U. S. Army Corps of Engineers
New York District

Montauk Point, New York: Reformulation Study

West of Shinnecock Inlet and Cherry Grove Multispecies Sampling

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EXECUTIVE SUMMARY

This report presents the study design, methodologies, and results of a 12-month marine environmental survey at two offshore sites to be potentially used as borrow areas. Sand is proposed to be removed from the borrow areas in order to replenish the beaches west of Shinnecock Inlet and adjacent to the communities of Fire Island Pines and Cherry Grove. The proposed borrow area sites are located approximately 1.5 miles offshore, to the east of Shinnecock Inlet and south of Cherry Grove in the Atlantic Ocean. Although the area near Shinnecock Inlet is a prime fishing region, it has not been extensively studied, and limited biological data is available. The area near Cherry Grove is also considered a prime fishing region, although not as heavily used due to the greater distance from the inlets. Limited biological information is available for the Cherry Grove region though several projects have been conducted in the general area. This program serves to fill the data gaps by intensively characterizing the benthic invertebrates and fisheries resources in the offshore environment of Shinnecock Inlet and Cherry Grove. Sampling was conducted monthly from May 2000 through April 2001. Major portions of the program included the collection of demersal finfish, shellfish, squid and other macroinvertebrates. Additional elements of the program included data collection on fishes and water quality. This program is a continuation of the one-year fisheries study entitled, 'West of Shinnecock Inlet Multispecies Sampling', which occurred April 1999 through April 2000. A third year of study is being conducted at the Cherry Grove borrow area, May 2001 through April 2002.

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

- Sampling was conducted along the 30, 40, 50, and 60-foot depth contours in each of the proposed borrow areas.
- Fisheries trawls were conducted both within the borrow area and at control stations east and west of the borrow area.
- 192 bottom trawls were conducted between May 2000 and April 2001.
- A combined total of 38,578 finfish were collected. Dominant species were: bay anchovy, Atlantic butterfish, scup, silver hake, little skate and winter skate.
- A combined total of 39,846 macroinvertebrates were collected in the trawls. Dominant species were: sand dollar, sevenspine bay shrimp, New England dog whelk and long-finned squid.
- Water quality parameters collected at each station included temperature, salinity, conductivity, dissolved oxygen, pH, and light transmission.

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I. INTRODUCTION

The U.S. Army Corps of Engineers (USACE) New York District is proposing beach nourishment projects in the area immediately west of Shinnecock Inlet and south of Cherry Grove, Fire Island. Initial construction would involve dredging approximately 800,000 cubic yards of material from a location roughly 1.5 miles offshore, east of Shinnecock Inlet, covering an area of 20,000 by 7,000 feet (approximately 3,200 acres). Two renourishment operations (approximately 400,000 cy each) are scheduled for the borrow area. The dredge disturbance area for initial construction is approximately 2,000 by 2,500 feet (115 acres), and for each renourishment operation, approximately 1,500 by 1,300 feet (45 acres). The total estimated area for initial construction and two renourishment operations is approximately 205 of the 3,200 acres within the entire identified borrow area (Figure 1). Although details of the Cherry Grove construction are not presently known, a representation of the present borrow area location indicates several smaller sections spread across a larger area than the Shinnecock borrow area (Figure 2).

This report presents the results of a 12-month study on finfish and macroinvertebrates collected in the west of Shinnecock Inlet and Cherry Grove borrow areas. The present study is being conducted in response to a request from the New York State Department of Environmental Conservation (NYSDEC), and other Federal and State agencies, for additional baseline data on demersal finfish, shellfish, squid, and other macroinvertebrates present within the west of Shinnecock and Cherry Grove borrow areas. Data presented in this report will be used to establish baseline biological conditions and for preparation of an impact analysis on the effects of sand dredging.

II. METHODOLOGY

A. Ecological Studies

1. Fisheries – Demersal Trawl Survey

To determine species composition and abundance of the demersal fish community, bottom trawls were conducted offshore at both the Shinnecock (SH) (Figure 1) and Cherry Grove (CG) borrow areas (Figure 2). Finfish and macroinvertebrates were collected by towing a 30-foot otter-trawl fitted with a ½ inch mesh cod end along the 30, 40, 50, and 60-foot contour lines from the R/V Kingfisher (Figure 3). The net was towed along transects at a speed of 2 to 3 knots for a distance of 0.25 nautical miles. Sampling was performed once per month. Every effort was made to sample during the first week of every month. This was not always feasible, however, due to weather conditions. A total of eight transects were sampled within and adjacent to the

Shinnecock borrow area (Figure 1). An additional eight transects were sampled within and adjacent to the Cherry Grove borrow area (Figure 2).

Shinnecock stations were identified on data sheets by using the prefix T, followed by water depth contour and transect designation. Transects were identified as A, B, C, D, with A being the westernmost transect and D the easternmost. Cherry Grove stations were identified by the prefix F, followed by water depth contour and transect designation. At Cherry Grove, transect A was the easternmost and D the westernmost. Four transects were sampled within each of the borrow areas along each depth contour. Stations were identified as follows: T-30C, T-40B, T-50C, T-60B, F-30A, F-40B, F-50B, and F-60C. Eight reference stations were sampled adjacent to and outside of the borrow areas along each depth contour and designated as follows: T-30A, T-40D, T-50A, T-60D, F-30B, F-40C, F-50A, and F-60D. The reference stations were trawled outside the borrow area and served as comparison sites on the east and west sides of the proposed borrow areas. A Garmin 185 Global Positioning System unit (GPS) was used for navigation. This unit was interfaced with a Garmin GBR-21 differential receiver in order to produce greater position accuracy. As a backup to GPS, the vessel was also equipped with a Raytheon loran navigation unit.

Bottom time for each trawl haul was 8-10 minutes. Trawl contents were processed on board the vessel. The catch was separated by species and identified to the lowest practical taxa. All species were weighed and enumerated. When large numbers of species were encountered (i.e. in excess of 1,000 individuals) a random subsample was taken. For each trawl, lengths were measured for a maximum of 30 individuals per finfish and squid species. Total weight by species was recorded for up to 30 individuals per species. Fish abundance was measured as the number of fishes occurring within a trawl area. Species diversity was measured as the number of different species. Catch-per-unit-effort (CPUE) was calculated as the number of fish collected per trawl. A student's t-test and correlation coefficient statistics were used to analyze differences in the data. Statistics were calculated using the computer software program SigmaPlot ©.

2. Age Determinations

a) Age and Growth

Seven species of finfish were targeted for age analyses: scup, winter flounder, summer flounder, black sea bass, weakfish, bluefish and striped bass. Representatives of all species, except striped bass, were collected during the survey. To conduct age analyses, otoliths and scales were removed from the target species. When large numbers of species were collected, a maximum of 30 individuals per species per cruise were analyzed. Scales were removed from all species except winter flounder, in which case otoliths were taken. Age was determined by counting annual scale and otolith growth increments. A length at age regression was computed to calculate annual growth rates.

3. Surf Clam Survey

A survey of surf clam populations was conducted in coastal waters between Ocean Beach, Fire Island to just west of Napeague Beach during the period of August 18th to September 27th, 2001. Sampling of the surf clam populations was undertaken in eight (8) delineated borrow areas. Twenty-eight sampling stations were randomly selected in 6 of the borrow areas. The remaining two borrow areas were sampled at 56 and 16 stations, respectively. A local commercial clamming vessel was subcontracted to conduct the survey. The clamming vessel's dredge was outfitted with modified gear to retain sub-legal clams. Documentation of each tow position was recorded using the vessel's on-board navigational system (LORAN C). Please refer to Figure 4 for the survey borrow areas.

The vessel employed a stern-rig towing dredge with a 90" blade. The dredge was lined with 1 inch by 3-inch wire mesh and modified culling rollers to ensure the capture of sub-legal clams. The tow duration was three (3) minutes at a speed of 1.5 knots. The blade was set at 4.5". Hose length and tow warp was 140 feet and 130 feet, respectively. Water pressure was set at 80 psi. The contents of each tow were sorted and quantified in number of US Bushels. A sub-sample (one half US Bushel) of each tow was retained. Each clam in the sub-sample was measured for total length and recorded in millimeters.

B. <u>Physical Studies</u>

1. Water Quality

a) Fisheries-Demersal Trawl Surveys

Water quality measurements were collected at the beginning and end of each trawl. Surface and bottom readings of temperature, dissolved oxygen, salinity and conductivity were recorded with a Yellow Springs Instruments (YSI) Model R85-10 meter. In addition, pH was recorded using an Oakton Waterproof pH tester. Bottom water samples were collected with a Van Dorn water bottle. Light transmission through the water column was measured using a Secchi disc.

III. RESULTS

A. <u>Ecological Studies</u>

1. Fisheries – Demersal Trawl Survey

    a) Finfish Abundance and Diversity

Trawl samples were collected monthly from May 2000 through April 2001. A total of 192 samples, 12 at each of the 16 stations, were collected. An overall total of 55 species were collected at both the Shinnecock and Cherry Grove borrow areas combined (Table 1). A total of 49 finfish species were collected at the Shinnecock borrow area comprising 32,460 individuals (Table 2). A total of 46 finfish species were collected at the Cherry Grove borrow area comprising 6,118 individuals (Table 3). Tables 2 and 3 present a summary of the trawl catch by taxa, monthly total, total catch at each borrow area, total catch overall, and percent composition. Note that in all tables finfish were listed to species level, with the exception of hake sp. and anchovy sp., which were identified either to genus or family. Incidental to the finfish collections, 20 species of macroinvertebrates were collected at the Shinnecock and Cherry Grove borrow areas (Table 4). A total of 18 species were collected at Shinnecock and 16 species at Cherry Grove.

Figure 5 shows the total number of fishes and species collected during each month. Total fish abundance peaked during the summer month of September at both sites. During September, values averaged 10 to 100 times greater than other times of the year. Species diversity exhibited random fluctuations over time. Species diversity at Shinnecock peaked during September and November. At Cherry Grove, species diversity was greatest during May and December. The dominant species collected at Shinnecock was bay anchovy. The 27,553 bay anchovies collected represent approximately 85% of the total catch. The next most abundant species was Atlantic butterfish, representing two percent of the total catch. The third through sixth ranked fish species, by abundance, were silver hake (2%), little skate (2%), anchovy sp. (1%) and winter skate (1%), respectively. Combined, these six dominant species represent approximately 95% of the total catch (Table 2). The dominant species collected at Cherry Grove was the Atlantic butterfish. A total of 2,227 Atlantic butterfish comprised 36% of the total catch. The second through sixth most abundant species at Cherry Grove were bay anchovy (14%), little skate (12%), scup (10%), silver hake (4%), winter skate (3%) and striped searobin (2%). Combined, these six species represent 80% of the total catch at Cherry Grove.

The twelve most abundant species collected at Shinnecock and Cherry Grove are shown in Figure 6. At the Shinnecock site, bay anchovy far exceeded all other species abundances. This was primarily due to extremely high landings of bay anchovy in September (27,498) (Table 2). A rank order of finfish by abundance for each borrow area is given in Table 5. At the Shinnecock site, bay anchovy ranked first in landings with an abundance of 27, 553. Atlantic butterfish (808), silver hake (796) and little skate (720) ranked second through fourth, respectively. Their landings each approximated twice the abundance of the fifth and sixth most abundant species, anchovy sp. (467) and winter skate (408). Atlantic croaker (259), scup (225), windowpane (157), weakfish (126) and Atlantic silverside (109) all had abundances greater than one hundred. Note that the numeric abundance is listed in parentheses after each species name. The remaining species all had landings of less than one hundred. Of these remaining species, nearly half had abundances of less than ten.

At the Cherry Grove site, Atlantic butterfish abundances far exceeded all other species, primarily due to extremely high landings in September (1,522) (Table 3). Table 5 lists the order of species collected ranked by abundance. Atlantic butterfish ranked first with total landings of 2,227. The second through fourth ranked species were bay anchovy (843), little skate (711) and scup (620). Landings for each of these species were approximately one third less than the top ranked Atlantic butterfish. The fifth through ninth ranked species in order of abundance were; silver hake (275), winter skate (213), striped searobin (150), hake sp. (149) and windowpane (113). The remaining species all had abundances of less than one hundred. Of the remaining species, nearly half had abundances of less than ten.

A student's t-test was performed to see if there was a difference in abundance of species between the two sites. The results of the t-test are listed in Table 5. The t-test results indicate that the abundances of finfish between the two sites are not similar (P value = 0.38). This P-value indicates that there is a 38% probability that the rank distribution of finfish at the Shinnecock site is the same as the rank order of species at the Cherry Grove site. However, it is important to note that the results of this analysis could be skewed due to the extremely high landings of a single species during September at both sites-bay anchovy at Shinneock and Atlantic butterfish at Cherry Grove.

Finfish species diversity by month for Shinnecock and Cherry Grove is presented in Figure 7. Species diversity was greatest in September and November at Shinnecock, when 20 and 21 species were collected, respectively. The fewest number of species were collected during October (11) and February (9). At Cherry Grove, species diversity was greatest in May and December when 18 and 16 species were collected, respectively. Species diversity was lowest at Cherry Grove during January (9) and March (5). Species that were collected during all months sampled at Shinnecock were little skate and winter skate (Table 2). Windowpane was collected during all months except February. At Shinnecock, species that were collected during only one month were hickory shad, northern pipefish, northern kingfish, dwarf goatfish, Atlantic menhaden, goosefish ocean pout, spot, Atlantic mackerel, bluefish, bluespotted cornetfish, cunner, fawn cusk-eel, fourspot flounder and hake sp. Interestingly, bay anchovy, the most abundant species, was collected during only two months of the survey. The only species collected during all months sampled at Cherry Grove was little skate (Table 3). Winter skate was collected during all months except March. Species that were collected during one month only at Cherry Grove were; hickory shad, red hake, ocean pout, threespine stickleback, alewife, blueback herring, dwarf goatfish, inshore lizardfish, round scad, sea raven, weakfish, American sand lance, Atlantic cod, Atlantic moonfish, bluefish, longhorn sculpin, lookdown, northern puffer, Pollock and smooth dogfish.

Weight and Catch-per-Unit-Effort (CPUE)

The monthly total weight for all species collected at Shinnecock and Cherry Grove is shown in Figure 8. Monthly weights peaked at Shinnecock during November and December. Monthly total weights at Cherry Grove peaked during December and were lowest during January and March (Figure 8). Tables 6 and 7 display the monthly weights for each species collected and the percent composition of the total weight at the Shinnecock and Cherry Grove borrow areas. Monthly total weights at Shinnecock varied from a low of 11,290 grams (February) to a high of 207,722 grams (November) (Table 6). The total weight of all species collected at Shinnecock was 862,497 grams. The species that comprised more than half of the weight was little skate with a total of 448,267 grams. Winter skate accounted for nearly one quarter of the total weight (209,682g). The remaining species each accounted for approximately five percent or less of the total weight. Monthly total weights at Cherry Grove varied from a low of 2,440 grams (January) to a peak of 169,920 grams (December) (Table 7). The total weight of all species collected at Cherry Grove was 657,124 grams. The species that comprised more than half of the weight was little skate with a total of 339,765 grams. Winter skate accounted for nearly one fifth of the total weight (108,258g). The remaining species each accounted for approximately eight percent or less of the total weight.

The five dominant species by weight at Shinnecock were little skate, winter skate, windowpane flounder, summer flounder and bay anchovy. Combined they comprise approximately ninety percent of the total weight (Table 6). At the Cherry Grove borrow area the five dominant species by weight were little skate, winter skate, spiny dogfish, windowpane flounder and summer flounder. Combined, these species comprise approximately ninety percent of the total weight (Table 7). The weight distributions by species are similar for the two borrow areas, with both little skate and winter skate accounting for the majority of the total weight. Figure 9 shows the total weight plotted for five of the most abundant species: little skate, winter skate, summer flounder, windowpane flounder and winter flounder. The distribution of weights for each of these species was similar at the two sites. Little skate dominated the landings, followed by winter skate, windowpane, summer and winter flounders, respectively. Percent composition by weight of the five most abundant species is shown graphically in Figure 10. This figure clearly shows the dominance of skates (in particular, little skate) over all other species at both sites. Little skate constitutes over one-half of the total catch.

Tables 8 and 9 summarize the mean monthly catch-per-unit-effort (CPUE) for the demersal fish species at each of the borrow areas. Catch-per-unit-effort was calculated as the total number of fish collected per trawl. Total catch rates peaked during September with a CPUE of 1,752 at Shinnecock (Table 8) and 183 at Cherry Grove (Table 9). The next highest CPUE was recorded in December at Shinnecock (69) and October at Cherry Grove (47). CPUE was lowest at Shinnecock in January with a value of 6. At Cherry Grove, CPUE was lowest in March with a value of 3.38. On a species basis, those with the highest overall combined CPUE values at Shinnecock were bay anchovy (1,722), Atlantic butterfish (51), silver hake (50), little skate (45), and anchovy sp. (29) (Table 8). At Cherry Grove, species with the highest CPUE values were Atlantic butterfish (139), bay anchovy (53), little skate (44), scup (39) and silver hake (17) (Table 9). Mean values for CPUE showed similar trends to total abundance values.

Commercially Important Finfish Species

The five trawl species generally considered to be of greatest commercial value are Atlantic butterfish, scup, summer flounder, winter flounder and bluefish. Length frequency distributions are shown for these five species in Figure 11. Sample sizes are indicated by 'n' in Figure 11. Sample sizes represent only those fish that were measured which is a subsample of the total number collected (refer to the methods section). Fish total lengths ranged from 14 to 749 millimeters at Shinnecock and 18 to 600 millimeters at Cherry Grove. Mean fish lengths for each species at Shinnecock were: Atlantic butterfish (53 mm), scup (106 mm), bluefish (244 mm), winter flounder (258 mm) and summer flounder (345 mm). At Cherry Grove, mean fish lengths for each species were: Atlantic butterfish (46 mm), scup (90 mm), bluefish (416 mm), winter flounder (216 mm) and summer flounder (352 mm). In general, fish species collected at Shinnecock had the larger mean length. Overall, Atlantic butterfish was the smallest fish collected with lengths ranging from 14 to 225 millimeters for both sites. Summer flounder was the largest fish collected, lengths ranging from 32 to 605 millimeters (both sites combined). Atlantic butterfish and scup length distributions each had a single mode, indicating one cohort. Length distributions for winter and summer flounder appear bimodal. This bimodality indicates the possibility of two cohorts for these species. A t-test was performed to compare mean lengths for finfish at both sites. Results from the t-test are shown in Table 10. T-test results indicate a high probability that length distributions from the two borrow areas are similar ($P=0.75$).

Figure 12 shows an annual weight summary for these five commercially important species. Overall, summer flounder had the greatest total weight of 37,694 grams at Shinnecock and 25,080 grams at Cherry Grove (Tables 6 and 7). The weight of summer flounder landed at Shinnecock is nearly twice the weight of winter flounder (16,203 g), six times that of scup (5,875 g), and nearly twenty times greater than Atlantic butterfish (1,745 g) (Table 6). Summer flounder landed at Cherry Grove represents one and a half times the weight of winter flounder (17,630 g), nearly four times the weight of scup (5,701 g) and approximately twenty-five times the Atlantic butterfish (1,035 g).

A monthly comparison of weight estimates for the five commercially important species is presented in Figure 13. Summer flounder, the species comprising most of the weight, had peak values in September at Shinnecock and May at Cherry Grove. Winter flounder, the species with the second highest weight, peaked in May and July at Shinnecock and December and April at Cherry Grove. Atlantic butterfish weights peaked in November and April at Shinneock and September through October at Cherry Grove. Scup weights peaked in May at Shinnecock and September at Cherry Grove. Only one bluefish was collected from each borrow area, therefore the weight of this species is negligible. Overall, the weights of scup, butterfish and bluefish are minimal compared to winter and summer flounders, on the order of one magnitude less. A trend is not apparent in weight distributions between the two borrow areas. Peak weights occur at different times of the year for similar species at the two borrow areas.

Tables 11 and 12 summarize the monthly weights of these five species as a mean weight, grams per fish, at Shinnecock and Cherry Grove. Summer and winter flounders consistently had the highest average weight each month. The maximum average weight for summer flounder occurred in October (1,250 g/fish) at Shinnecock and September at Cherry Grove (987 g/fish). This indicates when the largest summer flounder were collected. Winter flounder average weight was maximum in July at Shinnecock (763 g/fish) and February at Cherry Grove (1,100 g/fish). These average weights were two to six times higher than at other times of the year. Atlantic butterfish had the lowest mean weight per fish at both sites: 0.4 g/fish at Shinnecock in September and 0.2 g/fish in August and September at Cherry Grove

Spatial Analysis

Spatial analyses of the data were performed to determine if there were trends in an east-to-west direction and/or along depth contours. The total number of fish was plotted against depth in Figure 14 (stations were grouped by depth contour). At the Shinnecock borrow area there does not appear to be a relationship between the abundance of finfish with depth. There were peak abundances at stations T-30-A and T-50-A. The peak abundances at these two stations can be attributed to extremely high collections of bay anchovy during September. A correlation of fish abundance versus depth at Shinnecock indicates no relationship between depth and abundance (r^2=0.185). At Cherry Grove the abundances of finfish appear to be greater at the 40 and 50-foot depth contours than at the 30 and 60-foot contours. The high abundances at the 40 and 50-foot depth intervals can be attributed to increased landings of Atlantic butterfish and bay anchovy in September. A linear regression of abundance versus depth data at Cherry Grove has a correlation of 3% (r^2 = 0.03).

Transects A, B, C and D were combined for each depth contour and the average number of fishes were calculated. A plot of the data is shown in Figure 15. Similar to Figure 14, Figure 15 illustrates the randomness in finfish abundance at all four depth intervals. Generally, depth does not appear to affect finfish abundance. These results differ from findings of the previous year's study at the Shinnecock borrow area. During 1999-2000 there appeared to be a slightly increasing trend in fish abundance with depth, although this relationship is not strong ($r^2 = 0.56$). Most likely, exceptionally high collections of schooling fishes in September had a tendency to skew the data. A similar plot of the number of fish species at each station, grouped by depth, is shown in Figure 16. Correlation coefficient values (r^2) for the number of species at Shinnecock and Cherry Grove are and 0.07 and 0.19, respectively. This indicates that the number of species does not appear to be related to depth.

A similar analysis was conducted to examine trends in an east-west direction and possible influences of inlets. At the Shinnecock borrow area, the more easterly transects are farthest from Shinnecock inlet. An east-west analysis of Cherry Grove was also conducted, however this borrow area is located approximately equidistant between Moriches and Fire Island inlets. Therefore, it would be difficult to attribute inlet influences. Figure 17 shows the total number of fishes plotted for each station, with stations grouped by transect from west to east. At Shinnecock, transect A has the highest abundances of finfish. This is primarily due to the high catch of bay anchovy in September at stations T-30-A and T-50-A. At Cherry Grove, abundances were highest along transect B, however, a low abundance also occurred at the 30-foot depth contour for transect B. A correlation of the data shows a slight relationship between transect and fish abundance at Shinnecock, r^2=0.56. At Cherry Grove, there does not appear to be any correlation between transect and fish abundance, r^2=0.01.

A similar plot of the total number of species at each transect is shown in Figure 18. In this figure, all depth intervals are grouped for each transect. At the Shinnecock site, the number of species appears to decrease from west to east through transect C, then increase at the easternmost transect which is located farthest from the inlet. The opposite trend is apparent at Cherry Grove. Here there is an increasing number of species from east to west until the westernmost transect is reached, whereby species diversity decreases. Correlation coefficient values for each site are: r^2=0.19 (SH) and r^2=2.01 (CG). Interestingly, these results indicate no relationship between the total number of species along transects at the Shinnecock borrow area, however a strong relationship occurs at Cherry Grove.

Monthly CPUE values for finfish at each station are shown in Table 13. The greatest CPUE values at Shinnecock were during September at stations T-30-A (15,892) and T-50-A (11,403). The lowest catches were at stations T-30-A and T-30-C during May, August, September, February and April when no finfish were collected. Finfish CPUE at Cherry Grove was greatest during September at stations F-40-B (789) and F-50-B (704). Lowest CPUE values at Cherry Grove were during November and January through April at stations F-30-A, F-30-B, F-40-C, F-50-A and F-50-B (CPUE=0). Species diversity in Shinnecock was highest at station T-50-A (35), while station T-30-C had the lowest number of species (18) (Figure 18). Species diversity in Cherry Grove was highest at station F-50-B (29) and lowest at station F-30-A (12) (Figure 18).

b) Finfish Age and Growth

Of the seven species analyzed, scales and otoliths were collected from nearly four hundred fishes. Figure 19 shows the age frequency distribution for black sea bass, scup, winter flounder, weakfish, summer flounder, bluefish and striped bass. Tautog was also part of the study, however none were collected during the course of the study. Note that several species had collections limited to one or two fish. For example, only one striped bass and two black sea bass were collected from the Shinnecock borrow area, and only one bluefish was collected at each borrow area. Of the seven species analyzed, summer flounder was the only species with fishes older than 4 years at both Cherry Grove and Shinnecock. The percentage of summer flounder younger than four years age was ninety-four percent at Cherry Grove and eighty-two percent at Shinnecock-all were younger than 7 years. A monthly analysis of the mean age distribution is shown in Figure 20. Weakfish was the only species consistently collected with a mean age of 0 (SH). Black sea bass, striped bass and scup had mean ages of 0 to 1 year. Winter flounder mean ages were 1 to 3 years. The bluefish collected at Shinnecock had a mean age of 0 and at Cherry Grove a mean age of three. Summer flounder mean ages varied from 3 to 4 years primarily. Temporally, the oldest scup were collected in July. The oldest winter flounder were collected from July through December. Summer flounder mean ages were oldest from June through September, then steadily decreased through November.

Table 14 shows the number of fishes for each age class and the range of their total lengths. Summer flounder and winter flounder had the largest mean total length per age class, averaging 152 – 600mm. Scup and weakfish were the smallest for each age class, not exceeding an average of 161mm. Black sea bass collected at Shinnecock did not exceed 220mm. The bluefish collected was 224mm (SH) and 416mm (CG). A length was not available for the single striped baass collected at Cherry Grove. Length-at-age distributions are plotted in Figures 21 and 22 for Shinnecock and Cherry Grove. Regression equations were calculated for each species to obtain yearly growth rates. Growth rates for each species are as follows: Scup= 50mm/yr (SH) and 44mm/yr (CG), winter flounder = 59mm/yr (SH) and 66mm/yr (CG), summer flounder = 52mm/yr (SH) and 40mm/yr (CG) and weakfish = 6mm/yr (SH only). Regressions could not be calculated for striped bass, black sea bass and bluefish due to their small sample sizes. Of the species with appreciable sample sizes, scup had the lowest growth rate at Shinnecock (50mm/yr), while summer flounder was lowest at Cherry Grove (40mm/yr). The highest growth rate was recorded from winter flounder at both sites (59mm/yr-SH and 66mm/yr-CG). It is important to note that species-specific growth rates within and between years vary significantly. These growth rates represent growth of the fishes at the age collected. Generally, most fishes will have highest growth rates during their first year. As the fish ages, growth stabilizes to a constant rate.

The average age per station is plotted in Figures 23 and 24 for each borrow area. Figures 23 and 24 are three-dimensional plots of age versus depth and transect. At the Shinnecock borrow area, all species that were aged were subsampled from the 30-foot depth contour along all transects. Age distributions along transects appear similar. At Cherry Grove, scup and bluefish were subsampled from the 30-foot depth contour, while summer and winter flounders were subsampled from the 50-foot contour. Ages along each transect appear similar along the depth contours for Cherry Grove. Overall, age distributions appear similar along depth contours and transect profiles. Summer flounder were the oldest, approaching 7+ years. Scup were the youngest, not exceeding 1+ years. On average, all species, except summer flounder, were less than 4+ years. Sample sizes for bluefish, striped bass, weakfish and black sea bass were too small for analyses.

c) Macroinvertebrates

Abundance and Diversity

Macroinvertebrates collected in the trawl survey were analyzed for abundance and diversity. Tables 15 and 16 present a summary of the macroinvertebrates by taxa, month, borrow site and percent composition for the Shinnecock and Cherry Grove borrow areas. A total of 21,507 invertebrates were collected in the trawls at the Shinnecock borrow area, and a total of 18,339 invertebrates at Cherry Grove. Overall, a total of twenty different species were collected, eighteen at Shinneock and sixteen at Cherry Grove. Table 4 lists both the common and scientific names for all macroinvertebrate species collected.

The numerically dominant species at both sites was the sand dollar (Tables 15 and 16). A total of 13,458 sand dollars were collected at Shinnecock and 13,643 at Cherry Grove. At both sites, sand dollars represented greater than sixty-percent of the total catch. The second most abundant species at both sites was the sevenspine bay shrimp, representing approximately ten-percent of the catch at both sites. The third and fourth most abundant species at both sites were the New England dog whelk and long-finned squid, respectively. Abundances for these species accounted for four to nine percent of the total catch. The remaining species constituted approximately five percent of the catch. Figure 25 shows the total number of invertebrates plotted by species. In general, similar species appear to dominate at both sites, with minor differences in overall species composition. Of all species present, fourteen were found at both sites. Percent composition of the dominant invertebrate species is shown in Figure 26. Combined, sand dollar, sevenspine bay shrimp and New England dog whelk represent over eighty-two percent of the total catch at Shinnecock and ninety percent at Cherry Grove. Abundances for these three species exceed all others combined four to ten times.

Figure 27 shows the total monthly catch of macroinvertebrates in the trawls. The greatest number of invertebrates was collected during July at Shinnecock (3,483) and April at Cherry Grove (5,528) (Figure 27, Tables 15 and 16). This was primarily due to the high catches of sand dollars at both sites. At Shinnecock, sand dollars dominated the catch during all months except September, December, January and March (Table 15). During September, long-finned squid was dominant, while the sevenspine bay shrimp dominated the other months. Interestingly, no sand dollars were recorded in the December catch. Sand dollars dominated the catch during all months except October and February at Cherry Grove (Table 16). During October, long-finned squid was dominant, while during February the sevenspine bay shrimp dominated. The least number of invertebrates was collected during December at Shinnecock (316) and March at Cherry Grove (7).

Spatial Analysis

Spatial analyses of invertebrate data were performed to observe trends along depth contours and in a west-to-east direction. Figure 28 shows the total number of macroinvertebrates plotted for each depth interval. The data suggests a strong correlation for increasing numbers of macroinvertebrates with increasing depth at both sites, $r^2 = 0.71$ (SH), $r^2 = 0.72$ (CG). This relationship of increasing invertebrate abundances along increasing depth contours is similar to findings from the previous year's study at the Shinnecock borrow area. During 1999-2000 the correlation between greater abundances of macroinvertebrates with increasing depth accounted for seventy-four percent of the relationship. Similar to findings from 1999-2000, there appears to be a difference in macroinvertebrate abundances at the 30 and 40-foot contours versus the 50 and 60-foot contours at both sites. A t-test was performed to see if there was a significant difference in the two depth intervals. Results of the test proved highly significant at both sites: Shinnecock- $T=-3.02$, $P=0.02$ and Cherry Grove- $T=-4.28$, $P=0.005$. These results suggest a less than 2% probability the distribution is due to chance at Shinnecock and an even smaller probability at Cherry Grove (0.5%). Interestingly, these spatial trends are apparent in macroinvertebrate abundances at both Shinnecock and Cherry Grove. For example, animal abundances increase with increasing depth. The depth contour indicating a marked change in distribution appears to occur between 40 and 50 feet.

A plot of macroinvertebrate abundances along transects in a west-to-east direction is shown in Figure 29. The distribution of invertebrates along transects appears to fluctuate randomly. Linear regressions were calculated for each site, results indicate a weak relationship between transects and invertebrate abundances. Correlation coefficients for the two borrow areas are as follows; Shinnecock $r^2 = 0.10$ and Cherry Grove $r^2 = 0.30$. Neither borrow area shows a strong relationship between invertebrate abundances along transects, however, Cherry Grove has a slightly higher correlation.

Long-finned Squid

The Shinnecock and Cherry Grove borrow areas are considered to be important breeding grounds for long-finned squid. As a result, squid and squid egg masses were analyzed as part of the trawl survey. During the survey, a total of 1,710 long-finned squid were collected from the Shinnecock borrow area and 758 from Cherry Grove (Tables 15 and 16). The only squid egg masses collected were from Cherry Grove in August when five were collected at station F-60-D. A length frequency distribution is plotted for long-finned squid in Figure 30. Mantle lengths for squid ranged from 10 to 440 mm at Shinnecock and 10 to 214 mm at Cherry Grove. Greater than half of the long-finned squid at Shinnecock were less than 50mm (59%). Seventy-five percent were less than 75mm. At Cherry Grove, sixty-four percent were less than 50mm and eighty percent were smaller than 75mm. The distribution of lengths appears unimodal, indicating one cohort.

Monthly abundance and weight for long-finned squid is plotted in Figure 31. Distributions of abundance and weight follow similar monthly trends. At both borrow areas, long-finned squid abundance and weight peaked in September. Similarly sized smaller catches of long-finned squid are observed throughout the remainder of the year-long survey. To observe spatial trends in long-finned squid biomass, the monthly weight was plotted versus depth for each station (Figure 32). There appears to be a trend towards increasing long-finned squid weight with increasing depth. A linear regression was calculated for each site. The correlation coefficient value at Shinnecock was $r^2 = 0.69$, while at Cherry Grove $r^2 = 0.71$. These high correlation coefficients indicate a strong relationship between depth and long-finned squid biomass, accounting for nearly 70% of the relationship between the two variables. There appears to be higher biomass collections of squid at the deeper stations.

Long-finned squid weight was plotted for each transect in a west-to-east direction (Figure 33). The distribution of long-finned squid weight along transects appears to fluctuate randomly at both Shinnecock and Cherry Grove. There is a weak relationship between biomass and transect with correlation coefficient values for the two sites as follows: $r^2 = 0.16$ (SH) and $r^2 = 0.25$ (CG).

Atlantic Surfclam

The Atlantic surfclam, *Spisula solidissima,* is considered to be an economically important commercial species. As a result of it's importance, a separate survey was conducted to determine abundance and distribution for the Atlantic surfclam. Previously, during the 1999-2000 survey, abundances of the Atlantic surfclam were low at the Shinnecock borrow area. Of the clams collected in the trawl survey, none were adults. Results from the 2001 URS survey are presented below.

Preliminary data have been analyzed for surf clam population densities in each of the sampling stations of the eight borrow areas. These data indicate that the borrow areas delineated by the New York District have from very small, to no localized surf clam populations with exception to the borrow areas off Fire Island Pines east of Ocean Beach (Borrow Area 2AD) and West of Shinecock Inlet (WOSI). Dense populations of surf clams were noted in the near shore sampling stations of Borrow Area 2AD. Up to sixty-seven (67) US Bushels were taken in these stations. Mean size of clams in these stations ranged from approximately 97 to 136 mm. Dense localized clam populations were noted in sampling stations just outside and east of the WOSI Borrow Area. Up to seventy (70) US Bushels were taken from these sampling stations. Mean size of clams in these stations ranged from approximately 117 to 134 mm.

Please note that these data are preliminary and should be used for general information purposes only. A draft Surf Clam Survey Report is currently being prepared that will include exact location of sampling stations, borrow areas, and survey results. Applicable figures will also be included in the report. Additional information will include notes on other species taken in the borrow areas as well as varying bottom composition (e.g., clay,

B. Physical Studies

1. Water Quality

a) Trawl Surveys

Water quality parameters measured in conjunction with ecological sampling included temperature, salinity, dissolved oxygen (DO), pH, conductivity, and light transmission (measured with a Secchi disk). A survey of water quality parameters was conducted at the beginning and end of each trawl during the study. Tables 17 and 18 present mean monthly readings for demersal fisheries trawls at the Shinnecock and Cherry Grove borrow areas. Surface and bottom readings were recorded for all parameters measured except light transmission.

Figures 34 and 35 show mean monthly readings for each of the physical water variables measured. At both borrow areas, mean temperatures ranged from a bottom low of approximately 2°C (January) to a surface high of ~20°C (September). Temperature increased steadily from spring through summer, peaking in September at both sites. Mean dissolved oxygen surface values at both sites ranged from 5.2 to 11.5 mg/L. Dissolved oxygen values appeared to increase to approximately 10 mg/L from January through April. Dissolved oxygen levels at both sites were similar. Dissolved oxygen levels peaked in January at Shinnecock and January and March at Cherry Grove. Lowest DO measurements were recorded in October at Shinnecock and September at Cherry Grove. Salinity remained fairly constant at both sites (29.5-32.3 ppt). Peak salinity values occurred in September at Shinnecock for both surface and bottom. At Cherry Grove, salinity values were highest in May. Mean pH was constant throughout the year at both sites and depth levels (~8). Light transmission appeared to be greater at the Shinnecock site versus the Cherry Grove site. Values ranged from 3.3 to 5.1 meters at Shinnecock versus 2.7 to 4.8 meters at Cherry Grove. Light transmission through the water column fluctuated randomly throughout both sites, ranging from 1.1 to 5.1 meters. Highest values of light transmission were observed in October at Shinnecock and September at Cherry Grove. Light transmission was lowest in December at both sites. Conductivity is a measurement of salinity, thereby reflecting the same changes. Throughout this study conductivity remained fairly constant, ranging from 27.9 to 45.5 mS/cm). In general, the changes in physical variables followed expected seasonal trends.

Spatial changes in environmental water quality variables were measured both along depth contours and along transects in a west-to-east direction. Figures 36 and 37 show changes along depth contours for each of the physical variables measured. Measurements were averaged for each depth contour. At both sites, Shinnecock and Cherry Grove, temperature, salinity, dissolved oxygen, conductivity and pH do not change along the different depth intervals of 30, 40, 50 and 60 feet. The only parameter that appears to experience a change is light transmission. At Cherry Grove, it appears that light transmission increases with increasing depth. Water quality measured along the four transects (A, B, C and D) is plotted in Figures 38 and 39. Measurements along each transect are averaged and plotted in a west-to-east direction. Similar to findings along depth contours, there does not appear to be a difference in temperature, salinity, dissolved oxygen, conductivity and pH at any transect. Overall, all environmental water quality variables remained constant over depth and transect intervals. The only variable with a degree of change was light transmission. At Cherry Grove, it appears that light transmission tended to increase with increasing depth and along transects in an easterly direction.

IV. COMPARISON TO OTHER STUDIES

A. Fisheries

During 1995 and 1996 the U.S. Army Corps of Engineers New York District conducted fisheries studies for potential borrow areas off the Atlantic coast of New Jersey, Asbury Park to Manasquan. In order to collect offshore fisheries information, the New Jersey beach erosion control project utilized a similar gear type as the current study, an otter trawl. The data was reported for spring and fall seasons. For comparison, the New Jersey data is presented in Figure 40. Herring was the dominant species in the New Jersey program, comprising approximately half of the catch. Hake, winter flounder, American sand lance and windowpane contributed the next highest percentages. Figure 41 shows the dominant species collected as part of the USACE Fire Island Inlet to Montauk Point, New York: Reformulation Study. In Figure 41 data is presented from both 1999-2000 and the current year (2000-2001). During 1999-2000 butterfish was the dominant species (Figure 41-top panel). The bottom panel of Figure 41 shows the combined overall catches for both Shinnecock and Cherry Grove. During 2000-2001, bay anchovy dominated the catches, with butterfish the next most abundant. In the New Jersey study, few butterfish were found in 1995 and none in 1996. The Long Island study had anchovy, butterfish, scup, skates and hakes as the most abundant species. Although butterfish and scup appear in the New Jersey survey in 1995, they either do not occur in 1996 or occur in such small numbers that they are lumped into the 'other' category.

In general, the fisheries community structure for the two areas is comparable in that similar species were found. Species abundances, however, varied. Species diversity appeared similar for the two studies with approximately 40 species found in both areas. Results from the New Jersey study established seasonal and yearly trends in species composition and diversity. A similar observation was made in this study, where an obvious seasonal difference was noted.

V. CONCLUSIONS

Temporal and spatial analyses of the data demonstrate a strong seasonal link in community assemblages. During the previous year of this study, a possible trend was noticed along depth contours. However, the current year of the study does not establish a trend in either fisheries composition or abundance with depth. Seasonally, finfish abundance peaked during September at both sites. Species diversity was greatest in September and November at Shinnecock, and May and December at Cherry Grove. Bay anchovy was the dominant species at Shinnecock, constituting 85% of the total catch. This is primarily due to an extremely large catch in September. Other species of relative importance in abundance were Atlantic butterfish, silver hake, little skate, anchovy sp. and winter skate. Combined, these species constitute approximately 95% of the total catch. At Cherry Grove, Atlantic butterfish dominated comprising 36% of the total catch. The next most abundant species were bay anchovy, little skate, scup, silver hake, winter skate and striped searobin. Combined, these six species represent 80% of the total catch. Statistics indicated that species abundances at the two sites were different. This is most likely the result of extemely high landings of bay anchovy at Shinnecock and Atlantic butterfish at Cherry Grove during September.

The yearly total weight of all species collected at Shinnecock was 862,497 grams. Weight varied monthly from 11,290 g (February) to 207,722 g (October). The five dominant species by weight were little skate, winter skate, windowpane, summer flounder and bay anchovy. Combined, these species comprise approximately 90% of the total weight, little skate accounted for nearly half of the weight. The yearly total weight at Cherry Grove was 657,124 grams. Monthly weight varied from a low of 2,440 g (January) to a high of 169,920 g

(December). The five dominant species by weight at Cherry Grove were: little and winter skate, spiny dogfish, windowpane and summer flounder. Combined, these species comprised approximately 90% of the total weight. The weight distributions for the two borrow areas are similar.

Catch-per-unit-effort values peaked in September at both sites. Lowest CPUE values were recorded in January at Shinnecock and in March at Cherry Grove. Catch-per-unit-effort was highest for the following species: bay anchovy, Atlantic butterfish, silver hake, little skate, and anchovy spp., at Shinnecock. At Cherry Grove, highest CPUE values were recorded for the following species: Atlantic butterfish, bay anchovy, little skate, scup and silver hake. Mean CPUE values showed similar trends to fish abundance data.

Due to their commercial importance, five finfish species were analyzed separately: Atlantic butterfish, bluefish, scup, winter flounder, and summer flounder. Length frequency analyses determined that Atlantic butterfish and scup were likely from one cohort. Winter and summer flounder distributions, however, appeared bimodal, indicating the possibility of two cohorts. Atlantic butterfish was the smallest fish collected, while summer flounder was the largest. Statistics indicate that length distributions of these five species is similar at the two potential borrow areas. Summer flounder constituted the greatest weight from the two sites. Peak landings of summer flounder occurred in September at Shinnecock and May at Cherry Grove. Winter flounder landings also constituted a large portion of the biomass at both sites. Winter flounder weight peaked in May and July at Shinnecock and December and April at Cherry Grove. The weight of the remaining three commercially important species is negligible compared to the summer and winter flounder weights.

Spatially there does not appear to be a trend between fish abundance and depth. Although results from the previous year of the study indicated an apparent trend of increasing fish abundance with increasing depth, this trend is not observed in the current year. Finfish abundances were analyzed spatially along transects to look for a relationship in a west-to-east direction, as well as possible inlet influences. There appears to be a slight correlation between finfish abundance and transect location at Shinnecock (r^2=0.56). At Cherry Grove there does not appear to be a relationship between fish abundance and transect (r^2=0.01). A comparison of species diversity along transects at both sites indicates a weak relationship at Shinnecock (r^2=0.19) and a strong positive relationship at Cherry Grove (r^2=2.01).

Age and growth analyses of the seven species analyzed indicated that summer flounder was the oldest and only species collected older than 4 years (for both sites). Summer flounder had a mean age of 3 to 4 years. Weakfish was the only species collected with a mean age of 0, consistently. Black sea bass, striped bass and scup had mean ages of 0 to 1 year. Summer and winter flounder had the largest mean length per age class, averaging 152 to 600mm. Scup and weakfish were the smallest for each age class, not exceeding an average of 161mm. Growth rates for all species were approximately 50mm/year for all species except weakfish (6mm/year).

Macroinvertebrates collected in the trawl survey were dominated by the sand dollar. At both sites, sand dollars accounted for greater than 60% of the total catch. The second through fourth most abundant species at both sites were: sevenspine bay shrimp, New England dog whelk and long-finned squid, respectively. Abundances for these species combined accounted for four to nine percent of the total catch. The remaining species constituted five percent of the total catch. In general, the two potential borrow areas had similar species compositions and abundances of macroinvertebrates. Seasonally, abundances peaked in July at Shinnecock and April at Cherry Grove. Spatially, there is a strong relationship between increasing macroinvertebrate abundances with increasing depth at both sites. The depth contour where there appears to be a marked change in macroinvertebrate distributions occurs between 40 and 50 feet. These findings are similar to findings from the previous year of the study, 1999-2000.

The Shinnecock and Cherry Grove borrow areas are considered to be important breeding grounds for long-finned squid. During the survey, a total of 1,710 long-finned squid were collected from the Shinnecock borrow area and 758 from Cherry Grove. The only squid egg masses collected were from Cherry Grove in August when five were collected at station F-60-D. Mantle lengths for squid ranged from 10 to 440 mm at Shinnecock and 10 to 214 mm at Cherry Grove. The distribution of lengths appears unimodal, indicating one cohort. There appears to be higher biomass collections of squid at the deeper stations.

Environmental water quality variables (temperature, salinity, dissolved oxygen, conductivity, pH, light transmission) followed expected seasonal trends. Water quality did not change significantly between stations throughout the course of the survey. Additionally, measurements of water quality variables collected at the beginning and end of the trawl were fairly constant.

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TABLE 1

List of Finfish Species Collected in Bottom Trawls

May 2000 through April 2001

	ALEWIFE	*Alosa pseudoharengus*
	AMERICAN SAND LANCE	*Ammodytes americanus*
**	AMERICAN SHAD	*Alosa sapidissima*
	ANCHOVY sp.	Engraulidae
	ATLANTIC BUTTERFISH	*Peprilus triacanthus*
*	ATLANTIC COD	*Gadus morhua*
	ATLANTIC CROAKER	*Micropogonias undulatus*
	ATLANTIC HERRING	*Clupea harengus*
**	ATLANTIC MACKEREL	*Scomber scombrus*
	ATLANTIC MENHADEN	*Brevoortia tyrannus*
	ATLANTIC MOONFISH	*Selene setapinnis*
	ATLANTIC SILVERSIDE	*Menidia menidia*
	BAY ANCHOVY	*Anchoa mitchilli*
	BLACK SEA BASS	*Centropristis striata*
	BLUEBACK HERRING	*Alosa aestivalis*
	BLUEFISH	*Pomatomus saltatrix*
**	BLUESPOTTED CORNETFISH	*Fistularia tabacaria*
	CLEARNOSE SKATE	*Raja eglanteria*
**	CUNNER	*Tautogalabrus adspersus*
	DWARF GOATFISH	*Upeneus parvus*
**	FAWN CUSK-EEL	*Lepophidum cervinum*
	FOURSPOT FLOUNDER	*Paralichthys oblongus*
**	GOOSEFISH	*Lophius americanus*
	HAKE sp.	*Urophycis* sp.
	HICKORY SHAD	*Alosa mediocris*
	INQUILINE SNAILFISH	*Liparis inquilinus*
*	INSHORE LIZARDFISH	*Synodus foetens*
	LINED SEAHORSE	*Hippocampus erectus*
	LITTLE SKATE	*Raja erinacea*
	LONGHORN SCULPIN	*Myoxocephalus octodecemspinosus*
*	LOOKDOWN	*Selene vomer*
**	NORTHERN KINGFISH	*Menticirrhus saxatalis*
	NORTHERN PIPEFISH	*Syngnathus fuscus*
	NORTHERN PUFFER	*Sphoeroides maculatus*
	NORTHERN SEAROBIN	*Prionotus carolinus*
**	OCEAN POUT	*Macrozoarces americanus*
**	PLANEHEAD FILEFISH	*Monacanthus hispidus*
	POLLOCK	*Pollachius virens*
	RED HAKE	*Urophycis chuss*
	ROUGH SCAD	*Trachurus lathami*
**	ROUND SCAD	*Decapterus punctatus*
	SCUP	*Stenotomus chrysops*
*	SEA RAVEN	*Hemitripterus americanus*
	SILVER HAKE	*Merluccius bilinearis*
	SMALLMOUTH FLOUNDER	*Etropus microstomus*
	SMOOTH DOGFISH	*Mustelus canis*
*	SPINY DOGFISH	*Squalus acanthius*
**	SPOT	*Leiostomus xanthurus*
	SPOTTED HAKE	*Urophycis regia*
	STRIPED ANCHOVY	*Anchoa hepsetus*
	STRIPED SEAROBIN	*Prionotus evolans*
	SUMMER FLOUNDER	*Paralichthys dentatus*
*	THREESPINE STICKLEBACK	*Gasterosteus aculeatus*
	WEAKFISH	*Cynoscion regalis*
	WINDOWPANE	*Scophthalmus aquosus*
	WINTER FLOUNDER	*Pseudopleuronectes americanus*
	WINTER SKATE	*Raja ocellata*

* Collected at Cherry Grove only.

** Collected at Shinnecock only.

TABLE 2

SUMMARY OF TRAWL CATCH DATA - SHINNECOCK FISHERIES

MONTHLY TOTALS, TOTAL NUMBER, PERCENT COMPOSITION

	MAY 2000	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN. 2001	FEB.	MAR.	APR.	TOTAL CAUGHT	PERCENT OF TOTAL
BAY ANCHOVY					27,498		55						27,553	84.88
ATLANTIC BUTTERFISH	13	15	28	4	289	282	173					4	808	2.49
SILVER HAKE	3						74	716	1	2			796	2.45
LITTLE SKATE	24	30	55	8	8	72	216	162	26	6	63	50	720	2.22
ANCHOVY sp.							6			461			467	1.44
WINTER SKATE	26	13	30	15	4	8	142	49	9	5	71	36	408	1.26
ATLANTIC CROAKER				256	3								259	0.80
SCUP	136	21	17	1	47	3							225	0.69
WINDOWPANE	7	17	16	17	11	8	47	14	1		6	13	157	0.48
WEAKFISH					8		111	7					126	0.39
ATLANTIC SILVERSIDE								1	40	39	29		109	0.34
SPOTTED HAKE	1	9	1				71	10			3		95	0.29
SUMMER FLOUNDER	13	16	14	14	18	1	6					5	87	0.27
NORTHERN SEAROBIN	4	24	31	13	5		3					3	83	0.26
SMALLMOUTH FLOUNDER	5	9	11	6	3	2	6				15	3	60	0.18
HICKORY SHAD								54					54	0.17
ATLANTIC HERRING								51	1	1			53	0.16
ATLANTIC MOONFISH					51		1						52	0.16
RED HAKE							26	12			10	4	52	0.16
WINTER FLOUNDER	9	5	4		1		4	13	5	3	1	6	51	0.16
INQUILINE SNAILFISH								3	3	2	34		42	0.13
NORTHERN PUFFER					29	9	2						40	0.12
ROUGH SCAD	1				33	1						3	38	0.12
STRIPED SEAROBIN	8	1	1		4	1							15	0.05
ROUND SCAD				14									14	0.04
STRIPED ANCHOVY			1		10			1					12	0.04
NORTHERN PIPEFISH											11		11	0.03
CLEARNOSE SKATE			1	4								2	7	0.02
POLLOCK			6					1					7	0.02
ALEWIFE					1		2	3					6	0.02
AMERICAN SHAD											4	2	6	0.02
AMERICAN SAND LANCE			2						2	1			5	0.02
BLACK SEA BASS	1											3	4	0.01
LINED SEAHORSE						2	2						4	0.01
LONGHORN SCULPIN								2	1			1	4	0.01
NORTHERN KINGFISH							4						4	0.01
BLUEBACK HERRING					1		1		1				3	0.01
DWARF GOATFISH				3									3	0.01
SMOOTH DOGFISH	2	1											3	0.01
ATLANTIC MENHADEN									2				2	0.01
GOOSEFISH								2					2	0.01
OCEAN POUT												2	2	0.01
PLANEHEAD FILEFISH		1		1									2	0.01
SPOT							2						2	0.01
ATLANTIC MACKEREL												1	1	0.00
BLUEFISH					1								1	0.00
BLUESPOTTED CORNETFISH				1									1	0.00
CUNNER											1		1	0.00
FAWN CUSK-EEL											1		1	0.00
FOURSPOT FLOUNDER	1												1	0.00
HAKE sp.	1												1	0.00
MONTHLY TOTALS	255	162	218	357	28,025	389	954	1,101	92	520	249	138	32,460	

TABLE 3

SUMMARY OF TRAWL CATCH DATA - CHERRY GROVE FISHERIES

MONTHLY TOTALS, TOTAL NUMBER, PERCENT COMPOSITION

	MAY 2000	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN. 2001	FEB.	MAR.	APR.	TOTAL CAUGHT	PERCENT OF TOTAL
ATLANTIC BUTTERFISH	7	20	21	226	1,522	417	14						**2,227**	**36.40**
BAY ANCHOVY					688	155							**843**	**13.78**
LITTLE SKATE	71	70	64	35	5	113	24	206	16	21	2	84	**711**	**11.62**
SCUP	28	33	57	22	470	10							**620**	**10.13**
SILVER HAKE	3					3	8	253		2		6	**275**	**4.49**
WINTER SKATE	64	14	18	2	1	7	4	70	11	11		11	**213**	**3.48**
STRIPED SEAROBIN	31	9	1		82	27							**150**	**2.45**
HAKE sp.	5								139			5	**149**	**2.44**
WINDOWPANE	26	17	16		1	7	2	19	1	2		22	**113**	**1.85**
ATLANTIC HERRING								67	1	8	14		**90**	**1.47**
ROUGH SCAD					81		4						**85**	**1.39**
WINTER FLOUNDER	7	1		9			2	31	11	1		10	**72**	**1.18**
NORTHERN SEAROBIN	15	13	37	1	2							2	**70**	**1.14**
ATLANTIC SILVERSIDE	26							2	5	32	1		**66**	**1.08**
STRIPED ANCHOVY		2			64								**66**	**1.08**
SPOTTED HAKE	27	16	2									9	**54**	**0.88**
ANCHOVY sp.				2	3					12	36		**53**	**0.87**
SUMMER FLOUNDER	13	6	7	6	4	4	6					3	**49**	**0.80**
SMALLMOUTH FLOUNDER	2	10	9	2	1	1	4	1				15	**45**	**0.74**
SPINY DOGFISH			2			4	16	10					**32**	**0.52**
HICKORY SHAD								31					**31**	**0.51**
RED HAKE								16					**16**	**0.26**
ATLANTIC CROAKER			1	10									**11**	**0.18**
FOURSPOT FLOUNDER	2	3	5										**10**	**0.16**
OCEAN POUT												10	**10**	**0.16**
INQUILINE SNAILFISH								4	1	3			**8**	**0.13**
BLACK SEA BASS	4											3	**7**	**0.11**
THREESPINE STICKLEBACK										7			**7**	**0.11**
ALEWIFE		4											**4**	**0.07**
ATLANTIC MENHADEN								2	1				**3**	**0.05**
CLEARNOSE SKATE			1	2									**3**	**0.05**
BLUEBACK HERRING										2			**2**	**0.03**
DWARF GOATFISH				2									**2**	**0.03**
INSHORE LIZARDFISH					2								**2**	**0.03**
LINED SEAHORSE				1		1							**2**	**0.03**
NORTHERN PIPEFISH										1	1		**2**	**0.03**
ROUND SCAD				2									**2**	**0.03**
SEA RAVEN								2					**2**	**0.03**
WEAKFISH								2					**2**	**0.03**
AMERICAN SAND LANCE										1			**1**	**0.02**
ATLANTIC COD	1												**1**	**0.02**
ATLANTIC MOONFISH						1							**1**	**0.02**
BLUEFISH					1								**1**	**0.02**
LONGHORN SCULPIN								1					**1**	**0.02**
LOOKDOWN				1									**1**	**0.02**
NORTHERN PUFFER	1												**1**	**0.02**
POLLOCK			1										**1**	**0.02**
SMOOTH DOGFISH		1											**1**	**0.02**
MONTHLY TOTALS	**333**	**219**	**242**	**323**	**2,927**	**750**	**84**	**717**	**186**	**103**	**54**	**180**	**6,118**	

TABLE 5

Rank Abundance of Fish Species for Shinnecock and Cherry Grove Borrow Areas

SHINNECOCK

	Total Number	Rank
BAY ANCHOVY	27,553	1
ATLANTIC BUTTERFISH	808	2
SILVER HAKE	796	3
LITTLE SKATE	720	4
ANCHOVY sp.	467	5
WINTER SKATE	408	6
ATLANTIC CROAKER	259	7
SCUP	225	8
WINDOWPANE	157	9
WEAKFISH	126	10
ATLANTIC SILVERSIDE	109	11
SPOTTED HAKE	95	12
SUMMER FLOUNDER	87	13
NORTHERN SEAROBIN	83	14
SMALLMOUTH FLOUNDER	60	15
HICKORY SHAD	54	16
ATLANTIC HERRING	53	17
ATLANTIC MOONFISH	52	18.5
RED HAKE	52	18.5
WINTER FLOUNDER	51	20
INQUILINE SNAILFISH	42	21
NORTHERN PUFFER	40	22
ROUGH SCAD	38	23
STRIPED SEAROBIN	15	24
ROUND SCAD	14	25
STRIPED ANCHOVY	12	26
NORTHERN PIPEFISH	11	27
CLEARNOSE SKATE	7	28.5
POLLOCK	7	28.5
ALEWIFE	6	30.5
AMERICAN SHAD	6	30.5
AMERICAN SAND LANCE	5	32
BLACK SEA BASS	4	34.5
LINED SEAHORSE	4	34.5
LONGHORN SCULPIN	4	34.5
NORTHERN KINGFISH	4	34.5
BLUEBACK HERRING	3	38
DWARF GOATFISH	3	38
SMOOTH DOGFISH	3	38
ATLANTIC MENHADEN	2	42
GOOSEFISH	2	42
OCEAN POUT	2	42
PLANEHEAD FILEFISH	2	42
SPOT	2	42
ATLANTIC MACKEREL	1	48
BLUEFISH	1	48
BLUESPOTTED CORNETFISH	1	48
CUNNER	1	48
FAWN CUSK-EEL	1	48
FOURSPOT FLOUNDER	1	48
HAKE sp.	1	48

CHERRY GROVE

	Total Number	Rank
ATLANTIC BUTTERFISH	2,227	1
BAY ANCHOVY	843	2
LITTLE SKATE	711	3
SCUP	620	4
SILVER HAKE	275	5
WINTER SKATE	213	6
STRIPED SEAROBIN	150	7
HAKE sp.	149	8
WINDOWPANE	113	9
ATLANTIC HERRING	90	10
ROUGH SCAD	85	11
WINTER FLOUNDER	72	12
NORTHERN SEAROBIN	70	13
ATLANTIC SILVERSIDE	66	14.5
STRIPED ANCHOVY	66	14.5
SPOTTED HAKE	54	16
ANCHOVY sp.	53	17
SUMMER FLOUNDER	49	18
SMALLMOUTH FLOUNDER	45	19
SPINY DOGFISH	32	20
HICKORY SHAD	31	21
RED HAKE	16	22
ATLANTIC CROAKER	11	23
FOURSPOT FLOUNDER	10	24.5
OCEAN POUT	10	24.5
INQUILINE SNAILFISH	8	26
BLACK SEA BASS	7	27.5
THREESPINE STICKLEBACK	7	27.5
ALEWIFE	4	29
ATLANTIC MENHADEN	3	30.5
CLEARNOSE SKATE	3	30.5
BLUEBACK HERRING	2	35.5
DWARF GOATFISH	2	35.5
INSHORE LIZARDFISH	2	35.5
LINED SEAHORSE	2	35.5
NORTHERN PIPEFISH	2	35.5
ROUND SCAD	2	35.5
SEA RAVEN	2	35.5
WEAKFISH	2	35.5
AMERICAN SAND LANCE	1	44
ATLANTIC COD	1	44
ATLANTIC MOONFISH	1	44
BLUEFISH	1	44
LONGHORN SCULPIN	1	44
LOOKDOWN	1	44
NORTHERN PUFFER	1	44
POLLOCK	1	44
SMOOTH DOGFISH	1	44

T-test comparing Total Numbers at Cherry Grove to Shinnecock:

T value	0.8757
P value	0.3833
Degrees of Freedom	100

TABLE 6

Shinnecock Fisheries Trawl Data

Total Weight (grams) By Month For All Species

	May-00	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan-01	Feb.	March	April	*Species Totals*	*Percent of Total*
Little Skate	9,155	18,850	37,268	4,500	2,772	47,150	107,590	131,850	14,800	5,032	42,650	26,650	***448,267***	***51.97***
Winter Skate	16,445	3,230	21,050	17,950	1,260	4,800	57,417	28,550	4,180	4,750	19,100	30,950	***209,682***	***24.31***
Windowpane	1,325	3,000	5,200	3,990	3,592	5,950	17,600	4,950	425		415	2,695	***49,142***	***5.70***
Summer Flounder	7,100	3,724	5,130	7,030	8,970	1,250	3,300					1,190	***37,694***	***4.37***
Bay Anchovy					30,318		170						***30,488***	***3.53***
Winter Flounder	3,065	1,605	3,050				2,300	2,300	425	1,188	340	1,930	***16,203***	***1.88***
Weakfish					182		10,810	<10					***10,992***	***1.27***
Clearnose Skate												9,300	***9,300***	***1.08***
Northern Searobin	295	995	2,204	1,400	2,290		15					100	***7,299***	***0.85***
Silver Hake	405						235	6,256	<10	120		25	***7,041***	***0.82***
Spotted Hake	20	110					6,745	110			30		***7,015***	***0.81***
Scup	3,592	360	405		1,268	250							***5,875***	***0.68***
Atlantic Herring								5,150	110	<10			***5,260***	***0.61***
Striped Searobin	1,925	130	150		600								***2,805***	***0.33***
Atlantic Butterfish	50	30	100		110	325	580					550	***1,745***	***0.20***
Smooth Dogfish	1,610												***1,610***	***0.19***
Northern Puffer					300	1,285							***1,585***	***0.18***
Longhorn Sculpin								40	380			1,100	***1,520***	***0.18***
American Sand Lance			1,218						<10	<10			***1,218***	***0.14***
Ocean Pout												1,200	***1,200***	***0.14***
Smallmouth Flounder	50	20	265	530	140		90				25	<10	***1,120***	***0.13***
Hickory Shad								635			50		***685***	***0.08***
Alewife							110	550					***660***	***0.08***
Herring spp.												600	***600***	***0.07***
Red Hake							110	185			185	27	***507***	***0.06***
Northern Kingfish							500						***500***	***0.06***
Atlantic Silverside								<10	150	200	145		***495***	***0.06***
Atlantic Mackerel												430	***430***	***0.05***
Atlantic Moonfish					120		150						***270***	***0.03***
Atlantic Croaker				262	<10								***262***	***0.03***
Goosefish								210					***210***	***0.02***
Blueback Herring					<10				160				***160***	***0.02***
Inquiline Snailfish								<10	5	<10	145		***150***	***0.02***
Bluefish					150								***150***	***0.02***
Rough Scad	<10				111								***111***	***0.01***
Black Sea Bass	35											20	***55***	***0.01***
Fourspot Flounder	50												***50***	***0.01***
Northern Pipefish											40		***40***	***<0.01***
Striped Anchovy					37			<10					***37***	***<0.01***
Round Scad				24									***24***	***<0.01***
Lined Seahorse						20							***20***	***<0.01***
American Shad											10		***10***	***<0.01***
Planehead Filefish		10											***10***	***<0.01***
Atlantic Menhaden									<10				***<10***	***<0.01***
Engraulidae							<10			<10			***<10***	***<0.01***
Spot							<10						***<10***	***<0.01***
Fawn Cusk-Eel											<10		***<10***	***<0.01***
Pollock			<10					<10					***<10***	***<0.01***
Cunner											<10		***<10***	***<0.01***
Dwarf Goatfish													***<10***	***<0.01***
Monthly Totals	***45,122***	***32,064***	***76,040***	***35,686***	***52,220***	***61,030***	***207,722***	***180,786***	***20,635***	***11,290***	***63,135***	***76,767***	***862,497***	

TABLE 7

Cherry Grove Fisheries Trawl Data

Total Weight (grams) By Month For All Species

	May-00	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan-01	Feb.	March	April	*Species Totals*	*Percent of Total*
Little Skate	36,160	34,650	37,800	16,950	2,000	33,900	25,600	89,020	885	14,750	1,300	46,750	***339,765***	***51.70***
Winter Skate	15,130	7,800	10,758	350	100	1,750	6,450	36,100	490	9,600		19,730	***108,258***	***16.47***
Spiny Dogfish						7,200	25,350	20,500					***53,050***	***8.07***
Windowpane	5,800	9,900	3,975	1,950	200	1,400	600	6,850	670	1,450		5,470	***38,265***	***5.82***
Summer Flounder	6,750	2,300	3,450	3,520	3,950	1,400	3,700					10	***25,080***	***3.82***
Striped Searobin	3,650	950	50		12,997	4,860							***22,507***	***3.43***
Winter Flounder	1,790	150					1,400	5,705	125	1,100		7,360	***17,630***	***2.68***
Atlantic Herring								8,775	270	3,000	1,810		***13,855***	***2.11***
Ocean Pout												12,700	***12,700***	***1.93***
Scup	1,040	885	1,596	30	2,093	57							***5,701***	***0.87***
Northern Searobin	650	725	1,999	30	207							30	***3,641***	***0.55***
Clearnose Skate			800	2,000									***2,800***	***0.43***
Smooth Dogfish		1,700	950										***2,650***	***0.40***
Fourspot Flounder	550	580	760										***1,890***	***0.29***
Silver Hake	40					8	65	1,180		<10		45	***1,338***	***0.20***
Bay Anchovy					1,046	26							***1,072***	***0.16***
Atlantic Butterfish	120	80	130	45	332	318	10						***1,035***	***0.16***
Spotted Hake	410	475	27									45	***957***	***0.15***
Sea Raven								900					***900***	***0.14***
Bluefish					740								***740***	***0.11***
Black Sea Bass	660											78	***738***	***0.11***
Atlantic Silverside	360	<10						<10	<10	255	<10		***615***	***0.09***
Smallmouth Flounder	<10	110	40	<10	<10	<10	200	<10				10	***360***	***0.05***
Hickory Shad								345					***345***	***0.05***
Rough Scad				<10	276		12						***288***	***0.04***
Atlantic Menhaden								275	<10				***275***	***0.04***
Red Hake								200					***200***	***0.03***
Northern Puffer	150												***150***	***0.02***
American Sand Lance										108			***108***	***0.02***
Striped Anchovy		10			86								***96***	***0.01***
Longhorn Sculpin								50					***50***	***0.01***
Alewife		40											***40***	***0.01***
Weakfish								20					***20***	***<0.01***
Dwarf Goatfish				5									***5***	***<0.01***
Blueback Herring										<10			***<10***	***<0.01***
Engraulidae				<10	<10					<10	<10		***<10***	***<0.01***
Atlantic Cod	<10								<10				***<10***	***<0.01***
Threespine Stickleback										<10			***<10***	***<0.01***
Lined Seahorse				<10		<10							***<10***	***<0.01***
Inquiline Snailfish								<10	<10	<10			***<10***	***<0.01***
Atlantic Croaker			<10	<10									***<10***	***<0.01***
Pollock			<10										***<10***	***<0.01***
Atlantic Moonfish				<10		<10							***<10***	***<0.01***
Lookdown													***<10***	***<0.01***
Northern Pipefish										<10	<10		***<10***	***<0.01***
Inshore Lizardfish					<10								***<10***	***<0.01***
Monthly Totals	*73,260*	*60,355*	*62,335*	*24,880*	*24,027*	*50,919*	*63,387*	*169,920*	*2,440*	*30,263*	*3,110*	*92,228*	*657,124*	*100.00*

TABLE 8

SUMMARY OF TRAWL CATCH DATA - SHINNECOCK FISHERIES

Mean Monthly CPUE by Taxa (Number of Fish per Trawl)

	MAY 2000	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN. 2001	FEB.	MAR.	APR.	TOTAL CPUE	MEAN CPUE
BAY ANCHOVY					1718.63		3.44						**1722.06**	**143.51**
ATLANTIC BUTTERFISH	0.81	0.94	1.75	0.25	18.06	17.63	10.81					0.25	**50.50**	**4.21**
SILVER HAKE	0.19						4.63	44.75	0.06	0.13			**49.75**	**4.15**
LITTLE SKATE	1.50	1.88	3.44	0.50	0.50	4.50	13.50	10.13	1.63	0.38	3.94	3.13	**45.00**	**3.75**
ANCHOVY sp.							0.38			28.81			**29.19**	**2.43**
WINTER SKATE	1.63	0.81	1.88	0.94	0.25	0.50	8.88	3.06	0.56	0.31	4.44	2.25	**25.50**	**2.13**
ATLANTIC CROAKER				16.00	0.19								**16.19**	**1.35**
SCUP	8.50	1.31	1.06	0.06	2.94	0.19							**14.06**	**1.17**
WINDOWPANE	0.44	1.06	1.00	1.06	0.69	0.50	2.94	0.88	0.06		0.38	0.81	**9.81**	**0.82**
WEAKFISH					0.50		6.94	0.44					**7.88**	**0.66**
ATLANTIC SILVERSIDE								0.06	2.50	2.44	1.81		**6.81**	**0.57**
SPOTTED HAKE	0.06	0.56	0.06				4.44	0.63			0.19		**5.94**	**0.49**
SUMMER FLOUNDER	0.81	1.00	0.88	0.88	1.13	0.06	0.38					0.31	**5.44**	**0.45**
NORTHERN SEAROBIN	0.25	1.50	1.94	0.81	0.31		0.19					0.19	**5.19**	**0.43**
SMALLMOUTH FLOUNDER	0.31	0.56	0.69	0.38	0.19	0.13	0.38				0.94	0.19	**3.75**	**0.31**
HICKORY SHAD								3.38					**3.38**	**0.28**
ATLANTIC HERRING								3.19	0.06	0.06			**3.31**	**0.28**
ATLANTIC MOONFISH					3.19		0.06						**3.25**	**0.27**
RED HAKE							1.63	0.75			0.63	0.25	**3.25**	**0.27**
WINTER FLOUNDER	0.56	0.31	0.25		0.06		0.25	0.81	0.31	0.19	0.06	0.38	**3.19**	**0.27**
INQUILINE SNAILFISH								0.19	0.19	0.13	2.13		**2.63**	**0.22**
NORTHERN PUFFER					1.81	0.56	0.13						**2.50**	**0.21**
ROUGH SCAD	0.06				2.06	0.06						0.19	**2.38**	**0.20**
STRIPED SEAROBIN	0.50	0.06	0.06		0.25	0.06							**0.94**	**0.08**
ROUND SCAD				0.88									**0.88**	**0.07**
STRIPED ANCHOVY			0.06		0.63			0.06					**0.75**	**0.06**
NORTHERN PIPEFISH											0.69		**0.69**	**0.06**
CLEARNOSE SKATE			0.06	0.25								0.13	**0.44**	**0.04**
POLLOCK			0.38					0.06					**0.44**	**0.04**
ALEWIFE					0.06		0.13	0.19					**0.38**	**0.03**
AMERICAN SHAD											0.25	0.13	**0.38**	**0.03**
AMERICAN SAND LANCE			0.13						0.13	0.06			**0.31**	**0.03**
BLACK SEA BASS	0.06											0.19	**0.25**	**0.02**
LINED SEAHORSE						0.13	0.13						**0.25**	**0.02**
LONGHORN SCULPIN								0.13	0.06			0.06	**0.25**	**0.02**
NORTHERN KINGFISH							0.25						**0.25**	**0.02**
BLUEBACK HERRING					0.06		0.06		0.06				**0.19**	**0.02**
DWARF GOATFISH				0.19									**0.19**	**0.02**
SMOOTH DOGFISH	0.13	0.06											**0.19**	**0.02**
ATLANTIC MENHADEN									0.13				**0.13**	**0.01**
GOOSEFISH								0.13					**0.13**	**0.01**
OCEAN POUT												0.13	**0.13**	**0.01**
PLANEHEAD FILEFISH		0.06		0.06									**0.13**	**0.01**
SPOT							0.13						**0.13**	**0.01**
ATLANTIC MACKEREL												0.06	**0.06**	**0.01**
BLUEFISH					0.06								**0.06**	**0.01**
BLUESPOTTED CORNETFISH				0.06									**0.06**	**0.01**
CUNNER											0.06		**0.06**	**0.01**
FAWN CUSK-EEL											0.06		**0.06**	**0.01**
FOURSPOT FLOUNDER	0.06												**0.06**	**0.01**
HAKE sp.	0.06												**0.06**	**0.01**

Monthly CPUE All Taxa	**15.94**	**10.13**	**13.63**	**22.31**	**1751.56**	**24.31**	**59.63**	**68.81**	**5.75**	**32.50**	**15.56**	**8.63**	**2028.75**
Mean Monthly CPUE All Taxa	**0.94**	**0.78**	**0.91**	**1.59**	**87.58**	**2.21**	**2.84**	**4.05**	**0.48**	**3.61**	**1.20**	**0.54**	**41.40**
Number of Taxa	17	13	15	14	20	11	21	17	12	9	13	16	49
Number of Samples	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	

TABLE 9
SUMMARY OF TRAWL CATCH DATA - CHERRY GROVE FISHERIES
Mean Monthly CPUE by Taxa (Number of Fish per Trawl)

	MAY 2000	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN. 2001	FEB.	MAR.	APR.	Total CPUE	Mean CPUE
ATLANTIC BUTTERFISH	0.44	1.25	1.31	14.13	95.13	26.06	0.88						**139.19**	**11.60**
BAY ANCHOVY					43.00	9.69							**52.69**	**4.39**
LITTLE SKATE	4.44	4.38	4.00	2.19	0.31	7.06	1.50	12.88	1.00	1.31	0.13	5.25	**44.44**	**3.70**
SCUP	1.75	2.06	3.56	1.38	29.38	0.63							**38.75**	**3.23**
SILVER HAKE	0.19					0.19	0.50	15.81		0.13		0.38	**17.19**	**1.43**
WINTER SKATE	4.00	0.88	1.13	0.13	0.06	0.44	0.25	4.38	0.69	0.69		0.69	**13.31**	**1.11**
STRIPED SEAROBIN	1.94	0.56	0.06		5.13	1.69							**9.38**	**0.78**
HAKE sp.	0.31								8.69			0.31	**9.31**	**0.78**
WINDOWPANE	1.63	1.06	1.00		0.06	0.44	0.13	1.19	0.06	0.13		1.38	**7.06**	**0.59**
ATLANTIC HERRING								4.19	0.06	0.50	0.88		**5.63**	**0.47**
ROUGH SCAD					5.06		0.25						**5.31**	**0.44**
WINTER FLOUNDER	0.44	0.06		0.56			0.13	1.94	0.69	0.06		0.63	**4.50**	**0.38**
NORTHERN SEAROBIN	0.94	0.81	2.31	0.06	0.13							0.13	**4.38**	**0.36**
ATLANTIC SILVERSIDE	1.63							0.13	0.31	2.00	0.06		**4.13**	**0.34**
STRIPED ANCHOVY		0.13			4.00								**4.13**	**0.34**
SPOTTED HAKE	1.69	1.00	0.13									0.56	**3.38**	**0.28**
ANCHOVY sp.				0.13	0.19					0.75	2.25		**3.31**	**0.28**
SUMMER FLOUNDER	0.81	0.38	0.44	0.38	0.25	0.25	0.38					0.19	**3.06**	**0.26**
SMALLMOUTH FLOUNDER	0.13	0.63	0.56	0.13	0.06	0.06	0.25	0.06				0.94	**2.81**	**0.23**
SPINY DOGFISH			0.13			0.25	1.00	0.63					**2.00**	**0.17**
HICKORY SHAD								1.94					**1.94**	**0.16**
RED HAKE								1.00					**1.00**	**0.08**
ATLANTIC CROAKER			0.06	0.63									**0.69**	**0.06**
FOURSPOT FLOUNDER	0.13	0.19	0.31										**0.63**	**0.05**
OCEAN POUT												0.63	**0.63**	**0.05**
INQUILINE SNAILFISH								0.25	0.06	0.19			**0.50**	**0.04**
BLACK SEA BASS	0.25											0.19	**0.44**	**0.04**
THREESPINE STICKLEBACK										0.44			**0.44**	**0.04**
ALEWIFE		0.25											**0.25**	**0.02**
ATLANTIC MENHADEN								0.13	0.06				**0.19**	**0.02**
CLEARNOSE SKATE			0.06	0.13									**0.19**	**0.02**
BLUEBACK HERRING										0.13			**0.13**	**0.01**
DWARF GOATFISH				0.13									**0.13**	**0.01**
INSHORE LIZARDFISH					0.13								**0.13**	**0.01**
LINED SEAHORSE				0.06		0.06							**0.13**	**0.01**
NORTHERN PIPEFISH										0.06	0.06		**0.13**	**0.01**
ROUND SCAD				0.13									**0.13**	**0.01**
SEA RAVEN								0.13					**0.13**	**0.01**
WEAKFISH								0.13					**0.13**	**0.01**
AMERICAN SAND LANCE										0.06			**0.06**	**0.01**
ATLANTIC COD	0.06												**0.06**	**0.01**
ATLANTIC MOONFISH						0.06							**0.06**	**0.01**
BLUEFISH					0.06								**0.06**	**0.01**
LONGHORN SCULPIN								0.06					**0.06**	**0.01**
LOOKDOWN				0.06									**0.06**	**0.01**
NORTHERN PUFFER	0.06												**0.06**	**0.01**
POLLOCK			0.06										**0.06**	**0.01**
SMOOTH DOGFISH		0.06											**0.06**	**0.01**

	MAY 2000	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN. 2001	FEB.	MAR.	APR.	Total
Total CPUE All Taxa	**20.81**	**13.69**	**15.13**	**20.19**	**182.94**	**46.88**	**5.25**	**44.81**	**11.63**	**6.44**	**3.38**	**11.25**	**382.38**
Mean Monthly CPUE All Taxa	**1.16**	**0.91**	**1.01**	**1.35**	**12.20**	**3.61**	**0.53**	**2.80**	**1.29**	**0.50**	**0.68**	**0.94**	**8.31**
Number of Taxa	18	15	15	15	15	13	10	16	9	13	5	12	46
Number of Samples	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	

TABLE 10
Mean Length for Five Commercially Important Species

	SHINNECOCK			CHERRY GROVE		
	Range TL (mm)	Mean TL (mm)	Number	Range TL (mm)	Mean TL (mm)	Number
A. BUTTERFISH	14 - 225	53	419	18 - 170	46	483
SCUP	30 - 216	90	270	16 - 180	106	205
W. FLOUNDER	60 - 749	258	51	80 - 466	216	66
S. FLOUNDER	32 - 605	345	87	68 - 600	352	50
BLUEFISH	244	244	1	416	416	1
OVERALL RANGES	*14 - 749*	*198*	*828*	*18 - 600*	*227*	*805*

Results from t-test:

T value	-0.33
P value	0.75
Degrees of Freedom	8.00

TABLE 11
SHINNECOCK FISHERIES TRAWL DATA-COMMERCIALLY IMPORTANT SPECIES
MEAN MONTHLY WEIGHT BY SPECIES

	May-00		June		July		August		September		October	
	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish
Summer Flounder	546.2	13	232.8	16	366.4	14	502.1	14	498.3	18	1250.0	1
Winter Founder	340.6	9	321.0	5	763	4	0	0	80.0	1	0	0
Bluefish	0	0	0	0	0	0	0	0	150.0	1	0	0
Scup	26.4	136	17.1	21	23.8	17	1.0	1	27.0	47	83.3	3
Atlantic Butterfish	3.8	13	2.0	15	3.6	28	1.0	4	0.4	289	1.2	282

	November		December		January-01		February		March		April	
	Mean Weight (g/fish)	No. of Fish	Mean Weight (grams/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish
Summer Flounder	550.0	6	0	0	0	0	0	0	0	0	238.0	5
Winter Founder	575.0	4	176.9	13	85.0	5	396.0	3	340.0	1	321.7	6
Bluefish	0	0	0	0	0	0	0	0	0	0	0	0
Scup	0	0	0	0	0	0	0	0	0	0	0	0
Atlantic Butterfish	3.4	173	0	0	0	0	0	0	0	0	138	4

	Year Total	
	Mean Weight (g/fish)	No. of Fish
Summer Flounder	433.3	87
Winter Founder	319.3	51
Bluefish	150.0	1
Scup	26.1	225
Atlantic Butterfish	2.2	808

TABLE 12

CHERRY GROVE FISHERIES TRAWL DATA-COMMERCIALLY IMPORTANT SPECIES MEAN MONTHLY WEIGHT BY SPECIES

	May-00		June		July		August		September		October	
	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish
Summer Flounder	519.2	13	383.3	6	492.9	7	586.7	6	987.5	4	350.0	4
Winter Founder	255.7	7	150.0	1	0	0	166.7	9	0	0	0	0
Bluefish	0	0	0	0	0	0	0	0	740.0	1	0	0
Scup	37.1	28	26.8	33	28.0	57	1.4	22	4.5	470	5.7	10
Butterfish	17.1	7	4.0	20	6.2	21	0.2	226	0.2	1522	0.8	417

	November		December		January-01		February		March		April	
	Mean Weight (g/fish)	No. of Fish	Mean Weight (grams/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish	Mean Weight (g/fish)	No. of Fish
Summer Flounder	616.7	6	0	0	0	0	0	0	0	0	3.3	3
Winter Founder	700.0	2	184.0	31	11.4	11	1100.0	1	0	0	736.0	10
Bluefish	0	0	0	0	0	0	0	0	0	0	0	0
Scup	0	0	0	0	0	0	0	0	0	0	0	0
Butterfish	0.7	14	0	0	0	0	0	0	0	0	0	0

	Year Total	
	Mean Weight (g/fish)	No. of Fish
Summer Flounder	511.8	49
Winter Founder	265.7	72
Bluefish	740.0	1
Scup	9.2	620
Butterfish	0.5	2227

TABLE 13
SUMMARY OF FINFISH TRAWL CATCH DATA
MONTHLY CPUE BY STATION
(Number of Fish per Trawl)

SHINNECOCK

	May-00	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan-01	Feb.	March	April	TOTAL CPUE	MEAN CPUE
T-30-A	0	3	15	19	15,892	3	78	18	2	0	21	0	16,051	1,338
T-30-C	0	6	18	0	0	39	23	2	14	3	11	1	117	10
T-40-B	41	17	12	52	9	44	264	74	10	13	26	12	574	48
T-40-D	21	31	25	22	519	90	114	176	15	3	38	67	1,121	93
T-50-A	59	29	39	192	11,403	15	208	214	30	2	71	9	12,271	1,023
T-50-C	95	26	34	50	4	33	167	174	3	15	17	16	634	53
T-60-B	31	23	46	12	70	44	48	115	14	18	16	17	454	38
T-60-D	8	27	29	10	127	121	51	328	4	5	49	16	775	65

CHERRY GROVE

	May-00	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan-01	Feb.	March	April	TOTAL CPUE	MEAN CPUE
F-30-A	1	4	5	12	6	4	2	44	0	0	6	0	84	7
F-30-B	9	12	27	64	4	1	0	48	69	1	19	11	265	22
F-40-B	70	58	49	121	789	153	1	109	21	19	2	47	1,439	120
F-40-C	44	29	46	14	682	73	0	70	70	9	5	28	1,070	89
F-50-A	28	17	21	20	554	55	34	267	0	3	2	33	1,034	86
F-50-B	163	64	38	57	704	117	3	93	1	8	0	15	1,263	105
F-60-C	7	19	23	20	90	135	28	41	12	3	7	26	411	34
F-60-D	11	16	33	20	98	212	16	45	13	6	13	20	503	42

TABLE 14
Mean Length for Age Class

	CHERRY GROVE				SHINNECOCK			
	Age	Range TL (mm)	Mean TL (mm)	Number	Age	Range TL (mm)	Mean TL (mm)	Number
BLACK SEA BASS		(none collected)			0+	120	120	1
					1+	220	220	1
						(no fish older than 1+)		
SCUP	0+	49-164	87	71	0+	42-146	97	76
	1+	105-150	131	22	1+	120-180	147	30
		(no fish older than 1+)				(no fish older than 1+)		
WINTER FLOUNDER	0+	-	-	-	0+	-	-	-
	1+	130-250	190	2	1+	140-302	201	3
	2+	180-390	269	4	2+	182-405	297	16
	3+	302-350	327	6	3+	290-400	337	9
		(no fish older than 3+)				(no fish older than 3+)		
WEAKFISH		(none collected)			0+	105-240	155	34
					1+	161	161	1
						(no fish older than 1+)		
SUMMER FLOUNDER	0+	-	-	-	0+	104-260	152	5
	1+	292	292	1	1+	292	292	1
	2+	262-466	350	8	2+	310-383	349	8
	3+	120-420	352	18	3+	252-478	372	35
	4+	367-434	401	5	4+	324-516	397	26
	5+	352-600	435	6	5+	430	430	1
	6+	600	600	1	6+	440-618	543	3
		(no fish older than 6+)			7+	544	544	1
						(no fish older than 7+)		
BLUEFISH	0+	-	-	-	0+	224	224	1
	1+	-	-	-		(no fish older than 0+)		
	2+	-	-	-				
	3+	416	416	1				
		(no fish older than 3+)						
STRIPED BASS	0+	-	-	-		(none collected)		
	1+	-	-	-				
	2+	n/a	n/a	1				
		(no fish older than 2+)						

n/a - denotes data not available.

TABLE 15

SHINNECOCK TRAWL CATCH DATA - MACROINVERTEBRATES

MONTHLY TOTALS, TOTAL NUMBER, PERCENT COMPOSITION

	MAY-00	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN-01	FEB.	MAR.	APRIL	TOTAL NUMBER	PERCENT OF TOTAL
SAND DOLLAR	2,054	2,818	2,816	1,317	321	804	180		255	1,269	63	1,561	13,458	62.57
SEVENSPINE BAY SHRIMP	29	13	1				58	299	285	401	1,203	12	2,301	10.70
NEW ENGLAND DOG WHELK	330	125	252	82	12	8	144		178	413	71	349	1,964	9.13
LONG-FINNED SQUID	148	31	63	46	1,068	297	45					12	1,710	7.95
NORTHERN MOON SNAIL	110	171	80	52	7	9	55	7	22	171		73	757	3.52
LONGWRIST HERMIT CRAB	8	90	165	66	23	28	40	2		8	1	3	434	2.02
ROCK CRAB	1	37	12	10	2	6	73	5	19	38	44	1	248	1.15
ACADIAN HERMIT CRAB	14	34	29	22		11	2	1		26	1	53	193	0.90
FLATCLAW HERMIT CRAB	5	53	46	21	20	1	24	1		3		16	190	0.88
BLUE MUSSEL									110				110	0.51
LADY CRAB	1	2	6	18	28	7	11	1					74	0.34
SEA STAR			1		2	11	5			1	1	1	22	0.10
PORTLY SPIDER CRAB			10	8	2	1							21	0.10
ATLANTIC SURF CLAM	1	5	2						2	1	1	1	13	0.06
DEEP-SEA SCALLOP											6		6	0.03
HORSESHOE CRAB							1					3	4	0.02
BLUE CRAB											1		1	<0.01
GREEN CRAB		1											1	<0.01
Monthly Totals	2,701	3,380	3,483	1,642	1,485	1,183	638	316	871	2,331	1,392	2,085	21,507	

TABLE 16

CHERRY GROVE TRAWL CATCH DATA-MACROINVERTEBRATES

MONTHLY TOTALS, TOTAL NUMBER, PERCENT COMPOSITION

	MAY-00	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN-01	FEB.	MAR.	APRIL	TOTAL NUMBER	PERCENT OF TOTAL
SAND DOLLAR	903	420	1,579	521	280	366	327	2,225	1,751	216	5	5,050	13,643	74.39
SEVENSPINE BAY SHRIMP	48		1					686	363	414	1	82	1,595	8.70
NEW ENGLAND DOG WHELK	169	100	180	21	9		91		49	248		310	1,177	6.42
LONG-FINNED SQUID	117	16	65	109		400	47	4					758	4.13
LONGWRIST HERMIT CRAB	20	8	109	37	31	20	5		1			2	233	1.27
SEA STAR	10	35	46	50	21	20	28	9	1			7	227	1.24
NORTHERN MOON SNAIL	18	54	41	8		2	3	16	5	18		50	215	1.17
FLATCLAW HERMIT CRAB	7	98	40	8	7	3		3	4				170	0.93
ROCK CRAB	13	21	3	9	3	4		40	3	1	1	2	100	0.55
LADY CRAB	7	35	41	5	1	9	1						99	0.54
ACADIAN HERMIT CRAB	3	9	8				12	4		3		14	53	0.29
ATLANTIC SURF CLAM		1	18			4	1	4	1			5	34	0.19
HORSESHOE CRAB		3	8	1								5	17	0.09
PORTLY SPIDER CRAB	2	1	5	7		1							16	0.09
LIONS MANE SEA JELLY					1								1	0.01
OFFSHORE OCTOPUS												1	1	0.01
Monthly Totals	1,317	801	2,144	776	353	829	515	2,991	2,178	900	7	5,528	18,339	

TABLE 17

Mean Monthly Water Quality Parameters For All Stations

Shinnecock Borrow Area

Surface Mean Values

	Temperature (0C)	DO (mg/l)	Salinity (ppt)	pH	Light Transmission (m)	Conductivity (mS/cm)
May-00	13.7	8.2	30.3	8.3	4.0	36.6
June	18.5	8.6	n/a	8.3	n/a	n/a
July	18.3	8.0	31.4	8.4	4.9	42.3
August	19.3	7.6	31.2	8.4	3.3	42.5
September	20.6	8.3	31.7	8.4	4.7	44.4
October	16.0	6.6	31.2	8.6	5.1	39.5
November	13.0	8.1	31.1	8.6	5.1	36.6
December	n/a	n/a	n/a	8.6	1.1	n/a
January-01	2.5	11.5	31.0	8.7	2.9	28.0
February	3.2	10.6	31.1	n/a	4.9	28.6
March	3.4	11.2	30.3	7.8	2.1	28.0
April	7.8	10.2	29.7	7.9	4.6	31.1
Mean	**12.4**	**9.0**	**30.9**	**8.4**	**3.9**	**35.8**

Bottom Mean Values

	Temperature (0C)	DO (mg/l)	Salinity (ppt)	pH	Conductivity (mS/cm)
May-00	12.5	7.7	30.1	8.3	34.6
June	18.7	8.1	n/a	8.3	n/a
July	17.0	7.7	31.4	8.4	40.8
August	18.5	7.0	31.5	8.5	42.2
September	19.6	7.5	32.3	8.4	44.3
October	15.8	5.2	31.4	8.5	39.7
November	12.8	7.9	31.3	8.6	36.9
December	n/a	n/a	n/a	8.6	n/a
January-01	2.8	10.9	31.1	8.8	28.3
February	3.2	10.4	31.1	n/a	28.7
March	3.1	10.6	30.4	7.8	27.9
April	7.5	10.2	29.8	7.9	30.9
Mean	**12.0**	**8.5**	**31.0**	**8.4**	**35.4**

* n/a denotes no water quality measurements due to instrument malfunction.

TABLE 18

Mean Monthly Water Quality Parameters For All Stations

Cherry Grove Borrow Area

Surface Mean Values

	Temperature (0C)	DO (mg/l)	Salinity (ppt)	pH	Light Transmission (m)	Conductivity (mS/cm)
May-00	11.6	8.2	31.9	8.4	3.5	36.5
June	n/a	n/a	n/a	8.4	n/a	n/a
July	18.1	8.2	31.5	8.4	2.1	41.9
August	20.4	6.6	31.7	8.5	2.7	44.3
September	22.1	7.7	31.5	8.4	4.8	45.5
October	16.0	7.2	30.9	8.6	2.7	39.3
November	12.9	8.3	31.5	8.6	3.9	37.1
December	6.3	9.2	31.3	8.6	1.8	31.6
January-01	2.3	10.8	31.2	n/a	4.2	28.0
February	2.6	10.7	30.8	n/a	3.4	27.9
March	3.4	11.2	30.8	7.8	2.4	28.5
April	7.2	9.7	30.0	7.9	4.0	30.9
Mean	**11.2**	**8.9**	**31.2**	**8.4**	**3.2**	**35.6**

Bottom Mean Values

	Temperature (^{0}C)	DO (mg/l)	Salinity (ppt)	pH	Conductivity (mS/cm)
May-00	11.4	8.0	31.9	8.4	36.3
June	n/a	n/a	n/a	8.4	n/a
July	15.1	7.1	31.6	8.4	39.2
August	17.8	5.9	31.9	8.5	42.1
September	20.5	4.6	31.9	8.4	42.2
October	15.9	7.2	30.9	8.6	39.2
November	12.7	8.0	31.4	8.6	36.9
December	6.3	9.0	31.1	8.6	31.0
January-01	2.3	10.8	31.2	n/a	28.0
February	2.5	10.6	30.8	n/a	27.9
March	3.2	10.6	30.8	7.9	28.4
April	6.5	9.9	29.5	7.9	29.8
Mean	**10.4**	**8.3**	**31.2**	**8.4**	**34.6**

* n/a denotes no water quality measurements due to instrument malfunction.

FIGURE 1
Shinnecock Sampling Locations

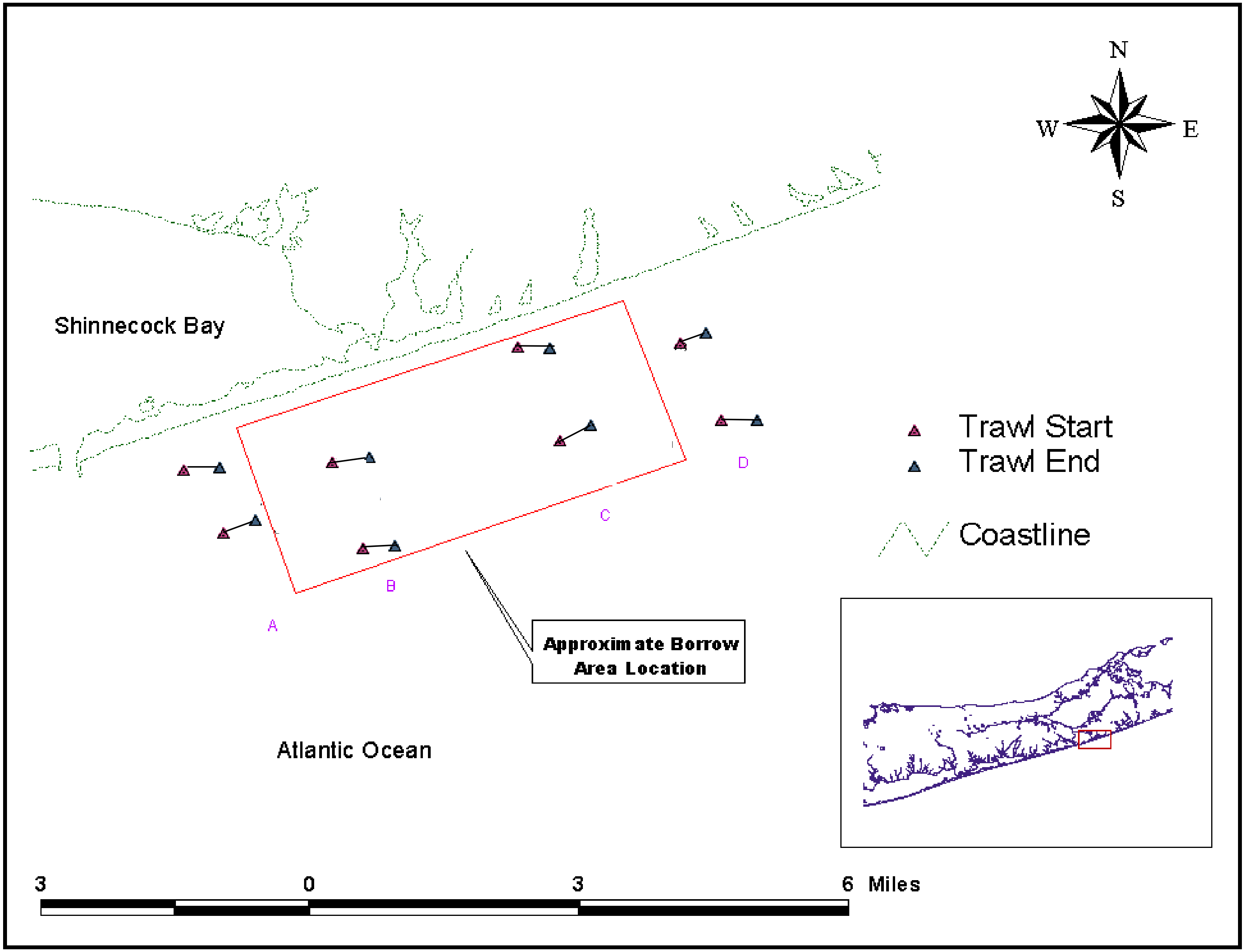


Figure 2

Cherry Grove Sampling Locations

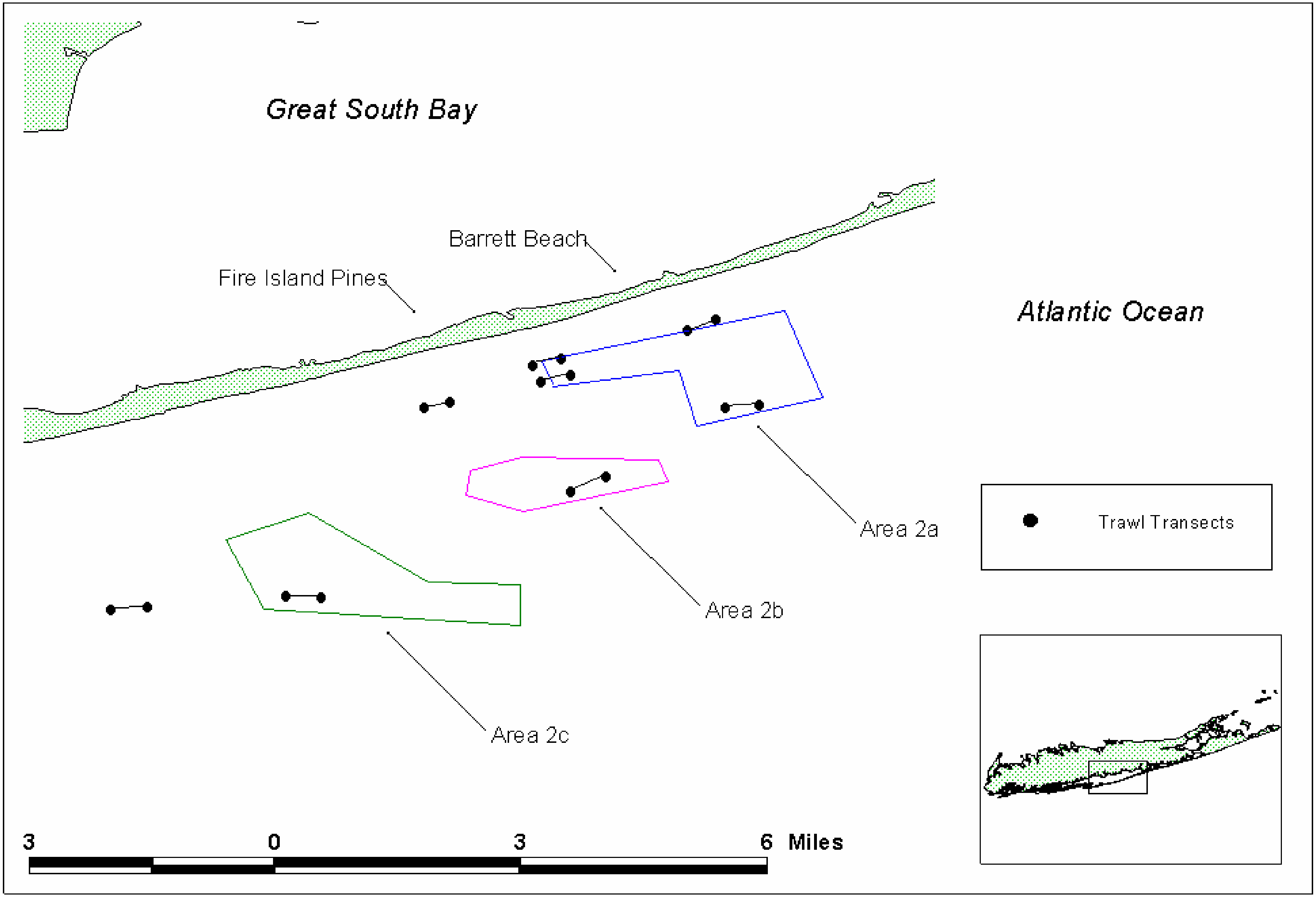


FIGURE 3

Fisheries Otter Trawl

FIGURE 4

Surf Clam Survey Area

2001 Clam Survey - West of Shinnecock Inlet (WOSI) Borrow Area

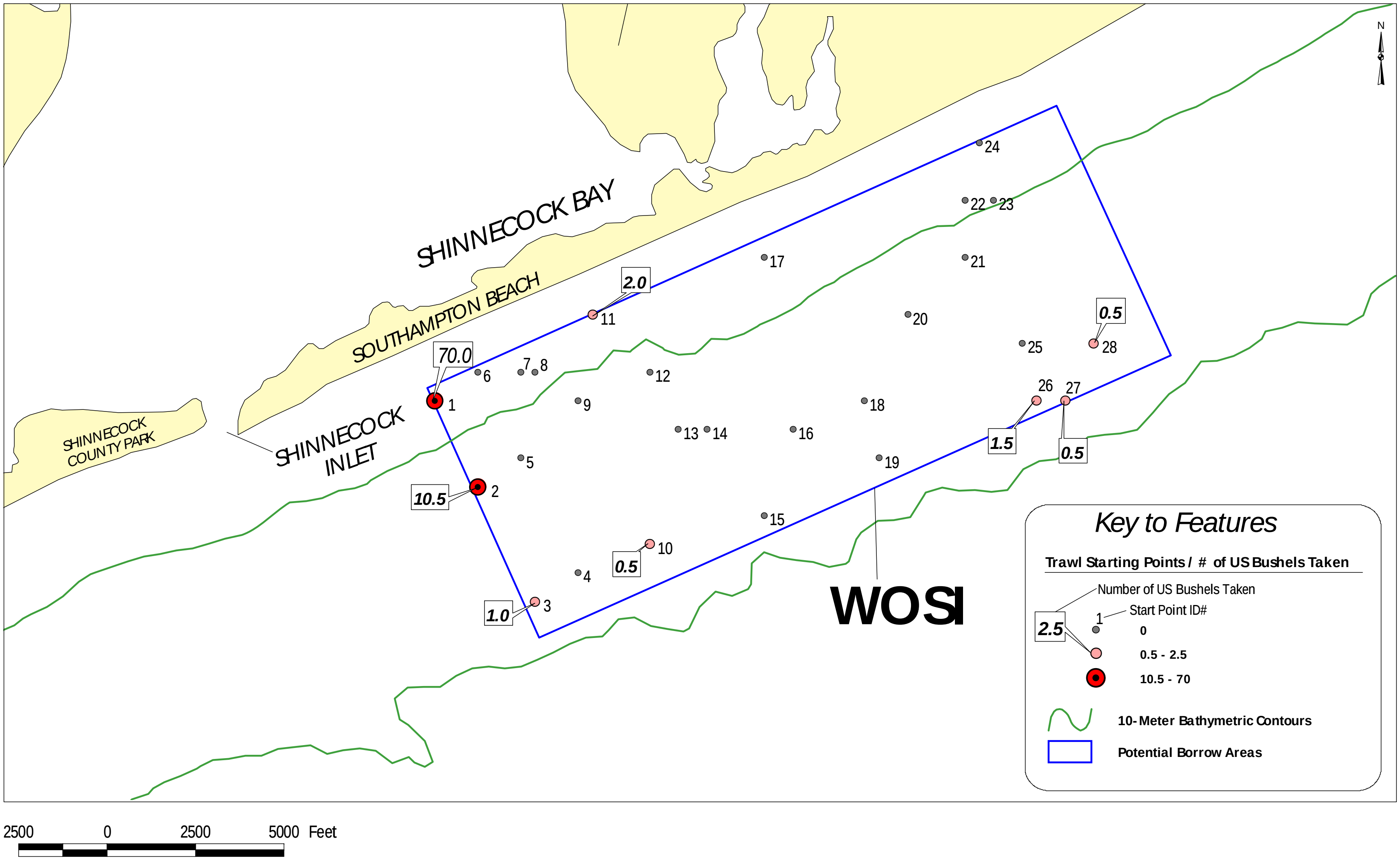


FIGURE 5
Total Number of Fishes and Species per Month

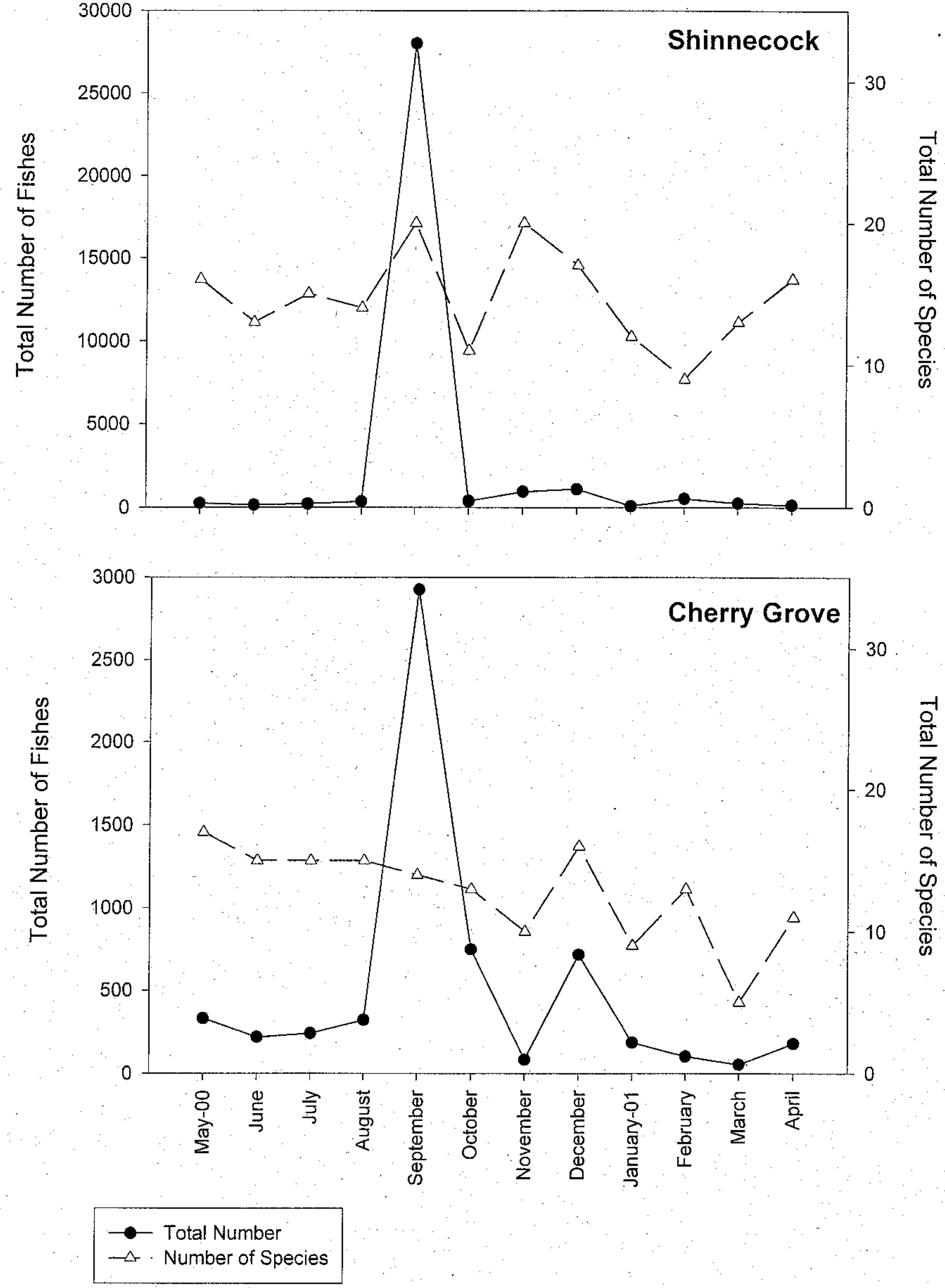


FIGURE 6
Fisheries Trawls Most Abundant Species
Shinnecock and Cherry Grove Borrow Areas

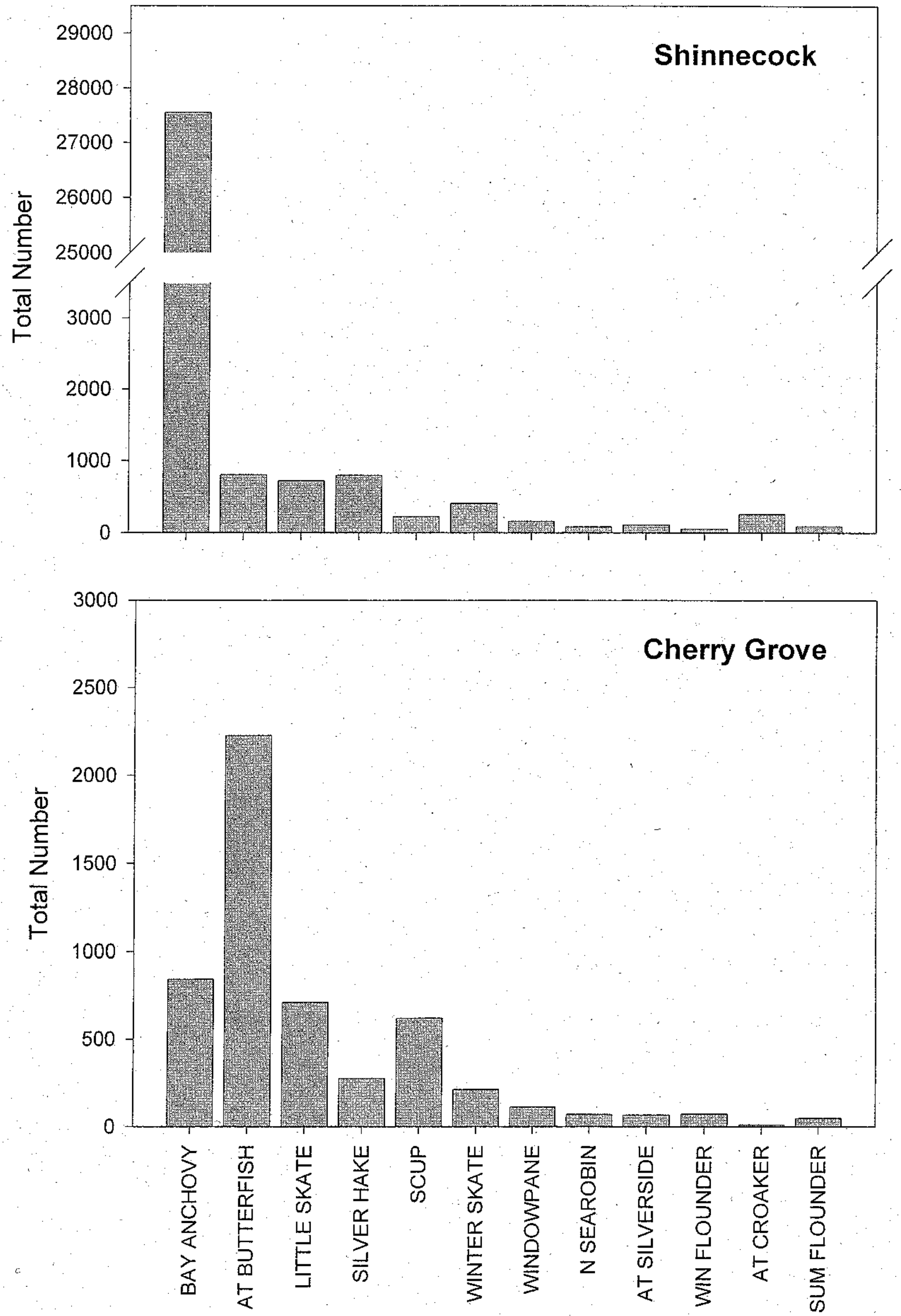


FIGURE 7
Total Number of Species by Month
Shinnecock and Cherry Grove Borrow Areas

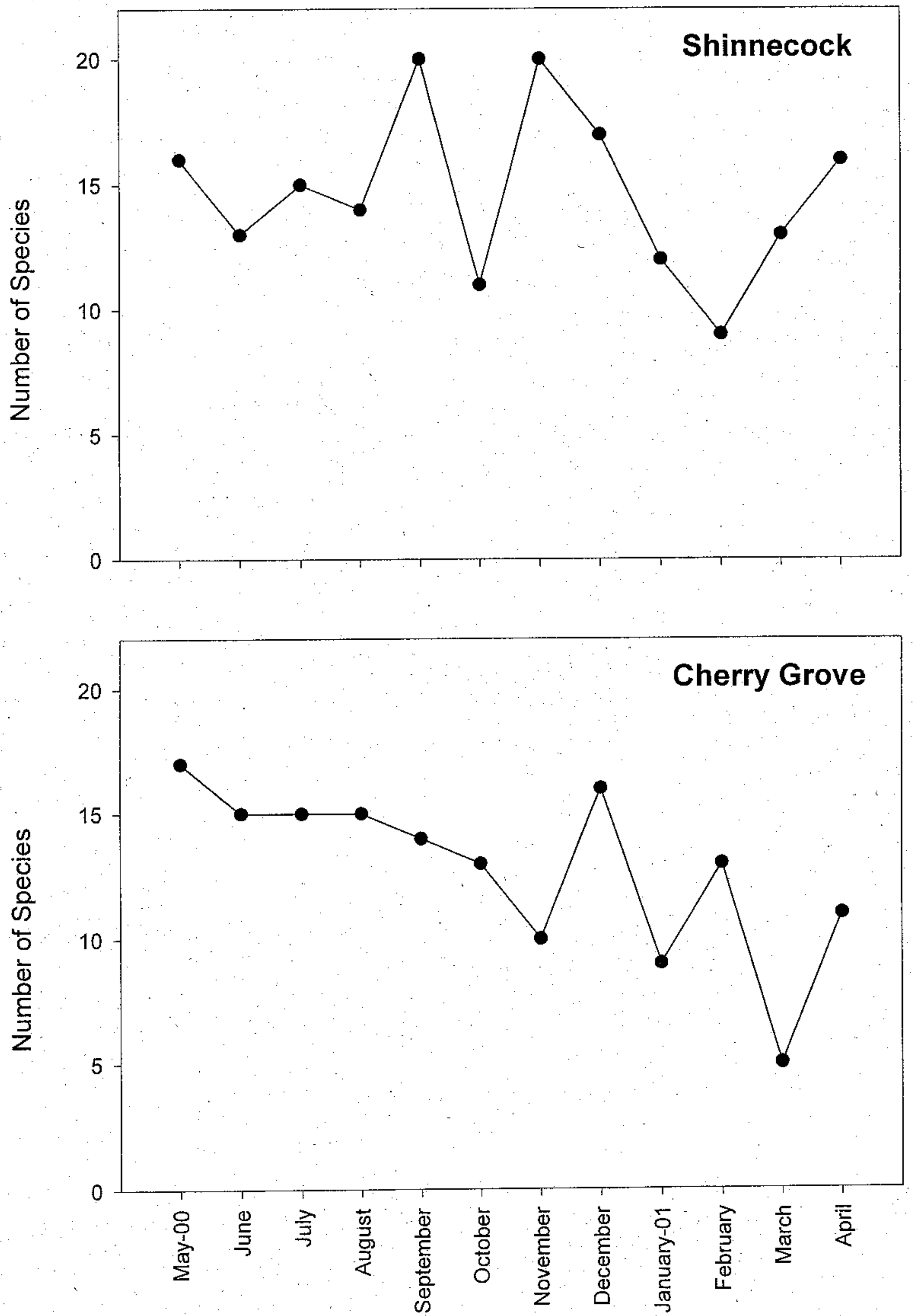


FIGURE 8
Total Weight of All Species by Month
Shinnecock and Cherry Grove Borrow Areas

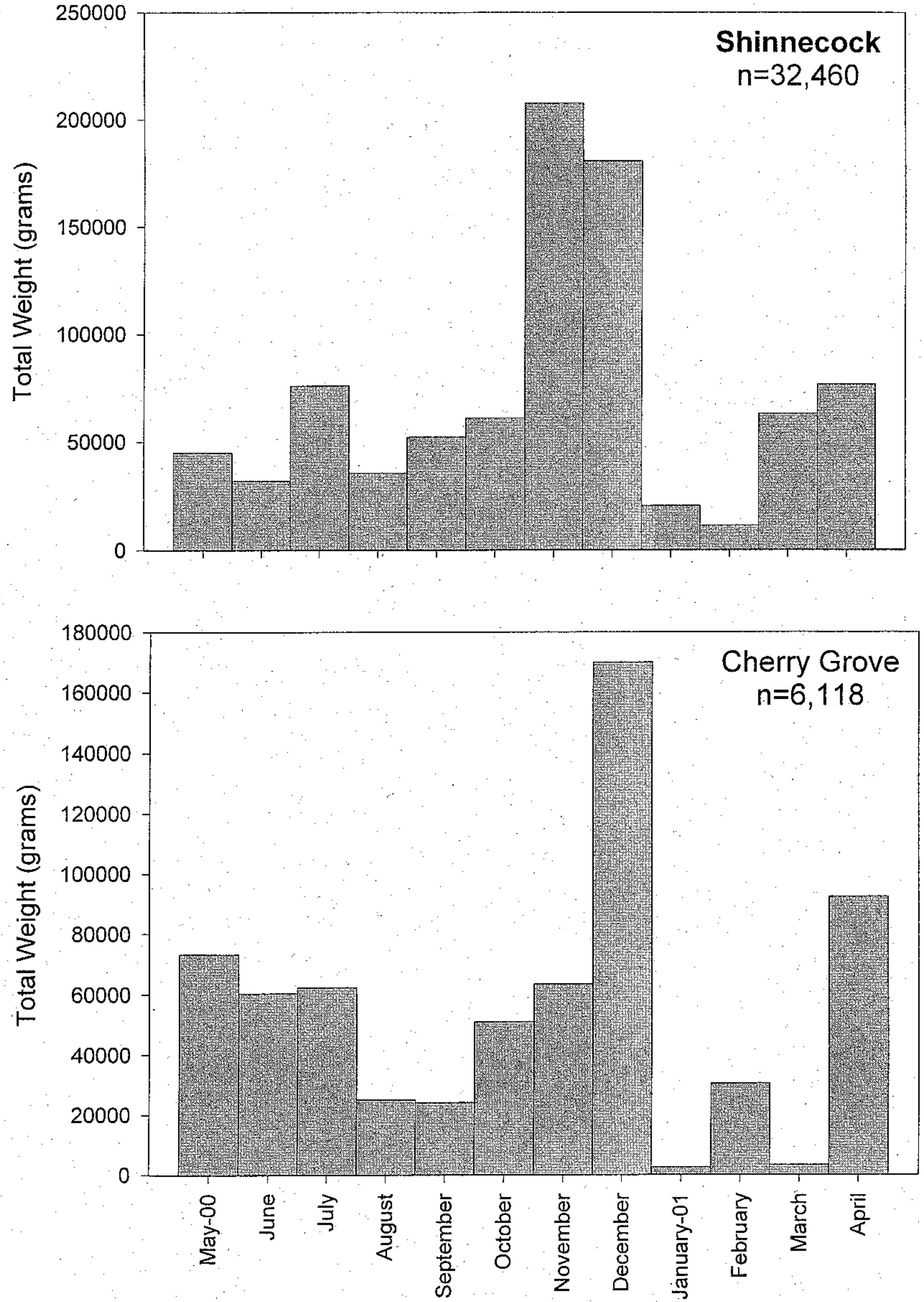


FIGURE 9
Total Weight of Five Most Abundant Species
Shinnecock and Cherry Grove Borrow Areas

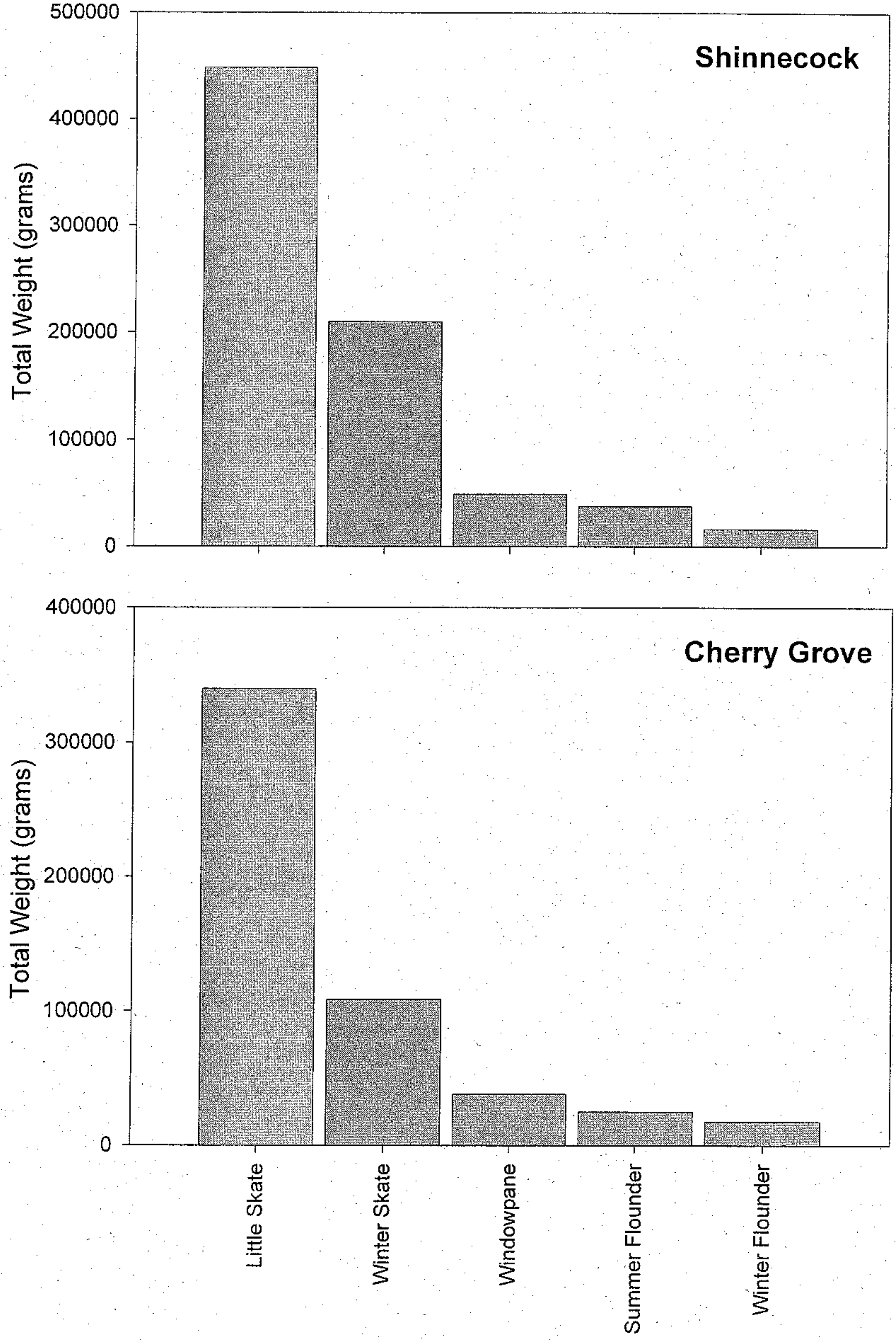
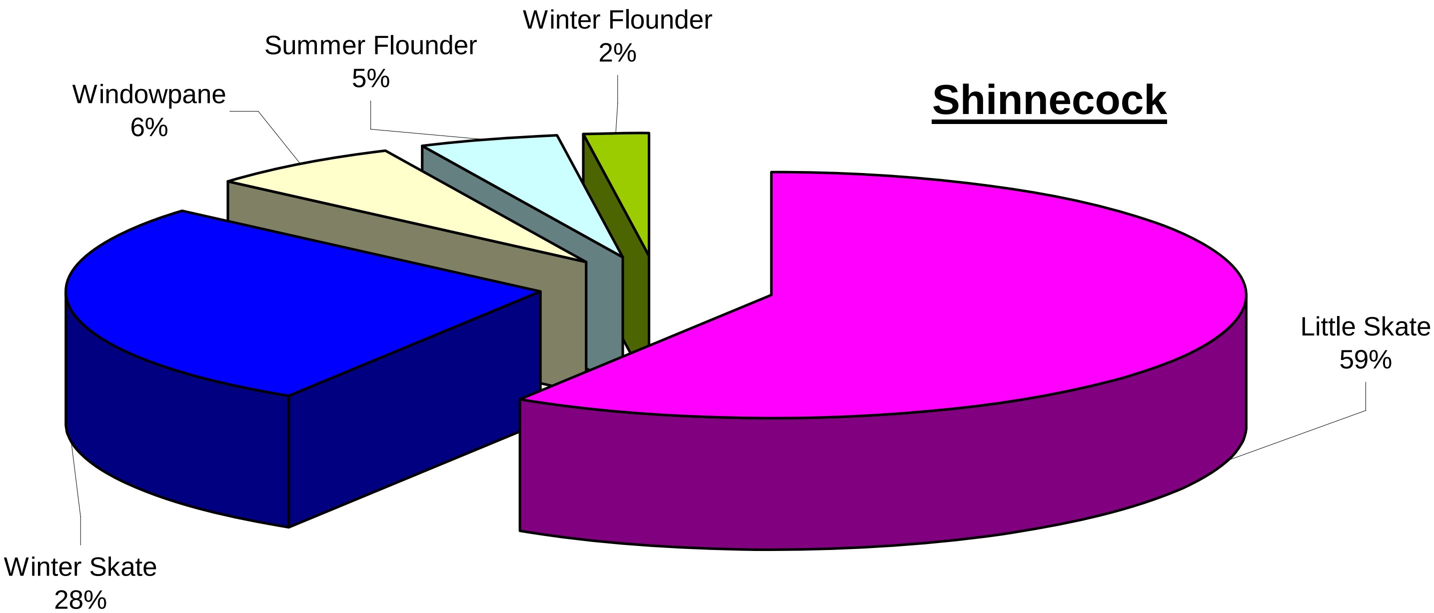


FIGURE 10
Percent of Total Weight of Five Most Abundant Species
Shinnecock and Cherry Grove Borrow Areas



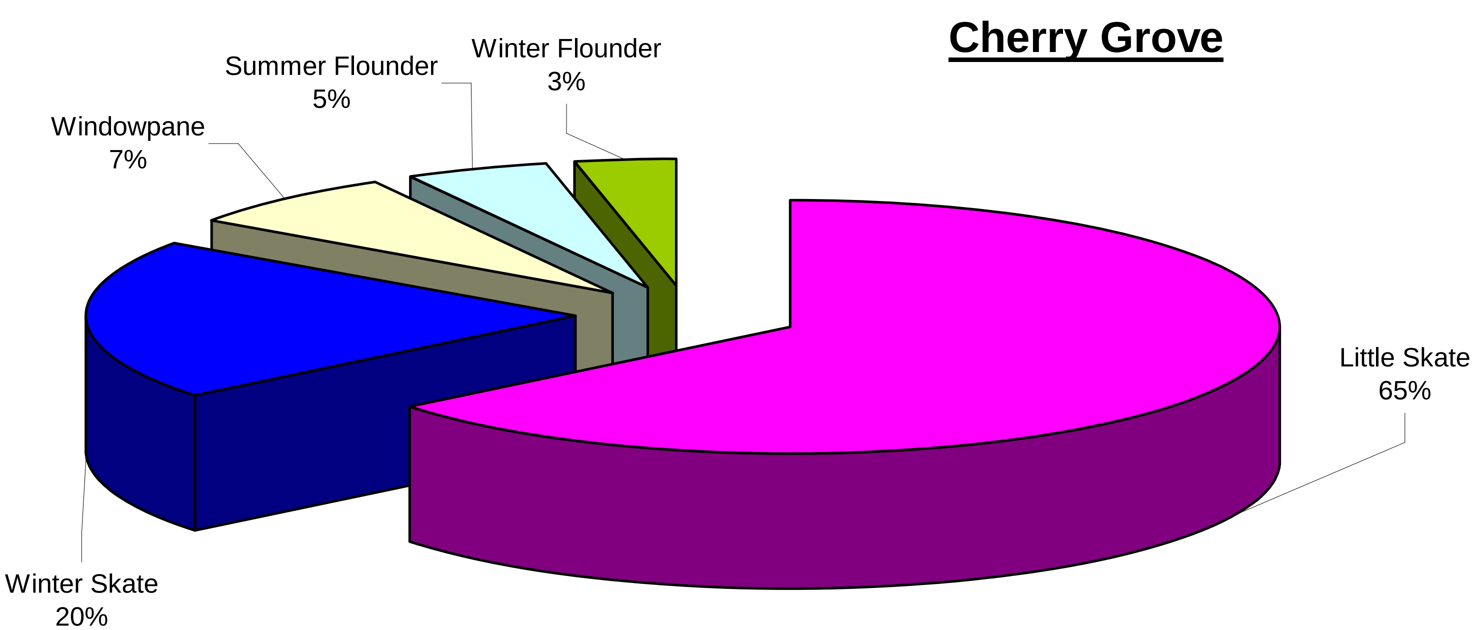


FIGURE 11
Length Frequency Distributions for Commercially Important Species

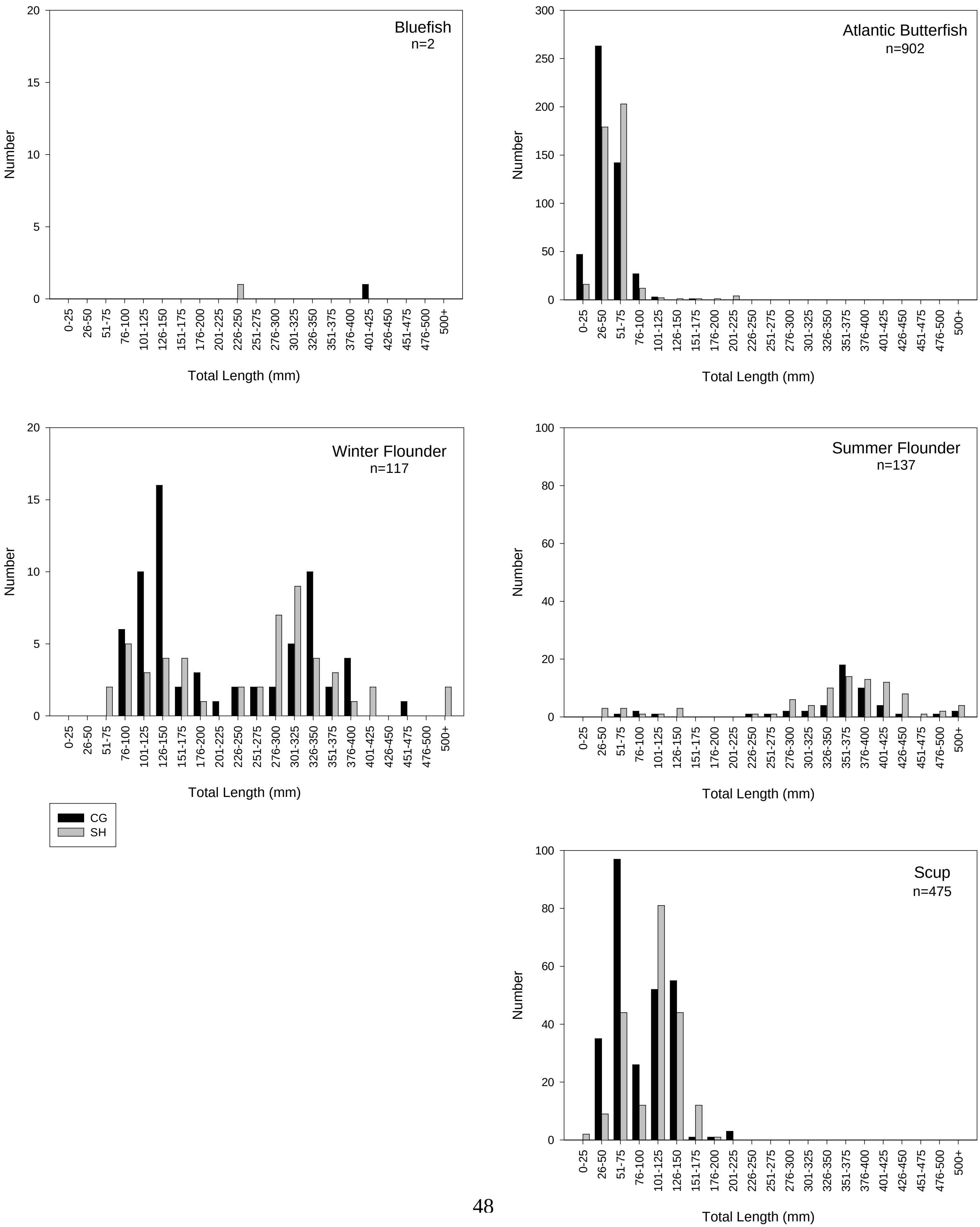


FIGURE 12
Total Annual Weight for Commercially Important Species

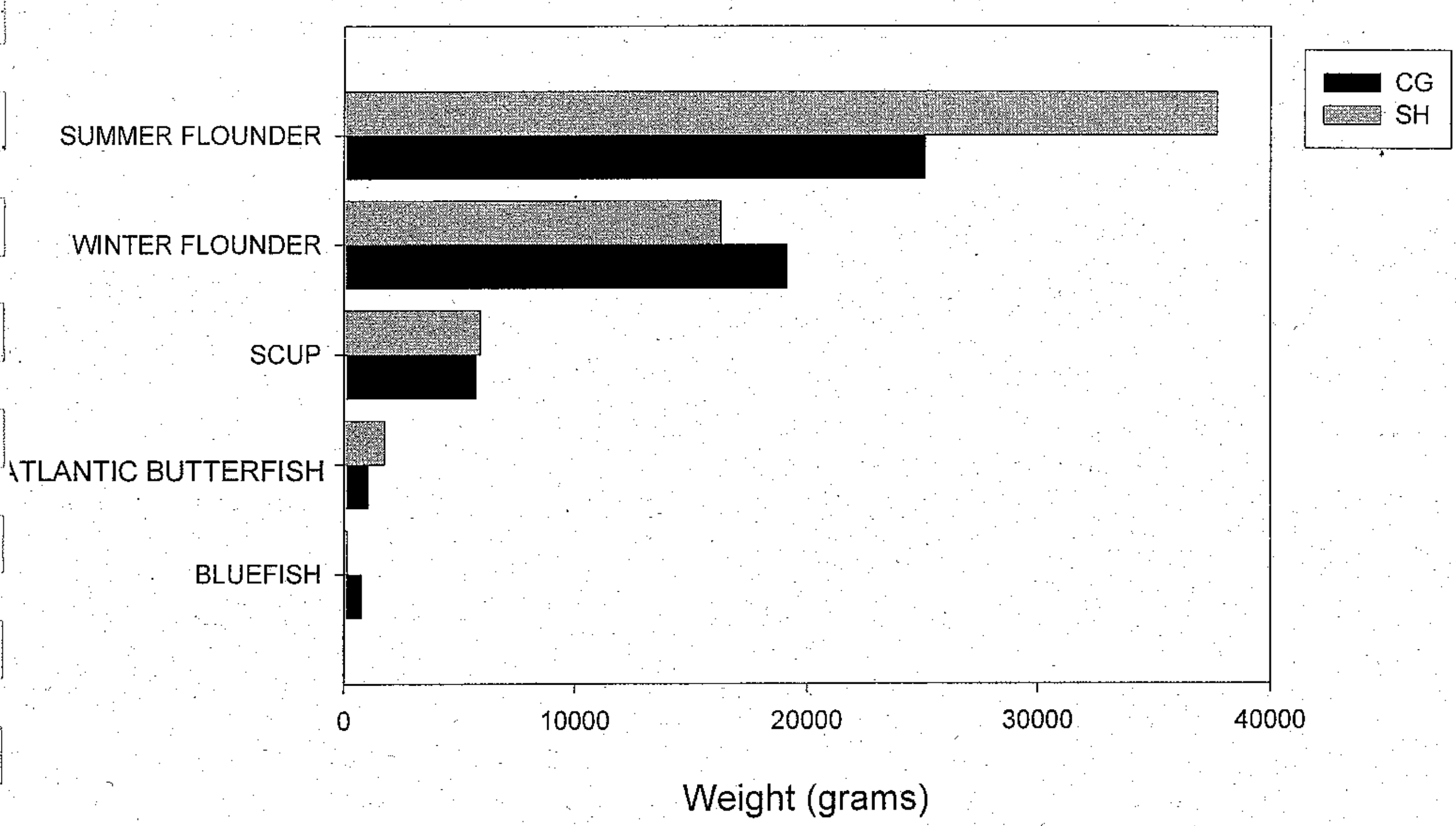


FIGURE 13
Monthly Weight for Commercially Important Species

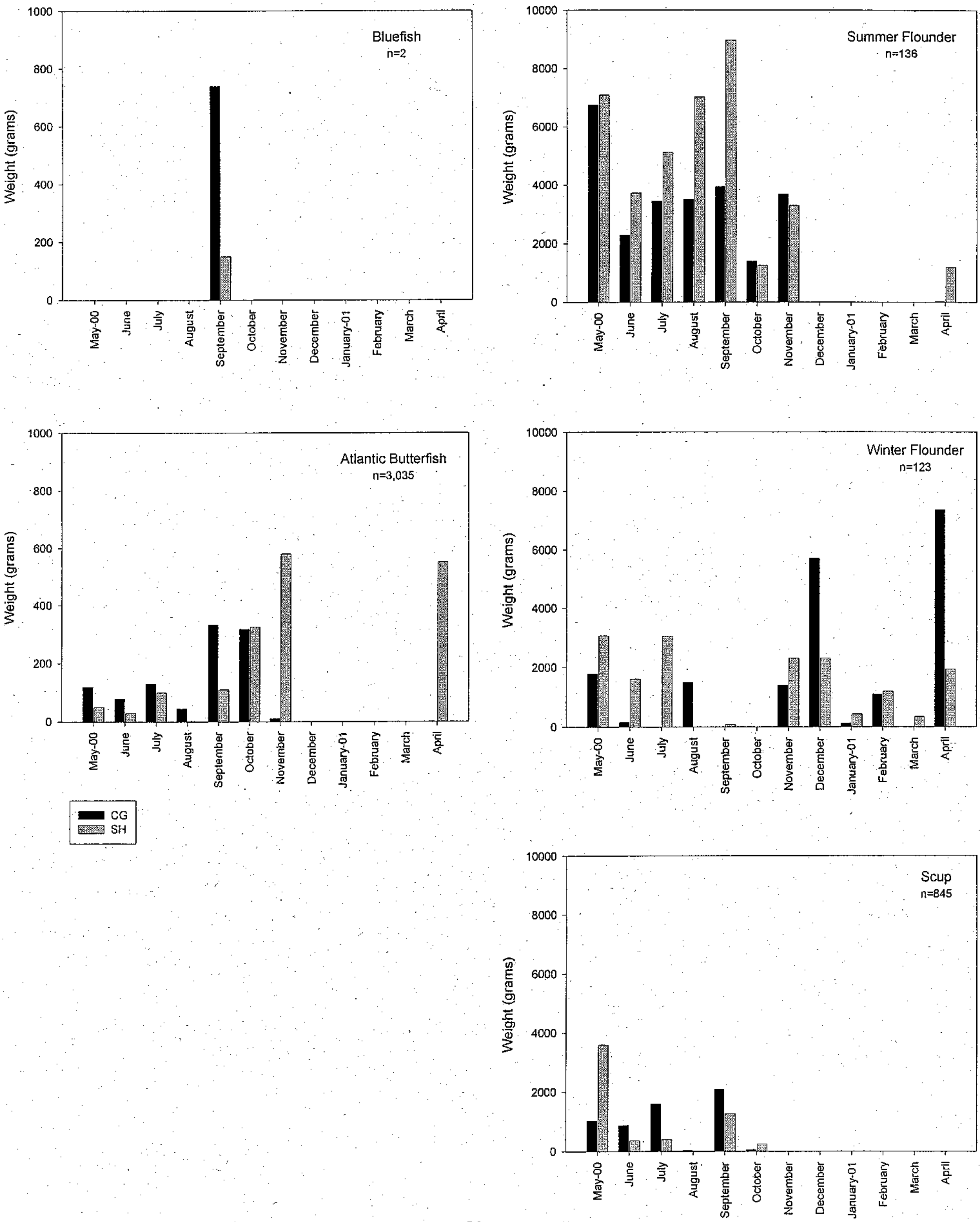
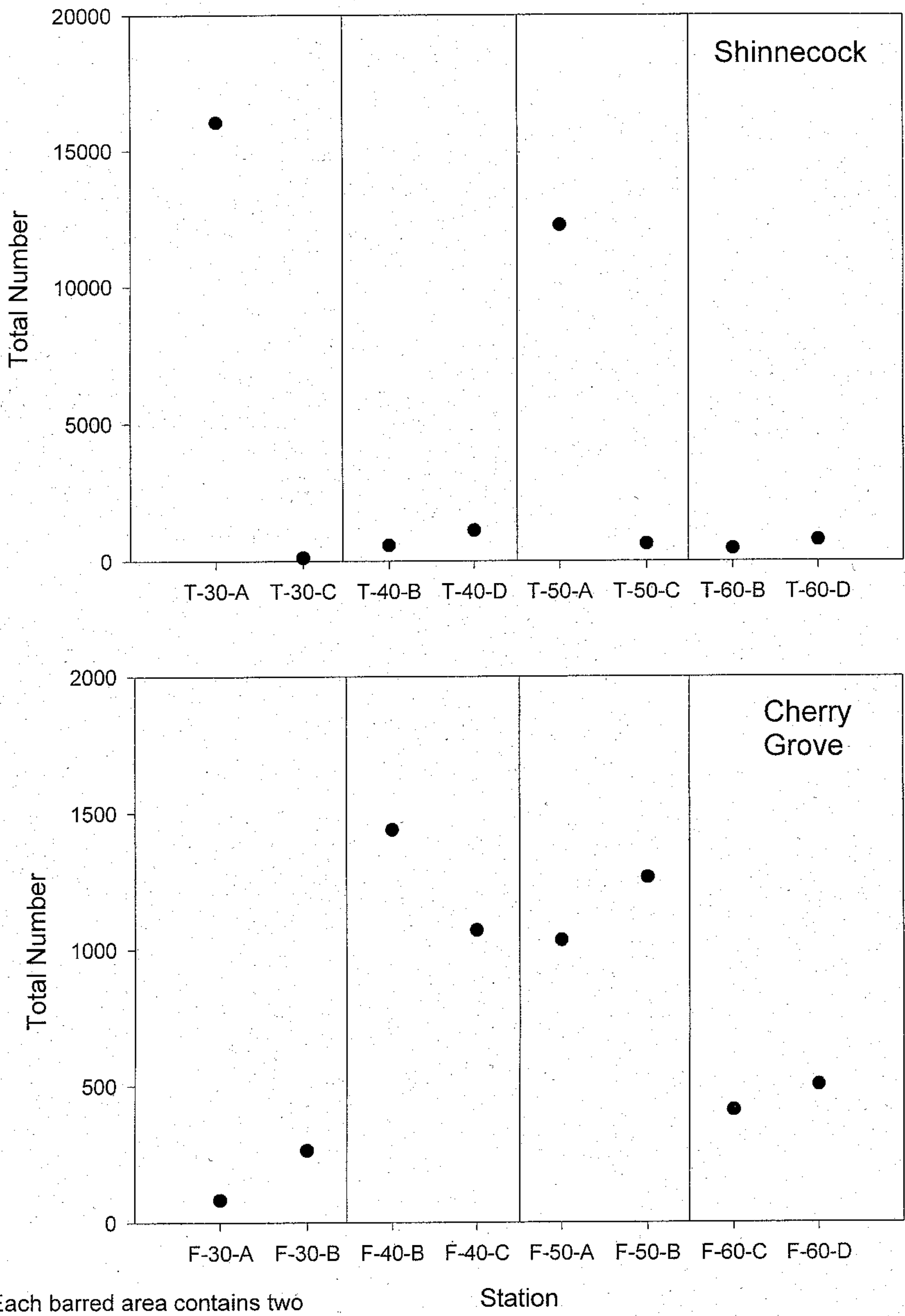


FIGURE 14
Total Number of Fishes per Station (Grouped by Depth)



*Each barred area contains two stations and represents a depth interval.

FIGURE 15
Total Number of Fishes vs. Depth (Averaged for All Transects)

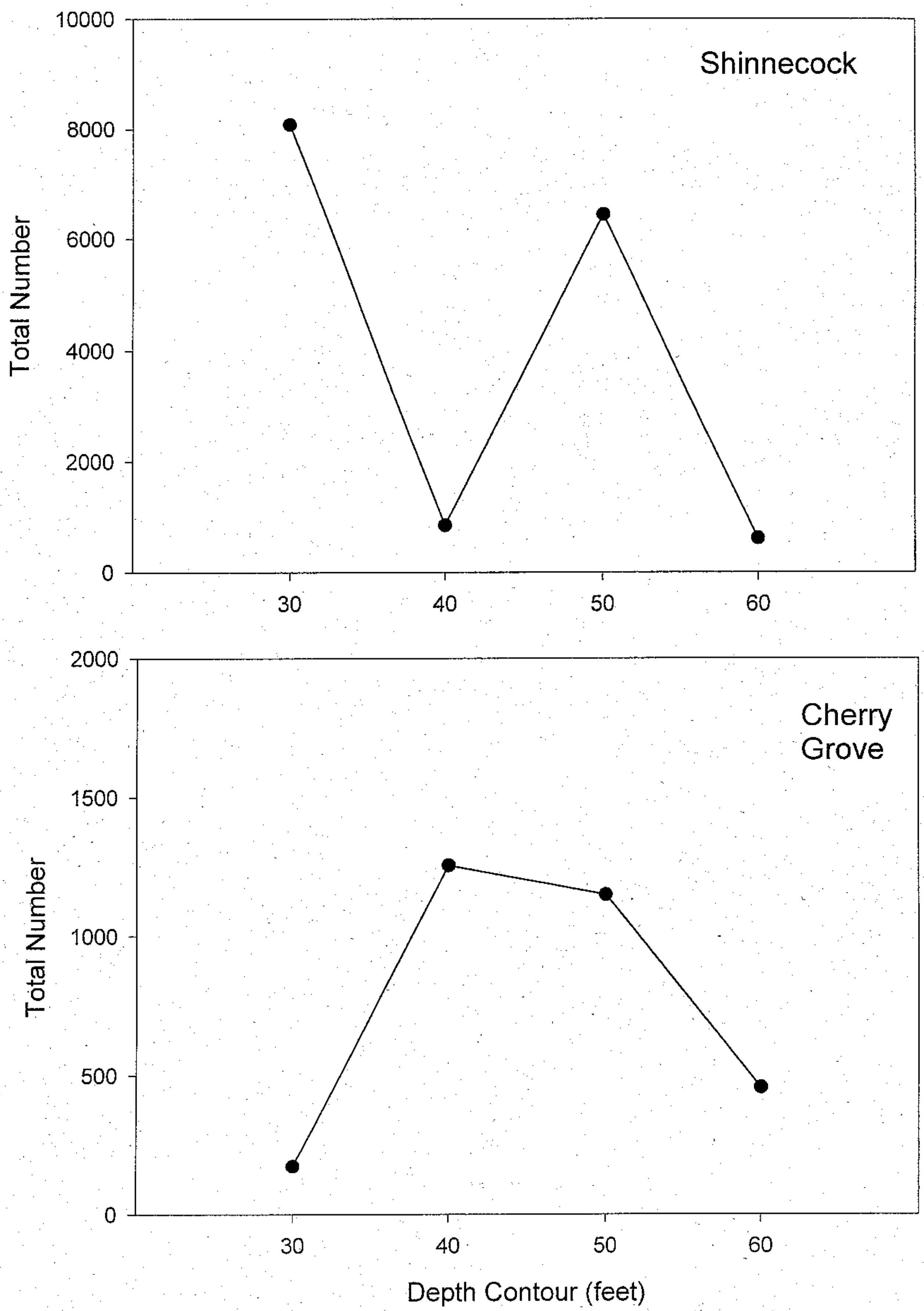
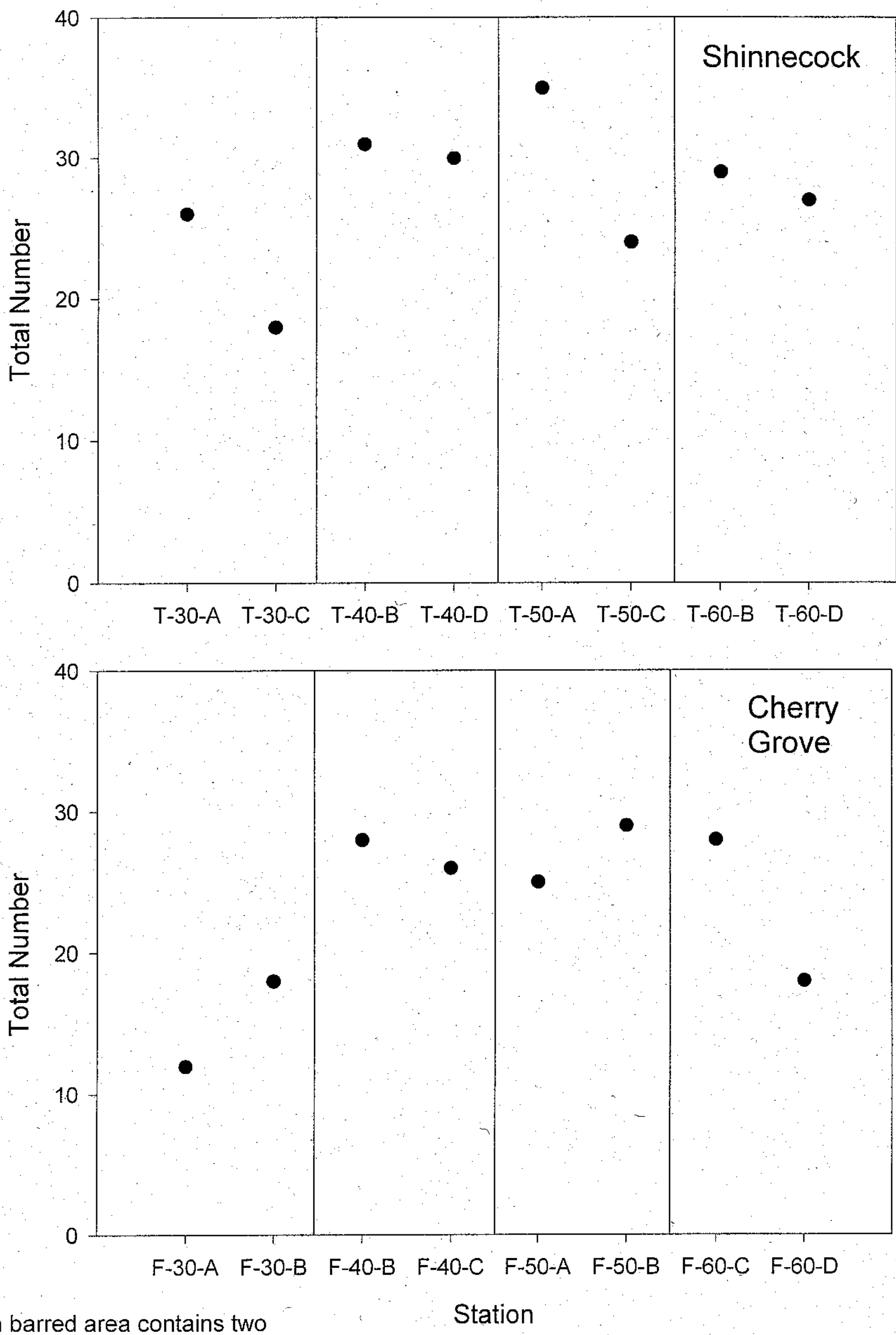
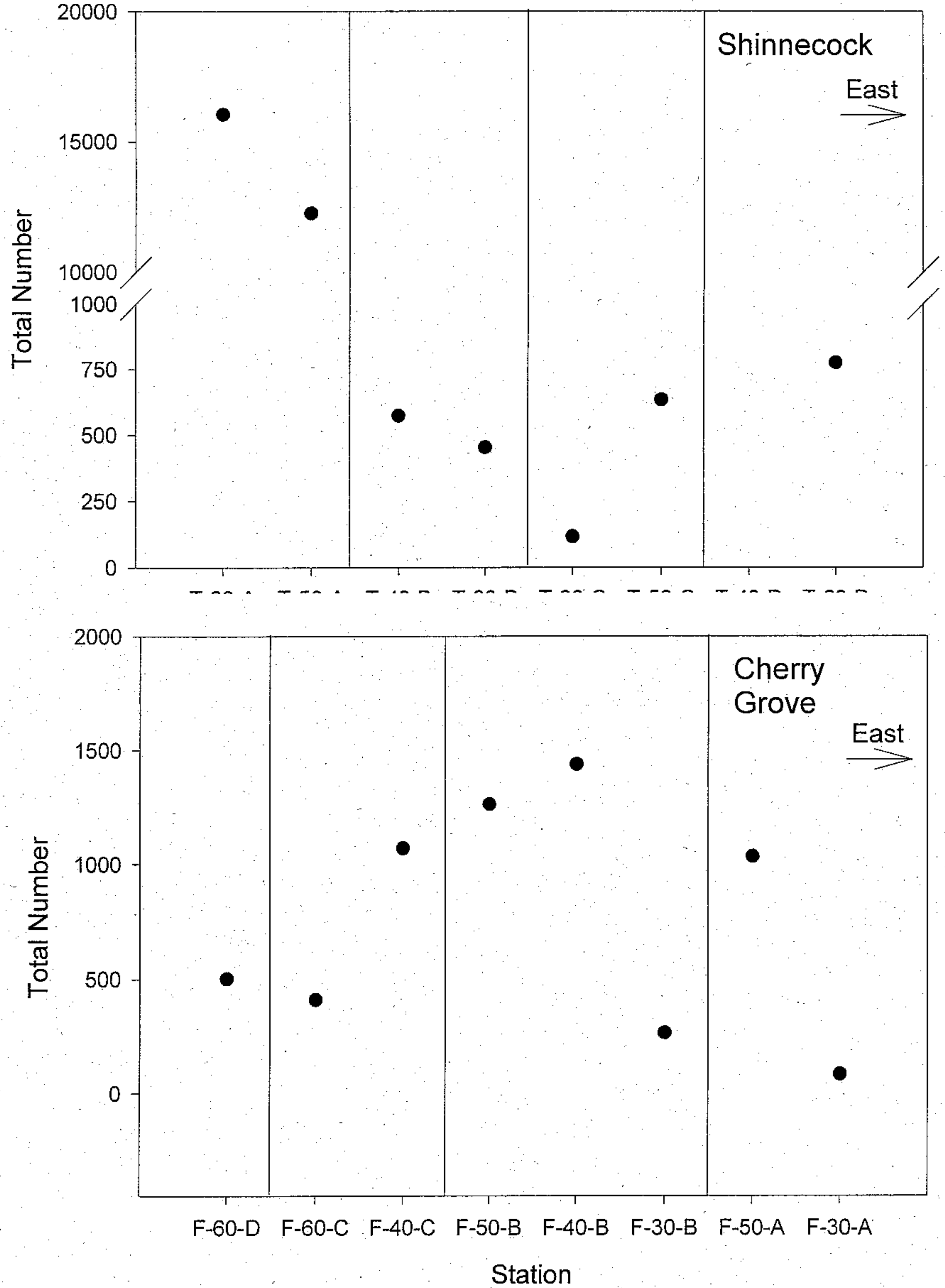


FIGURE 16
Total Number of Species per Station (Grouped by Depth)



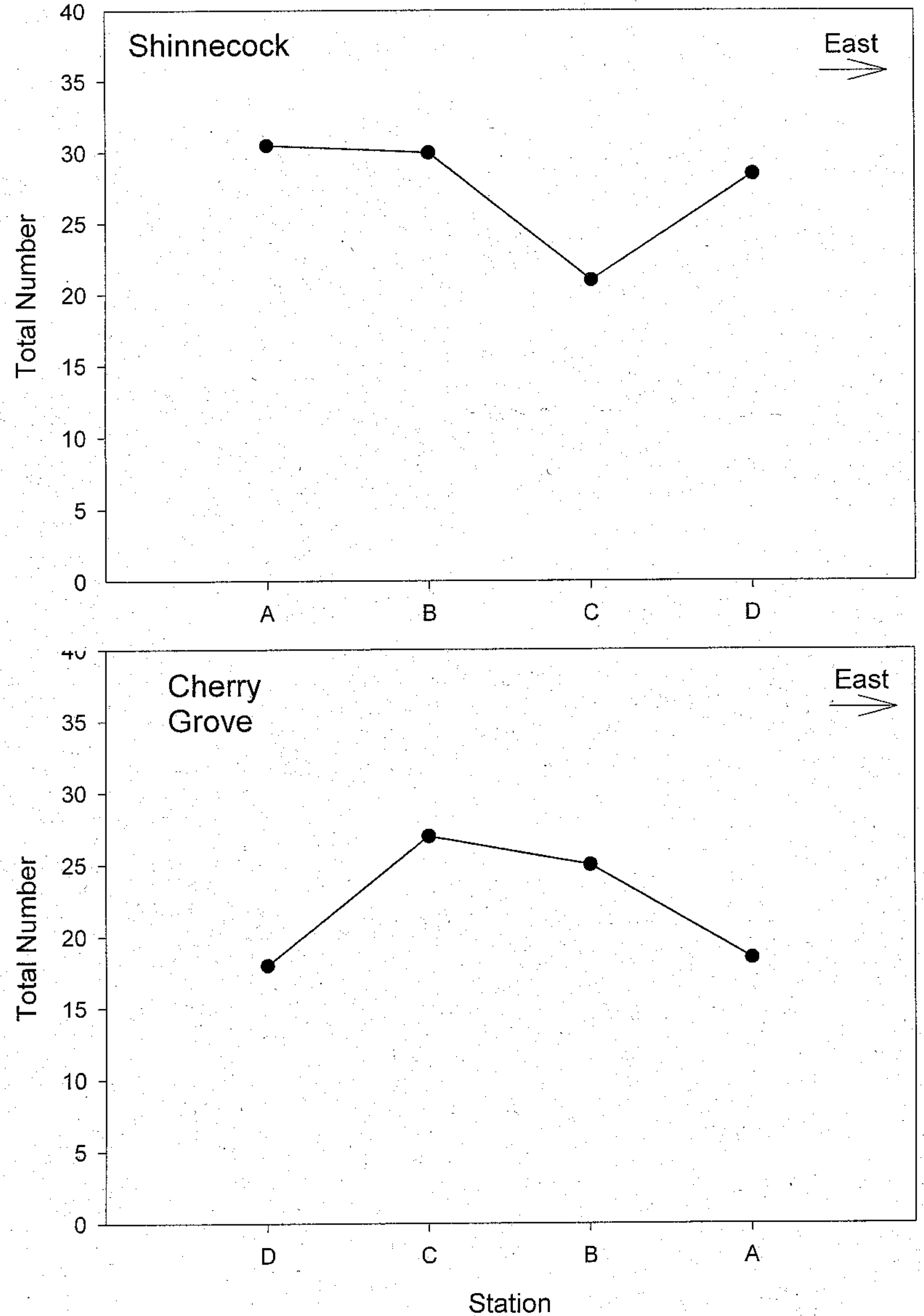
*Each barred area contains two stations and represents a depth interval.

FIGURE 17
Total Number of Finfish per Station (Grouped by Transect)



*Each barred area contains stations and represents a transect interval.

FIGURE 18
Total Number of Fish Species per Station (Grouped by Transect)



*Each barred area contains stations and represents a transect interval.

FIGURE 19
Age Frequency Distribution

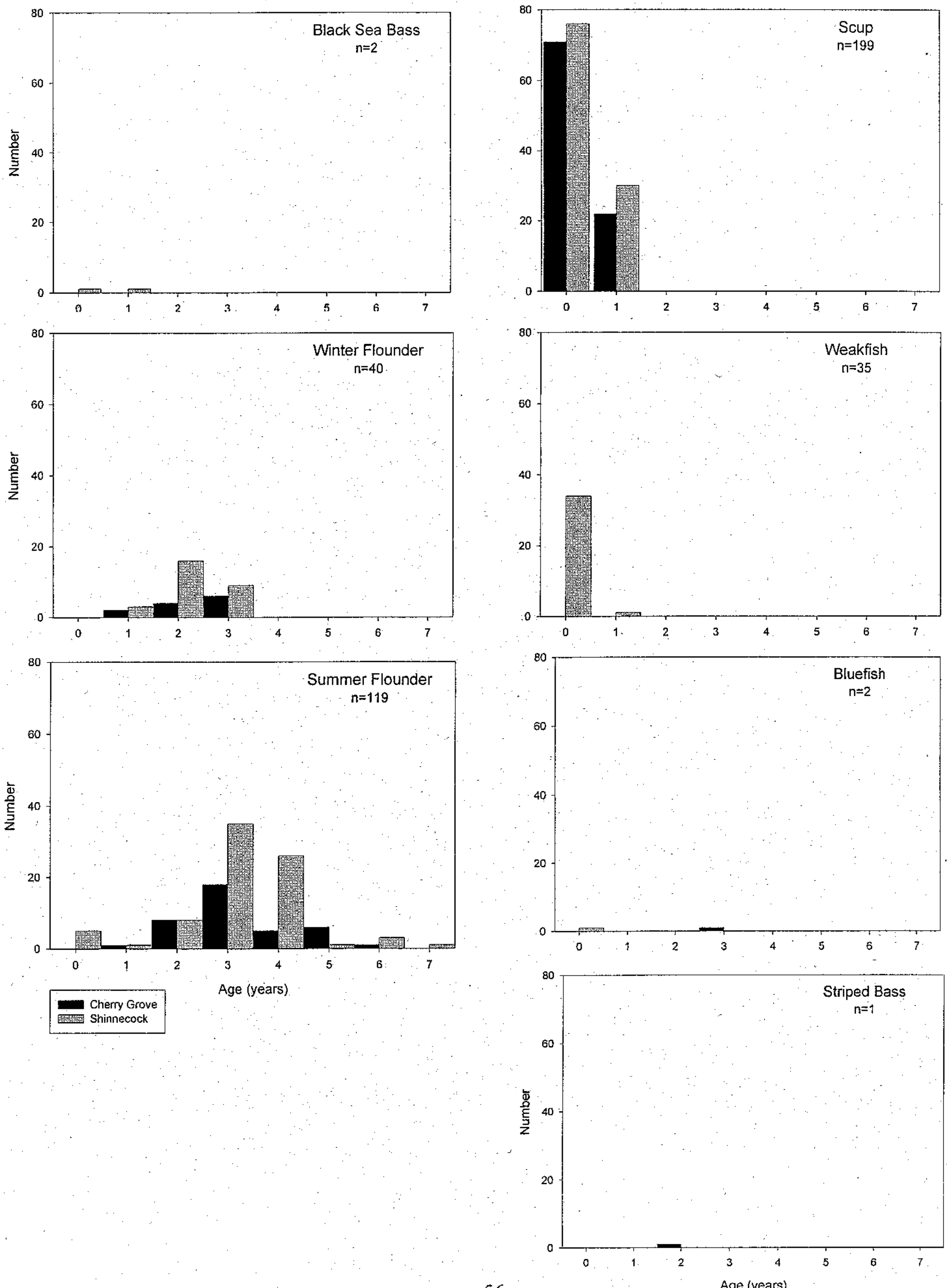


FIGURE 20
Monthly Mean Age Distribution

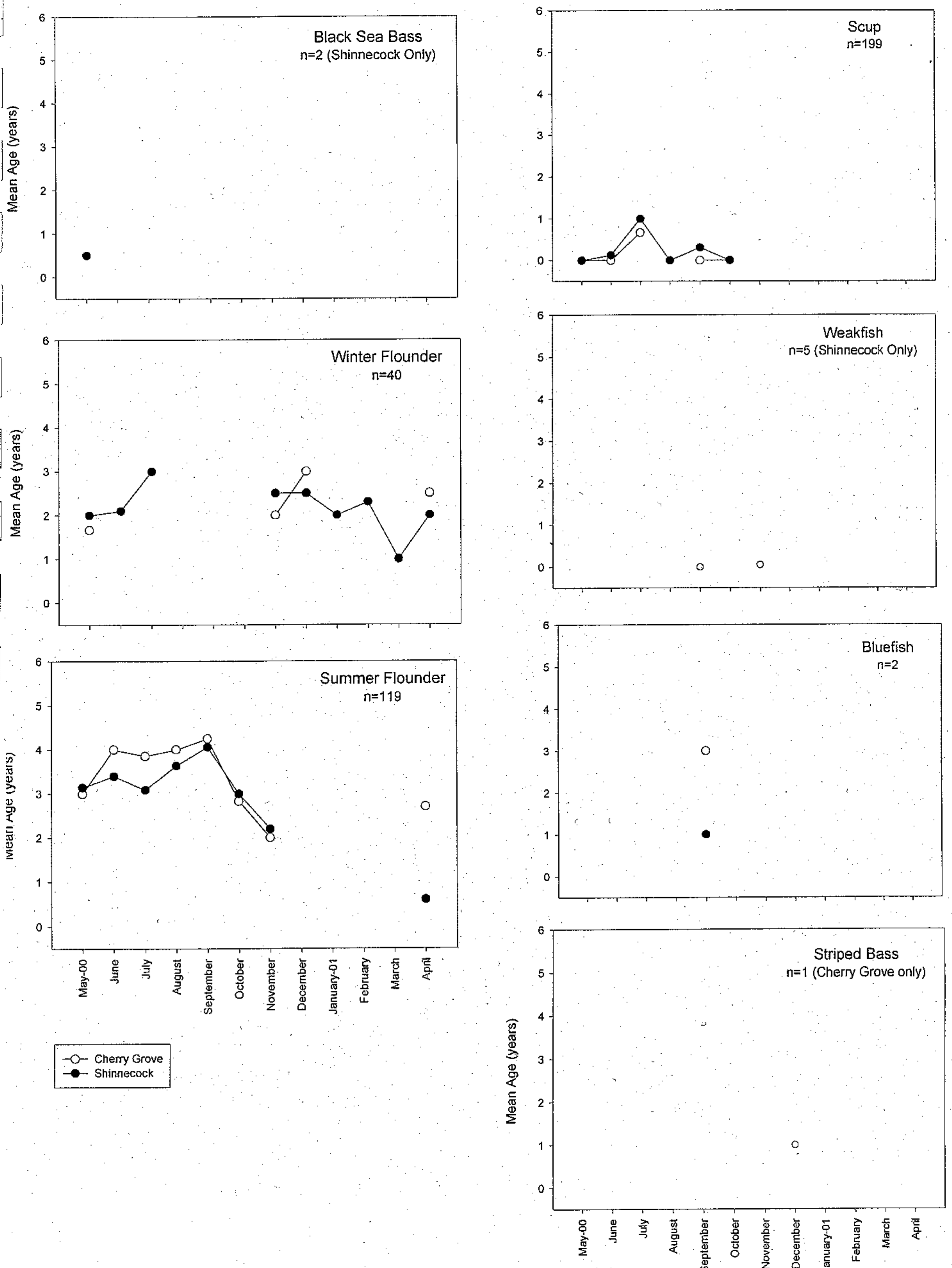


FIGURE 21
Length at Age Distributions – Shinnecock

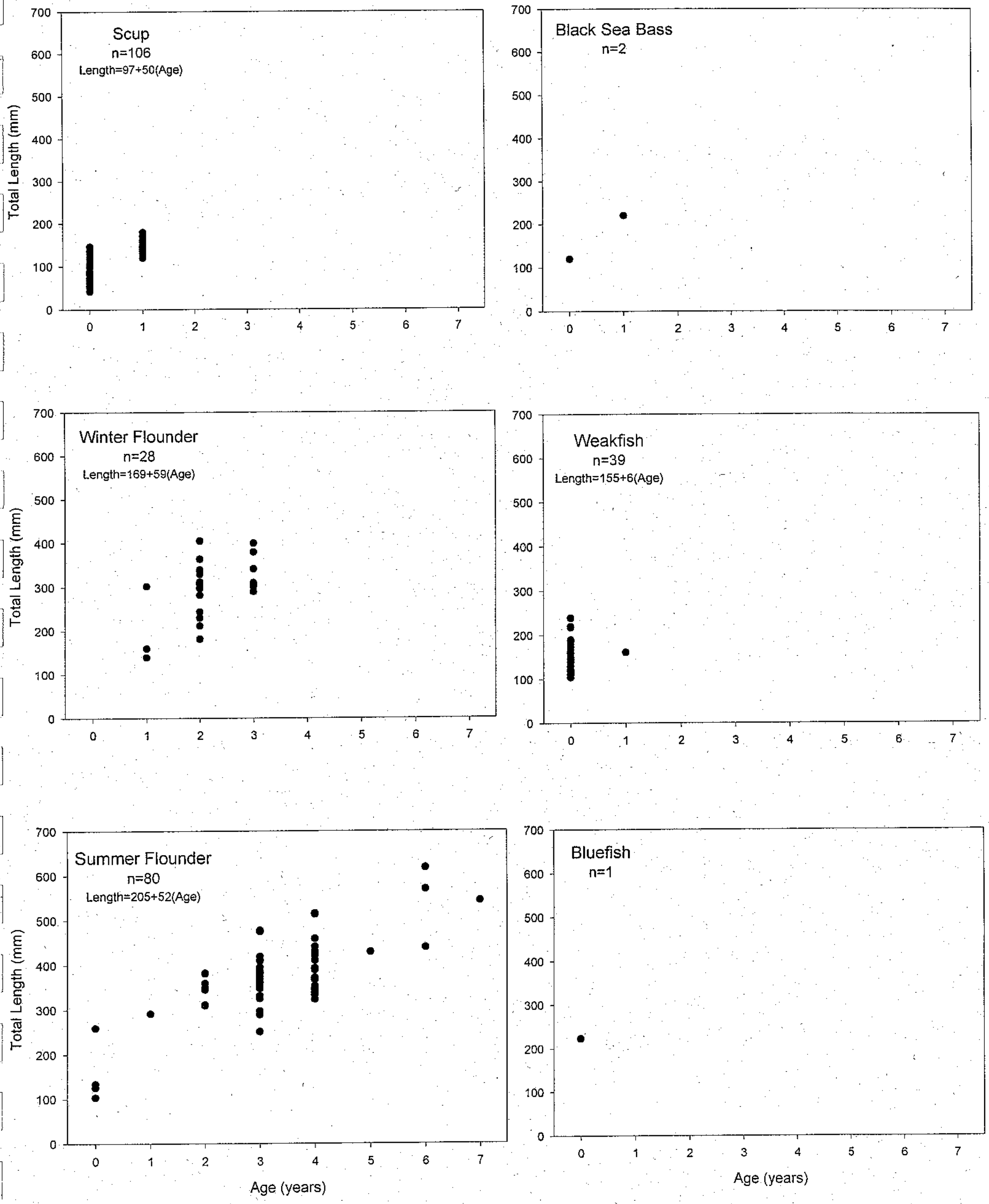


FIGURE 22
Length at Age Distributions – Cherry Grove

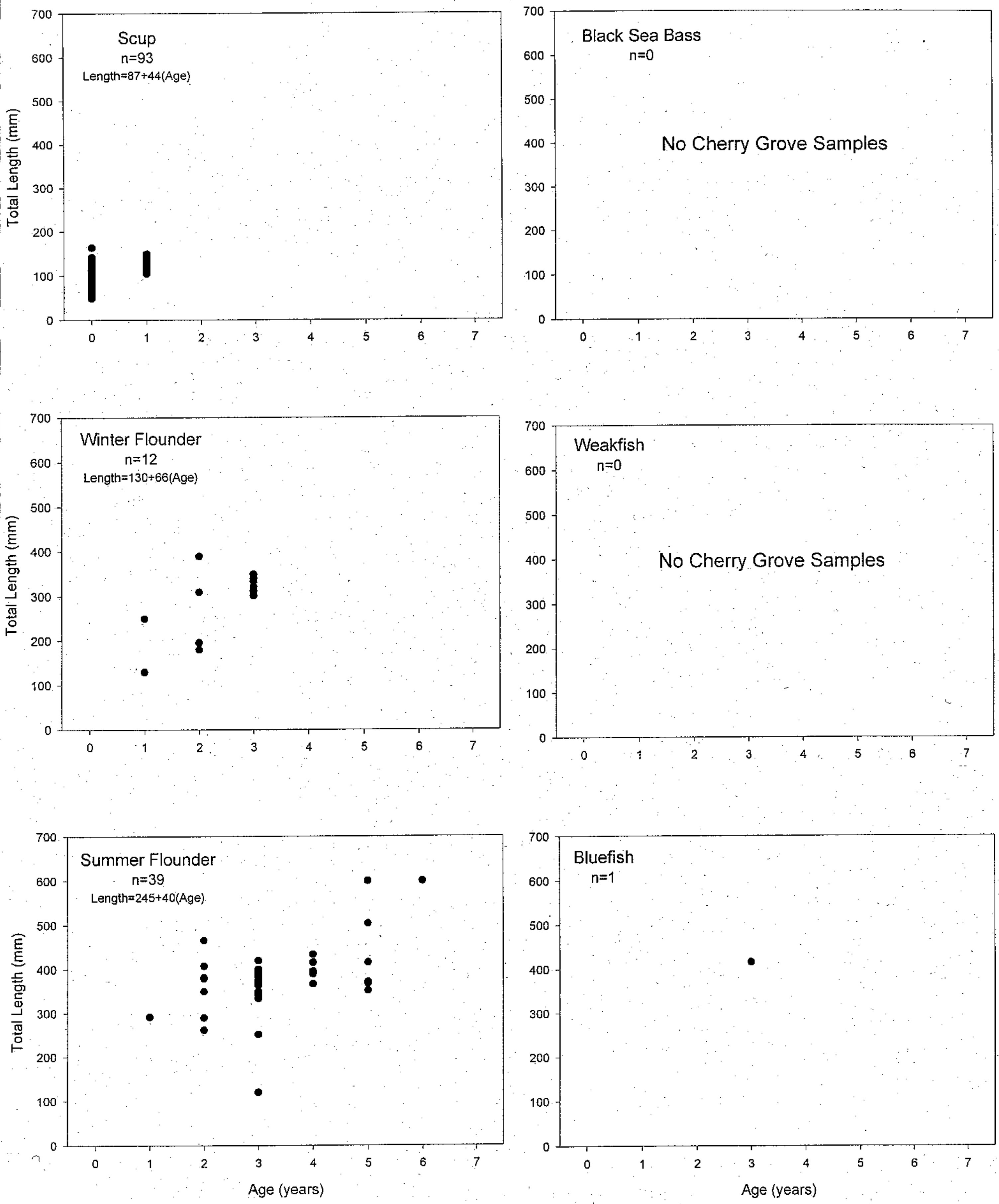
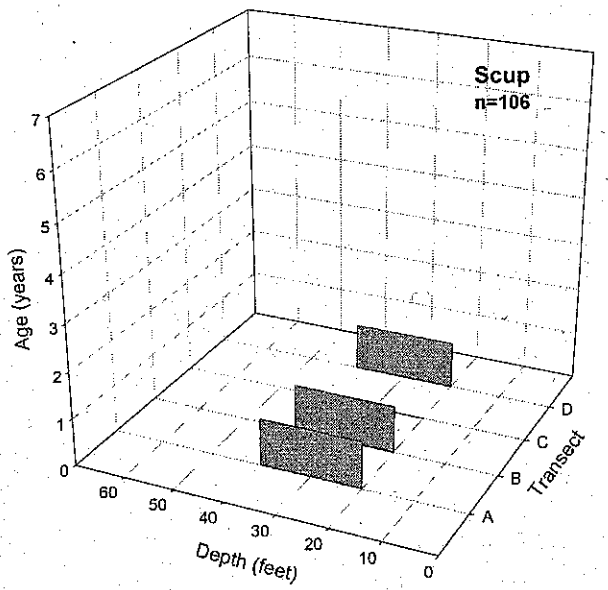
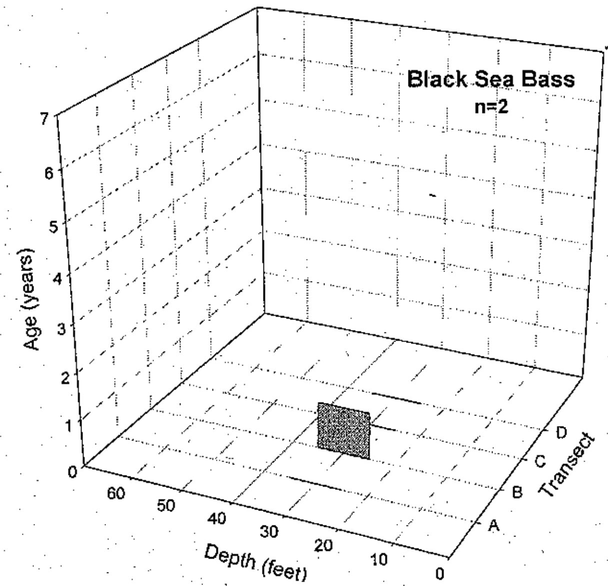
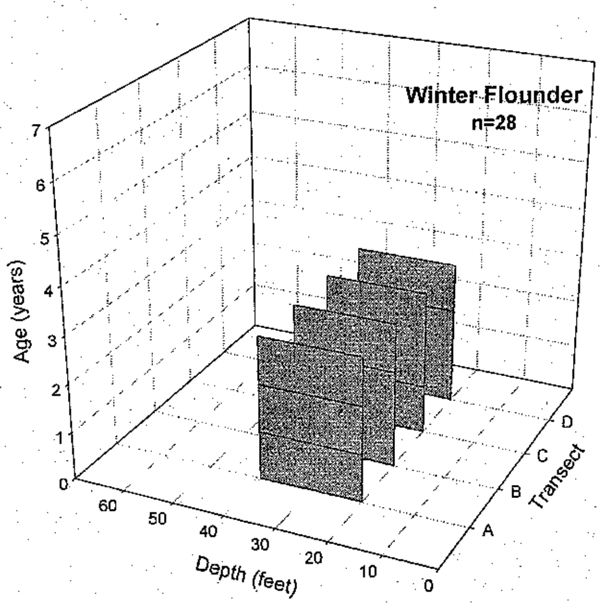
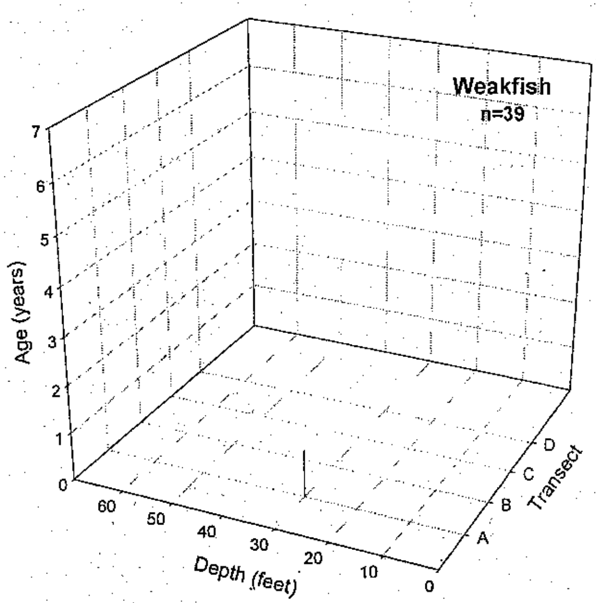


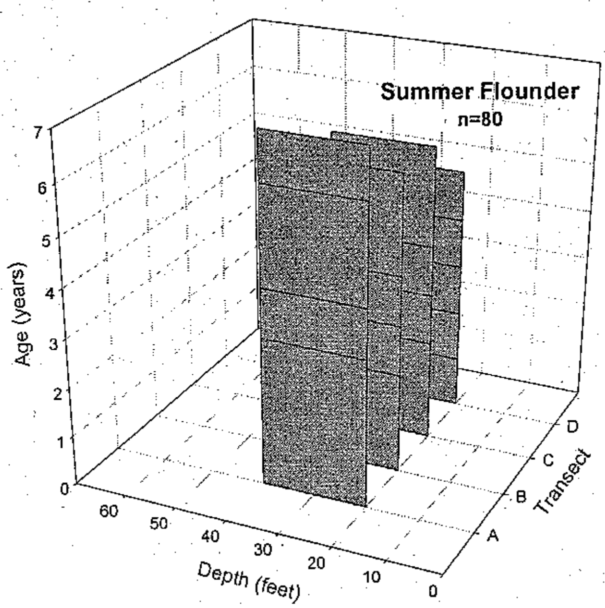
FIGURE 23
Age per Station – Shinnecock





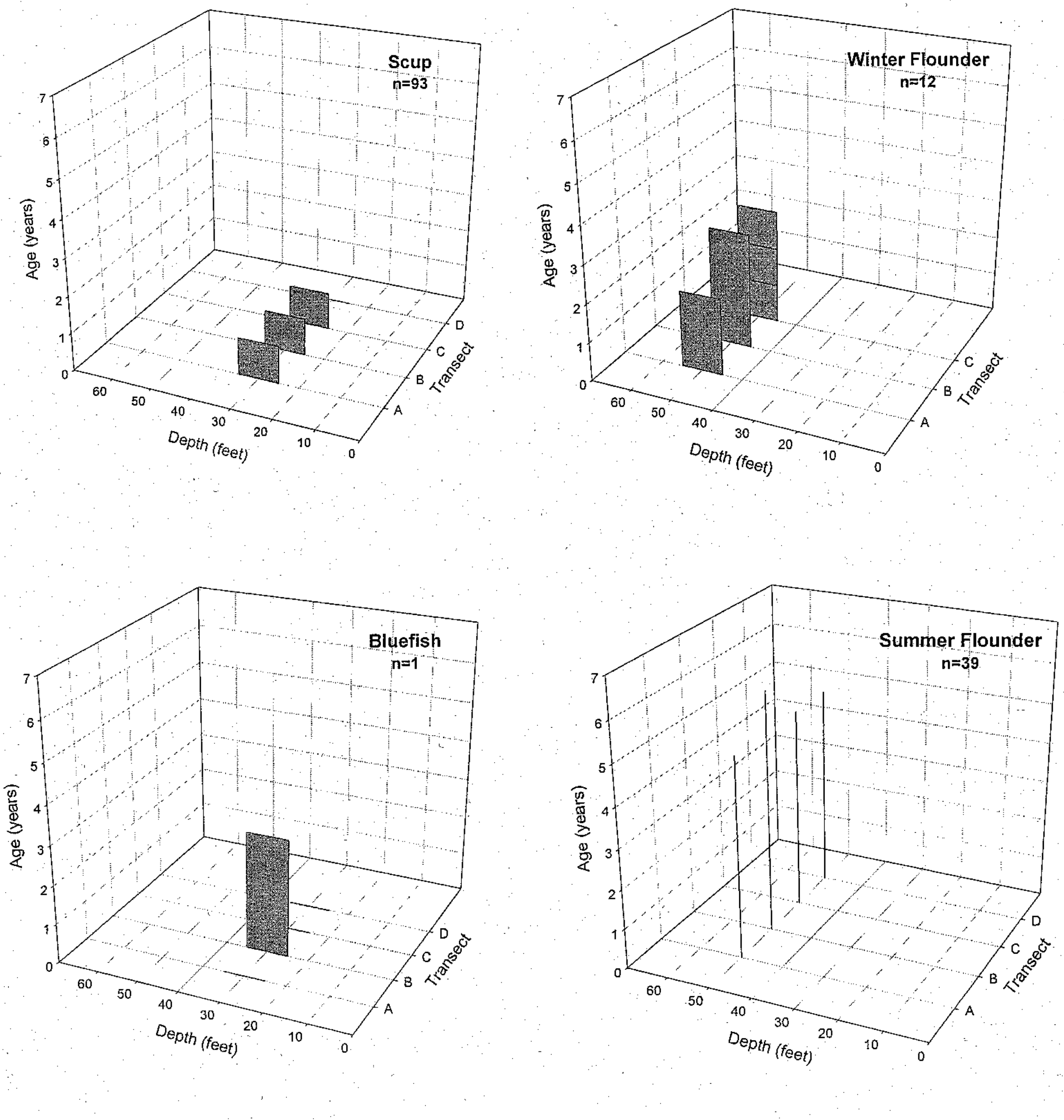






*Note-no striped bass collected at Shinnecock. No depth information on Bluefish collected.

FIGURE 24
Age per Station – Cherry Grove



*Note-no black sea bass, weakfish and striped bass collected at Cherry Grove.

FIGURE 25
Total Number of Macroinvertebrates by Species

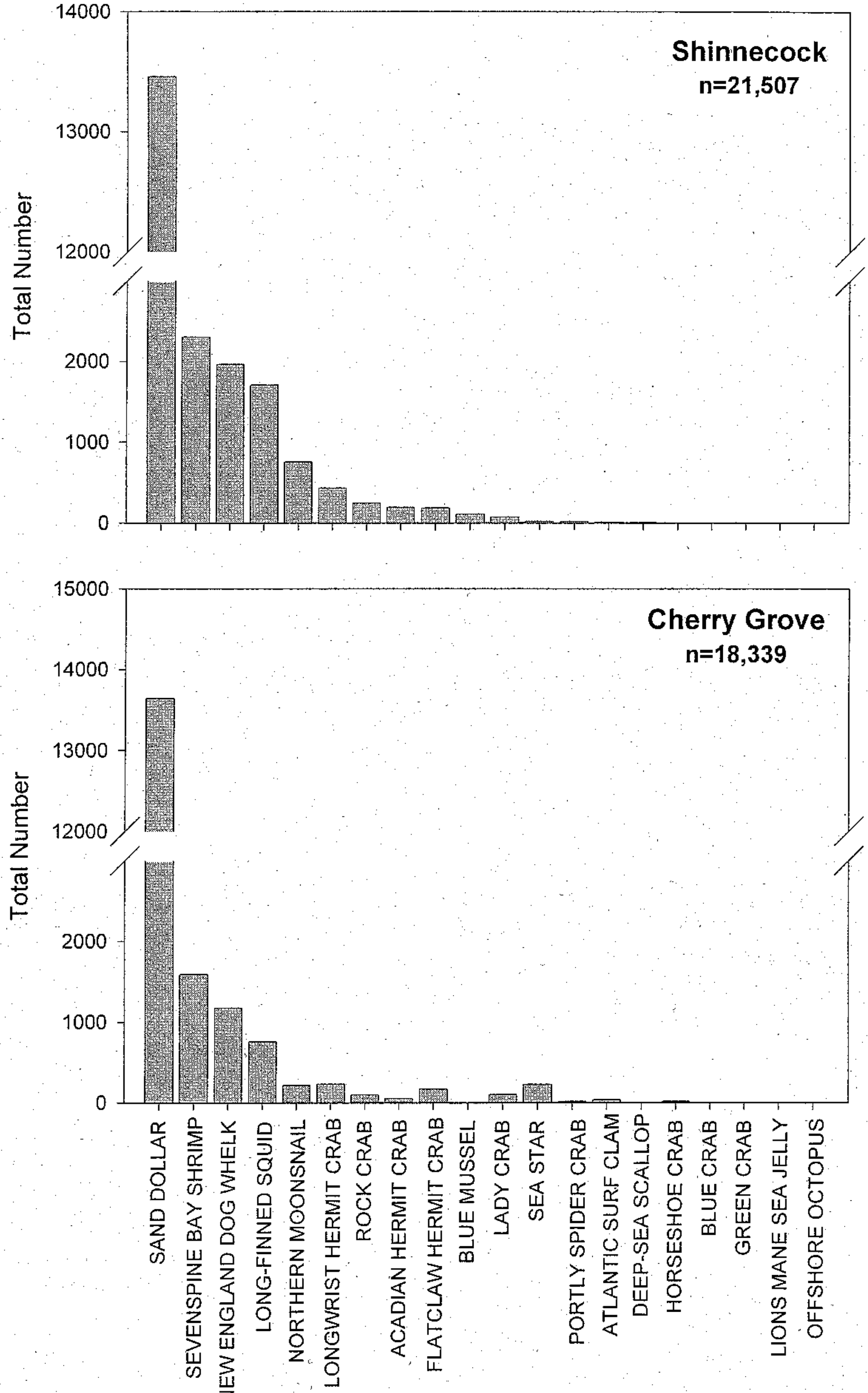
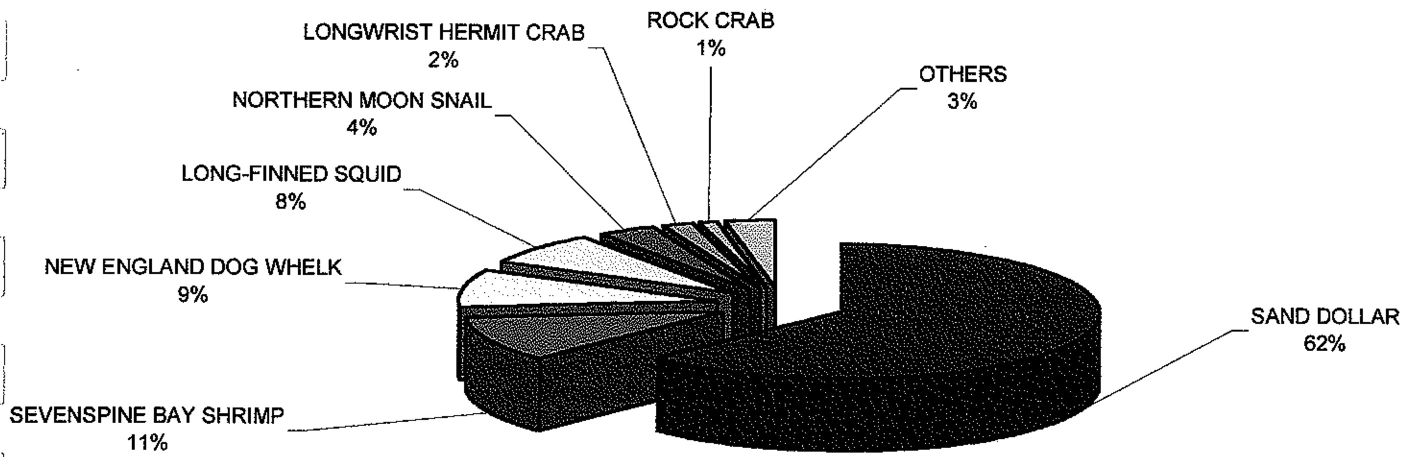


FIGURE 26
Percent Composition of Macroinvertebrates Collected in Trawls

Shinnecock



Cherry Grove

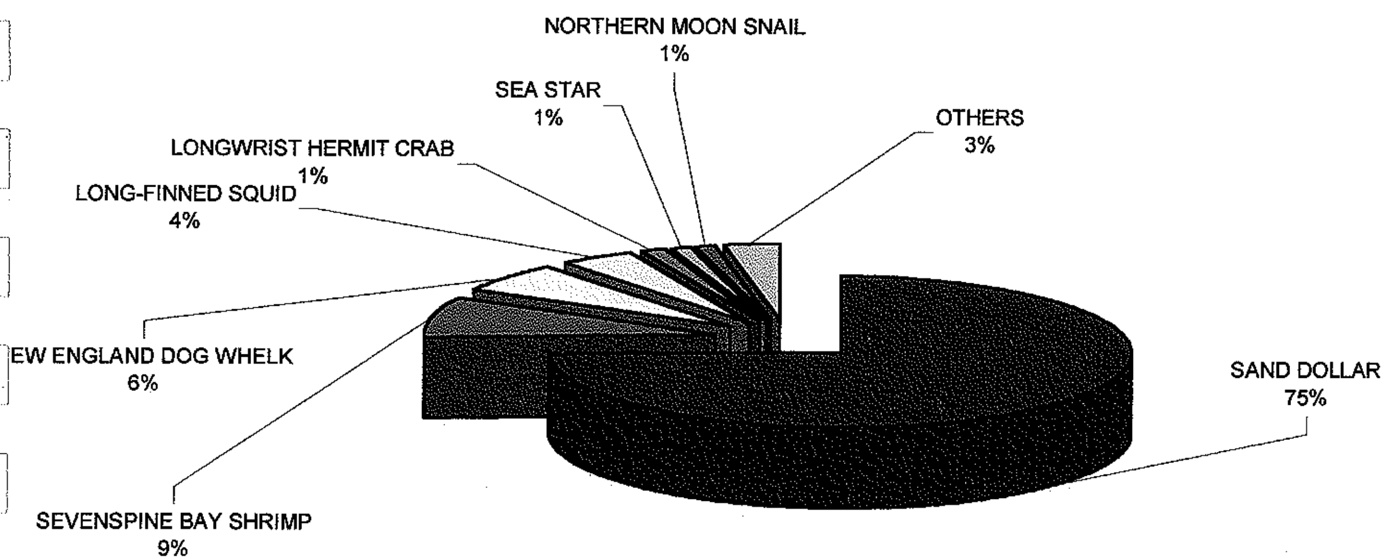


FIGURE 27
Monthly Macroinvertebrate Trawl Totals

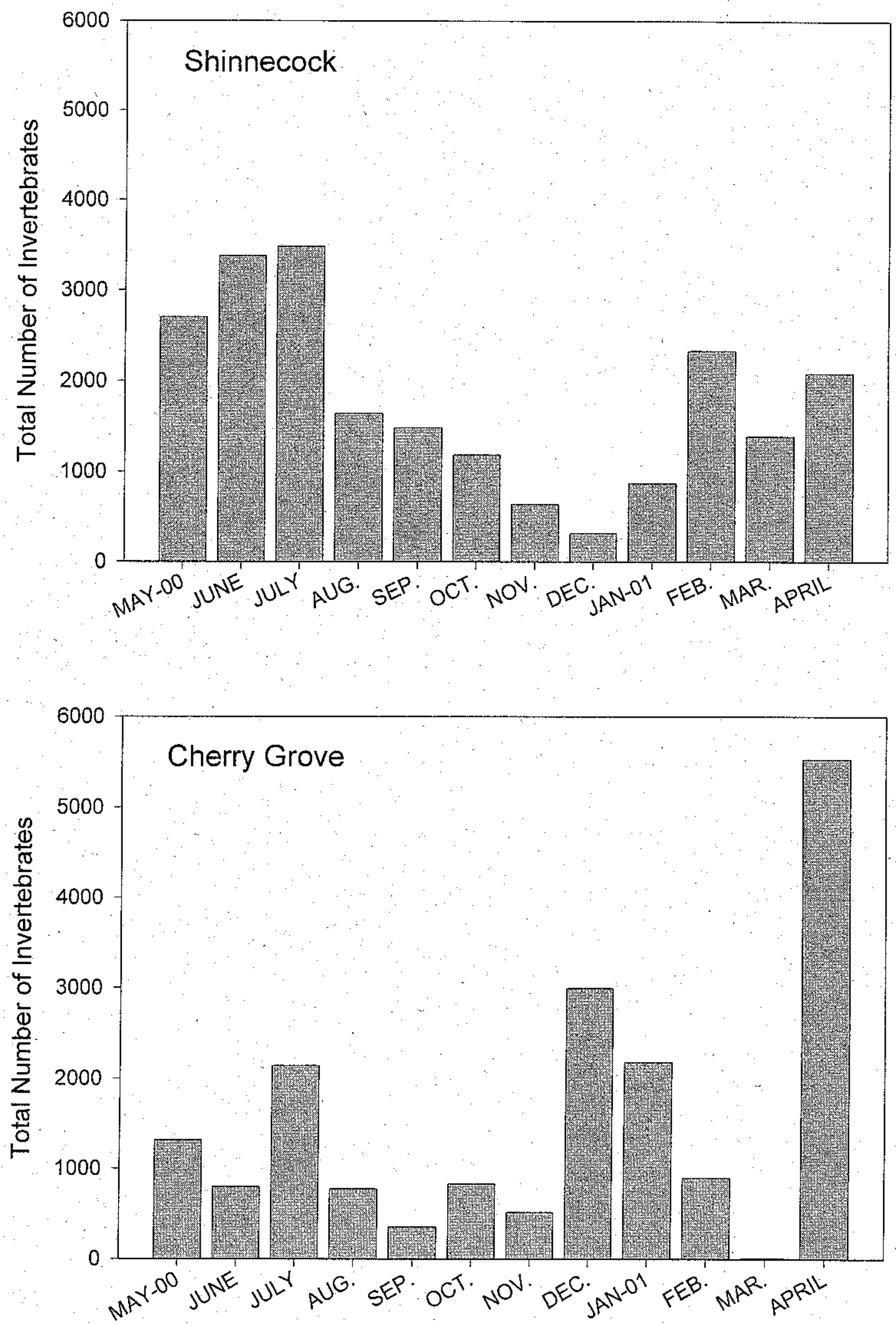


FIGURE 28
Total Number of Macroinvertebrates vs. Depth

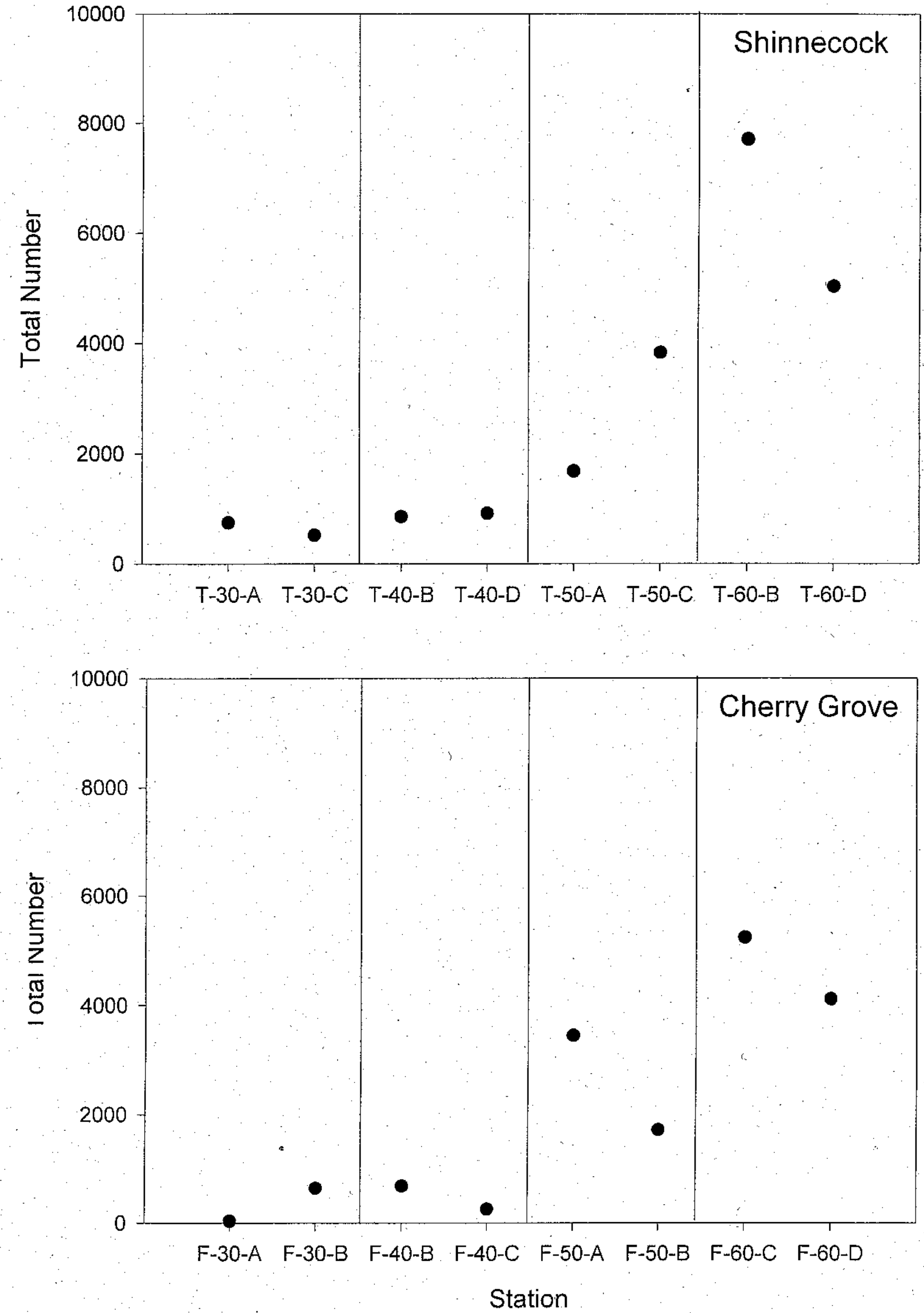


FIGURE 29
Total Number of Macroinvertebrates vs. Transect

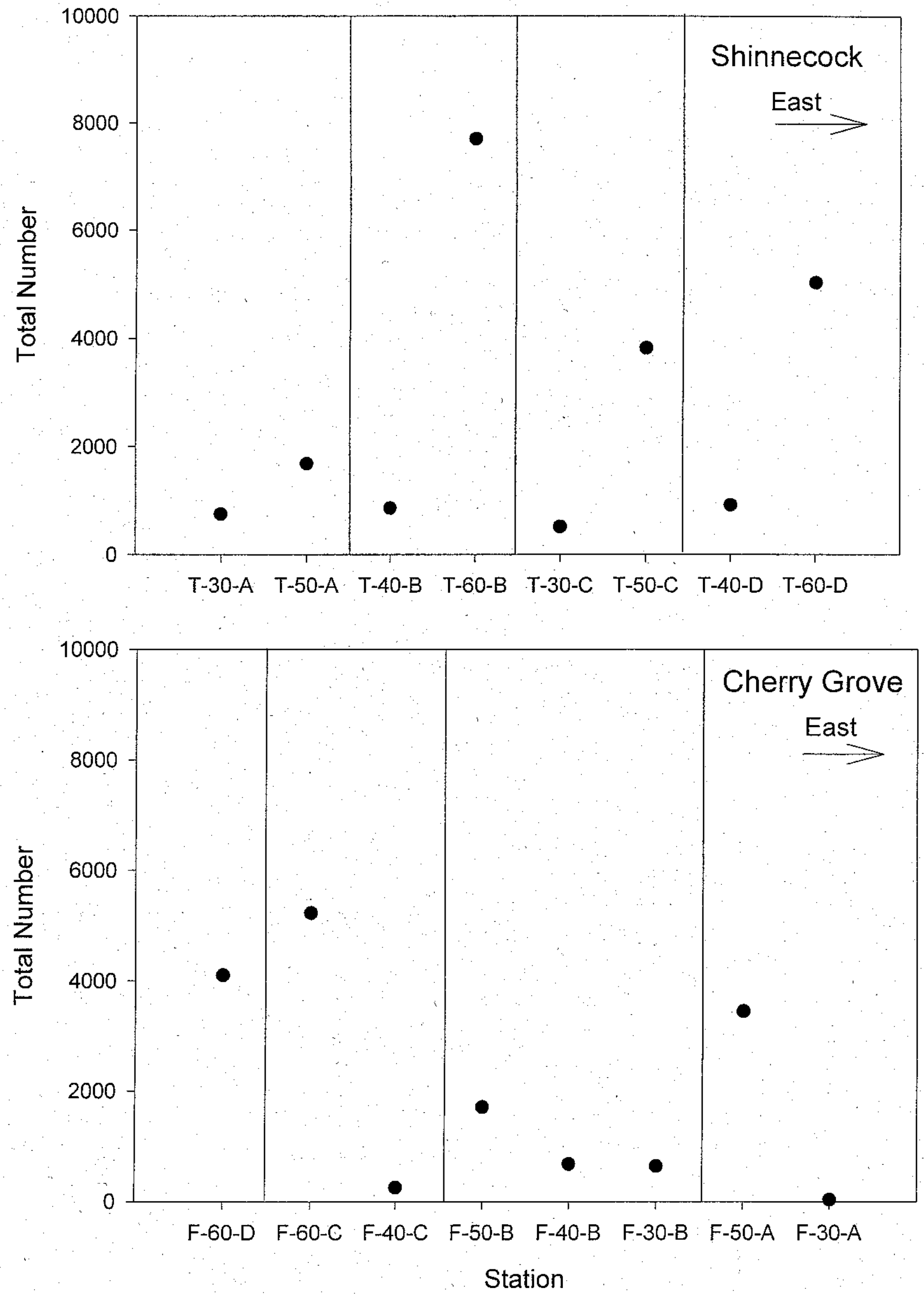


FIGURE 30
Length Frequency Distribution for Long-finned Squid

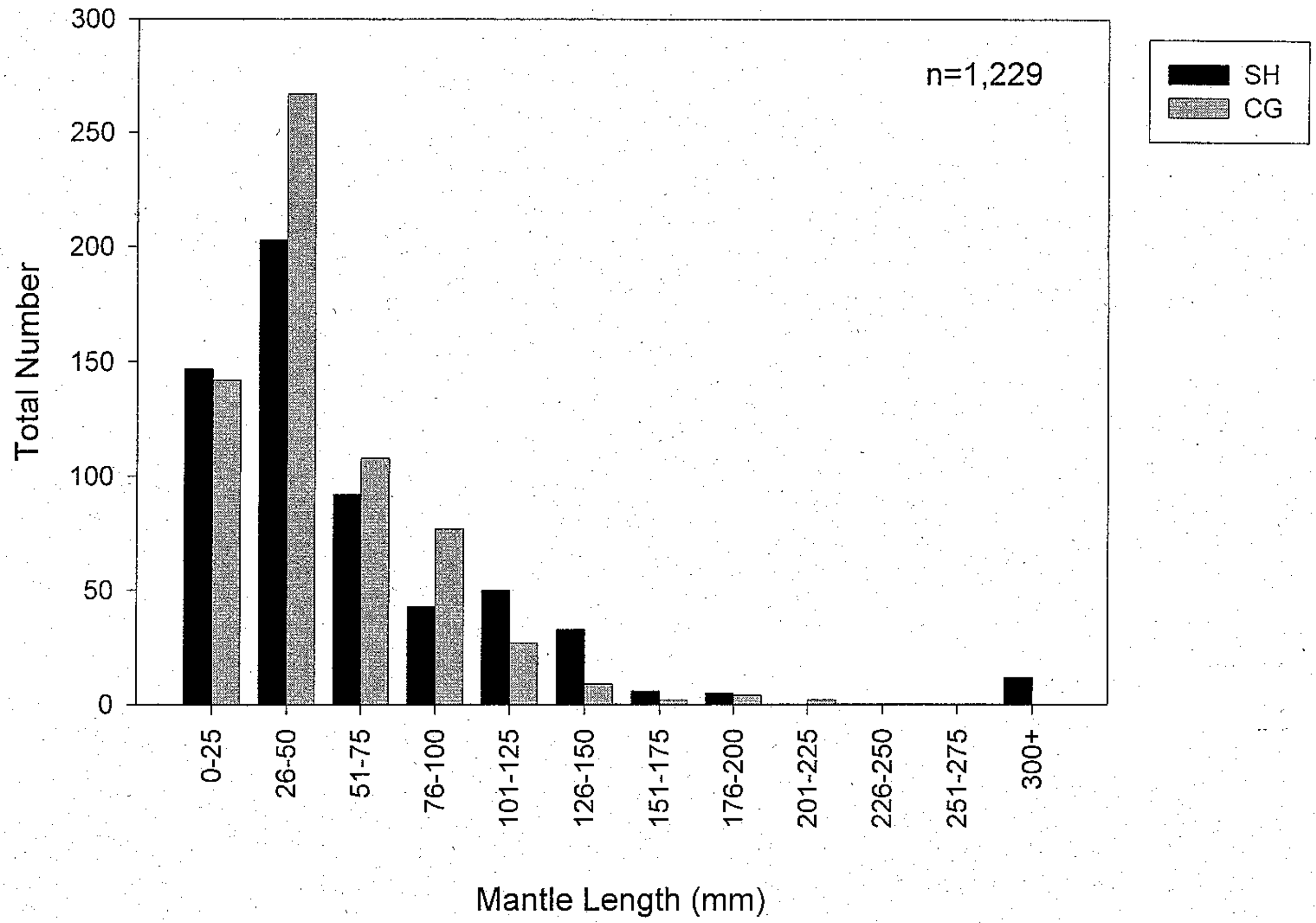


FIGURE 31
Monthly Squid Distributions
Total Number and Weight (grams)

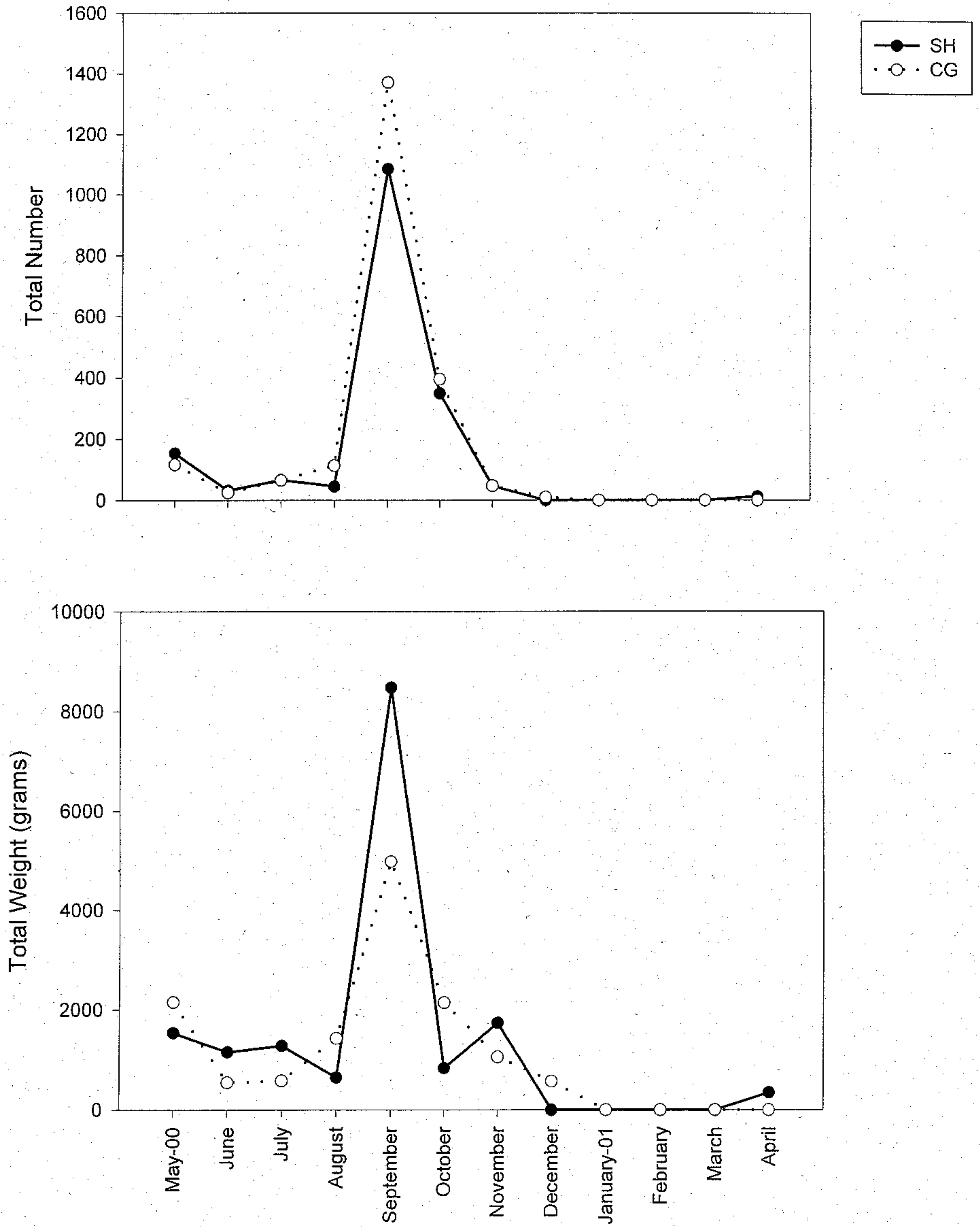
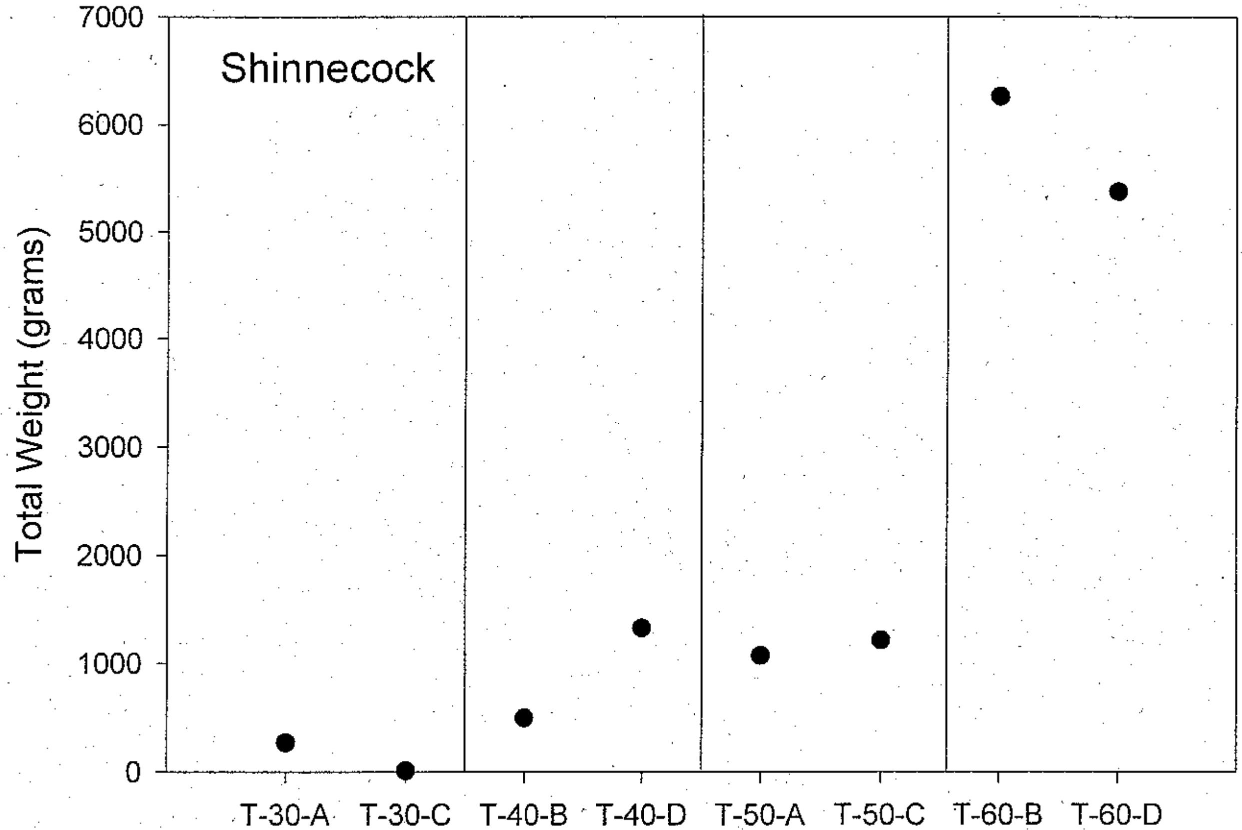


FIGURE 32
Long-finned Squid Weight by Depth



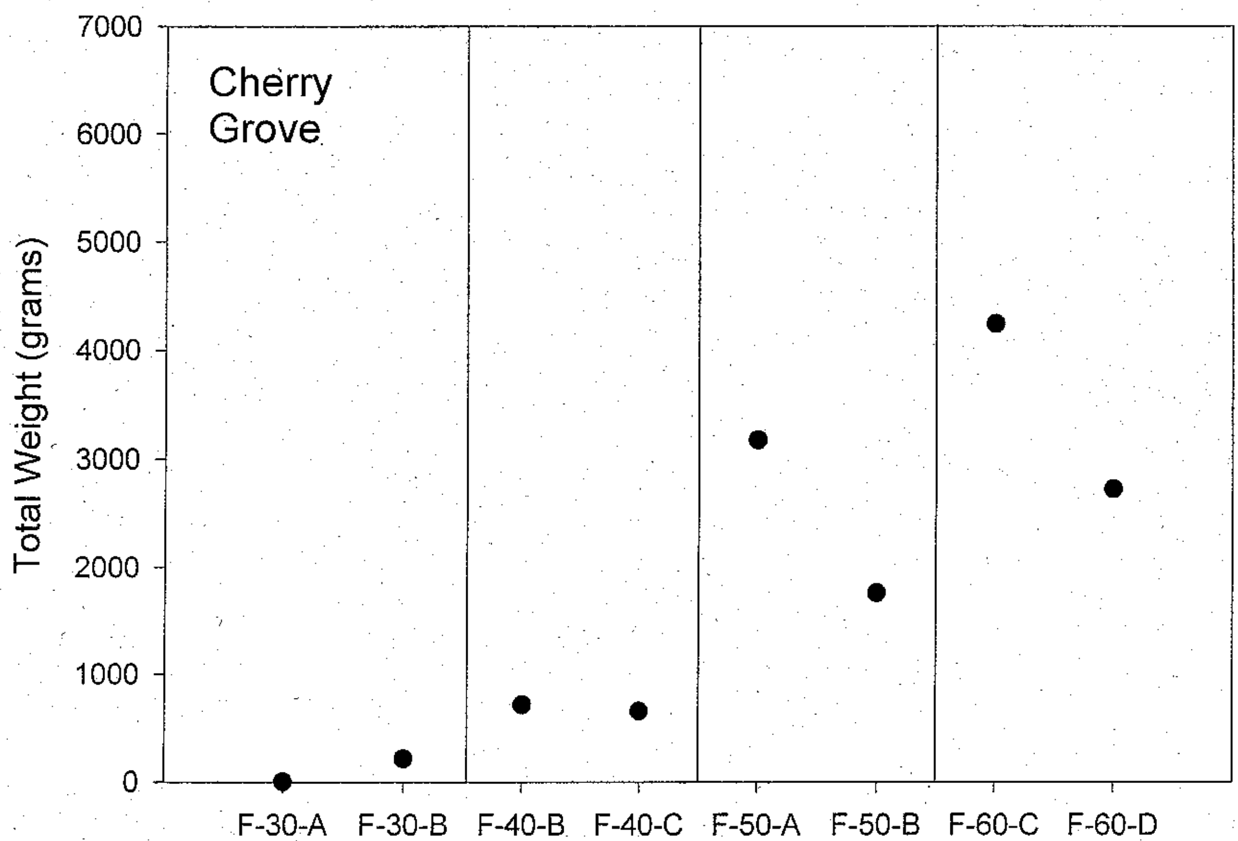
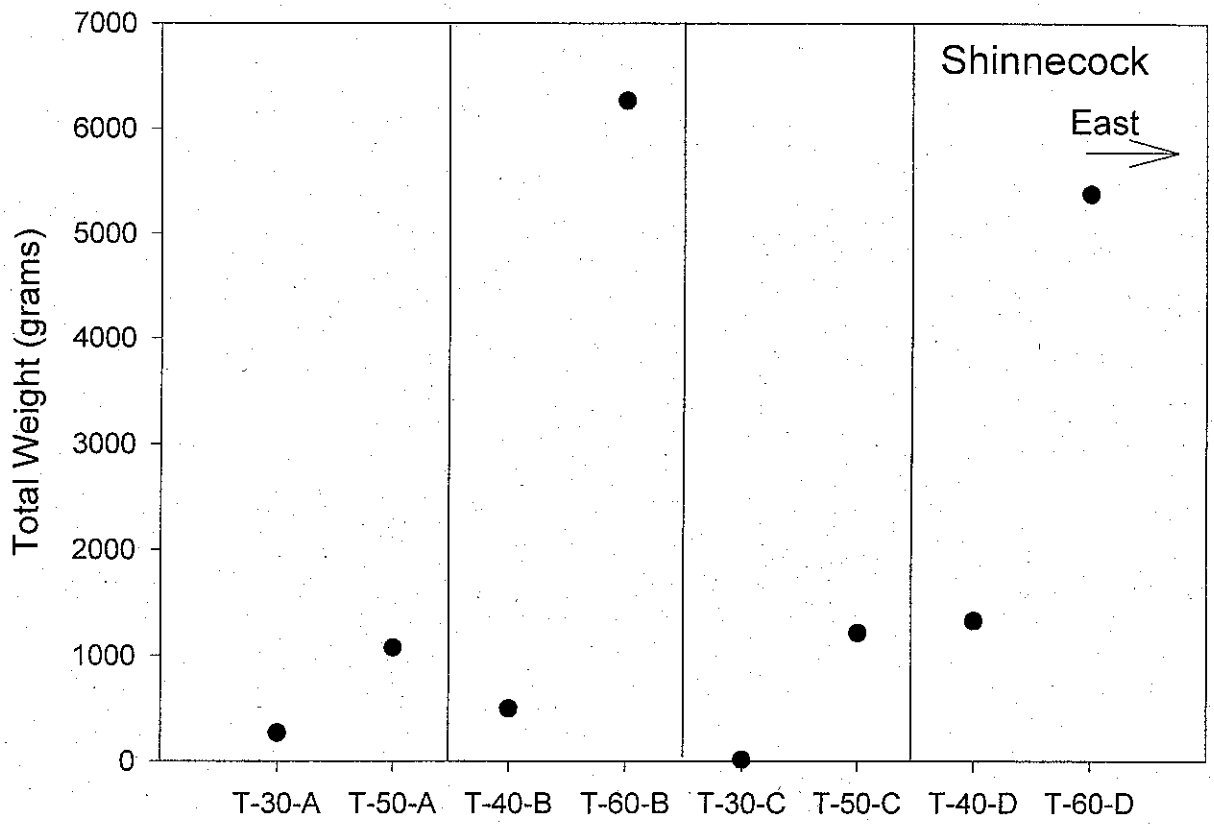


FIGURE 33
Long-finned Squid Weight by Transect



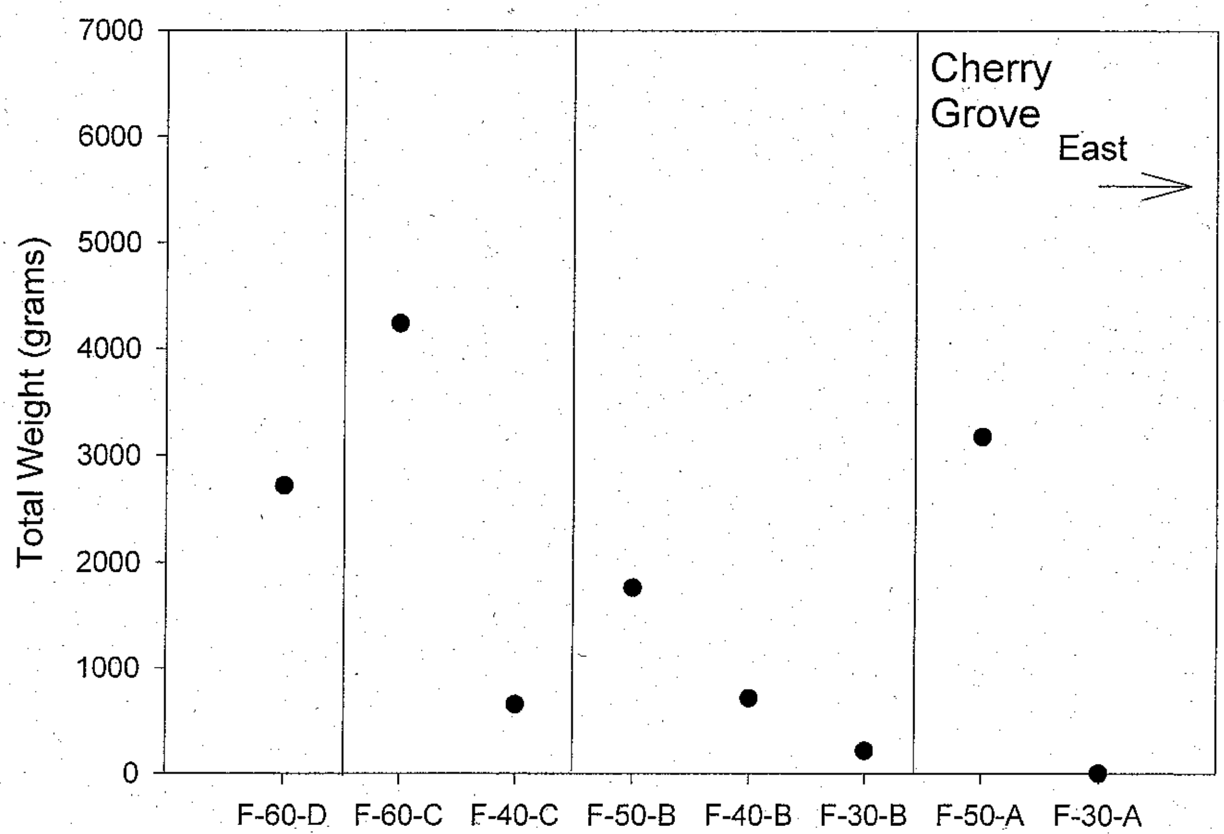


FIGURE 34
Mean Monthly Water Quality Values
Shinnecock

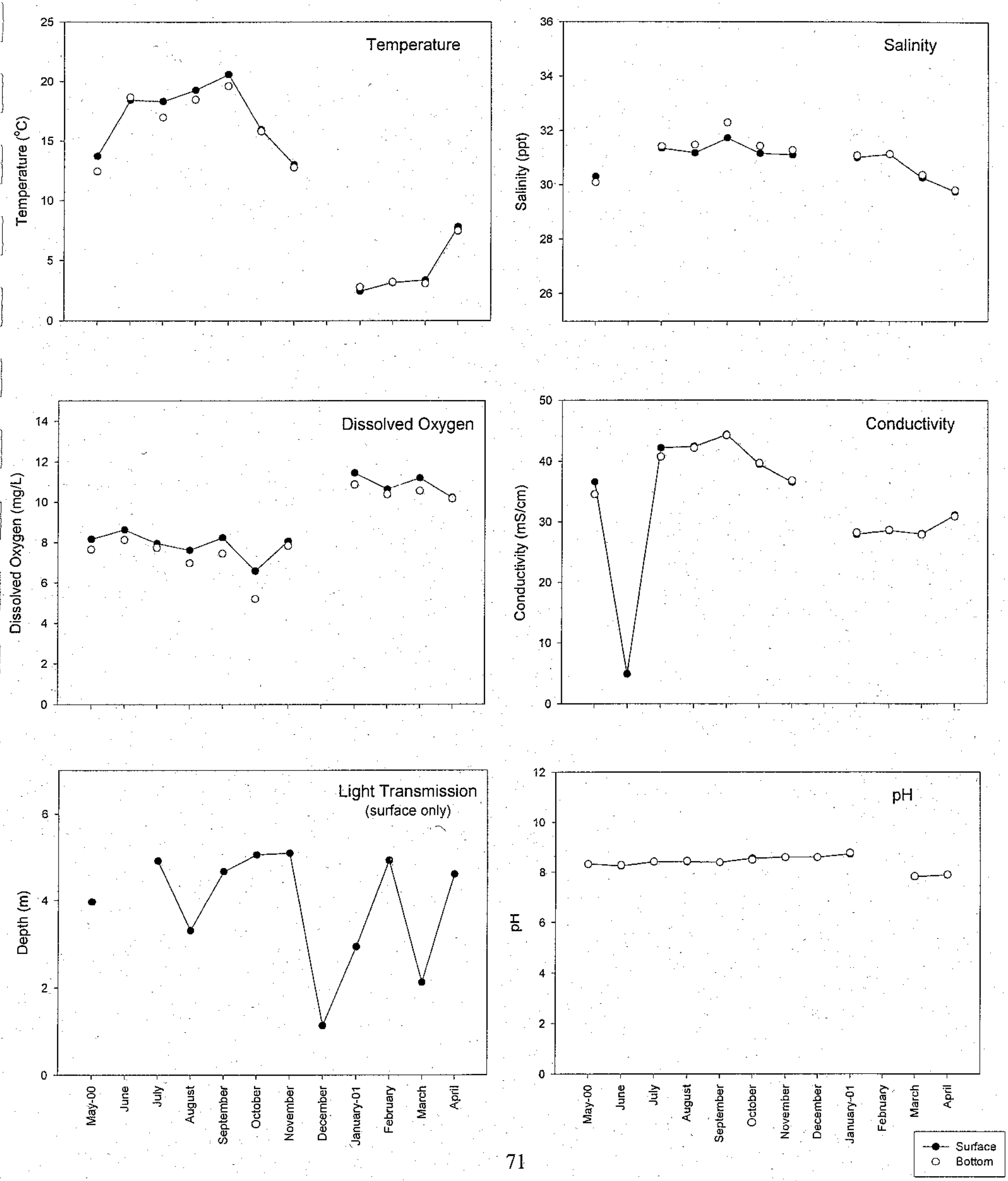


FIGURE 35
Mean Monthly Water Quality Values
Cherry Grove

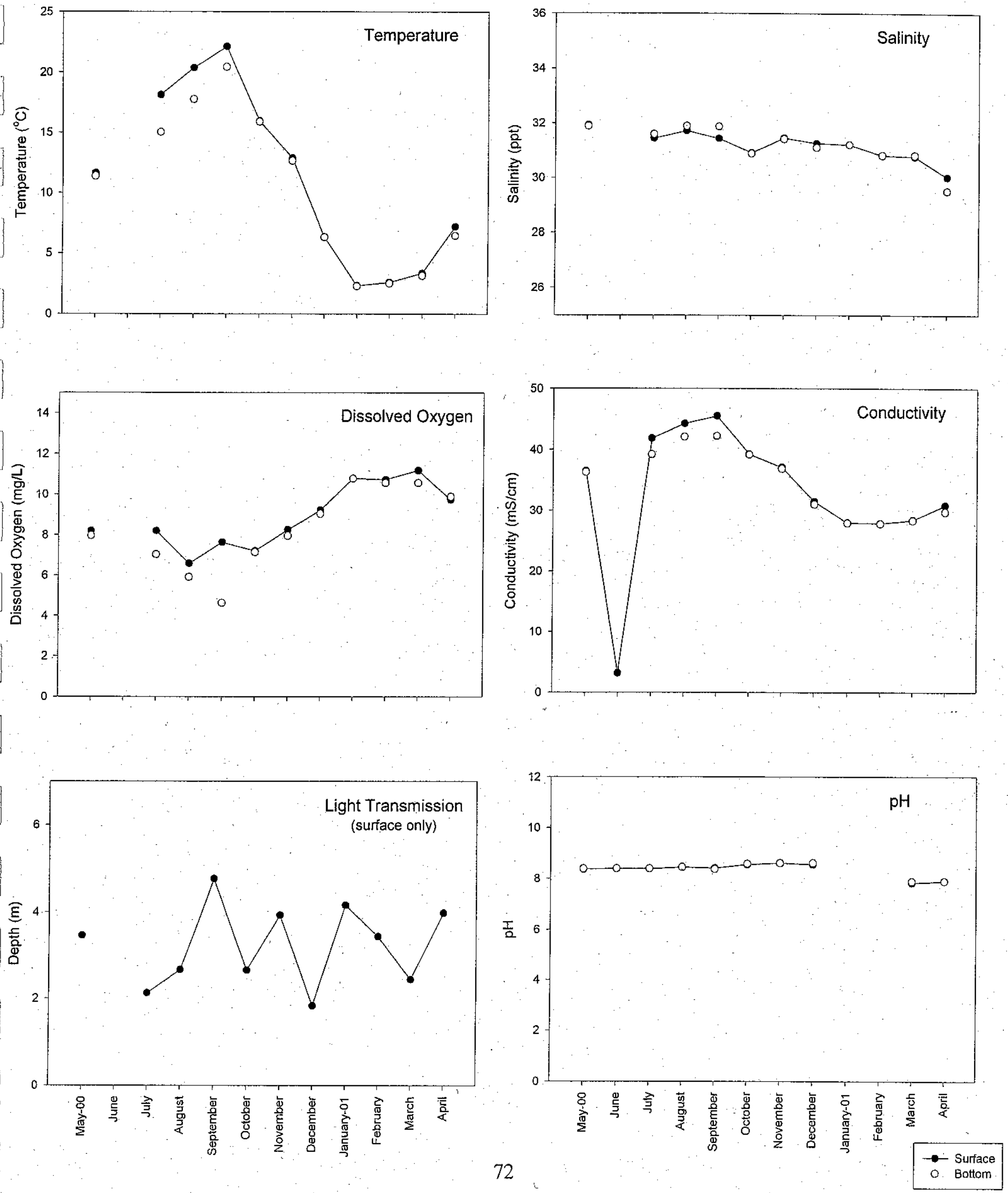


FIGURE 36
Mean Water Quality Values for Depth Contours
Shinnecock

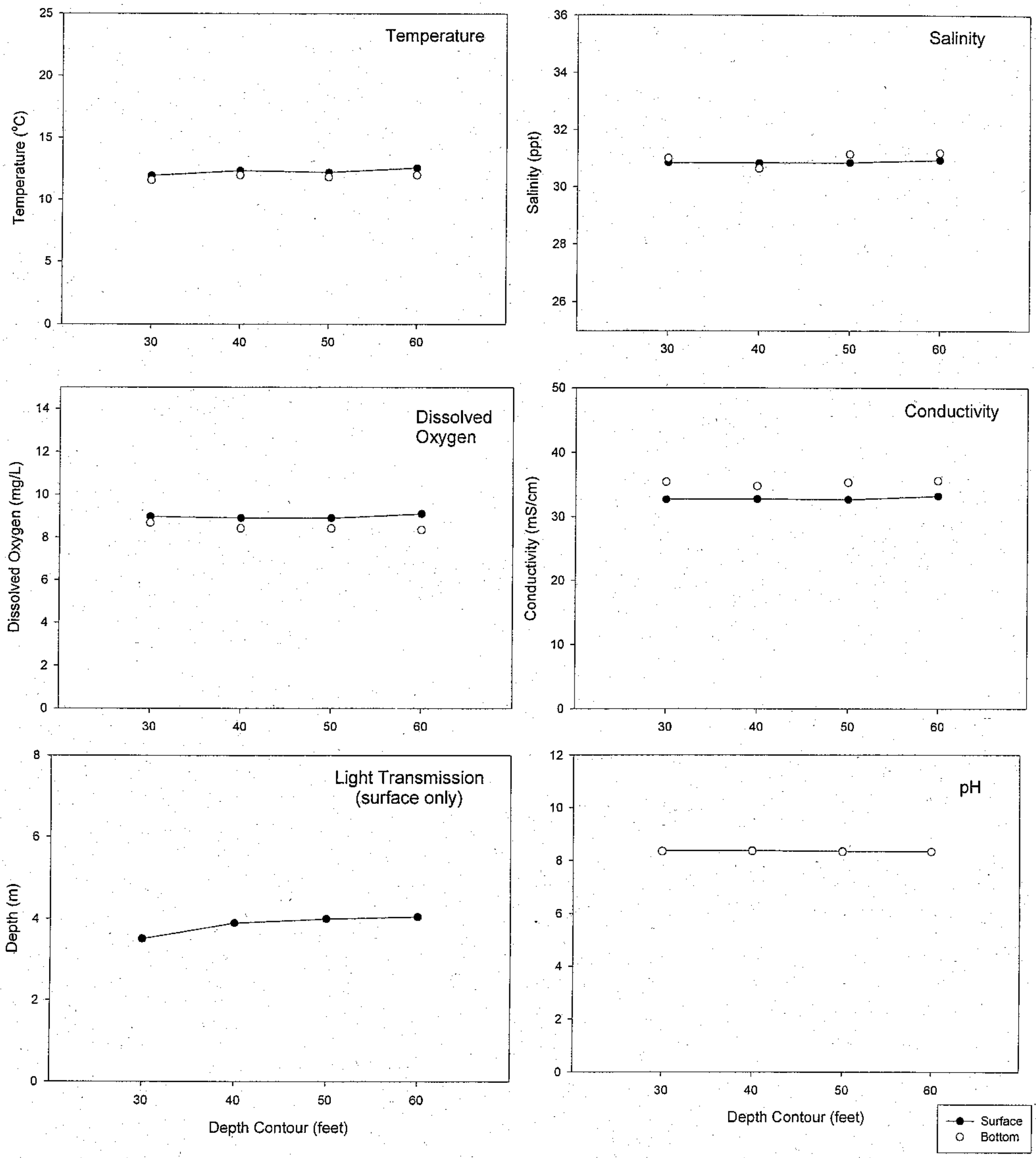


FIGURE 37
Mean Water Quality Values for Depth Contours
Cherry Grove

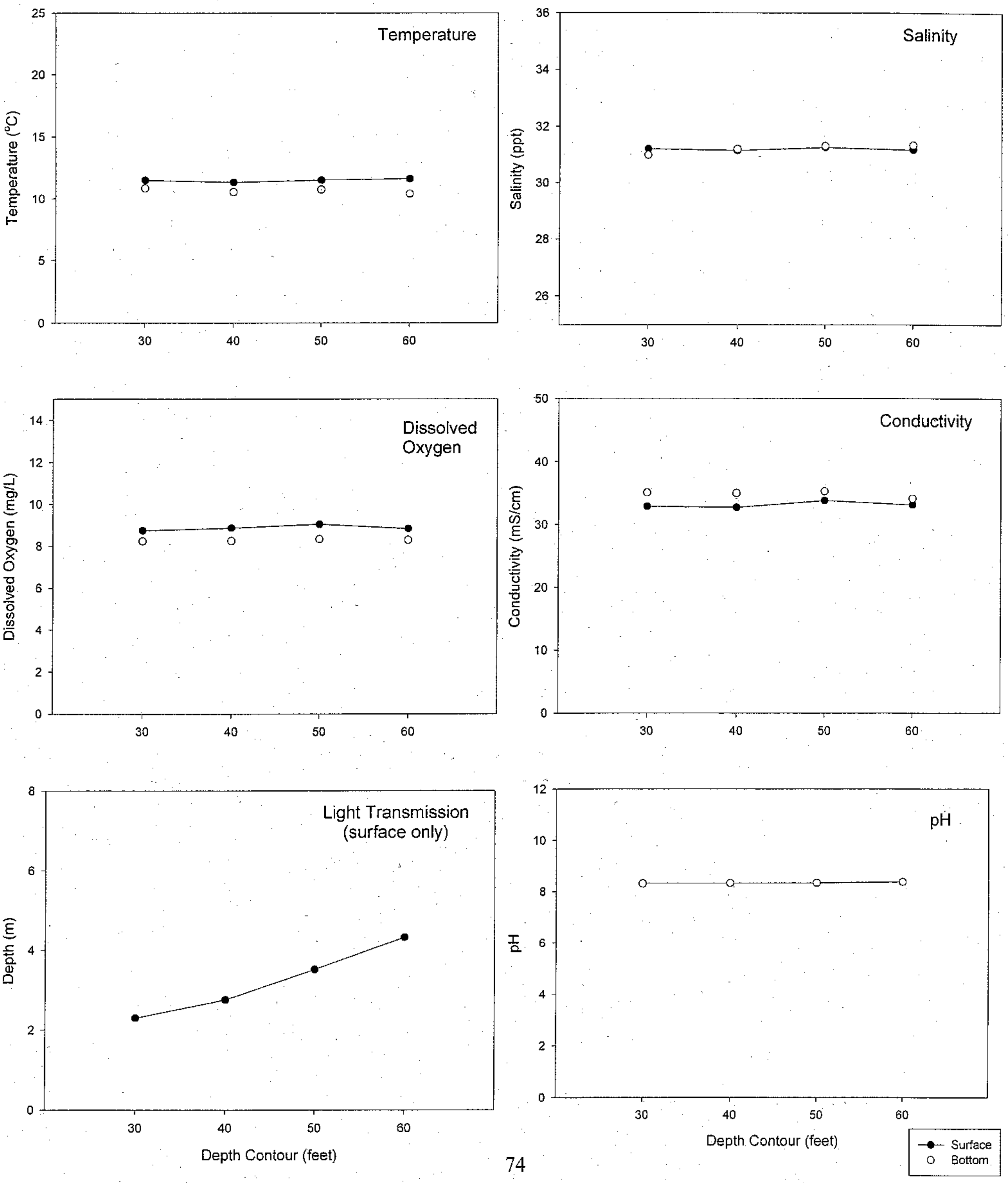


FIGURE 38
Mean Water Quality Values for Transects
Shinnecock

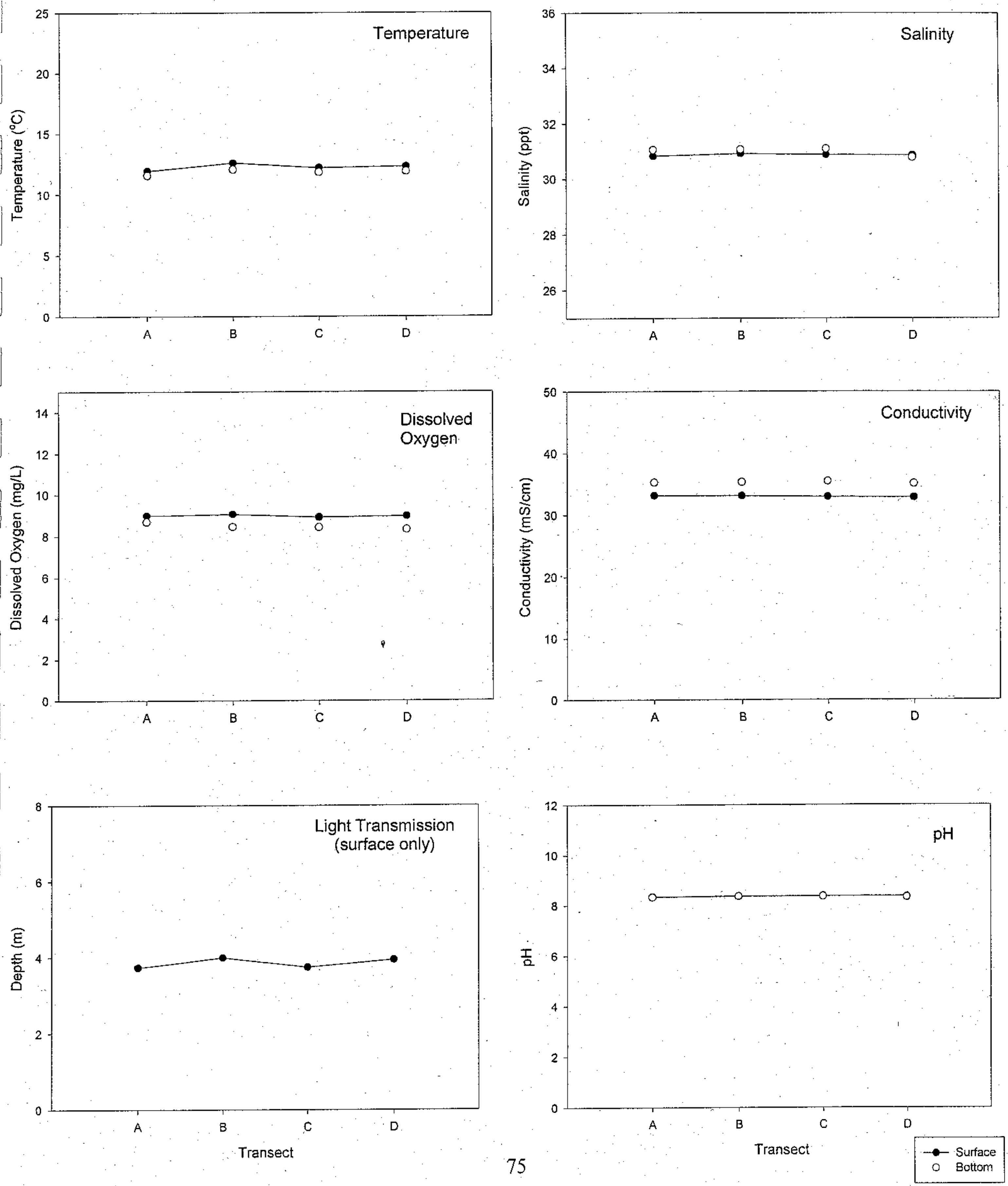


FIGURE 39
Mean Water Quality Values for Transects
Cherry Grove

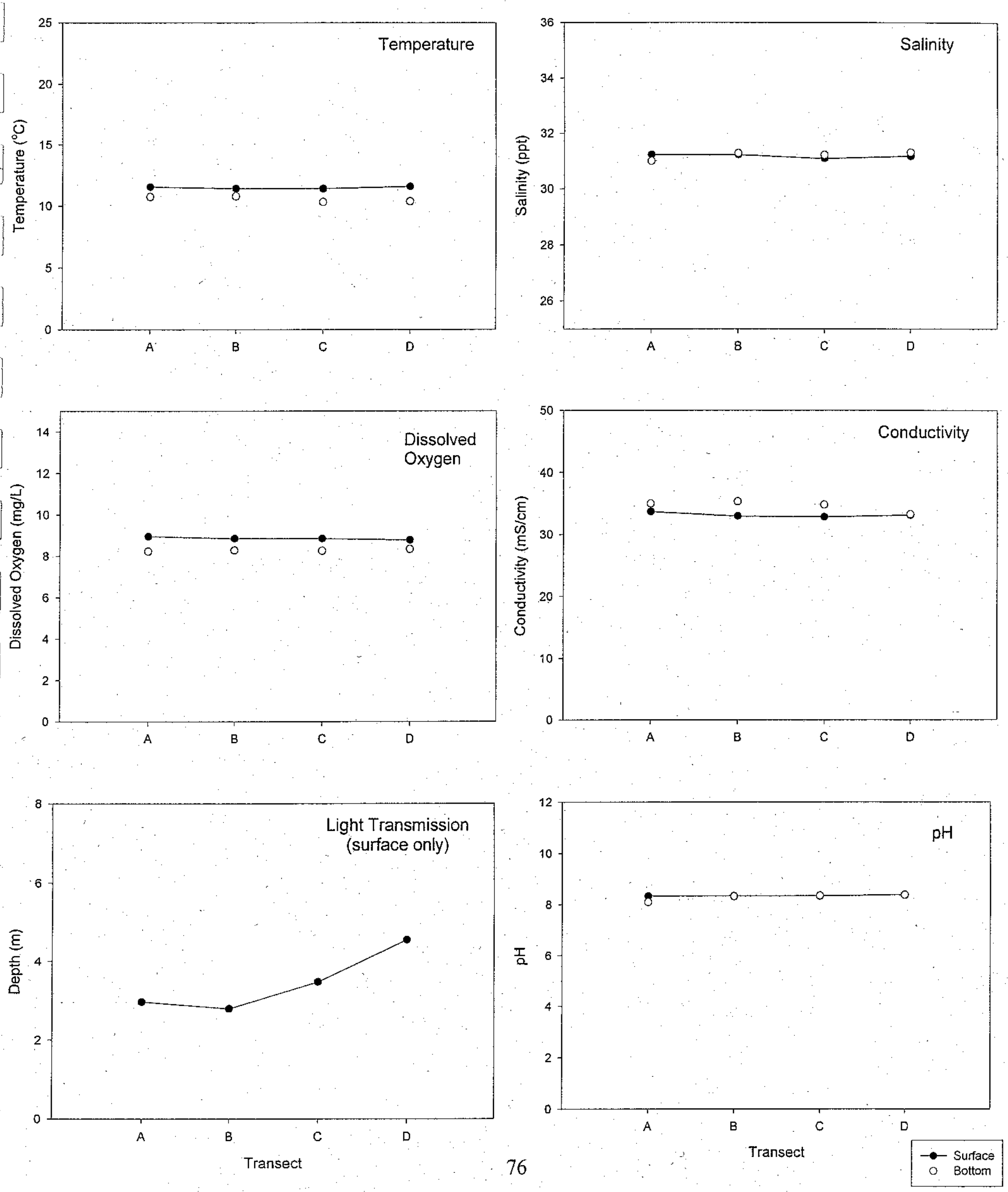
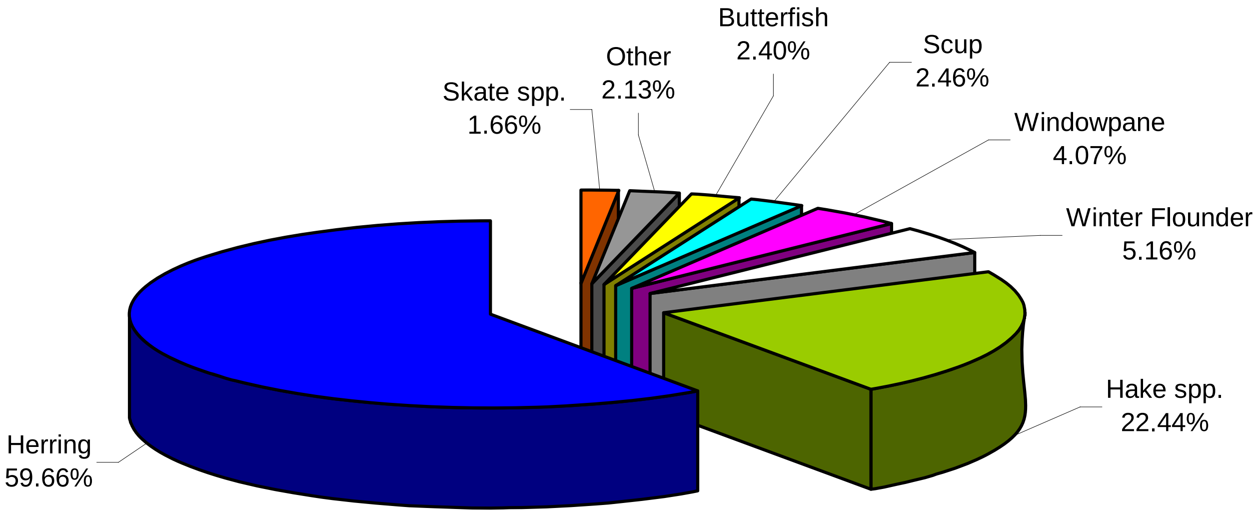
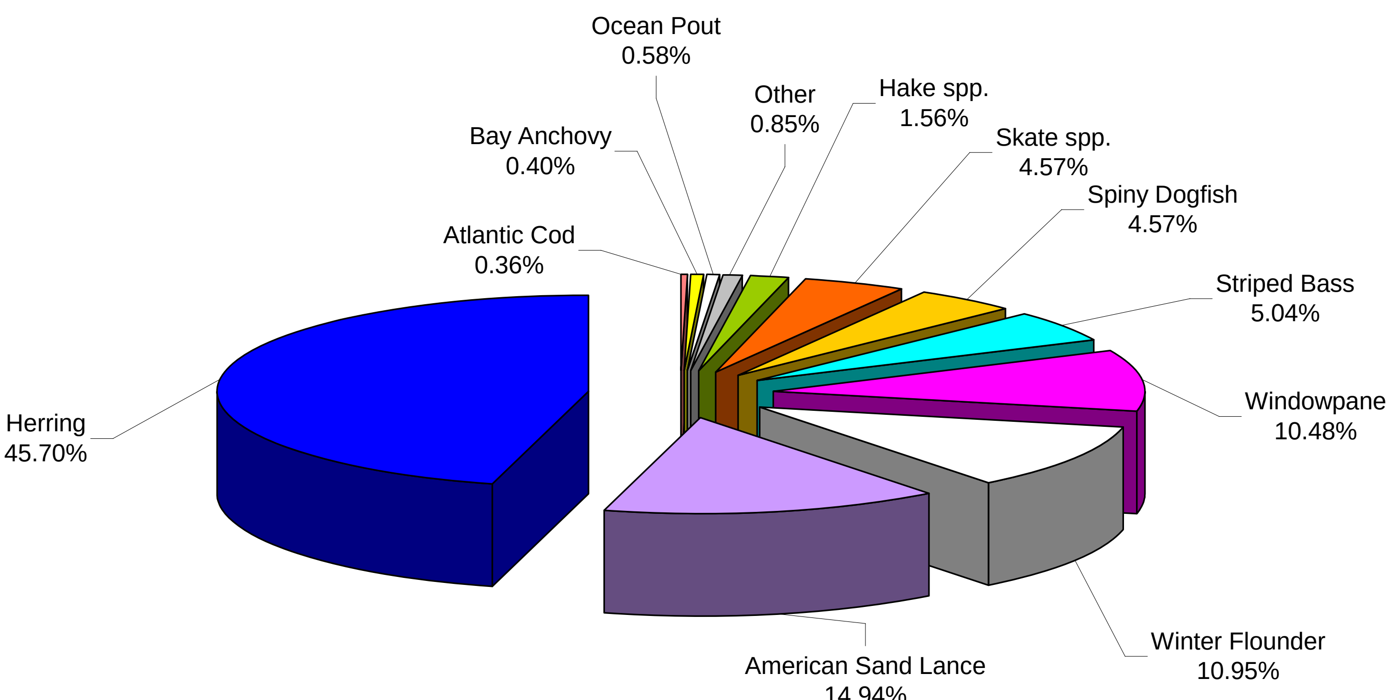


FIGURE 40
USACE Fisheries Trawl Data from the Atlantic Coast of New Jersey- Percent Composition



1995

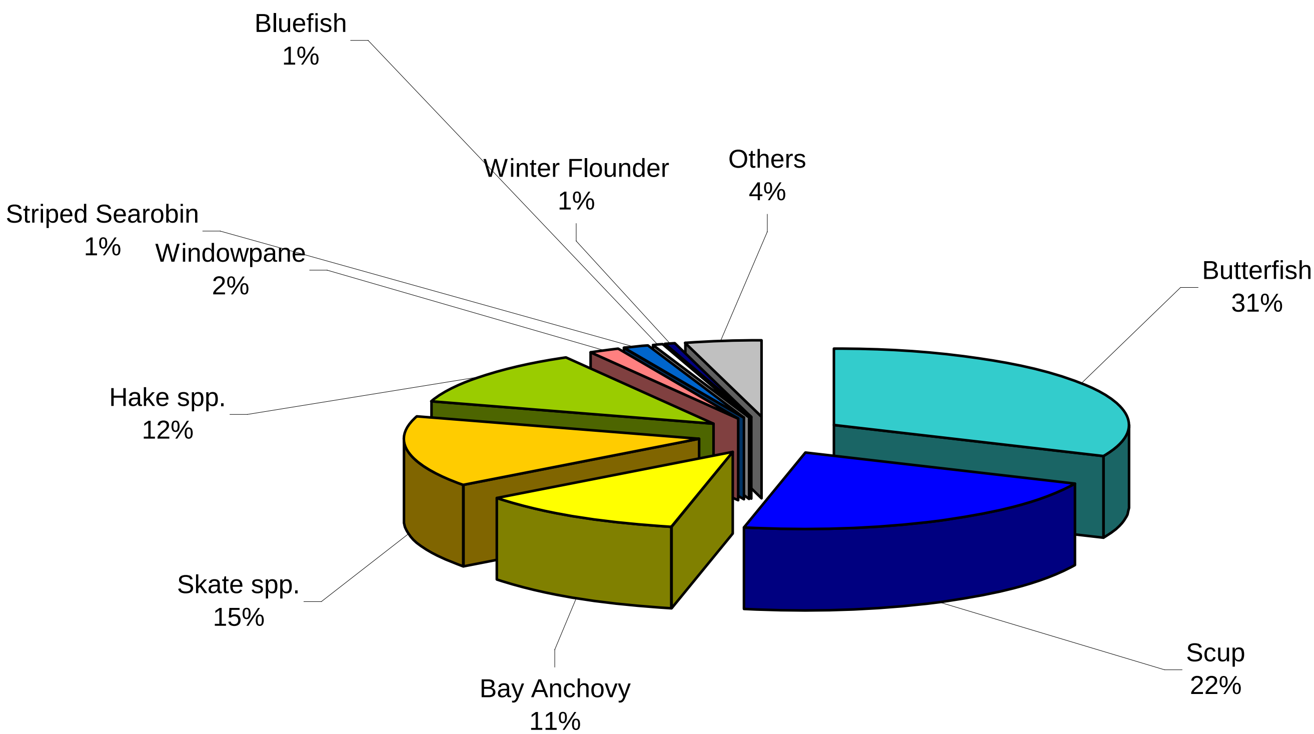


1996

Source: USACOE 1998 Draft. Waterways Experimental Station, Vicksburg, MS. The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury to Manasquan Section Beach Erosion Control Project.

FIGURE 41
USACE Fisheries Trawl Data from the Atlantic Coast of New York
Percent Composition

1999-2000



2000-2001