Hackensack Meadowlands Development Commission,

Division of Environmental Operations,

One DeKorte Park Plaza,

Lyndhurst, New Jersey 07071

Inventory of Fisheries Resources of the Hackensack River within the jurisdictional Boundary of the Hackensack Meadowlands Development Commission from Kearny, Hudson County, to Ridgefield, Bergen County, New Jersey.

Date Submitted: 5/18/89

Period of Study: February 1987 - December 1988

Investigated by: A. Brett Bragin

Winthrop Frame

Mark L. Kraus

Donald J. Smith

Arthur Goeller

Jeff Grabiec

Ed Konsevick

Sediment Analysis by: Arthur Goeller

Invertebrates Identified by: A Brett Bragin

Report by: Mark L. Kraus, Ph.D., and A. Brett Bragin

Administered by: Anne Galli

This study was supported by the Hackensack Meadowlands Development Commission through Special District Project Funds.

Introduction

The Hackensack River Basin in Northeastern New Jersey contains some of the last major expanses of open space in the Newark/New York metropolitan area. The lower River basin still contains approximately 8,000 acres of wetlands and major waterways which are crisscrossed by major transportation corridors.

Originally the area was considered only for its value as a repository for waste materials, and as a location for heavy industrial uses. This jaundiced view left the region with over 1,600 acres of landfill, three superfund sites, numerous hazardous waste site, and a myriad of dirty industrial sites and sub-standard warehouse facilities.

In 1964 the U.S. Congress authorized a planning grant to study the region. The Army Corps of Engineers was directed to study the basin for flood control and reclamation. One of the final recommendations of this study was that a state agency should be created to coordinate activities in the lower Hackensack River Basin.

In 1968 the New Jersey State Legislature enacted a law creating just such an agency. The Hackensack Meadowlands Development Commission (HMDC) was given broad regulatory, administrative, and financial powers which directly affected 14 municipalities in 2 counties. The HMDC was mandated, among other things, to:

1) Support orderly economic development in the District.

2) Plan for the disposal of all solid waste from communities then dumping in the District.

3) Protect the delicate balance of nature.

By 1970, under the auspices of the Hackensack Meadowlands Reclamation Act (N.J.S.A. 13:17-1 et seq.), the HMDC had completed a comprehensive study of the District and prepared draft zoning regulations. These zoning regulation were finalized in 1972 (N.J.A.C. 19:4-1 et seq.).

Since the inception of the HMDC, the view of the District has changed. It is no longer considered a dumping ground and heavy industrial region. Instead, the region is considered desireable for offices, housing, and clean industry. The Hackensack River is no longer eroneously, and derogatorily described as "dead". Instead, it is more properly viewed as a living and viable River.

With increasing development pressures came additional pressures on the River and its tributaries. The HMDC realized that these pressures could affect fisheries resources, but there was a significant lack of data pertaining to these issues. With this in mind, the HMDC initiated a two year survey of the lower Hackensack River in order to ascertain the fisheries values of the River, and to help guide intelligent decisions on development applications.

Material and Methods

A total of twenty-three (23) sampling sites were established on the Hackensack River and its major tributaries. These sites were chosen under the guidance of the New Jersey Department of Environmental Protection Bureau of Marine Fisheries. Sites were selected based on their distribution along the River, and their suitability for deployment of a given gear type.

Four different types of fishing gear were used. These included:

1) A 16 foot otter trawl (3/4 inch square body mesh, 5/8 inch square cod-end mesh, 1/4 inch mesh cod-end liner) was towed for 3 minutes at 2300 r.p.m. at 9 sites, with 2 repetitions per site. A 20 foot commercial Privateer with 120 h.p. outboard motor was used for towing. Trawls were towed unbridled with 5/8 inch polydacron rope fastened to the transom of the vessel, and deployed with the vessel in forward motion, with tension on the tow ropes and against the prevailing surface current. A minimum 5:1 ratio of tow rope length to station depth was maintained. The net was retrieved by hand.

2) A 60 foot long by 6 foot high by 1/4 inch bag seine was used at 3 sites. The seine was walked through the water in a semi-circular pattern against the shoreline.

3) A 200 foot long by 8 foot high experimental sinking gill net consisting of four 50 foot panels of 3/4 inch, 1 3/4 inch, 3 1/2 inch, and 4 inch square mesh was used at 3 sites. It was deployed with cinder block attached to both leadlines and two bouys attached to the blocks for marking. Sets were fished for approximately 24 hours. Three (3) sites were sampled using this method.

4) An Indiana Trap Net with a 50 foot leader, made up of 1/2 inch square mesh was fished at 6 sites. The nets were deployed at or near low tide and staked with three wooden dowels 1 5/8 inch in diameter and approximately 14 feet long, one at the lead end and two at the first frame brace. A cinder block was attached to the cod-end. The net was pulled taut until it stood erect and was perpendicular to the shore by means of a floatline attached to the cod-end cinder block. These nets were also fished for approximately 24 hour sets. A total of eight (8) sites were sampled using this method. Fish were identified and counted, and a subsample was measured in the field. Most fish were released, but some specimens were preserved in 10% formalin and taken to the laboratory for further identification or as reference specimens. Numbers in large catches of fish or invertebrates were estimated by counting a subsample.

Most sites were sampled monthly from February 1987 through January 1988. Sites were then sampled quarterly from February 1988 through December 1988.

In addition to collecting fisheries data, sediment samples were collected at each site using a 23cm x 23cm Ponar grab. Three grabs were taken at each of the fisheries site on a quarterly basis from February 1987 through January 1988. These samples were transported back to the laboratory and washed through a 1mm mesh stainless steel sieve. Material remaining on the screen was preserved in 10% rose bengal formalin. Each sample was sorted under a 3x illuminated magnifyer, and invertebrates were identified under a Bausch and Lomb binocular microscope (7x-60x). Sub-samples of identified invertebrates were sent to Mrs. Anne Frame of the National Marine Fisheries Service Laboratory at Sandy Hook, N.J. for verification.

Additional Ponar grabs were taken at each site to characterize particle size distribution of the sediments, and concentrations of selected heavy metals. Representative sub-samples of each grab were sealed in plastic bags and frozen at - 12° C prior to analysis.

Samples used for grain size analysis were dried to a constant weight at a temperature of 100°C. Three (3) 50g sub-samples of dried material were taken from each site and mixed with 100 ml of 0.01N sodium oxalate (dispersing agent) and 50 ml of distilled water. This solution was mixed in a blender for five (5) minutes. The contents of the blender were rinsed through a #230 sieve (0.0625 mm) until the water ran clear. The portion of the sample remaining on the sieve was collected and re-dried to a constant weight at 100°C. The re-dried material was placed in a series of nested sieves (0.125 mm - 4.0 mm) and shaken using a Ro-Tap shaker for 5 minutes.

The fractions of material left on each sieve were collected and weighed on a Mettler Precision balance (P-1000). The percentage of material retained on each sieve was then calculated and classified according to the Wentworth method.

Samples retained for heavy metal analysis were also dried to a constant weight at 100°C. Dried samples were pulverized then digested in analytical grade Nitric acid (HNO_3) and perchloric acid ($HClO_4$). Samples were analyzed using atomic absorption spectrophotometry (Perkin-Elmer 272). Quality control was maintained by analyzing standards of known metal content, and blanks, as well as National Bureau of Standards River Sediment (NBS 1645). Sediments were analyzed for nickle, copper, lead, cadmium, zinc, and chromium.

During each sampling event basic water quality parameters were measured. Dissolved oxygen was measured using a Yellow Spring Instrument Company (Y.S.I.) model 57 oxygen meter. The pH was measured using either a Cole-Parmer electronic pH pen or a Beckman model 21 pH meter. Salinity was measured using either a Y.S.I. model 33 Salinity-Temperature-Conductivity meter or an American Optical model 10419 temperature compensated refractometer. Water clarity was measured using a one foot diameter Secchi disk and temperature was measured using either the Y.S.I. oxygen meter or the Beckman pH meter.

Sampling Sites

Trawl 1 (T1) - Located at the mouth of Penhorn Creek, on the eastern side of the River at approximately River Mile (RM) 3.8. Penhorn Creek has a tide gate upstream from this point, therefore there is a freshwater flow out of Penhorn Creek. Cooling water from the Public Service Electric and Gas generator is also discharged near this site.

Trawl 2 (T2) - Located at the mouth of Sawmill Creek on the western side of the River at approximately RM 5.3. A ConRail swing bridge and the Eastern spur of the New Jersey Turnpike cross the River just south of this site.

Trawl 3 (T3) - Located on the River between the mouth of Berrys Creek, and the mouth of Berrys Creek Canal at approximately RM 7.3. This site is adjacent to the Harmon Cove housing development in Secaucus, Hudson County.

Trawl 4 (T4) - Located on the River between the mouth of Mill Creek and the mouth of Cromakill Creek at approximately RM 9.2. This site is adjacent to the Mill Creek mitigation site in Secaucus, New Jersey.

Trawl 5 (T5) - Located on the River adjacent to the Bergen County Utility Authority sewage treatment plant to the west, and the Ridgefield Public Service Electric and Gas generator to the east. This site is at approximately RM 11.4.

Trawl 6 (T6) - This site is on Sawmill Creek adjacent to the Western Spur of the New Jersey Turnpike. It is approximately 1 nautical mile from the mouth of Sawmill Creek.

Trawl 7 (T7) - This site is on Berrys Creek Canal just south of the New Jersey Route 3 Bridge. It is approximately 0.9 nautical miles from the mouth of Berrys Creek Canal.

Trawl 8 (T8) - This site is on Mill Creek approximately 0.1 nautical miles from the mouth of Mill Creek.

Trawl 9 (T9) - This site is on Cromakill Creek approximately 0.9 nautical miles from the mouth of Cromakill Creek.

Trap net 1 (TN1) - This site is adjacent to T1 near the mouth of Penhorn Creek at approximately RM 3.8.

Trap net 2 (TN2) - This site is near T6 on Sawmill Creek, approximately 1.3 nautical miles from the mouth of Sawmill Creek.

Trap net 3 (TN3) - This site is on the western shore of the River adjacent to T3 at approximately RM 7.2.

Trap net 4 (TN4) - This site is adjacent to T4 near the mouth of Mill Creek at approximately Rm 9.2.

Trap net 5 (TN5) - This site is on the Western bank of the River, near the mouth of Losen Slote at approximately Rm 10.9.

Trap net 6 (TN6) - This site is on the western bank of the River, immediately north of the New Jersey Route 46 Bridge at approximately RM 12.5.

Gill net 1 (GN1) - This site is along the ConRail bridge crossing the River at approximately RM 3.

Gill net 2 (GN2) - This site is along the ConRail River Crossing just north of the mouth of Berrys Creek at Rm 6.9.

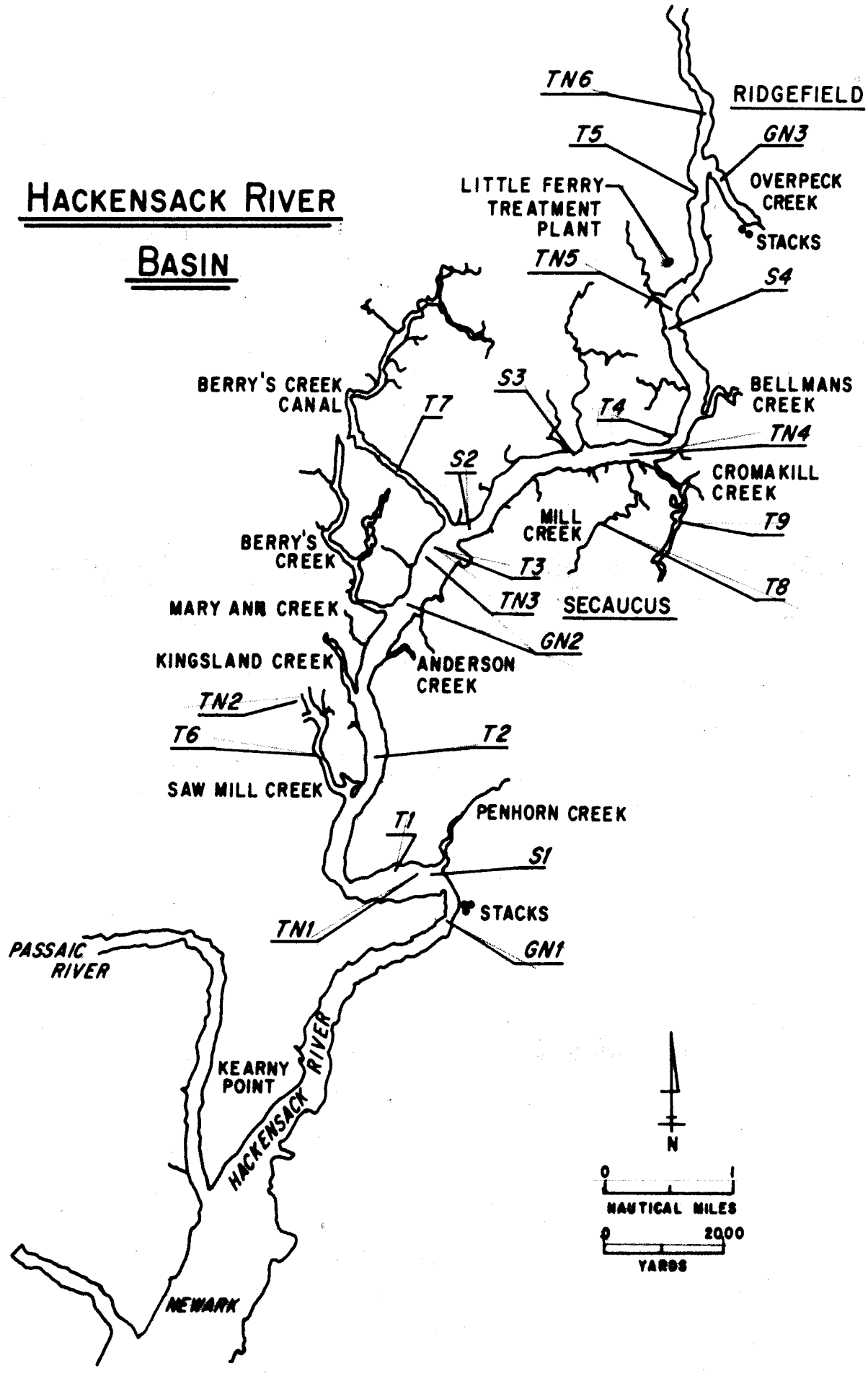
Gill net 3 (GN3) - This site is on Overpeck Creek, approximately 0.3 nautical miles from the mouth of the Creek.

Seine 1 (S1) - This site is on the eastern bank of the River adjacent to the Public Service Electric and Gas generator at approximately RM 3.5.

Seine 2 (S2) - This site is on the western bank of the River, just south of the mouth of Berrys Creek Canal at approximately Rm 7.4.

Seine 3 (S3) - This site was located on the western bank of the River between Bashes and Moonachie Creeks at approximately RM 8.7. This site was abandoned because of difficulty in sampling with the seine.

Seine 4 (S4) - This site is on the western bank of the River just below the New Jersey Turnpike Western Spur Bridge. It is at approximately RM 10.5.


HACKENSACK RIVER
BASIN
TN6
RIDGEFIELD
T5
GN3
LITTLE FERRY
TREATMENT
PLANT
OVERPECK
CREEK
STACKS
TN5
S4
BERRY'S CREEK
CANAL
S3
BELLMANS
CREEK
T7
T4
TN4
S2
CROMAKILL
CREEK
MILL
CREEK
T9
BERRY'S
CREEK
T3
T8
TN3
SECAUCUS
MARY ANN CREEK
GN2
KINGSLAND CREEK
ANDERSON
CREEK
TN2
T6
T2
SAW MILL CREEK
T1
PENHORN CREEK
S1
STACKS
TN1
GN1
PASSAIC
RIVER
KEARNY
POINT
HACKENSACK RIVER
N
0
1
NAUTICAL MILES
0
2000
YARDS
NEWARK

RESULTS AND DISCUSSION

Data from the first year of the study period, from February 1987 through January 1988 (when each site was sampled monthly), showed that the surface water temperature ranged from 2.9-37.0 °C. The dissolved oxygen levels ranged from 1.0-15.5 mg/l, and salinity ranged from 0-16 parts per thousand (ppt).

During this period a total of 339 collections were made, consisting of 211 trawl hauls, 61 trap net collections, 36 seine hauls and 31 gill net sets. Thirty one species of fish were taken. The 10 most abundant and commonly occurring fish were the mummichog (Fundulus heteroclitus), Atlantic silverside (Menidia menidia), inland silverside (Menidia beryllina), white perch (Morone americana), blueback herring (Alosa aestivalis), Atlantic tomcod (Microgadus tomcod), brown bullhead (Ictalurus nebulosus), pumpkinseed (Lepomis gibbosus), American eel (Anguilla rostrata) and bay anchovy (Anchoa mitchilli). The mummichog comprised 91% of the total catch of 43,393 fish, followed by Atlantic silverside (2.5%), inland silverside (1.4%), and white perch (1.3%). The other 27 species combined constituted 3.8% of the total catch. Also collected were 23 species of invertebrates. From these incidental catches it is evident that there are large populations of prey species, such as white fingered mud crab (Rhithropanoepus harrisii), mysid shrimp (Neomysis americana), sand shrimp (Crangon septemspinosa), grass shrimp (Palaemonetes pugio) and several species of amphipods. Also taken were 103 blue crab (Callinectes sapidus), 49 northern diamondback terrapin (Malaclemys terrapin) and 4 common snapping turtle (Chelydra serpentina).

During the second year of the study, from February 1988 through August 1988 (when each site was sampled quarterly), 26 species of fish were taken. Three of these were not captured prior to January 1988; spotted hake (Urophycis regia), striped mullet (Mugil cephalus) and yellow bullhead (Ictaluris natalis). Sixty seven collections consisted of 26 trawl hauls, 28 trap net collections, 6 seine hauls, and 7 gill net sets. The most abundant fish during the second year were the mummichog, inland silverside, white perch, brown bullhead, striped killifish (Fundulus majalis), blueback herring, Atlantic silverside, striped bass (Morone saxatilis) and pumpkinseed. The mummichog comprised 85% of the total catch of 11,562 fish, followed by inland silverside (9.2%), white perch (2%), and brown bullhead (1.4%). The remaining 22 species combined comprised 2.4% of the total catch for this period. Also collected were 191 blue crab, 18 northern diamondback terrapin, and 2 eastern painted turtle (Chrysemys picta), along with 11 species of invertebrates as part of our incidental catches. A total of 34 species of fish were taken from February 1987 to August 1988.

A total of fifty-three (53) different invertebrate species were collected in ponar grabs during the course of this study. Approximately thirty-six (36%) percent of these were polychaetes, fifteen percent (15%) were molluscs, and eleven percent (11%) were amphipods. The remaining thirty-eight percent (38%) was comprised of individuals from thirteen (13) other classes of organism.

The water quality of the Hackensack River fluctuates during the course of the year. During the spring the salinity is generally low, water temperatures begin increasing toward their summer peak and the dissolved oxygen levels are relatively high. As summer approaches the water quality declines. This is due to low freshwater input, increased water temperatures and extremely low dissolved oxygen levels, conditions which are probably stressful to the biota of the river. Beginning in autumn and continuing into winter, water temperatures decline and dissolved oxygen levels rebound to levels more hospitable to aquatic life.

Based on our first year of data the fish community seemed to vary on a seasonal basis, almost regardless of water quality. This is evident when the total number of all fish taken (mummichog excluded) are plotted by month. Two catch peaks are noted, one in May (when water quality is declining), and another larger peak in October (when water quality is starting to improve). These peaks also correspond to periods of seasonal use, such as spring and fall migrations. Fish using the estuary as a refuge from preadators, and/or as a nursery area due to the abundant supply of food also contributed to these peaks.

Fish found in the spring included migrants such as the alewife (Alosa pseudoharengus), Atlantic tomcod, blueback herring, and striped bass, and those seeking food and shelter, the Atlantic menhaden (Brevoortia tyrannus) and bluefish (Pomatomus saltatrix). Some of these fish occurred most of the year, the alewife was caught during 10 months of the year and the tomcod was caught during 11 months.

Some species (Atlantic tomcod, blueback herring, and bluefish) were not collected during July and/or August, because they either moved out of our sampling area or left the estuary altogether, perhaps due to poor water quality (possibly low dissolved oxygen). These fish returned in the fall, as most of the spring migratory species were leaving the river. This, along with other species that were just beginning to enter the estuary, such as the weakfish (Cynoscion regalis) and winter flounder (Pseudopleuronectes americana), yielded a larger fall peak. It should be noted that resident species such as the white perch, inland silverside, brown bullhead, pumpkinseed, carp (Cyprinus carpio) and American eel also contributed to the seasonal peaks.

After the first year of study it seemed apparent, on the basis of salinity and types of fish taken that there were "sections" in the portion of the river studied. Therefore the river was divided into upper, middle and lower zones, based on our sampling locations. Each zone contained one trawl, seine, gill net, and trap net station. An average annual surface salinity was calculated by averaging all of the observed surface salinities from the four stations within each zone. In addition a species list was generated for each zone. In the "lower" river the average annual salinity was 9.4 ppt. Twenty-two species of fish were taken; seven were marine, six diadromous (either migrating from the ocean to freshwater, or from freshwater to the ocean), five estuarine and four freshwater. Blue crab and diamondback terrapin were also taken in this area. In the "middle" river the average annual salinity was 5.6 ppt. Twenty-one species of fish were taken; six marine, seven diadromous, four estuarine and four freshwater.

Blue crab and diamondback terrapin were also present. At our upper sampling limit, the average annual salinity was 3.4 ppt. Fourteen species of fish were taken here; none were marine, but three were diadromous, four estuarine and seven were freshwater. No blue crab were taken, and the snapping turtle replaced the diamondback terrapin here.

The "lower" and "middle" zones of the river proved similiar in terms of the number of species and fish groups found. The salinities here are in the mesohaline range (18.0 to 5.0).ppt. The "upper" zone differs from the others in terms of number and groups of fish species, as well as salinity. Salinity here is oligohaline (5.0 to 0.5 ppt.). In general the mesohaline zone exists from River Mile (RM) 0-10 (the mouth of the river to Cromakill Creek), the oligohaline zone from RM 10-16 (Cromakill Creek to just upriver of Hackensack) and the tidal freshwater zone from RM 16 to Oradell Dam. The freshwater segment is the longest generally during winter and spring, due to rain, snow and ice melt, and it shrinks in summer and autumn, during periods of low freshwater input and increased evaporation. As the freshwater segment shrinks, the meso- and oligohaline segments expand upstream, at times upriver to the Oradell dam. Further upstream, outside of the Hackensack Meadowlands District, we would have encountered an increasingly freshwater system and fish community.