U. S. Army Corps of Engineers
New York District

Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York: Reformulation Study

Intertidal Wetland and Estuarine Finfish Survey of the Backbays

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE), New York District is conducting a comprehensive study of the barrier islands off the south shore of Long Island, New York. This study is part of the Fire Island to Montauk Point (FIMP) Beach Reformulation Program; a comprehensive reformulation of the shore protection and storm damage reduction project for the south shore of Long Island, New York. The main goal of this program is to protect erosion of the shoreline via storm damage through beach renourishment. Site-specific information is being collected in order to evaluate alternative protection plans.

The three bays of the study area, Shinnecock, Moriches and Great South Bay, are identified as Federal and State Significant Fish and Wildlife Habitats and have been listed in "Significant Habitat and Habitat Complexes of the New York Bight Watershed." Existing information on community structure of the South Shore Estuary intertidal wetland habitat of these bays is limited. As part of this major reformulation study, a multitude of studies is being conducted in order to bridge this data gap. This report presents the study design, methodologies and results of a one-year survey of the intertidal wetlands and nearshore waters of the FIMP study area entitled, "Intertidal Wetland and Estuarine Finfish Study." The project was designed as a comprehensive ecological inventory of 15 intertidal wetland sites located along the bays of the FIMP study area. This study will be used to provide baseline data on finfish, invertebrates and botany associated with these backbay habitats and potentially the patterns of usage.

The barrier island is a dynamic transition zone between land and sea, subject to sudden disturbances. Flooding and erosion of the barrier islands have the potential to severely impact the mainland communities bordering Shinnecock, Moriches and Great South Bays. The habitats of the barrier island bays vary from sandy shorelines to vegetated marsh areas and tidal ponds. The barrier islands function as protective buffers to this highly productive estuarine ecosystem.

The overall project study area extends 83 miles from Fire Island Inlet to Montauk Point (Figure 1). Great South Bay extends a coastal distance of 33.8 miles with connections to the ocean through Hempstead Bay to the west, Fire Island Inlet and Moriches Bay (at Narrow Bay) to the east (USFWS 1983). Moriches Bay extends 14.4 miles along the coast with oceanic connections at Great South Bay (Narrow Bay) to the west, Moriches Inlet and Shinnecock Bay to the east via Quantuck Canal, Quantuck Bay and Quogue Canal (USFWS 1983). Shinnecock Bay extends 11.2 miles coastally with connections to the ocean through Moriches Bay to the west via Quogue Canal and Shinnecock Inlet and to the east through Great Peconic Bay via the Shinnecock Canal (USFWS 1983).

Sampling was conducted at 15 sites along Shinnecock, Moriches and Great South Bays. The time span for sampling was a one-year period from June 2000 through May 2001. A three-month hiatus in sampling occurred from January through March when productivity was minimal. A second year of sampling is presently being conducted. Major portions of the program included collection of finfish and invertebrates using shoreline seines, pond seines and marsh throw traps. Additional elements of the program included collection of information on benthic invertebrates, sediment for grain size and composition analyses, vegetation cover and productivity and environmental water quality. An added feature to the program, a seine-comparison study, was conducted in conjunction with the New York State Department of Environmental Conservation (NYSDEC).

The following are major elements of the study design and results:

- Sampling was conducted at 15 sites along Shinnecock, Moriches and Great South Bays.
- Survey collections included shoreline seines, pond seines, marsh throw traps, intertidal vegetation analyses and benthic cores.
- Sampling was conducted from June through December 2000, and April through May 2001.
- Shoreline seines collected a total of 55,106 finfish representing 43 species. Dominant species were *Menidia menidia, Ammodytes americanus, Fundulus majalis* and *Anchoa mitchilli.* Dominant species of invertebrates were *Crangon septemspinosa, Palaemonetes vulgaris* and *Callinectes sapidus.*
- Pond seines collected a total of 1,164 finfish representing 10 species. Dominant finfish species were *Fundulus heteroclitus* and *Cyprinodon variegatus*. The dominant invertebrate species was *Palaemonetes vulgaris.*
- A seine-comparison study was conducted in conjunction with the NYSDEC in Jamaica Bay during September 2000.
- During the seine-comparison study, a total of 1,206 finfish were collected representing 15 species. Dominant finfish were *Menidia menidia, Fundulus majalis* and *Fundulus heteroclitus.* Dominant invertebrates were *Crangon septemspinosa, Palaemonetes vulgaris, Pagurus longicarpus* and *Callinectes sapidus.*
- Marsh throw trap sampling was conducted in September 2000 at nine of the 15 shoreline seine sites.
- The weight of *Spartina alterniflora* collected in the throw traps varied from 167 to 678 g/m^2, dependent on site.
- Animal abundances were highest in throw trap collections from Moriches Bay.
- Benthic cores were collected at six sites along West Hampton Island during June and October 2000.
- A total of 993 invertebrates were collected in benthic cores during the spring and 1,279 during the fall.

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I. INTRODUCTION

A plan to evaluate possible alternatives to the USACE Atlantic Coast of Long Island, Fire Island to Montauk Point, New York: Reformulation Study is being addressed. The potential exists for breaching and/or flooding of the barrier islands to significantly impact mainland communities bordering Shinnecock, Moriches and Great South Bays. Coastal communities of the study area are subject to economic losses during severe storms. Principal damages to these coastal areas are the result of flooding and erosion associated with extreme tides and wave action.

This report presents the study design, methodologies and results from a one-year survey of the intertidal wetlands in the FIMP study area. This project was designed to provide information that will assist the USACE in evaluating project alternatives to the reformulation study. Currently, little information exists on the intertidal wetland habitat of the South Shore Estuary. This program provides extensive information on finfishes, invertebrates, vegetation and sediment composition of the intertidal wetland zone of the FIMP study area (Figure 1).

The main objective of this study is to survey the varied habitats of the barrier island's north shore backbay environment. This type of survey provides information on the community structure of backbay estuarine ecosystems. Specifically, this project identifies finfish, invertebrates and botanical species found in the study area. Additionally, spatial and temporal trends in community structure are examined. The intertidal marsh environment along the barrier islands of the study area is comprised of a variety of different habitats; heavily vegetated salt marshes, small ponds (tidal pools), man-made mosquito ditches and sandy shorelines (Figure 2). Therefore, a variety of different techniques are employed to effectively sample each habitat type. Beach seining is conducted along the shoreline and tidal ponds, while throw traps are used in marsh areas.

During the first year of this study, sampling was conducted from June 2000 through May 2001. There was a 3-month hiatus in sampling from January through March, when productivity was minimal. Samples were collected at 15 sites along Shinnecock, Moriches and Great South Bays (Figure 3). Major portions of the program included collection of finfish and invertebrates using shoreline seines, pond seines and marsh throw traps. Additional elements of the program included collection of benthic invertebrates, environmental water quality, sediment for grain size and composition, as well as vegetation cover and productivity.

A review of the Data Gap Analysis performed for the Reformulation Program indicated a lack of background information on the backbay environment. At the request of the New York State Department of Environmental Conservation (NYSDEC) and other municipal agencies, the backbay program was formulated. The primary goal is to gather data to develop a baseline from which impacts of the backbay habitat can be assessed.

II. METHODOLOGY

A. Seine Survey

1. Shoreline

A total of 15 stations were sampled along the north side of the barrier island coastline from Fire Island Inlet to Shinnecock Inlet (Figure 3). Seven stations were sampled along Great South Bay; Kismet, Clam Pond, Sailor's Haven, Barrett Beach, Watch Hill, Old Inlet and Pattersquash. Five stations were sampled along Moriches Bay; Cupsogue, Dune Lane, Pikes Beach, Picket Point and Jessup Lane. Three stations were sampled along Shinnecock Bay; Tiana Beach, Ponquogue West and Ponquogue East. Sampling was conducted biweekly from June through October 2000, once monthly during November and December 2000 and biweekly again in April and May 2001. There was a 3-month hiatus in sampling from January through March 2001-a winter period when productivity is minimal.

Seining was conducted by setting a 30-foot beach seine approximately 50 feet offshore and parallel to the shoreline (Figure 4). The seine net was hauled onto the beach at a constant rate of speed. Finfish and invertebrates were collected and identified either to species or lowest practical taxonomic level. All finfish were counted and measurements of length and weight were recorded for up to 50 individuals of each finfish species (Figure 5). Fish were measured to the nearest millimeter and collective weights measured to the nearest one tenth of a gram. All crabs, shrimps, squid, sand dollars and clams were counted while other species of invertebrates were noted if present. Four groups of animals were identified to higher taxonomic groupings; amphipods, annelids, ctenophores and isopods. Environmental parameters measured for water quality included; temperature, dissolved oxygen, salinity and turbidity. All water quality measurements, except turbidity, were recorded with a Yellow Springs Instruments (YSI) R85-10 meter. Turbidity was measured with a Hach portable laboratory turbidimeter model 16800 and Hach portable 2100P turbidimeter. Measurements of tidal stage and lunar cycle were recorded along with time of day for future use in determining tidal effects.

2. Ponds

A pond seine survey was added to the sampling program in September 2000. Sampling periods for the pond survey coincided with the shoreline seine study. A total of four ponds were sampled within the study area; Old Inlet along Great South Bay, Cupsogue and Picket Point along Moriches Bay and Ponquogue East along Shinnecock Bay. Finfish and invertebrates were collected with a 5-foot beach seine. The seine was pulled a distance of approximately 20 feet along the pond shoreline. All finfish and invertebrates were identified either to species, or lowest practical taxonomic level. All finfish were counted and measurements of length and weight were recorded for up to 50 individuals of each species. Fish were measured to the nearest millimeter and weighed to the nearest one tenth of a gram. All crabs and shrimps were counted while other species of invertebrates were noted if present. Environmental parameters measured for water quality were; temperature, dissolved oxygen, salinity and turbidity. All water quality measurements, except turbidity, were recorded with a Yellow Springs Instruments (YSI) R85-10 meter. Turbidity was measured with a Hach portable laboratory turbidimeter model 16800 and

Hach portable 2100P turbidimeter. Measurements of tidal stage and lunar cycle were recorded along with time of day.

B. Seine-Comparison Study

1. Jamaica Bay

A seine-comparison study was conducted in conjunction with the NYSDEC in October 2000. Three stations were sampled in Jamaica Bay; JAM1, JAM2 and JAM22 (Figure 6). The three stations sampled were sampled during the ongoing NYSDEC Striped Bass Survey. Jamaica Bay was chosen as the study area due to sampling logistics. A 200-foot beach seine was set by the NYSDEC in an arc along the shoreline (Figure 7). EEA and URS staff then set a 30' seine inside of the 200' seine previously set by the NYSDEC. The 30' seine was hauled in first and all animals collected were processed. The NYSDEC then hauled in the 200' seine and processed all animals collected. For each of the seine collections all finfish were identified and counted. Measurements of length and combined species' weight were recorded for up to 50 individuals of each species. Fish were measured to the nearest millimeter and weighed to the nearest gram. All crabs were counted while other species of invertebrates were noted if present. Shrimps and sea jellies were rated on an abundance scale. In order to accurately represent finfish and invertebrate collections in the 200' seine, total numbers of animals collected in the 30' seine were added to the numbers collected in the 200' seine.

Environmental parameters measured for water quality included; temperature, dissolved oxygen, salinity, tidal stage and wave height. Other parameters measured included; condition of net set, air temperature, percent cloud cover, wind direction, wind speed, bottom type, surrounding vegetation and percent coverage by vegetation. Measurements of water temperature, salinity and dissolved oxygen were recorded with a Yellow Springs Instruments (YSI) R85-10 meter. The remaining parameters were recorded by visual observation.

C. Throw Trap Survey

1. Vegetation

While several previous marsh studies have focused on tidal creeks, few have been conducted on salt marsh surfaces. This may be attributed to the difficulty in sampling the marsh. For the purpose of this study, a throw trap survey was conducted to sample finfish and invertebrate assemblages in flooded marsh surfaces. The throw trap was used as a method of collecting data representative of the animal assemblages in an instantaneous picture in time of a specific area. Throw trap sampling was performed during September 2000. Only those sites that contained flooded marsh areas were sampled. Five random replicate samples were collected at each of nine sites; Clam Pond, Watch Hill, Old Inlet, Pattersquash, Cupsogue, Picket Point, Tiana, Ponquogue West and Ponquogue East (Figure 3). The throw trap consisted of a $1m^2$ x 0.75m aluminum frame (Figure 8). Before the trap was deployed, it was held motionless above the ground for a few minutes in order to let the disturbed area settle. The trap was then gently tossed into the marsh and set. Latitude and longitude were recorded using a hand-held Garmin

185 Global Positioning System unit (GPS). All vegetation was identified to species level and clipped from the trap area. Vegetation from one-tenth of the trap area was dug out in order to collect roots. Vegetation was bundled, dried to constant weight and weighed to the nearest gram (Figure 8).

Another component of this survey consisted of conducting stubble counts of sprouting vegetation at each of the fifteen seine sites. Stubble counts were recorded during May 2001 at the onset of the growing season. To record stubble counts a $1m^2$ wooden frame was randomly tossed at five locations within each of the fifteen sites (Figure 9). Latitude and longitude were measured at the center of each location using a Garmin 185 Global Positioning System unit (GPS). The $1m^2$ frame area was divided into four quadrats. Stubble counts were recorded from each quadrat and totaled. All plant species within the frame were identified to species.

2. Finfish and Invertebrates

Finfish and invertebrates were removed from the trap area with a 1mm mesh dip net. Animals were removed from the trap until the trap was empty. The trap was considered empty after three successive sweeps through the trap area with the net produced no animals. Finfish and invertebrates were collected and identified to species or lowest practical taxonomic level. All finfish were counted. Measurements of length and weight were recorded for up to 50 individuals of each finfish species. Fish were measured to the nearest millimeter and weighed to the nearest one tenth of a gram. All crabs and shrimps were counted while other species of invertebrates were noted if present.

D. Benthic Invertebrate Survey

1. Benthic Invertebrates

Benthic core samples were collected during this study as a complement to other studies being conducted in the Pikes Breach bayside area and the backbay of Fire Island. Samples were collected along West Hampton Island at six stations during both June (spring) and October (fall) 2000. Core samples were taken by hand with a 3" diameter x 8" long aluminum corer to a minimum depth of 3" (Figure 10). Cores were collected at seven points at each station. The first core was collected at a random central high tide point. Six additional cores were collected; two along the low and mid tide lines, and four located 50 feet to the east and 50 feet to the west of the both the low and mid tide line. Samples were sieved through a 0.5mm mesh screen, preserved in 5% formalin solution. Volume of the sample was recorded. Benthic organisms were identified either to species or lowest practical taxonomic level. All benthic invertebrates were counted and weighed to the nearest one-tenth of a gram.

2. Sediment Grain Size

Sediment samples were collected at each of the benthic core sites. Approximately 25 ml of the benthic core sediment was retained for composition and grain size analysis. Grain size was determined through sieve analysis. Grain sizes were classified as percent gravel, sand and fine sediment. A brief description of the sediment in each sample was provided.

III. RESULTS

A. Seine Survey

1. Shoreline

a. Finfish

Temporal Analysis

A shoreline seine survey was conducted at fifteen stations in Great South Bay, Moriches and Shinnecock Bays (Figure 3). Table 1 lists the species of finfish collected during the one-year survey. Data was analyzed to determine temporal trends throughout the course of the study. Nearly 10,000 fish were measured to determine length distributions. Fish ranged in length from 0.7 to 288 mm (Figure 11). Ninety-percent of the fish measured were in the size bin of 21 to 80 mm. Table 2 lists the total number of fish collected per month. Sampling was biweekly except during November and December when sampling occurred only once per month. The total number of finfish collected throughout the year was 55,106. Catches were highest during the summer months. The total weight of fishes collected during the year was 87,385 grams (Table 3). The mean monthly weight ranged from 97 grams in April to 32,650 grams in September (Figure 12). Monthly totals were converted to catch-per-unit-effort (CPUE) in Table 4. Catch-per-unit-effort is defined as the number of finfish per seine haul. The yearly CPUE for all species was 27,874 finfish representing 43 species. Mean CPUE ranged from lows in December (53) and May (137) to high values in August (9,066) and September (6,845) (Figure 13). Monthly mean CPUE and total number of species are plotted in Figure 14. Species diversity was lowest in November (7), December (8) and April (8) and highest in September (22) and October (21). As mentioned previously, abundances were highest in August and September.

The dominant finfish species in the shoreline seines was the Atlantic silverside, *Menidia menidia* (Table 5). *M. menidia* outranked all other species by at least one order of magnitude in both weight and number. The total number of *M. menidia* collected was 44,995 with a weight of 71,191 grams. The species with the next highest catches were *Ammodytes americanus* (3,890), *Fundulus majalis* (3,340) and *Anchoa mitchilli* (1,043) (Table 5). Rank ordering by weight, the dominant species after *M. menidia* were *F. majalis* (8,032g), *A. americanus* (3,437g) and *F. luciae* (1,242g). Four of the five species dominating the catch by number are similar to those dominating by weight. Figure 15 shows the ten species with the highest catches.

Spatial Analysis

Table 6 shows the total number of fish and species collected at each station during the survey (all months combined). The total number of species at any one station ranged from 7 (Barrett and Watch Hill) to 20 (Clam Pond and Jessup). Total numbers of finfish collected at each station ranged from the lowest catch at Sailor's Haven (745) to highest catches at Cupsogue (7,333) and Ponquougue East (7,918). Two of the three stations with the highest catches are located near an inlet (Cupsogue and Ponquogue East). The total number of finfish and species by station is displayed graphically in Figure 16. Stations are plotted from west to east and partitioned by bay. Species diversity appears to fluctuate randomly throughout all stations. Finfish abundances appear to be lowest in Great South Bay, peaking at Clam Pond (2,003). Overall catches in both Moriches and Shinnecock bays are greater than Great South Bay, however, abundances fluctuate from west to east. The ranges in abundances for all three bays are as follows; Great South Bay= 745 to 2,003, Moriches Bay= 2,547 to 7,333 and Shinnecock Bay= 3,081 to 7,918.

Finfish length frequency distributions were determined for each bay by combining stations within each bay (Figure 17). Fish of similar sizes were collected at all three bays, with modes ranging from 21 to 80 mm total length. In Great South Bay, seventy-five percent of the fish ranged in size from 21 to 80 mm. In Moriches Bay, eighty percent of the fish were in the range of 21 to 80 mm. In Shinnecock Bay fish were generally smaller, with 72% ranging in size from 21 to 60 mm.

b. Invertebrates

<u>Temporal Analysis</u>

Table 7 lists all of the invertebrate species collected during the shoreline seine survey. Total numbers of invertebrates collected by month is shown in Table 8. A total of 24,958 shrimps, crabs, squid, sand dollars and clams were collected during the survey. Note that sampling was biweekly for all months except November and December which were sampled once. Total numbers of invertebrates were converted to catch-per-unit-effort values for each month (Table ' . Values of CPUE were highest in September (4,469) and lowest in December (74). The total number of species collected throughout the survey was 27. Species diversity ranged from seven species in November to 19 species in September. Figure 18 displays invertebrate CPUE and the total number of species plotted for each month. In general, both invertebrate abundances and species diversity follow similar seasonal patterns. Abundances and diversity peaked during late summer through fall, decreased during the winter and began to increase during the spring. One interesting note is the low number of invertebrates collected in August. This will be referred to in the discussion.

A plot of both finfish and invertebrate CPUE indicates that the two distributions follow a similar monthly trend, with the exception of August (Figure 19). In general, abundances peaked during the summer and began to decrease in the fall. However, during August the reverse situation occurs. At this time, invertebrate abundances were at a low, while finfish abundances were substantially higher than previously found.

Of the invertebrate species that were counted, the six most abundant are shown in Figure 20. The shrimps were most abundant with 17,764 *Crangon septemspinosa* and 6,058 *Palaemonetes vulgaris.* Crabs were also abundant in the collections. Of the crabs collected, *Callinectes sapidus* was most abundant (755). Although they were not counted, *Ilyanassa obsoleta,* amphipods and ctenophores were also commonly found in the seine hauls.

Spatial Analysis

The total number of invertebrates collected at each station is shown in Table 10. The lowest abundances were found at Kismet (165), Cupsogue (287), Picket Point (279) and Ponquogue East (155). Interestingly, three of these stations are all stations within close proximity to inlets-Kismet, Cupsogue and Ponquogue East. Highest invertebrate abundances were found at Watch Hill (7,855) and Clam Pond (3,199). Watch Hill and Clam Pond are two well-protected stations found in Great South Bay. Figure 21 is a plot of the total number of invertebrates and species collected at each station, partitioned by bay. The number of species appears to fluctuate randomly in a west-to-east direction. Similarly, the abundance of invertebrates also appears random, with a peak at Watch Hill. All three bays appear to have similar invertebrate abundances. However, Moriches Bay has an overall total number slightly lower than Shinnecock and Great South Bay. The range of invertebrate abundances in Great South Bay is 165 to 7,855; Moriches Bay ranges from 279 to 1,425 and Shinnecock Bay from 155 to 2,414 invertebrates.

Finfish and invertebrate abundances were plotted for each station to determine if there is a spatial relationship (Figure 22). Patterns of abundances appear to mimic each other at most stations, with a few notable exceptions; Watch Hill, Cupsogue and Ponquogue East. At Watch Hill, invertebrate abundances peaked, while finfish numbers were low. At Cupsogue and Ponquogue East the opposite occurs, invertebrate catches were low while finfish abundances peaked. Again, it is important to note that Cupsogue and Ponquogue East are stations within close proximity to inlets.

c. Environmental Variables

Environmental water quality data collected for each station by month is shown in Table 11. Environmental variables (i.e., temperature, salinity, dissolved oxygen and turbidity) were averaged for each bay, by combining stations, and plotted by month in Figure 23. Temperature followed expected seasonal trends, decreasing fall through winter, increasing in spring and peaking during the summer. Salinity remained fairly constant throughout the year. Dissolved oxygen peaked during fall/winter and showed lowest values during the summer. Turbidity peaked in the spring then remained fairly constant the remainder of the year. The minimum and maximum values for each of the environmental parameters sampled at each of the sites are presented in Table 12. Yearly overall temperature ranged from 0.3 to 26.7^{0}C. Temperatures were lowest in December and highest in July for all bays. Yearly salinity ranged from 16.1 to 32.2 ppt. Salinity minimum and maximum values varied in each bay with highs and lows occurring from spring through fall. Dissolved oxygen ranged annually from 3.2 to 15.74 mg/L. Dissolved oxygen was lowest during the late summer into fall and highest from fall into winter. Turbidity ranged from 0.6 to 8.98 ntu annually. In general, turbidity peaked in the spring and then remained steady the remaining part of the year.

Finfish and invertebrate CPUE values were plotted against each of the environmental parameters (Figures 24, 25, 26 and 27). In order to determine if there was a relationship between finfish and invertebrate abundances with these environmental variables, t-tests were performed and probability values calculated (Table 13). For each of the environmental parameters measured, there does not appear to be any relationship between finfish and invertebrate abundances and the environmental parameter. Probability values are all less than 10% with the exception of one-Shinnecock Bay and salinity (20%). However, it is important to note that temperature is known to have an effect on life cycles of various finfish and invertebrates. This will be discussed later in the report. Tidal stage was recorded for each haul. Continuation of the project into the following year will aid in explaining fluctuations in abundance on a spatial scale.

2. Ponds

Table 14 lists all finfish and invertebrate species collected during the pond seine survey. A total of 1,164 finfish were collected representing ten species. Finfish ranged in length from 9 to 110 mm total length (Figure 28). Out of five hundred fishes that were measured, more than half were in the size range of 21-40 mm. Table 15 lists the total number of finfish collected at each station and monthly CPUE values. Note that pond seining coincides with the shoreline survey, however, pond seining did not begin until September. *Fundulus heteroclitus* was the most abundant of all species, comprising 72% of the total catch (Figure 29). *Cyprinodon variegatus* was also collected in large numbers (18% of total catch). Spatially, pond abundances decreased from east to west, with Ponquogue East having the greatest number of finfish (899) and Old Inlet with the least (48). On a monthly basis, October CPUE totals were highest in October (315.5) and September (262). The remaining months all exhibited low CPUE values not exceeding 46.

Invertebrate total numbers per station and monthly CPUE values are shown in Table 16. A total of 561 invertebrates representing twelve species were collected in the pond seines. Note that crabs and shrimps were the only species counted, all other animals were noted if present. *Palaemonetes vulgaris* was the dominant species collected representing over 93% of the total catch (Figure 30). Station totals were low except for at Ponquogue East where a high catch of *P. vulgaris* in October accounted for most of the total. In general, Ponquogue East had greater catches than the other stations. Out of six months sampled, only one shrimp was collected at Picket Point-the station with the lowest catch. CPUE was highest in October (218) and September (87). The high CPUE is primarily the result of the high catch of *P. vulgaris*. collected at Ponquogue East. The lowest CPUE occurred in May.

Finfish and invertebrate pond abundances by month and station were plotted together in Figure 31. The first plot displays animal CPUE versus month. Both finfish and invertebrate abundances increase to a peak in October then fall to lows in November through the spring. Spatially, animal and invertebrate abundances also appear to follow the same trend. Abundances are low at all sites except for Ponquogue East where they peak.

Environmental data are displayed in Table 17. Overall ranges in each variable are as follows; temperature= 3.3-24.8^{0}C, dissolved oxygen= 4.7-13.31 mg/L, salinity= 5.2-32.1 ppt and turbidity= 2.01-10.2 ntu. Temperature followed expected seasonal trends, decreasing during fall and winter and increasing in the spring. Dissolved oxygen values were highest during December and lowest in September/October. Salinity decreased into winter and increased during spring. Turbidity appeared to have lower values during the spring and remained fairly constant the remaining part of the year.

B. Seine-Comparison Study

1. Jamaica Bay

a. Finfish

A comparison of sampling efficiency of a 30' vs. 200' seine net was conducted once during October in conjunction with the DEC. Table 18 lists the finfish and invertebrate species collected during this study. A total of 1,206 finfish were collected in both seines from all three stations (Table 19). The 30' seine collected 506 finfish representing 8 species, while the 200' collected 1,206 fish representing 15 species. The most abundant species in both nets were *Menidia menidia, Fundulus majalis* and *Fundulus heteroclitus*. The dominant species ranked similarly in both nets in the following order; *M. menidia, F. majalis* and *F. heteroclitus.* Combined, these species comprised over ninety percent of the total catch in both nets (Table 20). The overall dominant species in both nets was *M. menidia,* constituting 71% and 50% of the catch in the 30' and 200' nets, respectively. An evaluation of the percentage of finfish numbers collected in the 30' seine indicates that 42% of the catch from the 200' was caught in the 30' seine.

The 200' seine collected over twice as many fish as the 30' net. A plot of the total number of fishes and species collected at each station is shown in Figure 32. At each station the 200' net collected both a greater number of fishes and species. At stations JAM1 and JAM22 the 200' net collected approximately twice as many fish, and nearly three times the total at station JAM2. At station JAM1, three times the number of species was collected in the 200' seine compared to less than twice the number of species at JAM2 and JAM22. The total number of fish at each station for each species is displayed graphically in Figures 33 and 34. Note that *M. saxatilis, Pomatomus saltatrix* and *Pseudopleuronectes americanus* are separated by age class as young-of-the-year (YOY) and age 1 and older. Generally, the 200' seine collected more of each species than the 30' seine. Two species of importance were not collected in the 30' seine, but were found in abundance in the 200' seine- *M.cephalus* and *P. saltatrix* (YOY). Also, note that older *M. saxatalis* (Age 1+) were found in abundance in the 200', while only YOY *M. saxatalis* were collected in the 30' seine. Species collected in the 200' seine that were not found in the 30' include; *M. cephalus, P. saltatrix, Syngnathus fuscus, Caranx hippos, Prionotus evolans, Etropus microstomus* and *Sphoeroides maculatus*. Possible explanations for these occurrences in one net and not the other will be discussed later in the report.

Fish lengths ranged from 19 to 333 mm (Table 19). Length frequency distributions for each species are shown in Figure 35. The smallest fishes were *Sphoeroides maculatus* and *Fundulus* spp., while the largest fishes were *Morone saxatalis* and *Pomatomus saltatrix*. The 30' seine was efficient at collecting smaller-sized fishes such as *M. menidia* and *Fundulus* spp. In addition to collecting the smaller-sized fishes, the 200' seine was more efficient at collecting larger-sized fishes. Larger fishes collected in the 200' net were *M. saxatilis, M. cephalus,, P. saltatrix* and *Synodus foetens*.

b. Invertebrates

Table 18 lists all invertebrate species collected in the seine-comparison study. For the purpose of this exercise, only crabs were counted while all other invertebrates were noted if present. Total numbers of crabs are shown in Table 21. Dominant species were *Pagurus pollicaris* and *Callinectes sapidus.* Other crabs collected in the seines were *Neopanopeus sayi* and *Ovalipes ocellatus,* however numbers were minimal. In addition to crabs, the presence of shrimps, snails and sea jellies was noted. Individuals of the blue crab, *C. sapidus,* were separated as either young-of-the-year or older. A plot of the two age classes at each station for each net is shown in Figure 36. At station JAM1, over twice as many *C. sapidus* YOY were collected, however, overall numbers were low. At two of the three stations, the 30' seine was efficient at collecting both YOY and older blue crabs. At the third station, the 30' seine did not collect any crabs, while the 200' net collected two crabs. A t-test comparing total numbers of all crab types from each net indicates that the collections are not very similar (P=0.48). This is primarily due to the higher number of *P. pollicaris* found in the 200' net. However, it is important to note that numbers from both nets were low which could skew the statistics.

C. Throw Trap Survey

2. Vegetation

A throw trap survey was conducted at nine locations during September 2000 (Figure 3). Vegetation clippings were removed from a $1m^2$ area and roots were removed from one-tenth of the sampled area. Vegetation consisted primarily of *Spartina alterniflora* (smooth cordgrass), with some *Salicornia europaea* (common glasswort) and dead *Zostera marina* (eelgrass). The amount of glasswort and eelgrass observed was minimal, therefore was left out of the data analysis other than to note presence or absence. The resultant dry weight of the *S. alterniflora* clippings and roots from each site is shown in Tables 22 and 23. Mean dry weights were calculated for each station from five replicate samples. There was a degree of variation in replicate weights at some of the stations. This is due to the fact that the stations contain spotty patches of vegetation. Mean biomasses for *S. alterniflora* roots and clippings ranged from 2,100 to 12,700 g/m^2. The station with the greatest biomass was Pattersquash, located in Great South Bay. The lowest biomass was found at Ponquogue West in Shinnecock Bay. The mean dry weight of *S. alterniflora* grass clippings only (no roots) ranged from 167 to 678 g/m^2. The highest biomass was again located in Great South Bay at a different station, Clam Pond. The lowest biomass was located at the same station, Ponquogue West in Shinnecock Bay. Figure 37 is an east-to-west spatial plot of the mean dry weight of *S. alterniflora.* Figure 37 shows the weight of the plants and roots in the top graph and plant weight alone in the bottom graph. In both instances, the mean dry weight of *S. alterniflora* varied throughout the study area.

Stubble counts of the vegetation were made at each of the fifteen seine stations during May 2001 (Figure 3). Vegetation consisted primarily of *S. alterniflora*, with some *S. europaea, Limonium nashii* (sea lavender) and *Lathyrus japonicus* (beach pea). The amounts of glasswort, sea lavender and beach pea counted were minimal and, therefore, left out of the analyses. Table 24 shows five replicate $1m^2$ stubble counts taken at each site. Mean stubble counts ranged from 25 to 371. Dune and Pattersquash had the lowest counts, 25 and 26 respectively. The highest mean counts recorded were at Tiana (371) and Picket Point (364). The ratio of plant (*S. alterniflora*) dry weight to stubble counts was calculated in order to determine general productivity of the system. The ratio indicates the amount of plant shoots supporting vegetation during peak growth. The higher the ratio of weight:count, the more productive the system. It is expected that fewer shoots supporting more growth indicate a healthier system. Table 25 shows the ratio of dry weight:stubble count for each of the stations sampled. Weight:count ratios ranged from 0.51 (Ponquogue West) to 16.33 (Pattersquash). Ponquogue East also had a high ratio (8.43). Two other stations had a ratio less than one; Picket Point (0.78) and Watch Hill (0.99). Within each bay system no trend was observed, with ratios varying.

3. Finfish and Invertebrates

In addition to the vegetative analysis of the throw trap survey, animals were collected from each site. After the vegetation was rooted and clipped, all finfish and invertebrates within the 1m^2 area were removed. Cupsogue and Watch Hill were not flooded at high tide, therefore no animals were collected from these sites and they were excluded from the analyses. Table 26 lists all of the finfish and invertebrates collected in the traps. *Fundulus* sp. were the dominant species collected at all sites. Other than killifishes, a single *Anchoa mitchilli* was collected at Pattersquash.

The total number of finfish, weight of finfish and total number of invertebrates for each throw trap station is shown in Table 27. The mean total number of finfish ranged from 1.0 to 16.0 fish per m^2. The lowest values were located at Clam Pond (1.0 fish/m^2) and Old Inlet (1.4 fish/m^2) in Great South Bay and Tiana (1.4 fish/m^2) in Shinnecock Bay. The mean weight of finfish ranged from 1.0 to 12.0 g/m^2. The lowest weights were recorded at Clam Pond and Tiana (1.0 g/m^2), while the greatest weight was at Ponquogue West (12.0 g/m^2). The mean total number of invertebrates at all throw trap stations ranged from zero to 26.2 per m^2. The lowest total numbers were collected from Old Inlet (0), Tiana (1.0 per m^2) and Ponquogue West (1.8 per m^2). In general, numbers of animals collected were low, with the exception of a few stations. Ponquogue West and Picket Point had high numbers of finfish, while Ponquogue East and Pattersquash had high numbers of invertebrates. Figure 38 is a graphic display of the same information plotted spatially from east to west Currently, there are no apparent trends in animal abundances spatially, with numbers fluctuating from east to west. However, more data is needed to observe spatial trends over a temporal scale. With the continuation of the study, more information will be collected to determine if patterns exist.

To look for trends in animal abundances associated with vegetation, *S. alterniflora* dry weight was plotted against both finfish and invertebrate abundances. Fish weight and abundance varied similarly, therefore, only abundance was plotted. Figure 39 shows the abundance of finfish plotted with *S. alterniflora* dry weight at each station. In the top panel of Figure 39, the abundance of finfish at Great South Bay stations appears to increase with increasing vegetation weight. Alternately, in Moriches and Shinnecock Bays, an increasing abundance of finfish is found in areas with decreasing vegetation and vice versa. The trend in abundance of invertebrates appears similar in all three bays, with animal abundances increasing in areas with increased vegetation and vice versa. A student's t-test was run to determine if animal abundances and weight were related to plant weight. The results of the t-test are shown in Table 28. According to t-test results, in all instances, animal abundances and weights were not dependent on plant weight (p values less than .00007). It is important to note that this data is based on one sampling effort. Future efforts involved with the continuation of the study will help to define potential patterns.

D. Benthic Invertebrate Survey

1. Sediment Grain Size

Sediment was analyzed from six stations along West Hampton Island; Cupsogue, Dune, Picket Point, Jessup, Ponquogue West and Ponquogue East. Samples were collected at seven tidal locations from each site (refer to methods). A total of 42 samples were collected in the spring and fall (total number of samples=84). Table 29 describes the composition of each sediment sample. All samples were composed primarily of sand and fine sediment (Figure 40). There were a few samples that contained trace amounts of gravel. Sand and fine sediment were found at each tidal location of every station, whereas gravel was present at each tidal location, but not every site. Gravel was found most frequently at the easternmost stations, Ponquogue West and East. Of the 42 samples, all but three had greater than 90% sand. The three locations with less than 90% sand were Ponquogue West low (54%), mid (86%) and high tide (70%). Sediment at these sites contained a higher percentage of gravel.

2. Benthic Invertebrates

Benthic invertebrates were analyzed from the same cores collected for sediment composition (refer to previous section). A total of 42 samples were collected each season, spring and fall. Table 30 lists all of the benthic invertebrates collected and their classification group. A total of 2,272 benthic invertebrtates comprising 5 phyla were collected (Table 31). A greater number of benthic organisms were collected during the fall (1,279) than the spring (993). During the spring, Picket Point had the most animals (471) and Cupsogue the least (45). During the fall, Dune had the most animals (549) and Ponquogue East the least (8). With the exception of two stations, Dune and Jessup, spring totals were higher. However, at those two stations, fall animal abundances were at least five times larger. Overall, Picket Point had the greatest number of animals for spring and fall combined, while Cupsogue had the least. These abundances reflect the spring totals.

Figures 41 and 42 show the percent composition of organisms at each station for the spring and fall. During the spring, the dominant taxa at Cupsogue, Dune, Jessup and Ponquogue West were annelida, comprised primarily of polychaetes. During the same time period, mollusca (primarily bivalves) were most abundant at Picket Point, while arthropoda (primarily amphipods) dominated Ponquogue East. During the fall, arthropoda abundances increase at all stations, most notably at Cupsogue and Dune thereby becoming the dominant taxa. Annelida is the most abundant taxa at Picket Point in the fall. Overall, species diversity between stations is low, however, there is a change in dominance between the spring and fall.

Samples were analyzed along tide lines at each of the stations. Benthic cores were taken along a central tide line from low to high, as well as 50 feet to the east and west of the low and mid tide line. Figures 43 and 44 display the density of animals collected at each of these tide locations for each station. During the spring, animals were collected at every tide location for all stations except Cupsogue. At Cupsogue, animals were collected at the central low tide mark only. The density of animals was highest at the central high tide location for Picket Point, Ponquogue West and Ponquogue East. Dune had the highest density of animals of the western mid-tide line. Jessup had similar densities at all locations. During the fall, animals were collected at every location from each station except Cupsogue and Ponquogue West. At Cupsogue, no animals were found at the central mid-tide location, while at Ponquogue West, no animals were found in the high tide sample. The mid-tide line had the highest density of animals at all stations. Dune, Picket Point and Jessup had the highest density of animals at the central mid-tide location. In general, there is a shift from spring to fall in the location of the greatest animal density from the high to mid-tide locations.

The relationship between sediment type and animal compositon and density is vague since all of the stations had a similar sediment composition. The one station with less sand and more gravel was Ponquogue West. At Ponquogue West, the animal composition was similar to all other stations sampled. The density of animals was somewhat different during the fall with no animals collected at the high tide location. This difference was also noticed for Cupsogue during the spring.

IV. DISCUSSION

Estuaries are highly productive areas supporting commercially and recreationally important fisheries resources that are estuarine-dependent at some point, if not all, of their life cycle (USFWS 1983). The south shore of Long Island is part of the Atlantic Flyway, thereby providing important nesting, feeding and shelter areas for waterfowl and shorebirds (USFWS 1983). These localized bays are poorly understood as little sampling has been conducted within their ecosystems over the years. There is a need to better understand the role and function of estuarine dynamics before the impacts of various activities and stresses on the ecosystem can be evaluated.

Salt marshes serve an important function as a nursery area for a variety of finfish and crustaceans. The link between productive marsh areas and the open-ocean is described using the "Trophic Relay Concept" (Figure 45). The trophic relay concept describes a chain of predator-prey interactions establishing a trophic relay. This trophic relay moves marsh production out to the open estuary through fisheries interactions. The pathway for productivity movement is via young resident marsh nekton to adult marsh residents to juvenile transients. The transients inhabit the marsh for a part of their life cycle. Predator-forage species whose life histories involve large-scale migrations of young from spawning grounds to the estuary and back, run through a gauntlet of predators along the way. In this scheme, young residents (e.g. killifishes, *Palaemonetes* sp.) are found in shallow puddles of water on the marsh surface. Adult residents wait in intertidal pools and shallow subtidal habitats. A portion of the adult residents move to subtidal channels becoming prey to the transients who forage in these waters. Transient juveniles accumulate in estuaries then migrate offshore as adults. *M. menidia* is considered a key vector in the trophic relay between the salt marsh and coastal waters (Conover and Ross 1982).

During this survey, *M. menidia* dominated our seine samples, ranking number one in abundance. Other important species were *A. americanus, F. majalis, F. luciae, F. heteroclitus, A. mitchilli* and *P. americanus.* These abundances follow expected seasonal peaks with highest catches occurring during summer months and lowest catches during the winter. One interesting note is the low catch during the spring (May CPUE=137). It appeared that in April catches were on the rise then decreased in May exhibiting one of the lowest catch rates. In general, both finfish and invertebrate abundances peaked during the summer and began to decrease in the fall. However, during August the reverse situation occurs. At this time, invertebrate abundances were at a low, while finfish abundances were substantially higher than previously found. It is possible that the low value in invertebrate abundances could be attributed to predation. This is speculative, however, and a variety of other factors need to be analyzed over the course of the next year in order to draw any firm conclusions.

These findings are similar to other local seine studies. In 1983 the USFWS conducted a study in Great South Bay and found that *M. menidia, F. majalis, P. americanus* and *F. heteroclitus* accounted for 93% of the total catch. From a New Jersey estuary study, Rountree and Able (1992) found the dominant seasonal residents to be; *M. menidia, F. heteroclitus, P. vulgaris, C. septemspinosa* and *C. sapidus.* They also found that *A. mitchilli* ranked important in weir samples, but not in seine samples. Seasonal transients of young-of-the-year and juveniles were most diverse. Faunal compositions were strongly seasonal, peaking in May and August (Rountree 1992). The ten most abundant finfish species in McCormick's 1975 study of Great South Bay were; *M. menidia, Apeltes quadracus, F. majalis, F. heteroclitus, C. variegates. S. maculatus, Syngnathus fuscus, Strongylura marina, Mugil curema* and *Gasterosteus aculeatus.* McCormick's study also showed seasonal changes in abundance with a peak in August. In addition to seasonal changes, there appeared to be a species preference for habitat. Marsh residents such as *F. heteroclitus, S. fuscus, A. quadracus* and juvenile *M. menidia* preferred vegetated bottoms. Marsh transients that preferred vegetated habitats were *C. harengus, Anguilla rostrata, Microgadus tomcod, Pollachius virens, Tautoga onitis* and *P. americanus.* McCormick's 1975 study concluded that sand may cause a decrease in species diversity by eliminating shelter and food. However, the study found certain species would benefit from sand filling, e.g. *F. majalis, Menticirrhus saxatilis* and mugilidae species.

Briggs and O'Connor (1971) seined Great South Bay in 1967 and 1968. Natural bottom habitats (eelgrass) were dominated by *A. quadracus, M. menidia* and *F. heteroclitus. M. menidia, F. majalis, A. quadracus* and *C. variegates* were found over sandy bottoms. They also noted that of 40 species collected, 17 preferred natural bottom, 6 preferred sand, and the remaining 17 had no preference. Briggs and O'Connor concluded that the diversity of bay fishes was related to aquatic vegetation. Eliminating vegetation would decrease species diversity and, for some species, population density. A report by the USFWS in 1981 states that in Great South Bay fish species distributions were affected by bottom type, vegetation cover, nearness of ocean and wind velocity. That same report states that estuarine animal distributions are basically dependent on salinity, along with temperature, oxygen substrate and current velocity. Castro and Cowen (1991) report that bay anchovy abundances in Great South Bay are not related to either temperature or salinity, but instead to larval food abundances for early life stages. Using otolith aging techniques, Poole (1966) showed that the growth of *P. americanus* in Great South Bay was slower than in more easterly bays (Moriches, Shinnecock and Peconic). In Great South Bay, *P. americanus* growth was at least one year behind. Poole related this slower growth to environmental differences affecting productivity, competition and/or salinity. According to Kneib (1997), the estuarine nekton of tidal marshes experience a wide range of physical and environmental conditions. Kneib (1997) considers hydrography to be the single most important factor in development and functioning of wetlands.

In 1997 Raposa and Oviatt conducted a study in Great South Bay for the National Park Service. The study was similar to this study, however the spatial and temporal scale was much smaller. In the Raposa and Oviatt study, sampling was conducted in Great South Bay for six months, from May through October 1995. Raposa and Oviatt reported that vegetated areas support higher densities and numbers of species of nekton than unvegetated areas. They hypothesize that this is probably due to the role vegetated areas play as shelters from predation, providing more abundant food supplies and a quiescent environment. Eelgrass beds were preferred by *S. fuscus, P. americanus* and *Palaemonetes pugio* for at least part of the year. Species that had a negative relation to eelgrass beds were *C. septemspinosa* and *A. quadracus*. These two species appear to be related to macroalgae for at least part of the year. Total nekton abundance and biomass was higher along beach shorelines primarily due to *M. menidia* and *C. septemspinosa*. Conversely, species diversity was higher along salt marsh shorelines. Schaefer (1967) conducted a seine study of surf zone fishes during 1961-63 and found the most abundant species to be *P. triacanthus, S. maculatus, A. aestivalis, A. pseudoharengus, Alosa mediocris, M. saxatilis, P. saltatrix* and *B. tyrannus*. In general, he found less species in surf environment.

It is important to continue baseline surveys of the bay habitats as a means of tracking impacts over time. For example, in a Maryland coastal bay the switch from sensitive finfish species to pollution-tolerant species can be used as environmental indicators of stress (Figure 46). Estuarine intertidal beaches are the least studied in FINS area. There is a need for annual seine/trawl surveys as no other agency monitors fish in the bays of the barrier islands. Due to the extreme interdependency between Fire Island National Seashore and bay habitats, this survey provides a missing link in our knowledge of the link between bayside and oceanic environments. Additionally, this survey will enable changes in species composition and abundance to be tracked over time. This will allow us to monitor habitat changes resulting from environmental stressors.

V. CONCLUSIONS

The shoreline seine survey showed a strong seasonal link in finfish and invertebrate abundances in Shinnecock, Moriches and Great South Bay. Fishes of a similar size range (i.e., 21-80 mm total length) were collected in each bay. Animal abundances peaked during the summer and were lowest during the winter and spring months. Finfish catches were dominated by *M. menidia*. Other species of importance were *A. americanus, F. majalis, A. mitchilli* and *F. luciae*. Landings of crabs and shrimps were dominated by *C. sapidus, C. septemspinosa* and *P. vulgaris*. Species diversity fluctuated throughout the year. Spatial analyses indicate that Great South Bay had lower abundances of finfishes than Moriches and Shinnecock Bays. There is also some indication that stations near inlets had higher abundances. Conversely, invertebrate abundances appeared to be lower at stations near inlets and peaked at more protected locations. Fluctutations in environmental parameters such as temperature, salinity, dissolved oxygen and turbidity do not appear to have a significant effect on animal abundances in the bays. However, it is important to note that temperature is a trigger for spawning activity of most species in the bay. Peak abundances occur during the summer, when water temperatures are warmest. Salinity is also considered to be an important factor in determining benthic animal distributions. Correlations between sediment composition and grain size to benthic invertebrate abundances cannot be determined since the sediment was similar throughout the study area.

Some differences were noted in species composition of the ponds versus the shoreline seines. In the ponds the finfishes consisted primarily of species of killifishes. The dominant finfishes were *F. heteroclitus* and *C. variegatus*. Although these species were present in the shoreline seines, their abundances were much greater in the ponds. The predominant invertebrate species present in the ponds was *P. vulgaris*. Generally, invertebrate catches were lower in the ponds than in the shoreline seines. Spatially, it appeared that animal abundances in the ponds decreased from east to west.

The seine-comparison study evaluated the collection efficiency of a 30' vs. 200' seine showed that the larger seine collected greater numbers of similar species, as well as larger-sized individuals. The species composition between the two nets was similar for dominant species, however, there were some differences in the less dominant species. Additionally, the size frequency distribution between the two nets differed for the transient, predatory species that tend to be larger individuals. Young-of-the-year (YOY) and 1+ year old blue crabs (*C. sapidus)* were collected equally well in both nets.

The throw trap survey identified *S. alterniflora* as the primary vegetation growing in the marsh areas of the study. There is a high variation in *S. alterniflora* biomass due to its patchy distribution in the study area. Biomass fluctuates throughout all stations. The greatest biomass was at the easternmost station of Great South Bay. The lowest *S. alterniflora* biomass was east in Shinnecock Bay. *Fundulus* spp. were the most abundant finfishes in the throw traps. Collections of animals were low in the throw traps. In Great South Bay the abundance of finfishes appears to increase with increasing vegetation, while in Moriches and Shinnecock Bays the alternate is true. Invertebrate abundances appear to increase with increasing vegetation in all three bays.

Sediment samples analyzed from West Hampton Island were composed primarily of sand with some gravel and fine sediment. The composition of benthic fauna collected in core samples predominantly consisted of polychaetes, bivalves and amphipods. Spring samples contained higher numbers in general. Species composition remained the same during spring and summer, however dominance shifted from polychaetes to arthropods. There also appears to be a seasonal shift in density of animals along tide lines. Spring densities are highest along the high tide mark. In the fall, this shifts to highest densities along mid-tide elevations.

VI. REFERENCES

Briggs, P.T. and J.S. O'Connor. Jan. 1971. Comparison of Shore-Zone Fishes Over Naturally Vegetated and Sand-Filled Bottoms in Great South Bay. NY Fish and Game J. 18(1):15-41.

Castro, L.R. and R.K. Cowen. 1991. Environmental Factors Affecting the Early Life History of Bay Anchovy Anchoa mitchilli in Great South Bay, New York. MEPS 76:235-247.

Conover, D.O. and M.R. Ross 1982. Patterns in seasonal abundance, growth and biomass of the Atlantic silverside, Menidia menidia, in a New England estuary. Estuaries. 5:275-286.

Kneib, R.T. March 1997. Early Life Stages of Resident Nekton in Intertidal Marshes. Estuaries 20(1):214-230.

Kneib, R.T. 1997. The Role of Tidal Marshes in the Ecology of Estuarine Nekton. Ocean. and Mar. Bio: an Annual Review. 35:163-220.

McCormick & Associates, Inc. Feb. 1975. Environmental Inventory of the Fire Island National Seashore and the William Floyd Estate, Suffolk County, New York. Submitted to National Park Service, U.S. Department of the Interior. Contract No. 2000-4-0010.

New York Sea Grant Institute. Marine Resources in the Vicinity of the Fire Island National Seashore. May 1993.

Nixon, S.W. 1980. Between Coastal Marshes and Coastal Waters-A Review of Twenty Years of Speculation an Research on the Role of Salt Marshes in Estuarine Productivity and Water Chemistry. In *Estuarine and Wetland Processes*. P. Hamilton & K.B MacDonald (eds). New York: Plenum, 437-525.

Poole, J.C. 1966. Growth and Age of Winter Flounder in Four Bays of Long Island. NY Fish and Game J. 13(2):206-220.

Raposa, K.B. and C.A. Oviatt. Aug. 1997. A Field Evaluation of Fire Island National Seashore Estuarine Resources with an Emphasis on Nekton Communities. U.S. Department of the Interior National Park Service. Technical Report NPS/NESO-RNR/NRTR/97-08.

Rountree, R.A. and K.W. Able. June 1992. Fauna of Polyhaline Subtidal Marsh Creeks in Southern New Jersey: Composition, Abundance and Biomass. Estuaries: 15(2):171-185.

Schaefer, R.H. 1967. Species Composition, Size and Seasonal Abundance of Fish in the Surf Waters of Long Island. NY Fish and Game J. 14(1):1-46.

Schubel, J.R. , T.M. Bell and H.H. Carter. 1991. The Great South Bay. MSRC, SUNY Press.

U.S. Environmental Protection Agency. Nov. 1998. Condition of Mid-Atlantic Estuaries. EPA/600/R-98/147.

REFERENCES (continued)

USFWS. Feb. 1981. Environmental Inventory for the Fire Island to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project Reformulation Study.

USFWS. May 1983. Fish and Wildlife Resource Studies for the Fire Island to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project Reformulation Study. Estuarine Resource Component.

U.S. Fish and Wildlife Service. Final Report. Northeast Coastal Areas Study: Significant Coastal Habitats of Southern New England and Portions of Long Island, New York. Aug. 1991Charlestown, RI.

TABLE 1
Shoreline Seine Finfish Species List

Scientific Name	Common Name
Alosa aestivalis	Blueback Herring
Alosa psuedoharengus	Alewife
Ammodytes americanus	American Sand Lance
Anchoa mitchilli	Bay Anchovy
Anguilla rostrata	American Eel
Apeltes quadracus	Fourspine Stickleback
Ariomma bondi	Silver Rag
Brevoortia tyrannus	Atlantic Menhaden
Chasmodes bosquianus	Striped Blenny
Chilomycterus schoepfi	Striped Burrfish
Cyprinodon variegatus	Sheepshead Minnow
Eel leptocephalus	Anguilliformes
Etropus microstomus	Smallmouth Flounder
Fundulus diaphanus	Banded Killifish
Fundulus heteroclitus	Mummichog
Fundulus luciae	Spotfin Killifish
Fundulus majalis	Striped Killifish
Gasterosteus aculeatus	Threespine Stickleback
Gobiosoma bosci	Naked Goby
Lucania parva	Rainwater Killifish
Menidia menidia	Atlantic Silverside
Menticirrhus saxatilis	Northern Kingfish
Micropogonias undulatus	Atlantic Croaker
Morone americanus	White Perch
Mugil cephalus	Striped Mullet
Ocyurus chrysurus	Yellowtail Snapper
Paralichthys dentatus	Summer Flounder
Pomatomus saltatrix	Bluefish
Prionotus carolinus	Northern Searobin
Pseudopleuronectes americanus	Winter Flounder
Scomber scombrus	Atlantic Mackerel
Selene vomer	Lookdown
Seriola zonata	Banded Rudderfish
Sphoeroides maculatus	Northern Pufferfish
Strongylura marina	Atlantic Needlefish
Syngnathus fuscus	Northern Pipefish
Synodus foetens	Inshore Lizardfish
Tautoga onitis	Blackfish
Tautogolabrus adspersus	Cunner
Trachinotus falcatus	Permit
Tylosurus crocodilus	Houndfish
Urophycis chuss	Red Hake

Source: Robins and Ray. 1986. Peterson Field Guides: A Field Guid to Atlantic Coast Fishes: North America

TABLE 2

Monthly Totals for Finfish Collected in Shoreline Seines

	JUNE 2000	JULY	AUG.	SEP.	OCT.	NOV. *	DEC. *	APR.	MAY	TOTAL	PERCENT OF TOTAL
Menidia menidia	3,467	8,953	16,777	12,838	1,499	412	40	937	72	44,995	81.65
Ammodytes americanus	3,741	1	10			137			1	3,890	7.06
Fundulus majalis	11	143	732	587	1,764	26	6	44	27	3,340	6.06
Anchoa mitchilli	29	734	237	13	30					1,043	1.89
Engraulidae Larvae		70	238		12		1			321	0.58
Fundulus heteroclitus	3	3		58	10	9	1	8	124	216	0.39
Fundulus luciae	19	18	27	23	100			2	25	214	0.39
Syngnathus fuscus	36	59	16	66	30		1	2	2	212	0.38
Mugil cephalus		151		35				2		188	0.34
Micropogonias undulatus	117	63	1	3						184	0.33
Cyprinodon variegatus		3		15	115	3	1			137	0.25
Pseudopleuronectes americanus	25	26		12	10		1	6	6	86	0.16
Alosa aestivalis			69	2		1				72	0.13
Gasterosteus aculeatus	27	5	2	1	3		2	1	5	46	0.08
Pomatomus saltatrix	10	12	12	2						36	0.07
Synodus foetens			2	18	1					21	0.04
Strongylura marina	2	9	4		1					16	0.03
Lucania parva		3		3					5	11	0.02
Trachinotus falcatus				3	8					11	0.02
Alosa psuedoharengus		7		1		1				9	0.02
Anguilla rostrata									6	6	0.01
Tautogolabrus adspersus	1			2	3					6	0.01
Apeltes quadracus	4		1							5	0.01
Ariomma bondi	5									5	0.01
Morone americanus				1	4					5	0.01
Ocyurus chrysurus		1		3	1					5	0.01
Chasmodes bosquianus				3						3	0.01
Etropus microstomus		1			2					3	0.01
Brevoortia tyrannus		2								2	<0.01
Chilomycterus schoepfi			2							2	<0.01
Fundulus diaphanus	1	1								2	<0.01
Paralichthys dentatus	1								1	2	<0.01
Tautoga onitis					2					2	<0.01
Eel leptocephalus			1							1	<0.01
Gobiosoma bosci					1					1	<0.01
Menticirrhus saxatilis					1					1	<0.01
Prionotus carolinus					1					1	<0.01
Scomber scombrus		1								1	<0.01
Selene vomer					1					1	<0.01
Seriola zonata			1							1	<0.01
Sphoeroides maculatus				1						1	<0.01
Tylosurus crocodilus		1								1	<0.01
Urophycis chuss	1									1	<0.01
Monthly Totals	7,500	10,267	18,132	13,690	3,599	589	53	1,002	274	55,106	

* Note: Sampling conducted biweekly for all months except November and December which were sampled once.

TABLE 3

Monthly Weights for Finfish Collected in Shoreline Seines

	2000							2001			
	JUNE	JULY	AUG.	SEP.	OCT.	NOV. *	DEC. *	APR.	MAY	TOTAL WEIGHT (g)	PERCENT OF TOTAL
Menidia menidia	3133.5	10862	17537	30266.1	3313	842.2	72.4	4326.5	838.7	71,191	81.41
Fundulus majalis	49	173.3	1088.85	1384.69	5061.8	49	8.7	101.8	114.4	8,032	9.18
Ammodytes americanus	2803.4	<1	18.3			614.31			1.1	3,437	3.93
Fundulus luciae	37	121.3	231	151.3	589.91			28	83.3	1,242	1.42
Pseudopleuronectes americanus	73.8	126		193	134.2		13.6	147.6	38.5	727	0.83
Fundulus heteroclitus	7	14.3		92.2	18.1	3	2	24.3	333.7	495	0.57
Mugil cephalus		241.3		163.4				0.5		405	0.46
Pomatomus saltatrix	5	103.5	181	109.1						399	0.46
Paralichthys dentatus	300								39.4	339	0.39
Synodus foetens			3.9	246.8	0.8					252	0.29
Micropogonias undulatus	13	224.4	5.7	<1						243	0.28
Anchoa mitchilli	29	70.19	37.082	8	11.8					156	0.18
Cyprinodon variegatus		8.3		2.5	117.78	1.3	<1			130	0.15
Etropus microstomus		13.8			44.2					58	0.07
Tautoga onitis					56.48					56	0.06
Alosa aestivalis			54.1	<1		1				55	0.06
Trachinotus falcatus				20	25.6					46	0.05
Menticirrhus saxatilis					40.2					40	<0.01
Strongylura marina	<1	3.2	32.1		1.7					37	0.04
Fundulus diaphanus	5	13.7								19	0.02
Lucania parva		14.4		0.7					1.2	16	0.02
Ocyurus chrysurus		2.9		10	<1					13	0.01
Tautogolabrus adspersus	8			1.2	2.4					12	0.01
Scomber scombrus		11.4								11	0.01
Alosa psuedoharengus		6.3		1.4		1.2				9	0.01
Selene vomer					2.8					3	<0.01
Seriola zonata			2.8							3	<0.01
Morone americanus				<1	0.8					1	<0.01
Gobiosoma bosci					0.3					<1	<0.01
Anguilla rostrata									0.2	<1	<0.01
Ariomma bondi	<1									<1	<0.01
Brevoortia tyrannus		<1								<1	<0.01
Chasmodes bosquianus				<1						<1	<0.01
Chilomycterus schoepfi			<1							<1	<0.01
Eel leptocephalus			<1							<1	<0.01
Prionotus carolinus					<1					<1	<0.01
Sphoeroides maculatus				<1						<1	<0.01
Tylosurus crocodilus		<1								<1	<0.01
Urophycis chuss	<1									<1	<0.01
Apeltes quadracus	n/a		n/a							n/a	n/a
Syngnathus fuscus	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a
Gasterosteus aculeatus	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a
Engraulidae Larvae		n/a	n/a		n/a		n/a			n/a	n/a
Monthly Total Weights	6,464	12,010	19,192	32,650	9,422	1,512	97	4,629	1,451	87,425	

* Note: Sampling conducted biweekly for all months except November and December which were sampled once.

TABLE 4

MEAN MONTHLY CATCH-PER-UNIT-EFFORT (CPUE) BY TAXA

(Number of Fish per Seine Haul)

	JUNE 2000	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	APR. 2001	MAY	TOTAL CPUE	MEAN CPUE
Menidia menidia	1,734	4,476	8,389	6,419	750	412	40	469	36	22,723	2,524.81
Ammodytes americanus	1,871	1	5			137			1	2,014	223.72
Fundulus majalis	6	72	366	294	882	26	6	22	14	1,686	187.33
Anchoa mitchilli	15	367	119	7	15					522	57.94
Engraulidae Larvae		35	119		6		1			161	17.89
Fundulus heteroclitus	2	2		29	5	9	1	4	62	113	12.56
Fundulus luciae	10	9	14	12	50			1	13	107	11.89
Syngnathus fuscus	18	30	8	33	15		1	1	1	107	11.83
Mugil cephalus		76		18				1		94	10.44
Micropogonias undulatus	59	32	1	2						92	10.22
Cyprinodon variegatus		2		8	58	3	1			71	7.83
Pseudopleuronectes americanus	13	13		6	5		1	3	3	44	4.83
Alosa aestivalis			35	1		1				37	4.06
Gasterosteus aculeatus	14	3	1	1	2		2	1	3	24	2.67
Pomatomus saltatrix	5	6	6	1						18	2.00
Synodus foetens			1	9	1					11	1.17
Strongylura marina	1	5	2		1					8	0.89
Lucania parva		2		2					3	6	0.61
Trachinotus falcatus				2	4					6	0.61
Alosa psuedoharengus		4		1		1				5	0.56
Anguilla rostrata									3	3	0.33
Tautogolabrus adspersus	1			1	2					3	0.33
Apeltes quadracus	2		1							3	0.28
Ariomma bondi	3									3	0.28
Morone americanus				1	2					3	0.28
Ocyurus chrysurus		1		2	1					3	0.28
Chasmodes bosquianus				2						2	0.17
Etropus microstomus		1			1					2	0.17
Brevoortia tyrannus		1								1	0.11
Chilomycterus schoepfi			1							1	0.11
Fundulus diaphanus	1	1								1	0.11
Paralichthys dentatus	1								1	1	0.11
Tautoga onitis					1					1	0.11
Eel leptocephalus			1							1	0.06
Gobiosoma bosci					1					1	0.06
Menticirrhus saxatilis					1					1	0.06
Prionotus carolinus					1					1	0.06
Scomber scombrus		1								1	0.06
Selene vomer					1					1	0.06
Seriola zonata			1							1	0.06
Sphoeroides maculatus				1						1	0.06
Tylosurus crocodilus		1								1	0.06
Urophycis chuss	1									1	0.06

	JUNE 2000	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	APR. 2001	MAY	TOTAL
Total CPUE All Species	3,750	5,133	9,066	6,845	1,800	589	53	501	137	27,874
Mean CPUE All Species	208	233	604	311	86	84	7	63	12	648
Number of Species	18	22	15	22	21	7	8	8	11	43
Number of Samples	2	2	2	2	2	1	1	2	2	

TABLE 5
RANK ABUNDANCE OF FISH SPECIES BY NUMBER AND WEIGHT

	TOTAL NUMBER	RANK
Menidia menidia	44,995	1
Ammodytes americanus	3,890	2
Fundulus majalis	3,340	3
Anchoa mitchilli	1,043	4
Engraulidae Larvae	321	5
Fundulus heteroclitus	216	6
Fundulus luciae	214	7
Syngnathus fuscus	212	8
Mugil cephalus	188	9
Micropogonias undulatus	184	10
Cyprinodon variegatus	137	11
Pseudopleuronectes americanus	86	12
Alosa aestivalis	72	13
Gasterosteus aculeatus	46	14
Pomatomus saltatrix	36	15
Synodus foetens	21	16
Strongylura marina	16	17
Lucania parva	11	18.5
Trachinotus falcatus	11	18.5
Alosa psuedoharengus	9	20
Anguilla rostrata	6	21
Tautogolabrus adspersus	6	22
Apeltes quadracus	5	24.5
Ariomma bondi	5	24.5
Morone americanus	5	24.5
Ocyurus chrysurus	5	24.5
Chasmodes bosquianus	3	27.5
Etropus microstomus	3	27.5
Brevoortia tyrannus	2	31
Chilomycterus schoepfi	2	31
Fundulus diaphanus	2	31
Paralichthys dentatus	2	31
Tautoga onitis	2	31
Eel leptocephalus	1	38.5
Gobiosoma bosci	1	38.5
Menticirrhus saxatilis	1	38.5
Prionotus carolinus	1	38.5
Scomber scombrus	1	38.5
Selene vomer	1	38.5
Seriola zonata	1	38.5
Sphoeroides maculatus	1	38.5
Tylosurus crocodilus	1	38.5
Urophycis chuss	1	38.5

	TOTAL WEIGHT (g)	RANK
Menidia menidia	71,191.06	1
Fundulus majalis	8,031.59	2
Ammodytes americanus	3,437.11	3
Fundulus luciae	1,241.81	4
Pseudopleuronectes americanus	726.70	5
Fundulus heteroclitus	494.60	6
Mugil cephalus	405.20	7
Pomatomus saltatrix	398.60	8
Paralichthys dentatus	339.40	9
Synodus foetens	251.50	10
Micropogonias undulatus	243.10	11
Anchoa mitchilli	156.07	12
Cyprinodon variegatus	129.88	13
Etropus microstomus	58.00	14
Tautoga onitis	56.48	15
Alosa aestivalis	55.10	16
Trachinotus falcatus	45.60	17
Strongylura marina	37.00	18
Fundulus diaphanus	18.70	19
Lucania parva	16.30	20
Ocyurus chrysurus	12.90	21
Tautogolabrus adspersus	11.60	22
Scomber scombrus	11.40	23
Alosa psuedoharengus	8.90	24
Selene vomer	2.80	25.5
Seriola zonata	2.80	25.5
Morone americanus	0.80	27
Gobiosoma bosci	<1	33.5
Anguilla rostrata	<1	33.5
Ariomma bondi	<1	33.5
Brevoortia tyrannus	<1	33.5
Chasmodes bosquianus	<1	33.5
Chilomycterus schoepfi	<1	33.5
Eel leptocephalus	<1	33.5
Menticirrhus saxatilis	<1	33.5
Prionotus carolinus	<1	33.5
Sphoeroides maculatus	<1	33.5
Tylosurus crocodilus	<1	33.5
Urophycis chuss	<1	33.5
Apeltes quadracus	n/a	n/a
Syngnathus fuscus	n/a	n/a
Gasterosteus aculeatus	n/a	n/a
Engraulidae Larvae	n/a	n/a

TABLE 6

Station Totals for Finfish Collected in Shoreline Seines

	Kismet	Clam Pond	Sailor's Haven	Barrett	Watch Hill	Old Inlet	Pattersquash	Cupsogue	Dune	Pikes	Picket Point	Jessup	Tiana	Ponquogue West	Ponquogue East	Species Totals
Menidia menidia	803	1,691	476	1,007	1,319	1,589	1,273	5,305	4,293	5,608	2,239	6,078	5,622	2,364	5,328	44,995
Ammodytes americanus	125	2						1,931						1	1,831	3,890
Fundulus majalis		114		3	9	16	348	77	65	763	22	10	1,206	616	91	3,340
Anchoa mitchilli	10	16	176	89	9	7	3				56	23		6	648	1,043
Engraulidae Larvae				125	11						181	3		1		321
Fundulus heteroclitus		20			5	3	6			1		4	141	32	4	216
Fundulus luciae		18				3	8	1	14	86	13		30	37	4	214
Syngnathus fuscus	38	28	31	7	25	2	47		1	17		15	1			212
Mugil cephalus				2					151			1	34			188
Micropogonias undulatus		71	29			2	13		1	30	17	2	19			184
Cyprinodon variegatus		3					53			11		3	49	18		137
Pseudopleuronectes americanus	1	8	6	1	4	17	5	3	7	3	13	2	9	3	4	86
Alosa aestivalis	4	1					32	7	1			22	2	1	2	72
Gasterosteus aculeatus	6	1	2		4	2	4	4	1	15		6	1			46
Pomatomus saltatrix	3	8	10	1		3	1	4	1		2	1	2			36
Synodus foetens	2	5				5	3			2	1	3				21
Strongylura marina	4	1	1			3	4				1		2			16
Lucania parva		6													5	11
Trachinotus falcatus			11													11
Alosa psuedoharengus		3					2					1	3			9
Anguilla rostrata		3							1					1	1	6
Tautogolabrus adspersus	3						2					1				6
Apeltes quadracus										2	1	2				5
Ariomma bondi							3			2						5
Morone americanus		2											3			5
Ocyurus chrysurus		2					1		1				1			5
Chasmodes bosquianus													3			3
Etropus microstomus						1			2							3
Brevoortia tyrannus	2															2
Chilomycterus schoepfi			2													2
Fundulus diaphanus											1	1				2
Paralichthys dentatus	1											1				2
Tautoga onitis	2															2
Eel leptocephalus														1		1
Gobiosoma bosci												1				1
Menticirrhus saxatilis	1															1
Prionotus carolinus										1						1
Scomber scombrus								1								1
Selene vomer			1													1
Seriola zonata												1				1
Sphoeroides maculatus	1															1
Tylosurus crocodilus	1															1
Urophycis chuss										1						1
Station Totals	1,007	2,003	745	1,235	1,386	1,653	1,808	7,333	4,539	6,542	2,547	6,181	7,128	3,081	7,918	55,106
Number of Species	17	20	11	7	7	13	18	9	13	14	11	20	17	10	10	43

*Note: Engraulidae larvae and eel leptocephalus not considered a separate species.

TABLE 7
Shoreline Seine Invertebrate Species List

Scientific Name	Common Name
Aurelia aurita	Moon Sea Jelly
Callinectes sapidus	Blue Crab
Carcinus maenas	Green Crab
Crangon septemspinosa	Sand Shrimp
Cyanea capillata	Lions Mane Sea Jelly
Echinarachnius parma	Sand Dollar
Elysia catula	Eelgrass Slug
Geukensia demissa	Ribbed Mussel
Hippolyte zostericola	Grass Shrimp
Ilyanassa obsoleta	Mud Dog Whelk
Libinia emarginata	Spider Crab
Limulus polyphemus	Horseshoe Crab
Loligo pealeii	Longfin Squid
Melampus bidentatus	Salt-Marsh Snail
Merceneria merceneria	Hard-Shelled Clam
Mytilus edulis	Blue Mussel
Neopanopeus sayi	Black-fingered Mud Crab
Ovalipes ocellatus	Lady Crab
Ovatella myosotis	Oval Marsh Snail
Pagurus longicarpus	Longwrist Hermit Crab
Pagurus pollicaris	Flatclaw Hermit Crab
Palaemonetes vulgaris	Grass Shrimp
Pinnotheres maculatus	Pea Crab
Amphipods	
Annelids	
Ctenophores	
Isopods	

Source: Weiss. 1995. Marine Animals of Southern New England and New York

TABLE 8

Monthly Totals for Invertebrates Collected in Shoreline Seines

	JUNE 2000	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	APR. 2001	MAY	SPECIES TOTAL	PERCENT OF TOTAL
Crangon septemspinosa	1,027	2,129	104	6,987	3,068	176	70	2,456	1,747	17,764	71.18
Palaemonetes vulgaris	1,528	1,272	335	1,493	700	44	3	30	653	6,058	24.27
Callinectes sapidus	43	193	18	389	101			2	9	755	3.03
Ovatella myosotis	134									134	0.54
Hippolyte zostericola		2		37	20					59	0.24
Pagurus longicarpus	4	2		8	12			21	12	59	0.24
Ovalipes ocellatus	32	15		3	2					52	0.21
Carcinus maenas	4		2	6	4			2	16	34	0.14
Pinnotheres maculatus	5	5	1	1	3				1	16	0.06
Neopanopeus sayi				5	2		1	2	1	11	0.04
Pagurus pollicaris				8				0		8	0.03
Loligo pealeii			2		2					4	0.02
Echinarachnius parma		1								1	<0.01
Libinia emarginata					1					1	<0.01
Limulus polyphemus			1							1	<0.01
Merceneria merceneria	1									1	<0.01
Aurelia aurita				Present	Present					Present	Present
Cyanea capillata				Present		Present		Present	Present	Present	Present
Elysia catula				Present	Present	Present			Present	Present	Present
Geukensia demissa		Present		Present			Present	Present	Present	Present	Present
Ilyanassa obsoleta	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Melampus bidentatus			Present					Present		Present	Present
Mytilus edulis	Present	Present		Present	Present		Present	Present	Present	Present	Present
Amphipods	Present	Present		Present	Present	Present		Present	Present	Present	Present
Annelids	Present							Present		Present	Present
Ctenophores	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Isopods	Present	Present	Present	Present	Present		Present	Present	Present	Present	Present
Monthly Totals	2,778	3,619	463	8,937	3,915	220	74	2,513	2,439	24,958	

* Note: Sampling conducted biweekly for all months except November and December, which were sampled once.

TABLE 9

MEAN MONTHLY CATCH-PER-UNIT-EFFORT (CPUE) BY TAXA

(Number of Invertebrates per Seine Haul)

	JUNE 2000	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	APR. 2001	MAY	TOTAL CPUE	MEAN CPUE
Crangon septemspinosa	513.5	1,064.5	52.0	3,493.5	1,534.0	176.0	70.0	1,228.0	873.5	9,005.0	1,000.6
Palaemonetes vulgaris	764.0	636.0	167.5	746.5	350.0	44.0	3.0	15.0	326.5	3,052.5	339.2
Callinectes sapidus	21.5	96.5	9.0	194.5	50.5			1.0	4.5	377.5	41.9
Ovatella myosotis	67.0									67.0	7.4
Hippolyte zostericola		1.0		18.5	10.0					29.5	3.3
Pagurus longicarpus	2.0	1.0		4.0	6.0			10.5	6.0	29.5	3.3
Ovalipes ocellatus	16.0	7.5		1.5	1.0					26.0	2.9
Carcinus maenas	2.0		1.0	3.0	2.0			1.0	8.0	17.0	1.9
Pinnotheres maculatus	2.5	2.5	0.5	0.5	1.5				0.5	8.0	0.9
Neopanopeus sayi				2.5	1.0		1.0	1.0	0.5	6.0	0.7
Pagurus pollicaris				4.0						4.0	0.4
Loligo pealeii			1.0		1.0					2.0	0.2
Echinarachnius parma		0.5								0.5	0.1
Libinia emarginata					0.5					0.5	0.1
Limulus polyphemus			0.5							0.5	0.1
Merceneria merceneria	0.5									0.5	0.1
Aurelia aurita				Present	Present					Present	Present
Cyanea capillata				Present		Present		Present	Present	Present	Present
Elysia catula				Present	Present	Present			Present	Present	Present
Geukensia demissa		Present		Present			Present	Present	Present	Present	Present
Ilyanassa obsoleta	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Melampus bidentatus			Present					Present		Present	Present
Mytilus edulis	Present	Present		Present	Present		Present	Present	Present	Present	Present
Amphipods	Present	Present		Present	Present	Present		Present	Present	Present	Present
Annelids	Present							Present		Present	Present
Ctenophores	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Isopods	Present	Present	Present	Present	Present		Present	Present	Present	Present	Present
Monthly Total CPUE	**1,389**	**1,810**	**232**	**4,469**	**1,958**	**220**	**74**	**1,257**	**1,220**	**12,626**	
Monthly Mean CPUE	**93**	**129**	**21**	**235**	**109**	**31**	**9**	**84**	**81**	**468**	
Number of Species	**15**	**14**	**11**	**19**	**18**	**7**	**8**	**15**	**15**	**27**	
Number of Samples	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**2**		

TABLE 10
Invertebrate Abundances by Station

	Kismet	Clam Pond	Sailor's Haven	Barrett	Watch Hill	Old Inlet	Pattersquash	Cupsogue	Dune	Pikes	Picket Point	Jessup	Tiana	Ponquogue West	Ponquogue East	Species Totals
Crangon septemspinosa	66	1,386	2,277	969	7,279	464	555	275	1,361	522	190	614	823	859	124	17,764
Palaemonetes vulgaris	80	1,678	136	39	313	11	1,539	4	38	402	12	329	1,446	15	16	6,058
Callinectes sapidus	4	105	29	11	159	102	99		11	8	55	23	89	60		755
Ovatella myosotis					100	9					9		16			134
Hippolyte zostericola	14		5		3		33	2						2		59
Pagurus longicarpus	1	20	2		1	1	1		6			1	10	11	5	59
Ovalipes ocellatus		3	5					4	5	1	11	2	18	3		52
Carcinus maenas		4	1				1	1			1		6	13	7	34
Pinnotheres maculatus		1	3				4		2	1		3		1	1	16
Neopanopeus sayi		2									1		2	4	2	11
Pagurus pollicaris				3					1				2	2		8
Loligo pealeii									1				1	2		4
Echinarachnius parma							1									1
Libinia emarginata													1			1
Limulus polyphemus								1								1
Merceneria merceneria							1									1
Aurelia aurita						Present	Present	Present		Present			Present	Present	Present	Present
Cyanea capillata	Present	Present	Present	Present	Present	Present	Present							Present	Present	Present
Elysia catula		Present		Present												Present
Geukensia demissa		Present					Present							Present		Present
Ilyanassa obsoleta	Present	Present	Present	Present	Present	Present	Present			Present	Present	Present	Present	Present	Present	Present
Melampus bidentatus		Present														Present
Mytilus edulis								Present	Present					Present	Present	Present
Amphipods	Present	Present	Present	Present	Present	Present	Present	Present	Present			Present	Present	Present	Present	Present
Annelids							2			Present	Present		Present			Present
Ctenophores	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Isopods	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
Station Totals	165	3,199	2,458	1,022	7,855	587	2,234	287	1,425	934	279	972	2,414	972	155	24,958
Number of Species	10	16	13	10	11	11	17	11	12	10	11	10	17	19	13	27

TABLE 11
Shoreline Seines Monthly Water Quality Data

Great South Bay

Station	Month	Temp. (^{o}C)	D.O. (mg/L)	Salinity (ppt)	Turbid. (ntu)
Kismet	June	19.75	9.48	27.40	2.56
	July	24.35	7.68	29.35	2.63
	Aug.	22.10	6.96	29.00	2.28
	Sep.	22.10	3.92	28.85	3.03
	Oct.	17.65	8.94	29.70	2.15
	Nov.	n/a	n/a	n/a	2.50
	Dec.	3.30	12.30	28.20	n/a
	April	8.33	10.76	26.85	2.10
	May	17.80	10.21	26.65	3.59
Clam Pond	June	21.45	9.57	17.30	6.86
	July	24.55	7.23	29.25	2.30
	Aug.	22.40	6.46	27.80	2.58
	Sep.	21.40	7.95	28.55	2.63
	Oct.	17.35	8.68	28.20	1.73
	Nov.	n/a	n/a	n/a	1.55
	Dec.	2.30	11.72	28.20	n/a
	April	11.85	10.14	26.30	2.15
	May	18.05	8.99	26.90	2.22
Sailor's Haven	June	21.40	9.31	24.20	6.47
	July	24.90	6.96	25.90	3.30
	Aug.	23.85	8.87	24.80	3.78
	Sep.	21.10	9.64	27.15	2.88
	Oct.	17.05	9.43	25.60	2.95
	Nov.	n/a	n/a	n/a	3.55
	Dec.	1.60	12.34	27.40	n/a
	April	12.05	11.49	23.90	2.15
	May	17.70	8.95	25.00	2.89
Barrett	June	20.75	8.99	22.80	4.82
	July	24.05	7.00	25.25	3.03
	Aug.	23.05	7.45	23.85	3.08
	Sep.	20.80	8.77	26.90	3.15
	Oct.	16.35	8.97	24.50	3.73
	Nov.	n/a	n/a	n/a	2.25
	Dec.	1.40	12.24	27.10	n/a
	April	12.30	9.97	23.55	0.80
	May	17.10	9.78	24.60	2.56
Watch Hill	June	18.60	9.10	16.10	4.43
	July	23.75	6.79	25.00	2.93
	Aug.	22.10	7.69	25.10	2.80
	Sep.	20.85	8.08	26.60	3.25
	Oct.	16.20	8.58	25.05	2.63
	Nov.	n/a	n/a	n/a	1.75
	Dec.	0.30	12.88	26.50	n/a
	April	11.75	10.29	22.95	0.90
	May	15.45	9.71	24.40	2.37
Old Inlet	June	16.70	8.68	26.00	7.65
	July	24.05	5.74	25.80	3.05
	Aug.	21.70	5.70	28.05	2.55
	Sep.	20.55	7.65	26.95	3.33
	Oct.	16.00	7.93	25.95	3.75
	Nov.	*Not sampled.	*Not sampled.	*Not sampled.	*Not sampled.
	Dec.	*Not sampled.	*Not sampled.	*Not sampled.	*Not sampled.
	April	11.45	9.53	23.55	1.10
	May	13.60	9.13	25.40	1.22
Patter-squash	June	18.25	8.79	23.10	4.79
	July	23.15	5.72	27.66	2.15
	Aug.	21.20	5.80	28.35	1.85
	Sep.	19.50	7.56	28.50	2.88
	Oct.	15.35	7.04	28.75	0.88
	Nov.	6.40	12.31	22.90	2.80
	Dec.	3.20	11.29	25.20	n/a
	April	15.35	10.13	24.70	1.00
	May	20.70	9.81	24.85	1.12

Moriches Bay

Station	Month	Temp. (^{o}C)	D.O. (mg/L)	Salinity (ppt)	Turbid. (ntu)
Cup-sogue	June	16.71	6.86	31.57	1.42
	July	20.95	7.96	30.90	0.60
	Aug.	22.90	7.82	31.10	1.23
	Sep.	19.65	7.63	32.20	1.90
	Oct.	15.70	7.56	31.10	3.83
	Nov.	12.30	9.31	29.50	2.55
	Dec.	4.00	11.50	30.40	n/a
	April	9.05	10.34	29.45	3.25
	May	16.85	8.90	28.80	4.20
Dune	June	20.23	6.64	27.08	2.10
	July	24.60	7.50	29.75	1.50
	Aug.	22.85	7.38	29.65	1.10
	Sep.	20.30	8.70	30.45	3.83
	Oct.	14.50	8.02	30.55	3.88
	Nov.	10.80	8.63	28.60	2.35
	Dec.	3.80	10.38	28.70	n/a
	April	12.15	9.81	28.25	1.50
	May	16.10	9.92	28.00	1.31
Pikes	June	20.38	6.52	29.79	n/a
	July	26.70	7.60	30.05	1.68
	Aug.	23.75	7.57	28.85	1.78
	Sep.	21.25	8.69	26.55	3.83
	Oct.	14.35	3.20	29.90	2.65
	Nov.	10.40	9.70	27.60	2.30
	Dec.	3.10	10.69	29.20	n/a
	April	12.65	10.04	24.15	2.35
	May	17.15	9.30	28.00	1.58
Picket Point	June	22.56	8.61	27.51	3.84
	July	25.70	7.03	29.30	2.78
	Aug.	22.30	7.41	27.90	3.28
	Sep.	21.40	9.31	29.35	2.05
	Oct.	13.75	7.60	28.85	3.45
	Nov.	10.40	10.50	27.10	4.80
	Dec.	3.90	10.70	26.10	n/a
	April	12.70	11.34	23.90	0.95
	May	19.50	10.19	25.35	0.96
Jessup	June	21.65	6.84	28.00	8.98
	July	25.40	6.67	28.75	3.00
	Aug.	22.35	6.91	27.25	2.15
	Sep.	21.55	8.58	28.65	3.50
	Oct.	13.35	6.39	28.70	2.15
	Nov.	10.50	9.67	26.40	2.00
	Dec.	3.50	15.74	27.00	n/a
	April	13.15	11.05	24.95	0.75
	May	17.70	9.69	24.95	1.08

Shinnecock Bay

Station	Month	Temp. (^{o}C)	D.O. (mg/L)	Salinity (ppt)	Turbid. (ntu)
Tiana	June	21.10	6.84	28.80	1.82
	July	23.95	5.99	30.50	2.25
	Aug.	21.45	5.55	29.45	2.68
	Sep.	18.80	6.96	30.25	4.55
	Oct.	11.95	6.45	29.40	2.98
	Nov.	4.50	9.87	25.20	3.00
	Dec.	3.40	11.03	26.40	n/a
	April	11.10	7.98	26.55	0.60
	May	15.65	8.86	26.80	3.16
Pon-quogue West	June	21.95	7.10	27.85	4.05
	July	22.25	6.62	29.65	0.95
	Aug.	20.50	6.09	29.95	3.15
	Sep.	18.35	8.02	30.70	1.13
	Oct.	12.50	6.94	31.00	1.13
	Nov.	5.70	10.50	27.40	n/a
	Dec.	3.20	13.42	28.10	n/a
	April	10.10	8.70	27.05	5.10
	May	15.55	10.14	28.05	1.32
Pon-quogue East	June	18.35	6.88	31.25	1.99
	July	20.45	6.98	30.40	0.88
	Aug.	20.05	6.80	30.85	1.40
	Sep.	18.95	7.58	31.00	2.15
	Oct.	13.20	7.93	31.50	1.38
	Nov.	9.20	10.55	28.90	2.20
	Dec.	4.00	10.61	29.20	n/a
	April	9.05	9.93	29.15	2.40
	May	14.35	9.27	29.50	1.33

* Not sampled due to missing navigation aids.
n/a denotes data point missing due to instrument malfunction.

TABLE 12

Maximum and Minimum Values for Environmental Variables

	GSB	MOR	SH	Overall
Temperature (°C)	0.3-24.9	3.1-26.7	3.2-23.95	**0.3-26.7**
Salinity (ppt)	16.1-29.35	23.9-32.2	25.2-31.25	**16.1-32.2**
Dissolved Oxygen (mg/L)	3.92-12.88	3.2-15.74	5.55-13.42	**3.2-15.74**
Turbidity (ntu)	0.8-7.65	0.6-8.98	0.6-5.1	**0.6-8.98**

Stations where Maximum and Minimum Values Occur

	GSB	MOR	SH	Overall
Temperature Minimum	Watch Hill	Pikes	PonW	**Watch Hill**
Temperature Maximum	Sailor's	Pikes	Tiana	**Pikes**
Salinity Minimum	Watch Hill	Picket	Tiana	**Watch Hill**
Salinity Maximum	Kismet	Cupsogue	PonE	**Cupsogue**
Dissolved Oxygen Minimum	Kismet	Pikes	Tiana	**Pikes**
Dissolved Oxygen Maximum	Watch Hill	Jessup	PonW	**Jessup**
Turbidity Minimum	Barrett	Cupsogue	Tiana	**Tiana/Cupsogue**
Turbidity Maximum	Old Inlet	Jessup	PonW	**Jessup**

Months when Maximum and Minimum Values Occur

	GSB	MOR	SH	Overall
Temperature Minimum	December	December	December	**December**
Temperature Maximum	July	July	July	**July**
Salinity Minimum	June	April	November	**June**
Salinity Maximum	July	September	June	**September**
Dissolved Oxygen Minimum	September	October	August	**October**
Dissolved Oxygen Maximum	December	December	December	**December**
Turbidity Minimum	April	July	April	**April/July**
Turbidity Maximum	June	June	April	**June**

TABLE 13

T-test Results Relating Animal Abundances to Environmental Variables

(P-values converted to percent)

Finfish	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Turbidity (ntu)
Great South Bay	1.9	4.2	1	0.9
Moriches Bay	4.3	5.1	3.8	4.7
Shinnecock Bay	1.3	1.6	1.1	1.5

Invertebrates	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Turbidity (ntu)
Great South Bay	3.9	5.6	3.1	3.5
Moriches Bay	1.1	3.5	4.5	3
Shinnecock Bay	8.8	20.2	5.9	5.3

TABLE 14
Pond Seine Species List

Scientific Name	Common Name
Finfish	
Anguilla rostrata	American Eel
Cyprinodon variegatus	Sheepshead Minnow
Fundulus heteroclitus	Mummichog
Fundulus luciae	Spotfin Killifish
Fundulus majalis	Striped Killifish
Gasterosteus aculeatus	Threespine Stickleback
Gobiosoma bosci	Naked Goby
Lucania parva	Rainwater Killifish
Menidia menidia	Atlantic Silverside
Pseudopleuronectes americanus	Winter Flounder
Invertebrates	
Aurelia aurita	Moon Sea Jelly
Callinectes sapidus	Blue Crab
Carcinus maenas	Green Crab
Crangon septemspinosa	Sand Shrimp
Illyanassa obsoleta	Mud Dog Whelk
Mytilus edulis	Blue Mussel
Ovalipes ocellatus	Lady Crab
Pagurus pollicaris	Flatclaw Hermit Crab
Palaemonetes vulgaris	Grass Shrimp
Amphipods	
Ctenophores	
Isopods	

Sources: Robins and Ray. 1986. Peterson Field Guides: A Field Guid to Atlantic Coast Fishes: North America
Weiss. 1995. Marine Animals of Southern New England and New York

TABLE 15
SUMMARY OF POND SEINE COLLECTIONS FISH DATA
Station and Monthly Totals by Species

Station Totals

	Old Inlet	Cupsogue	Picket Point	Ponquogue East	Species Totals	Percent of Total
Fundulus heteroclitus	32	14	2	790	838	71.99
Cyprinodon variegatus	16	52	126	25	219	18.81
Fundulus majalis		20	1	57	78	6.70
Menidia menidia		1		17	18	1.55
Fundulus luciae		1		2	3	0.26
Anguilla rostrata				2	2	0.17
Lucania parva				2	2	0.17
Pseudopleuronectes americanus				2	2	0.17
Gasterosteus aculeatus				1	1	0.09
Gobiosoma bosci				1	1	0.09
Station Totals	48	88	129	899	1,164	

Monthly Totals (CPUE)

	SEP.	OCT.	NOV.	DEC.	APR.	MAY	Species Totals
Fundulus heteroclitus	183	293		34	4.5		514.5
Cyprinodon variegatus	50	18	27	4	0.5		99.5
Fundulus majalis	14		4	8	13.5	1.5	41
Menidia menidia	12	3					15
Fundulus luciae	2					0.5	2.5
Lucania parva		0.5	1				1.5
Pseudopleuronectes americanus	1	0.5					1.5
Anguilla rostrata					1		1
Gasterosteus aculeatus					0.5		0.5
Gobiosoma bosci		0.5					0.5
Monthly Totals	262	316	32	46	20	2	

TABLE 17
Pond Seines Water Quality Data

	Date	Temperature (°C)	Dissolved Oxygen (mg/L)	Salinity (ppt)	Turbidity (ntu)
Old Inlet	September	21.7	7.24	5.8	n/a
	October	16.65	7.005	16.2	8.1
	November	*Not sampled.			n/a
	December	*Not sampled.			n/a
	April	10.15	9.17	5.2	8.3
	May	15.6	10.85	10.9	3.53
Cupsogue	September	21.9	8.89	31.1	n/a
	October	18.25	7.83	30	7
	November	10.8	10.2	26.2	7.15
	December	3.3	13.31	27.9	n/a
	April	14.65	9.605	22.2	3.3
	May	18.5	9.37	22.85	2.01
Picket Point	September	23.2	n/a	32.1	n/a
	October	15.25	7.55	28.6	9.375
	November	10.7	9.33	26.6	11.25
	December	4	11.69	22.7	n/a
	April	16.6	10.53	25.75	10.2
	May	24.8	8.31	29.3	n/a
Ponquogue East	September	18.9	4.70	31.00	n/a
	October	11.5	7.05	30.95	9.35
	November	5.2	9.25	27.20	8
	December	4	12.65	27.60	n/a
	April	9.75	9.185	28.2	7.65
	May	14.25	9.34	29.05	2.16

*Not sampled due to missing navigation aids.
n/a denotes sample not available due to instrument malfunction.

TABLE 18

Seine-Comparison Study
Species Lists

Finfish

Scientific Name	Common Name
Caranx hippos	CREVALLE JACK
Etropus microstomus	SMALLMOUTH FLOUNDER
Fundulus heteroclitus	MUMMICHOG
Fundulus luciae	SPOTFIN KILLIFISH
Fundulus majalis	STRIPED KILLIFISH
Menidia menidia	ATLANTIC SILVERSIDE
Morone saxatalis	STRIPED BASS
Mugil cephalus	STRIPED MULLET
Pomatomus saltatrix	BLUEFISH
Prionotus evolans	STRIPED SEAROBIN
Pseudopleuronectes americanus	WINTER FLOUNDER
Sphoeroides maculatus	NORTHERN PUFFER
Syngnathus fuscus	NORTHERN PIPEFISH
Synodus foetens	INSHORE LIZARDFISH

Invertebrates

Callinectes sapidus	BLUE CRAB
Crangon septemspinosa	SAND SHRIMP
Ilyanassa obsoleta	MUD DOG WHELK
Neopanopeus sayi	BLACK-FINGERED MUD CRAB
Ovalipes ocellatus	LADY CRAB
Pagurus pollicaris	FLATCLAW HERMIT CRAB
Palaemonetes vulgaris	GRASS SHRIMP
	SEA JELLIES

TABLE 19

Seine-Comparison Study Finfish Collections

		30'		200' (not including 30')		Actual 200' (30' + 200')	
Station	Species	Total Number	Total Length (mm)	Total Number	Total Length (mm)	Total Number	Total Length (mm)
JAM1	*Fundulus heteroclitus*	4	30-35	50	26-68	54	26-68
JAM1	*Fundulus luciae*	1	75	4	66-94	5	66-94
JAM1	*Fundulus majalis*			27	34-92	27	34-92
JAM1	*Menidia menidia*	146	52-105	80	57-99	226	52-105
JAM1	*Morone saxatilis-Age 1+*			2	165-168	2	165-168
JAM1	*Pomatomus saltatrix-YOY*			2	203-225	2	203-225
JAM1	*Prionotus evolans*			2	60-88	2	60-88
JAM1	*Pseudopleuronectes americanus-YOY*			1	94	1	94
JAM1	*Sphoeroides maculatus*			1	19	1	19
JAM1	*Synodus foetens*	1	83	7	100-187	8	83-187
	Total Number Fishes JAM1	151		169		320	
	Total Number Species JAM1	3		9		9	
JAM2	*Caranx hippos*			4	106-153	4	106-153
JAM2	*Etropus microstomus*			1	52	1	52
JAM2	*Fundulus heteroclitus*	29	40-72	104	38-69	133	38-72
JAM2	*Fundulus majalis*	72	42-65	135	40-65	207	40-65
JAM2	*Menidia menidia*	69	58-100	58	57-99	127	57-100
JAM2	*Morone saxatilis-Age 1+*			1	302	1	302
JAM2	*Morone saxatilis-YOY*			2	136-146	2	136-146
JAM2	*Mugil cephalus*			33	168-221	33	168-221
JAM2	*Pseudopleuronectes americanus-YOY*	1	99			1	99
JAM2	*Syngnathus fuscus*			4	75-188	4	75-188
JAM2	*Synodus foetens*	1	137	2	74-114	3	74-137
	Total Number Fishes JAM2	172		344		516	
	Total Number Species JAM2	5		9		9	
JAM22	*Fundulus luciae*	6	77-110	1	72	7	72-110
JAM22	*Fundulus majalis*	26	64-130	24	43-100	50	43-130
JAM22	*Menidia menidia*	145	53-105	104	54-105	249	53-105
JAM22	*Morone saxatalis-YOY*	6	100-135			6	100-135
JAM22	*Morone saxatalis-Age 1+*			41	177-333	41	177-333
JAM22	*Pomatomus saltatrix-YOY*			13	158-212	13	158-212
JAM22	*Syngnathus fuscus*			4	114-190	4	114-190
	Total Number Fishes JAM22	183		187		370	
	Total Number Species JAM22	4		6		7	
	Total Number Fishes All Stations	506		700		1,206	
	Total Number Species All Stations	8		15		15	

*YOY designates young-of-year.

TABLE 20

Seine-Comparison Study Finfish
Total Number, Percent Composition

Species	30' Total Number	200' Total Number		30' Percent Composition	200' Percent Composition		30' Percent Compositon of 200'
Menidia menidia	360	602		71	50		30
Fundulus majalis	98	284		19	23		8
Fundulus heteroclitus	33	187		7	15		3
Morone saxatalis	6	52		1	4		<1
Mugil cephalus		33			3		0
Pomatomus saltatrix		15			1		0
Fundulus luciae	7	12		1	<1		<1
Synodus foetens	2	11		<1	<1		<1
Syngnathus fuscus		8			<1		0
Caranx hippos		4			<1		0
Prionotus evolans		2			<1		0
Pseudopleuronectes americanus	1	2		<1	<1		<1
Etropus microstomus		1			<1		0
Sphoeroides maculatus		1			<1		0
Total	*507*	*1214*					*42%*

T value	-0.1940007
P value	0.8482344
Degrees of Freedom	19

TABLE 21

Seine-Comparison Study
Invertebrate Collections

Station	Species	30'	200'	Actual 200' (30' + 200')
		Total No.	Total No.	Total No.
JAM1	*Pagurus pollicaris* [1]	3	7	10
JAM1	*Callinectes sapidus*-YOY [2]	8		8
JAM1	*Neopanopeus sayi*	2	1	3
JAM1	*Callinectes sapidus*-OLDER	2		2
JAM1	*Ilyanassa obsoleta*	P [3]	P	P
JAM1	*Crangon septemspinosa*	P		P
JAM1	*Palaemonetes vulgaris*	P		P
JAM1	Sea Jellies	P	P	P
JAM2	*Callinectes sapidus*-YOY	1		1
JAM2	*Crangon septemspinosa*	P		P
JAM2	Sea Jellies	P		P
JAM22	*Ovalipes ocellatus*	3		3
JAM22	*Callinectes sapidus*-YOY	2		2
JAM22	*Callinectes sapidus*-OLDER	2		2

[1] Only crabs were counted in invertebrate collections.
[2] YOY = young-of-the-year.
[3] P denotes animal present, but not counted.

Results from t-test:

T value	-0.720917
P value	0.482826
Degrees of Freedom	14

TABLE 22

Dry Weight of Plant Clippings (g/m^2)

Spartina alterniflora

Shinnecock Bay

	Ponquogue East	Ponquogue West	Tiana Beach
Replicate 1	722	111	556
Replicate 2	444	222	556
Replicate 3	444	167	778
Replicate 4	333	111	472
Replicate 5	139	222	278
Mean	**417**	**167**	**528**

Moriches Bay

	Picket Point	Cupsogue Beach
Replicate 1	56	694
Replicate 2	194	611
Replicate 3	167	444
Replicate 4	111	611
Replicate 5	889	361
Mean	**283**	**544**

Great South Bay

	Pattersquash	Old Inlet	Long Cove	Clam Pond
Replicate 1	500	194	528	722
Replicate 2	556	83	139	444
Replicate 3	444	361	56	444
Replicate 4	389	83	222	500
Replicate 5	250	139	250	1,278
Mean	**428**	**172**	**239**	**678**

TABLE 23

Dry Weight of Plant and Roots (g/m^2)

Spartina alterniflora

Shinnecock Bay

	Ponquogue East	Ponquogue West	Tiana Beach
Replicate 1	4,500	1,000	3,500
Replicate 2	21,000	5,000	2,750
Replicate 3	14,000	2,500	7,000
Replicate 4	1,250	500	3,000
Replicate 5	1,500	1,500	3,500
Mean	8,450	2,100	3,950

Moriches Bay

	Picket Point	Cupsogue Beach
Replicate 1	250	2,500
Replicate 2	2,250	8,500
Replicate 3	1,250	8,500
Replicate 4	2,000	6,000
Replicate 5	15,000	15,500
Mean	4,150	8,200

Great South Bay

	Pattersquash	Old Inlet	Long Cove	Clam Pond
Replicate 1	16,500	4,000	4,500	2,000
Replicate 2	13,000	2,500	2,250	1,250
Replicate 3	19,500	3,250	750	9,250
Replicate 4	2,500	5,750	3,500	8,500
Replicate 5	12,000	6,000	3,000	7,000
Mean	12,700	4,300	2,800	5,600

TABLE 24
Throw Trap and Stubble Sites
Vegetation Survey

Throw Trap Sites: Great South Bay

Station	Rep	Latitude	Longitude	Weight (g/m^2)
Kismet	not sampled			
Clam Pond	1	40'38'29.27	73'11'36.66	722
Clam Pond	2	40'38'29.97	73'11'36.18	444
Clam Pond	3	40'38'30.40	73'11'36.35	444
Clam Pond	4	40'38'30.19	73'11'34.97	500
Clam Pond	5	40'38'29.57	73'11'34.86	1,278
Mean				*678*
Sailors Haven	not sampled			
Barrett Beach	not sampled			
Watch Hill	1	40'42'01.31	72'57'58.16	528
Watch Hill	2	40'42'01.91	72'57'59.09	139
Watch Hill	3	40'42'02.75	72'57'59.64	56
Watch Hill	4	40'42'03.36	72'57'59.97	222
Watch Hill	5	40'42'04.12	72'58'00.71	250
Mean				*239*
Old Inlet	1	40'43'45.33	72'53'39.66	194
Old Inlet	2	40'43'47.32	72'53'39.66	83
Old Inlet	3	40'43'47.46	72'53'39.00	361
Old Inlet	4	40'43'47.27	72'53'39.26	83
Old Inlet	5	40'43'47.54	72'53'39.16	139
Mean				*172*
Pattersquash	1	40'44'48.18	72'49'40.32	500
Pattersquash	2	40'44'47.71	72'49'40.87	556
Pattersquash	3	40'44'47.60	72'49'41.25	444
Pattersquash	4	40'44'47.10	72'49'42.00	389
Pattersquash	5	40'44'48.31	72'49'40.49	250
Mean				*428*

Stubble Sites: Great South Bay

Station	Rep	Latitude	Longitude	Count
Kismet	1	40'39'09.936	73'11'39.928	27
Kismet	2	40'38'04.632	73'12'53.208	68
Kismet	3	40'38'04.992	73'12'52.416	188
Kismet	4	40'38'04.668	73'12'54.684	61
Kismet	5	40'38'04.308	73'12'55.656	12
Mean				*71*
Clam Pond	1	40'39'27.144	73'06'34.2	181
Clam Pond	2	40'38'58.47	73'06'34.2	303
Clam Pond	3	40'38'29.796	73'06'34.2	120
Clam Pond	4	40'38'29.796	73'11'36.096	130
Clam Pond	5	40'38'30.012	73'11'35.664	104
Mean				*168*
Sailors Haven	1	40'39'24.012	73'06'34.200	42
Sailors Haven	2	40'39'23.94	73'06'34.236	70
Sailors Haven	3	40'39'21.600	73'06'35.532	15
Sailors Haven	4	40'39'23.04	73'06'35.532	26
Sailors Haven	5	40'39'23.616	73'06'37.008	1
Mean				*31*
Barrett Beach	1	40'40'27.300	73'02'18.384	13
Barrett Beach	2	40'40'27.300	73'07'19.56	60
Barrett Beach	3	40'40'27.300	73'12'21.528	22
Barrett Beach	4	40'40'27.300	72'57'16.812	45
Barrett Beach	5	40'40'27.300	72'52'13.8	42
Mean				*36*
Watch Hill	1	40'42'01.692	72'57'58.536	87
Watch Hill	2	40'42'02.016	72'57'59.148	233
Watch Hill	3	40'42'03.096	72'57'59.328	248
Watch Hill	4	40'42'02.736	72'58'00.696	344
Watch Hill	5	40'42'03.276	72'58'01.272	294
Mean				*241*
Old Inlet	1	40'43'43.896	72'53'36.96	125
Old Inlet	2	40'43'44.328	72'53'36.96	199
Old Inlet	3	40'43'43.932	72'53'36.528	16
Old Inlet	4	40'43'43.14	72'53'36.168	83
Old Inlet	5	40'43'41.772	72'53'38.796	188
Mean				*122*
Pattersquash	1	40'47'42.936	72'38'46.248	22
Pattersquash	2	40'47'42.936	72'33'44.676	23
Pattersquash	3	40'47'42.936	72'26'12.318	64
Pattersquash	4	40'47'42.936	72'43'47.82	9
Pattersquash	5	40'47'42.936	72'51'20.178	13
Mean				*26*

TABLE 24 (continued)
Throw Trap and Stubble Sites
Vegetation Survey

Throw Trap Sites: Moriches Bay

Station	Rep	Latitude	Longitude	Weight (g/m^2)
Cupsogue	1	40'46'20.96	72'44'19.45	694
Cupsogue	2	40'46'19.63	72'44'18.07	611
Cupsogue	3	40'46'19.27	72'44'14.57	444
Cupsogue	4	n/a	n/a	611
Cupsogue	5	40'46'22.43	72'44'16.80	361
Mean				*544*
Dune	not sampled			
Pikes	not sampled			
Picket Point	1	40'47'27.70	72'39'49.85	56
Picket Point	2	40'47'29.90	72'39'50.37	194
Picket Point	3	40'47'30.71	72'39'50.78	167
Picket Point	4	40'47'32.16	72'39'51.36	111
Picket Point	5	40'47'31.13	72'39'51.28	889
Mean				*283*
Jessup	not sampled			
		Shinnecock Bay		
Tiana	1	40'49'29.68	72'32'51.15	556
Tiana	2	40'49'30.08	72'32'50.44	556
Tiana	3	40'49'30.43	72'32'50.93	778
Tiana	4	40'49'31.21	72'32'50.47	472
Tiana	5	40'49'30.25	72'32'52.58	278
Mean				*528*
Pon West	1	40'51'10.72	72'30'21.02	111
Pon West	2	40'51'10.64	72'30'22.09	222
Pon West	3	40'51'10.93	72'30'23.02	167
Pon West	4	40'51'11.67	72'30'21.94	111
Pon West	5	40'51'11.93	72'30'18.29	222
Mean				*167*
Pon East	1	40'50'25.43	72'29'18.39	722
Pon East	2	40'50'24.98	72'29'19.43	444
Pon East	3	40'50'25.46	72'29'19.43	444
Pon East	4	40'50'25.46	72'29'19.40	333
Pon East	5	40'50'26.52	72'29'19.78	139
Mean				*416*

Stubble Sites: Moriches Bay

Station	Rep	Latitude	Longitude	Count
Cupsogue	1	40'46'22.08	72'44'19.86	164
Cupsogue	2	40'46'22.5	72'44'19.14	82
Cupsogue	3	40'46'21.06	72'44'19.86	28
Cupsogue	4	40'46'21.72	72'44'20.04	173
Cupsogue	5	40'46'22.14	72'44'19.8	190
Mean				*127*
Dune	1	40'46'31.116	72'43'19.56	22
Dune	2	40'46'31.836	72'43'19.236	37
Dune	3	40'46'31.548	72'43'17.76	6
Dune	4	40'46'29.928	72'43'20.244	55
Dune	5	40'46'31.332	72'43'21.504	4
Mean				*25*
Pikes	1	40'46'47.82	72'42'03.312	30
Pikes	2	40'46'47.28	72'42'02.664	36
Pikes	3	40'46'49.584	72'42'02.052	149
Pikes	4	40'46'48.792	72'42'01.656	38
Pikes	5	40'46'48.0	72'42'05.76	21
Mean				*55*
Picket Point	1	40'47'22.08	72'39'51.0	732
Picket Point	2	40'47'26.94	72'39'50.76	238
Picket Point	3	40'47'26.88	72'39'50.58	203
Picket Point	4	40'47'15.78	72'39'50.1	536
Picket Point	5	40'47'28.14	72'39'50.34	111
Mean				*364*
Jessup	1	40'46'31.152	72'43'21.468	66
Jessup	2	40'47'42.54	72'38'45.852	189
Jessup	3	40'47'43.044	72'38'46.968	103
Jessup	4	40'47'43.188	72'38'48.12	50
Jessup	5	40'47'43.26	72'38'46.428	0
Mean				*82*
		Shinnecock Bay		
Tiana	1	40'50'10.32	72'30'20.16	531
Tiana	2	40'49'29.1	72'32'54.84	245
Tiana	3	40'49'29.46	72'32'54.78	340
Tiana	4	40'49'29.64	72'32'54.84	732
Tiana	5	40'43'29.82	72'32'54.78	9
Mean				*371*
Pon West	1	40'50'10.74	72'30'19.26	427
Pon West	2	40'50'10.74	72'30'19.08	370
Pon West	3	40'50'10.5	72'30'19.56	326
Pon West	4	40'50'10.38	72'30'19.92	324
Pon West	5	40'50'10.32	72'30'20.16	189
Mean				*327*
Pon East	1	40'50'25.68	72'29'17.64	75
Pon East	2	40'50'25.86	72'29'17.7	50
Pon East	3	40'50'25.98	72'29'17.76	68
Pon East	4	40'50'26.04	72'29'18.0	33
Pon East	5	40'50'26.64	72'29'18.0	21
Mean				*49*

TABLE 25
Vegetation Survey
Ratio of Plant Dry Weight to Stubble Count

Station	Throw Trap Mean Weight (g/m^2)	Stubble Mean Count	Ratio Weight:Count
Great South Bay			
Kismet	not sampled	71	
Clam Pond	678	168	4.04
Sailors Haven	not sampled	31	
Barrett Beach	not sampled	36	
Watch Hill	239	241	0.99
Old Inlet	172	122	1.41
Pattersquash	428	26	16.33
Moriches Bay			
Cupsogue	544	127	4.27
Dune	not sampled	25	
Pikes	not sampled	55	
Picket Point	283	364	0.78
Jessup	not sampled	82	
Shinnecock Bay			
Tiana	528	371	1.42
Pon West	167	327	0.51
Pon East	416	49	8.43

TABLE 26

List of Finfish and Invertebrates Species Collected in Throw Traps

Finfish:

Anchoa mitchilli	Bay Anchovy
Cyprinodon variegatus	Sheepshead Minnow
Fundulus heteroclitus	Mummichog
Fundulus majalis	Striped Killifish

Invertebrates:

Amphipods	
Callinectes sapidus	Blue Crab
Ctenophores	
Geukensia demissa	Ribbed Mussel
Ilyanassa obsoleta	Eastern Mud Snail
Isopods	
Limulus polyphemus	Horseshoe Crab
Lunatia heros	Northern Moonsnail
Mytilus edulis	Blue Mussel
Neopanopeus sayi	Say Mud Crab
Palaemonetes vulgaris	Grass Shrimp
Pinnotheres maculatus	Squatter Pea Crab
Polychaetes	
Spisula solidissima	Atlantic Surf Clam
Uca pugilator	Atlantic Sand Fiddler Crab

TABLE 27

Throw Trap Survey - September 2000
Fishes and Invertebrates Abundances & Weights

Shinnecock Bay

Ponquogue East	# Fish/m²	Wt. Fish/m² (g)	# Inverts/m²
Replicate 1	2	1.1	6
Replicate 2	2	2.3	1
Replicate 3	6	2.2	2
Replicate 4	13	2	18
Replicate 5	2	2.6	60
Mean	*5.0*	*2.0*	*17.4*

Ponquogue West	# Fish/m²	Wt. Fish/m² (g)	# Inverts/m²
Replicate 1	2	0.8	1
Replicate 2	4	2.2	2
Replicate 3	0	0	0
Replicate 4	3	1.4	3
Replicate 5	38	55.5	3
Mean	*9.4*	*12.0*	*1.8*

Tiana	# Fish/m²	Wt. Fish/m² (g)	# Inverts/m²
Replicate 1	0	0	0
Replicate 2	2	1.7	3
Replicate 3	4	2.5	2
Replicate 4	1	1.0	--
Replicate 5	0	0	0
Mean	*1.4*	*1.0*	*1.0*

Great South Bay

Pattersquash	# Fish/m²	Wt. Fish/m² (g)	# Inverts/m²
Replicate 1	6	3.8	1
Replicate 2	0	0	0
Replicate 3	1	0.6	5
Replicate 4	15	13.1	27
Replicate 5	1	0.7	98
Mean	*4.6*	*3.6*	*26.2*

Old Inlet	# Fish/m²	Wt. Fish/m² (g)	# Inverts/m²
Replicate 1	1	1.4	0
Replicate 2	0	0	0
Replicate 3	0	0	0
Replicate 4	1	1.2	0
Replicate 5	5	7.6	0
Mean	*1.4*	*2.0*	*0.0*

Clam Pond	# Fish/m²	Wt. Fish/m² (g)	# Inverts/m²
Replicate 1	0	0	1
Replicate 2	1	1.4	5
Replicate 3	0	0	6
Replicate 4	1	2.0	3
Replicate 5	3	1.7	4
Mean	*1.0*	*1.0*	*3.8*

Moriches Bay

Picket Point	# Fish/m²	Wt. Fish/m² (g)	# Inverts/m²
Replicate 1	29	27.9	0
Replicate 2	0	0	0
Replicate 3	27	13.8	1
Replicate 4	24	4.1	10
Replicate 5	0	0	0
Mean	*16.0*	*9.2*	*2.2*

TABLE 28

Throw Trap Survey
T-tests Comparing Vegetation with Animals

Vegetation vs. Fish Abundance

T value	5.518779417
P value	**7.56483E-05**
Degrees of Freedom	14

Vegetation vs. Fish Weight

T value	5.536131507
P value	**7.33417E-05**
Degrees of Freedom	14

Vegetation vs. Invertebrate Abundance

T value	5.48579358
P value	**8.02439E-05**
Degrees of Freedom	14

TABLE 29
West Hampton Island Sediment Samples

STATION	SAMPLE	DESCRIPTION
Cupsogue	Lo	Brown medium to fine SAND
Cupsogue	Lo-East	Brown medium to fine SAND
Cupsogue	Lo-West	Brown medium to fine SAND, trace fine gravel
Cupsogue	Mid	Light brown medium to fine SAND
Cupsogue	Mid-East	Light brown medium to fine SAND, trace fine gravel
Cupsogue	Mid-West	Brown medium to fine SAND
Cupsogue	Hi	Light brown fine SAND, trace medium sand
Dune	Lo	Brown medium to fine SAND
Dune	Lo-East	Brown medium to fine SAND
Dune	Lo-West	Brown medium to fine SAND
Dune	Mid	Light brown medium to fine SAND
Dune	Mid-East	Brown medium to fine SAND
Dune	Mid-West	Brown medium to fine SAND
Dune	Hi	Light brown medium to fine SAND
Picket Point	Lo	Brown medium to fine SAND
Picket Point	Lo-East	Brown medium to fine SAND
Picket Point	Lo-West	Brown medium to fine SAND
Picket Point	Mid	Brown medium to fine SAND
Picket Point	Mid-East	Light brown medium to fine SAND
Picket Point	Mid-West	Brown medium to fine SAND
Picket Point	Hi	Light brown medium to fine SAND
Jessup	Lo	Brown medium to fine SAND, trace fine gravel
Jessup	Lo-East	Brown medium to fine SAND
Jessup	Lo-West	Brown medium to fine SAND, trace fine gravel
Jessup	Mid	Light brown medium to fine SAND
Jessup	Mid-East	Light brown medium to fine SAND
Jessup	Mid-West	Brown medium to fine SAND
Jessup	Hi	Brown medium to fine SAND
Ponquogue West	Lo	Dark brown coarse to fine gravelly coarse to fine SAND, trace silt
Ponquogue West	Lo-East	Dark brown fine SAND, trace medium sand, silt, organic matter
Ponquogue West	Lo-West	Dark brown coarse to fine SAND, trace fine gravel, silt, organic matter
Ponquogue West	Mid	Dark brown medium to fine SAND, trace fine gravel
Ponquogue West	Mid-East	Brown medium to fine SAND
Ponquogue West	Mid-West	Brown medium to fine SAND, trace fine gravel
Ponquogue West	Hi	Dark brown coarse to fine gravelly coarse to fine SAND, trace silt
Ponquogue East	Lo	Brown medium to fine SAND, trace course sand
Ponquogue East	Lo-East	Brown medium to fine SAND, trace course sand
Ponquogue East	Lo-West	Brown medium to fine SAND, trace course sand
Ponquogue East	Mid	Brown medium to fine SAND
Ponquogue East	Mid-East	Brown medium to fine SAND
Ponquogue East	Mid-West	Light brown medium to fine SAND
Ponquogue East	Hi	Light brown medium to fine SAND

TABLE 30
List of Benthic Invertebrates from West Hampton Island

Scientific Name	Common Name
ANNELIDA	
Aricidea jeffreysii	Orbiniid Worm
Capitellidae	Capitellid Thread Worm
Heteromastus filiformis	Capitellid Thread Worm
Lumbrineris acuta	Lumbrinerid Thread Worm
Lumbrineris tenuis	Lumbrinerid Thread Worm
Nereis arenaceodonta	White Clam Worm
Nereis virens	Common Clam Worm
Oligochaeta	Aquatic Earthworm
Opheliidae	Opheliid Worm
Oweniidae	Bamboo Worm
Paraonidae	Thread Worm
Polydora ligni	Mud Worm
Scoloplos robustus	Orbiniid Worm
Scoloplos sp.	Orbiniid Worm
Scyphacella arenicola	Aquatic Sowbug-Isopod
Spio filicornis	Mud Worm
Streblospio benedicti	Mud Worm
Syllidae	Syllid Worm
ARTHRPODA	
Coleoptera	Beetle
Copepoda	Copepod
Corophium acherusicum	Tubicolous Amphipod
Gammarus annulatus	Scud Amphipod
Gammarus oceanicus	Scud Amphipod
Limonia sp.	Crane Fly
Limoniinae	Crane Fly
Limulus polyphemus	Horseshoe Crab
Orchestia grillus	Beach Flea Amphipod
Protohaustorius wigleyi	Scud Amphipod
Saldidae sp.	
Aracnida	Spider
Tanais cavolini	Tanaid
ASCHELMINTHES	
Nematoda	Roundworm
Nematomorpha	Hairworm
MOLLUSCA	
Gemma gemma	Gem Shell Clam
Mytilus edulis	Blue Mussel
Spisula solidissima	Surf Clam
Tellina agilis	Dwarf Tellin Clam
RHYNCHOCOELA	
Rhynchocoela	Ribbon Worm

TABLE 31
Total Number of Benthic Invertebrates by Station

Station	Taxon	Spring Number by Group	Spring Station Total
Cupsogue	Annelida	42	45
	Arthropoda	2	
	Aschelminthes	0	
	Mollusca	1	
	Rhynchocoela	0	
Dune	Annelida	92	100
	Arthropoda	3	
	Aschelminthes	2	
	Mollusca	3	
	Rhynchocoela	0	
Picket Point	Annelida	43	471
	Arthropoda	1	
	Aschelminthes	1	
	Mollusca	426	
	Rhynchocoela	0	
Jessup	Annelida	24	47
	Arthropoda	3	
	Aschelminthes	12	
	Mollusca	2	
	Rhynchocoela	6	
Ponquogue West	Annelida	76	116
	Arthropoda	4	
	Aschelminthes	6	
	Mollusca	30	
	Rhynchocoela	0	
Ponquogue East	Annelida	72	214
	Arthropoda	113	
	Aschelminthes	2	
	Mollusca	27	
	Rhynchocoela	0	
Totals			**993**

Station	Taxon	Fall Number by Group	Fall Station Total
Cupsogue	Annelida	14	40
	Arthropoda	25	
	Aschelminthes	1	
	Mollusca	0	
	Rhynchocoela	0	
Dune	Annelida	62	549
	Arthropoda	472	
	Aschelminthes	10	
	Mollusca	5	
	Rhynchocoela	0	
Picket Point	Annelida	149	253
	Arthropoda	21	
	Aschelminthes	62	
	Mollusca	21	
	Rhynchocoela	0	
Jessup	Annelida	185	375
	Arthropoda	73	
	Aschelminthes	115	
	Mollusca	2	
	Rhynchocoela	0	
Ponquogue West	Annelida	33	54
	Arthropoda	8	
	Aschelminthes	0	
	Mollusca	13	
	Rhynchocoela	0	
Ponquogue East	Annelida	3	8
	Arthropoda	4	
	Aschelminthes	0	
	Mollusca	1	
	Rhynchocoela	0	
Totals			**1,279**

FIGURE 1
Fire Island to Montauk Point Reformulation Project Study Area

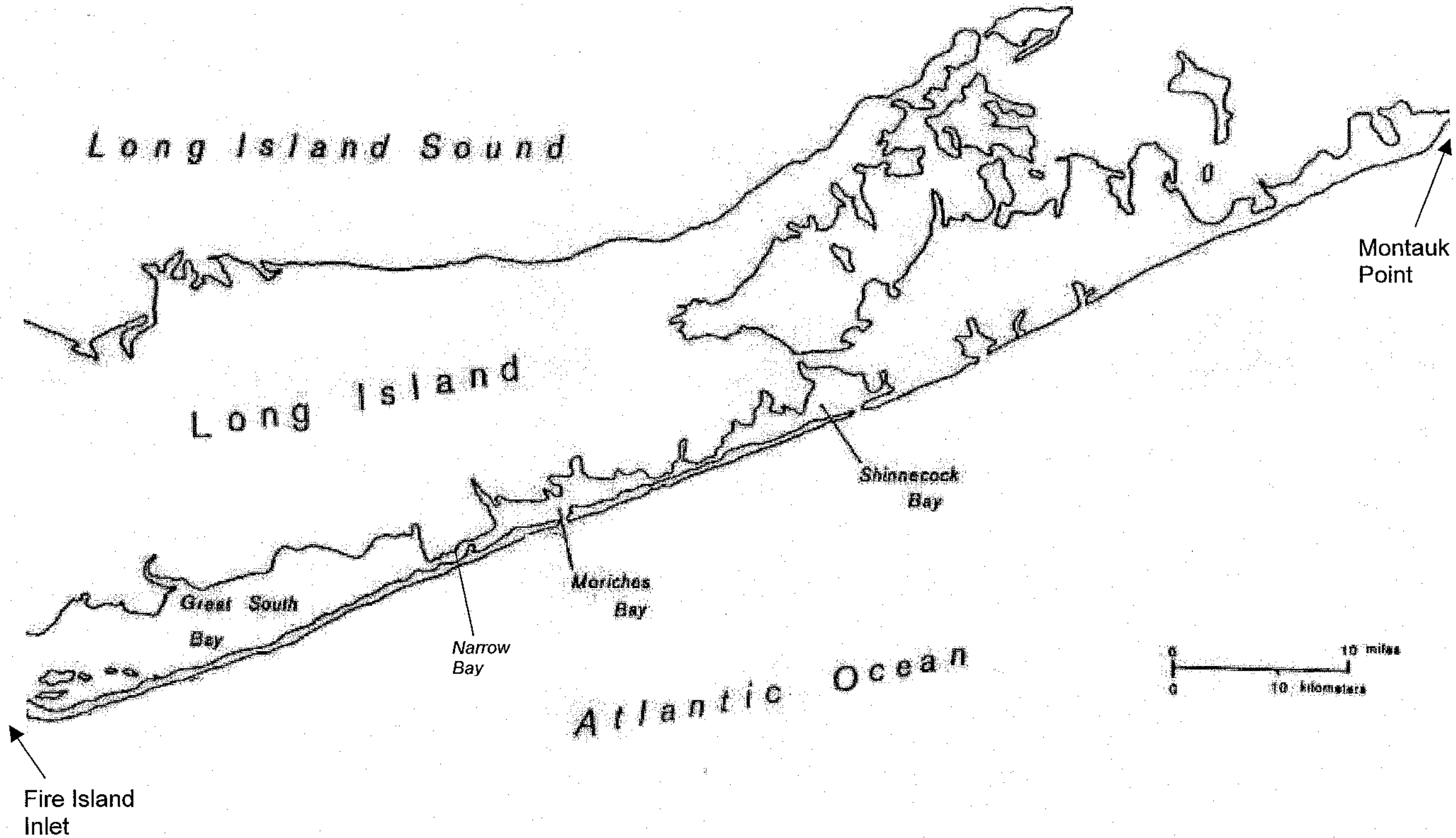


FIGURE 2
Backbay Habitat Types

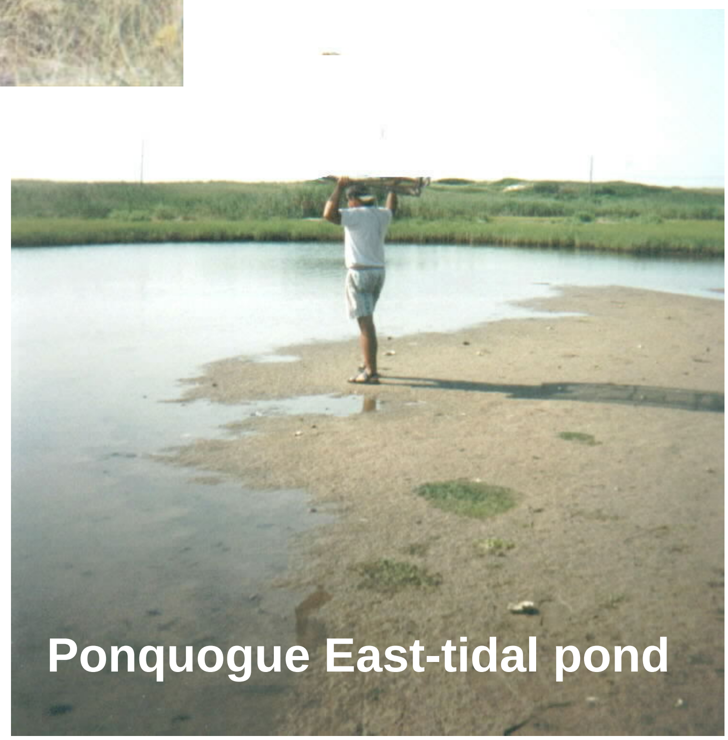


FIGURE 3
Station Sampling Map

Key

ss - Shoreline Seine & Stubble
ps - Pond Seine
tt - Throw Trap
bs - Benthics & Sediment

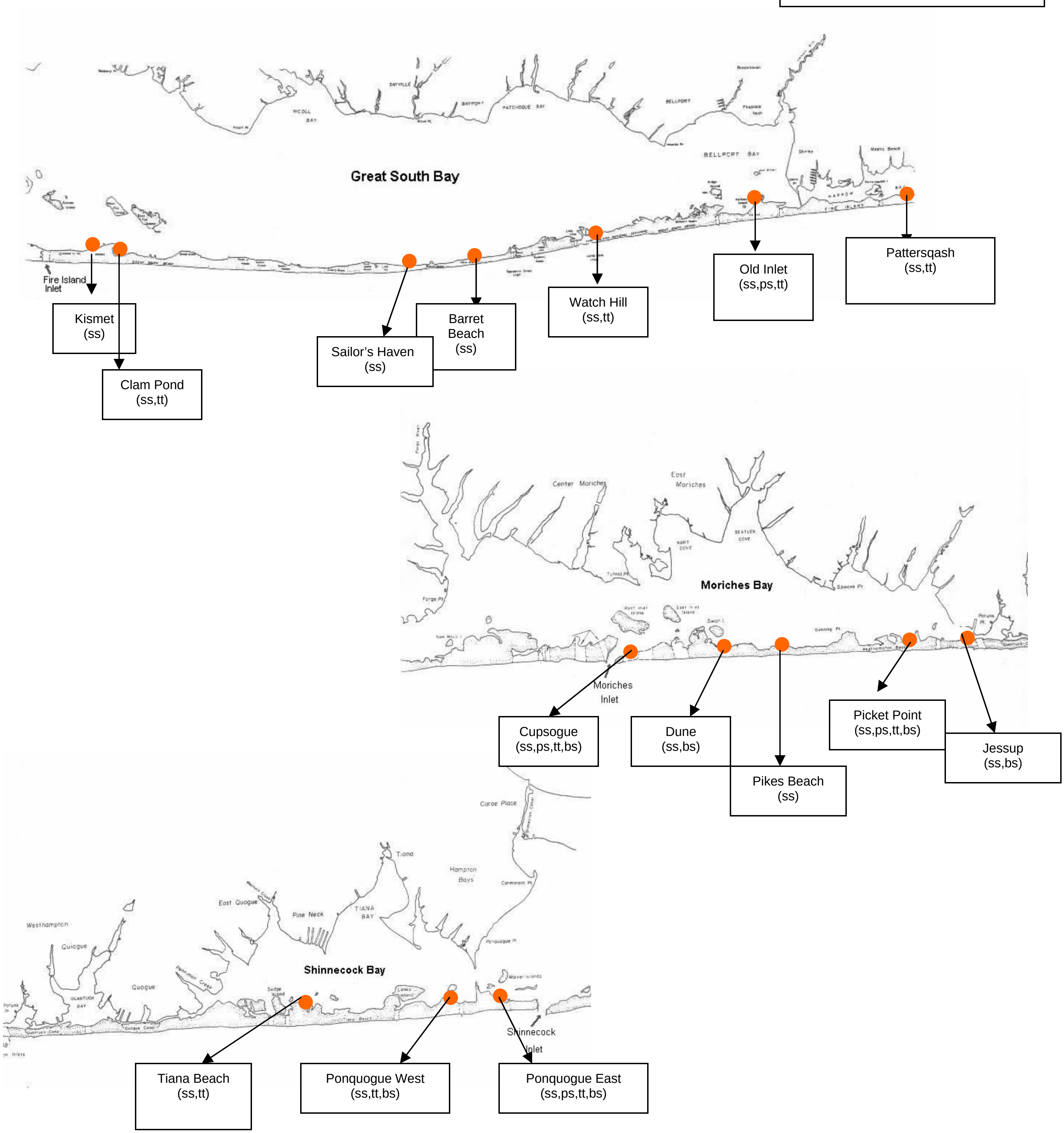


FIGURE 4
Shoreline Seine Survey

Hauling the Seine

FIGURE 5
Processing Seine Catch

Menidia menidia
(Atlantic silversides)

Identify, Measure,
Weigh and Count

Data Logging

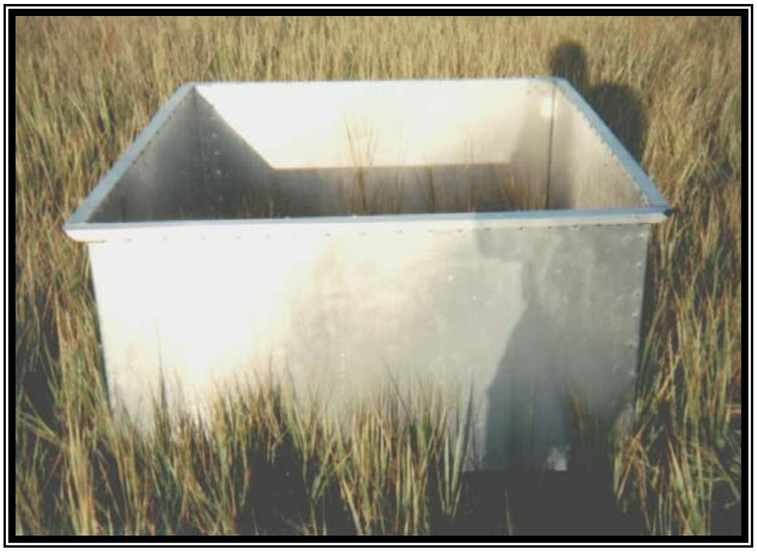
FIGURE 6
Seine Comparison Study
Jamaica Bay Stations

FIGURE 7
Seine Comparison Study with NYSDEC

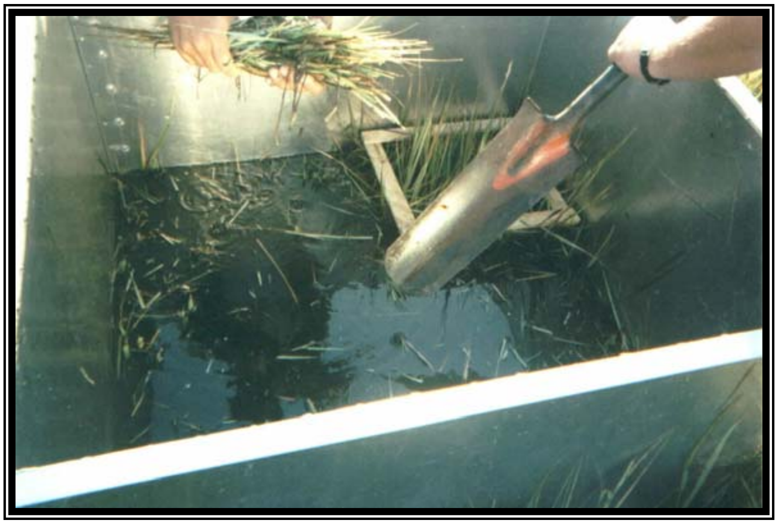
NYSDEC Setting the 200' Seine

EEA/URS Setting the 30' Net Inside of the 200' Seine

FIGURE 8
Throw Trap Survey (September 2000)

1 m^2 Aluminum Throw Trap




Clipping, Rooting and Bundling *Spartina alterniflora*

FIGURE 9
Spartina alterniflora Stubble Counts

Collecting Latitude and Longitude Using GPS

Pikes Beach **Old Inlet**

FIGURE 10
Benthic Core Survey

Collecting the Core

Sieving the Sample

FIGURE 11

Shoreline Seines

Finfish Length Frequency Distribution

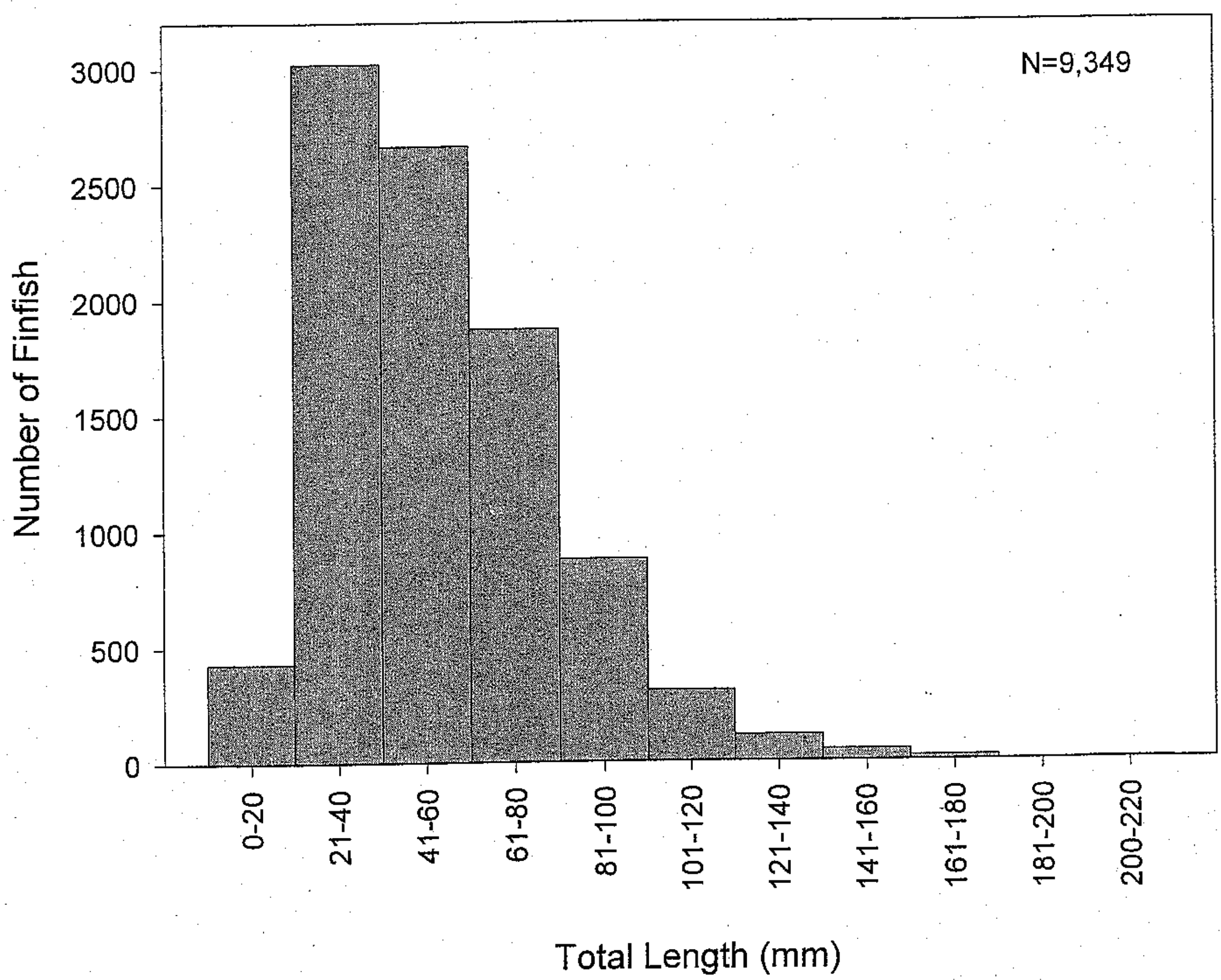


FIGURE 12
Shoreline Seines
Mean Weight (g) of Finfish per Month

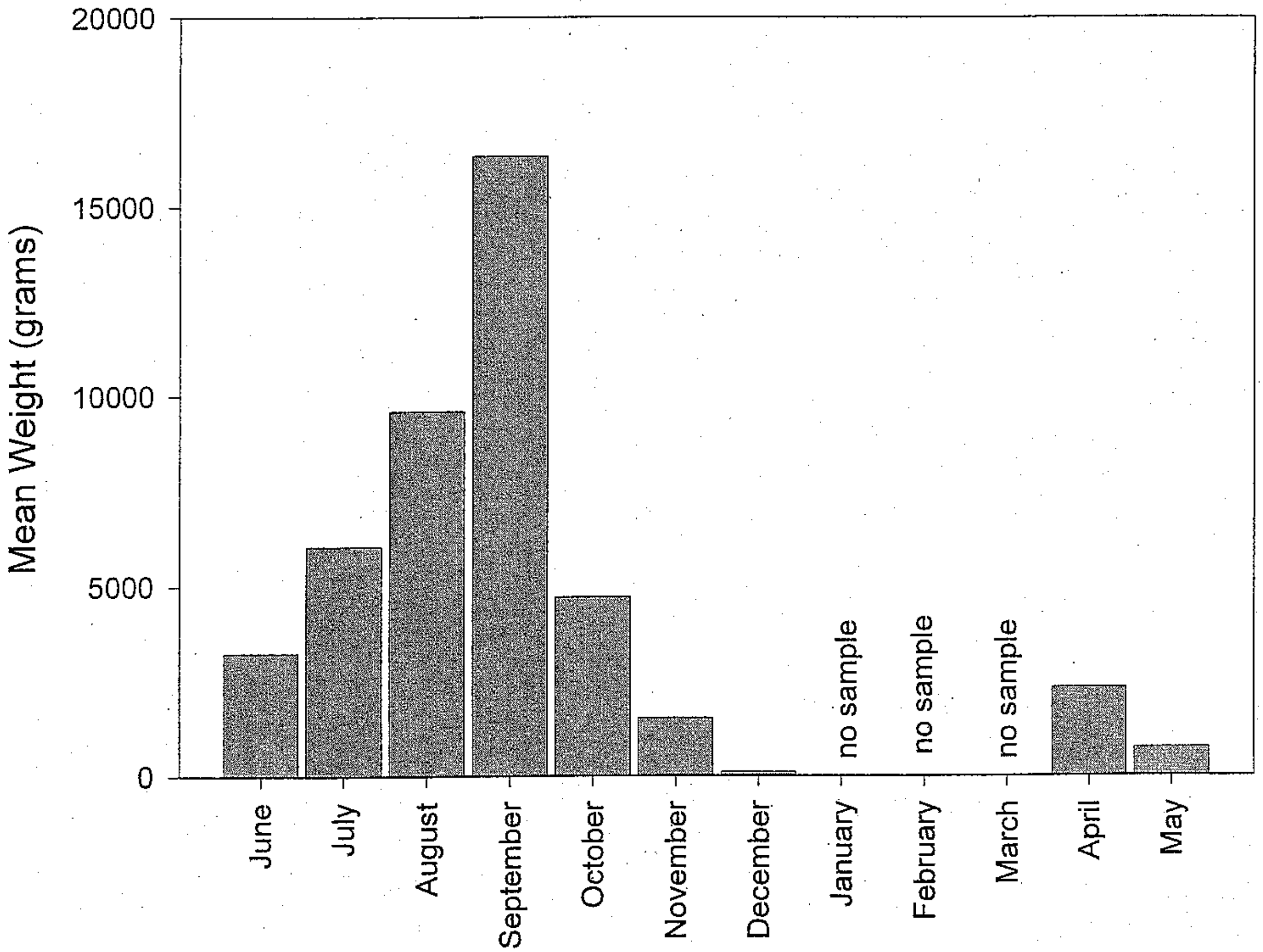


FIGURE 13
Shoreline Seines

Mean Number of Finfish per Month (CPUE)

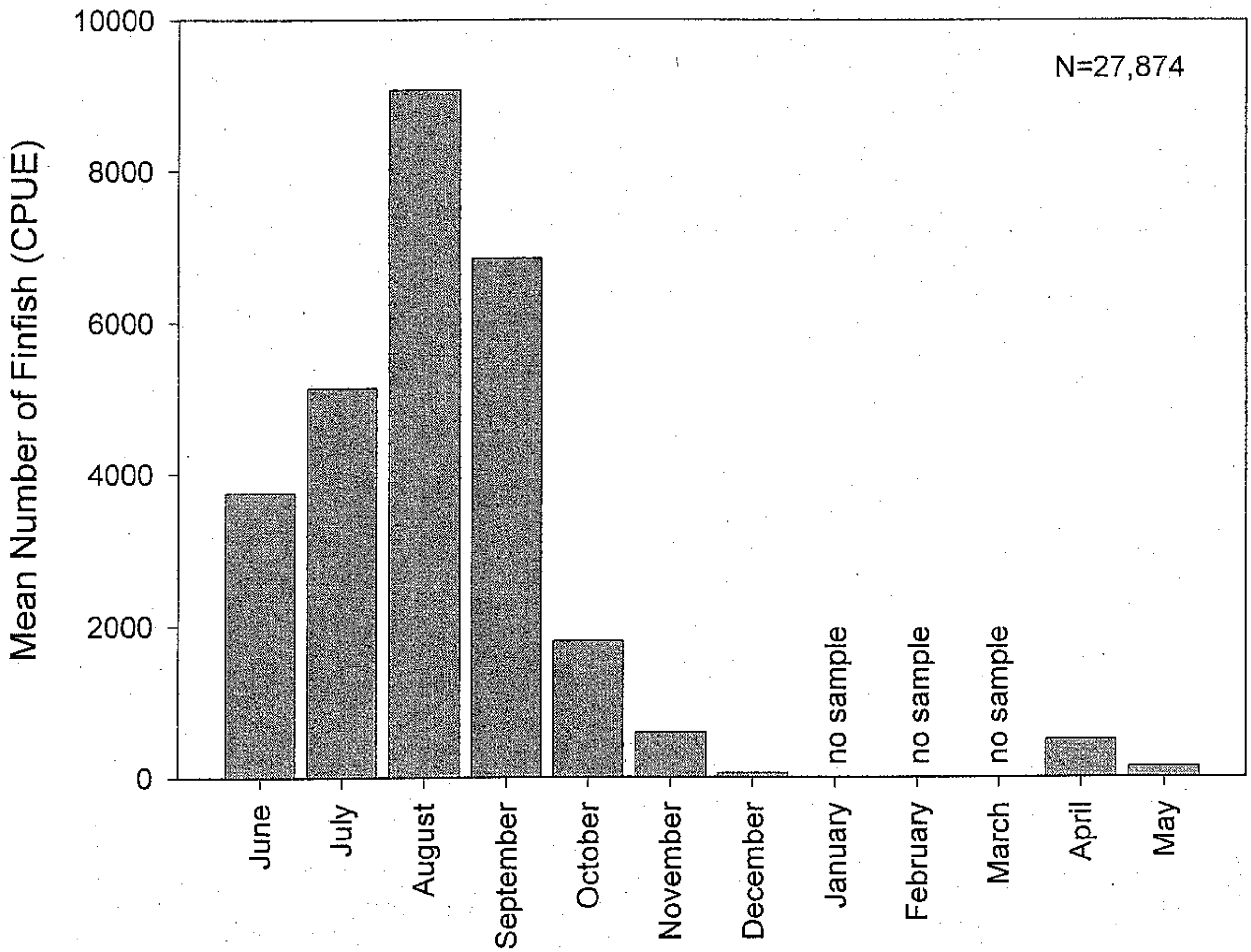


FIGURE 14

Shoreline Seines

Mean Number of Finfish and Species per Month

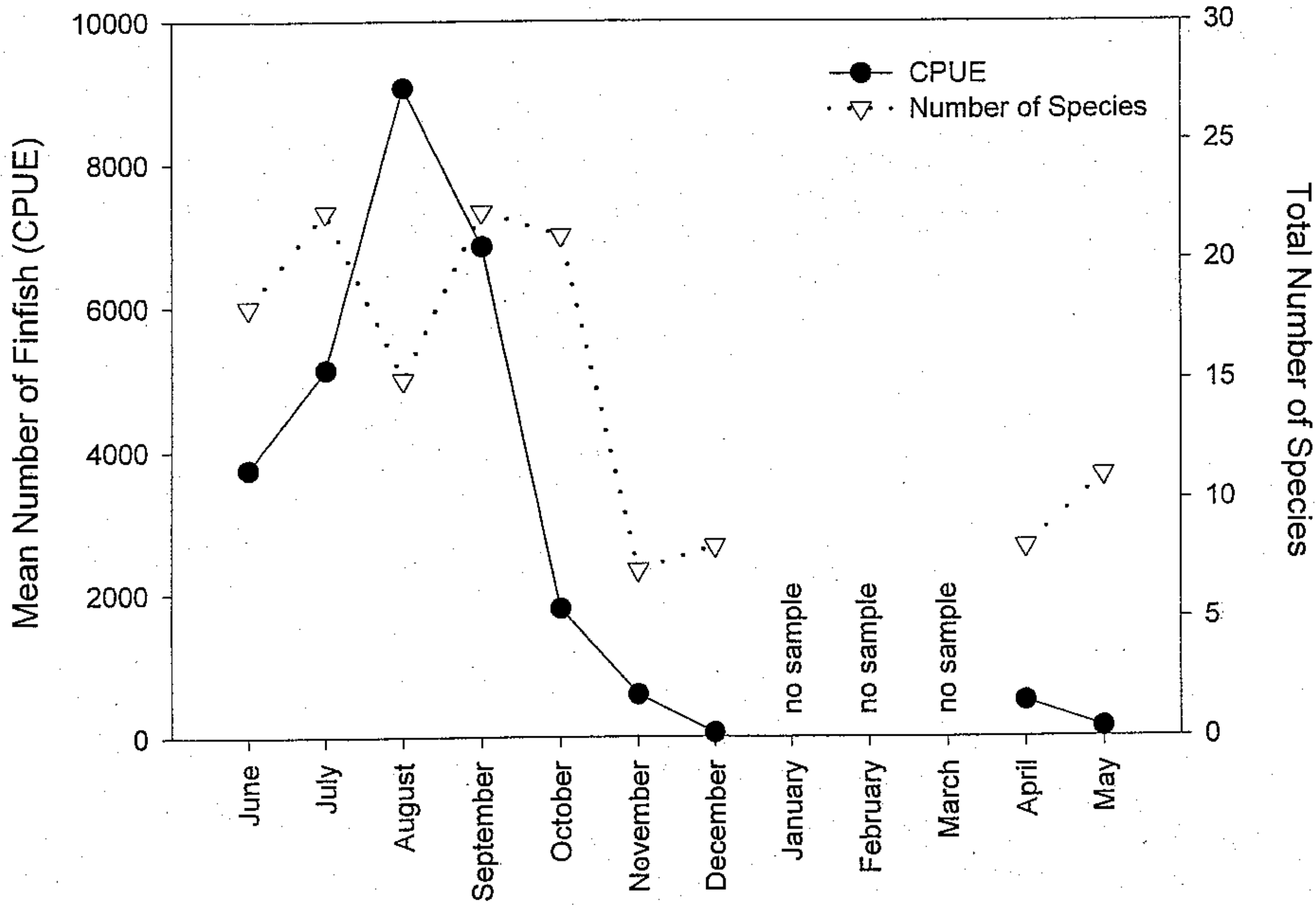


FIGURE 15

Ten Most Abundant Species: Shoreline Seines

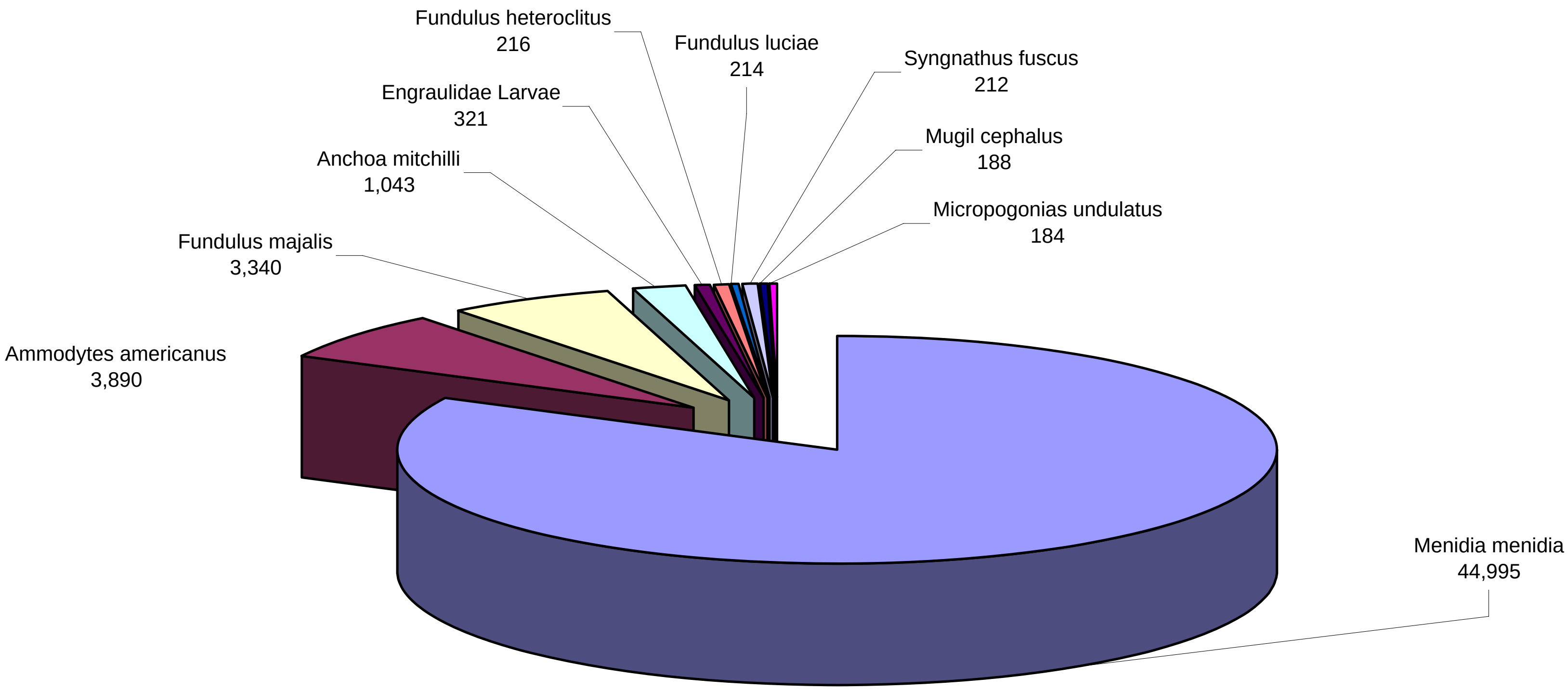


FIGURE 16
Total Number of Fishes and Species per Station

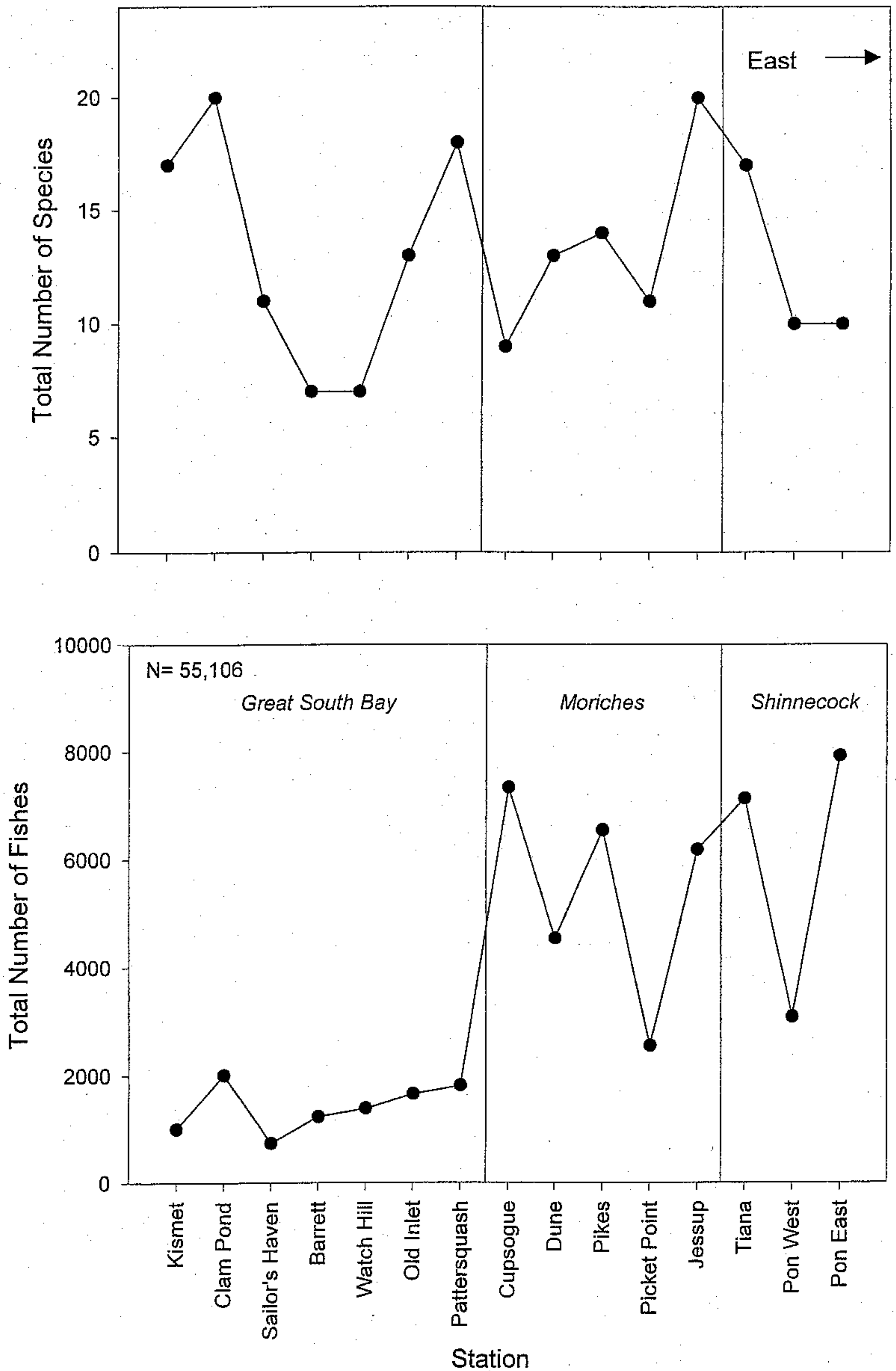


FIGURE 17
Length Frequency Distributions
Great South Bay, Moriches and Shinnecock Bays

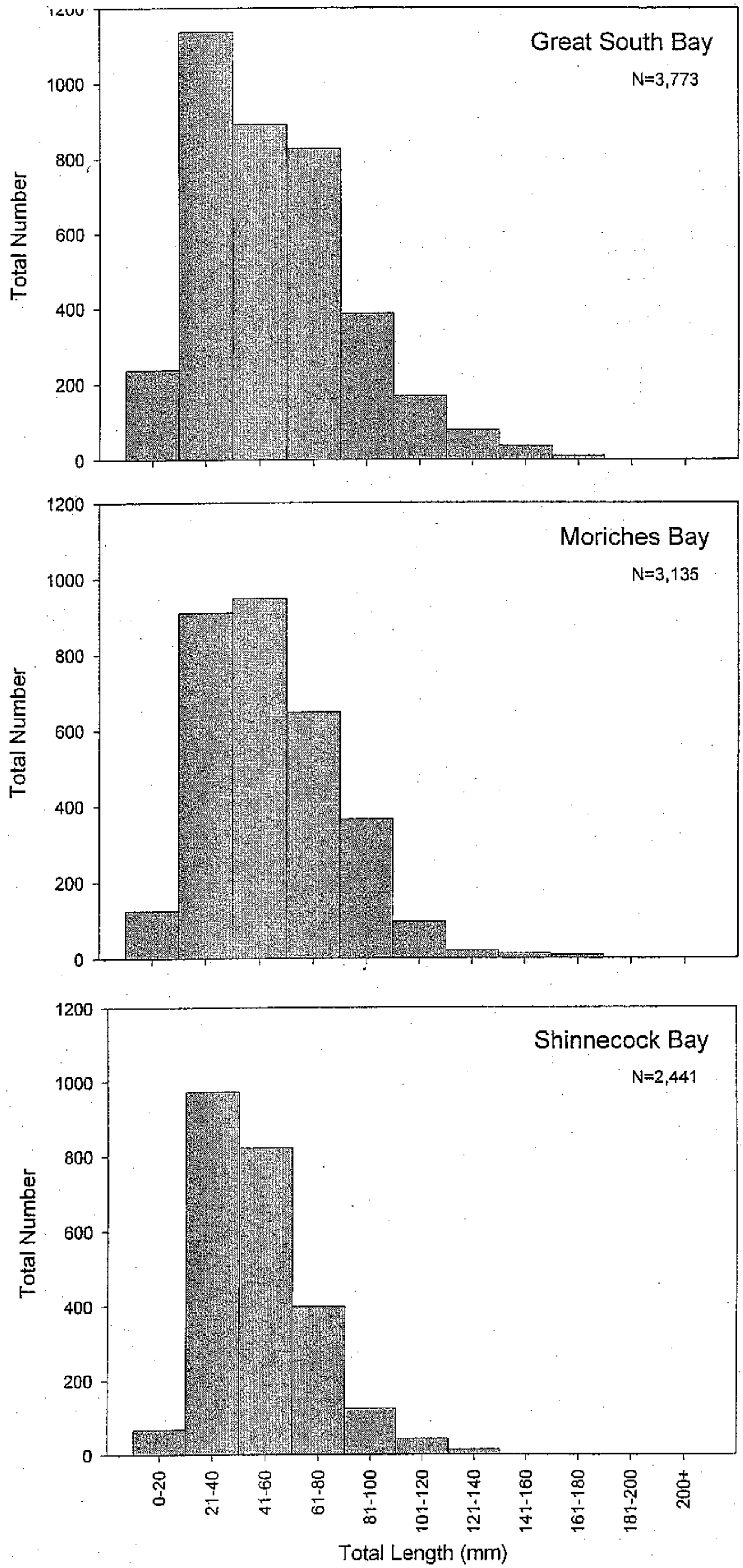


FIGURE 18
Monthly Invertebrate CPUE and Total Number of Species
Shoreline Seines

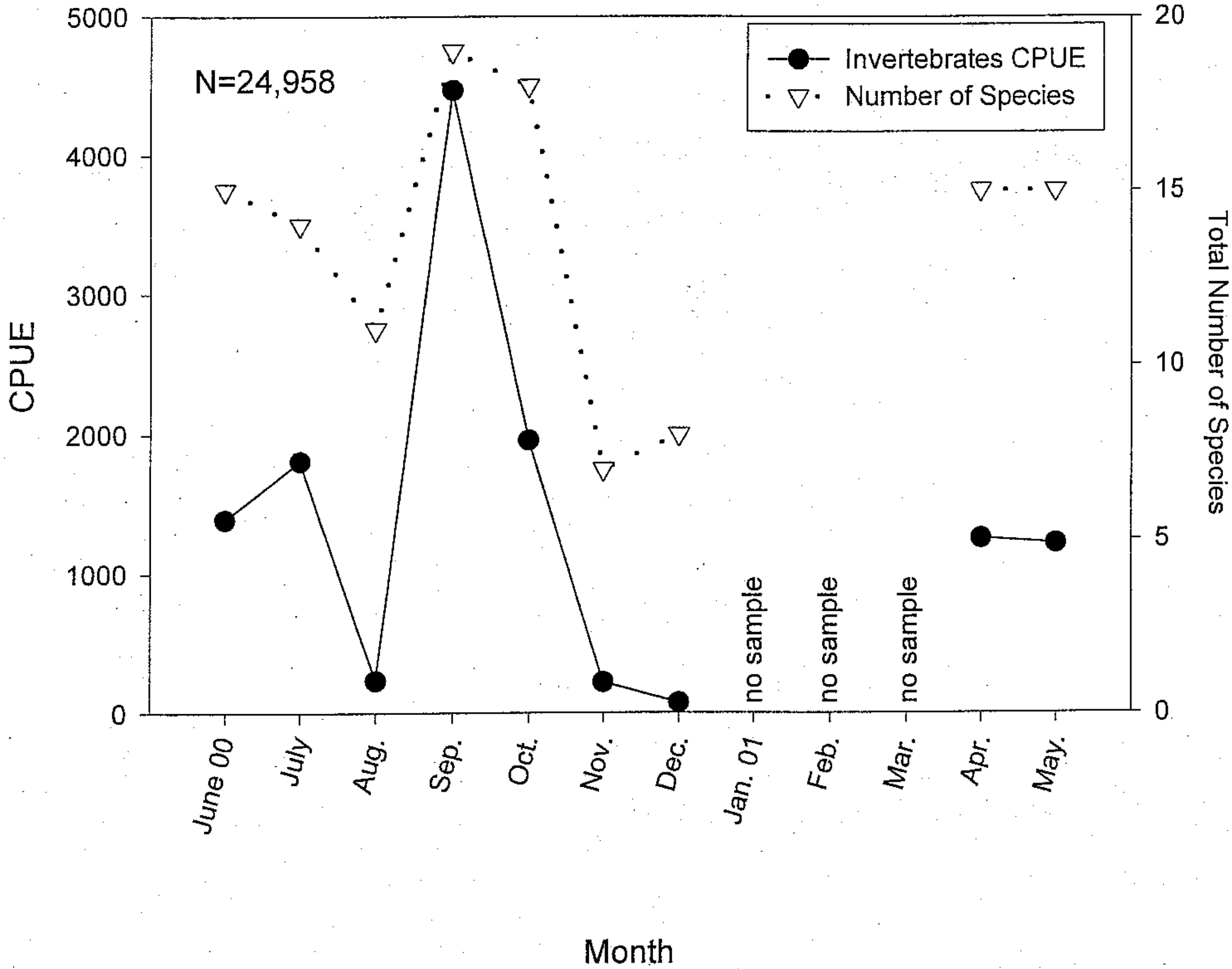


FIGURE 19
Finfish and Invertebrate CPUE per Month
Shoreline Seines

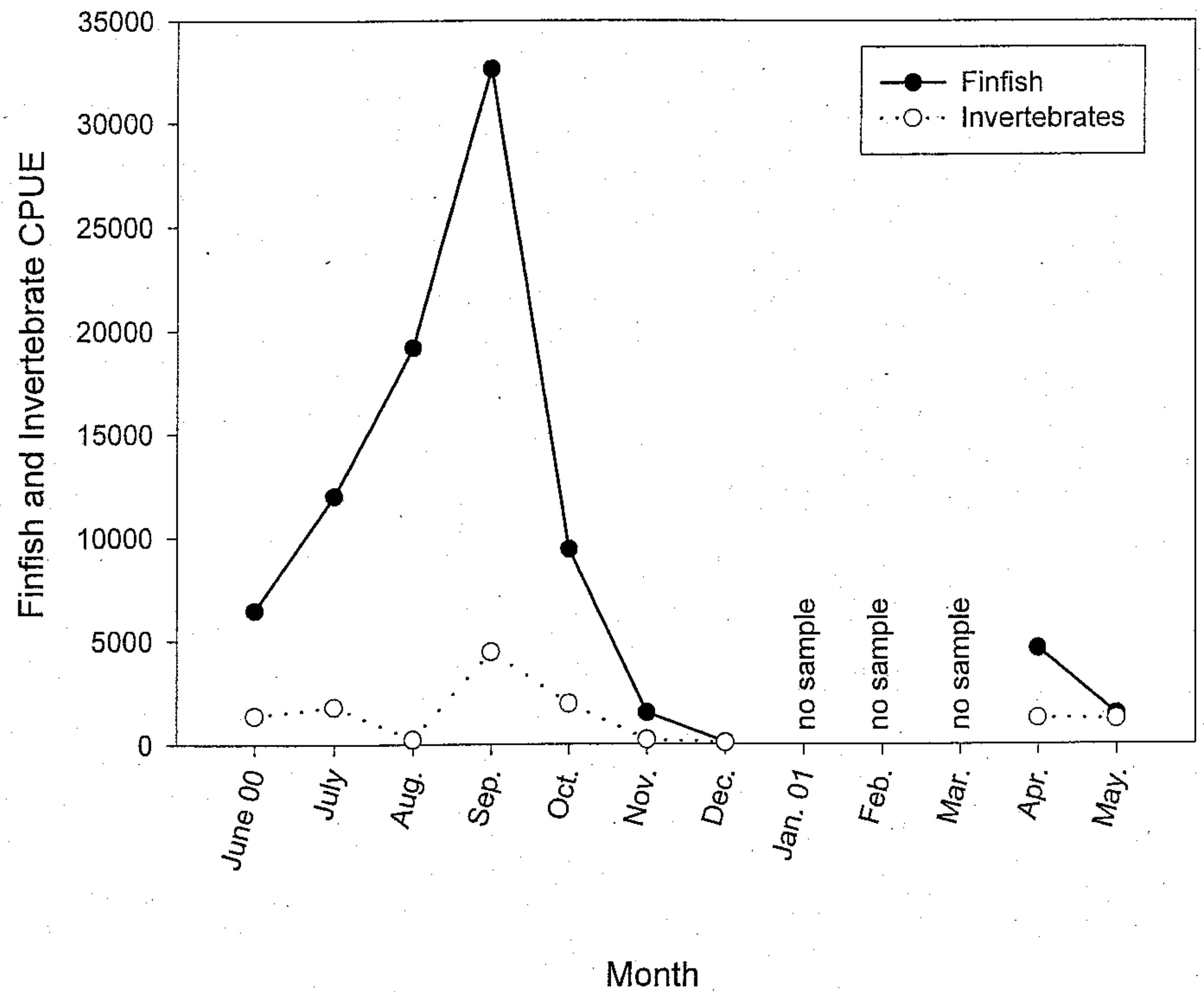


FIGURE 20
Six Most Abundant Invertebrate Species in Shoreline Seines

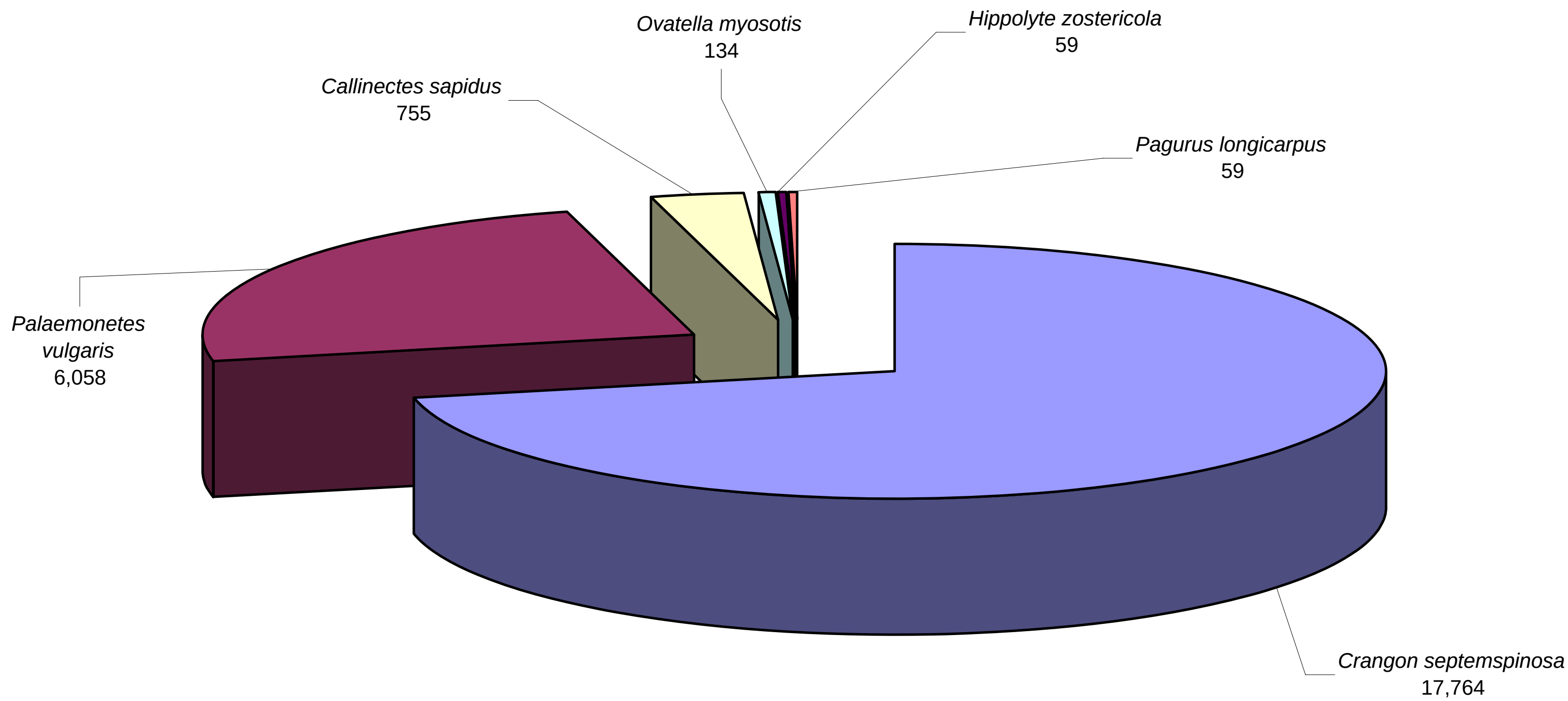


FIGURE 21
Total Number of Invertebrates and Species per Station

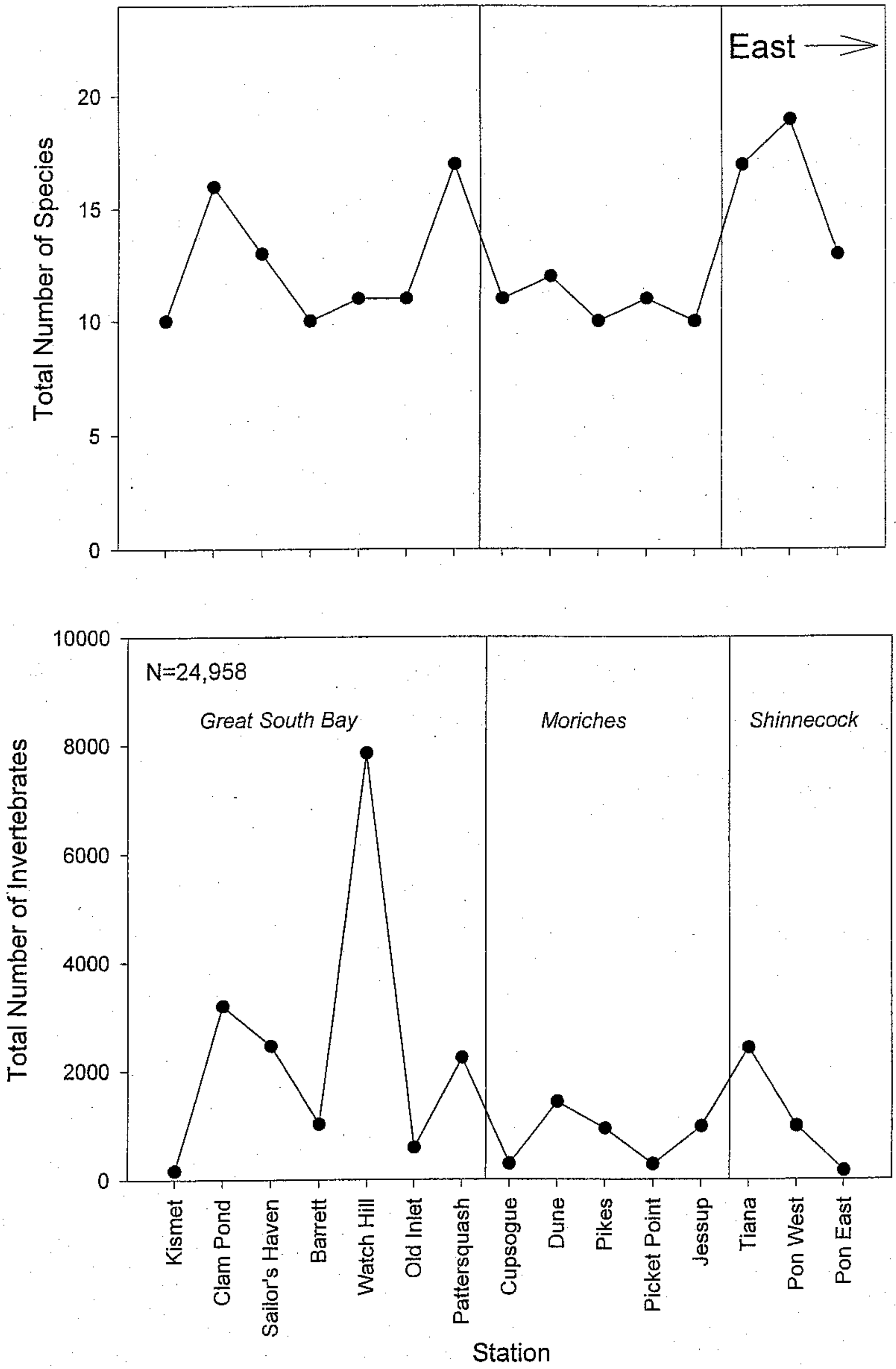


FIGURE 22
Total Number of Finfish and Invertebrates per Station
Shoreline Seines

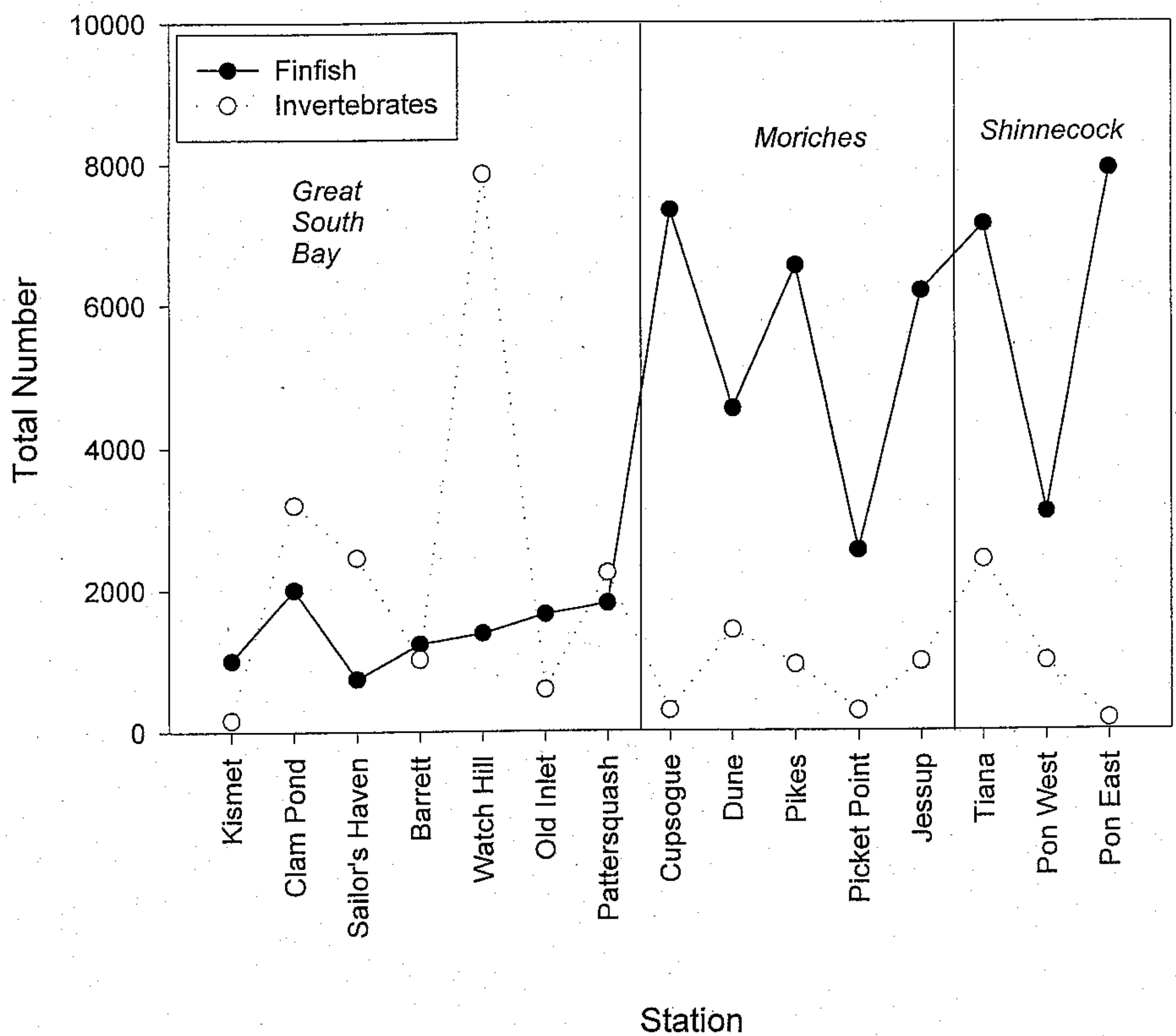


FIGURE 23
Water Quality Variables by Month

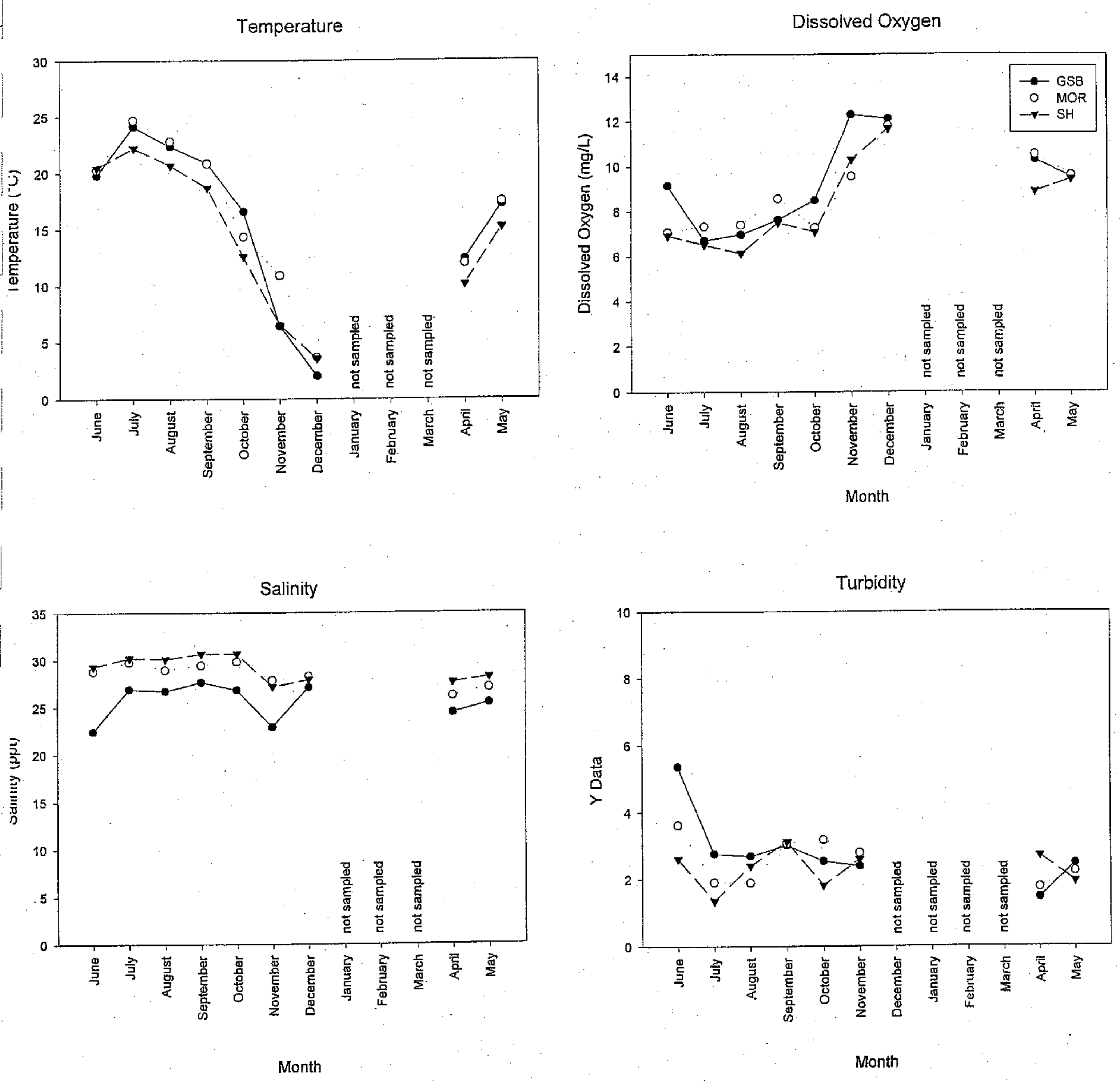


FIGURE 24
Finfish and Invertebrate Catch-per-Unit-Effort Plotted with Temperature
Monthly by Bay

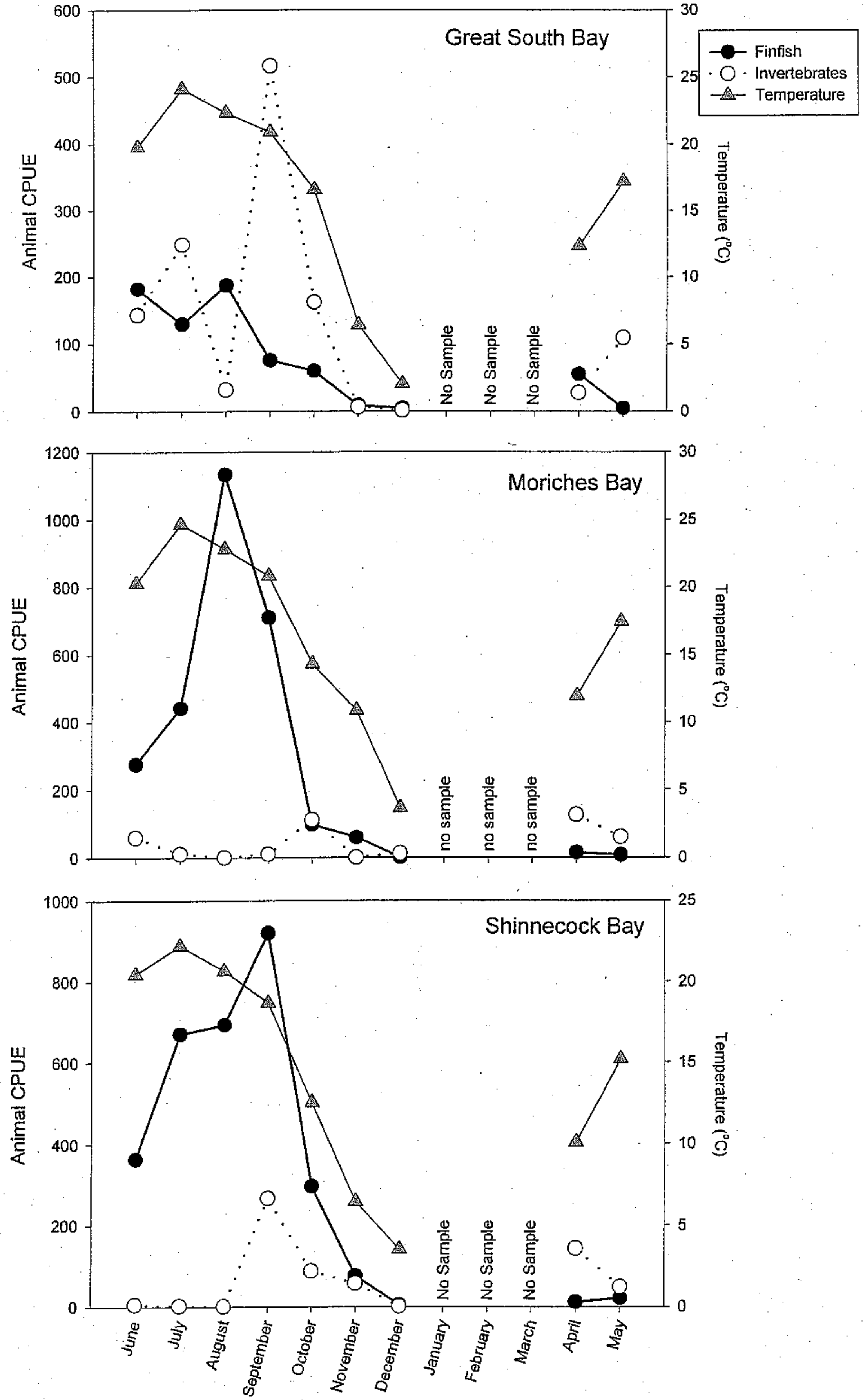


FIGURE 25

Finfish and Invertebrate Catch-per-Unit-Effort Plotted with Salinity

Monthly by Bay

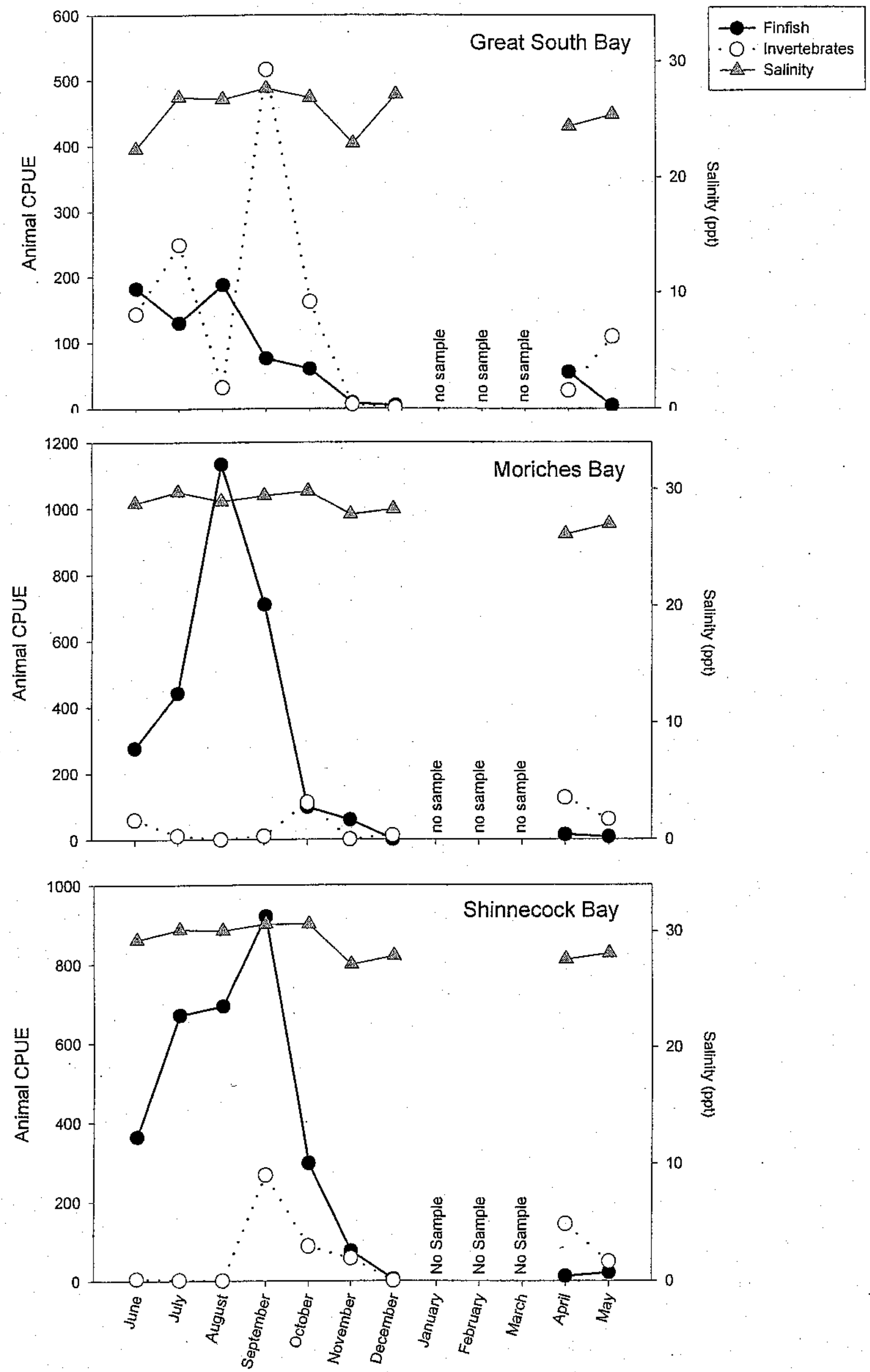


FIGURE 26

Finfish and Invertebrate Catch-per-Unit-Effort Plotted with Dissolved Oxygen

Monthly by Bay

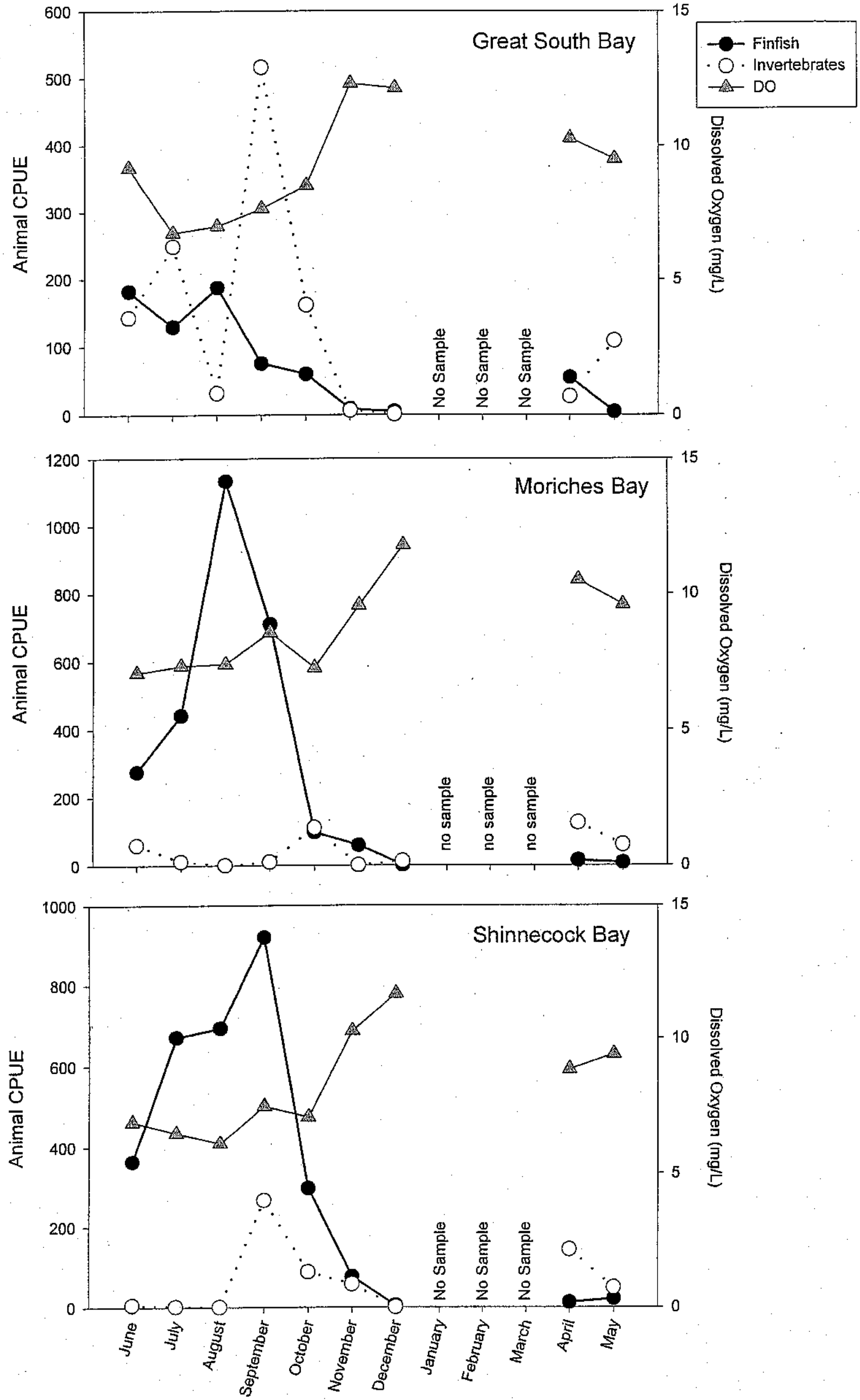


FIGURE 27
Finfish and Invertebrate Catch-per-Unit-Effort Plotted with Turbidity
Monthly by Bay

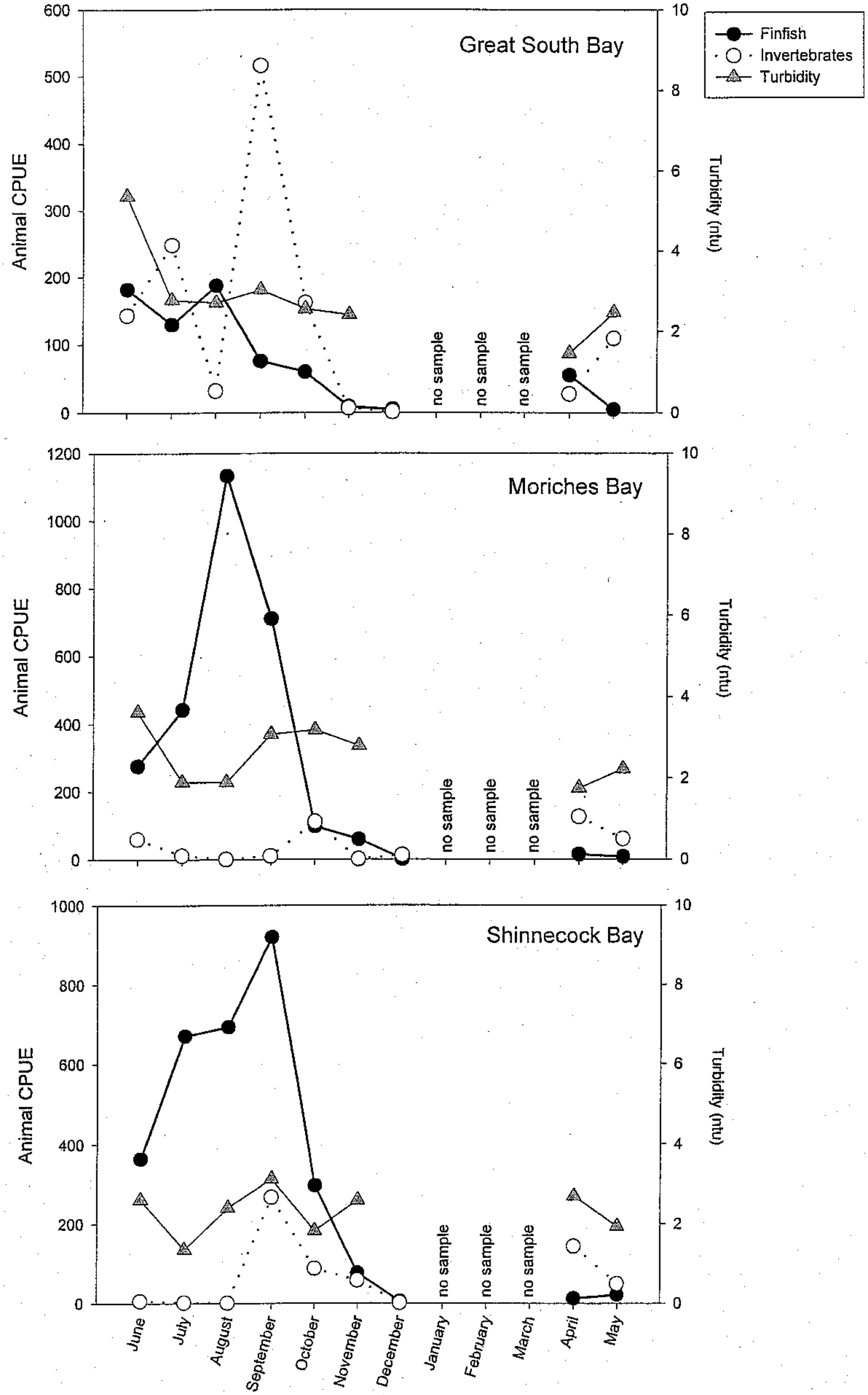


FIGURE 28
Finfish Length Frequency – Pond Seines

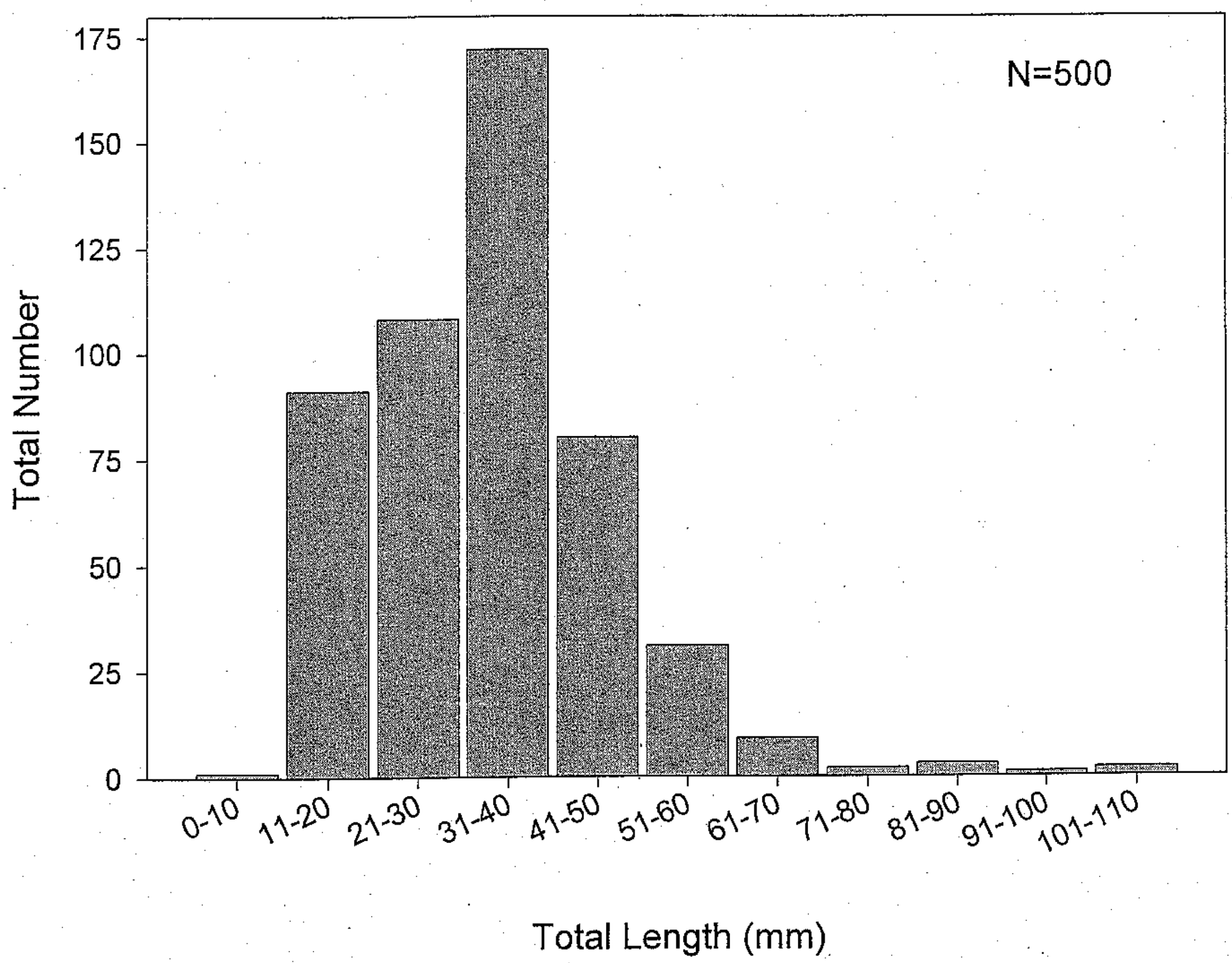


FIGURE 29
Finfish Abundances in Pond Seines

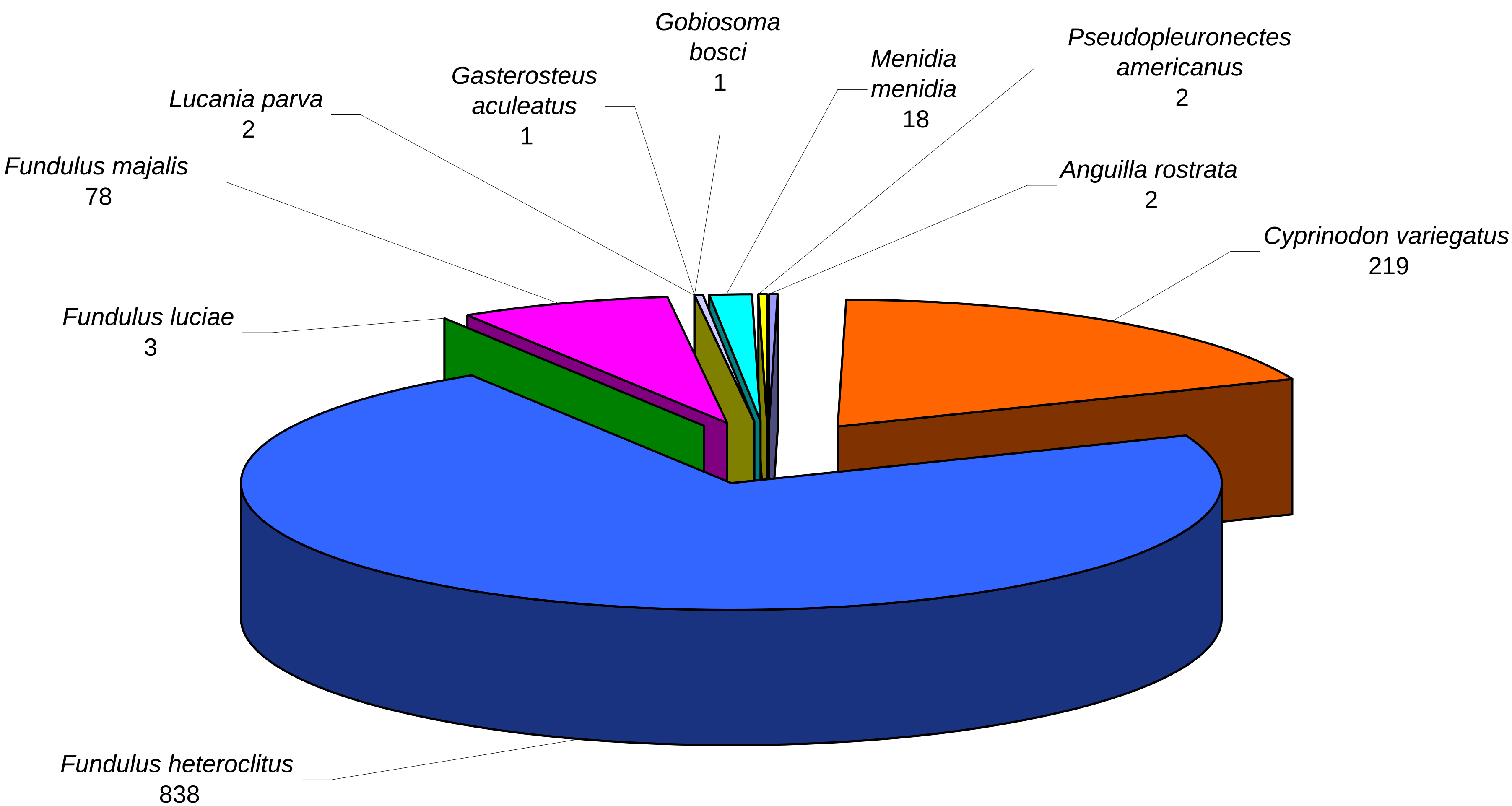


FIGURE 30
Invertebrate Abundances in Pond Seines

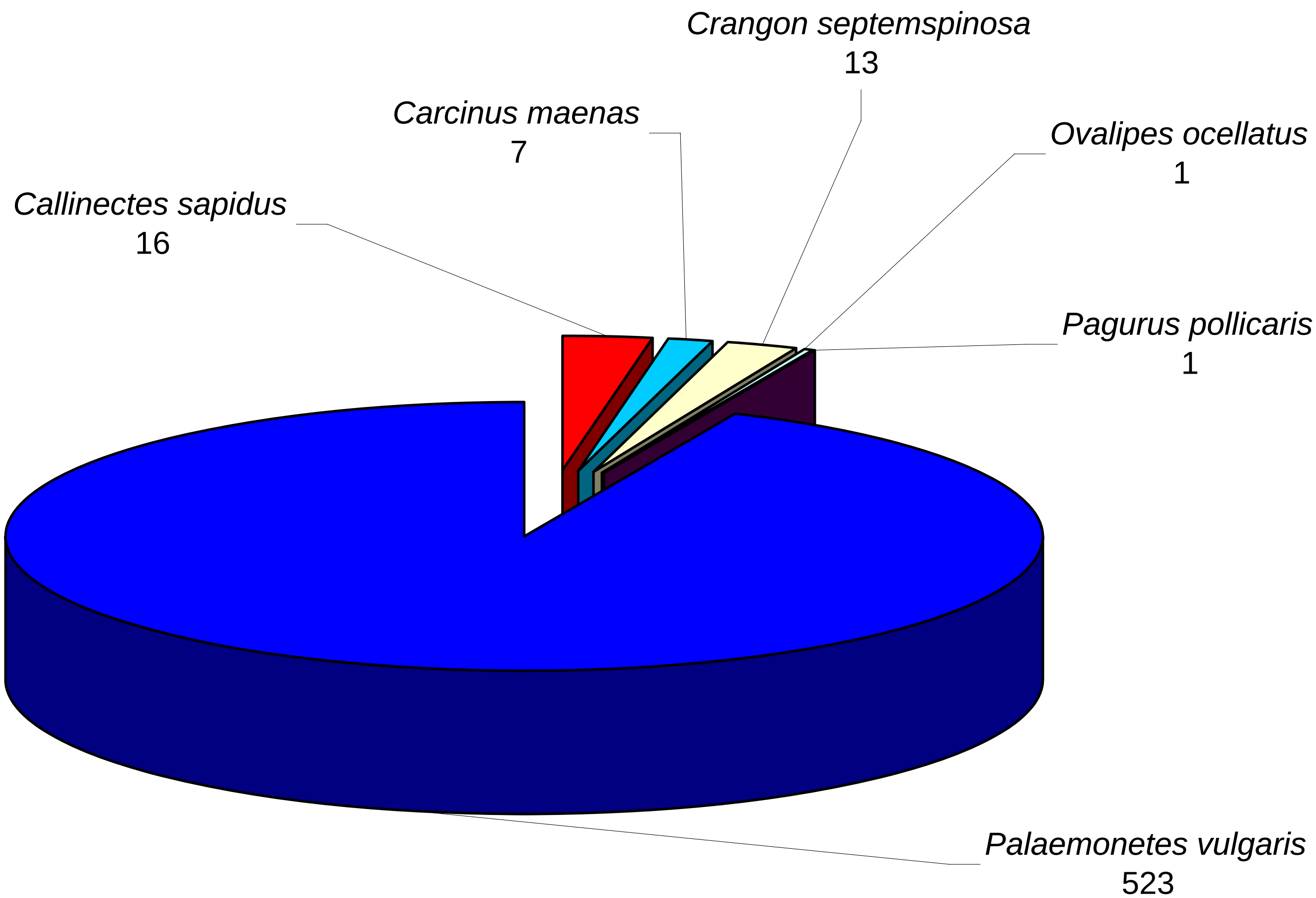


FIGURE 31
Finfish and Invertebrate Monthly and Station Totals – Pond Seines

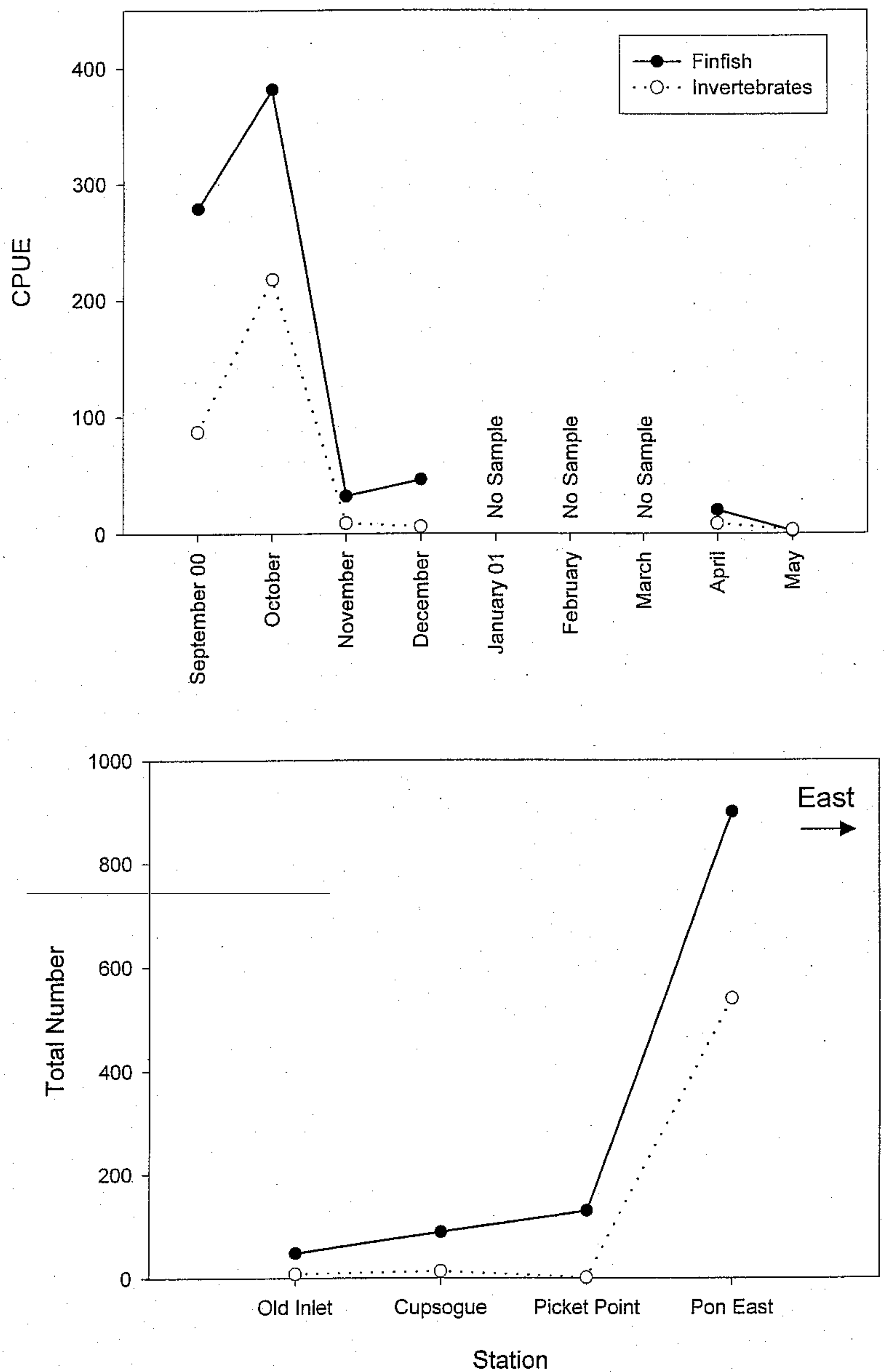


FIGURE 32
Seine-Comparison Study
Total Number of Finfish and Species

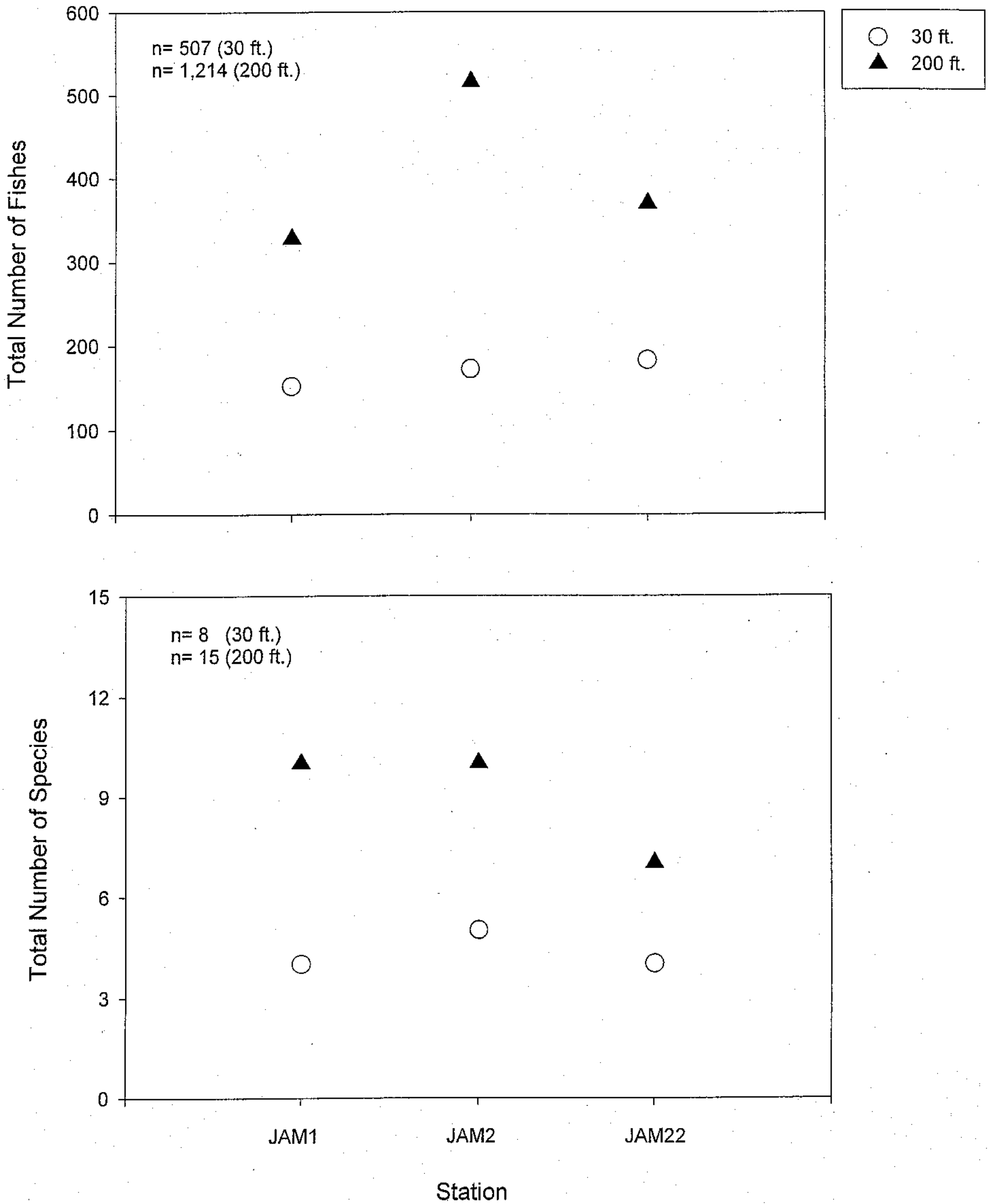


FIGURE 33
Seine Comparison Study
Total Number of Finfish by Species

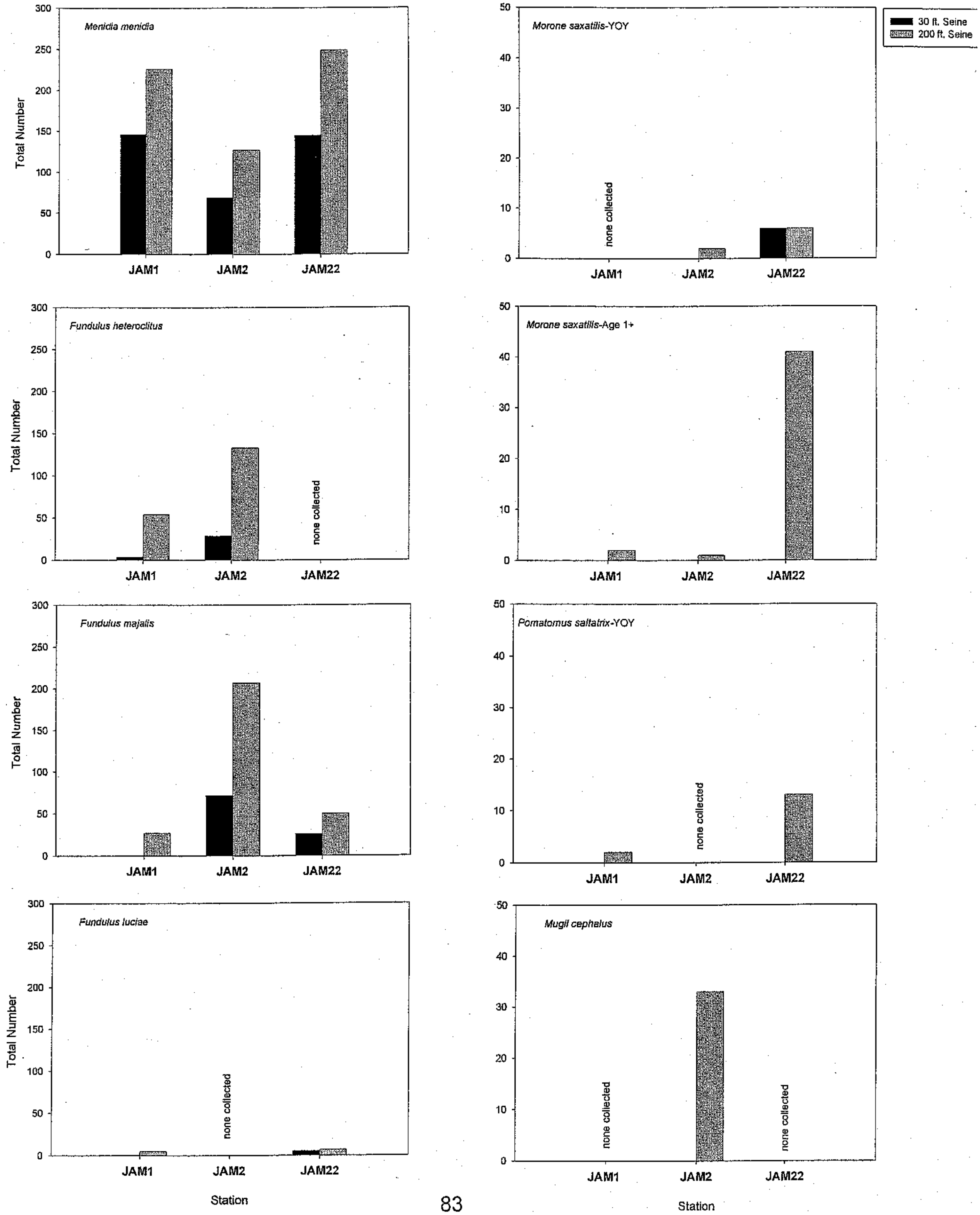


FIGURE 34
Seine Comparison Study
Total Number of Finfish by Species (continued)

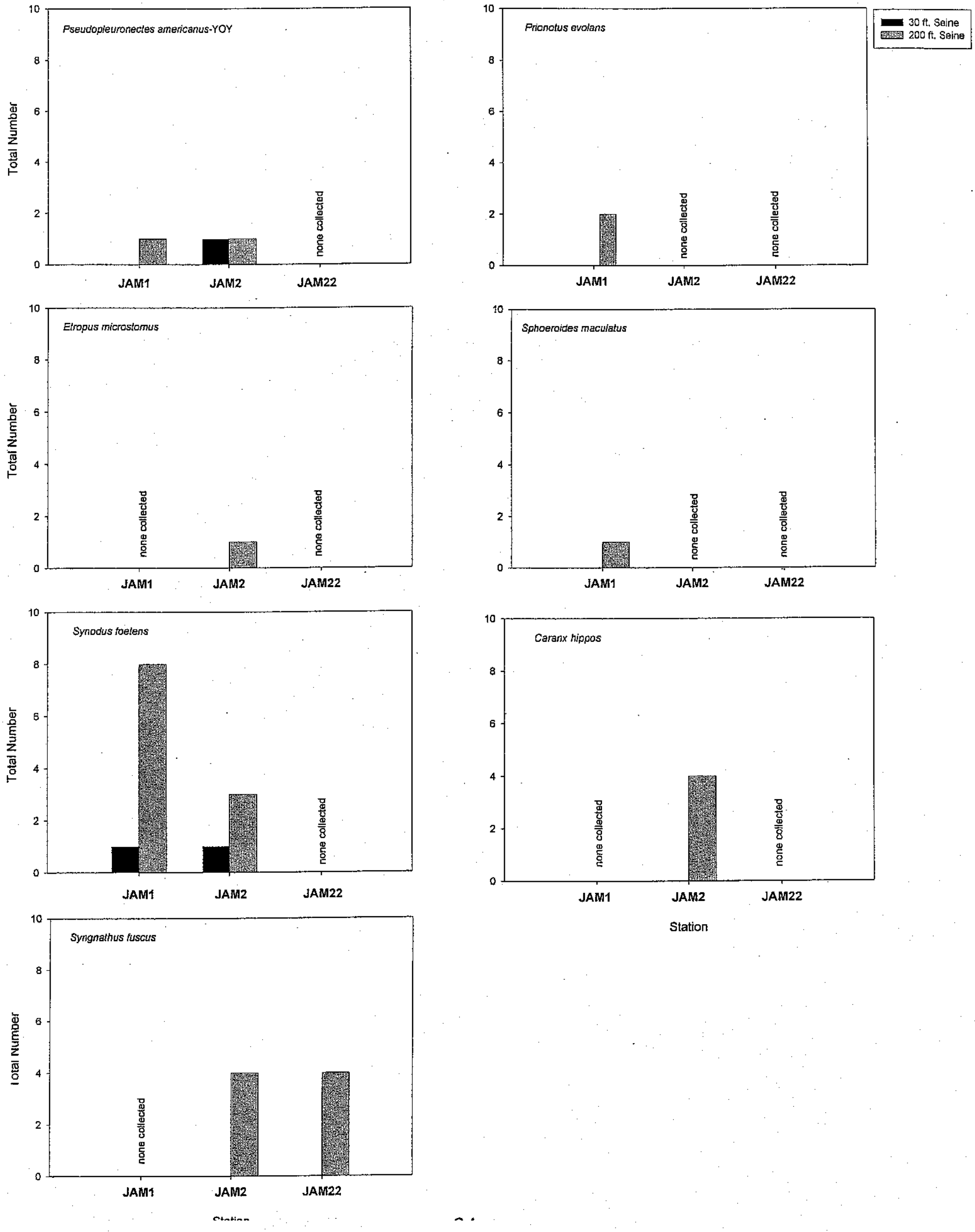


FIGURE 35
Seine-Comparison Study: Length Frequency Distributions

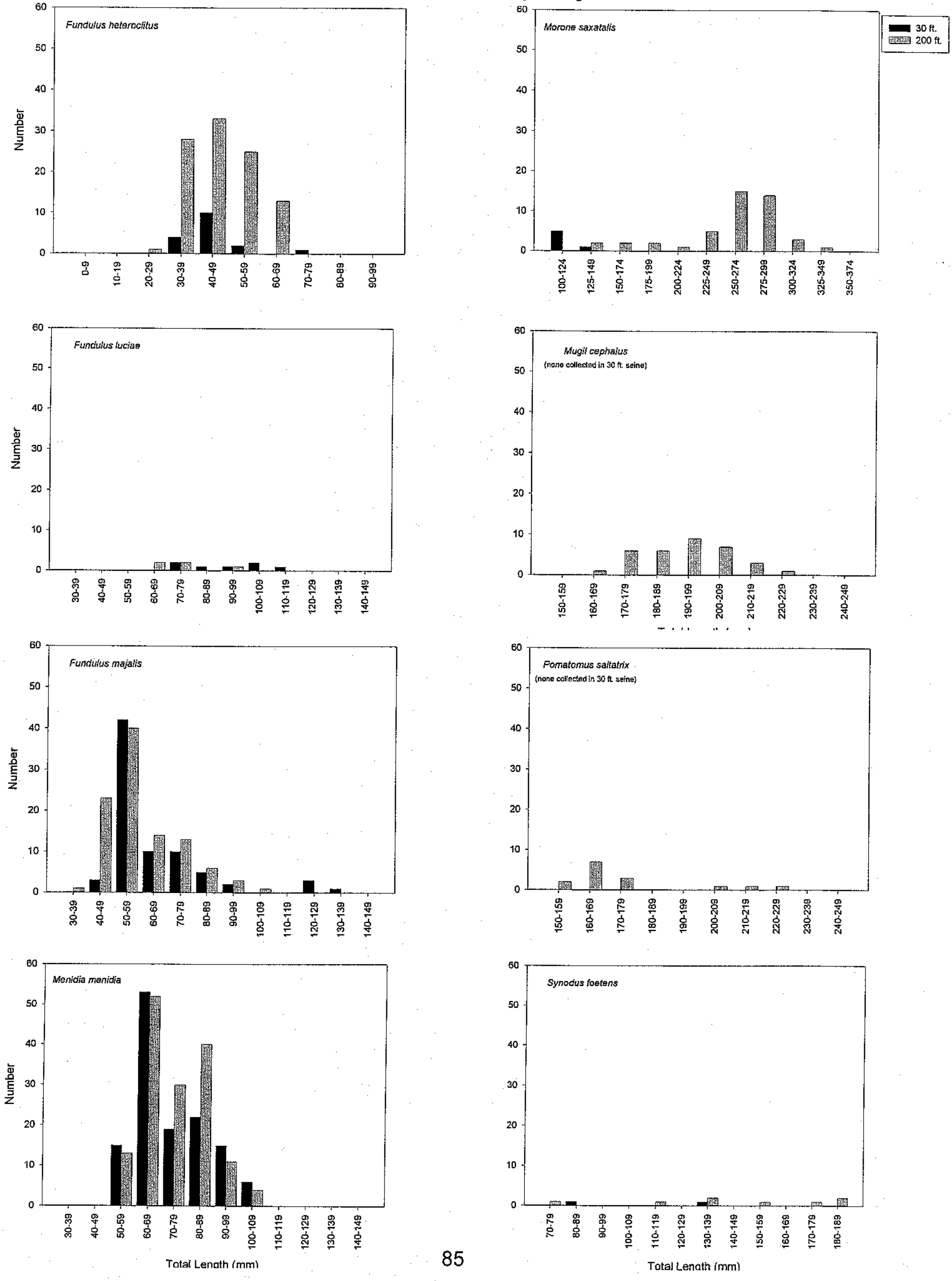


FIGURE 36
Seine-Comparison Study
Total Number of Blue Crabs (*Callinectes sapidus)*, Age 0 & 1

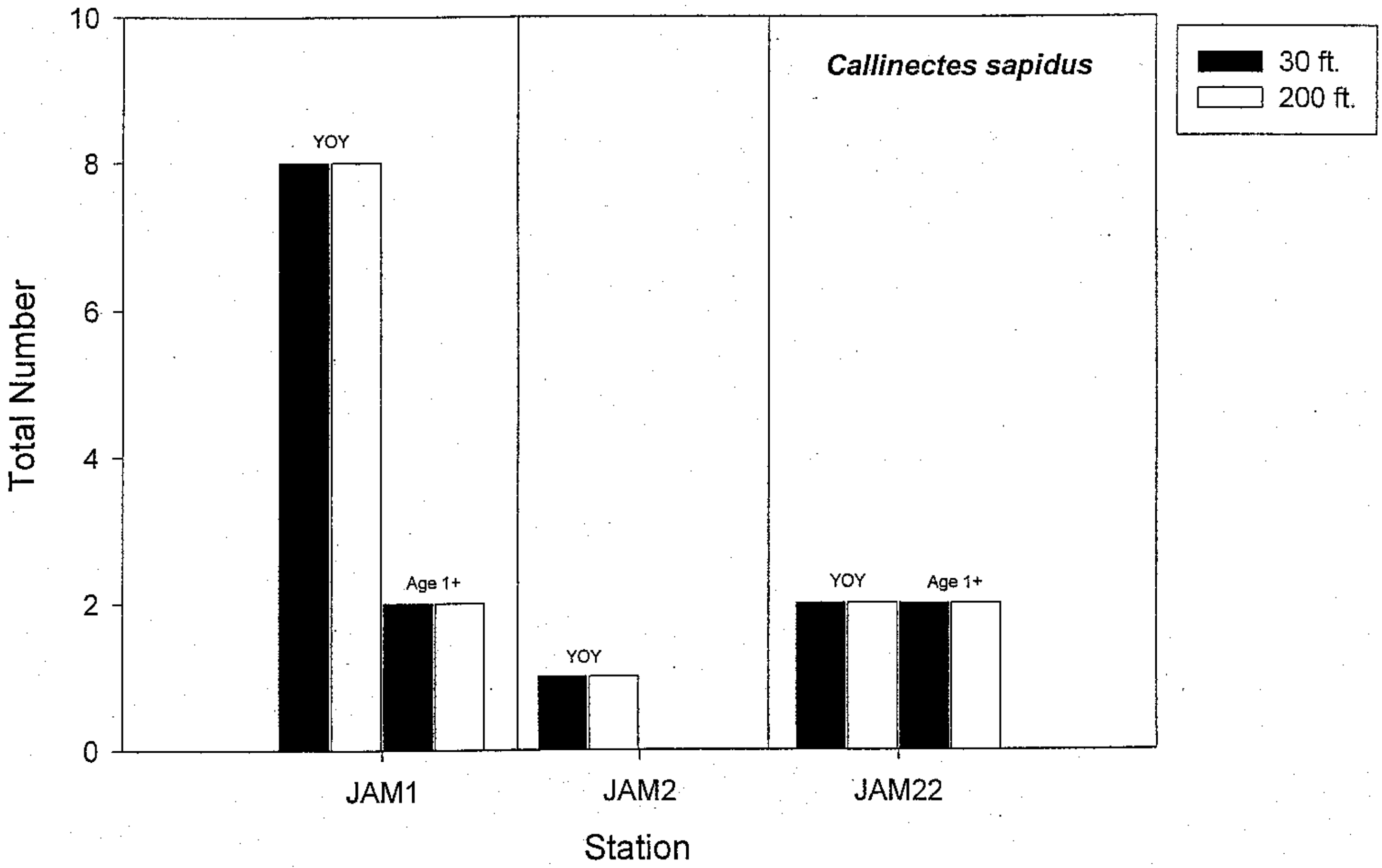
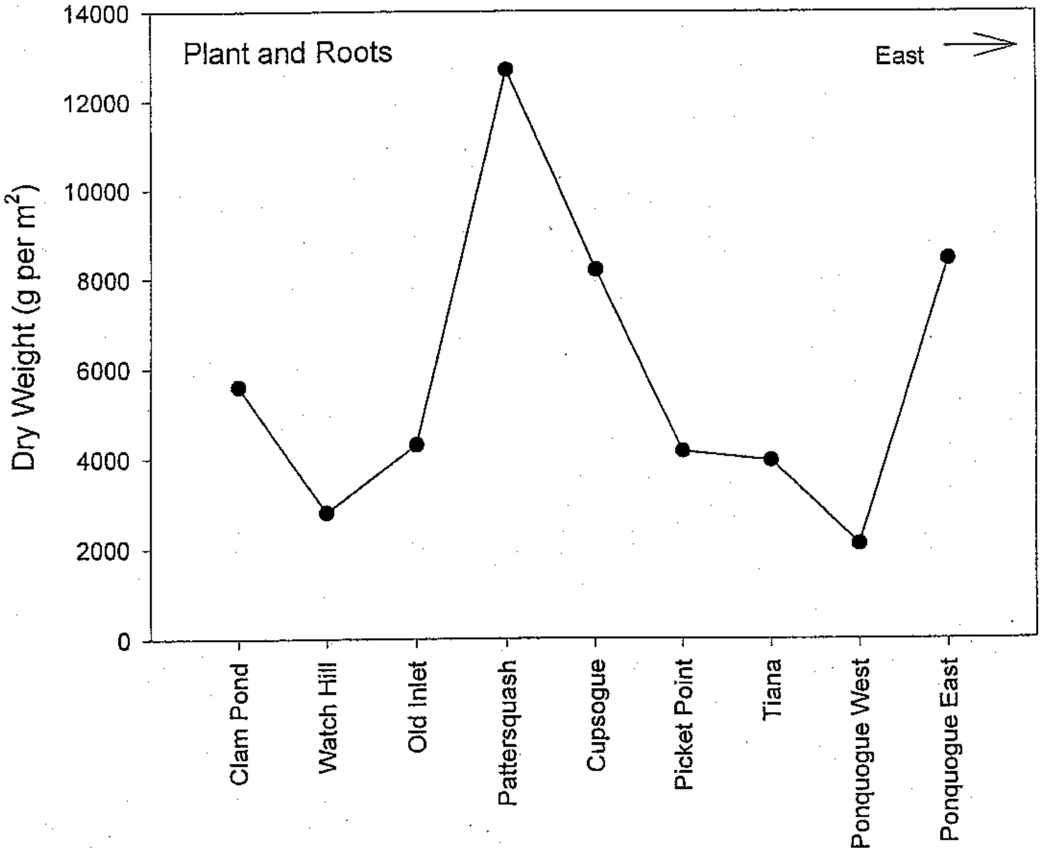


FIGURE 37

Spartina alterniflora **Mean Dry Weight (g per m^2)**



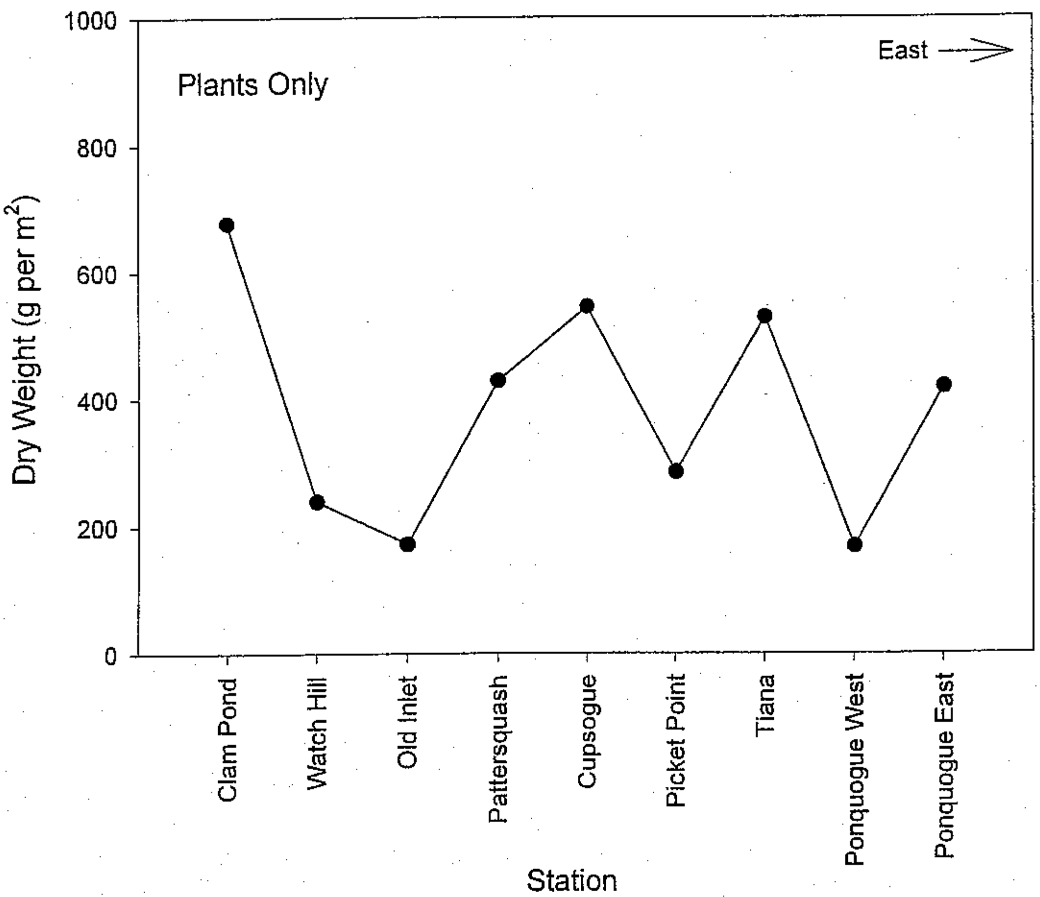


FIGURE 38
Throw Trap Survey-Animal Abundances

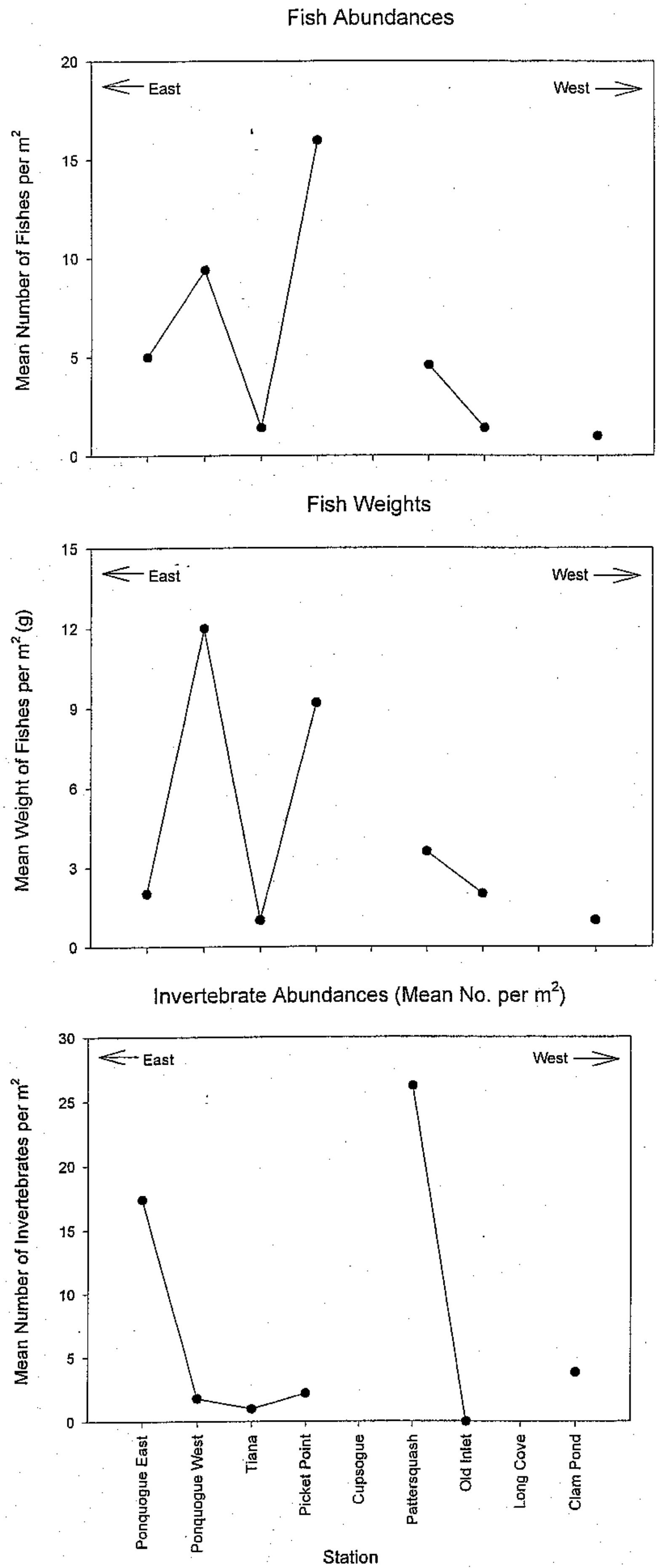


FIGURE 39
Animal Abundance vs. Vegetation Cover

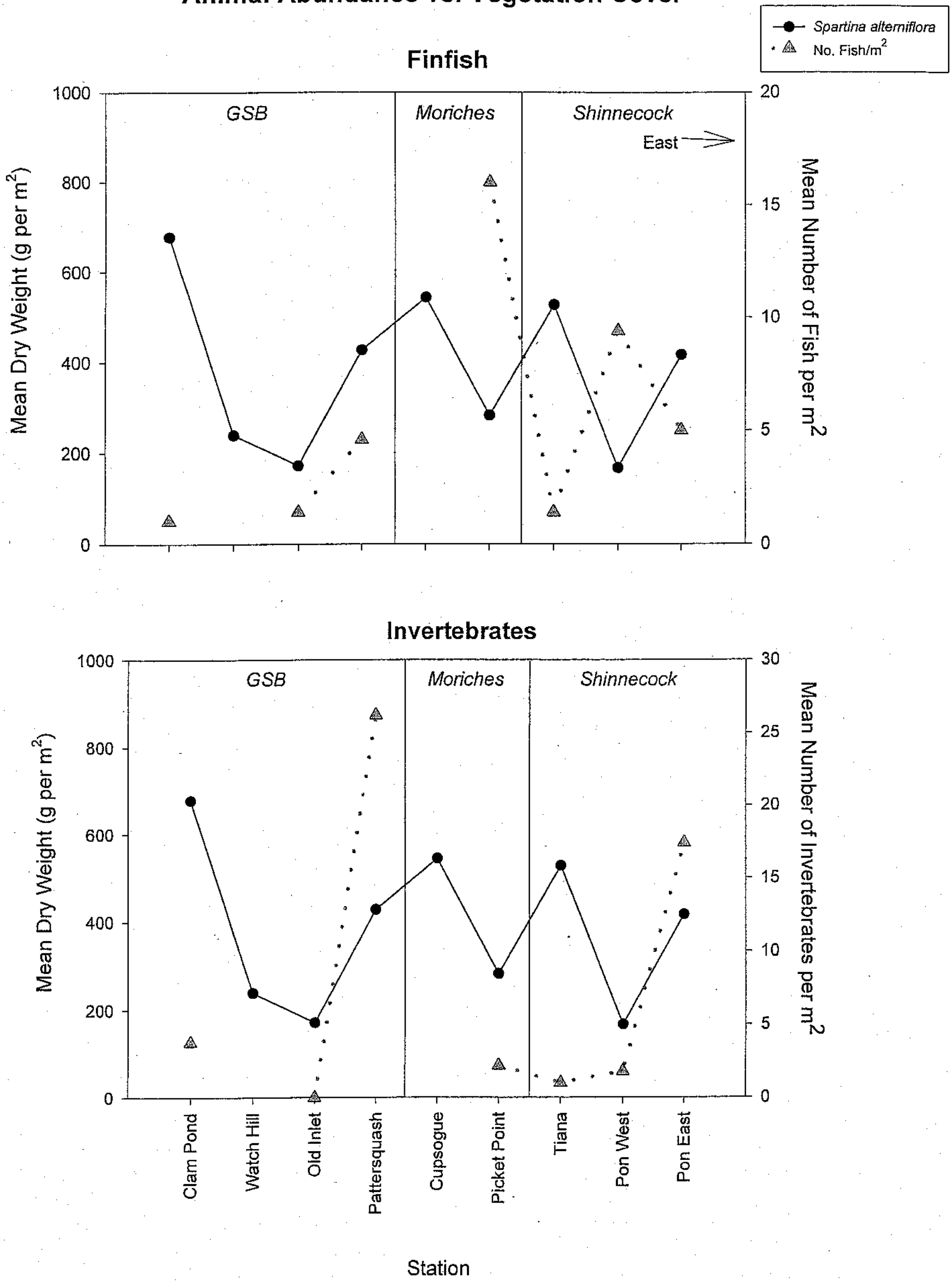


FIGURE 40
Sediment Composition at West Hampton Island Sites

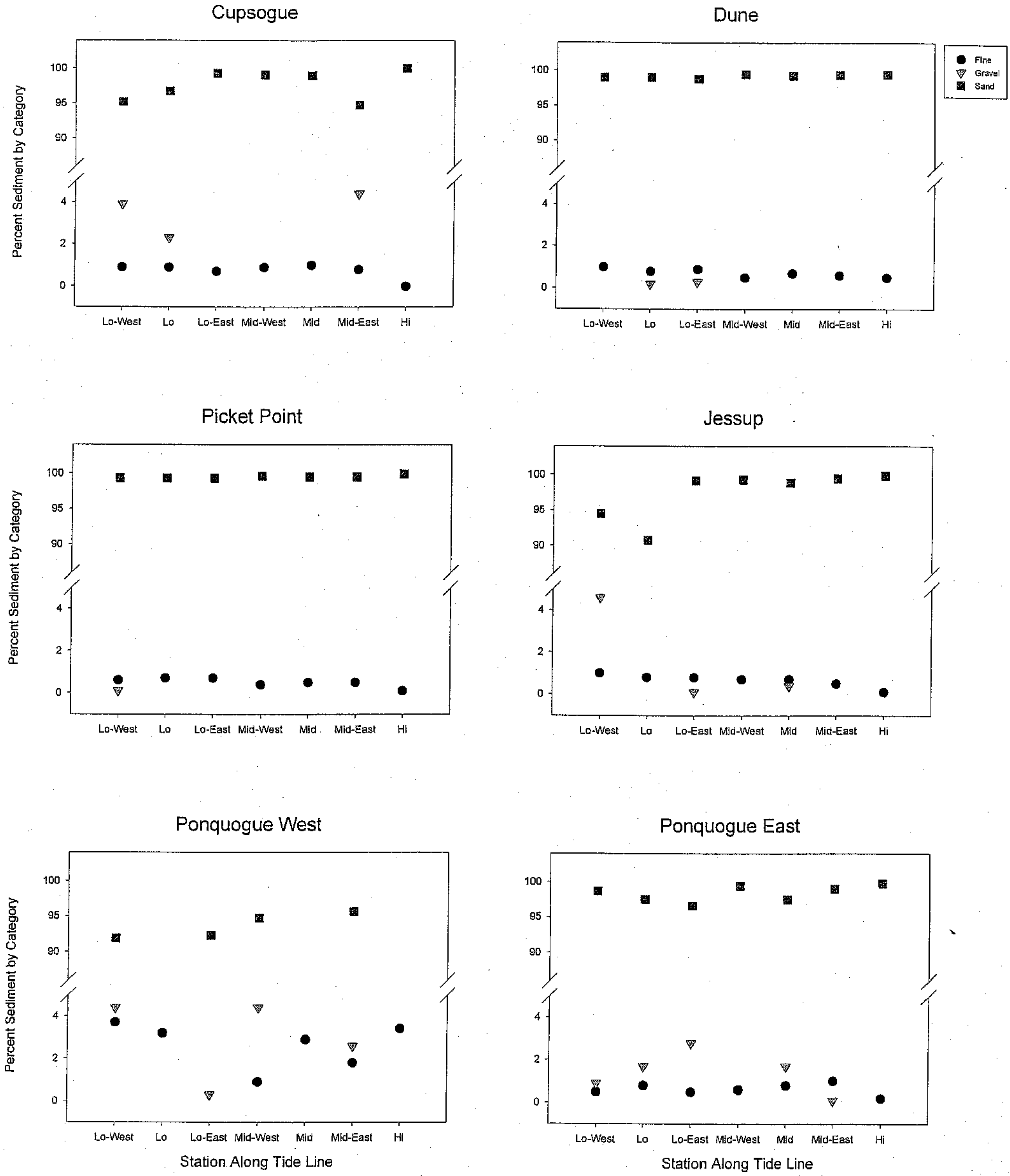


FIGURE 41

Benthic Invertebrates Percent Composition-Cupsogue, Dune & Picket Point

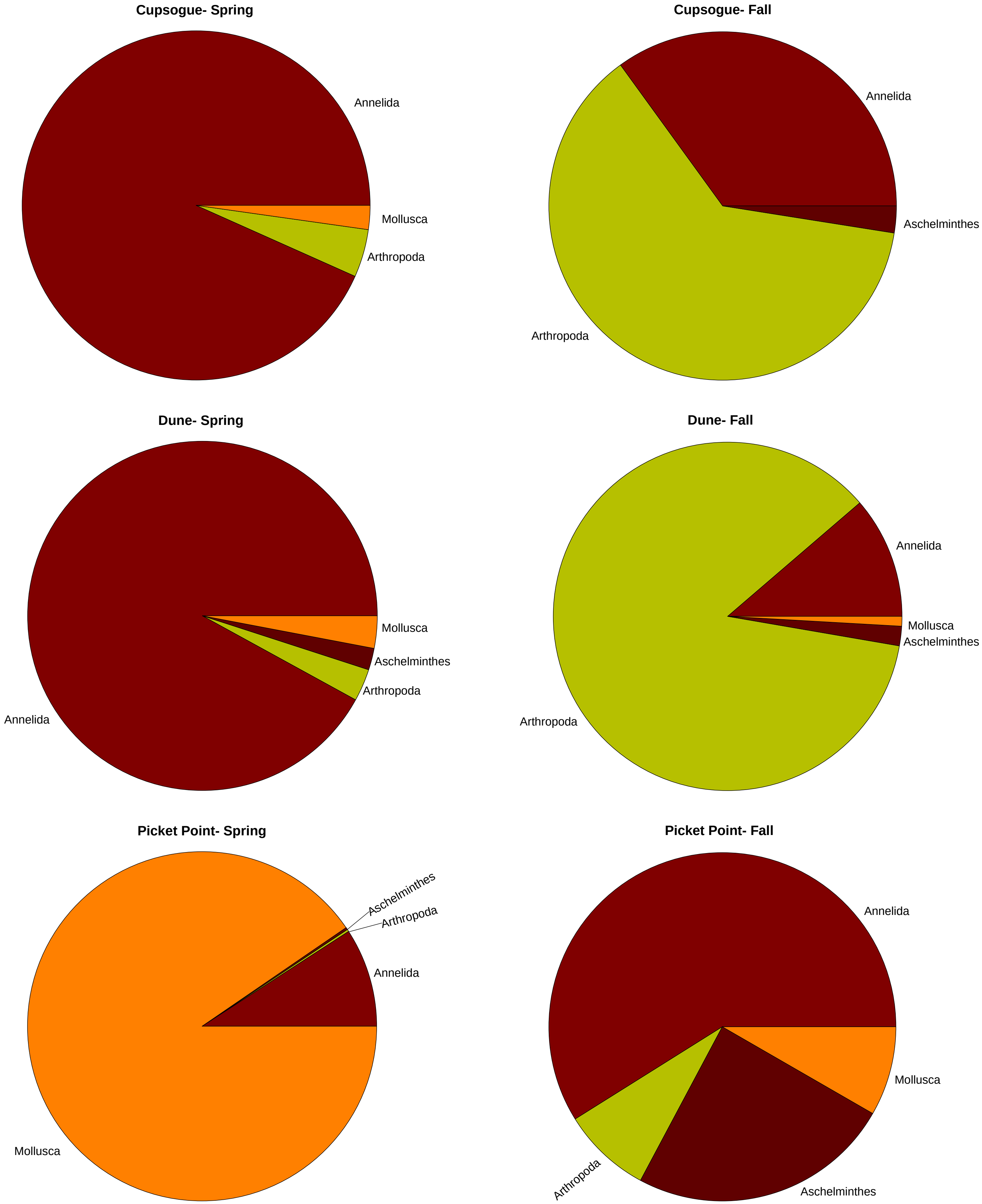


FIGURE 42

Benthic Invertebrates Percent Composition-Jessup, Ponquogue West & East

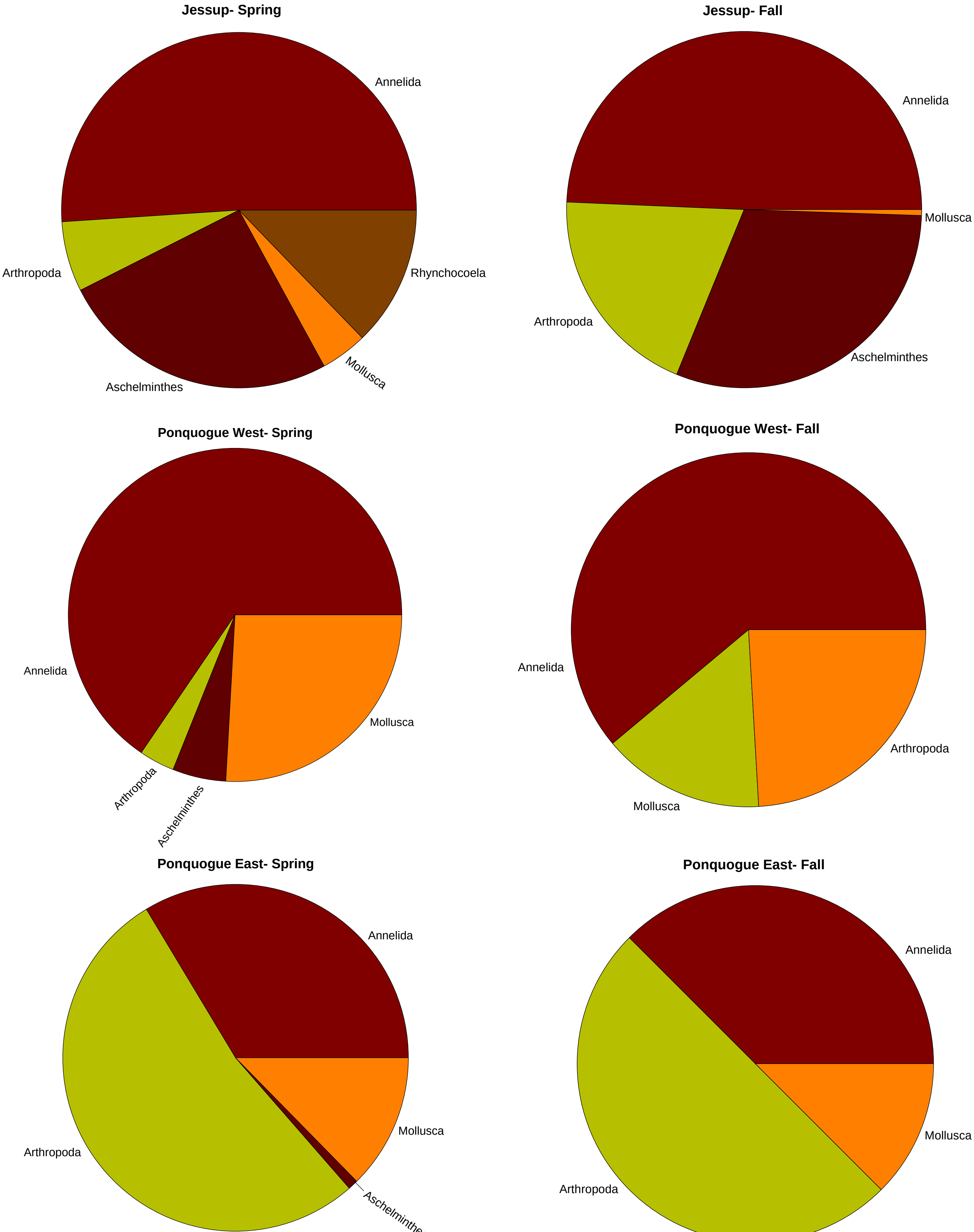


FIGURE 43
Density of Benthic Organisms Along Tide Locations

SPRING | **FALL**

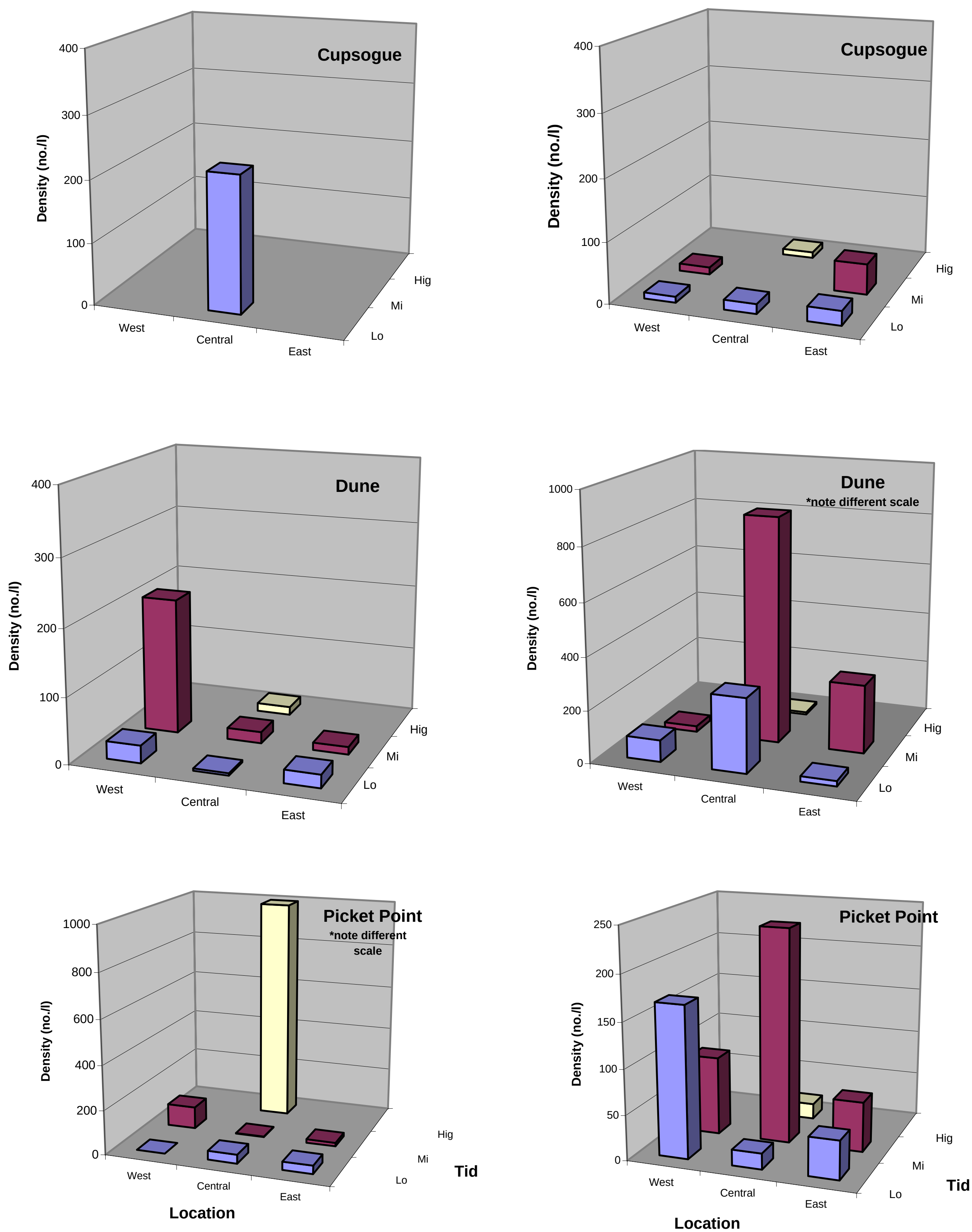


FIGURE 44
Density of Benthic Organisms Along Tide Locations

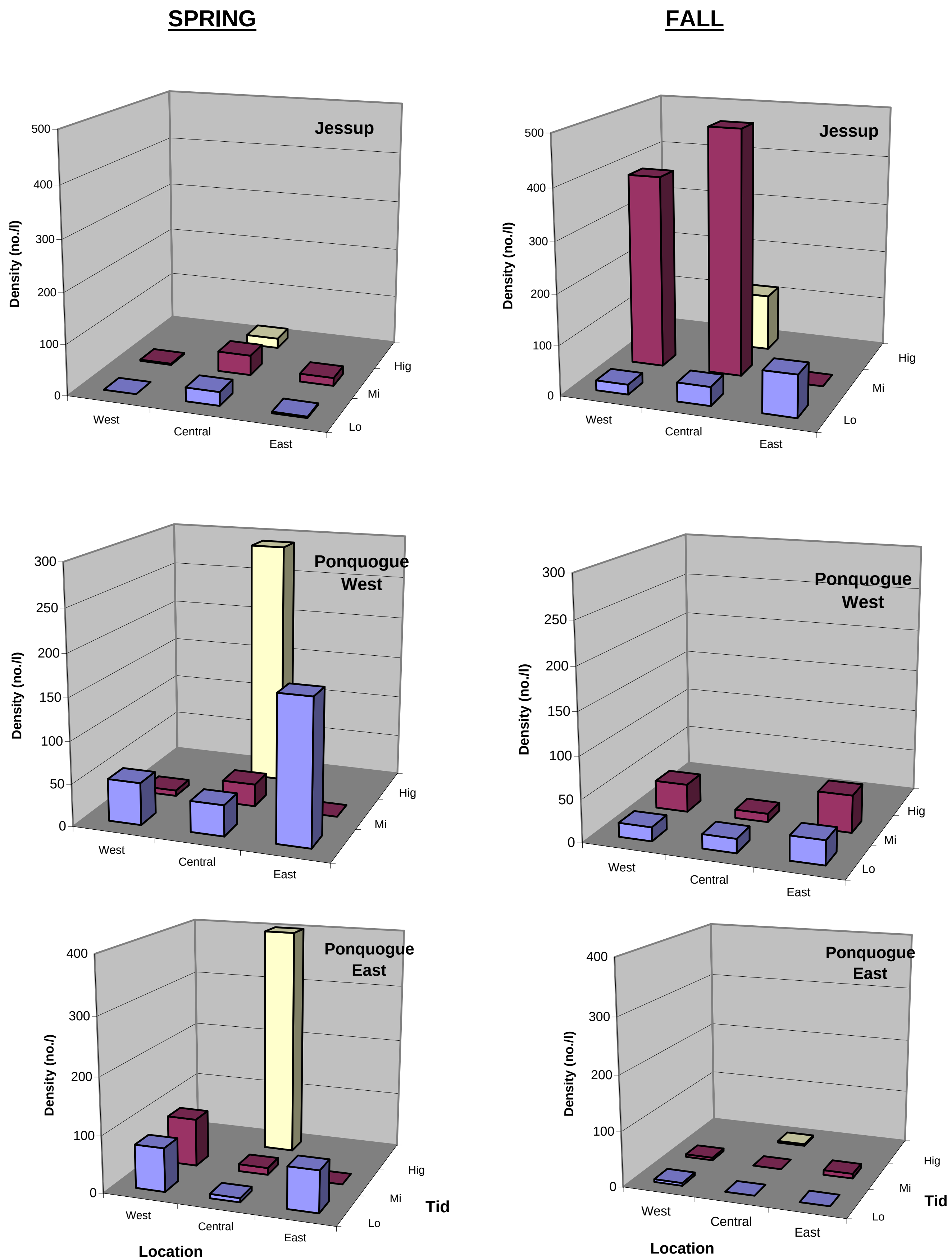


FIGURE 45
Trophic Relay Concept

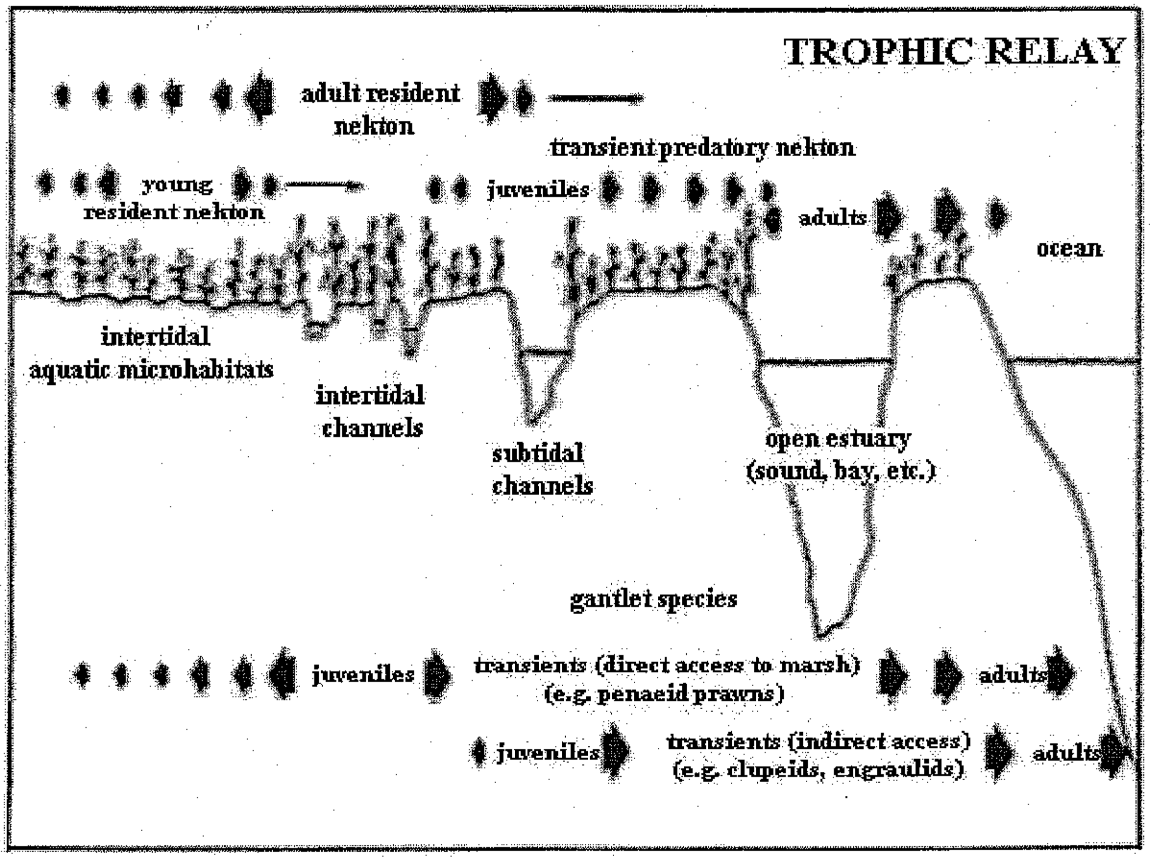
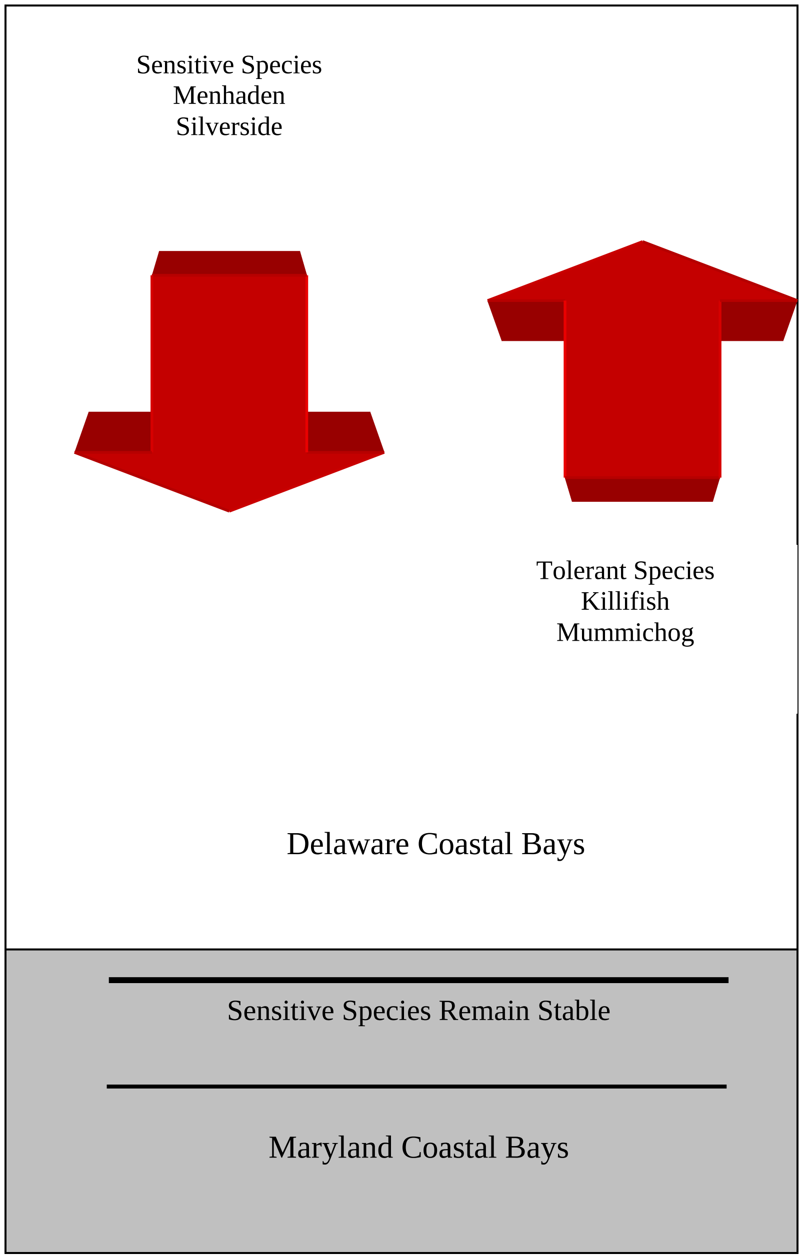


Figure 3: Conceptual model of a trophic relay involving different life stages of marsh resident nekton and juvenile transient species in the horizontal transfer of intertidal marsh production across landscape boundaries to the subtidal estuary.

Source: Kneib, R.T. 1997. The Role of Tidal Marshes in the Ecology of Estuarine Nekton. Ocean. and Mar. Biol: an Annual Review. 35:163-220.

FIGURE 46
Indicator Species in Coastal Bays



Source: U.S. Environmental Protection Agency. Nov. 1998. Condition of Mid-Atlantic Estuaries. EPA/600/R-98/147.