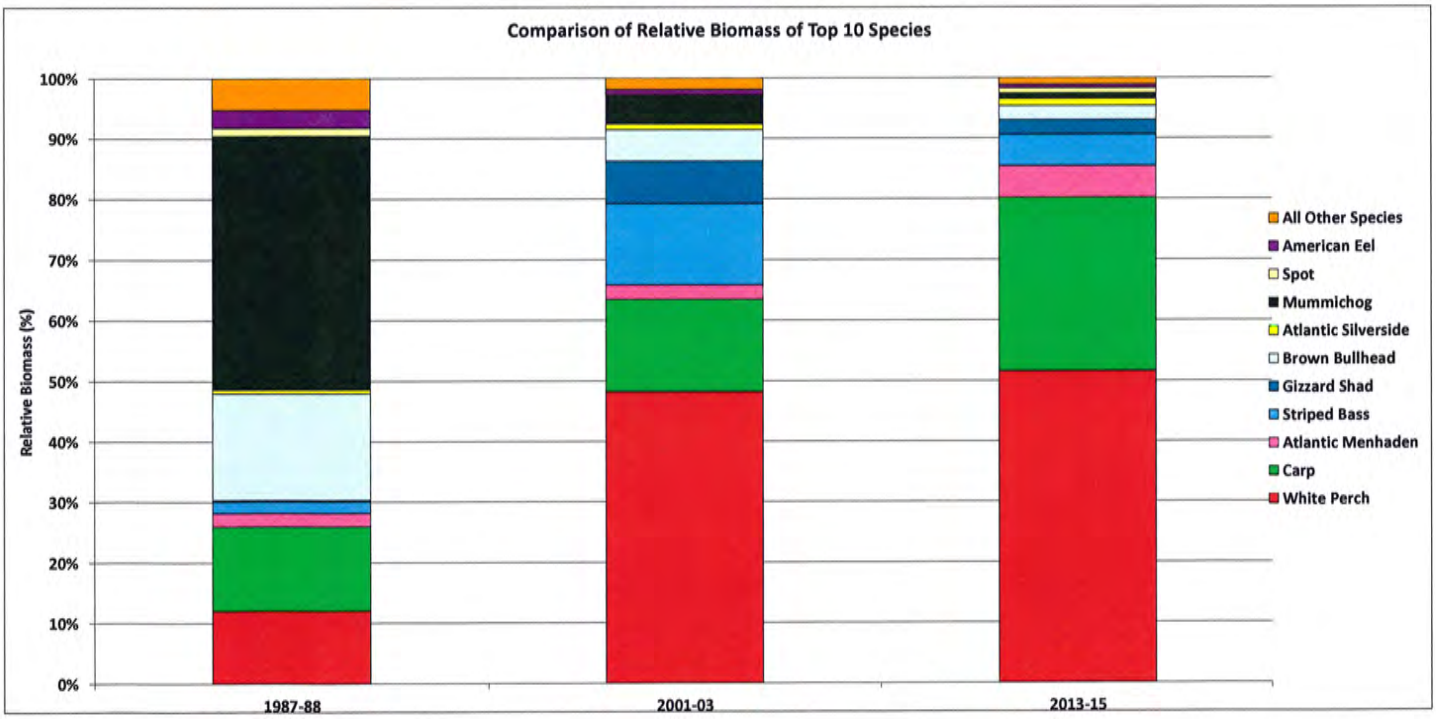
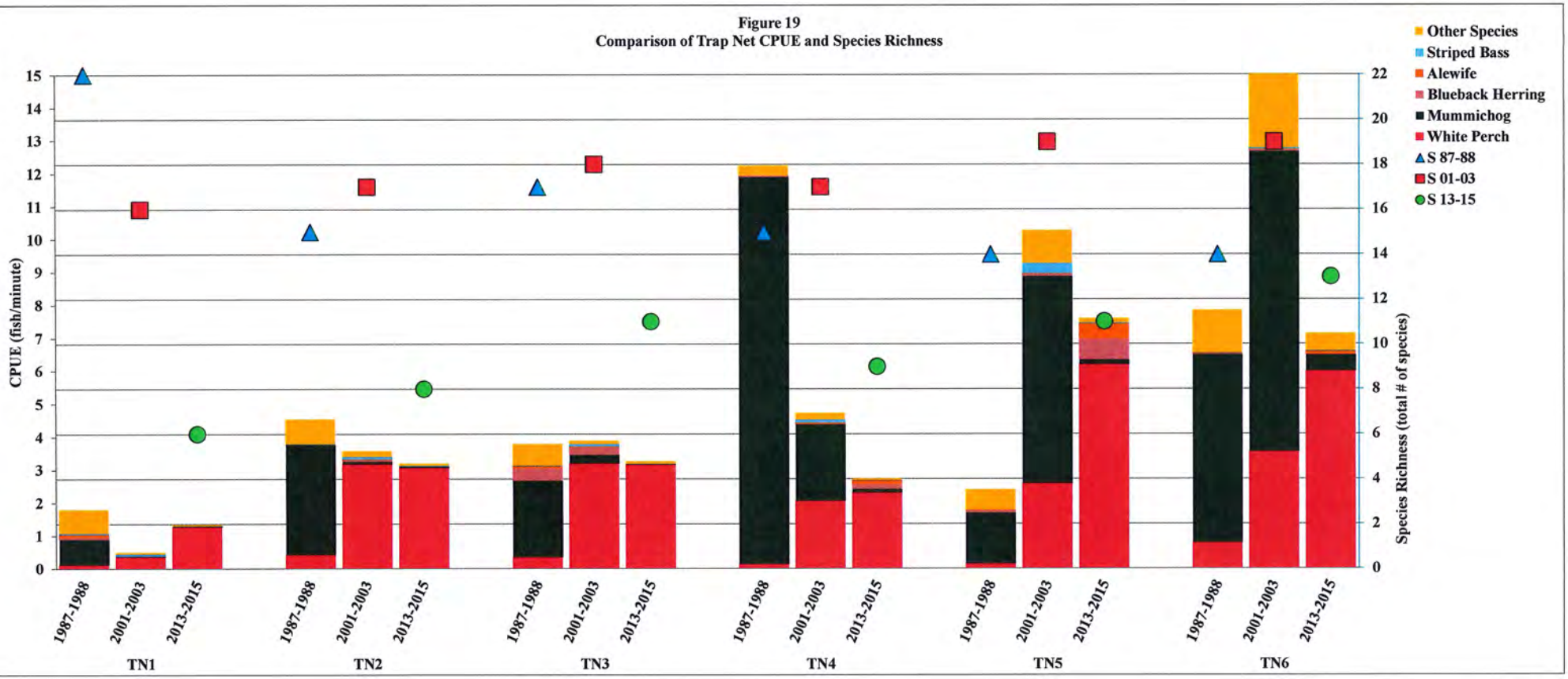

Comparison of Relative Biomass of Top 10 Species
Relative Biomass (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1987-88
2001-03
2013-15
All Other Species
American Eel
Spot
Mummichog
Atlantic Silverside
Brown Bullhead
Gizzard Shad
Striped Bass
Atlantic Menhaden
Carp
White Perch

Figure 19
Comparison of Trap Net CPUE and Species Richness



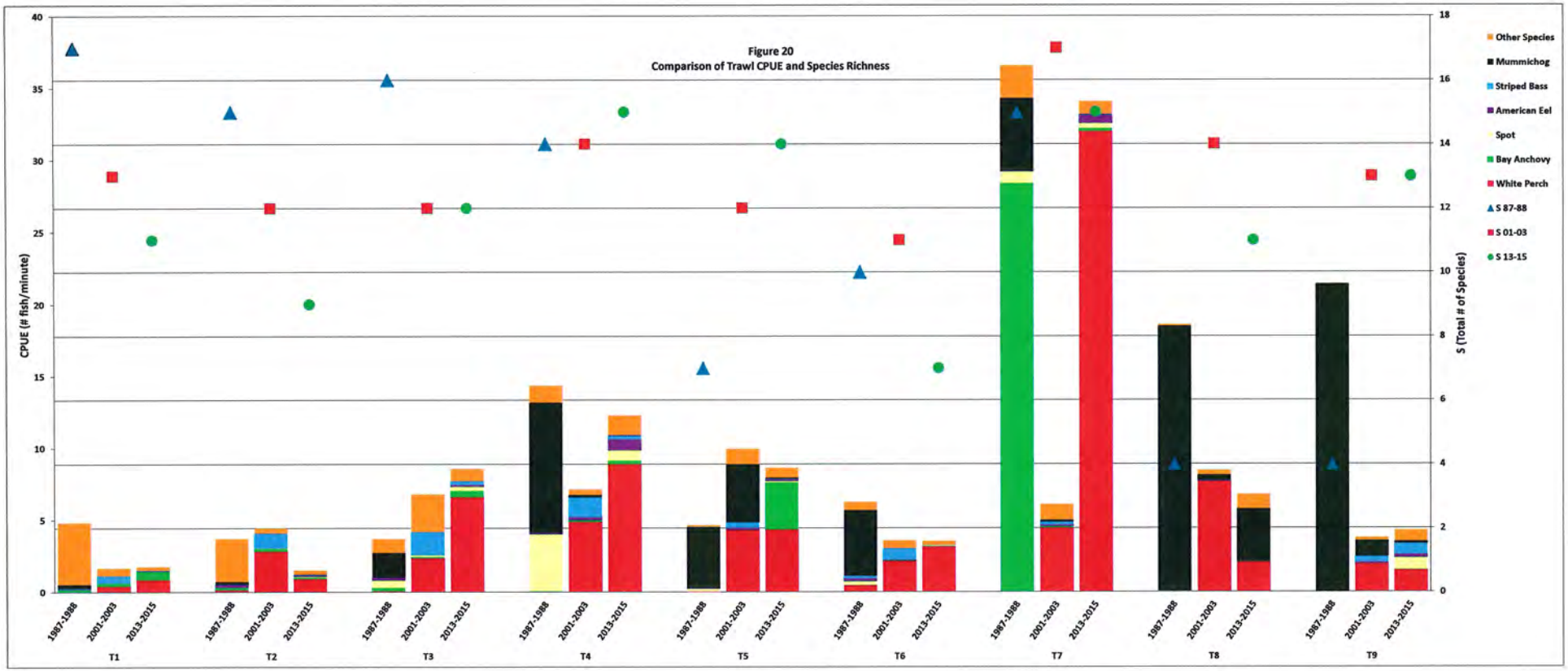


Figure 20
Comparison of Trawl CPUE and Species Richness
CPUE (# fish/minute)
S (Total # of Species)
Other Species
Mummichog
Striped Bass
American Eel
Spot
Bay Anchovy
White Perch
S 87-88
S 01-03
S 13-15
1987-1988
2001-2003
2013-2015
T1
T2
T3
T4
T5
T6
T7
T8
T9

Figure 21
Comparison of CPUE and Species Richness

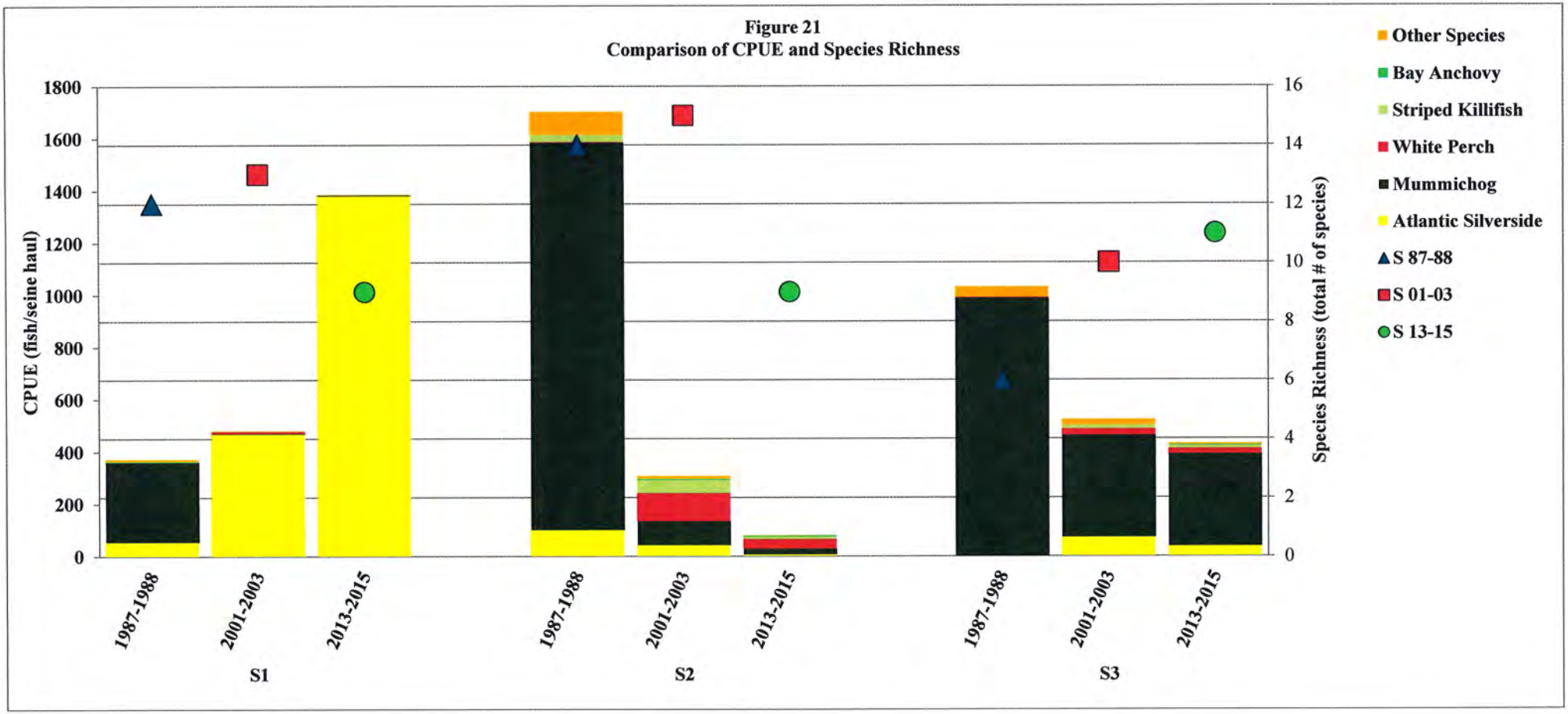


Figure 22
Comparison of Gill Net CPUE and Species Richness

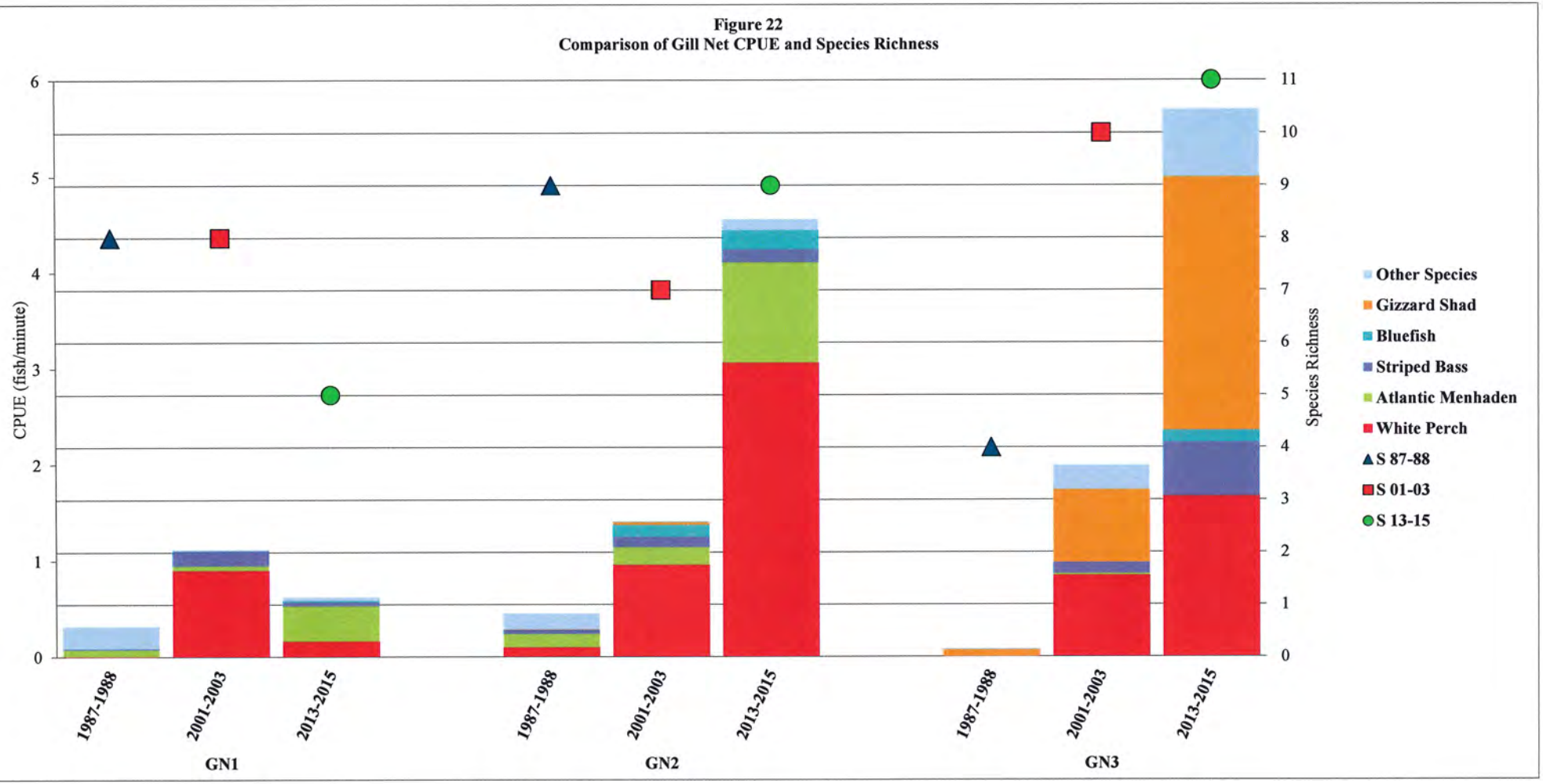
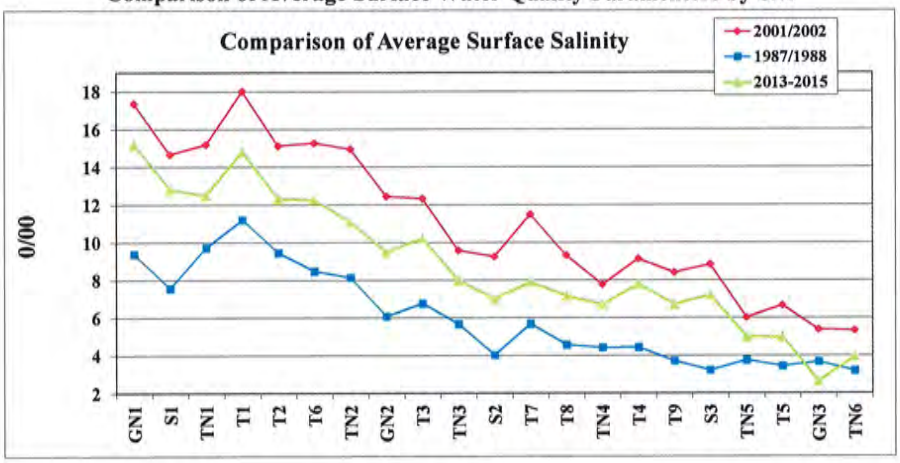
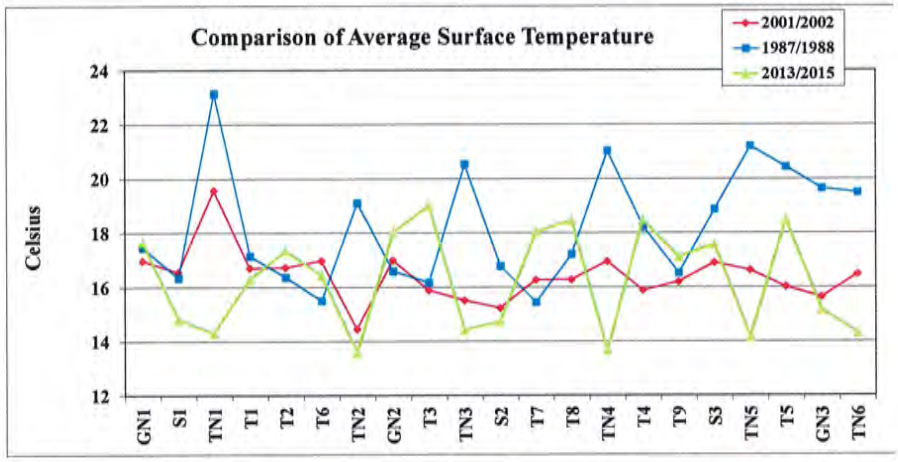
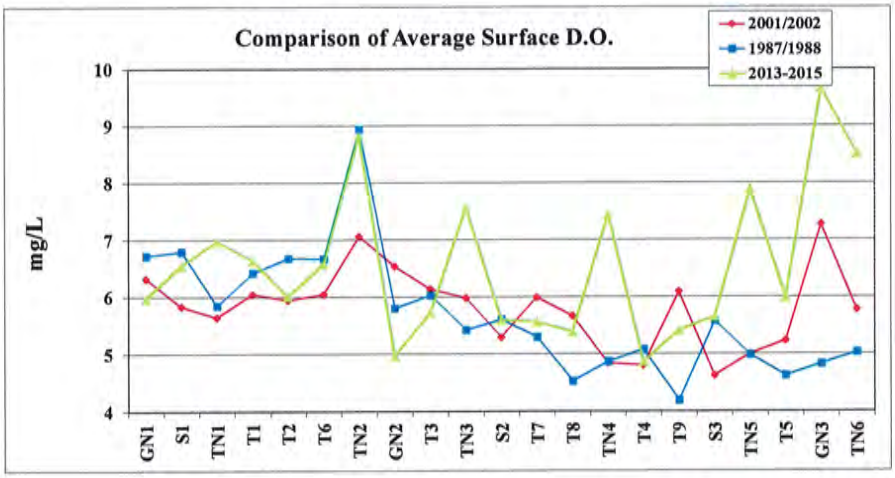


Figure 23
Comparison of Average Surface Water Quality Paramenters by Site







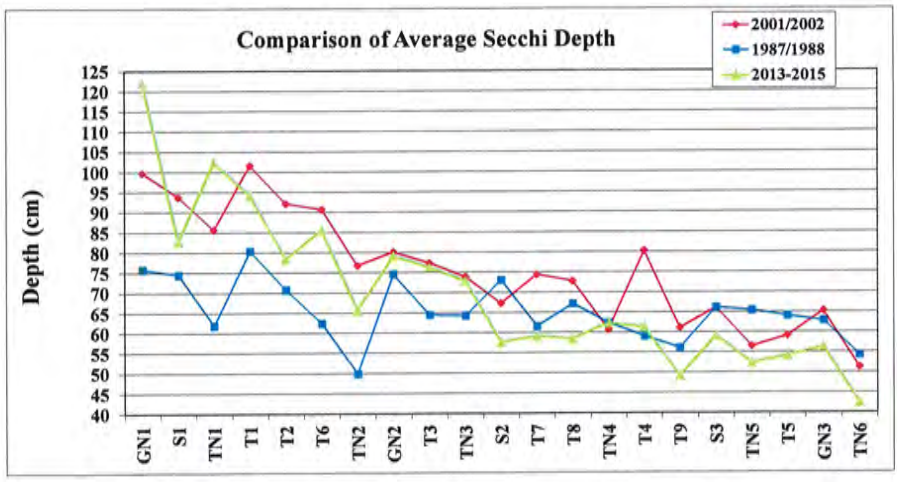


Figure 24

White Perch (*Morone americana*) collected at site TN3 on June 06, 2014, showing an apparent Sea Lamprey (*Petromyzon marinus*) scar.

APPENDIX A

TABLE A-1
Catch and Water Quality at Station S1 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**S1**			**S1**			**S1**			**S1**			**S1**			**S1**			**S1**		
	Collection Number	023			059			0065			0092			0149			0168			0208		
	Date	9/17/2013			11/15/2013			5/12/2014			7/23/2014			12/4/2014			3/18/2015			6/3/2015		
	Time	13:41			12:10			12:05			12:57			11:05			11:55			12:56		
	Tidal Stage (+ hrs.)	High +5.5			High + 5.0			High +4.25			low + 0			high + 4			high + 4.1			high + 3		
	Depth (ft.)	4.5			~4.5			to 4			0-4			0-3.5			0-4			to 4 ft		
Water Quality																						
Temp (oC)	air	18.5			9.9			22.8			28.2			6.4			0.2			21.1		
	surface	21.0			7.6			18.3			27.6			6.2			3.6			19.5		
	bottom	--			--			--														
D.O. (%)	surface	59.7			75.6			51.9			72.3			68.0			75.0			66.8		
	bottom	--			--			--														
D.O. (ppm)	surface	4.97			8.18			4.71			5.39			7.79			9.22			5.65		
	bottom	--			--			--														
Specific Conductivity (uS/cm)	surface	23820			27849			12303			17019			23288			20044			25601		
	bottom	--			--			--														
Conductivity (uS/cm)	surface	21986			18603			10726			17852			14921			11861			22805		
	bottom	--			--			--														
T.D.S. (mg/L)	surface	15483.00			18102.50			7995.00			11063.0			15145.00			13026.0			16640.00		
	bottom	--			--			--														
Salinity (0/00)	surface	14.47			17.01			7.07			9.97			13.96			11.75			15.66		
	bottom	--			--			--														
pH	surface	7.46			7.63			7.56			7.62			7.94			8.00			7.85		
	bottom	--			--			--														
Secchi (cm)	depth to disk	65			90			80			85			70			90			100		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Microgadus tomcod	Atlantic Tomcod							1	43	0.8												
Fundulus heteroclitus	Mummichog	1	56	2.2	1	44	1				9	34-88	0.6-15	2	46-72	0.9-4						
Fundulus majalis	Striped Killifish													1	98	11				1	112	16
Menidia menidia	Atlantic Silverside	205	51-101	0.9-6.1	47	45-114	0.5-7.8	1	94	4.5	9,412	38.5-77.5	0.3-2.6	2	46-83	0.5-2.6						
Gasterosteus aculeatus	Threespine Stickleback																			1	62	2
Morone americanus	White Perch	3	50-106	1.3-14																		
Pomatomus saltatrix	Bluefish	1	131	18							4	122-158	15-36									
Leiostomus xantharus	Spot	1	152	50																		
Gobiosoma bosci	Naked Goby	1	36	0.6																		
INVERTEBRATES																						
Callinectes sapidus	blue crab	3	17-21								1	40										
Crangon septemspinosa	sand shrimp	1			4									7								
Palaeomonetes pugio	grass shrimp	34			21			4			1			2						1		

NOTES: No collections during Winter 2013-14

TABLE A-2
Catch and Water Quality at Station S2 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**S2**			**S2**			**S2**			**S2**			**S2**			**S2**			**S2**		
	Collection Number	022			058			0064			0091			0148			0167			0209		
	Date	9/17/2013			11/15/2013			5/12/2014			7/23/2014			12/4/2014			3/18/2015			6/3/2015		
	Time	12:10			11:08			10:51			11:17			10:02			11:18			14:05		
	Tidal Stage (+ hrs.)	High +4.5			High + 4.0			High +3.1			high + 4			high + 3			high + 3.25			high + 4		
	Depth (ft.)	4.5			3.5			to 3.5			0-4			3.5-4.0			0-4			to 4 ft		
Water Quality																						
Temp (oC)	air	14.6			10.4			25.4			24.9			8.8			-0.5			22.8		
	surface	20.9			7.0			18.5			26.7			5.8			3.9			20.5		
	bottom	--			--			--														
D.O. (%)	surface	51.6			64.4			31.1			77.5			62.1			65.3			36.8		
	bottom	--			--			--														
D.O. (ppm)	surface	4.38			7.25			2.87			6.02			7.38			8.18			3.18		
	bottom	--			--			--														
Specific Conductivity (uS/cm)	surface	19680			21959			5938			10114			17078			12954			13990		
	bottom	--			--			--														
Conductivity (uS/cm)	surface	18123			14396			5199			10446			10794			7736			12777		
	bottom	--			--			--														
T.D.S. (mg/L)	surface	12792.00			14274.00			3861.00			6571.5			11102.50			8424.0			9100.00		
	bottom	--			--			--														
Salinity (0/00)	surface	11.75			3.12			3.24			5.68			9.96			7.35			8.12		
	bottom	--			--			--														
pH	surface	7.39			7.47			7.71			7.58			7.86			8.10			7.96		
	bottom	--			--			--														
Secchi (cm)	depth to disk	35			65			60			50			60			70			65		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Alosa pseudoharengus	Alewife										1	69	2.5									
Anchoa mitchilli	Bay Anchovy	9	32-45	0.4-0.7																		
Fundulus heteroclitus	Mummichog	21	33-100	0.5-14	6	31-86	0.4-8	4	48-62	1.2-3	67	35-101	0.7-17				4	38-91	0.1-10.8	55	51-114	1-23
Fundulus majalis	Striped Killifish	39	45-120	1.1-24	6	62-91	3-9.5	28	76-140	4-42	15	96-138	11-37	2	82-88	6-7.1				1	90	9
Menidia menidia	Atlantic Silverside	10	52-85	0.7-3.7							21	25-106	0.1-5.6	16	42-70	0.5-1.4						
Gasterosteus aculeatus	Threespine Stickleback																1	61	2			
Morone americanus	White Perch	88	52-242	1.4-208	3	55-75	1.5-4.6	28	77-261	3-285	102	25-207	0.3-129							19	81-234	11-173
Pomatomus saltatrix	Bluefish	1	142	20							6	111-140	12-23									
Caranx hippos	Crevalle Jack	1	122	24																		
INVERTEBRATES																						
Balanus improvisus	bay barnacle	200																				
Callinectes sapidus	blue crab	2	15-20					2	19-26		6	35-120								1	32	
Crangon septemspinosa	sand shrimp				1									1								
Palaeomonetes pugio	grass shrimp	88			15			6			68			18						301		
Paleomon macrodactylus	Oriental shrimp																			2		
Rhithropanopeus harrisii	white-fingered mud crab	1																				

NOTES: No collections during Winter 2013-14

TABLE A-3
Catch and Water Quality at Station S3 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**S3**			**S3**			**S3**			**S3**			**S3**			**S3**			**S3**		
	Collection Number	024			049			0078			0118			0144			0166			0210		
	Date	9/18/2013			10/21/2013			5/28/2014			9/8/2014			11/7/2014			3/18/2015			6/15/2015		
	Time	11:02			13:21			11:40			11:36			11:55			10:38			11:15		
	Tidal Stage (+ hrs.)	High + 2.0			High +2.0			High +2.0			high + 3			high + 3			high + 2.5			high + 2		
	Depth (ft.)	4-4.5			4.5			to 4			0-4			0-3			0-4			to 4 ft		
Water Quality																						
Temp (oC)	air	18.6			18.3			15.5			24.3			11.5			-0.3			24.8		
	surface	20.6			17.4			20.3			25.2			11.0			3.5			25.2		
	bottom	--			--			--														
D.O. (%)	surface	69.5			43.6			34.4			77.7			49.9			72.4			74.4		
	bottom	--			--			--														
D.O. (ppm)	surface	6.02			3.93			3.09			6.15			5.13			9.36			5.94		
	bottom	--			--			--														
Specific Conductivity (uS/cm)	surface	14701			18757			3205			16009			16635			7957			10165		
	bottom	--			--			--														
Conductivity (uS/cm)	surface	13469			16052			2917			16048			12178			4680			10202		
	bottom	--			--			--														
T.D.S. (mg/L)	surface	9555.00			12194.00			2086.50			10406.5			10816.00			5174.0			6604.00		
	bottom	--			--			--														
Salinity (0/00)	surface	8.56			11.17			1.68			9.35			9.78			4.36			5.73		
	bottom	--			--			--														
pH	surface	7.47			7.29			7.80			7.74			8.14			8.37			7.77		
	bottom	--			--			--														
Secchi (cm)	depth to disk	45			75			70			50			75			45			55		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anchoa mitchilli	Bay Anchovy	3	46-50	0.6-0.9							2	35-41	0.2-0.4									
Cyprinus carpio	Carp							4	501-647	2,200-3,900												
Fundulus heteroclitus	Mummichog	410	30-69	0.4-4	174	37-93	0.5-5.7	81	49-110	1-18	511	20-62	0.1-2.7	307	38-115	0.5-24	5	40-68	0.4-2.5	980	19-112	0.1-22
Fundulus majalis	Striped Killifish	17	75-98	4-14	65	80-121	8-30	19	69-123	2-20										2	94-115	10-20
Menidia berrylina	Inland Silverside	2	55-61	0.7-1.1	4	50-65	0.6-1.5							13	36-63	3-14						
Menidia menidia	Atlantic Silverside	53	51-88	0.7-3.9	99	56-88	0.9-2.8				102	48-92	0.6-3.7	13	60-110	11-67						
Morone americanus	White Perch	99	36-274	0.5-354	9	140-217	50-156	6	75-258	5-248				8	85-226	8-200				9	2.3-168	0.1-71
Morone saxatilis	Striped Bass	1	140	32																		
Perca flavescens	Yellow Perch																			17	3.8-4.5	0.5-0.9
Pomatomus saltatrix	Bluefish										1	107	8.8									
Gobiosoma bosci	Naked Goby										1	42	0.8									
INVERTEBRATES																						
Crangon septemspinosa	sand shrimp													2								
Palaeomonetes pugio	grass shrimp	10			17			15			2,620			516						3		

NOTES: No collections during Winter 2013-14

TABLE A-4
Catch and Water Quality at Station TN1 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**TN1**			**TN1**			**TN1**			**TN1**			**TN1**			**TN1**			**TN1**		
	Collection Number	006			057			0087			0109			0145			0154			0186		
	Date (Set)	8/1/2013			10/30/2013			6/5/2014			08/05/14			11/13/2014			01/15/15			4/29/2015		
	Time (Set)	11:29			12:05			10:38			10:28			7:48			11:15			12:18		
	Tidal Stage (+ hrs.)	Low +0			High +5.5			Low +1.1			low + 0			low +0.5			low + 0.5			high + 5.0		
	Depth (ft.)	2-3			2-3			3-4			2			2-3			2.5-3.5			2-3		
	Length of Net Set (hrs:min)	24:11			24:15			24:07			24:12			24:50			23:55			24:17		
Water Quality																						
Temp (oC)	air	21.8			15.8			19.4			25.2			4.0			1.4			16.3		
	surface	25.4			12.9			21.9			26.9			10.0			0.9			13.3		
	bottom	--			--			--														
D.O. (%)	surface	69.3			67.5			66.8			82.1			56.2			81.2			93.6		
	bottom	--			--			--														
D.O. (ppm)	surface	5.30			6.45			5.57			6.10			5.79			10.60			9.10		
	bottom	--			--			--														
Specific Conductivity (uS/cm)	surface	20836			27641			13851			20827			24740			21336			17,393		
	bottom	--			--			--														
Conductivity (uS/cm)	surface	21003			21266			13036			21595			17654			11526			13,547		
	bottom	--			--			--														
T.D.S. (mg/L)	surface	13546			17966.00			9002.5			13539.5			16087.00			13864.5			11,329.50		
	bottom	--			--			--														
Salinity (0/00)	surface	12.45			17.02			8.02			12.43			15.03			12.41			10.31		
	bottom	--			--			--														
pH	surface	7.48			7.55			7.77			7.70			8.13			8.09			8.31		
	bottom	--			--			--														
Secchi (cm)	depth to disk	70			140			105			75			125			80			90		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Fundulus heteroclitus	Mummichog	2	64-68	3.5-4.5				3	59-63	4-5												
Gasterosteus aculeatus	Threespine Stickleback																			1	51	1
Syngnathus fuscus	Northern Pipefish							1	124	1												
Morone americanus	White Perch	40	52-79	2.1-11	99	73-212	4-152	7	74-312	4-442	1	244	228	47	130-302	27-445	1	222	159	21	120-215	18-136
Leiostomus xantharus	Spot	1	71	4.7																		
Paralichthys dentatus	Summer Flounder	3	245-275	134-221																		
REPTILES																						
Malaclemys terrapin	Diamondback Terrapin	18			1		1394	7			2									2		
Chelydra serpentina	Snapping Turtle																					
INVERTEBRATES																						
Callinectes sapidus	blue crab	10	101-183					8	99-145		6	67 - 141										
Ctenophora	comb jellies				1000																	
Synidotea laevidorsalis	isopod										5											

NOTES: No collections during Winter 2013-14

TABLE A-5
Catch and Water Quality at Station TN2 (Sawmill Creek)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**TN2**			**TN2**			**TN2**			**TN2**			**TN2**			**TN2**			**TN2**		
	Collection Number	005			056			0088			0110			0146			0155			0185		
	Date (Set)	8/1/2013			10/30/2013			6/5/2014			08/05/14			11/13/2014			01/15/15			4/29/2015		
	Time (Set)	10:58			11:32			11:04			11:12			8:15			11:42			11:50		
	Tidal Stage (+ hrs.)	High +5.5			High +5.5			Low +2.0			low + 0.75			low + 1			low + 1			high + 5.5		
	Depth (ft.)	1-3			2-3			2.5-3			2			2			2-3			4-6		
	Length of Net Set (hrs:min)	24:10			23:50			24:36			24:03			25:13			24:00			24:05		
Water Quality																						
Temp (oC)	air	24.5			14.4			17.6			25.9			5.6			2.4			18.3		
	surface	24.8			12.5			20.7			26.3			7.9			0.1			14.1		
	bottom	--			--			--														
D.O. (%)	surface	95.2			62.3			86.2			163.0			65.5			72.7			107.4		
	bottom	--			--			--														
D.O. (ppm)	surface	7.42			6.05			7.43			12.29			7.15			9.67			10.42		
	bottom	--			--			--														
Specific Conductivity (uS/cm)	surface	18920			25547			11500			18763			22975			18552			15,237		
	bottom	--			--			--														
Conductivity (uS/cm)	surface	18840			19434			10558			19244			15461			9721			12,063		
	bottom	--			--			--														
T.D.S. (mg/L)	surface	12298			16607.50			7475.0			12194.0			14937.00			12064.0			9,906.00		
	bottom	--			--			--														
Salinity (0/00)	surface	11.22			15.61			6.57			11.10			13.81			10.62			8.92		
	bottom	--			--			--														
pH	surface	7.84			7.49			8.00			8.47			8.14			8.09			8.34		
	bottom	--			--			--														
Secchi (cm)	depth to disk	40			95			60			35			55			75			75		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Dorosoma cepedianum	Gizzard Shad													5	121-167	15-42						
Cyprinus carpio	Carp	2	510-605	2,190-4,900																		
Amierus nebulosus	Brown Bullhead																			1	339	554
Fundulus heteroclitus	Mummichog							7	56-104	3-16												
Morone americanus	White Perch	17	63-255	4-253	233	67-335	2-540	22	77-330	20-506	55	114-325	18-556	105	71-309	5-518				89	170-301	64-451
Morone saxatilis	Striped Bass				1	216	110				2	144	26	1	570	2,086						
Pomatomus saltatrix	Bluefish										1	175	44									
Selene setapinnis	Atlantic Moonfish										1	52	1									
REPTILES																						
Malaclemys terrapin	Diamondback Terrapin				1			2			6									7		
Chelydra serpentina	Snapping Turtle																					
INVERTEBRATES																						
Amphipoda	scuds																			30		
Callinectes sapidus	blue crab	1	71		2	105		3	30-95		33	79 - 169								2	45-49	
Ctenophora	comb jellies	many			300																	
Rhithropanopeous harisii	white-fingered mud crab													1						15		

NOTES: No collections during Winter 2013-14

TABLE A-6
Catch and Water Quality at Station TN3 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**TN3**			**TN3**			**TN3**			**TN3**			**TN3**			**TN3**			**TN3**		
	Collection Number	004			055			0089			0111			0147			0156			0184		
	Date (Set)	8/1/2013			10/30/2013			6/5/2014			08/05/14			11/13/2015			01/15/15			4/29/2015		
	Time (Set)	10:20			11:00			11:35			11:48			8:45			12:15			11:20		
	Tidal Stage (+ hrs.)	High +5.0			High + 5.0			Low +2.0			low + 1			low + 1.5			low + 1.5			high + 6.0		
	Depth (ft.)	3			2-3			3.5-5			2			2.5			2-2.5			3-4		
	Length of Net Set (hrs:min)	23:57			23:39			24:50			24:27			25:35			24:00			24:00		
Water Quality																						
Temp (oC)	air	26.3			14.4			20.8			25.5			4.2			4.0			18.1		
	surface	25.1			12.3			23.0			26.3			10.0			0.7			14.3		
	bottom	--			--			--														
D.O. (%)	surface	67.2			55.1			77.1			120.3			44.8			73.2			98.1		
	bottom	--			--			--														
D.O. (ppm)	surface	5.24			5.45			6.46			9.32			4.75			9.81			9.63		
	bottom	--			--			--														
Specific Conductivity (uS/cm)	surface	14981			22827			6910			11747			17693			13119			10,596		
	bottom	--			--			--														
Conductivity (uS/cm)	surface	15017			17286			6639			12046			12624			7032			8,429		
	bottom	--			--			--														
T.D.S. (mg/L)	surface	9737			14839.50			4491.5			763.5			11498.50			8528.0			6,890.00		
	bottom	--			--			--														
Salinity (0/00)	surface	8.70			13.80			3.79			6.68			10.44			7.34			6.03		
	bottom	--			--			--														
pH	surface	7.41			7.40			7.84			8.07			8.09			8.11			8.19		
	bottom	--			--			--														
Secchi (cm)	depth to disk	55			85			55			40			105			65			70		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel	2	498-539	234-306							1	655	604									
Brevoortia tyrannus	Atlantic Menhaden							1	341	371				1	309	292				2	348-348	418-445
Cyprinus carpio	Carp										2	336-660	546-4,016									
Amierus nebulosus	Brown Bullhead	1	335	398																		
Microgadus tomcod	Atlantic Tomcod																1	190	45			
Fundulus heteroclitus	Mummichog							1	102	9												
Fundulus majalis	Striped Killifish													2	128-144	29-43						
Syngnathus fuscus	Northern Pipefish	1	72	0.2																		
Morone americanus	White Perch	63	69-302	3.8-414	75	67-266	4-270	74	108-262	16-247	196	131-336	32-534	124	70-273	4-315				7	74-220	60-146
Morone saxatilis	Striped Bass				1	210	102															
Pseudopleuronectes americanus	Winter Flounder													1	115	17						
REPTILES																						
Malaclemys terrapin	Diamondback Terrapin				1		370	6						1	125	391						
Chelydra serpentina	Snapping Turtle																					
INVERTEBRATES																						
Amphipoda	scuds																			15		
Callinectes sapidus	blue crab	6	48-152					18	35-145		30	76 - 147										
Ctenophora	comb jellies				200																	
Rhithropanopeous harisii	white-fingered mud crab																			3		

NOTES: No collections during Winter 2013-14

TABLE A-7
Catch and Water Quality at Station TN4 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**TN4**			**TN4**			**TN4**			**TN4**			**TN4**			**TN4**			**TN4**		
	Collection Number	001			052			0061			0112			0127			0151			0181		
	Date (Set)	7/30/2013			10/28/2013			5/6/2014			08/07/14			10/14/2014			01/13/15			4/27/2015		
	Time (Set)	09:08			10:43			09:45			10:57			9:30			10:23			10:45		
	Tidal Stage (+ hrs.)	High +5			High +5.75			Low +0			high + 4.5			low + 1			low + 1.5			high + 6.0		
	Depth (ft.)	~3			2-3			2-3			3			2.5			2-3			2-3		
	Length of Net Set (hrs:min)	24:39			23:57			24:40			23:18			24:10			25:02			24:04		
Water Quality																						
Temp (oC)	air				10.6			18.0			22.9			21.9			-5.6			13.4		
	surface				12.1			15.6			24.9			18.5			-0.2			13.1		
	bottom				--			--														
D.O. (%)	surface				51.4			43.0			76.9			52.3			67.3			111.0		
	bottom				--			--														
D.O. (ppm)	surface	YSI UNIT			5.31			4.27			6.15			4.66			9.71			11.40		
	bottom	NOT			--			--														
Specific Conductivity (uS/cm)	surface	WORKING			15911			1046			12483			16063			8830			5,506		
	bottom				--			--														
Conductivity (uS/cm)	surface				11984			859			12470			14076			4574			4,250		
	bottom	NO W.Q.			--			--														
T.D.S. (mg/L)	surface	DATA			10341.50			682.5			8122.0			10439.00			5746.0			3,575.00		
	bottom				--			--														
Salinity (0/00)	surface				9.33			0.52			7.15			9.44			4.79			2.99		
	bottom				--			--														
pH	surface				7.40			7.47			7.97			7.85			8.06			7.98		
	bottom				--			--			--											
Secchi (cm)	depth to disk	65			80			65			25			80			70			55		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Alosa aestivalis	Blueback Herring				1	227	76	1	202	64				21	70-94	2-7						
Alosa pseudoharengus	Alewife				3	75-142	3.1-24				17	85-89	4-6							1	261	157
Brevoortia tyrannus	Atlantic Menhaden	1	114	18																		
Dorosoma cepedianum	Gizzard Shad													2	207-216	86-94						
Fundulus heteroclitus	Mummichog	2	66-80	8-20	2	101-102	12-14	11	59-74	2-8				2	55-62	2-3				1	110	22
Menidia menidia	Atlantic Silverside													4	97-132	2-6						
Morone americanus	White Perch	9	41-209	1-146	166	55-309	1.5-464	80	100-304	14-428	73	142-253	45-219	33	128-277	26-316				31	77-282	4-347
Morone saxatilis	Striped Bass										1	217	105									
Leiostomus xantharus	Spot	1	ND	ND																		
REPTILES																						
Malaclemys terrapin	Diamondback Terrapin	9						5			6									1		
Chelydra serpentina	Snapping Turtle																					
INVERTEBRATES																						
Amphipoda	scuds	many									1,000									25		
Callinectes sapidus	blue crab	6	79-166								6	90 - 128										
Rhithropanopeous harisii	white-fingered mud crab	many						15			10									3		

NOTES: No collections during Winter 2013-14
ND = No Data (Head only)

TABLE A-8
Catch and Water Quality at Station TN5 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**TN5**			**TN5**			**TN5**			**TN5**			**TN5**			**TN5**			**TN5**		
	Collection Number	002			053			0062			0113			0128			0152			0182		
	Date (Set)	7/30/2013			10/28/2013			5/6/2014			08/07/14			10/14/2014			01/13/15			4/27/2015		
	Time (Set)	09:33			11:00			10:00			11:23			9:35			10:43			11:00		
	Tidal Stage (+ hrs.)	High +5.5			High +5.75			Low +0			high + 5			low +1.3			low + 1.75			high + 6.0		
	Depth (ft.)	3			2-4			3			3-4			2			2.5-3.5			3-5		
	Length of Net Set (hrs:min)	25:00			24:22			25:05			24:00			24:30			25:27			24:25		
Water Quality																						
Temp (oC)	air				11.5			18.2			23.4			21.6			-3.3			13.4		
	surface				13.4			16.0			25.4			18.5			0.2			13.4		
	bottom				--			--														
D.O. (%)	surface				72.6			59.9			72.2			59.2			66.8			102.9		
	bottom				--			--														
D.O. (ppm)	surface	YSI UNIT			7.41			5.96			5.80			6.1			9.52			10.62		
	bottom	NOT			--			--														
Specific Conductivity (uS/cm)	surface	WORKING			10680			785			8186			13530			7623			3,263		
	bottom				--			--														
Conductivity (uS/cm)	surface				8310			650			8245			11904			4109			2,540		
	bottom	NO W.Q.			--			--														
T.D.S. (mg/L)	surface	DATA			6942.00			507.00			5323.5			8801.00			5076.5			2,119.00		
	bottom				--			--														
Salinity (0/00)	surface				6.80			0.39			4.54			7.84			4.21			1.72		
	bottom				--			--														
pH	surface				7.58			7.74			7.96			7.89			8.10			8.12		
	bottom				--			--														
Secchi (cm)	depth to disk	55			60			55			30			60			65			45		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel							1	57	<1				1	680	822						
Alosa aestivalis	Blueback Herring				34	69-89	2.2-5.0	3	237-260	116-167				69	67-97	2-7				1	259	156
Alosa pseudoharengus	Alewife	25	55-90	1.8-10	1	130	18				50	77-96	3-8	5	110-135	9-17						
Dorosoma cepedianum	Gizzard Shad	1	112	18																		
Cyprinus carpio	Carp							4	289-620	383-3,400				1	514	1900				2	541-586	2,500-3,000
Amierus nebulosus	Brown Bullhead							6	239-344	180-580												
Fundulus heteroclitus	Mummichog				3	53	1.8	2	60-68	2-4							15	40-102	1-16	4	62-101	1-10
Menidia menidia	Atlantic Silverside													6	95-110	5-8						
Morone americanus	White Perch	216	51-289	2.1-450	231	64-282	1.7-330	491	181-295	94-406	8	127-224	29-173	60	139-263	38-296				65	159-270	51-321
Morone saxatilis	Striped Bass	3	140-217	32-120	1	205	80	1	429	660												
Pomatomus saltatrix	Bluefish	1	84	6							1	163	43									
REPTILES																						
Malaclemys terrapin	Diamondback Terrapin				1		314															
Chelydra serpentina	Snapping Turtle																					
INVERTEBRATES																						
Amphipoda	scuds										1,000											
Callinectes sapidus	blue crab	1	100								11	76 - 125										
Rhithropanopeous harisii	white-fingered mud crab				4															4		

NOTES: No collections during Winter 2013-14

TABLE A-9
Catch and Water Quality at Station TN6 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**TN6**			**TN6**			**TN6**			**TN6**			**TN6**			**TN6**			**TN6**		
	Collection Number	003			054			0063			0114			0129			0153			0183		
	Date (Set)	7/30/2013			10/28/2013			5/6/2014			08/07/14			10/14/2014			01/13/15			4/27/2015		
	Time (Set)	10:04			11:25			10:26			11:55			9:55			11:08			11:20		
	Tidal Stage (+ hrs.)	Low +0			Low +0			Low + 0.75			high + 5.5			low +1.7			low + 2			high + 6.25		
	Depth (ft.)	4-5			3-5			5			7			3			2-2.5			4-6		
	Length of Net Set (hrs:min)	25:19			24:50			25:38			24:15			25:10			25:42			24:45		
Water Quality																						
Temp (oC)	air				12.5			14.0			26.2			22.8			-3.3			13.6		
	surface				12.5			15.2			25.9			18.5			1.3			13.4		
	bottom				--			--														
D.O. (%)	surface				84.9			67.9			65.2			71			68.4			121.8		
	bottom				--			--														
D.O. (ppm)	surface	YSI UNIT			8.86			6.84			5.25			6.24			9.59			12.62		
	bottom	NOT			--			--														
Specific Conductivity (uS/cm)	surface	WORKING			10561			658			5377			12419			5786			1,558		
	bottom				--			--														
Conductivity (uS/cm)	surface				8036			535			5468			10869			3162			1,212		
	bottom	NO W.Q.			--			--														
T.D.S. (mg/L)	surface	DATA			6864.00			429.0			3497.0			8073.00			3763.5			1,014.00		
	bottom				--			--														
Salinity (0/00)	surface				6.00			0.32			2.89			7.15			3.08			0.79		
	bottom				--			--														
pH	surface				7.70			7.92			7.96			7.91			8.08			8.54		
	bottom				--			--														
Secchi (cm)	depth to disk	45			55			55			30			50			55			20		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel													2	615-615	434-518				1	61	0.1
Alosa aestivalis	Blueback Herring																			1	149	20
Alosa pseudoharengus	Alewife	9	67-84	4-8							2	ND	ND							5	130-290	19-206
Dorosoma cepedianum	Gizzard Shad	2	82-105	8-16	5	205-230	80-112															
Cyprinus carpio	Carp	1	167	92	5	298-326	412-462	11	266-512	286-1,977	1	377	855									
Amierus nebulosus	Brown Bullhead	2	263-287	254-326				22	125-365	20-774				1	323	408				27	140-392	34-855
Fundulus heteroclitus	Mummichog	3	60-98	4-14	2	62-65	2.9-3.1	1	82	8	3	43-52	1.2-1.8				42	55-115	2-26	34	47-120	1-24
Morone americanus	White Perch	458	57-289	2.4-386	142	59-291	2.1-416	235	135-276	20-324	15	126-253	39-228	113	72-275	3-343				90	66-301	5-424
Morone saxatilis	Striped Bass	1	141	24	3	171-226	60-132							1	205	82						
Lepomis gibbosus	Pumpkinseed	1	130	54	2	109-151	24-76															
Pomoxis nigromaculatus	Black Crappie	6	62-76	2-6																		
Perca flavescens	Yellow Perch																2	165-232	43-138			
Pomatomus saltatrix	Bluefish	1	106	8																		
REPTILES																						
Malaclemys terrapin	Diamondback Terrapin																					
Chelydra serpentina	Snapping Turtle	2																				
INVERTEBRATES																						
Amphipoda	scuds										500,000											
Callinectes sapidus	blue crab	5	35-130								6	79 - 115										
Rhithropanopeous harisii	white-fingered mud crab										5											

NOTES: No collections during Winter 2013-14
ND = No Data (heads only)

TABLE A-10
Catch and Water Quality at Station T1 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T1**			**T1**			**T1**			**T1**			**T1**			**T1**			**T1**		
	Collection Number	029-030			039-040			0072-0073			0099/0100			0130/0131			0173/0174			0187/0188		
	Date	9/19/2013			10/17/2013			5/14/2014			7/30/2014			10/17/2014			03/19/15			05/04/15		
	Time (Set)	12:59 & 13:25			11:34 & 11:54			11:01 & 11:17			11:11			10:35			13:07			11:41		
	Tidal Stage (+ hrs.)	High +4.0			High +3.5			High +2.0			low + 5.1			high + 6			high + 4.5			High + 2.0		
	Depth Range (ft.)	12-20			8-16.5			8-16			11.5 -21.9			12-18			14 - 22			9.6 - 18.0		
	No.& length per tow (#/min:sec)	2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	21.9			19.3			18.0			22.2			19.6			-0.2			22.4		
	surface	20.5			18.0			16.2			24.8			18.7			2.5			13.5		
	bottom	20.4			18.1			15.5			24.7			18.5			3.6			13.4		
D.O. (%)	surface	59.9			67.0			67.9			76.0			69.8			74.0			90.7		
	bottom	61.1			67.6			68.9			77.4			68.1			74.2			91.6		
D.O. (ppm)	surface	4.95			5.65			6.29			5.78			5.92			9.24			8.69		
	bottom	5.02			5.69			6.45			5.88			5.78			9.24			8.75		
Specific Conductivity (uS/cm)	surface	26745			30007			19461			26712			24716			18476			24,437		
	bottom	27440			30436			20640			27049			25498			18899			25,499		
Conductivity (uS/cm)	surface	24435			26024			16183			26617			21721			10923			19,091		
	bottom	25077			26421			16884			26906			22340			11207			19,866		
T.D.S. (mg/L)	surface	17387.5			19506.50			12649.00			17361.50			16061.50			12012.0			15,886.00		
	bottom	17842.5			19779.50			13416.00			17582.50			16575.00			12298.0			16,575.00		
Salinity (0/00)	surface	16.43			18.65			11.63			16.35			15.08			10.77			14.88		
	bottom	16.90			18.94			12.39			16.58			15.6			11.04			15.59		
pH	surface	7.47			7.50			7.70			7.75			7.9			8.15			8.08		
	bottom	7.45			7.49			7.63			7.73			7.79			8.09			8.11		
Secchi (cm)	depth to disk	50			90			80			95			85			95			165		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel	1	394	124																		
Alosa aestivalis	Blueback Herring																1	95	4			
Anchoa mitchilli	Bay Anchovy				13	30-89	0.1-6	1	83	3				10	22-74	0.05 - 1.9						
Opsanus tau	Oyster Toadfish										1	200	166									
Syngnathus fuscus	Northern Pipefish				1	145	1	2	102-151	0.3-1.1										1	176	1.4
Morone americanus	White Perch	14	100-226	13-166	6	207-307	138-484	15	116-237	18-212	1	180	89									
Morone saxatilis	Striped Bass	1	230	110							1	ND	ND									
Cynoscion regalis	Weakfish	2	83-85	4-5																		
Leiostomus xantharus	Spot	1	215	146																		
Paralichthys dentatus	Summer Flounder							1	202	68												
Trinectes maculatus	Hogchoker	2	90-101	15-21																		
INVERTEBRATES																						
Amphipoda	scuds							10									20			35		
Balanus improvisus	bay barnacle	20			70			5			500			80			1,015			2,015		
Callinectes sapidus	blue crab	5	90-161		4	20-101		4	25-90		4	50-158		1	110		9	23-106				
Congeria leucopheata	platform mussel				25																	
Crangon septemspinosa	sand shrimp							8						2			10					
Crassostrea virginica	American oyster	1			1						10			4			11			12		
Ctenophora	comb jelly				50			5														
Guekensia demissus	ribbed mussel	3						15			10			17			73			20		
Molgula sp.	sea squirt													15								
Mya arenarea	soft-shell clam				1																	
Palaeomonetes pugio	grass shrimp													3			10					
Rhithropanopeus harrissii	white-fingered mud crab				2			10						5			1					

NOTES: No collections during Winter 2013-14
ND = No Data, fish escaped before it could be measured.

TABLE A-11
Catch and Water Quality at Station T2 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T2**			**T2**			**T2**			**T2**			**T2**			**T2**			**T2**		
	Collection Number	027-028			041-042			0074-0075			0103/0104			0132/0133			0171/0172			0191/0192		
	Date	9/19/2013			10/17/2013			5/14/2014			7/30/2014			10/17/2014			03/19/15			05/04/15		
	Time (Set)	12:03 & 12:24			12:27 & 12:44			12:02 & 12:19			13:01			11:26			12:05			13:15		
	Tidal Stage (+ hrs.)	High +3.0			High +4.5			High +3.0			high + 1			low + 0.5			high + 3.5			High + 3.25		
	Depth Range (ft.)	12-19			6-14			12-20			10.3 - 19			10-18			10 - 18			10 - 17		
	No.& length per tow (#/min:sec)	2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	19.5			19.9			18.5			24.2			17.5			0.6			21.0		
	surface	20.4			18.0			18.4			26.0			19.2			3.5			16.0		
	bottom	20.3			17.8			17.5			25.6			18.5			3.4			16.3		
D.O. (%)	surface	58.4			58.9			48.6			70.3			68.6			73.4			79.8		
	bottom	58.6			52.5			54.7			68.2			65.0			72.6			80.7		
D.O. (ppm)	surface	4.83			5.05			4.43			5.29			5.84			9.19			7.46		
	bottom	4.92			4.51			5.04			5.14			5.57			9.14			7.50		
Specific Conductivity (uS/cm)	surface	25858			26685			12490			23337			21614			17635			16,426		
	bottom	26982			26427			15053			24363			23009			17770			16,991		
Conductivity (uS/cm)	surface	23621			23079			10922			23771			19211			10403			13,616		
	bottom	24577			22825			12917			24648			20159			10453			14,167		
T.D.S. (mg/L)	surface	16809.0			17342.00			8118.50			15171.00			14046.50			11466.0			10,679.50		
	bottom	17543.5			17179.50			9782.50			15834.00			14956.50			11550.5			11,043.50		
Salinity (0/00)	surface	15.83			16.40			7.19			14.09			13.02			10.23			9.67		
	bottom	16.59			16.22			8.80			14.77			13.94			10.31			10.03		
pH	surface	7.51			7.43			7.59			7.77			7.91			8.08			8.09		
	bottom	7.48			7.36			7.51			7.69			7.83			8.03			8.08		
Secchi (cm)	depth to disk	75			70			55			105			85			80			80		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel	1	260	28																		
Anchoa mitchilli	Bay Anchovy										1	15	<0.1	4	25-80	0.3-2.8						
Fundulus heteroclitus	Mummichog																1	45	0.5			
Gasterosteus aculeatus	Threespine Stickleback							1	23	<0.1							7	58-70	2-3			
Morone americanus	White Perch	16	77-223	4-167	12	105-320	14-488	3	115-212	19-144	1	222	186	4	164-195	57-105	1	98	10	1	111	16
Morone saxatilis	Striped Bass							1	342	430				2	202-222	82-111						
Pomatomus saltatrix	Bluefish	3	206-239	82-120																		
Leiostomus xantharus	Spot	3	205-250	123-248																		
Paralichthys dentatus	Summer Flounder				1	152	32															
INVERTEBRATES																						
Amphipoda	scuds							40									20					
Balanus improvisus	bay barnacle	1000			60			90			50						300					
Callinectes sapidus	blue crab	1	58		3	26-85		1	71		3	35-89					1	ND				
Crangon septemspinosa	sand shrimp				2			1									13					
Crassostrea virginica	American oyster										1											
Ctenophora	comb jelly	many			5																	
Guekensia demissus	ribbed mussel							2			20						4					
Palaeomonetes pugio	grass shrimp																5					
Rhithropanopeus harrissii	white-fingered mud crab	10			2			1			7						10					
Uca minax	brackish water fiddler crab																1					

NOTES: No collections during Winter 2013-14
ND = No data, not measured

TABLE A-12
Catch and Water Quality at Station T3 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T3**			**T3**			**T3**			**T3**			**T3**			**T3**			**T3**		
	Collection Number	020-021			045-046			0083-0084			0107/0108			0134/0135			0177/0178			0201/0202		
	Date	9/11/2013			10/18/2013			5/30/2014			8/1/2014			10/17/2014			03/24/15			05/08/15		
	Time (Set)	13:43 & 14:16			11:58 & 12:29			13:09 & 13:26			12:42			12:23			12:00			11:33		
	Tidal Stage (+ hrs.)	High + 0			High + 3.0			High +2.0			low + 5.75			low + 1.5			low + 5			Low + 4.5		
	Depth Range (ft.)	13-20			7-14			10-15			13 - 18			12-16			13 - 21.5			12.5 - 17.0		
	No.& length per tow (#/min:sec)	2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	29.0			16.1			20.8			27.4			16.6			1.7			23.9		
	surface	25.5			17.8			20.7			26.8			19.4			4.5			18.5		
	bottom	24.0			17.6			20.4			26.8			18.8			3.9			18.0		
D.O. (%)	surface	64.6			52.6			42.3			92.2			69.6			75.4			52.4		
	bottom	53.9			49.8			41.3			76.5			56.4			74.6			47.5		
D.O. (ppm)	surface	4.92			4.57			3.69			7.01			6.00			9.31			4.65		
	bottom	4.19			4.32			3.61			5.83			4.85			9.32			4.29		
Specific Conductivity (uS/cm)	surface	21917			24677			9720			17887			16821			14632			15,624		
	bottom	23985			25264			10558			18743			20807			14973			15,873		
Conductivity (uS/cm)	surface	22132			21288			8920			18542			15036			8919			13,697		
	bottom	23551			21716			9640			19329			18393			9011			13,755		
T.D.S. (mg/L)	surface	14254.5			16042.00			6318.00			11661.00			10939.50			9516.0			10,153.00		
	bottom	15593.5			16419.00			6864.00			12194.00			13559.00			9802.0			10,322.00		
Salinity (0/00)	surface	13.16			15.05			5.48			10.56			9.92			8.40			9.16		
	bottom	14.54			15.45			5.99			11.09			12.53			8.66			9.32		
pH	surface	7.42			7.34			7.61			7.91			8.03			8.28			8.06		
	bottom	7.35			7.34			7.52			7.78			7.86			8.19			7.96		
Secchi (cm)	depth to disk	50			75			85			60			95			100			70		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel	3	250-475	38-213													2	58-155	.1-6			
Alosa pseudoharengus	Alewife	1	140	27																		
Brevoortia tyrannus	Atlantic Menhaden										1	312	275							3	329-341	330-382
Dorosoma cepedianum	Gizzard Shad				24	135-200	26-74															
Anchoa mitchilli	Bay Anchovy				5	46-77	0.6-2.4							14	26-89	0.1-5						
Fundulus majalis	Striped Killifish																1	78	5			
Gasterosteus aculeatus	Threespine Stickleback																1	63	3			
Morone americanus	White Perch	76	70-261	4-281	74	80-261	6-284	7	186-251	95-222	82	119-236	24 - 210	8	124-239	29-200				29	142-279	33-313
Morone saxatilis	Striped Bass	6	115-253	13-164				1	105	9	2	139-144	28 - 30	1	190	63				1	179	56
Pomatomus saltatrix	Bluefish				1	227	120				1	147	27									
Leiostomus xantharus	Spot	12	141-241	42-231																		
Trinectes maculatus	Hogchoker	3	97-106	18-23																		
INVERTEBRATES																						
Amphipoda	scuds																30			5		
Callinectes sapidus	blue crab	8	97-155					2	104-105					1	174		5	25-38				
Crangon septemspinosa	sand shrimp													1						1		
Macoma balthica	Baltic macoma clam																20					
Rangia cuneata	Atlantic rangia				5																	
Rhithropanopeus harrissii	white-fingered mud crab													16			26			10		

NOTES: No collections during Winter 2013-14

TABLE A-13
Catch and Water Quality at Station T4 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T4**			**T4**			**T4**			**T4**			**T4**			**T4**			**T4**		
	Collection Number	012-013			035-036			0068-0069			0095/0096			0123/0124			0162/0163			0203/0204		
	Date	9/10/2013			10/16/2013			5/13/2014			7/29/2014			10/9/2014			03/17/15			05/08/15		
	Time (Set)	12:29			12:27			11:17			12:27			11:54			11:49			12:17		
	Tidal Stage (+ hrs.)	Low + 6.0			High +4.75			High +2.5			high + 1			high + 2.0			high + 4.75			Low + 5.25		
	Depth Range (ft.)	20-10			9-19			8-20			11 - 22			11-18.5			9 - 17.5			9 - 17		
	No.& length per tow (#/min:sec)	2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	24.0			22.1			17.8			18.5			17.7			10.0			21.4		
	surface	23.5			17.6			18.9			25.9			17.9			5.2			20.5		
	bottom	23.3			17.6			18.9			25.3			17.7			5.3			18.6		
D.O. (%)	surface	60.5			41.2			29.9			71.6			67.3			60.4			38.7		
	bottom	56.0			32.5			29.9			38.8			63.7			59.2			34.9		
D.O. (ppm)	surface	4.87			3.70			2.78			5.57			5.93			7.35			3.88		
	bottom	4.54			2.90			2.81			3.05			5.62			7.18			3.19		
Specific Conductivity (uS/cm)	surface	18020			17890			3756			12958			22232			7817			11,062		
	bottom	18665			18380			3733			13409			23392			7824			12,422		
Conductivity (uS/cm)	surface	17522			15370			3313			13173			19208			4855			10,119		
	bottom	18067			15782			3295			13491			20137			4884			10,942		
T.D.S. (mg/L)	surface	11713.0			11628.50			2444.00			8424.00			14449.50			5083.0			7,189.00		
	bottom	12129.0			11947.00			2424.50			8716.50			15203.50			5083.0			8,086.00		
Salinity (0/00)	surface	10.65			10.61			1.99			7.43			13.43			4.30			6.30		
	bottom	11.07			10.92			1.98			7.72			14.2			4.31			7.16		
pH	surface	7.40			7.24			7.58			7.75			7.62			8.16			8.00		
	bottom	7.36			7.18			7.50			7.59			7.61			8.07			7.90		
Secchi (cm)	depth to disk	40			60			60			55			75			65			75		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel	21	235-442	24-168	1	475	150	1	295	52	7	210-475	15 - 187	1	483	258						
Alosa aestivalis	Blueback Herring																			1	218	54
Alosa pseudoharengus	Alewife										1	73	3.1	3	98-128	11-20						
Dorosoma cepedianum	Gizzard Shad				18	134-230	22-256															
Anchoa mitchilli	Bay Anchovy													11	47-155	0.8-3						
Amierus nebulosus	Brown Bullhead	1	309	360							3	304-339	370 - 669									
Fundulus heteroclitus	Mummichog							1	59	2.5												
Menidia menidia	Atlantic Silverside													1	92	6						
Gasterosteus aculeatus	Threespine Stickleback																1	60	3			
Morone americanus	White Perch	202	56-259	1.9-264	79	75-258	6-400	1	219	152	81	42-244	0.9 - 216	6	167-212	64-155	2	158-164	50-55	1	274	304
Morone saxatilis	Striped Bass	6	175-266	60-194	4	212-447	220-980							2	171-372	45-496						
Pomatomus saltatrix	Bluefish													1	238	120						
Cynoscion regalis	Weakfish	11	57-94	1.7-7.6							1	44	0.7									
Leiostomus xantharus	Spot	30	147-276	42-224																		
Trinectes maculatus	Hogchoker	15	66-146	6-52				1	110	24												
INVERTEBRATES																						
Amphipoda	scuds																20			510		
Balanus improvisus	bay barnacle	10			8,020									500								
Callinectes sapidus	blue crab	8	85-151														1	48				
Congeria leucopheata	platform mussel				300															1		
Guekensia demissus	ribbed mussel																			1		
Palaeomonetes pugio	grass shrimp																6					
Rangia cuneata	Atlantic rangia	10												2			2					
Rhithropanopeus harrissii	white-fingered mud crab	50			31			50						30			35			155		

NOTES: No collections during Winter 2013-14

TABLE A-14
Catch and Water Quality at Station T5 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T5**			**T5**			**T5**			**T5**			**T5**			**T5**			**T5**		
	Collection Number	010-011			033-034			0066-0067			0097/0098			0125/0126			0164/0165			0197/0198		
	Date	9/10/2013			10/16/2013			5/13/2014			7/29/2014			10/9/2014			03/17/15			05/05/15		
	Time (Set)	11:00			11:23			10:31			13:34			13:03			12:42			12:44		
	Tidal Stage (+ hrs.)	Low + 4.0			High +3.5			High +1.4			high + 2			high + 2.5			high + 5.5			High + 2.25		
	Depth Range (ft.)	12-8			11-7			12-17-15			9 - 15			9-15			8 - 12			10 - 17		
	No.& length per tow (#/min:sec)	2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	23.8			16.8			18.2			21.2			18.0			9.9			24.5		
	surface	23.0			17.7			19.3			25.9			18.1			5.6			20.0		
	bottom	22.6			17.5			19.0			25.1			17.7			5.7			18.2		
D.O. (%)	surface	73.7			32.9			27.3			127.4			74.4			66.8			51.7		
	bottom	57.1			30.5			22.2			26.2			48.4			63.8			35.6		
D.O. (ppm)	surface	6.15			2.98			2.55			10.12			6.65			8.19			4.65		
	bottom	4.79			2.76			2.15			2.10			4.46			7.83			3.32		
Specific Conductivity (uS/cm)	surface	11059			15873			1899			6387			14944			3770			5,596		
	bottom	11799			16639			2230			8355			17499			3991			7,380		
Conductivity (uS/cm)	surface	10634			13649			1690			6492			13033			2376			5,054		
	bottom	11260			14268			1974			8375			15062			2524			6,311		
T.D.S. (mg/L)	surface	7189.0			10315.50			1235.00			4153.50			9711.00			2450.5			3,640.00		
	bottom	7670.0			10816.00			1449.50			5434.00			11375.00			2593.5			4,712.50		
Salinity (0/00)	surface	6.29			9.32			0.97			3.48			8.73			1.98			3.04		
	bottom	6.74			9.81			1.15			4.64			10.36			2.11			4.01		
pH	surface	7.42			7.19			7.61			8.05			7.87			8.27			8.10		
	bottom	7.33			7.16			7.46			7.73			7.69			8.14			7.95		
Secchi (cm)	depth to disk	25			65			80			35			70			45			65		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel										3	86-285	1.3 - 42				1	130	2			
Alosa aestivalis	Blueback Herring																			1	249	128
Alosa pseudoharengus	Alewife				2	72-80	2.1-3.3							4	112-132	12-20						
Dorosoma cepedianum	Gizzard Shad	4	151-205	36-90																		
Anchoa mitchilli	Bay Anchovy	1	~30	0.5	137	27-55	0.1-1.2															
Cyprinus carpio	Carp	1	221	176																		
Amierus nebulosus	Brown Bullhead	4	305-329	420-534							2	215-220	113 - 133	4	320-350	433-703	3	346-372	536-813			
Fundulus heteroclitus	Mummichog										2	42-86	0.8 - 14				1	61	2			
Morone americanus	White Perch	79	70-240	4-240	4	75-105	2-8							31	98-243	13-222	61	74-238	4-217	6	95-216	10-160
Morone saxatilis	Striped Bass	1	176	54										2	212-303	101-294						
Pomatomus saltatrix	Bluefish	2	185-220	66-102																		
Cynoscion regalis	Weakfish				1	126	17															
Leiostomus xantharus	Spot	4	145-165	44-70																		
Gobiosoma bosci	Naked Goby													1	41	0.8						
INVERTEBRATES																						
Amphipoda	scuds							20						150			45			40		
Balanus improvisus	bay barnacle							1,020			1,015			5,015								
Callinectes sapidus	blue crab	5	85-163								5	80-128										
Congeria leucopheata	platform mussel							600			100			155								
Crangon septemspinosa	sand shrimp													2								
Palaeomonetes pugio	grass shrimp													1			10					
Rhithropanopeus harrissii	white-fingered mud crab							120			155			6			3			1,025		

NOTES: No collections during Winter 2013-14

TABLE A-15
Catch and Water Quality at Station T6 (Sawmill Creek)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T6**			**T6**			**T6**			**T6**			**T6**			**T6**			**T6**		
	Collection Number	025-026			037-038			0076-0077			0101/0102			0140/0141			0175/0176			0189/0190		
	Date	9/19/2013			10/17/2013			5/14/2014			7/30/2014			11/5/2014			03/24/15			05/04/15		
	Time (Set)	10:56 & 11:15			10:49 & 11:07			12:57 & 13:15			12:18			11:48			11:04			12:26		
	Tidal Stage (+ hrs.)	High +2.0			High +3.0			High +4.0			high + 0.25			high + 5.0			low + 4			High + 2.5		
	Depth Range (ft.)	16-21			15-20			10-18			17 - 20			12.8-18			15 - 20			16.5 - 20.0		
	No.& length per tow (#/min:sec)	2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	19.2			19.0			17.3			22.9			11.3			1.8			21.3		
	surface	20.7			17.7			18.9			26.5			11.2			3.7			16.4		
	bottom	20.1			17.9			18.9			25.8			11.2			3.6			15.4		
D.O. (%)	surface	58.0			57.0			50.2			74.6			84.1			77.7			91.1		
	bottom	60.9			63.8			52.7			68.2			82.9			77.1			85.3		
D.O. (ppm)	surface	4.79			4.90			4.22			5.59			8.50			9.73			8.40		
	bottom	5.02			5.65			4.77			5.14			8.36			9.69			7.99		
Specific Conductivity (uS/cm)	surface	25037			27103			10570			21901			23482			16960			18,461		
	bottom	28588			29427			10614			23730			23476			17067			19,341		
Conductivity (uS/cm)	surface	22999			23336			9346			22521			17262			10068			15,414		
	bottom	25909			25486			9393			24102			17303			10090			15,821		
T.D.S. (mg/L)	surface	16276.0			17615.00			6870.50			14241.50			15262.00			11030.5			11,999.00		
	bottom	18583.5			17706.00			6903.00			15424.50			15255.50			11095.5			12,571.00		
Salinity (0/00)	surface	15.28			16.68			6.00			13.14			14.22			9.82			10.98		
	bottom	17.67			11.67			6.03			14.35			14.21			9.88			11.54		
pH	surface	7.45			7.38			7.64			7.78			7.99			8.40			8.14		
	bottom	7.48			7.43			7.58			7.70			7.94			8.28			8.11		
Secchi (cm)	depth to disk	80			115			50			90			60			105			100		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Brevoortia tyrannus	Atlantic Menhaden							1	329	355	1	320	290							1	340	395
Dorosoma cepedianum	Gizzard Shad				8	141-184	28-60															
Anchoa mitchilli	Bay Anchovy	1	85	4																		
Gasterosteus aculeatus	Threespine Stickleback																1	ND	ND			
Morone americanus	White Perch	18	75-211	6-126				35	151-245	44-207	2	144-217	44 - 144	75	0-257	0-269				1	214	150
Morone saxatilis	Striped Bass													1	220	100						
Leiostomus xantharus	Spot	3	182-195	96-116																		
INVERTEBRATES																						
Amphipoda	scuds							10									1			30		
Balanus improvisus	bay barnacle	150			10						100						75			30		
Callinectes sapidus	blue crab	3	68-75					1	110		1	128		1	75					1	30	
Crangon septemspinosa	sand shrimp																2			1		
Crassostrea virginica	American oyster										3						1					
Ctenophora	comb jelly	many			35																	
Guekensia demissus	ribbed mussel	6									10									3		
Palaeomonetes pugio	grass shrimp													1						1		
Palaeomon macrodactylus	Oriental Shrimp																			3		
Rhithropanopeus harrissii	white-fingered mud crab													6			10			25		

NOTES: No collections during Winter 2013-14
ND = No Data (animal squished before it could be measured)

TABLE A-16
Catch and Water Quality at Station T7 (Berry's Creek Canal)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T7**			**T7**			**T7**			**T7**			**T7**			**T7**			**T7**		
	Collection Number	018-019			047-048			0081-0082			0105/0106			0142/0143			0169/0170			0199/0200		
	Date	9/11/2013			10/18/2013			5/30/2014			8/1/2014			11/5/2014			03/19/15			05/08/15		
	Time (Set)	12:07 & 12:51			13:11 & 13:47			12:03 & 12:28			11:22			12:44			11:17			10:57		
	Tidal Stage (+ hrs.)	Low + 4.5			High + 4.0			High +1.0			low + 4.5			high + 5.25			high + 2.25			Low + 3.5		
	Depth Range (ft.)	13-15			11-12			13-15			13.6 - 14.5			8-11			14.5 - 16.5			14.2 - 14.5		
	No.& length per tow (#/min:sec)	2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	29.5			18.5			18.1			30.4			14.5			0.7			27.0		
	surface	25.6			18.0			22.4			27.0			10.8			3.7			18.9		
	bottom	24.0			18.0			20.4			25.7			10.7			3.7			18.4		
D.O. (%)	surface	64.2			39.4			40.4			117.3			65.8			69.1			32.6		
	bottom	52.3			39.1			37.4			73.9			68.6			67.3			31.5		
D.O. (ppm)	surface	4.96			3.48			3.47			9.04			6.94			8.82			2.29		
	bottom	4.15			3.49			3.33			5.58			7.28			8.64			2.86		
Specific Conductivity (uS/cm)	surface	17764			20110			6520			13246			15187			11077			11,911		
	bottom	19223			20443			8927			14256			15342			11746			12,484		
Conductivity (uS/cm)	surface	17959			17411			6196			13616			11073			6580			10,531		
	bottom	18866			17701			8154			14467			11156			6970			10,922		
T.D.S. (mg/L)	surface	11550.5			13071.50			4238.00			8521.50			9873.50			7202.0			7,741.50		
	bottom	12493.0			13286.00			5804.50			9226.00			9971.00			7637.5			8,118.50		
Salinity (0/00)	surface	10.47			12.05			3.57			7.51			8.86			6.21			6.83		
	bottom	11.42			12.26			5.00			8.24			8.96			6.62			7.19		
pH	surface	7.37			7.33			7.58			7.96			8.12			8.19			7.92		
	bottom	7.32			7.25			7.49			7.77			7.96			8.09			7.84		
Secchi (cm)	depth to disk	45			65			70			45			55			55			80		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel	3	390-575	86-365	2	280-300	42-44	2	385-495	122-226	14	275-495	43 - 270	1	ND	ND						
Alosa pseudoharengus	Alewife	1	116	12	1	131	20															
Brevoortia tyrannus	Atlantic Menhaden													4	322-360	305-386				3	322-328	286-321
Dorosoma cepedianum	Gizzard Shad				4	171-210	36-74							3	199-227	77-110						
Anchoa mitchilli	Bay Anchovy	9	60-82	1.3-3.3																		
Microgadus tomcod	Atlantic Tomcod																			1	2.9	0.2
Fundulus heteroclitus	Mummichog																			1	105	19
Morone americanus	White Perch	190	66-255	3-270	279	59-250	2.5-294	51	95-256	11-228	573	45-239	1.0 - 202	193	73-251	4-256	1	99	10	55	95-259	9-258
Morone saxatilis	Striped Bass							2	209-232	78-124	1	160	44									
Pomatomus saltatrix	Bluefish	1	233	111																		
Cynoscion regalis	Weakfish	11	60-156	2.3-32							3	33-46	0.4 - 1.0									
Leiostomus xantharus	Spot	11	151-221	50-183	4	133-182	34-80															
Micropogonias undulatus	Atlantic Croaker													1	26	0.2						
Pseudopleuronectes americanus	Winter Flounder													3	100-115	11-19						
Trinectes maculatus	Hogchoker	1	153	74																1	107	16
INVERTEBRATES																						
Amphipoda	scuds							4,000			20						40			275		
Callinectes sapidus	blue crab	9	72-150					2	97-109		9	56-130		1	55		2	27-36				
Crangon septemspinosa	sand shrimp													3						1		
Macoma balthica	Baltic macoma clam																			1		
Palaeomonetes pugio	grass shrimp													5			30					
Penaeus aztecus	brown shrimp													2								
Rhithropanopeus harrissii	white-fingered mud crab							15			5			10			17			105		

NOTES: No collections during Winter 2013-14
ND = No Data (escaped before it could be measured)

TABLE A-17
Catch and Water Quality at Station T8 (Mill Creek)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T8**			**T8**			**T8**			**T8**			**T8**			**T8**			**T8**		
	Collection Number	014-015			043-044			0079-0080			0093/0094			0121/0122			0179/0180			0193/0194		
	Date	9/10/2013			10/18/2013			5/30/2014			7/29/2014			10/9/2014			03/24/15			05/05/15		
	Time (Set)	14:29 &14:46			10:21 & 10:49			10:57 & 11:13			11:11			10:56			13:15			11:04		
	Tidal Stage (+ hrs.)	High + 1.5			High +1.0			High +0			high + 0			high + 0.6			high + 0			High + 0		
	Depth Range (ft.)	12-4			6-10			3-12			5 - 11			5-12			4 - 10			4 - 8		
	No.& length per tow (#/min:sec)	1/2:50, 1/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	27.1			15.3			22.4			19.9			17.7			1.5			24.9		
	surface	24.1			17.5			20.8			25.5			17.8			5.2			18.5		
	bottom	23.5			17.6			20.5			25.4			17.7			4.9			18.0		
D.O. (%)	surface	85.0			39.2			30.7			69.5			58.0			82.4			42.9		
	bottom	58.3			38.3			31.7			58.6			57.5			79.6			39..1		
D.O. (ppm)	surface	6.79			3.49			2.74			5.51			5.17			10.22			3.87		
	bottom	4.70			3.41			2.82			4.76			5.16			9.96			3.64		
Specific Conductivity (uS/cm)	surface	16110			19597			4110			9557			19637			9077			8,847		
	bottom	17150			19668			4221			9705			17512			9188			9,124		
Conductivity (uS/cm)	surface	15830			16806			3780			9647			16953			5646			7,755		
	bottom	16652			16885			3861			9773			17512			5661			7,903		
T.D.S. (mg/L)	surface	10471.5			12740.00			2671.50			6214.00			12766.00			5902.0			5,752.50		
	bottom	11147.5			12785.50			2743.00			6311.50			13221.00			5973.5			5,934.50		
Salinity (0/00)	surface	9.43			11.71			2.19			5.36			11.74			5.05			4.96		
	bottom	10.09			11.76			2.25			5.45			12.19			5.11			5.13		
pH	surface	7.54			7.30			7.80			7.56			7.55			8.26			8.24		
	bottom	7.35			7.23			7.57			7.52			7.53			8.21			8.07		
Secchi (cm)	depth to disk	40			50			70			45			70			70			65		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel										1	229	24									
Alosa pseudoharengus	Alewife				1	135	18							1	104	10						
Dorosoma cepedianum	Gizzard Shad				2	159-205	38-80															
Anchoa mitchilli	Bay Anchovy													2	53-88	1-4						
Amierus nebulosus	Brown Bullhead							4	278-352	318-655	3	75-335	6 - 554							3	221-315	157-500
Fundulus heteroclitus	Mummichog										149	36-106	0.6 - 21				1	43	0.4	1	66	4
Menidia menidia	Atlantic Silverside				19	60-101	1.4-6							7	67 - 100	2 - 5						
Morone americanus	White Perch	30	36-224	0.6-174	46	70-235	4-188							5	155-206	53-141				5	137-204	34-135
Morone saxatilis	Striped Bass				1	246	140															
Pomatomus saltatrix	Bluefish	1	180	50																		
Ctenogobius shufeldti	Freshwater Goby													1	41	1						
INVERTEBRATES																						
Amphipoda	scuds							100									1					
Callinectes sapidus	blue crab	5	64-137		3	22-84		6	20-37		4	32-109		1	104					1	31	
Crangon septemspinosa	sand shrimp													3								
Palaeomonetes pugio	grass shrimp	1																				
Rangia cuneata	Atlantic rangia	1			3																	
Rhithropanopeus harrissii	white-fingered mud crab							1			10			1						15		

NOTES: No collections during Winter 2013-14

TABLE A-18
Catch and Water Quality at Station T9 (Cromakill Creek)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**T9**			**T9**			**T9**			**T9**			**T9**			**T9**			**T9**		
	Collection Number	016-017			031-032			0070 - 0071			0119/0120			0138/0139			0160/0161			0195/0196		
	Date	9/11/2013			10/16/2013			5/13/2014			9/8/2014			11/5/2014			03/17/15			05/05/15		
	Time (Set)	10:23 & 11:04			10:30 & 10:42			12:07 & 12:26			13:02			10:44			11:04			11:55		
	Tidal Stage (+ hrs.)	Low + 3.0			High +2.75			High +3.0			high + 3.0			high + 3.25			high + 4			High + 2.0		
	Depth Range (ft.)	5-12			8-13			4-12			7 - 12			10-12			7 - 12			7.5 - 12.5		
	No.& length per tow (#/min:sec)	2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00			2/3:00		
Water Quality																						
Temp (oC)	air	26.9			18.9			15.8			24.7			14.6			11.9			22.9		
	surface	24.2			17.0			19.8			24.6			10.9			4.3			19.1		
	bottom	23.9			17.1			20.0			24.7			11.0			4.4			17.7		
D.O. (%)	surface	70.7			34.7			42.5			74.4			66.1			63.8			48.6		
	bottom	55.9			35.4			46.7			73.4			64.7			61.3			40.6		
D.O. (ppm)	surface	5.72			3.12			3.89			5.98			6.94			7.89			4.41		
	bottom	4.54			3.20			4.28			5.90			6.78			7.58			3.83		
Specific Conductivity (uS/cm)	surface	12682			19176			2242			14850			15572			8828			8,427		
	bottom	12860			19489			2354			15099			15642			9144			9,832		
Conductivity (uS/cm)	surface	12496			16253			2020			14724			11369			5336			7,476		
	bottom	12591			16550			2127			14999			11451			5546			8,480		
T.D.S. (mg/L)	surface	8242.0			12467.00			1456.00			9625.50			10120.50			5739.5			5,479.50		
	bottom	8359.0			12668.50			1527.50			9815.00			10166.00			5947.5			6,396.00		
Salinity (0/00)	surface	7.28			11.44			1.15			8.63			9.11			4.88			4.71		
	bottom	7.39			11.64			1.21			8.78			9.15			5.07			5.56		
pH	surface	7.38			7.14			7.75			7.83			8.22			8.45			8.04		
	bottom	7.30			7.16			7.63			7.79			8.05			8.23			7.95		
Secchi (cm)	depth to disk	30			65			40			35			65			45			65		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Anguilla rostrata	American Eel				1	445	162	2	255-260	29-36	6	220-310	18 - 57									
Alosa aestivalis	Blueback Herring							1	276	179												
Brevoortia tyrannus	Atlantic Menhaden													1	322	324						
Dorosoma cepedianum	Gizzard Shad	8	141-191	32-74							3	165-184	45 - 71									
Anchoa mitchilli	Bay Anchovy				1	82	3.1															
Cyprinus carpio	Carp	1	296	450				2	292-314	434-528										1	688	4,600
Amierus nebulosus	Brown Bullhead							1	320	470												
Fundulus heteroclitus	Mummichog																6	42-95	.5-11			
Menidia menidia	Atlantic Silverside										1	87	4									
Morone americanus	White Perch	56	75-274	2-337	1	92	9.5	2	230-239	193-233	2	150-228	45 - 171				1	171	66	1	181	87
Morone saxatilis	Striped Bass	31	116-255	44-163							2	241-252	138 - 157									
Pomatomus saltatrix	Bluefish	13	165-195	40-70																		
Leiostomus xantharus	Spot	35	106-195	55-114																		
INVERTEBRATES																						
Amphipoda	scuds							300						10			20			150		
Balanus improvisus	bay barnacle	150						100,000						50			10					
Callinectes sapidus	blue crab	4	67-142								1	133					1	28				
Congeria leucopheata	platform mussel	100						50,000														
Crangon septemspinosa	sand shrimp										2											
Cyathura polita	slender isopod							1														
Mulinia lateralis	small surf clam																3					
Palaeomonetes pugio	grass shrimp										1			15			13			1		
Paleomonetes vulgaris	common shore shrimp																			2		
Rangia cuneata	Atlantic rangia				1																	
Rhithropanopeus harrissii	white-fingered mud crab	10			10			200			35			105			20			130		

NOTES: No collections during Winter 2013-14

TABLE A-19
Catch and Water Quality at Station GN1 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**GN1**			**GN1**			**GN1**			**GN1**			**GN1**			**GN1**			**GN1**		
	Collection Number	008			050			0086			0116			0136			0159			0207		
	Date (Set)	8/29/2013			10/24/2013			6/2/2014			08/21/14			10/30/2014			03/12/15			5/28/2015		
	Time (Set)	10:46			11:22			11:38			11:15			11:05			11:30			11:20		
	Tidal Stage (+ hrs.)	Low + 0.5			Low + 4.5			Low +4.5			high + 4.25			low + 2.5			low + 3.5			high + 6		
	Depth (ft.)	9-28			7-22			9-25			10-25			5-12-10			7-15			6-12		
	Length of Net Set (hrs:min)	23:49			23:14			24:34			23:40			24:10			24:05			24:45		
Water Quality																						
Temp (oC)	air	24.6			8.5			26.2			21.4			12			5.2			23.8		
	surface	25.9			14.7			19.9			23.8			14			2.8			22.7		
	bottom	25.9			14.7			19.3			23.8			13.9			2.9			22.4		
D.O. (%)	surface	50.1			67.0			69.4			60.0			71.5			67.1			77.9		
	bottom	48.6			68.7			69.5			59.4			70.9			68.3			77.0		
D.O. (ppm)	surface	3.82			6.15			5.87			4.59			6.73			8.39			6.31		
	bottom	3.57			6.37			5.90			4.54			6.71			8.55			6.22		
Specific Conductivity (uS/cm)	surface	25050			28666			20237			29549			24700			23869			23055		
	bottom	24975			29115			22574			29513			24745			24514			22931		
Conductivity (uS/cm)	surface	25472			23018			18254			28890			19504			13762			22023		
	bottom	25391			23373			20147			28859			19503			14186			22063		
T.D.S. (mg/L)	surface	16282.50			18635.50			13156.00			19214.0			16055.00			15515.5			14989.00		
	bottom	16237.00			18928.00			14677.00			19181.5			16097.50			15931.5			15080.00		
Salinity (0/00)	surface	15.22			17.73			12.12			18.29			15.06			14.15			13.95		
	bottom	15.17			18.03			13.65			18.25			15.09			14.57			14.04		
pH	surface	7.34			7.49			7.66			7.75			7.88			7.94			7.97		
	bottom	7.32			7.52			7.60			7.70			7.78			7.90			7.93		
Secchi (cm)	depth to disk	70			165			110			125			125			150			110		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Brevoortia tyrannus	Atlantic Menhaden	37	119-331	19-448				9	306-350	258-401	8	310-352	332-414	5	335-367	354-448				3	316-364	306-380
Morone americanus	White Perch	3	234-237	195-240	2	115-224	18-178	6	129-254	25-235	3	225-294	209-429	3	215-243	156-256	1	250	219	9	145-296	52-343
Morone saxatilis	Striped Bass	4	391-765	624-4,542	2	321-531	342-1,508													1	393	608
Pomatomus saltatrix	Bluefish	1	ND	ND	1	184	64													1	414	614
Leiostomus xantharus	Spot	5	134-239	32-197							1	171	67									
INVERTEBRATES																						
Balanus improvisus	bay barnacle	40			50						20			50								
Callinectes sapidus	blue crab	3	116-153								4	115 - 145								2	110-145	
Crassostrea virginica	American oyster	2			1						6			5								
Guekensia demissus	ribbed mussel										20			20								
Rhithropanopeus harrisii	white-fingered mud crab										5											
Synidotea laevidorsalis	isopod	30			2						10											

NOTES: No collections during Winter 2013-14
ND = No Data (head only)

TABLE A-20
Catch and Water Quality at Station GN2 (Hackensack River)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**GN2**			**GN2**			**GN2**			**GN2**			**GN2**			**GN2**			**GN2**		
	Collection Number	009			051			0085			0117			0137			0158			0206		
	Date (Set)	8/29/2013			10/24/2013			6/2/2014			08/21/14			10/30/2014			03/12/15			5/28/2015		
	Time (Set)	12:34			11:53			11:10			11:45			11:35			11:08			10:57		
	Tidal Stage (+ hrs.)	Low + 2.25			Low + 5.0			Low +4.0			high + 5			low + 3.0			low + 3			high + 5.5		
	Depth (ft.)	7-16			8-17			9-14			7-12			5-12			5-11			5-11		
	Length of Net Set (hrs:min)	23:16			23:37			23:58			24:33			24:30			23:52			23:50		
Water Quality																						
Temp (oC)	air	23.6			9.9			26.2			21.2			9.9			1.8			24.2		
	surface	25.5			13.6			22.2			24.1			13.6			4.0			23.2		
	bottom	25.2			13.6			21.5			24.2			13.5			3.1			22.8		
D.O. (%)	surface	65.5			59.1			50.5			45.2			61.4			51.8			43.1		
	bottom	39.5			61.3			49.3			46.2			64.6			42.4			43.9		
D.O. (ppm)	surface	5.11			5.68			4.28			3.58			5.95			6.67			3.55		
	bottom	3.11			5.91			4.23			3.67			6.32			5.53			3.64		
Specific Conductivity (uS/cm)	surface	15666			23659			9206			19035			19572			10777			15396		
	bottom	16644			23998			10110			20522			19864			13540			16379		
Conductivity (uS/cm)	surface	15813			18496			8722			18709			15318			6458			14875		
	bottom	16719			18765			9445			20198			15490			7879			15709		
T.D.S. (mg/L)	surface	10185.50			15379.00			5986.50			12369.5			12720.50			7007.0			10010.00		
	bottom	10822.50			15600.00			6571.50			13338.0			12909.00			8801.0			10647.00		
Salinity (0/00)	surface	9.13			14.37			5.16			11.30			11.69			6.04			8.98		
	bottom	9.76			14.59			5.71			12.26			11.88			7.69			9.61		
pH	surface	7.38			7.47			7.60			7.77			7.85			8.07			7.85		
	bottom	7.23			7.46			7.55			7.65			7.76			7.92			7.80		
Secchi (cm)	depth to disk	55			105			90			65			90			85			65		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Alosa pseudoharengus	Alewife							1	140	29	1	161	34							1	166	36
Brevoortia tyrannus	Atlantic Menhaden	93	124-356	36-563				40	295-341	232-403	11	321-357	298-506	2	331-354	285-341				29	309-360	339-480
Cyprinus carpio	Carp							3	326-785	3,300-7,800												
Prionotus carolinus	Northern Searobin	1	151	30																		
Morone americanus	White Perch	42	137-272	38-322	36	113-334	20-626	34	116-256	23-222	90	129-276	33-358	30	133-281	40-397				281	141-290	36-347
Morone saxatilis	Striped Bass	3	166-238	44-147				3	329-444	432-969	4	159-189	41-70	3	405-800	662-5,200				10	156-244	37-147
Pomatomus saltatrix	Bluefish	11	173-209	48-86							22	171-305	40-336									
Leiostomus xantharus	Spot	11	125-237	35-238																		
Trinectes maculatus	Hogchoker							1	ND											1	119	27
INVERTEBRATES																						
Amphipoda	scuds																40					
Balanus improvisus	bay barnacle				140																	
Callinectes sapidus	blue crab	16	85-182					6	101-164		5	124 - 170								5	112-138	
Crassostrea virginica	American oyster							2														
Mytilus edulis	blue mussel							2														
Rhithropanopeus harrisii	white-fingered mud crab							10														

NOTES: No collections during Winter 2013-14
ND= No Data (escaped before it could be measured)

TABLE A-21
Catch and Water Quality at Station GN3 (Overpeck Creek)
NJMC/NJSEA Hackensack River Fishery Resource Inventory
Summer 2013 to Spring 2015

		Summer 2013			Autumn 2013			Spring 2014			Summer 2014			Autumn 2014			Winter 2014-15			Spring 2015		
	Site Location	**GN3**			**GN3**			**GN3**			**GN3**			**GN3**			**GN3**			**GN3**		
	Collection Number	007			060			0090			0115			0150			0157			0205		
	Date (Set)	8/15/2013			10/25/2013			6/9/2014			08/18/14			12/15/2014			03/12/15			5/26/2015		
	Time (Set)	10:57			09:45			12:25			10:38			10:25			09:12			11:10		
	Tidal Stage (+ hrs.)	Low +0.5			Low +1.25			High +5.5			low + 0			low+0.5			low + 1			low + 0.25		
	Depth (ft.)	3-6			~3-7			3-7			4-7			4-6.5			3-6			3-7		
	Length of Net Set (hrs:min)	23:58			23:35			23:25			24:32			24:03			24:48			24:05		
Water Quality																						
Temp (oC)	air	21.5			3.6			27.4			24.7			6			5.9			26.1		
	surface	25.5			3.1			23.8			24.8			3.8			2.8			22.5		
	bottom	24.2			4.3			22.6			23.7			4.7			2.6			21.9		
D.O. (%)	surface	137.0			73.5			63.1			155.0			69.3			71.1			116.5		
	bottom	52.7			65.0			15.1			44.7			58.6			68.4			40.0		
D.O. (ppm)	surface	11.16			9.60			5.33			12.76			9.14			9.70			9.96		
	bottom	4.35			8.19			1.30			3.71			7.5			9.34			3.50		
Specific Conductivity (uS/cm)	surface	4530			11437			812			5741			1809			3349			6577		
	bottom	6653			12403			2248			9115			3063			3450			7288		
Conductivity (uS/cm)	surface	4569			6642			793			5715			1079			1929			6259		
	bottom	6554			7496			2144			8887			1876			1978			6864		
T.D.S. (mg/L)	surface	2944.50			7436.00			526.50			3731.0			1176.50			2177.5			4277.00		
	bottom	4322.50			8060.00			1462.50			5928.0			1989.00			2242.5			7738.50		
Salinity (0/00)	surface	2.41			6.41			0.40			3.11			0.92			1.74			3.60		
	bottom	3.64			7.03			1.15			5.10			1.59			1.79			4.07		
pH	surface	8.54			7.67			8.07			8.74			8.45			8.87			7.89		
	bottom	7.36			7.53			7.59			8.05			7.93			8.64			7.80		
Secchi (cm)	depth to disk	35			80			70			45			60			60			45		
Scientific Name	**Common Name**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**	**#**	**Size Range (mm)**	**Weight Range (grams)**
Alosa aestivalis	Blueback Herring	1	156	35																2	246-261	121-122
Dorosoma cepedianum	Gizzard Shad	253	120-154	16-42	1	263	168	1	376	501	187	114-149	15-39	2	440-518	1293-1752						
Cyprinus carpio	Carp	19	616-736	3,500-7,500	2	632-634	4,200-4,400	18	244-775	238-7,100	29	409-702	100-5,800	1	595	3,046	3	598-696	3,700-4,600	19	530-813	2,100-7,600
Amierus nebulosus	Brown Bullhead							3	289-305	335-492	1	274	340				1	322	560			
Microgadus tomcod	Atlantic Tomcod													1	176	53						
Morone americanus	White Perch	59	124-274	30-305	1	121	18	74	113-280	25-353	10	140-287	38-360	1	ND	ND	1	280	325	135	119-281	22-285
Morone saxatilis	Striped Bass	83	160-515	26-1,295	1	727	4,900	6	158-246	38-146	1	281	258	2	748-838	4,639-6,300	1	732	4,500	1	346	412
Pomoxis nigromaculatus	Black Crappie							2	117-132	23-34										1	110	18
Perca flavescens	Yellow Perch	3	181-199	68-91				8	135-155	33-46	3	51-56	36-47									
Pomatomus saltatrix	Bluefish	3	151-170	35-52							18	76-192	32-64									
Leiostomus xantharus	Spot	2	120-152	27-47																		
INVERTEBRATES																						
Callinectes sapidus	blue crab	3	57-159								11	106 - 195										
Rhithropanopeus harrisii	white-fingered mud crab							1														

NOTES: No collections during Winter 2013-14
ND= No Data (escaped before it could be measured)

APPENDIX B

TABLE B-1
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Seine Locations
NJMC 2001-2003 Fisheries Resource Inventory

Site Location	S1	S1	S1	S1	S1	S1	S1	S1	S2	S2	S2	S2	S2	S2	S2	S2	S3	S3	S3	S3	S3	S3	S3	S3
Season	Summer 2001-02*	Autumn 2001	Winter 2001-02	Spring 2002**	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02*	Autumn 2001	Winter 2001-02	Spring 2002**	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02 +	Autumn 2001	Winter 2001-02	Spring 2002 ++	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003
Number of Collections	2	3	3	4	1	1	1	1	2	3	3	4	1	1	1	1	4	3	3	2	1	1	1	1
Date	--	--	--	--	08/26/03	11/14/02	03/17/03	05/27/03	--	--	--	--	08/26/03	11/04/02	03/17/03	05/27/03	--	--	--	--	07/29/03	10/21/02	03/18/03	06/02/03
Common Name																								
Alewife									2.00															
Atlantic Menhaden					1				2.00			0.25					7.00					1		
Gizzard Shad						1			10.00	0.67														
Bay Anchovy										0.33			14											
Goldfish																					1			
Carp																				0.50			5	
Atlantic Tomcod								2																
Mummichog	2.00	1.33				6			250.50	31.67	3.00	35.50	374		1	35	1033.75	130.67	5.00	137.00	1474	314	9	18
Striped Killifish		3.00			4	7			220.50	46.33	112.00	12.00	24	12		2	6.25	2.00		35.00	2	70		16
Inland Silverside		2.33	0.33							5.33	1.67	0.50		19			35.75	24.67	0.67	3.00	72	13		
Atlantic Silverside	794.00	70.00	1.33		2859	19	2		251.50	28.67	0.33	5.00	50	5	2	2	55.00	72.67	0.67	8.50	424	21		
Northern Pipefish		1.33																						
Northern Searobin						1																		
White Perch	5.00	9.00			36				57.00	16.67		2.50	765			2	0.25	0.67		2.00	166			5
Striped Bass	4.00	1.33			1				4.50	2.67		3.50	17			1								
Bluefish	1.50								2.50	1.00			1				0.50				4			
Crevalle Jack									9.50															
Spot									2.00			0.25												
Striped Mullet																	1.25			0.50				
Summer Flounder			0.33																					
Winter Flounder												1.25												
Hogchoker												0.50												
Total No.	806.50	88.32	1.99	0.00	2,901	34	2	2	812.00	133.34	117.00	61.25	1,245	36	3	42	1,139.75	230.68	6.34	186.50	2,143	419	14	39
Total No. of Species	5	7	3	0	5	5	1	1	11	9	4	10	7	3	2	5	8	5	3	7	7	5	2	3

Notes; *=sampled August 2001 & July 2002
**=sampled late March & April/May/June
+=sampled Aug 2001, Sept 2001, late June 2002 & July 2002
++=sampled April & May

TABLE B-2
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Trap Net Locations
NJMC 2001-2003 Fisheries Resource Inventory

Site Location	TN1	TN1	TN1	TN1	TN1	TN1	TN1	TN1	TN2	TN2	TN2	TN2	TN2	TN2	TN2	TN2	TN3	TN3	TN3	TN3	TN3	TN3	TN3	TN3
Season	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003
Number of Collections	3	3	3	3	1	1	1	1	3	3	3	3	1	1	1	1	3	3	3	3	1	1	1	1
Date	--	--	--	--	07/24/03	10/17/02	03/13/03	05/06/03	--	--	--	--	07/24/03	10/17/02	03/13/03	05/06/03	--	--	--	--	07/24/03	10/17/02	03/11/03	05/06/03
Length of Set	24:53:00	23:46:00	24:50:00	24:25:00	24:05:00	22:12:00	23:25:00	25:18:00	24:22:00	24:27:00	24:48:00	24:28:00	24:30:00	23:04:00	23:30:00	25:42:00	24:31:00	24:03:00	25:27:00	24:34:00	24:50:00	23:50:00	24:20:00	26:20:00
Common Name																								
American Eel	0.33								2.00	1.00		1.00	1			1				0.33	1			
Blueback Herring				1.67								10.33							1.33	43.33				
Alewife												2.00					0.33		0.33	3.67				
American Shad																				0.33				
Atlantic Menhaden										1.00		1.67		2								1		
Gizzard Shad	0.67		0.33			1			0.33	0.33								0.33						
Bay Anchovy				0.67																				
Carp												0.33								0.33				
Brown Bullhead																	0.67			2.00				1
Spotted Hake				1.33								0.67								0.33				
Mummichog	0.33		0.33	0.67	1				0.33	1.00	2.67	3.00			1	6	9.67		23.33	1.33	14		3	1
Striped Killifish		3.00									0.33				2	4	0.33		1.33	0.67			1	
Atlantic Silverside		0.33		0.33						0.67	0.33			1		12	0.33			1.00		2		1
Threespine Stickleback			0.33																0.33					
White Perch	22.00	19.33	4.67	2.67		17		3	215.00	30.00	5.33	54.67	49	227		38	182.33	42.67	20.33	89.00	101	110	6	80
Striped Bass	6.67	2.00		0.67	2			1	8.67	1.33		0.67	2	5			5.67	2.33	0.33	1.67	2	1	1	1
Green Sunfish				0.33																				
Bluefish		1.00							0.67								0.33							
Crevalle Jack	0.67	0.33							0.33								1.00							
Lookdown									0.33															
Weakfish	0.67								0.67								1.00	0.33				4		
Winter Flounder			0.33									0.33												
Total No.	31.34	25.99	5.99	8.34	3	18	0	4	228.33	35.33	8.66	74.67	52	235	3	61	201.66	45.66	47.31	143.99	118	118	11	84
Total No. of Species	7	6	5	8	2	2	0	2	9	7	4	10	3	4	2	5	10	4	7	12	4	5	4	5

Site Location	TN4	TN4	TN4	TN4	TN4	TN4	TN4	TN4	TN5	TN5	TN5	TN5	TN5	TN5	TN5	TN5	TN6	TN6	TN6	TN6	TN6	TN6	TN6	TN6
Season	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003
Number of Collections	3	3	3	3	1	1	1	1	3	3	3	3	1	1	1	1	3	3	3	3	1	1	1	1
Date	--	--	--	--	07/22/03	11/14/02	03/13/03	05/08/03	--	--	--	--	07/22/03	10/31/02	03/11/03	07/22/03	--	--	--	--	07/22/03	10/31/02	03/11/03	05/08/03
Length of Set	25:30:00	24:52:00	24:27:00	23:53:00	24:31:00	26:40:00	23:20:00	24:26:00	24:59:00	25:26:00	25:16:00	24:26:00	25:20:00	23:50:00	26:10:00	24:44:00	25:03:00	25:33:00	25:38:00	24:12:00	25:48:00	24:20:00	24:30:00	25:08:00
Common Name																								
American Eel		1.00		1.33	1				1.67	1.00							2.00			0.67		1		
Blueback Herring				1.67						11.00		0.67		1		1		9.33						
Alewife				7.00				1	0.67	1.67		0.33						0.33		0.33				2
Atlantic Menhaden	1.33				4									6			7.33					97		
Gizzard Shad	1.00	0.33			2				9.00	2.00			3	4			313.67	2.67		0.67	3	4		
Goldfish									1.67	2.00	2.33	0.33	7	4					1.00					
Carp				0.33	1				1.33							1	1.33	0.33		0.67	2	1		
Brown Bullhead			0.33	0.67					9.33	2.67	0.33	24.67	5			54	18.33	0.67	0.33	12.00	14			10
Mummichog	320.67	74.00	11.00	2.00	21	27		1	523.67	55.00	42.00	17.00	322	297		1	1012.00	91.67	28.67	194.67	2	450	42	4
Striped Killifish		2.67	0.33	0.33										3										
Inland Silverside						1													0.33	0.33				
Atlantic Silverside				1.33		16						1.33		6			0.33			0.67				
Threespine stickleback			0.33								0.33								0.33					
White Perch	26.33	30.67	3.33	134.33	144	13		55	119.00	106.33	3.00	117.67		125		46	228.67	211.33	1.67	119.67	35	13	1	100
Striped Bass	11.00	0.67		2.67	5				9.33	32.67	0.33	3.33		17		1		5.00		1.00	1	1		1
Pumpkinseed						1				0.67							3.33	0.33		0.67				
Bluegill													1											
Largemouth Bass									0.33	0.33							1.00							
Black Crappie										1.67		0.67	37				1.00	3.00	2.33	3.00	18	2		1
Yellow Perch																				0.33				
Weakfish		3.33							4.00					1			3.67	0.33				2		
Winter Flounder				0.33																				
Total No.	360.33	112.67	15.32	151.99	178	58	0	57	680.00	217.01	48.32	166.00	375	464	0	104	1,592.66	324.99	34.66	334.68	75	571	43	118
Total No. of Species	5	7	5	11	7	5	0	3	11	12	6	9	6	10	0	6	12	11	7	13	7	9	2	6

TABLE B-3
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Trawl Locations
NJMC 2001-2003 Fisheries Resource Inventory

Site Location	T1	T1	T1	T1	T1	T1	T1	T1	T2	T2	T2	T2	T2	T2	T2	T2	T3	T3	T3	T3	T3	T3	T3	T3
Season	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003
Number of Collections	6	6	6	6	2	2	2	2	6	6	6	6	2	2	2	2	6	6	6	6	2	2	2	2
Date	--	--	--	--	08/04/03	10/30/02	03/10/03	05/12/03	--	--	--	--	08/04/03	10/30/02	03/10/02	05/12/03	--	--	--	--	08/07/03	10/29/02	03/11/03	05/13/03
length of tow (min:sec)	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Common Name																								
American Eel																								
Blueback Herring			1.67																11.33	0.33				
Alewife			2.33													1		3.00	0.33	0.67		2		7
American Shad	1.00	1.00	2.00																					
Atlantic Menhaden																	0.33			2.00		1		
Gizzard Shad		2.67							0.67	7.33							5.00	28.67				9		
Bay Anchovy	4.50				6				4.00			0.33	4				3.00			1.33				
Carp																1								
Brown Bullhead																								
Atlantic Tomcod																								3
Spotted Hake				0.33				1																
Mummichog																								
Striped Killifish																								
Inland Silverside																								
Atlantic Silverside											0.33													
Threespine Stickleback																								
Northern Pipefish																								
White Perch	0.67	4.00	0.67	7.33	3	2		2	1.33	24.67	0.33	32.00	1	52		24	20.67	24.00	1.00	10.00	2	11		44
Striped Bass	1.00	2.33	0.33	2.00	1	11		7	6.00	2.67		6.00	4	3		28	12.67	8.00		11.67		9		36
Pumpkinseed																								
Black Crappie																								
Bluefish	3.00	0.67							1.00	0.33							0.67	3.00						
Crevalle Jack	1.33																							
Weakfish					6				1.67				1				45.00	1.67						
Spot									2.67								2.33			4.00				
Atlantic Croaker											0.33							0.33						
Naked Goby															2									
Summer Flounder				0.67				1																
Winter Flounder		0.33																						
Total No.	11.5	11	7	10.33	16	13	0	11	17.34	35	0.99	38.33	10	55	2	54	89.67	68.67	12.66	30	2	32	0	90
Total No. of Species	6	6	5	4	4	2	0	4	7	4	3	3	4	2	1	4	8	7	3	7	1	5	0	4

Site Location	T4	T4	T4	T4	T4	T4	T4	T4	T5	T5	T5	T5	T5	T5	T5	T5	T6	T6	T6	T6	T6	T6	T6	T6
Season	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003
Number of Collections	6	6	6	6	2	2	2	2	6	6	6	6	2	2	2	2	6	6	6	6	2	2	2	2
Date	--	--	--	--	08/07/03	10/25/16	03/04/03	05/14/03	--	--	--	--	08/07/03	10/25/02	03/04/03	05/13/03	--	--	--	--	08/04/03	10/30/02	03/10/03	05/12/03
length of tow (min:sec)	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Common Name																								
American Eel	6.33	0.33		0.33			2		1.00			0.67	2			2	0.33		0.33					
Blueback Herring				0.67															20.67					
Alewife		1.67		4.00				1				0.33				1			0.33					
American Shad		1.00																						
Atlantic Menhaden	1.00			0.33					1.00	0.33														
Gizzard Shad	2.33	2.33							1.00	0.33	0.33			8			2.50	0.33	0.33					
Bay Anchovy	3.00					2												0.33	0.33					
Carp																								
Brown Bullhead	0.33								0.33			7.33	19	1	1	4								
Atlantic Tomcod																								
Spotted Hake																								
Mummichog					8				1.33		0.67	0.33	191											
Striped Killifish																								
Inland Silverside																								
Atlantic Silverside														2										
Threespine Stickleback																								
Northern Pipefish																				0.33				
White Perch	2.33	23.67	3.00	139.67	3	39	1	22	3.33	2.67	31.00	36.67	96	7	8	22	52.00	13.67		16.33				21
Striped Bass	6.33	5.67	1.33	27.00		19		8	0.33	1.00	0.33	9.00	1	3		5	1.33			2.00				36
Pumpkinseed																								
Black Crappie														1										
Bluefish	1.67	0.33							1.00	0.33							0.67							
Crevalle Jack																								
Weakfish	1.00									0.33				1			1.00							
Spot				0.33													1.00							
Atlantic Croaker																								
Naked Goby																								
Summer Flounder																								
Winter Flounder																								
Total No.	24.32	35	4.33	172.33	11	60	3	31	9.32	4.99	32.33	54.33	309	23	9	34	58.83	14.33	21.99	18.66	0	0	0	57
Total No. of Species	9	7	2	7	2	3	2	3	8	6	4	6	5	7	2	5	7	3	5	3	0	0	0	2

TABLE B-3 (Continued)
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Trawl Locations
NJMC 2001-2003 Fisheries Resource Inventory

Site Location	T7	T7	T7	T7	T7	T7	T7	T7	T8	T8	T8	T8	T8	T8	T8	T8	T9	T9	T9	T9	T9	T9	T9	T9
Season	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003	Summer 2001-02	Autumn 2001	Winter 2001-02	Spring 2002	Summer 2003	Autumn 2002	Winter 2002-03	Spring 2003
Number of Collections	6	6	6	6	2	2	2	2	6	6	6	6	2	2	2	2	6	6	6	6	2	2	2	2
Date	--	--	--	--	09/11/03	10/29/02	03/11/03	05/13/03	--	--	--	--	09/11/03	10/25/02	03/04/03	05/14/03	--	--	--	--	09/11/03	10/29/02	03/04/03	05/14/03
length of tow (min:sec)	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00	5:30	6:00	6:00	6:00	6:00	6:00	6:00	6:00	6:00
Common Name																								
American Eel	1.33			0.67	1		1	1	0.33			0.33									5			
Blueback Herring			7.00	0.33								0.33												
Alewife	0.33	1.67	1.33	4.33		3		1				0.33												
American Shad																								
Atlantic Menhaden	2.67		0.33	0.33																				
Gizzard Shad	0.67	2.67				5			2.00								0.33							
Bay Anchovy	4.67																							
Carp																				1.00		2		
Brown Bullhead				0.67						0.33		1.00				2					1			
Atlantic Tomcod																								
Spotted Hake																								
Mummichog			0.67	0.33				5	3.33	0.33	0.67	1.33	11			1	49.67		3.00	0.67				
Striped Killifish							1																	
Inland Silverside																			0.67					
Atlantic Silverside						1								2			0.33							
Threespine Stickleback																			0.33					
Northern Pipefish						1						0.33								0.33				
White Perch	9.00	11.00	3.67	21.67	31	30	1	105	1.00	5.33	1.33	8.33	250	86		12	43.33	0.33		14.00	16	10		9
Striped Bass	2.00	0.33	0.67	1.00		4		3		0.33		0.33		2			5.67	1.33		3.33	2	3		5
Pumpkinseed			1.00										2											
Black Crappie													1											
Bluefish	0.33	1.33							0.33								1.33				1			
Crevalle Jack																								
Weakfish	3.67				11								2	2								1		
Spot	0.33																							
Atlantic Croaker																								
Naked Goby																								
Summer Flounder																								
Winter Flounder																								
Total No.	25.00	17.00	14.67	29.33	43	44	3	115	6.99	6.32	2.00	12.31	266	92	0	15	100.66	1.66	4.00	19.33	25	16	0	14
Total No. of Species	10	5	7	8	3	6	3	5	5	4	2	8	5	4	0	3	6	2	3	5	5	4	0	2

TABLE B-4
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Gill Net Locations
NJMC 2001-2003 Fisheries Resource Inventory

Site Location	GN1	GN1	GN1	GN1	GN1	GN1	GN1	GN1	GN2	GN2	GN2	GN2	GN2	GN2	GN2	GN2	GN3	GN3	GN3	GN3	GN3	GN3	GN3	GN3
Season	**Summer 2001-02**	**Autumn 2001**	**Winter 2001-02**	**Spring 2002**	**Summer 2003**	**Autumn 2002**	**Winter 2002-03**	**Spring 2003**	**Summer 2001-02**	**Autumn 2001**	**Winter 2001-02**	**Spring 2002**	**Summer 2003**	**Autumn 2002**	**Winter 2002-03**	**Spring 2003**	**Summer 2001-02**	**Autumn 2001 ***	**Winter 2001-02**	**Spring 2002****	**Summer 2003**	**Autumn 2002**	**Winter 2002-03**	**Spring 2003**
Number of Collections	3	3	3	3	1	1	1	1	3	3	3	3	1	1	1	1	3	2	3	4	1	1	1	1
Date	--	--	--	--	08/18/03	11/12/02	03/24/03	05/22/03	--	--	--	--	09/16/03	11/12/02	03/24/03	05/22/03	--	--	--	--	08/05/03	11/14/02	03/17/03	06/05/03
Length of Set	25:03:00	23:15:00	23:37:00	24:35:00	24:00:00	24:17:00	23:50:00	24:33:00	24:34:00	23:50:00	23:50:00	24:22:00	24:00:00	24:29:00	23:40:00	24:35:00	24:34:00	24:27:00	25:10:00	24:15:00	24:15:00	24:00:00	25:00:00	24:03:00
Common Name																								
Alligator Gar																				0.25				
Blueback Herring																				0.50				2
Alewife																				1.00		1		
Atlantic Menhaden	1.67		5.00	0.33	3				6.67	14.00		2.00	12			1	3.33							
Gizzard Shad		0.33							0.33		0.67		3	1			125.00	1.50	1.33			20	1	
Carp													1				3.67	3.00		4.50	6	9		7
Brown Bullhead																	1.33	1.00				2	4	
Striped Searobin	0.33																							
White Perch	6.33	49.67	27.00	24.67	14	34	2	16	22.00	47.67	7.00	61.33	15	18	8	6	17.00	6.50		15.25	76	37		14
Striped Bass	2.00	3.00	6.33	7.67	3	1		5	1.33	2.33	0.33	8.00	6	2		1	3.33	7.00	2.00	2.25	2	6		
Black Crappie																	0.67	0.50		0.50			2	
Bluefish	0.33	0.33							2.33	1.00			21											
Weakfish	0.67			0.67				1					1											
Spot						1																		
Total No.	11.33	53.33	38.33	33.34	20	36	2	22	32.66	65.00	8.00	71.33	59	21	8	8	154.33	19.50	3.33	24.25	84	75	7	23
Total No. of Species	6	4	3	4	3	3	1	3	5	4	3	3	7	3	1	3	7	6	2	7	3	6	3	3

Notes; *sampled in October & November

TABLE B-5
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Seine Locations
HMDC 1987-1988 Fisheries Resource Inventory

Site Location	S1	S1	S1	S1	S1	S1	S1	S1	S2	S2	S2	S2	S2	S2	S2	S2	S3	S3	S3	S3	S3	S3	S3	S3
Season	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987	Summer 1987	Autumn 1987*	Winter 1988	Spring 1988	Summer 1988	Autumn 1988
Number of Collections	3	3	3	3	0	1	1	1	3	3	3	3	0	1	1	1	3	3	3	2	1	1	1	1
Date	--	--	--	--	--	06/07/88	08/22/88	11/03/88	--	--	--	--	--	06/07/88	08/22/88	11/03/88	--	--	--	--	01/12/88	06/07/88	08/22/88	11/03/88
Common Name																								
Blueback Herring		0.33								1.33														
Gizzard Shad																			2.00					
Bay anchovy		0.33				14		2				0.33												
Goldfish							1																	
Carp										0.67														
Mummichog	1.00	30.00	1256.00	27.00		4	771	50	108.00	1284.33	1681.67	867.00		600	3638	2206	124.00	650.67	686.00	2265.00	81	404	3071	624
Striped Killifish		1.00	0.67	1.33						0.33	2.67	9.33		12	50	125		2.00	1.33				6	1
Inland Silverside	2.33		5.33	8.67				38	3.67	9.33	81.67	73.67			230	204			14.67	7.50	1		151	147
Atlantic Silverside		2.00	36.00	320.00		4	18	7	0.33		3.33	3.33			686	11								
Northern Pipefish		0.67																						
White Perch			0.33							1.00	0.33			1		2		0.33					1	
Striped Bass		0.33								0.33				4										
Pumpkinseed											1.00			1	2			1.67	1.67				1	
Bluefish		0.67		0.33																				
Crevalle Jack							2																	
Weakfish																1								
Striped Mullet														1										
Windowpane																1								
Winter Flounder																1								
Total No.	3.33	35.33	1,298.33	357.33	N.S.	22	792	97	112.00	1,297.32	1,770.67	953.66	N.S.	619	4,606	2,551	124.00	654.67	705.67	2,272.50	82	404	3,230	772
Total No. of Species	2	8	5	5	N.S.	3	4	4	3	7	6	5	N.S.	6	5	8	1	4	5	2	2	1	5	3

Notes: N.S. = Not Sampled
* = sampled Oct. and Nov.

TABLE B-6
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Trap Net Locations
HMDC 1987-1988 Fisheries Resource Inventory

Site Location	TN1	TN1	TN1	TN1	TN1	TN1	TN1	TN1	TN2	TN2	TN2	TN2	TN2	TN2	TN2	TN2	TN3	TN3	TN3	TN3	TN3	TN3	TN3	TN3
Season	Winter 1987	Spring 1987*	Summer 1987@	Autumn 1987**	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987*	Summer 1987	Autumn 1987**	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987	Summer 1987	Autumn 1987**	Winter 1988	Spring 1988	Summer 1988	Autumn 1988
Number of Collections	0	4	4	2	1	1	1	1	0	4	3	2	1	1	1	1	0	3	3	2	1	1	1	1
Date	--	--	--	--	03/15/88	05/10/88	08/08/88	10/20/88	--	--	--	--	03/15/88	05/10/88	07/19/88	10/20/88	--	--	--	--	03/15/88	05/11/88	08/08/88	10/20/88
Length of Set (hours)	--	24.4	23.3	23.8	24.0	24.0	24.0	24.0	--	24.1	24.5	23.5	24.0	23.5	24.5	23.5	--	24.0	23.5	24.3	24.0	24.0	24.0	23.0
Common Name																								
American Eel		1.00	0.50			3				8.25	0.67			2	2	5		2.33						
Blueback Herring		0.25	0.50	0.50		11												53.67	6.00	0.50		1		1
Alewife				5.00		3		4				0.50						1.00		1.50		1		7
American Shad						1										24				1.00				42
Atlantic Menhaden				1.00														0.67						
Gizzard Shad											0.33													
Bay anchovy				0.50																				
Carp		1.00		0.50						4.75				1				1.67		1.00			1	
Golden Shiner																								
White Catfish																								
Brown Bullhead																		2.00				1		
Atlantic Tomcod			0.25																					7
Spotted Hake						8																		
Mummichog		15.50	46.00	3.00	4		59			126.00	27.00	31.50	290	1	47	39		68.33	78.00	134.50	7	1	40	59
Striped Killifish			0.25							0.25		1.00	8			40						3		1
Atlantic Silverside		0.50				1	2																	
Northern Pipefish						1																		
White Perch		2.00		10.00		8		1		22.25	10.00	9.00	1	4	8	16		28.33	11.00	8.00	1	2	1	6
Striped Bass			2.50	2.00		4										3		1.00		0.50		1		2
Green Sunfish																		0.33	1.67	0.50				1
Pumpkinseed		1.50	0.75			1	1			1.75					6			2.00	15.33	7.00			1	8
Bluegill		0.25	0.50							0.25														
Black Crappie		0.25								1.00														
Yellow Perch																								
Bluefish				1.00				5																
Crevalle Jack			2.75	6.50				69											1.00				1	
Weakfish								7																
Spot												0.50				16							1	5
Windowpane																1								
Winter Flounder				1.00		1										2								1
Total No.	N.S.	22.25	54.00	31.00	4	42	62	86	N.S.	164.50	38.00	42.50	299	8	63	146	N.S.	161.33	113.00	154.50	8	10	45	140
Total No. of Species	N.S.	9	9	11	1	11	3	5	N.S.	8	4	5	3	4	4	9	N.S.	11	6	9	2	7	6	12

Site Location	TN4	TN4	TN4	TN4	TN4	TN4	TN4	TN4	TN5	TN5	TN5	TN5	TN5	TN5	TN5	TN5	TN6	TN6	TN6	TN6	TN6	TN6	TN6	TN6
Season	Winter 1987+	Spring 1987	Summer 1987#	Autumn 1987**	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987+	Spring 1987	Summer 1987	Autumn 1987**	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987*	Summer 1987	Autumn 1987**	Winter 1988	Spring 1988	Summer 1988	Autumn 1988
Number of Collections	1	3	4	2	1	1	1	1	1	3	3	2	1	1	1	1	0	4	3	2	1	1	1	1
Date	03/18/88	--	--	--	03/15/88	05/10/88	08/09/88	10/19/88	3/18/8/	--	--	--	02/25/88	04/26/88	07/19/88	10/09/88	--	--	--	--	02/25/88	04/26/88	08/09/88	10/19/88
Length of Set (hours)	24.5	24.0	24.8	24.3	24.0	24.0	23.5	23.0	24.0	24.0	25.0	24.0	23.5	23.5	29.5	23.5		24.0	23.5	24.5	23.5	24.0	24.0	23.5
Common Name																								
American Eel		2.67	0.50	0.50						0.67								0.25				2		
Blueback Herring	1	0.33		0.50				6		1.00		5.50		6		2		0.25				1		2
Alewife			1.25							0.33		2.00			1									4
American Shad								24																
Atlantic Menhaden																								
Gizzard Shad											1.00				1				4.67					
Bay anchovy																								
Carp		3.00							3	4.00	2.33			3				0.25	0.33	0.50		2		2
Golden Shiner										0.33								1.25						
White Catfish								1																
Brown Bullhead	2	7.33	2.00	1.00	1			1	24	7.67	2.67	8.50	3	40		3		12.25	7.33	9.00	19	74		56
Atlantic Tomcod								1																
Spotted Hake																								
Mummichog	106	365.00	1579.00	137.00	18	22	12	18	14	132.67	27.33	60.50	18	12	37	3		112.25	174.67	31.50	321	6	245	63
Striped Killifish			0.50																					
Atlantic Silverside																								
Northern Pipefish																								
White Perch		15.33	2.00			8		1		3.00	1.00			24				5.00	20.00	18.00	3	58		26
Striped Bass																			0.67					
Green Sunfish											0.33										1			2
Pumpkinseed		2.67	2.75	0.50						4.33	0.33	4.50	4					0.75	1.00	1.00	1			
Bluegill																								
Black Crappie		0.33								1.00														
Yellow Perch																		0.50						
Bluefish																								
Crevalle Jack																								
Weakfish								2								1								
Spot								2								2								19
Windowpane																								
Winter Flounder																								
Total No.	109	396.66	1,588.00	139.50	19	30	12	56	41	155.00	34.99	81.00	25	85	39	11	N.S.	132.75	208.67	60.00	345	143	245	174
Total No. of Species	3	8	7	5	2	2	1	9	3	10	7	5	3	5	3	5	N.S.	9	7	5	5	6	1	8

Notes: N.S. = Not Sampled
*= sampled Mar., Apr., May and June
**=sampled Oct. and Nov.
@=sampled Jul., Jul., Aug., and Sep.
#=sampled Jun., Jul., Aug. and Sep.
+=sampled Mar.

TABLE B-7
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Trawl Locations
HMDC 1987-1988 Fisheries Resource Inventory

Site Location	T1	T1	T1	T1	T1	T1	T1	T1	T2	T2	T2	T2	T2	T2	T2	T2	T3	T3	T3	T3	T3	T3	T3	T3
Season	Winter 1987*	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988
Number of Collections	4	6	6	6	0	2	2	2	6	6	6	6	0	2	2	2	6	6	6	6	0	2	2	2
Date	--	--	--	--	--	04/21/88	08/03/88	11/09/88	--	--	--	--	--	04/21/88	08/03/88	11/09/88	--	--	--	--	--	04/21/88	08/03/88	10/28/88
length of tow (min:sec)	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00
Common Name																								
American Eel		0.33	0.33	0.33					0.67	1.67	0.67	1.00				4	0.33	1.33	3.67	2.00			1	
Conger Eel																1								
Blueback Herring	2.00	23.67	0.67			53								1				3.00	0.67					
Alewife	1.50	9.67		0.67						0.33							0.67	0.33	0.33	0.33				
American Shad						1		1														1		
Atlantic Menhaden			0.33							0.33										1.00				
Gizzard Shad																								
Bay Anchovy			1.67	5.00							7.00	0.33							9.00	1.67				
Golden Shiner																								
Brown Bullhead																								
Rainbow Smelt		0.33																						
Atlantic Tomcod		8.33		6.67		1		44		0.33		17.67				80	0.33	0.33		17.00				3
Spotted Hake						3																		
Mummichog			11.33						2.00	1.67	3.67	0.67					1.67	5.67	42.33	21.67				
Striped Killifish									0.67			0.33					0.33			2.00				
Inland Silverside																								
Atlantic Silverside																								
Northern Pipefish		0.33																						
White Perch									3.33	1.33		0.67					1.00	0.67						
Striped Bass			0.33	0.33		2								1				0.33						
Pumpkinseed																				0.33				
Bluegill																								
Black Crappie		0.33																						
Bluefish			0.67	0.33																				
Crevalle Jack																								
Weakfish				2.00				6			2.00	3.33				11				1.33				7
Spot								1								1								22
Seaboard Goby																				0.33				
Windowpane																1								
Winter Flounder				1.67				12				2.33				4				1.00				
Total No.	3.50	42.99	15.33	17.00	N.S.	60	0	64	6.67	5.66	13.34	26.33	N.S.	2	0	102	4.33	11.66	56.00	48.66	N.S.	1	1	32
Total No. of Species	2	7	7	8	N.S.	5	0	5	4	6	4	8	N.S.	2	0	7	6	7	5	11	N.S.	1	1	3

Site Location	T4	T4	T4	T4	T4	T4	T4	T4	T5	T5	T5	T5	T5	T5	T5	T5	T6	T6	T6	T6	T6	T6	T6	T6
Season	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988
Number of Collections	6	6	6	6	0	2	2	2	6	6	6	6	0	2	2	2	6	6	6	6	0	2	2	2
Date	--	--	--	--	--	04/28/88	09/19/88	10/28/88	--	--	--	--	--	04/28/88	09/19/88	10/28/88	--	--	--	--	--	04/28/88	09/20/88	11/09/88
length of tow (min:sec)	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00
Common Name																								
American Eel	0.33			1.67		2			0.33					2				2.33		0.67			4	
Conger Eel																								
Blueback Herring							14							2					0.33					
Alewife				0.67																				
American Shad							3																	
Atlantic Menhaden																								
Gizzard Shad														1										
Bay Anchovy			0.33	0.67															0.33	0.33				
Golden Shiner																								
Brown Bullhead		0.33								1.00		0.33												
Rainbow Smelt																								
Atlantic Tomcod				0.33				23										0.33		3.33				15
Spotted Hake																								
Mummichog	183.67	10.00	23.00	76.00		6	80		37.00	71.67	6.33	49.33		11	2	1	4.67	99.33	10.33	9.67			67	
Striped Killifish	0.33																							
Inland Silverside							1																	
Atlantic Silverside																								
Northern Pipefish																								
White Perch	0.67								0.33									1.67	0.33	0.33			14	2
Striped Bass						1														0.33		3		6
Pumpkinseed																								
Bluegill																								
Black Crappie																								
Bluefish																								
Crevalle Jack																							1	
Weakfish							2	5												0.33			3	
Spot							113	54								9							12	
Seaboard Goby																								
Windowpane																								
Winter Flounder																								
Total No.	185.00	10.33	23.33	79.34	N.S.	9	213	82	37.66	72.67	6.33	49.66	N.S.	16	2	10	4.67	103.66	11.32	14.99	N.S.	3	101	23
Total No. of Species	4	2	2	5	N.S.	3	6	3	3	2	1	2	N.S.	4	1	2	1	4	4	7	N.S.	1	6	3

Notes: N.S. = Not Sampled
*=sampled Mar. 1987 and Jan. 1988

TABLE B-7 (Continued)
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Trawl Locations
HMDC 1987-1988 Fisheries Resource Inventory

Site Location	T7	T7	T7	T7	T7	T7	T7	T7	T8	T8	T8	T8	T8	T8	T8	T8	T9	T9	T9	T9	T9	T9	T9	T9
Season	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987*	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988	Winter 1987	Spring 1987	Summer 1987	Autumn 1987	Winter 1988	Spring 1988	Summer 1988	Autumn 1988
Number of Collections	6	6	6	6	0	2	2	2	4	6	6	6	0	2	2	2	6	6	6	6	0	2	2	2
Date	--	--	--	--	--	04/28/88	09/20/88	10/88/88	--	--	--	--	--	05/03/88	09/19/88	11/29/88	--	--	--	--	--	05/03/88	09/19/88	11/29/88
length of tow (min:sec)	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00	6:00	6:00	6:00	6:00	--	6:00	6:00	6:00
Common Name																								
American Eel	0.67	0.67		1.00					0.50								0.67							
Conger Eel																								
Blueback Herring		0.33				1	18																	
Alewife	0.33	0.67		0.33		1	10																	
American Shad						1	13																	
Atlantic Menhaden																								
Gizzard Shad												4.00								0.33				
Bay Anchovy			0.67	3.33			1187																	
Golden Shiner	0.33																							
Brown Bullhead																								
Rainbow Smelt																								
Atlantic Tomcod				1.67																				
Spotted Hake																								
Mummichog	38.00	0.67	41.00	22.00		42	68		18.00	22.67	23.00	24.00		13	11	661	20.00	28.33	22.33	89.33		23	11	703
Striped Killifish																								
Inland Silverside																								
Atlantic Silverside							25																	
Northern Pipefish																								
White Perch																								
Striped Bass							1																	
Pumpkinseed							4											0.33						
Bluegill		0.33																						
Black Crappie																								
Bluefish							1																	
Crevalle Jack																								
Weakfish				0.33			16																	
Spot							34								2									
Seaboard Goby																								
Windowpane																								
Winter Flounder																								
Total No.	39.33	2.67	41.67	28.66	N.S.	45	1377	0	18.50	22.67	23.00	28.00	N.S.	13	13	661	20.67	28.66	22.33	89.66	N.S.	23	11	703
Total No. of Species	4	5	2	6	N.S.	4	11	0	2	1	1	2	N.S.	1	2	1	2	2	1	2	N.S.	1	1	1

Notes: N.S. = Not Sampled
*=sampled Mar. 1987 and Jan. 1988

TABLE B-8
Average Number (First Year Collections) and Total Number (Second Year Collections) of Fish Captured at Gill Net Locations
HMDC 1987-1988 Fisheries Resource Inventory

Site Location	GN1	GN1	GN1	GN1	GN1	GN1	GN1	GN1	GN2	GN2	GN2	GN2	GN2	GN2	GN2	GN2	GN3	GN3	GN3	GN3	GN3	GN3	GN3	GN3
Season	**Winter 1987***	**Spring 1987**	**Summer 1987**	**Autumn 1987**	**Winter 1988**	**Spring 1988**	**Summer 1988**	**Autumn 1988**	**Winter 1987***	**Spring 1987**	**Summer 1987**	**Autumn 1987**	**Winter 1988**	**Spring 1988**	**Summer 1988**	**Autumn 1988**	**Winter 1987***	**Spring 1987****	**Summer 1987**	**Autumn 1987+**	**Winter 1988**	**Spring 1988**	**Summer 1988**	**Autumn 1988**
Number of Collections	2	3	3	3	1	1	1	1	2	3	3	3	1	1	1	1	2	2	3	2	0	1	1	1
Date	--	--	--	--	03/09/88	05/09/88	08/22/88	11/03/88	--	--	--	--	03/09/88	05/09/88	08/22/88	11/03/88	--	--	--	--	--	06/23/88	09/22/88	11/14/88
Length of Set (hours)	23.8	24.3	24.0	23.8	24.0	23.5	24.0	24.0	24.0	24.2	24.0	24.0	24.0	23.5	24.0	24.0	36.5	34.0	24.0	24.0	--	24.0	24.0	23.5
Common Name																								
Blueback Herring		0.67				1						0.33												
Alewife				0.33						1.67														
Atlantic Menhaden		6.00	4.67			1	2			11.33	4.33	2.00		8	1									
Gizzard Shad															1				10.33	2.00				1
Carp																		1.00						
Golden Shiner																		0.50						
Brown Bullhead																		0.50		0.50				
Atlantic Tomcod	1.00	0.67		16.00	1	1		10				4.33				24								
Striped Killifish												1.00												
White Perch			0.67						0.50	13.33	2.33	0.67				2								
Striped Bass							1	1		7.33	0.33	0.33												
Bluefish				0.33																				
Spot							3	10																
Winter Flounder																1								
Total No.	1.00	7.34	5.34	16.66	1	3	6	21	0.50	33.66	6.99	8.66	0	8	2	27	0.00	2.00	10.33	2.50	N.S.	0	0	1
Total No. of Species	1	3	2	3	1	3	3	3	1	4	3	6	0	1	2	3	0	3	1	2	N.S.	0	0	1

Notes: N.S. = Not Sampled
* = sampled Feb. and Mar. 1987
**= sampled Apr. and May 1987
+=sampled Oct. and Nov. 1987