Environmental Assessment
Appendix C:
Biological Sampling

U.S. Army Corps of Engineers
New York District

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Environmental Assessment
Appendix C1:
2001 - 2002 Biological Sampling

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NEW YORK AND NEW JERSEY HARBOR NAVIGATION PROJECT

AQUATIC BIOLOGICAL SAMPLING PROGRAM SURVEY REPORT 2001–2002

Final Report

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1.0 INTRODUCTION

1.1 BACKGROUND

This report presents and summarizes results of a biological sampling program conducted in the New York and New Jersey Harbor (Harbor) from December 2001 through July 2002 (2001–2002 Aquatic Biological Sampling Program). The program's focus was the collection of adult and early life stages of finfish and macroinvertebrates, with an emphasis on winter flounder *(Pseudopleuronectes americanus).*

The 2001–2002 Aquatic Biological Sampling Program supplements data gathered in the baseline 1998–1999 New York and New Jersey Harbor Navigation Study (NYNJHNS) and a 2000–2001 Supplemental Sampling Program. Collectively, the three studies comprise the NYNJHN Project (NYNJHNP). A primary goal of the NYNJHNP investigation is to collect biological data on Harbor finfish, shellfish, and macroinvertebrate distribution patterns, community structure, and seasonal patterns of habitat use, as well as water quality. The information collected will assist in determining the potential biological impacts of deepening existing Harbor navigation channels, anchorages, and berthing areas to depths of 50 ft or greater.

The 1998–1999 NYNJHNS found that the Harbor finfish community consisted of a variety of resident and migratory fish species typical of large coastal estuaries and inshore waterways along the Mid-Atlantic Bight. The Harbor estuary serves as a spawning ground, migratory pathway, and nursery/foraging area for many fish and macroinvertebrate species. To obtain more information on the use of Harbor habitats by early life stages of fish, particularly winter flounder, the NYNJHN Supplemental Sampling Program was conducted during 2000–2001.

Although both the 1998–1999 NYNJHNS baseline program and the 2000–2001 Supplemental Sampling Program provided extensive information about adult and early life stages of winter flounder in the Harbor, it was determined that additional data were needed to further understand the species' spatial and temporal occurrence patterns, use of Harbor navigation channels and shallow/shoal areas, and the role played by Lower New York Bay (Lower Bay) with respect to winter flounder overwintering and spawning. Furthermore, it was determined that data covering multiple years are needed to understand whether the use of navigation channels and shallow/shoal areas by winter flounder is consistent over time. The Aquatic Biological Sampling Program was designed to meet the need for additional data about how finfish use the New York and New Jersey Harbor.

1.2 STUDY OBJECTIVES

The 2001–2002 Aquatic Biological Sampling Program, with its emphasis on winter flounder, collected data on adult and early life stages of finfish resident in the Harbor between the months of December and July. This is typically the period when winter flounder spawning and early lifestages occur in the New York and New Jersey Harbor.

With regard to winter flounder, the specific objectives were to:

- Determine the utilization and significance of Harbor habitat designated as essential fish habitat (EFH) for adults for the months of December through June.

- Determine the utilization and significance of Harbor habitat designated as essential fish habitat (EFH) for early life stages (eggs and larvae) from January through July.

- Determine spawning areas and periodicity by analyzing the sex ratio of adults in the Harbor.

To meet program objectives, two sampling methodologies were employed. Bottom trawling was conducted to address the objectives related to adult finfish, and an epibenthic sled-mounted plankton net was used to sample early life stages.

1.3 REPORT ORGANIZATION

This report describes the 2001–2002 Aquatic Biological Sampling Program and presents and summarizes the data collected. This report is organized as follows: Chapter 2 describes sampling stations and summarizes the methods used to sample adult finfish and ichthyoplankton. Chapter 3 presents the results of bottom-trawl and epibenthic-sled sampling. The final chapter (Chapter 4) discusses how the data collected relate to program objectives as well as to previous NYNJHN investigations.

2.0 METHODS

2.1 SAMPLING LOCATIONS

Twenty-six (26) sampling locations were selected for the 2001–2002 Aquatic Biological Sampling Program to optimize the evaluation of different Harbor areas and habitat (Table 2-1 and Figure 2-1). Of these, 14 were located in shallow/shoal or interpier areas, and 12 were located in navigation channels. Of the 26 stations, eight were sampled during both the 2000–2001 Supplemental Sampling Program and 2001–2002 Aquatic Biological Sampling Program; an additional eight stations were sampled during the NYNJHN baseline program as well as the 2000–2001 and 2001–2002 sampling programs.

For the Aquatic Biological Sampling Program, the Harbor was divided into three areas based on geography: Arthur Kill/Newark Bay (AKNB), Upper Bay (UB), and Lower Bay (LB). Among the three areas, stations were established as follows:

- Arthur Kill and Newark Bay (AK and NB)
  Nine stations were located in this area. Of these, two were in Arthur Kill shallow/shoal areas (AK-1 and AK-4) and two were in channels at the Arthur Kill/Kill Van Kull confluence area (AK-2 and AK-3). Two other stations were located in the navigation channel in Newark Bay (NB-5, and NB-6), while the shallow/shoal areas were represented by the three remaining Arthur Kill/Newark Bay stations: NB-3, NB-4, and NB-7. Note that stations NB-l and NB-2, which were sampled the 1998–1999 NYNJHN baseline program and the 2000–2001 Supplemental Sampling Program, were not included in the Aquatic Biological Sampling Program in order to add stations in Lower New York Bay.

- Upper New York Bay
  Eleven stations were sampled in the Upper Bay, which includes South Brooklyn (SB) and Port Jersey (PJ) marine facilities. Two were in the South Brooklyn interpier areas (shallow/shoal area stations SB-1 and SB-2) and one was on the Bay Ridge

Flats (SB-3). Three stations were located in navigation channels—one (1) in Bay Ridge Channel (SB-4) and two (2) in the Anchorage Channel (SB-5 and SB-6). Three (3) shallow/shoal area stations were located in the immediate vicinity of Port Jersey (PJ-l, PJ-2, PJ-3) and two (2) were located in Port Jersey Channel (PJ-4 and PJ-5).

- Lower New York Bay

  Six (6) stations were located in this area—three (3) in channels (LB-2, LB-4 and LB-6) and three (3) in shallow/shoal areas (LB-1, LB-3, and LB-5). The Lower Bay sites were added in the 2001–2002 Aquatic Biological Sampling Program to provide better spatial coverage for the evaluation of winter flounder EFH in the Harbor.

2.2 ADULT FINFISH SAMPLING (BOTTOM TRAWLS)

Adult finfish and bottom dwelling macroinvertebrates were sampled via bottom trawl surveys conducted from 16 December 2001 to 20 June 2002. Trawls were conducted on a stratified sampling schedule to target the period when adult winter flounder historically are present in the Harbor to spawn. Sampling was conducted twice monthly on an alternating-week schedule from January through March and once monthly during December and April through June.

Bottom trawl surveys were conducted using a 30-foot (9.1 m) otter trawl (Table 2-2), the same trawl used during the 1998–1999 NYNJHNS baseline program. A minimum ratio of tow cable length to maximum station water depth of 5:1 was maintained to ensure that the trawl was in contact with the bottom.

Bottom trawls were conducted during the night hours (from one hour after sunset to one hour before sunrise) against the prevailing current at a bottom speed of 4.9 feet/sec (150 cm/sec). Target tow duration was ten minutes, although tow times were adjusted as needed to account for obstructions, limited interpier distances, commercial traffic, and several other factors.

A total of 255 bottom trawls where conducted (Table 2-3): 118 at navigation channel stations and 137 at shallow/shoal stations.

All fish were identified and enumerated directly on the research vessel. Total lengths of each winter flounder caught were recorded to the nearest millimeter (mm). When available, a total of 10 winter flounder per trawl that measured greater than 250 mm were preserved on ice and returned to the laboratory for sex determination. A 250-mm total length was established to limit the number of immature fish kept for analysis. Winter flounder typically exhibit adult gonad development at 250 mm total length and reach sexual maturity between 280 mm and 300 mm (Witherell 1993).

For each species collected, total length was measured for a minimum of 25 individuals in each trawl sample. An unbiased selection of 25 specimens was made for non-target species when the number of fish collected exceeded 25. Except for winter flounder preserved for laboratory analysis, all fish collected were released after on-board examination.

2.3 ICHTHYOPLANKTON SAMPLING (EPIBENTHIC SLED TOWS)

Ichthyoplankton sampling was conducted from 22 January to 11 July 2002. A stratified sampling schedule was used to target winter flounder spawning and early development in the Harbor. The 26 sampling stations were sampled twice monthly from February through June and once monthly during January and July.

Samples were collected with an epibenthic sled-mounted 0.5-m mouth diameter plankton net with 0.5-mm mesh (Table 2-4). Typically, a 4:1 ratio of cable length to bottom depth was used and an inclinometer was used to determine the warp angle from the boat to confirm that the sled was on the bottom. The net was fitted with a General Oceanics flowmeter (Model 2030R) to calculate sample volume.

All samples were collected during daylight hours (from one hour after sunrise to one hour before sunset). Whenever possible, each tow was conducted against the prevailing current or tide for ten minutes. Tow direction and duration were adjusted as needed to account for obstructions, limited transect distances, and commercial traffic.

A total of 312 epibenthic sled tows were conducted—144 at navigation channel stations and 168 at shallow/shoal stations (Table 2-3). Each sample was washed from the plankton net into containers and preserved with 5% buffered formalin containing the vital stain rose bengal. Samples were returned to the laboratory for sorting and identification.

All specimens were identified to the lowest taxonomic level practicable, assigned a life stage (egg, yolk-sack larvae, post yolk-sac larvae, or juvenile) based on morphometric characteristics, and enumerated. Data about unidentified species were recorded when eggs or larvae could not be identified to species. For some larvae, it was not possible to discern between yolk-sac and post yolk-sac life stages because specimens were damaged. Indiscernible larval life stages were combined with the yolk-sac life stage during analysis because these unidentified specimens were a small percentage of the total larval catch (2%).

Strict quality control (QC) procedures consisting of a continuous sampling plan (CSP) to assure an average outgoing quality limit (AOQL) of ≥90% were followed during sample sorting, identification, enumeration, and life-stage designation.

2.4 WATER QUALITY AND VELOCITY MEASUREMENTS

On each sampling date at each station, dissolved oxygen (DO), temperature, conductivity, and salinity were measured after each trawl and epibenthic sled tow (Table 2-5). Water quality parameters were recorded one foot (0.3 m) above the substrate using calibrated meters.

Measurement of current velocity and direction was also done during three sample events (19-21 February, 2-4 April and 4-6 June) at each of the 26 stations using a calibrated Endeco Type 110 Current Meter. Current velocity readings were taken with the sampling vessel anchored in the middle of each station. Velocity measurements were recorded at three depths: one foot (0.3 m) below the surface, mid-way in the water column, and one foot (0.3 m) above the bottom. When the water depth was less than 10 feet (3 m), only the surface and mid-water-column readings were recorded

2.5 DATA ANALYSIS

2.5.1 Trawl

Catch per unit effort (CPUE), defined as number per 10 minute trawl tow, was determined for each trawl tow based on the time each net sampled on the bottom. Trawl duration was ten minutes; however, total tow times were reduced to account for obstructions, limited transect distances, commercial traffic, etc.

2.5.2 Ichthyoplankton

Ichthyoplankton densities (Number per 1000 cubic meters [m^3]) were determined for each epibenthic sled tow. The volume of water sampled was determined using the area of the net mouth and the velocity meter revolutions.

3.0 RESULTS

Adult finfish and ichthyoplankton data were analyzed for the two general habitat types (navigation channels and shallow/shoal areas), and the three Harbor areas (Arthur Kill/Newark Bay, Upper Bay, and Lower New York Bay). Following is a summary of results for all species combined and for winter flounder. Detailed station data for adult finfish, ichthyoplankton, and water quality are provided in Appendices A through C, respectively.

Note that the following data-unit definitions apply in the figures accompanying the main report text and in Appendices A and B:

- Trawl: Catch per unit effort (CPUE), defined as number caught per 10 minute trawl tow.

- Epibenthic sled tow: Ichthyoplankton density (number per 1000 cubic meters).

3.1 ALL SPECIES

3.1.1 Adults (Trawl Sampling)

A total of 50 fish species representing 29 families were identified during the bottom trawl survey. Tables 3-1a and 3-1b report average trawl CPUEs by species for all navigation channel stations combined and for all shallow/shoal stations combined for each month of the 2001–2002 Aquatic Biological Sampling Program.

The lowest fish abundance occurred in the Lower Bay (Tables 3-2a to 3-2c). The most common species (e.g., spotted hake and striped bass) were collected throughout the Harbor, regardless of sample area or station depth. As shown in Figure 3-1, which plots weekly abundance by station type (navigation channel vs. shallow/shoal) in the three Harbor areas examined, fish abundance ranged from less than 10 to greater than 100 during a number of weeks, and was typically higher in navigation channel areas. Peaks in abundance were observed at the Arthur Kill/Newark Bay and Lower Bay stations, where the CPUEs exceeded 150. The highest CPUE (252 fish) was observed at the Arthur Kill navigation channel stations during mid-April.

Figures 3-2 through 3-4 present monthly species composition collected in the three Harbor areas. As can be seen, flounder species abundance was patchy. Winter flounder were collected throughout the program, but at relatively low abundances except in the Arthur Kill/Newark Bay area during June, when they represented 23% of the catch. Windowpane were collected from April to June in the Upper Bay and Lower Bay, and during April in the Arthur Kill/Newark Bay. Smallmouth flounder were collected at Lower Bay stations from December through May but were most abundant during winter months (December through February). Smallmouth flounder were not collected in the Arthur Kill/Newark Bay, and few were collected during December in the Upper Bay. Summer flounder were collected during June in the Arthur Kill/Newark Bay and Upper Bay but were more abundant in the Upper Bay. No summer flounder were collected at Lower Bay stations.

Blueback herring, white perch and striped bass were the dominant species in the Arthur Kill/Newark Bay during the winter months (December through February), representing approximately 40% to 55% of the catch (Figure 3-2). In the Upper Bay, species diversity was high during the winter months, represented by 22 species (Figure 3-3). Consistent with the high species diversity, no one species dominated in the Upper Bay during the winter months, although alewife, blueback herring, spot, spotted hake, and winter flounder were all common. During the same period, spotted hake, smallmouth flounder, and, to a lesser degree, winter flounder dominated the catch in the Lower Bay (Figure 3-4). Species composition was more consistent throughout the Harbor from March to May, when spotted hake was the most common species (28%–75%). Spotted hake remained a large component of the species composition through June at the Arthur Kill/Newark Bay and Upper Bay stations, while bay anchovy, scup, and striped searobin were common at the Lower Bay stations in May and June.

In general, fish were collected in greater abundance at the navigation channel stations. This was especially true in the Lower Bay, where CPUEs were generally two to three times greater for the navigation channel stations than for the shallow/shoal stations. Spotted hake, the dominant species collected throughout the Harbor, had higher CPUEs at the navigation channel stations than at the shallow/shoal stations (Tables 3-2a through 3-2c). Bay anchovy, a common species from May to June, was collected more often at the shallow sites in the Upper and Lower Bays.

3.1.2 Ichthyoplankton (Epibenthic Sled Sampling)

Among the eggs, larvae, and juveniles collected throughout the 2001–2002 Aquatic Biological Sampling Program, fish eggs and larvae of 36 species representing 23 families were identified.

The greatest densities were recorded during May and June in the Lower Bay and during June and July in the Arthur Kill/Newark Bay and Upper Bay areas (Tables 3-3a through 3-3f). Throughout the Harbor, fish eggs were the most abundant ichthyoplankton life stage collected during the sampling program, followed by post yolk-sac larvae.

3.1.2.1 Eggs

Eggs were collected in the Harbor from January to July, with the greatest densities collected in the Lower Bay from late May to late June (ranging from 89/1000 m^3 to 25,603/1000 m^3) and in the Arthur Kill/Newark Bay and Upper Bay during June (Figure 3-5). In each of the areas sampled, the highest egg densities were collected in early June, including the peak density of 25,603/1000 m^3 in the Lower Bay. The Arthur Kill/Newark Bay area consistently had lower egg densities compared to the Upper Bay and Lower Bay throughout the month of June. Egg densities were similar between navigation channel and shallow/shoal stations throughout the sampling program except during early June.

During June, in both the Upper Bay and Lower Bay, high bay anchovy and Labridae spp. densities resulted in nearly twice as many eggs at the shallow/shoal stations compared to the navigation channel stations.

Winter flounder dominated overall ichthyoplankton densities in the Arthur Kill/Newark Bay and Lower Bay during February and March (Figures 3-6 through 3-8). Throughout the Harbor, Atlantic menhaden and winter flounder were most common in March catches, while weakfish dominated in April. Bay anchovy dominated June catches throughout the Harbor, while the dominant abundances in the Upper Bay and Lower Bay shifted to other species (labridae and hogchoker, respectively) during July.

3.1.2.2 Yolk-sac Larvae

Yolk-sac larvae were collected from February to June and ranged in density from 1/1000 m^3 to 231/1000 m^3 (Figure 3-9). The highest average yolk-sac larvae density (231/1000 m^3) was observed at shallow/shoal stations in the Lower Bay during mid-May. In contrast to Lower Bay densities, those at the Arthur Kill/Newark Bay and Upper Bay stations generally were similar, remaining below 52/1000 m^3 throughout the sampling time frame. Yolk-sac larvae densities were similar between navigation channel and shallow/shoal stations throughout the Harbor except in the Lower Bay, where yolk-sac larvae were more common at the shallow/shoal stations.

Species composition was consistent throughout the Harbor from February through April, when winter flounder and grubby dominated catches (Figures 3-10 through 3-12). It shifted in May, when Atlantic menhaden dominated Upper Bay catches (80%) and was the only species collected at the Arthur Kill/Newark Bay and Lower Bay stations. The highest diversity of yolk-sac larvae were caught during June, in the Upper Bay, where unidentified clupeid (37%) and goosefish (20%) were common in the catch. June catches in the Arthur Kill/Newark Bay area were dominated by bay anchovy (69%), while weakfish and goosefish were the only yolk-sac larvae collected in the Lower Bay. Throughout the Harbor, no yolk-sac larvae were collected in July.

3.1.2.3 Post Yolk-sac Larvae

Post yolk-sac larvae densities were greater than 2,000 /1000 m^3 throughout the Harbor prior to June (Figure 3-13). The peak post yolk-sac larvae densities were collected in June and July, especially in the Lower Bay during mid-June, when the highest density (12,000 /1000 m^3) was recorded. In general, post yolk-sac larvae densities at the shallow/shoal stations were greater than at navigation channel stations in Arthur Kill/Newark Bay and Lower Bay. During the June peak in Lower Bay, post yolk-sac densities were nearly five-fold greater at the shallow/shoal stations than at the navigation channel stations.

The species composition of post yolk-sac larvae was similar throughout the Harbor during January through April: rock gunnel dominated the catch during January, while winter flounder and grubby were the most common species from February through April (Figures 3-14 to 3-16). In May, species composition varied by Harbor area, with winter flounder dominating in the Arthur Kill/Newark Bay and Upper Bay, and windowpane dominating in the Lower Bay. Bay anchovy and Clupeidae spp. dominated the catch across sampling areas (>61% of the total) in June, when the highest post yolk-sac densities were observed. As in June, species composition shifted again in July. In this final sampling month, unidentified members of the Gobidae were the most commonly collected post yolk-sac larvae throughout the Harbor.

3.1.2.4 Juveniles

Juveniles represented the lowest densities of all ichthyoplankton life stages collected. They were present in samples from mid-May to July (Figure 3-17). The greatest density of juveniles (<10/1000 m^3) was observed at navigation channel stations in the Upper Bay. The Lower Bay had the lowest juvenile densities of the Harbor areas sampled, and juveniles were collected only at the navigation channel stations in the Lower Bay.

Species composition of juveniles by Harbor area is shown in Figures 3-18 through 3-20. The peak abundance of juveniles in May in the Upper Bay (Figure 3-17) was entirely Atlantic tomcod (Figure 3-19). The northern pipefish was the most abundant juvenile species throughout the Harbor during June and at Arthur Kill/Newark Bay and Lower Bay stations in July. Northern pipefish was the only juvenile species collected in multiple months.

3.2 WINTER FLOUNDER

3.2.1 Adults (Trawl Sampling)

3.2.1.1 Densities

Winter flounder were collected in trawls from December to June throughout the Harbor (Figure 3-21). The highest winter flounder CPUE (19) was recorded in mid-June at shallow/shoal stations in the Arthur Kill/Newark Bay area. In general, winter flounder CPUEs were similar in the three Harbor areas. Winter flounder were more common at navigation channel stations from December through April, especially in the Lower Bay. In the Arthur Kill/Newark Bay and Upper Bay areas, abundance shifted toward shallow/shoal stations later in the sampling schedule. Overall, however, winter flounder were collected in greater densities at the navigation channel stations.

3.2.1.2 Size Distribution

All winter flounder caught in the trawl were measured. Of a total of 828 winter flounder measured, total lengths ranged from 25 mm to 397 mm (Figure 3-22). A length frequency plot of winter flounder lengths from all Harbor areas combined exhibited a bimodal distribution pattern, with an initial length frequency cluster ranging from 25 to 80 mm and a second larger cluster with lengths ranging from 90-220 mm. The smaller length frequency cluster is representative of the young-of-year fish, and the larger length cluster is representative of immature and adult fish.

Temporal occurrence of winter flounder length frequencies in the three Harbor areas is shown in Figures 3-23 through 3-25. Winter flounder collected in the Arthur Kill/Newark Bay area from December to March— the period when winter flounder typically spawn in the Harbor— generally were less than 240 mm. By June in this area, smaller winter flounder (20 to 80 mm) were collected, and few large fish (>200 mm) were observed. Most of the winter flounder collected at Upper Bay stations from December to March were between 100 mm and 260 mm. Similar to Arthur Kill/Newark Bay collections, most winter flounder in June samples in the Upper Bay area ranged from 30 mm to 80 mm. In general, winter flounder collected in the Lower Bay ranged from 110 mm to 290 mm. A peak in the density of small winter flounder in June was not observed in the Lower Bay.

3.2.1.3 Sex Ratio

Of 93 winter flounder analyzed for sex determination, ranging in preserved length from 229 mm to 371 mm, 2 were immature, 71 were female, and 20 were male. Mature winter flounder were collected in greater numbers in the Upper Bay and Lower Bay than at Arthur Kill/Newark Bay stations (Figure 3-26). More females were collected in both the Upper Bay and the Lower Bay; the sex ratio was 4:1 females to male in the Upper Bay and 2.5:1 in the Lower Bay. No mature male winter flounder were collected in the Arthur Kill/Newark Bay area.

3.2.2 Ichthyoplankton (Epibenthic Sled Sampling)

The winter flounder egg, yolk-sac larvae, and post yolk-sac larvae life stages were distributed similarly throughout the Harbor: the greatest abundance of each life stage was collected from the Lower Bay, followed by the Upper Bay and then the Arthur Kill/Newark Bay area (Figure 3-27). No juvenile winter flounder were collected during the ichthyoplankton sampling program. Post yolk-sac larvae was the dominant life stage collected (88.8%), followed by yolk-sac larvae and eggs. Winter flounder eggs were collected in greater densities in the Lower Bay than any other area, constituting 83% of the winter flounder eggs collected. The Upper Bay had the second highest percentage of winter flounder eggs (12%). In the Arthur Kill/Newark Bay area, representing the lowest percentage (5%) of the total winter flounder eggs collected, eggs were collected on only two dates (Figure 3-28).

Winter flounder eggs were collected in the Harbor from mid-February through late April (Figure 3-28). Peak egg densities (85/1000 m^3) were collected in mid-February at the Lower Bay shallow/shoal stations. Throughout the Harbor, winter flounder egg densities were greater at the shallow/shoal stations than at the navigation channel stations.

Winter flounder yolk-sac larvae densities were greatest in the Lower Bay, where a peak density of 99/1000 m^3 was observed at the shallow/shoal stations (Figure 3-29). Yolk-sac larvae were collected in the lowest densities in the Arthur Kill/Newark Bay area. They were collected over the longest time frame (mid-February to late April) in the Upper Bay. Preference for station depth (i.e., navigation channel vs. shallow/shoal station) could not be determined at the Arthur Kill/Newark Bay stations because too few yolk-sac larvae were collected. Winter flounder yolk-sac larvae densities were greater at navigation channel stations in the Upper Bay and at shallow/shoal stations in the Lower Bay.

Post yolk-sac larvae was the most abundant winter flounder life stage; it was collected in the Harbor from mid-February to mid-May (Figure 3-30). Densities were highest at Lower Bay navigation channel stations, where density gradually increased during the sample program to a mid-April peak (>1616/1000 m^3). Post yolk-sac larvae densities were similar to each other (<200/1000 m) in the Arthur Kill/Newark Bay and Upper Bay areas.

3.3 WATER QUALITY

Average bottom water temperatures ranged from a low of 4.9 ºC in the Arthur Kill/Newark Bay and Lower Bay areas during January to a high of 22.6 ºC in Arthur Kill/Newark Bay during July (Figure 3-31). Water temperatures among the three Harbor areas were similar across the sampling period; however, temperatures at the Arthur

Kill/Newark Bay stations were warmer than those at Lower Bay and Upper Bay stations toward the final weeks of the program.

Salinity recorded from near bottom depth during ichthyoplankton surveys ranged between 17.3 ppt and 28.6 ppt over the course of the program. Salinities in the Arthur Kill/Newark Bay and the Upper Bay were similar, whereas the Lower Bay had higher salinity.

Dissolved oxygen concentration in water is largely dependent on the water temperature, and to a lesser degree, the salinity. As temperature increases, the amount of oxygen capable of being held in solution decreases. Similarly, as salinity increases, the amount of oxygen that can be held in solution decreases. Trends in dissolved oxygen levels were similar across the three Harbor areas, remaining near 10 mg/L during January through February and decreasing throughout the remainder of the program to approximately 6 mg/L during June and July. All water quality sampling data are presented in Appendix C.

4.0 DISCUSSION

4.1 ALL SPECIES

Finfish species composition in the Harbor based on bottom trawl surveys was dominated by spotted hake juveniles (<100 mm total length). Juvenile spotted hake use the Harbor as nursery habitat and are common in shallow estuaries of the Middle Atlantic Bight (Able and Fahay 1998). Few spotted hake ichthyoplankton were collected during the Biological Sampling Program because the species' spawning does not occur within the sampling areas (Able and Fahay 1998).

In the trawl sampling done as part of the 1998–1999 NYNJHNS baseline program, spotted hake were a relatively small component of the catch, while bay anchovy, striped bass, and weakfish dominated the collections (USACE 1999). As with many fish populations, these species exhibit year-to-year fluctuations in recruitment success that can influence their relative abundance during annual surveys. Although bay anchovy were not common in trawls during the 2001–2002 Aquatic Biological Sampling Program, they were a common species in the Harbor during the program time frame, as indicated by egg and post yolk-sac larvae catches.

4.2 WINTER FLOUNDER

Spatial and temporal trends observed in the Aquatic Biological Sampling Program's winter flounder abundance patterns suggest that different areas of the Harbor are important to winter flounder at different stages of their life history. Of the three Harbor areas sampled, adult winter flounder were most common in the Upper and Lower Bays during January to March, the peak spawning period in the study area (Able and Fahay 1998). The winter flounder collected during the spawning period were the largest individuals collected (>250 mm), and most of these fish (98%) were sexually mature.

Mature winter flounder were collected in larger numbers in the Upper Bay and the Lower Bay than in the Arthur Kill/Newark Bay. Sex ratios varied slightly among the main sampling areas. The ratio of females to males was 4:1 in the Upper Bay and 2.5:1 in the Lower Bay; in the Arthur Kill/Newark Bay area, no mature male winter flounder were collected. This variation in sex ratios among sample areas suggests a gender-specific distribution pattern that can help characterize the relative value of winter flounder spawning areas. Stoner et al. (1999) also noted a gender-specific distribution pattern among winter flounder in the Navesink River estuary, where females outnumbered males in the middle and upper reaches of the estuary, with males more abundant in the lower estuary. Mature males were found throughout the Navesink River estuary (Stoner et al. 1999), unlike the Biological Sampling Program findings, which report mature males only in the Upper and Lower Bays.

The majority of adults collected in the Upper and Lower Bays were found in the navigation channels. Previous Harbor studies have found that adult winter flounder use both navigation channel and shallow/shoal habitats (NMFS 1994; USACE 1999). Although many of the adult fish >250 mm collected in the 2001–2002 Aquatic Biological Sampling Program were in spawning condition, it is unclear if the navigation channel habitat was used for spawning or possibly as staging habitat prior to spawning. The literature supports the premise that winter flounder can spawn over depths ranging from 2 to 80 m (NMFS 1999), and therefore the potential for spawning in the Harbor's navigation channel habitat exists. In any event, the 2001–2002 data indicate that the navigation channels provide important habitat for adult winter flounder during the spawn.

The predominance of winter flounder eggs from February to March in the Lower Bay provides further support for the view that the Lower Bay provides important winter flounder spawning habitat. Winter flounder produce demersal eggs that adhere to the substrate. As a result, it can be assumed that the location in which the eggs are collected is primary spawning habitat. In the 2001–2002 Aquatic Biological Sampling Program, eggs were most common in shallow/shoal habitats, whereas in previous years they were more common in the navigation channels (USACE 1999; USACE 2002). Differences in the depth at which eggs were found across years suggests that other factors—e.g., possibly substrate (i.e., sediment type) or food availability—acting either alone or in combination, might have a greater influence on winter flounder spawning habitat than depth.

Results of the 2000–2001 Supplemental Sampling Program and 2001–2002 Aquatic Biological Sampling Program and the 1998–1999 NYNJHNS baseline program suggest that winter flounder spawning success in the Harbor could in fact be linked to the quality of the substrate (i.e., sand/gravel vs. silt/clay). Species that spawn demersal eggs can have reduced spawning success in areas of high deposition of fine material because eggs can suffocate without sufficient aeration (Wootton 1992). Areas with fine sediment substrate (silt/clay) are more characteristic of low-energy or low-velocity areas, whereas coarse substrates consisting of sand and gravel are indicative of higher energy areas. In the 2000–2001 Supplemental Sampling Program, the greatest densities of winter flounder eggs were collected at SB-6, a station characterized by coarse (gravel/sand) substrate (Figure 4-1). The highest winter flounder egg densities observed in the 2001–2002 Aquatic Biological Sampling Program were in areas dominated by coarse gravel/sand substrate in the Lower Bay. Fine silt and clay substrate are more common in the northern parts of the Upper Bay and throughout the Arthur Kill/Newark Bay. Based on collection data, winter flounder spawning in these areas was rare during the 2001–2002, 2000–2001, and 1998–1999 investigations. The data suggest that the Lower Bay, with its prevalence of areas of coarse substrate with low deposition, likely provides the best spawning habitat.

Winter flounder juveniles seek nursery habitat in estuaries of the Middle Atlantic Bight to feed and grow (Able and Fahay 1998). Juvenile winter flounder were most common in the upper sections of the Harbor (Arthur Kill/Newark Bay and parts of the Upper Bay), where little spawning occurred. This suggests that young winter flounder move from the primary spawning area in the Lower Bay to areas further into the Harbor estuary. Winter flounder have been recorded using tidal currents to move from spawning areas to settling habitat in coves and inlets (Chant et al. 2000), possibly because these areas have less energetic cost than higher energy open-water areas. Another hypothesis is that nutrients are replenished in slack-water areas with each tidal cycle, thereby providing ongoing forage for developing winter flounder (Chant et al. 2000). The pattern of movement away from the spawning area and further into the estuary could be important to winter flounder population dynamics because larvae that move directly to the ocean without using the nursery habitat could be lost to the population (Chant et al. 2000).

The pattern of winter flounder early life-stage migration found in the 2001–2002 Aquatic Biological Sampling Program is similar to that described in the 2000–2001 Supplemental Sampling Program. Specifically in the biological program, winter flounder eggs were collected primarily in lower areas of the Upper Bay, and no eggs were collected in the Arthur Kill/Newark Bay. Winter flounder collected as yolk-sac larvae in the Arthur Kill/Newark Bay constituted a small percentage (8%) of the winter flounder yolk-sac larvae caught in the Harbor. Winter flounder post yolk-sac larvae were collected at all stations in the Harbor, and their occurrence and abundance extended further into the Harbor, with post yolk-sac larvae in the Arthur Kill/Newark Bay constituting 36% of the overall winter flounder catch.

The 2001–2002 Aquatic Biological Sampling Program provides additional support to the findings of the Supplemental Study (2000–2001), which indicated that winter flounder move or disperse further into the New York and New Jersey Harbor Estuary after hatching. The patterns observed in the Aquatic Biological Sampling Program suggest that winter flounder eggs are laid primarily in the Lower Bay and to a lesser degree in other areas of the Harbor. After hatching and developing into larvae, winter flounder move from the Lower Bay further into the Harbor.

As noted earlier, the Harbor is part of the Hudson-Raritan Estuary, which supports a diverse fish community consisting of estuarine, marine, and anadromous fish species indicative of large coastal estuaries in the Middle Atlantic Bight. The Harbor's varied and dynamic habitats—ranging widely in depth, hydraulic conditions, sediment type, and water quality conditions—serve as spawning grounds, migratory pathways, and nursery/foraging area to many estuarine species. The 2001–2002 Aquatic Biological Sampling Program, a complement to the 1998–1999 NYNJHN baseline program and the 2001–2001 Supplemental Sampling Program, has pinpointed the spatial and temporal occurrence of species, especially winter flounder, in the Harbor's Arthur Kill/Newark Bay, Upper Bay, and Lower Bay areas. The program's occurrence data sheds important light on the significance of habitat characteristics of the three Harbor areas examined.

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Table 2-1 Description of stations sampled during the 2001–2002 Aquatic Biological Sampling Program.

Area	Station Name	Type	Station Location	Average Depth (ft)	GPS Coordinates (deg., min., sec.)			
					Start		End	
					North	West	North	West
South Brooklyn/ Upper Bay	SB–1*	Shallow/shoal	Gowanus Bay Interpier South	27	40:39.45	74:00.86	40:39.56	74:01.05
	SB–2 **	Shallow/shoal	Gowanus Bay Interpier	30	40:39.60	74:00.48	40:39.75	74:00.75
	SB–3*	Shallow/shoal	Bay Ridge Flats	22	40:39.36	74:02.26	40:38.91	74:02.36
	SB–4 **	Navigation Channel	Bay Ridge Channel	42	40:39.28	74:01.52	40:38.98	74:01.79
	SB–5*	Navigation Channel	Anchorage Channel Middle	57	40:39.53	74:03.30	40:39.69	74:03.19
	SB–6 **	Navigation Channel	Anchorage Channel South	49	40:38.76	74:03.11	40:38.48	74:02.98
Port Jersey	PJ–1 **	Shallow/shoal	Jersey Flats	12	40:39.91	74:03.57	40:40.17	74:03.45
	PJ–2*	Shallow/shoal	Caven Point	10	40:40.62	74:03.44	40:41.02	74:03.35
	PJ–3 **	Shallow/shoal	Constable Hook	13	40:39.75	74:04.75	40:39.53	74:04.19
	PJ–4 **	Navigation Channel	Port Jersey Channel	39	40:39.91	74:04.11	40:40.07	74:04.51
	PJ–5*	Navigation Channel	Port Jersey Channel East	42	40:39.48	74:03.64	40:39.78	74:03.96
Newark Bay	NB–3*	Shallow/shoal	Newark Bay Flats Middle	10	40:41.06	74:07.61	40:41.40	74:07.44
	NB–4*	Shallow/shoal	Newark Bay Flats South	16	40:40.72	74:07.76	40:40.38	74:07.92
	NB–5 **	Navigation Channel	Newark Bay Middle Reach	42	40:40.59	74:07.96	40:40.19	74:08.26
	NB–6 **	Navigation Channel	Newark Bay South Reach	46	40:39.44	74:08.52	40:39.15	74:08.75
	NB–7*	Shallow/shoal	Elizabeth Flats North	13	40:39.62	74:09.29	40:39.51	74:08.99
Lower Bay	LB–1	Shallow/shoal	East Bank	13	40:33.45	74:00.24	40:33.94	74:00.52
	LB–2	Navigation Channel	North End Ambrose Channel	50	40:33.23	74:01.54	40:33.40	74:01.55
	LB–3	Shallow/shoal	Swash Channel Range	17	40:33.34	74:04.46	40 33.00	74 04.44
	LB–4	Navigation Channel	Chapel Hill South Channel	30	40:31.06	74:02.41	40:30.64	74:02.39
	LB–5	Shallow/shoal	Old Orchard Shoals	13	40:30.59	74:04.72	40:30.75	74:05.22
	LB–6	Navigation Channel	Raritan Bay East Reach	41	40 29.41	74 06.39	40 29.53	74 06.90
Arthur Kill	AK-1	Shallow/shoal	Elizabeth Flats South	19	40:38.84	74:10.58	40:38.85	74:10.13
	AK-2	Navigation Channel	North of Shooter Island Reach	39	40:38.80	74:10.75	40:38.77	74:10.26
	AK-3	Navigation Channel	Elizabeth Reach	42	40:38.32	74:11.59	40:38.53	74:11.30
	AK-4	Shallow/shoal	Prall's Island	20	40:36.83	74:11.91	40:36.24	74:11.82

* Also sampled during the 2000 - 2001 Supplemental Sampling Program
** Also sampled during the NYNJHN 1998 – 1999 Baseline Program and 2000-2001 Supplemental Sampling Program

Table 2-2 Specifications of bottom trawl used to collect adult finfish during the 2001-2002 Aquatic Biological Sampling Program.

Part	**Specification**
Headrope	25.9 ft. (7.9 m)
Footrope	27.9 ft (8.5 m)
Wing height	3.6 ft. (1.1 m)
Total length	35.1 ft (10.7 m)
Wing mesh (square)	2.0-in. (5.1 cm)
Body mesh (square)	2.0-in. (5.1 cm)
Cod end mesh (square)	0.75-in. (1.9 cm)
Cod end liner mesh (square)	0.25-in. (0.6 cm)
Trawl doors	32.0 x 17.0 x 0.75-in (79.2 x 39.6 x 3.1 cm)
Tow line length	5 times maximum station water depth

Table 2-3 Numbers of trawl and epibenthic sled tows conducted during the 2001-2002 Aquatic Biological Sampling Program.

Area	Arthur Kill	Newark Bay	Port Jersey	South Brooklyn	Lower Bay
Number of Trawls	39	50	50	60	56*
Number of Epibenthic Sled Tows	48	60	60	72	72

*Four sites (LB-3, LB-4, LB-5 and LB-6) were not sampled during the week of 18 December because of weather conditions.

Table 2-4 Specifications of epibenthic sled and plankton net used to collect early life stages of finfish during the 2001-2002 Aquatic Biological Sampling Program.

Part	Specification
Mouth diameter	0.5 m
Overall length	3.0 m
Mesh size	0.5 mm
Cod-end diameter	10.1 cm
Cod-end mesh	0.5 mm (PVC cod-end bucket)
Epibenthic sled	Constructed of PVC pipe

Table 2-5 Water quality and velocity measurements made during the 2001-2002 Aquatic Biological Sampling Program.

Water Quality Parameter	Units and Accuracy	Sample Depths
Temperature	+/- 0.2	Bottom
Dissolved oxygen	+/- 0.5 mg/L	Bottom
Conductivity	+/- 100 microseimens	Bottom

Table 3-1 a. Monthly average trawl CPUE by species for all navigation channel stations combined during the 2001-2002 NYNJHN Sampling Program.

Species	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02
Alewife	1.15	4.98	3.39	2.36	0.08	0.17	
American Eel		0.04				0.52	0.25
American Shad	0.65	0.38	0.58	0.17			
Atherinid unidentified		0.05					
Atlantic Herring		0.08	0.07	0.04	1.67	0.08	
Atlantic Menhaden	0.10	0.26		0.25		0.42	0.75
Atlantic Silverside			0.17				
Atlantic Tomcod						0.25	
Bay Anchovy	0.35	0.04		0.08	0.08	4.54	4.33
Black Sea Bass	0.30				0.17	0.08	
Blueback Herring	8.20	8.38	13.15	11.34	0.67	6.96	0.42
Bluefish							0.17
Butterfish						0.25	0.08
Clearnose Skate	1.00	6.00	0.96	0.58	0.83	1.10	0.25
Clupeid unidentified					0.20		0.17
Conger Eel		0.25		0.17			0.08
Cunner	0.20	0.25	2.21	0.29	0.42		
Fourspot Flounder	0.10	0.67	0.04			0.08	0.50
Gizzard Shad		0.17	0.08				
Grubby	0.10	0.48	0.13		0.24	0.08	0.25
Hogchocker						0.08	
Lined Seahorse				0.04			
Longhorn Sculpin		0.04					
Naked Goby	0.10			0.13			
Northern Pipefish	0.10	1.10	1.17	0.92	0.50	0.52	
Northern Puffer						0.10	
Northern Searobin	0.20		0.21	0.17	0.50	1.98	0.58
Oyster Toadfish						0.08	
Red Hake	0.30	1.02	2.00	0.79	1.25	1.94	
Rock Gunnel			0.04	0.04	0.12	0.17	
Scup						10.77	0.25
Silver Hake	0.10		0.88	0.46	0.08		
Smallmouth Flounder	1.40	7.36	5.88	0.71	0.75	1.42	0.17
Spot	0.20	1.01	0.04				
Spotted Hake	6.15	14.32	19.23	19.54	106.22	78.10	20.33
Striped Bass	2.10	14.12	12.49	1.67	0.63	0.08	0.08
Striped Cuskeel		0.17	0.04	0.25	0.25	0.17	0.08
Striped Searobin				0.08		9.23	3.83
Summer Flounder	0.10	0.13		0.08	0.25	1.02	1.17
Tautog		0.46		0.04	0.17		0.08
Unidentified	0.10						
Weakfish	1.60	4.75				0.25	0.17
White Perch	0.75	17.92	25.71	1.00			
Windowpane	2.20	4.93	2.52	0.96	3.36	3.25	3.33
Winter Flounder	2.75	7.35	6.05	2.04	6.57	4.96	2.25

Table 3-1 b. Monthly average trawl CPUE by species for all shallow/shoal stations combined during the 2001-2002 NYNJHN Sampling Program.

Species	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02
Alewife	0.69	7.68	1.96	3.25	0.64		
American Eel					0.24	0.36	
American Shad	1.42	1.27	1.46	1.57			
Atherinid unidentified		1.01					
Atlantic Herring		0.13	0.54	0.04	0.07	0.09	
Atlantic Menhaden		0.05		0.26	0.07	0.71	1.05
Atlantic Silverside		0.07	1.11	0.22			
Atlantic Tomcod				0.12		3.29	1.43
Bay Anchovy	0.09	0.16		0.05	0.15	20.37	6.42
Black Sea Bass					0.32	0.14	0.38
Blueback Herring	2.83	3.84	3.12	2.42	0.83	0.81	
Bluefish							0.21
Butterfish						0.18	
Clearnose Skate	0.50	1.28	0.23	0.11	0.85	0.07	0.07
Clupeid unidentified		0.10			0.46		
Conger Eel					0.12		
Cunner			0.12		0.18	0.25	0.48
Feather Blenny				0.04			
Gizzard Shad		0.16		0.06			
Grubby		0.68	0.15	0.04	0.07	0.07	0.33
Hickory Shad						0.07	
Lined Seahorse				0.04	0.07		
Naked Goby	0.17			0.07	0.16		0.12
Northern Pipefish		0.04		0.11	0.60	0.14	0.50
Northern Puffer						0.07	
Northern Searobin				0.14	0.81	0.24	1.00
Oyster Toadfish							0.14
Red Hake	0.70	0.12	0.04	0.04			
Rock Gunnel				0.04	0.18		
Scup						5.00	4.69
Seaboard Goby		0.18					
Smallmouth Flounder	1.97	3.72	1.15	0.79	0.75	1.31	0.81
Smooth Dogfish							0.29
Spot	10.00	3.95	0.36				
Spotted Hake	1.53	0.55	0.55	5.74	20.07	34.16	5.77
Striped Bass	1.36	9.90	12.16	4.90	14.09	6.24	2.60
Striped Cuskeel				0.04	0.65		
Striped Killifish		0.04					
Striped Searobin					0.07	0.29	
Summer Flounder					0.37	2.47	6.04
Tautog	0.17	0.12			0.18	0.14	
Weakfish	0.17					0.17	0.14
White Perch		11.93	2.12	1.25			
Windowpane		1.13	0.40	0.77	3.90	1.74	3.88
Winter Flounder	0.92	1.35	1.22	1.22	3.01	2.38	10.19

Table 3-2 a. Monthly average trawl CPUE by species for all navigation channel stations combined and all shallow/shoal stations combined in the Arthur Kill/Newark Bay during the 2001-2002 NYNJHN Sampling Program.

Navigation Channel Stations

Species	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02
Alewife	0.63	1.59	2.71	0.75	0.25		
American Eel		0.13				1.31	0.25
American Shad	0.63		0.50	0.13			
Atlantic Herring			0.21	0.13	4.75	0.25	
Atlantic Menhaden		0.13		0.13		0.25	2.00
Atlantic Silverside			0.13				
Bay Anchovy	0.63			0.25		5.38	10.75
Blueback Herring	12.00	2.05	8.63	6.25	0.50	20.38	0.25
Butterfish							0.25
Clupeid unidentified					0.61		0.50
Conger Eel							0.25
Cunner		0.13		0.25			
Fourspot Flounder			0.13				
Gizzard Shad		0.50	0.25				
Grubby		0.43	0.13		0.71	0.25	0.75
Hogchocker						0.25	
Naked Goby				0.13			
Northern Pipefish		0.13		0.13	0.25	0.31	
Northern Searobin						2.69	1.00
Oyster Toadfish						0.25	
Red Hake				0.13	0.25		
Rock Gunnel					0.36		
Smallmouth Flounder		0.38	0.25	0.13	0.25		
Spotted Hake	3.63	1.80	5.33	6.88	233.91	85.38	29.25
Striped Bass	5.00	36.46	37.33	4.88	0.88	0.25	
Striped Cuskeel			0.13		0.50		0.25
Striped Searobin						0.31	1.25
Summer Flounder				0.13		0.50	0.75
Tautog					0.25		
Weakfish	1.25						0.50
White Perch	1.88	49.78	77.13	3.00			
Windowpane	0.50	1.89	2.58	0.38	3.59	1.13	1.00
Winter Flounder	2.13	5.22	4.04	2.38	5.46	1.06	2.25

Shallow/Shoal Stations

Species	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02
Alewife		2.57	1.30	1.00	1.20		
American Eel					0.67	0.50	
American Shad		0.60	0.30	2.81			
Atherinid unidentified		2.50					
Atlantic Herring						0.25	
Atlantic Menhaden				0.53			1.33
Atlantic Silverside			1.20	0.10			
Bay Anchovy		0.20		0.14	0.20	6.04	8.67
Black Sea Bass					0.50	0.20	0.67
Blueback Herring	1.00	0.30	2.48	4.22	1.50	1.27	
Bluefish							0.20
Clearnose Skate			0.33				
Clupeid unidentified					0.50		
Conger Eel					0.33		
Cunner			0.13				0.33
Gizzard Shad		0.44		0.17			
Grubby							0.53
Naked Goby							0.33
Northern Pipefish					0.50		1.20
Northern Searobin						0.49	2.00
Rock Gunnel					0.50		
Scup							0.33
Smallmouth Flounder		0.30	0.10		1.50	0.57	1.67
Spot		0.10					
Spotted Hake		0.43	0.35	10.42	19.80	23.74	1.87
Striped Bass		14.63	33.04	10.19	32.17	11.29	7.27
Striped Killifish		0.10					
Striped Searobin						0.20	
Summer Flounder					0.83	2.61	3.40
Tautog					0.50	0.20	
Weakfish						0.29	0.20
White Perch		33.40	5.93	3.50			
Windowpane		0.54	0.30	0.30	7.97	0.29	0.87
Winter Flounder		0.31	1.58	1.33	6.83	2.37	19.13

Table 3-2 b. Monthly average trawl CPUE by species for all navigation channel stations combined and all shallow/shoal stations combined in the Upper Bay during the 2001-2002 NYNJHN Sampling Program.

Navigation Channel Stations

Species	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02
Alewife	1.40	7.99	3.68	2.76		0.40	
American Eel						0.20	0.20
American Shad	0.80	0.72	1.00	0.30			
Atherinid unidentified		0.11					
Atlantic Herring					0.20		
Atlantic Menhaden	0.20	0.52		0.51		0.60	0.20
Atlantic Silverside			0.30				
Atlantic Tomcod						0.60	
Bay Anchovy	0.20	0.10			0.20	6.40	1.20
Black Sea Bass					0.20		
Blueback Herring	6.80	16.08	24.05	17.52	1.20	0.40	0.80
Bluefish							0.40
Butterfish						0.60	
Clearnose Skate	2.00	4.80	0.70	0.20	1.40	1.60	0.40
Conger Eel				0.10			
Cunner		0.10	4.80	0.40	0.40		
Fourspot Flounder						0.20	1.20
Lined Seahorse				0.10			
Naked Goby				0.20			
Northern Pipefish		2.04	1.80	1.40	0.60	0.80	
Northern Searobin				0.30	1.00	1.40	0.40
Red Hake	0.20	0.94	1.70	0.60	1.00	3.60	
Rock Gunnel						0.20	
Scup						0.40	0.60
Silver Hake	0.20		0.10	0.10	0.20		
Smallmouth Flounder	0.40	1.35	0.20	0.30	0.20	0.20	0.20
Spot	0.40	2.43	0.10				
Spotted Hake	7.60	12.83	11.28	22.30	49.80	69.20	23.60
Striped Bass	0.20	2.29	0.10	0.10	0.80	0.20	
Striped Cuskeel				0.20	0.20	0.40	
Striped Searobin				0.10		0.80	2.00
Summer Flounder		0.10			0.40	0.60	2.20
Tautog		1.00		0.10	0.20		0.20
Unidentified	0.20						
Weakfish	2.20	11.40				0.40	
Windowpane	4.00	8.03	3.28	1.30	2.80	5.00	6.20
Winter Flounder	2.40	9.09	7.38	1.40	4.40	1.60	2.80

Shallow/Shoal Stations

Species	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02
Alewife	1.19	15.71	3.38	6.68	0.33		
American Eel						0.42	
American Shad	2.43	2.46	3.17	1.32			
Atherinid unidentified		0.28					
Atlantic Herring		0.21			0.17		
Atlantic Menhaden		0.12		0.18	0.17	1.67	1.17
Atlantic Silverside			0.83	0.44			
Atlantic Tomcod				0.28		7.67	3.33
Bay Anchovy	0.17	0.20			0.19	42.17	1.92
Black Sea Bass						0.17	0.33
Blueback Herring	4.29	8.55	5.21	2.06	0.52	0.83	
Bluefish							0.17
Butterfish						0.42	
Clearnose Skate	0.86	1.32	0.08	0.25	0.97		
Clupeid unidentified		0.24			0.67		
Cunner			0.18		0.42	0.42	0.83
Grubby		0.08	0.27	0.08	0.17		0.33
Hickory Shad						0.17	
Naked Goby	0.29			0.08	0.37		
Northern Pipefish					0.97	0.33	0.17
Northern Puffer						0.17	
Northern Searobin				0.25	1.89	0.17	0.67
Oyster Toadfish							0.33
Red Hake	1.28	0.28	0.08				
Rock Gunnel				0.08			
Scup						1.67	4.50
Seaboard Goby		0.42					
Smallmouth Flounder	3.61	2.09	0.52	0.42	0.17	2.42	0.50
Spot	18.33	9.13	0.83				
Spotted Hake	2.48		0.42	4.12	24.32	49.92	11.75
Striped Bass	2.33	10.91	0.84	2.95	6.06	5.00	
Striped Cuskeel					1.53		
Striped Searobin					0.17	0.17	
Summer Flounder					0.17	3.25	11.25
Tautog	0.29	0.20					
Weakfish	0.29					0.17	0.17
Windowpane		0.94	0.26	1.47	1.64	3.50	8.33
Winter Flounder	1.57	2.71	1.19	1.65	0.67	2.58	7.83

Table 3-2 c. Monthly average trawl CPUE by species for all navigation channel stations combined and all shallow/shoal stations combined in the Lower Bay during the 2001-2002 NYNJHN Sampling Program.

Navigation Channel Stations

Species	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02
Alewife	2.00	4.50	3.83	3.83			
American Eel							0.33
American Shad		0.33					
Atlantic Herring		0.33					
Atlantic Menhaden						0.33	
Bay Anchovy						0.33	1.00
Black Sea Bass	3.00				0.33	0.33	
Blueback Herring		4.00	1.00	7.83			
Clearnose Skate		16.00	2.67	2.00	1.00	1.75	0.33
Conger Eel		1.00		0.50			
Cunner	2.00	0.67	0.83	0.17	1.00		
Fourspot Flounder	1.00	2.67					
Grubby	1.00	1.33	0.33				
Longhorn Sculpin		0.17					
Naked Goby	1.00						
Northern Pipefish	1.00	0.83	1.67	1.17	0.67	0.33	
Northern Puffer						0.42	
Northern Searobin	2.00		0.83	0.17	0.33	2.00	0.33
Red Hake	2.00	2.50	5.17	2.00	3.00	1.75	
Rock Gunnel			0.17	0.17		0.33	
Scup						42.42	
Silver Hake			3.33	1.67			
Smallmouth Flounder	12.00	26.67	22.83	2.17	2.33	5.33	0.33
Spotted Hake	9.00	33.50	51.00	31.83	30.00	83.25	3.00
Striped Bass		0.33					
Striped Cuskeel		0.67		0.67			
Striped Searobin				0.17		35.17	10.33
Summer Flounder	1.00	0.33		0.17	0.33	2.42	
Tautog		0.17					
Weakfish						0.33	
Windowpane		4.33	1.17	1.17	4.00	3.17	1.67
Winter Flounder	7.00	7.67	6.50	2.67	11.67	15.75	1.33

Shallow/Shoal Stations

Species	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02
Alewife		0.17	0.33	0.17	0.33		
Atlantic Herring		0.17	2.50	0.17			
Atlantic Menhaden							0.33
Atlantic Silverside		0.33	1.50				
Bay Anchovy						0.67	11.67
Black Sea Bass					0.67		
Blueback Herring		0.33		0.17	0.33		
Bluefish							0.33
Clearnose Skate		3.33	0.33		2.00	0.33	0.33
Cunner						0.33	
Feather Blenny				0.17			
Grubby		3.00	0.17			0.33	
Lined Seahorse				0.17	0.33		
Naked Goby				0.17			
Northern Pipefish		0.17		0.50			
Northern Searobin				0.17			
Red Hake				0.17			
Scup						20.00	12.33
Smallmouth Flounder		12.67	3.71	2.83	0.67	0.33	
Smooth Dogfish							1.33
Spotted Hake	1.00	1.83	1.17	1.17	12.00	20.00	0.33
Striped Bass						0.33	
Striped Cuskeel				0.17			
Striped Searobin						0.67	
Summer Flounder						0.67	
Tautog		0.17				0.33	
Windowpane		2.50	0.83	0.17	1.67	0.67	
Winter Flounder		0.33	0.67	0.17	1.33	2.00	

Table 3-3 a Monthly average ichthyoplankton density (No./1000m³) by species for all navigation channel stations in Arthur Kill/Newark Bay during the 2001-2002 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic menhaden			1.19		95.97	12.75	
Bay anchovy						2221.03	355.95
Four beard rockling			0.69	0.56			
Hogchocker						38.83	2.96
Labridae					41.88	252.98	48.66
Unidentified						2.04	
Weakfish				4.88	33.56	41.20	
Windowpane						998.05	

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Atlantic menhaden					0.97		
Atlantic silverside						0.64	
Grubby		13.54	14.70	6.00			
Winter flounder		1.85	12.80	2.67			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
Atlantic menhaden	1.67			1.56	1.08		
Bay anchovy						114.33	66.31
Blennidae							1.38
Butterfish							1.48
Clupeid unidentified						59.95	20.29
Gobiid unidentified						45.72	1462.52
Grubby		18.85	36.96	16.48	1.14		
Northern pipefish						16.54	10.79
Northern puffer						0.83	
Rock gunnel	9.80	3.28	1.25				
Spot		1.73			0.85		
Summer flounder		0.67					
Unidentified						5.68	114.88
Weakfish						8.80	40.54
Windowpane					2.26	2.38	
Winter flounder		1.25	14.06	39.16	64.47	1.66	

Juvenile

Species	January	February	March	April	May	June	July
Northern pipefish						0.89	4.00
Windowpane						0.47	

Table 3-3 b. Monthly average ichthyoplankton density (No./1000m³) by species for all shallow/shoal stations in Arthur Kill/Newark Bay during the 2001-2002 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic menhaden					45.20	48.28	
Bay anchovy					7.61	3085.73	619.90
Hogchocker					0.60	4.16	1.35
Labridae					46.42	325.10	29.05
Unidentified						12.79	
Weakfish				4.06	10.59	5.12	0.97
Windowpane						456.25	
Winter flounder		0.52	3.04				

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Bay anchovy						5.01	
Cunner						1.74	
Grubby		4.58	11.77	2.54			
Winter flounder		3.34	2.12	8.14			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance			0.50				
Atlantic mackerel					0.60		
Atlantic menhaden				0.46		6.55	
Atlantic silverside					3.99		
Bay anchovy				0.48		438.86	204.26
Blennidae							3.50
Clupeid unidentified						168.58	9.73
Gobiid unidentified						290.00	2295.95
Goosefish						0.67	
Grubby		11.02	52.67	15.24	0.49		
Northern pipefish					0.43	59.90	16.02
Rock gunnel	2.64	3.59					
Spot			0.51				
Tautog						1.08	
Unidentified						18.67	101.23
Weakfish						44.10	2.71
Windowpane					1.76	0.90	
Winter flounder		2.24	41.92	73.14	13.39		

Juvenile

Species	January	February	March	April	May	June	July
Northern pipefish						2.46	

Table 3-3 c. Monthly average ichthyoplankton density (No./1000m³) by species for all navigation channel stations in Upper Bay during the 2001-2002 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic menhaden		0.98	9.82	5.68	308.79	136.63	
Bay anchovy					4.03	1791.62	16.79
Bothid unidentified				1.03			
Four beard rockling		0.49	1.26	0.41	1.16		
Gobiid unidentified						1.74	
Hogchocker					5.16	666.76	27.49
Labridae				10.40	305.57	1269.18	265.03
Unidentified	1.14						
Weakfish				185.77	308.68	515.16	54.73
Windowpane				2.80		1537.67	10.97
Winter flounder			0.44	0.33			

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Gobiid unidentified						0.39	
Goosefish						0.34	
Grubby		4.54	25.16	5.29			
Winter flounder		17.58	11.33	13.40	0.46		

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance				0.41			
Atlantic mackerel					9.91		
Atlantic menhaden			0.38	0.34	0.76		
Atlantic tomcod			0.44				
Bay anchovy						162.14	228.07
Blennidae							2.48
Butterfish							8.06
Clupeid unidentified						211.36	14.86
Cunner							2.48
Gobiid unidentified						6.75	4152.15
Grubby		9.56	96.03	33.05			
Northern pipefish						8.01	31.51
Rock gunnel	22.68	3.07		0.41			
Spot		1.82					
Striped bass						0.45	
Summer flounder	1.32						
Tautog						0.39	1.44
Unidentified					0.58	35.32	
Weakfish						10.03	135.65
Windowpane					4.53	15.15	
Winter flounder		43.23	51.15	106.32	39.94	0.74	
Yellowtail flounder						0.74	

Juvenile

Species	January	February	March	April	May	June	July
Atlantic tomcod					6.04		
Prionotus sp.							2.48
Windowpane						1.24	

Table 3-3 d. Monthly average ichthyoplankton density (No./1000m³) by species for all shallow/shoal stations in Upper Bay during the 2001-2002 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic menhaden			1.46	1.41	10.92	413.10	
Bay anchovy						5704.45	19.59
Bothid unidentified		0.34					
Four beard rockling			0.56	1.20			
Grubby		0.58					
Hogchocker						36.59	27.77
Labridae				0.98	37.10	2134.39	427.48
Weakfish				40.69	69.51	186.14	19.71
Windowpane						1498.26	63.82
Winter flounder		0.68	7.99				

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Atlantic menhaden					1.58		
Clupeid unidentified						3.30	
Gobiid unidentified						0.96	
Goosefish						1.48	
Grubby		10.36	13.43	6.44			
Unidentified						0.96	
Weakfish						0.85	
Windowpane						0.72	
Winter flounder		6.82	0.65	3.17			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance			0.51				
Atlantic mackerel					2.67		
Atlantic menhaden					0.52		
Atlantic silverside						0.37	
Bay anchovy						113.87	74.42
Blennidae							1.99
Butterfish							9.81
Clupeid unidentified						215.06	
Cunner						0.51	6.44
Four beard rockling			0.82		1.15		
Gobiid unidentified						19.96	3537.27
Goosefish						0.58	
Grubby		26.04	61.20	15.86			
Northern pipefish						29.75	34.45
Rock gunnel	7.68	8.66	0.32				
Summer flounder			0.33				
Tautog						2.84	
Unidentified		0.89				50.90	
Weakfish						7.97	6.32
Windowpane					3.27	7.13	
Winter flounder		24.77	133.30	61.09	56.01		

Juvenile

Species	January	February	March	April	May	June	July
Northern pipefish						2.73	
Windowpane						0.72	

Table 3-3 e. Monthly average ichthyoplankton density (No./1000m³) by species for all navigation channel stations in Lower Bay during the 2001-2002 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic menhaden			11.65	5.01	3248.34	492.11	
Bay anchovy					323.21	6007.78	15.84
Four beard rockling			1.18				
Gadid unidentified				1.56			
Hogchocker					95.65	743.95	60.44
Labridae				28.51	262.53	542.93	34.70
Spotted hake				0.85			
Weakfish				408.86	729.00	256.81	29.23
White perch				0.46			
Windowpane				16.66		623.23	
Winter flounder			6.92	1.23			

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Atlantic menhaden				0.46	110.92		
Grubby		5.41	12.30	0.43			
White perch				1.37			
Winter flounder			26.56	9.47			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance			1.80	2.05			
Atlantic mackerel					14.83		
Atlantic menhaden				1.83			
Atlantic silverside					1.17		
Bay anchovy						513.14	6.93
Butterfish							6.78
Clupeid unidentified						168.52	
Cunner							4.65
Four beard rockling					2.39	1.86	
Gobiid unidentified						1.35	88.83
Grubby		5.56	106.29	16.21			
Northern pipefish						12.57	
Prionotus sp.							2.31
Rock gunnel	23.42	11.28	1.18	0.44			
Spot		1.09					
Striped cuskeel			1.24				
Tautog							6.93
Unidentified						46.89	10.65
Weakfish						26.43	50.31
White perch				15.56			
Windowpane				0.86	117.72	48.81	4.44
Winter flounder		3.02	186.71	716.06	12.01		

Juvenile

Species	January	February	March	April	May	June	July
Northern pipefish						1.35	4.62

Table 3-3 f. Monthly average ichthyoplankton density (No./1000m³) by species for all shallow/shoal stations in Lower Bay during the 2001-2002 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic menhaden			2.58	17.41	2957.45	2229.54	
Bay anchovy					255.18	6193.17	22.41
Four beard rockling				1.01			
Gadid unidentified				0.54			
Hogchocker				0.47	33.83	1303.73	55.07
Labridae				16.71	695.43	2125.22	5.76
Weakfish				233.86	507.46	460.12	
Windowpane				4.85		3102.73	
Winter flounder		42.57	14.29	3.81			

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Atlantic menhaden					231.07		
Goosefish						2.24	
Grubby		6.94	9.19	1.05			
Weakfish						3.40	
Winter flounder		14.22	6.65	37.23			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance		0.95	1.27	0.54			
Atlantic mackerel					41.01		
Atlantic menhaden					5.03		
Bay anchovy						4677.76	
Butterfish							5.76
Clupeid unidentified						987.23	
Four beard rockling					1.58		
Gobiid unidentified						413.36	51.75
Goosefish						0.70	
Grubby		13.20	70.25	3.01			
Northern pipefish						63.82	7.17
Rock gunnel	11.43	2.61	0.57				
Unidentified						602.15	
Weakfish						77.53	
Windowpane					112.04	6.44	
Winter flounder		5.50	87.71	259.11	4.35		

Juvenile

Species	January	February	March	April	May	June	July

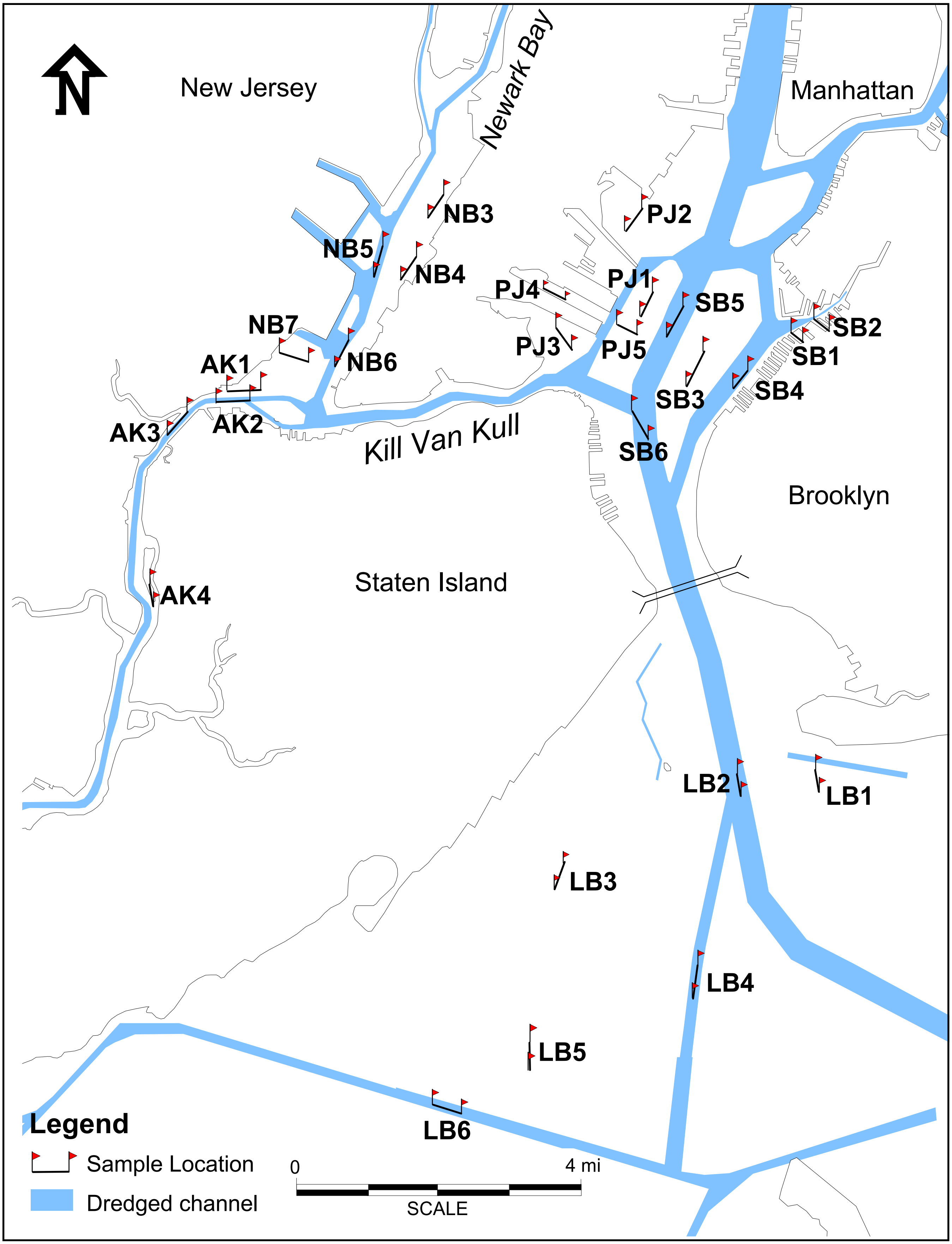


Figure 2-1. Map of sampling stations during the 2001-2002 Aquatic Biological Sampling Program.

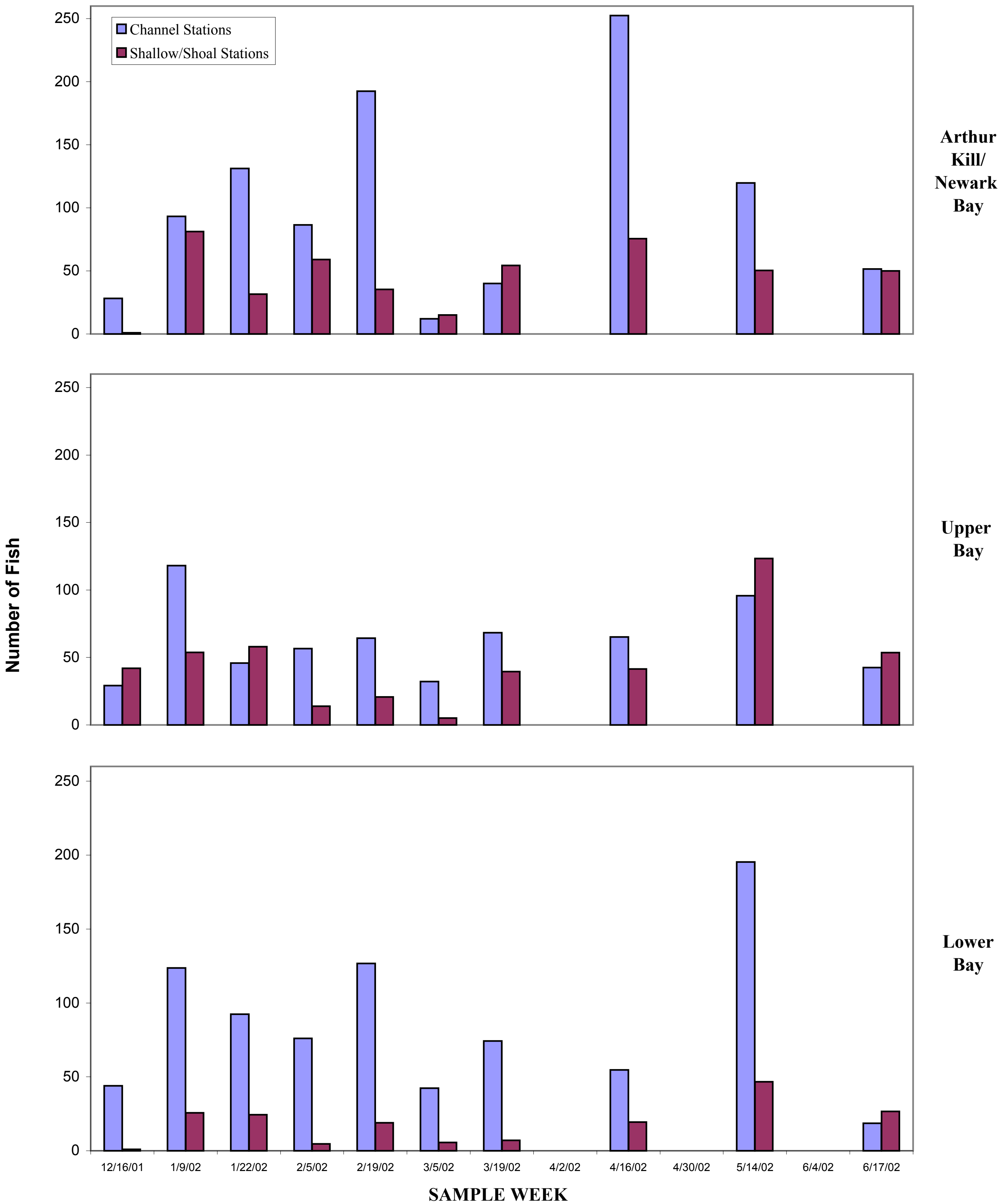


Figure 3-1 **Average weekly trawl CPUE for all species combined at navigation channel and shallow/shoal stations in three study areas during the 2001-2002 Aquatic Biological Sampling Program.**

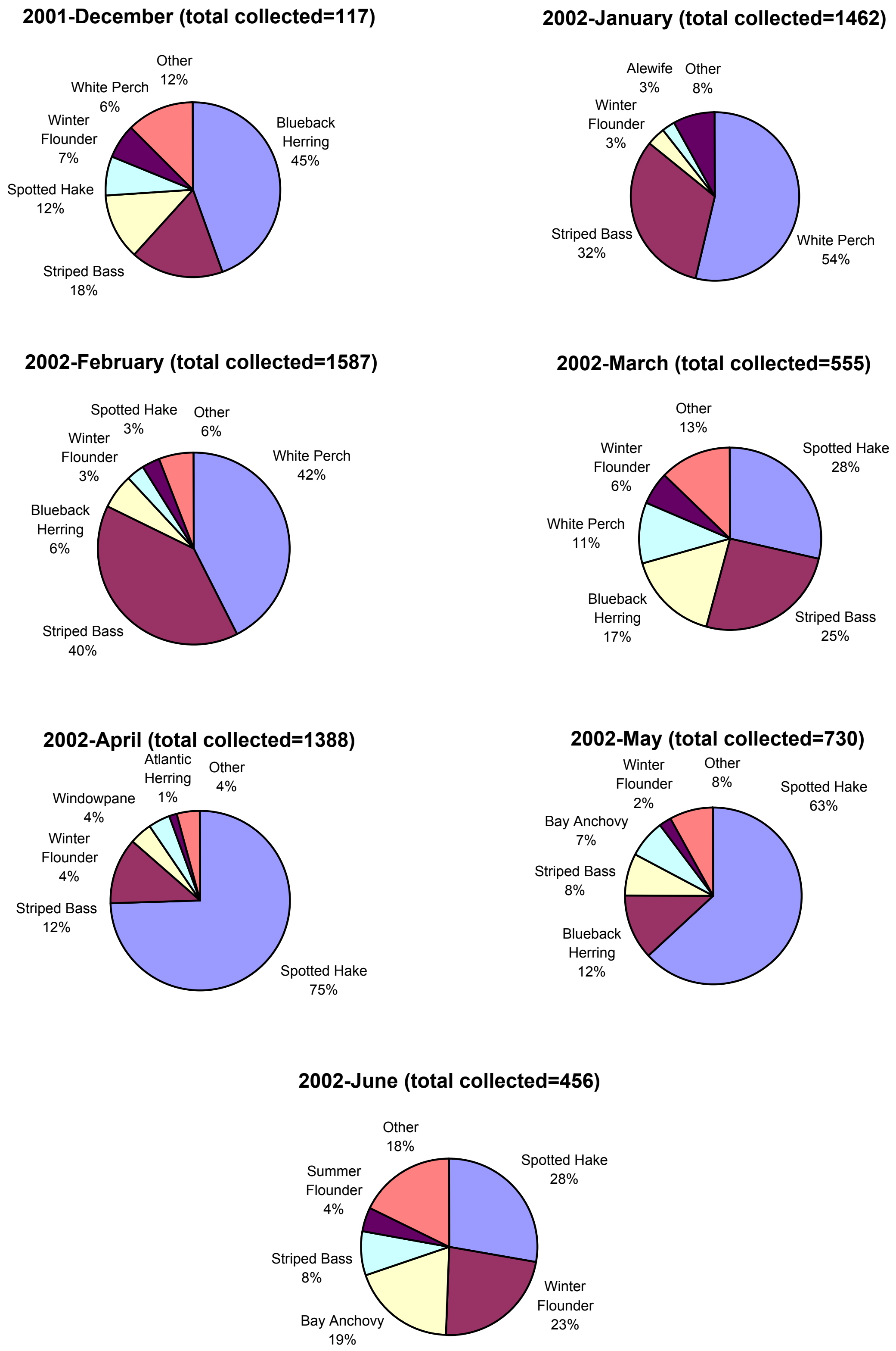


Figure 3-2 **Species composition of trawls conducted at the Arthur Kill/Newark Bay stations during the 2001-2002 Aquatic Biological Sampling Program.**

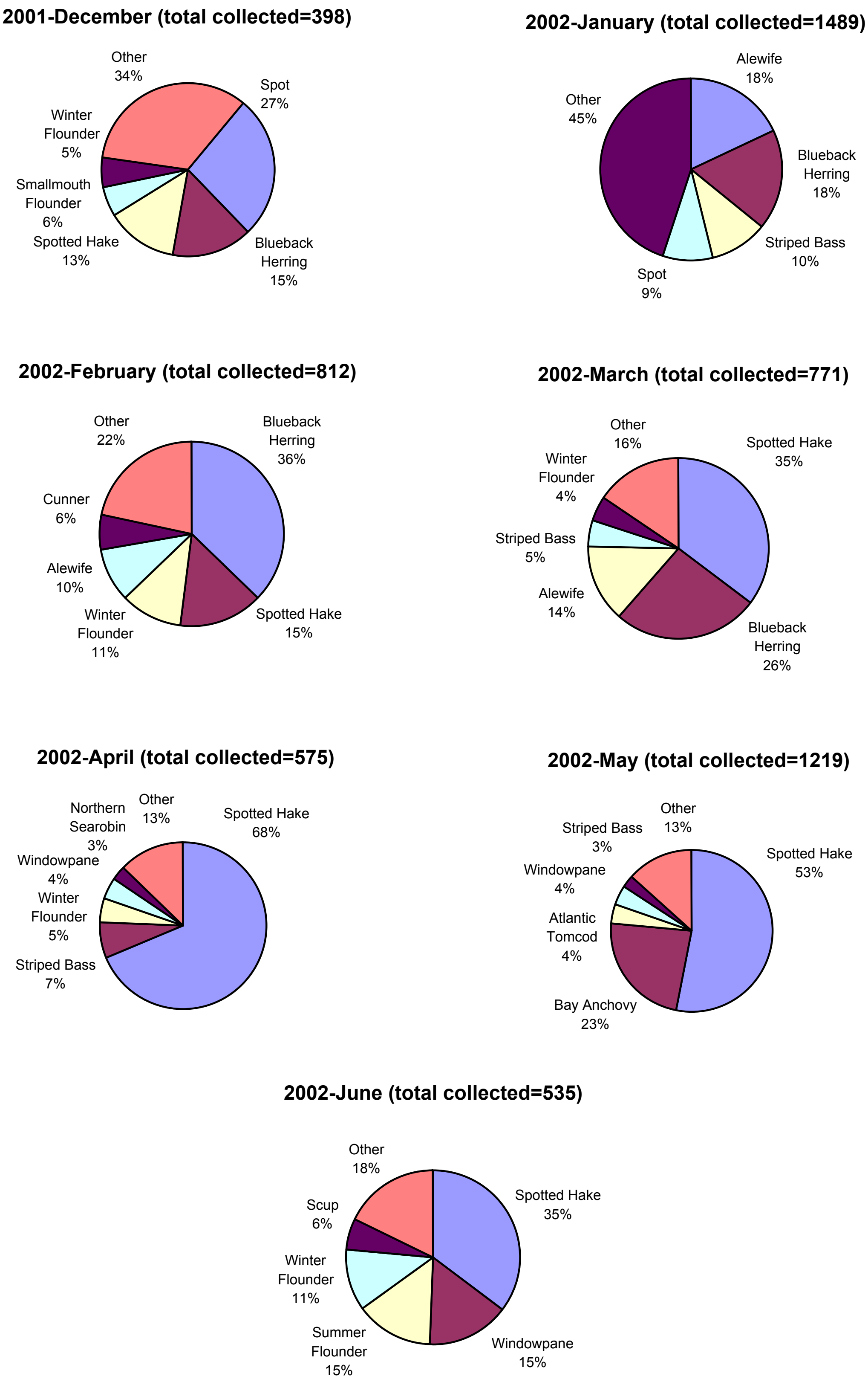


Figure 3-3 **Species composition of trawls conducted at the Upper Bay stations during the 2001-2002 Aquatic Biological Sampling Program.**

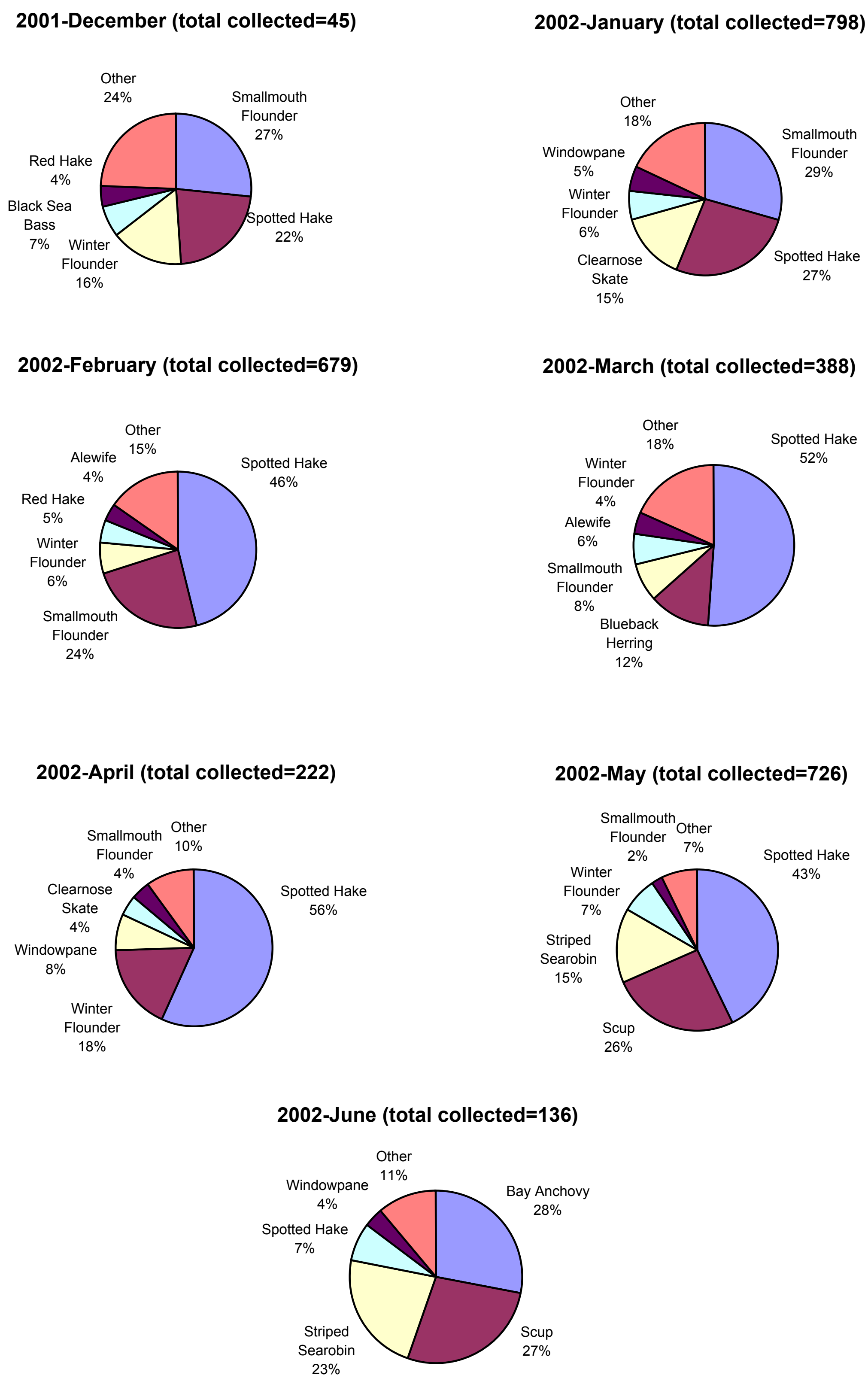


Figure 3-4 **Species composition of trawls conducted at the Lower Bay stations during the 2001-2002 Aquatic Biological Sampling Sampling Program.**

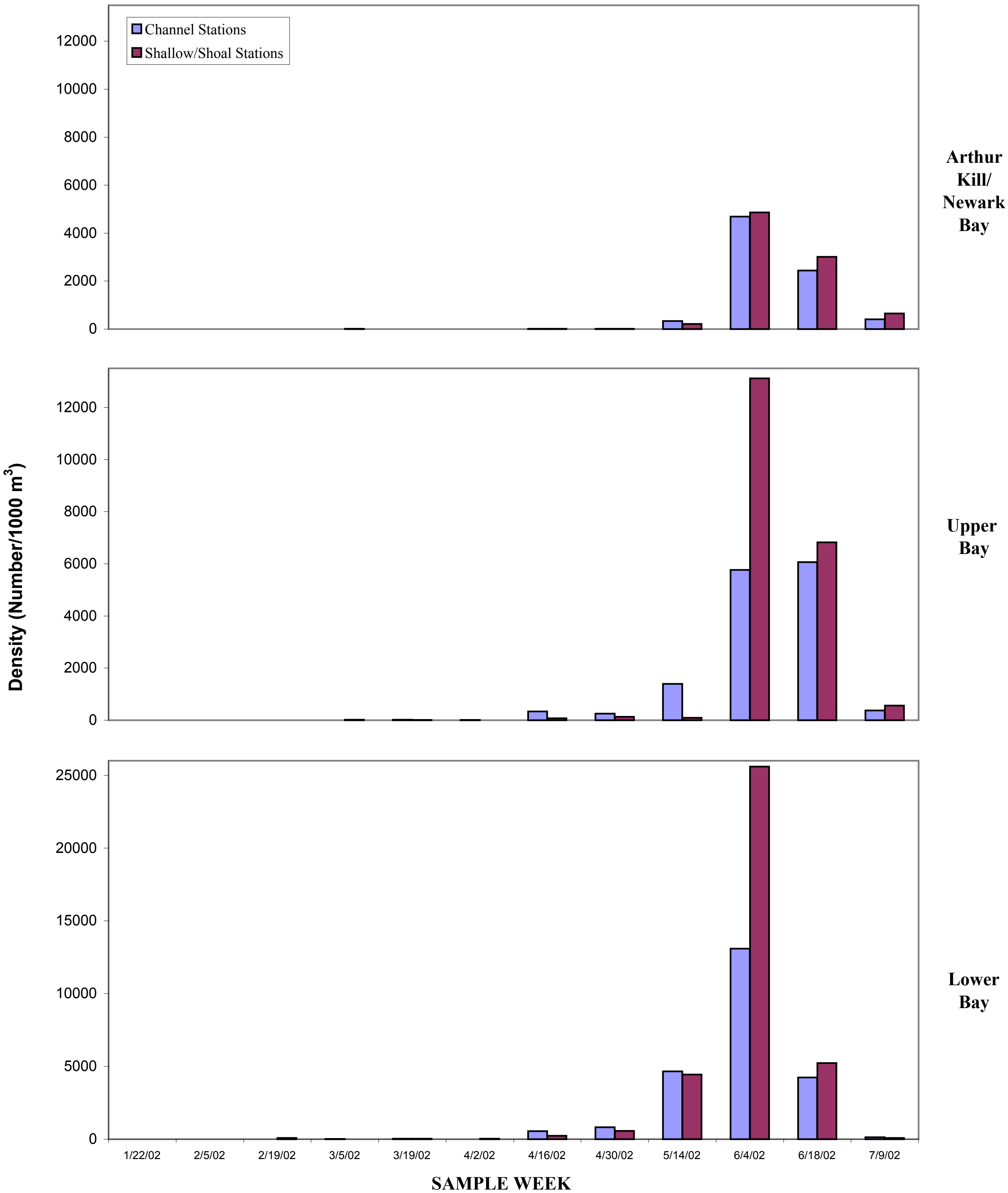


Figure 3-5 Average weekly egg density of all species combined at navigation channel and shallow/shoal stations in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.

Note(s): Note the scale change for Lower Bay. Dates listed indicate the first day of each sample week.

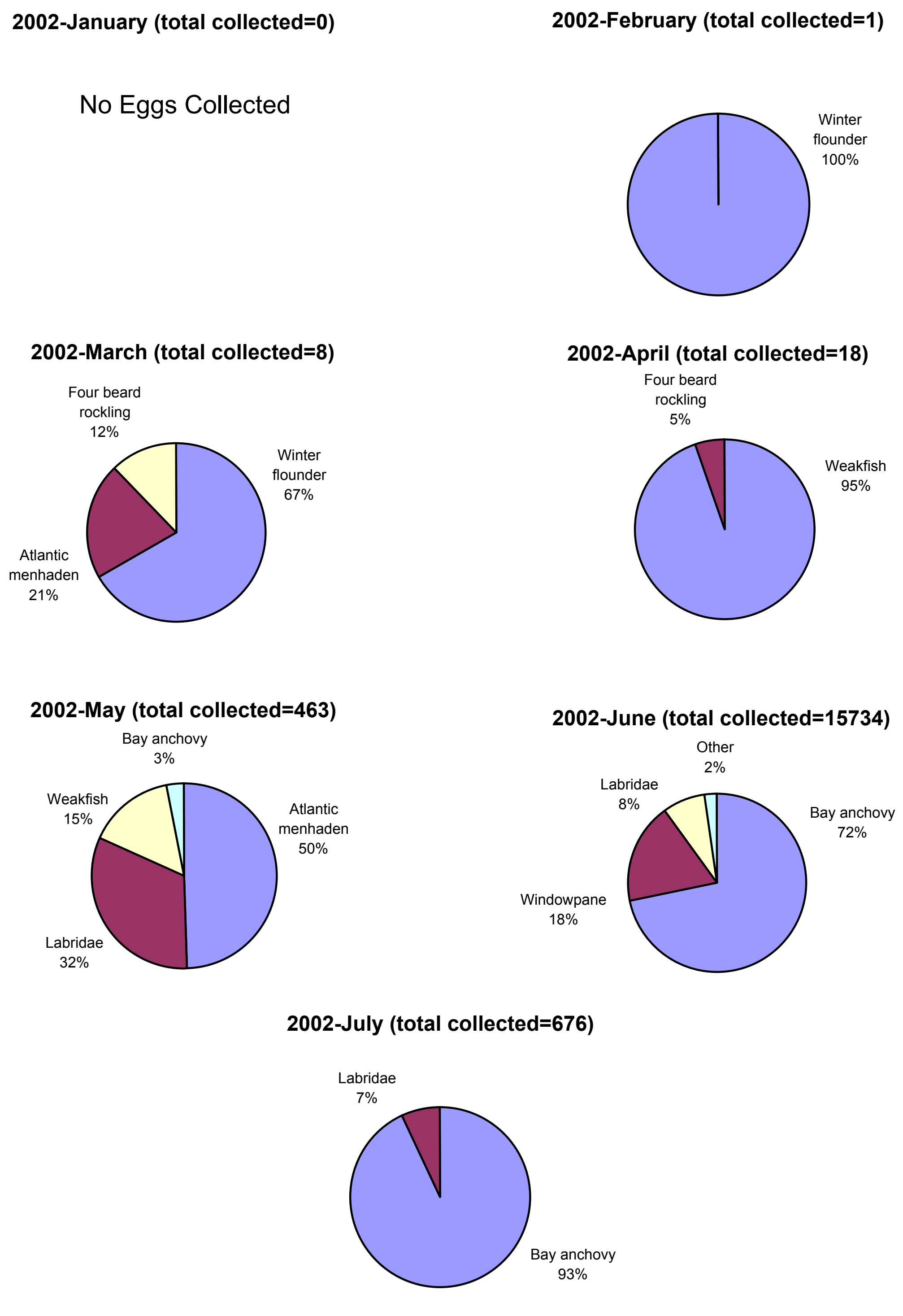


Figure 3-6 **Species composition of eggs collected at the Arthur Kill/Newark Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

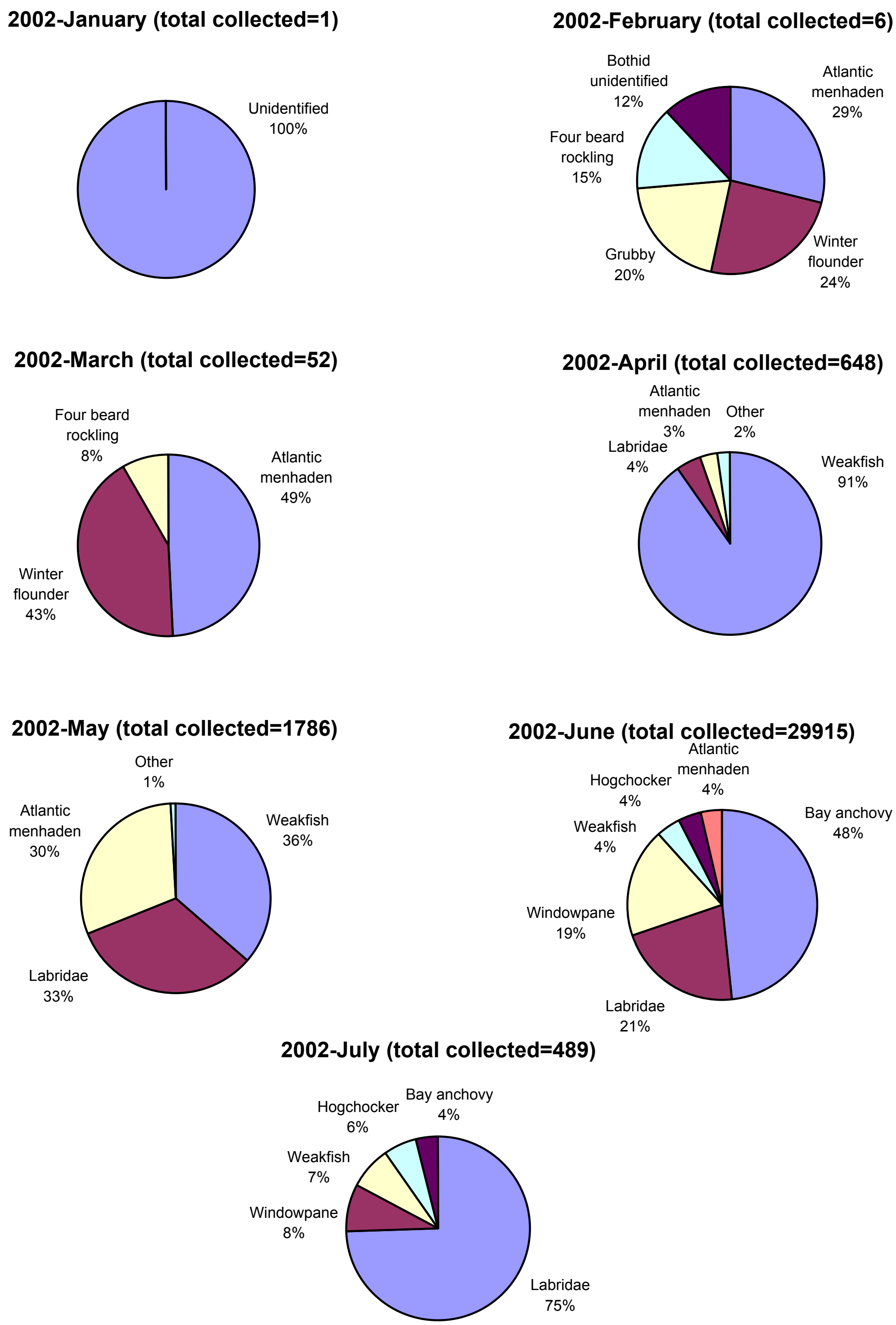


Figure 3-7 **Species composition of eggs collected at the Upper Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

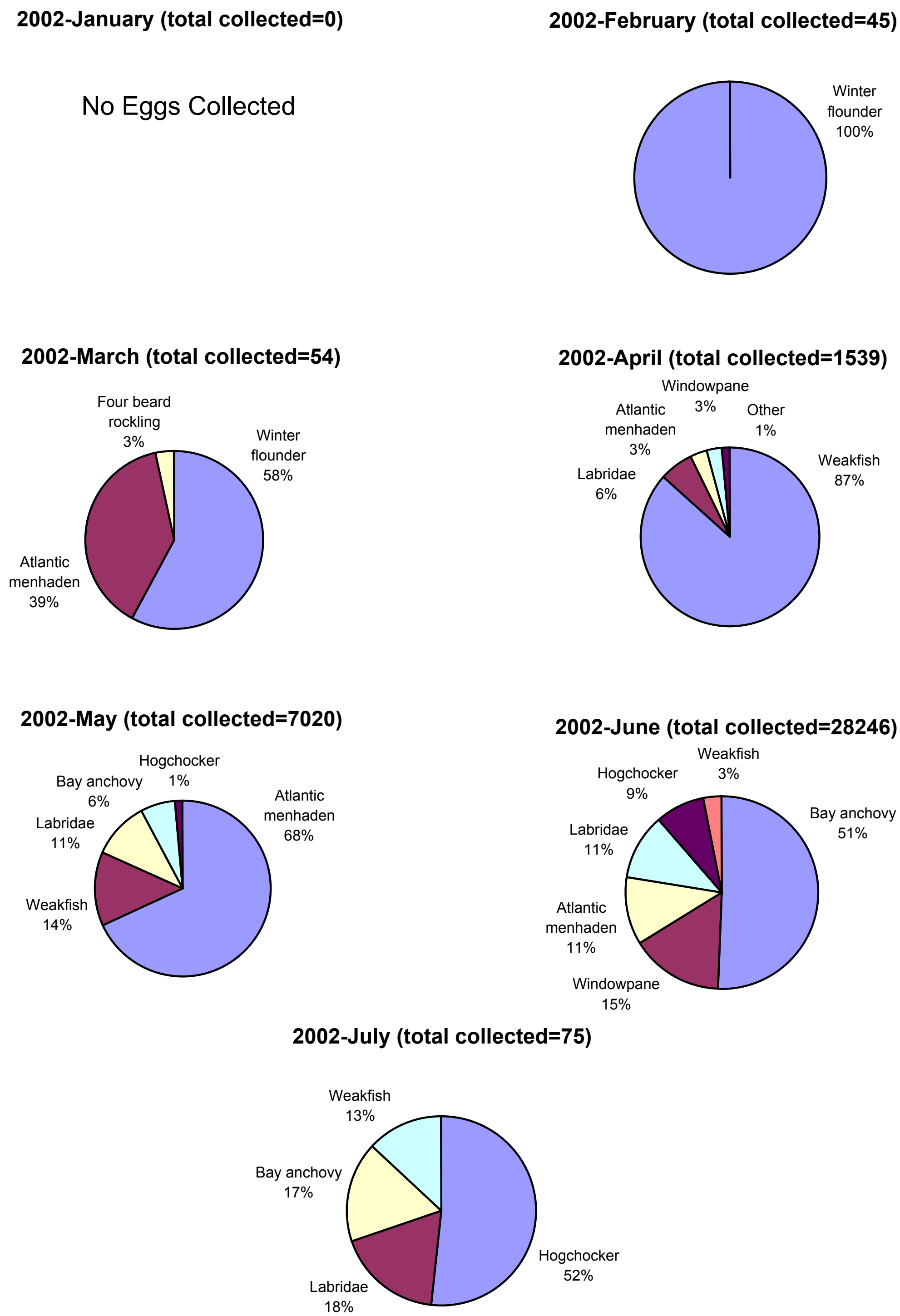


Figure 3-8 **Species composition of eggs collected at the Lower Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

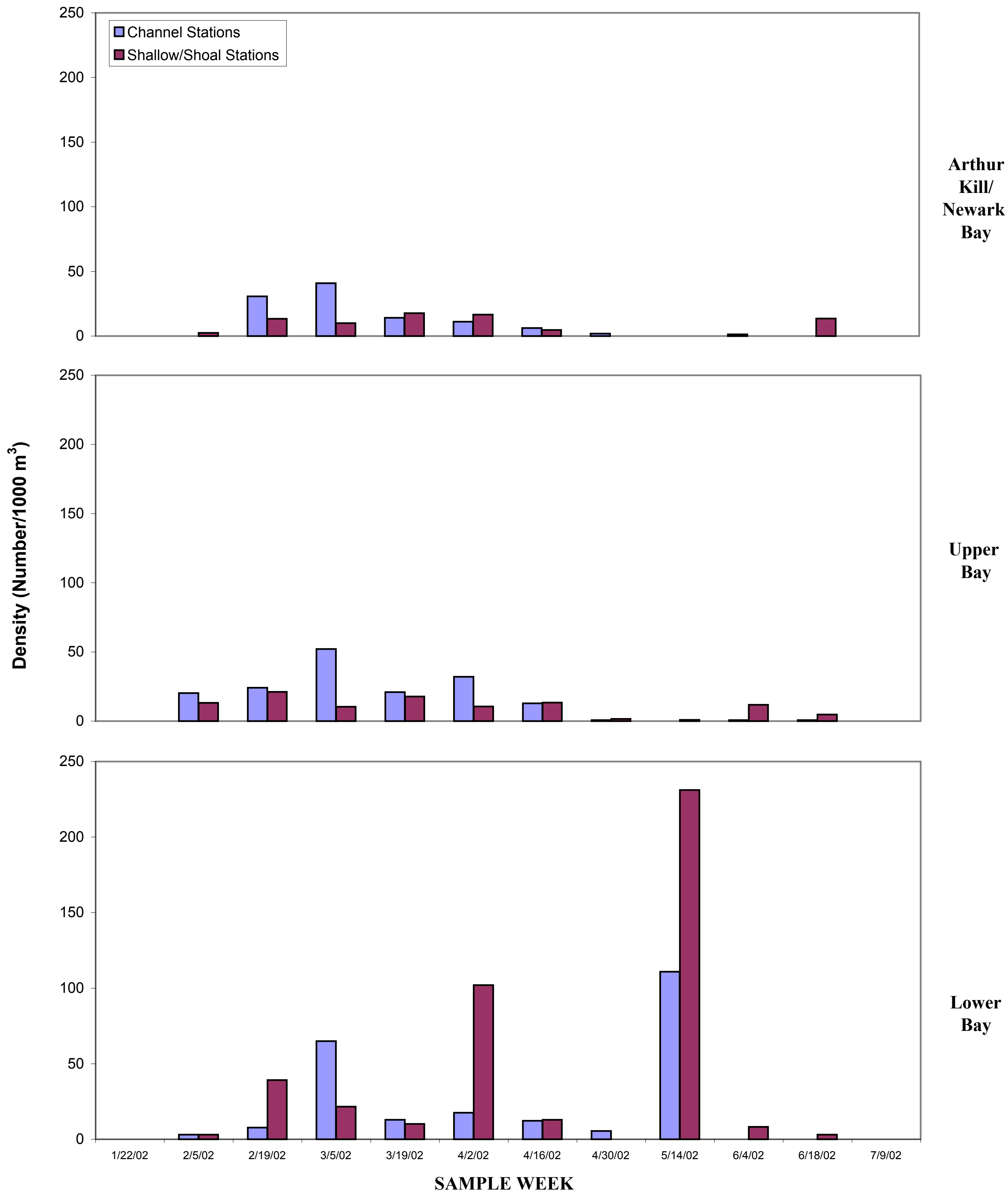


Figure 3-9 **Average weekly yolk-sac larvae density of all species combined at navigation channel and shallow/shoal stations in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week.

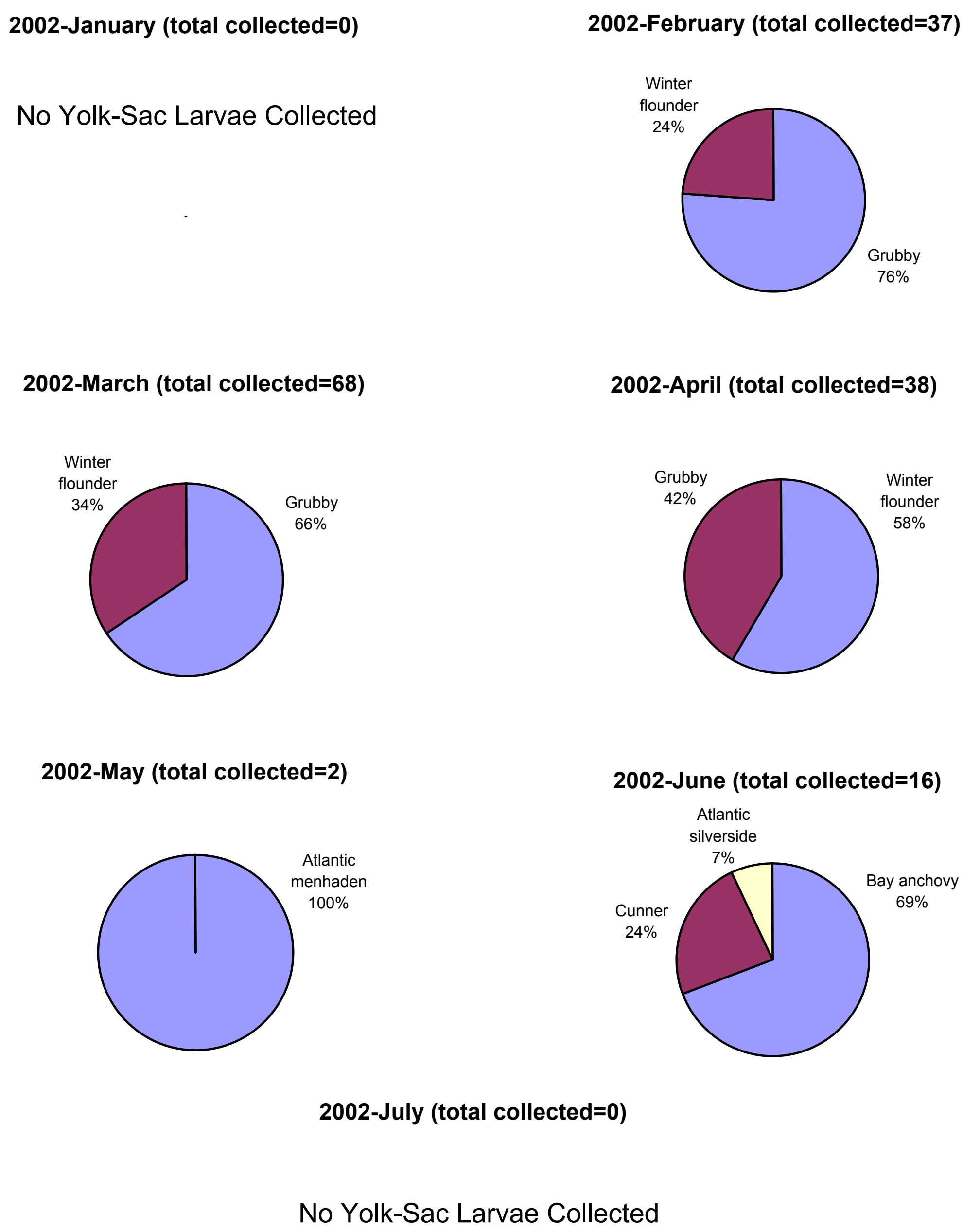


Figure 3-10 **Species composition of yolk-sac larvae collected at the Arthur Kill/Newark Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

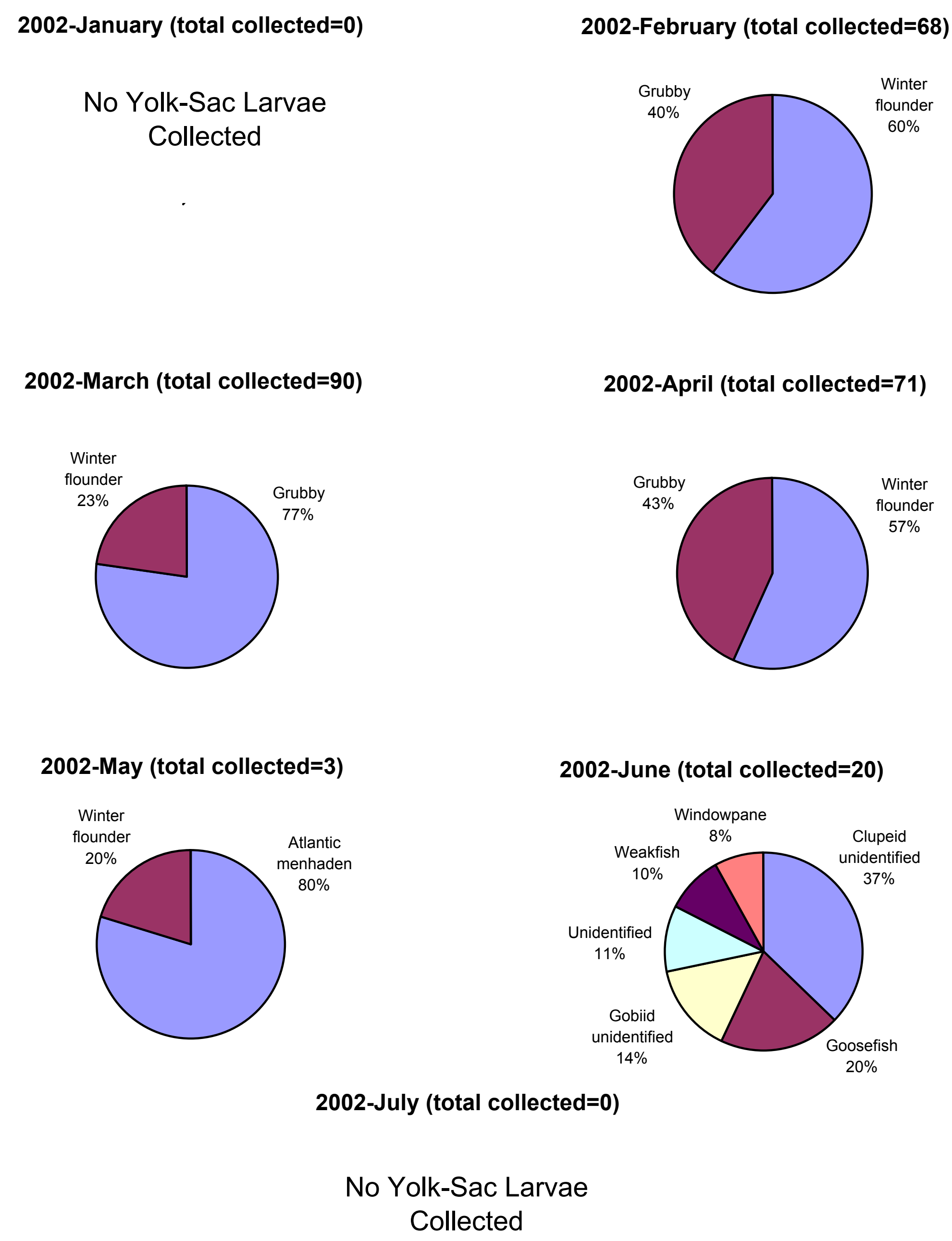


Figure 3-11 **Species composition of yolk-sac larvae collected at the Upper Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

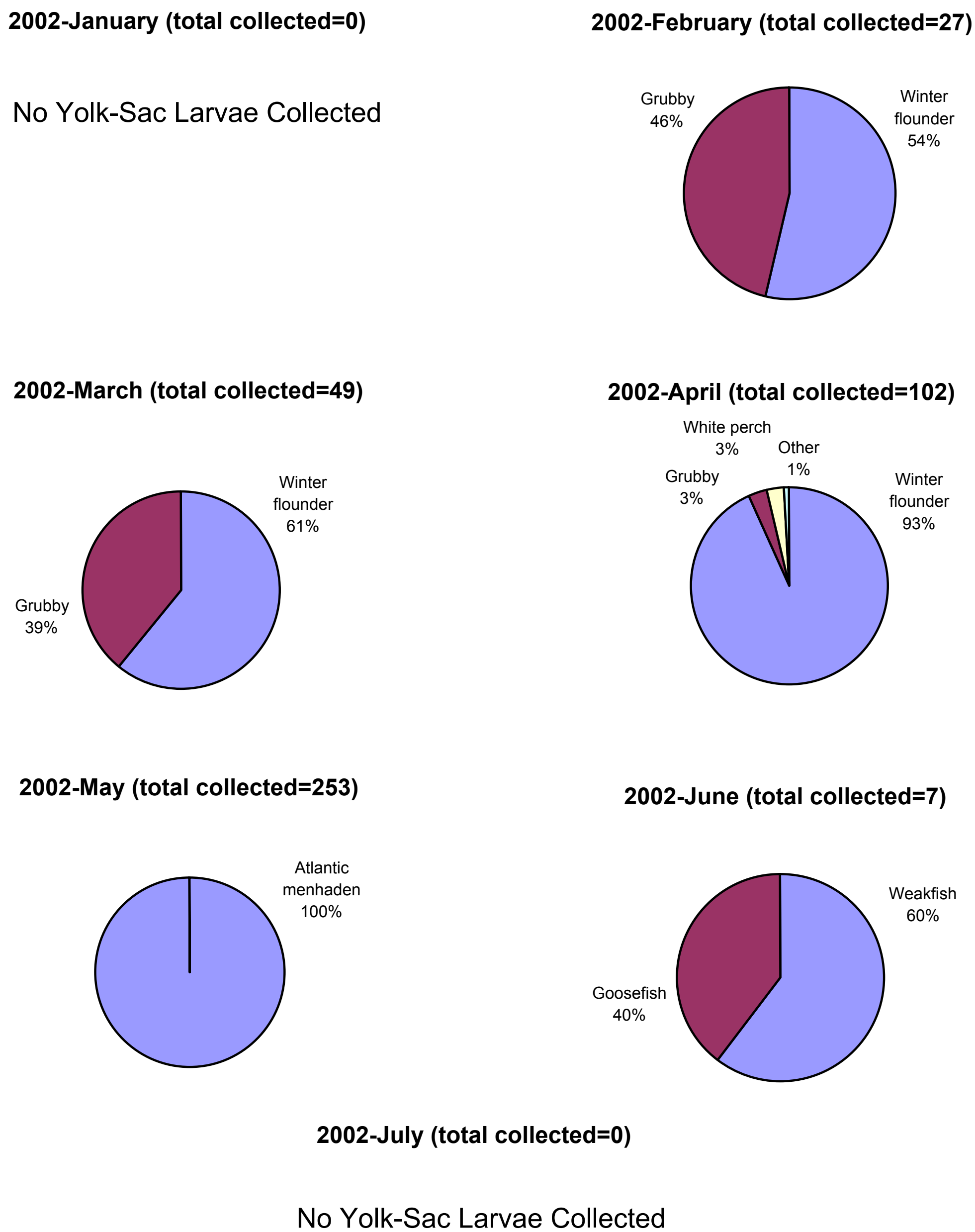


Figure 3-12 **Species composition of yolk-sac larvae collected at the Lower Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

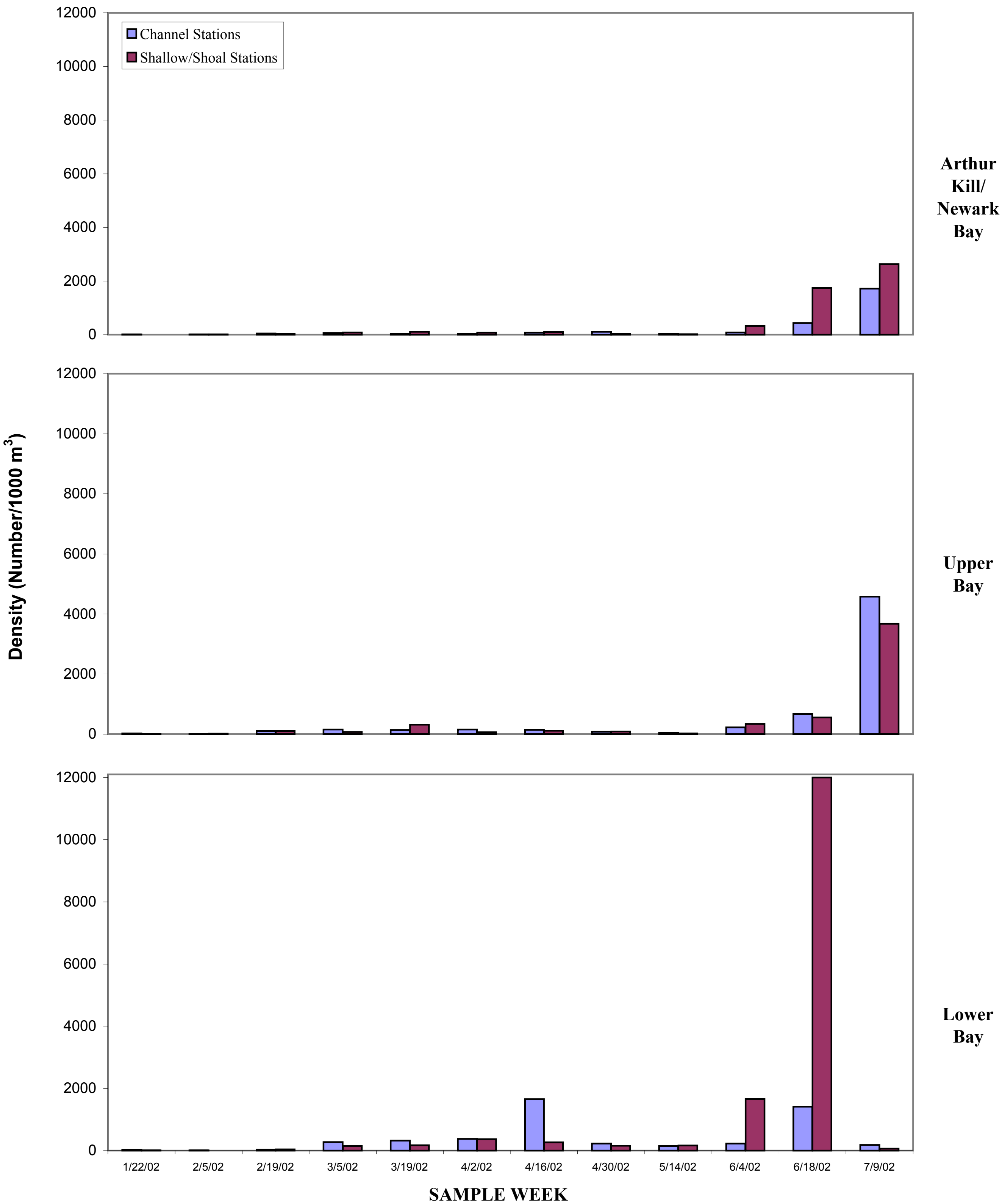


Figure 3-13 **Average weekly post yolk-sac larvae density of all species combined at navigation channel and shallow/shoal stations in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week.

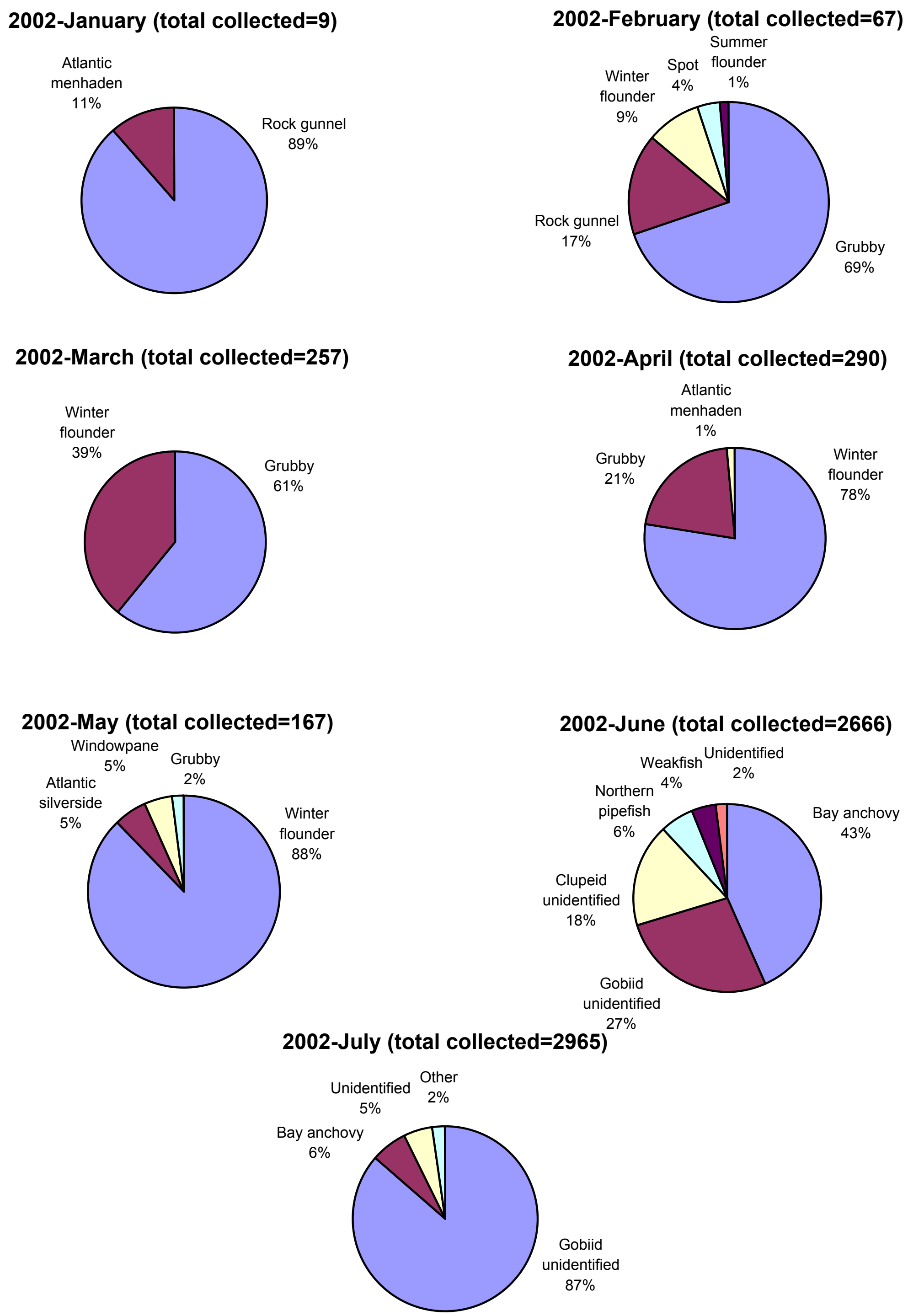


Figure 3-14 **Species composition of post yolk-sac larvae collected at the Arthur Kill/ Newark Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

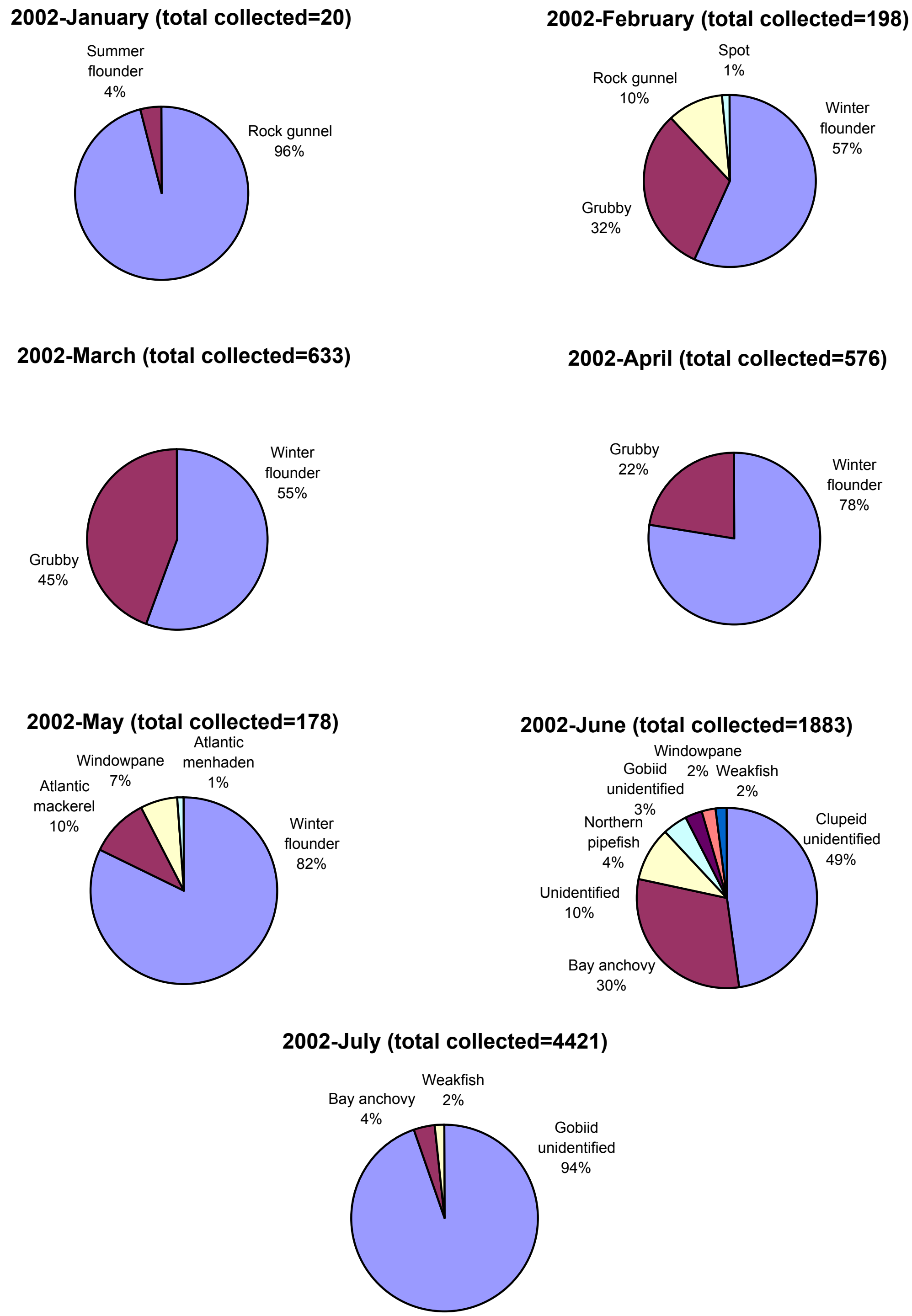


Figure 3-15 **Species composition of post yolk-sac larvae collected at the Upper Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

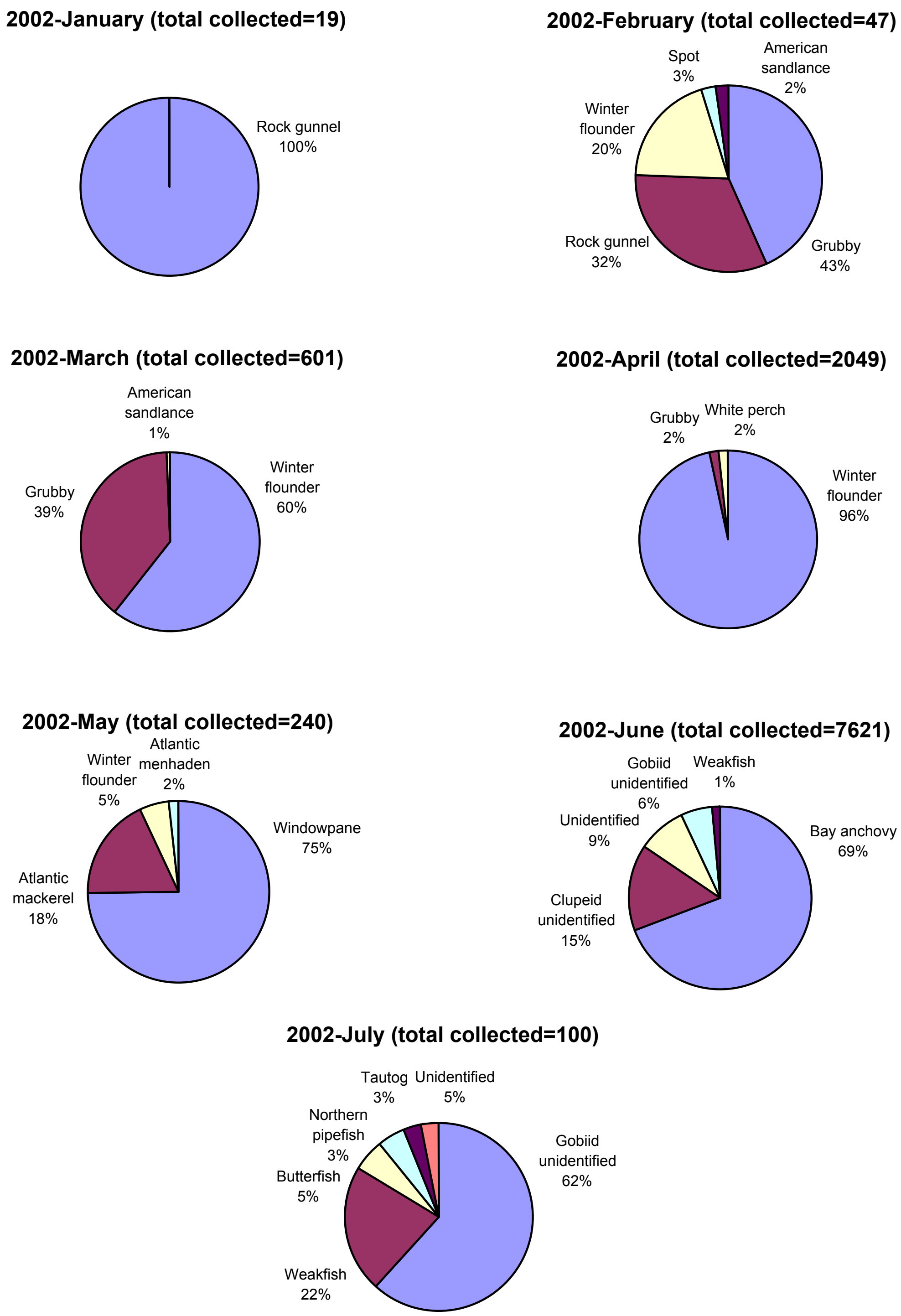


Figure 3-16 **Species composition of post yolk-sac larvae collected at the Lower Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

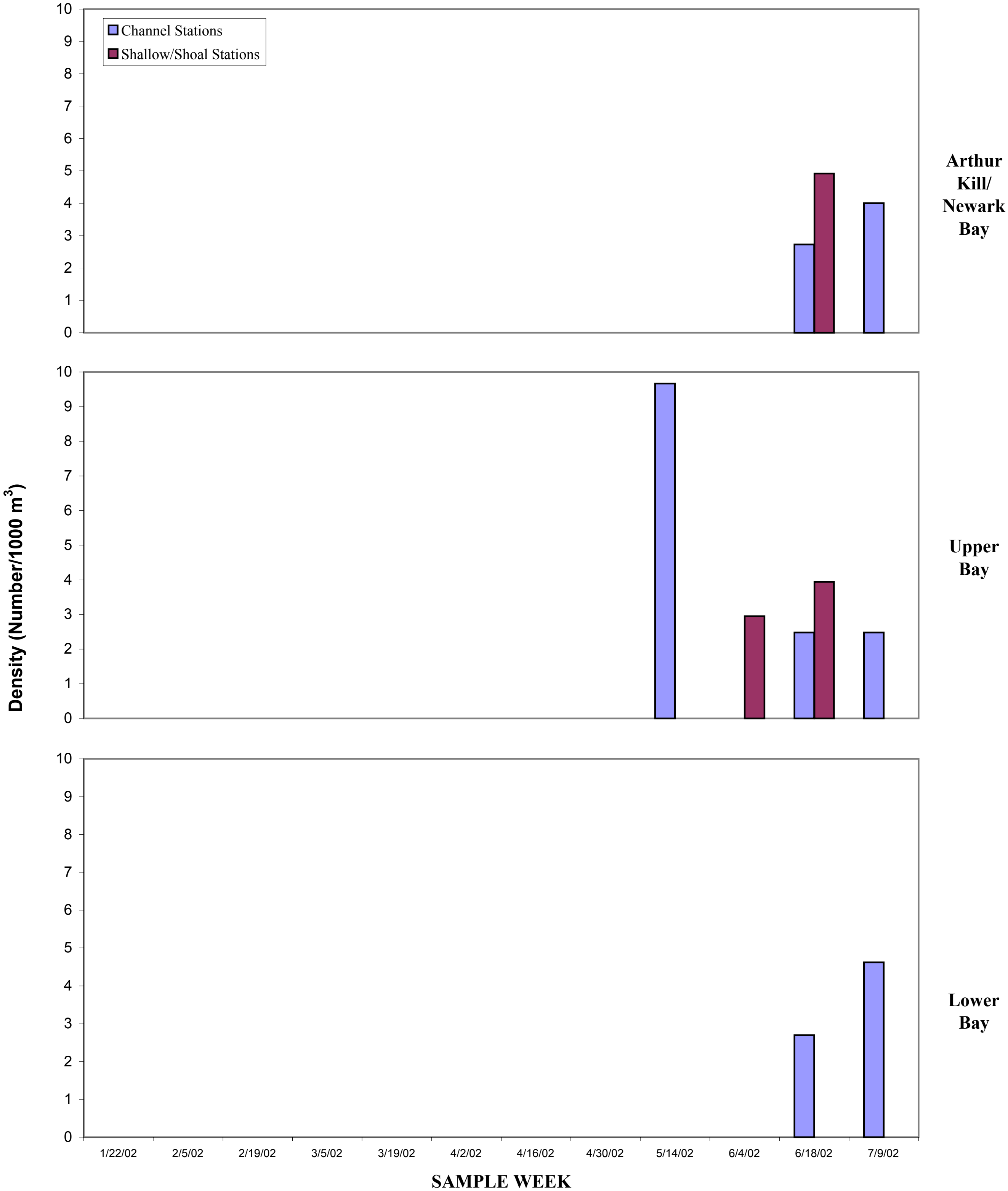


Figure 3-17 Average weekly juvenile density of all species combined at navigation channel and shallow/shoal stations in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.

Note(s): Dates listed indicate the first day of each sample week.

2002-January (total collected=0)

No Juveniles Collected

2002-February (total collected=0)

No Juveniles Collected

2002-March (total collected=0)

No Juveniles Collected

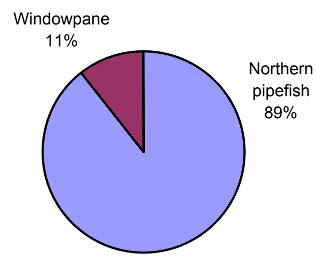
2002-April (total collected=0)

No Juveniles Collected

2002-May (total collected=0)

No Juveniles Collected

2002-June (total collected=8)



2002-July (total collected=2)

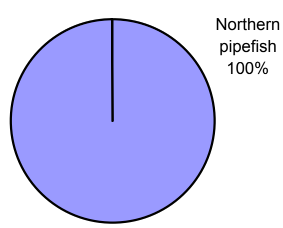


Figure 3-18 **Species composition of juveniles collected at the Arthur Kill/Newark Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

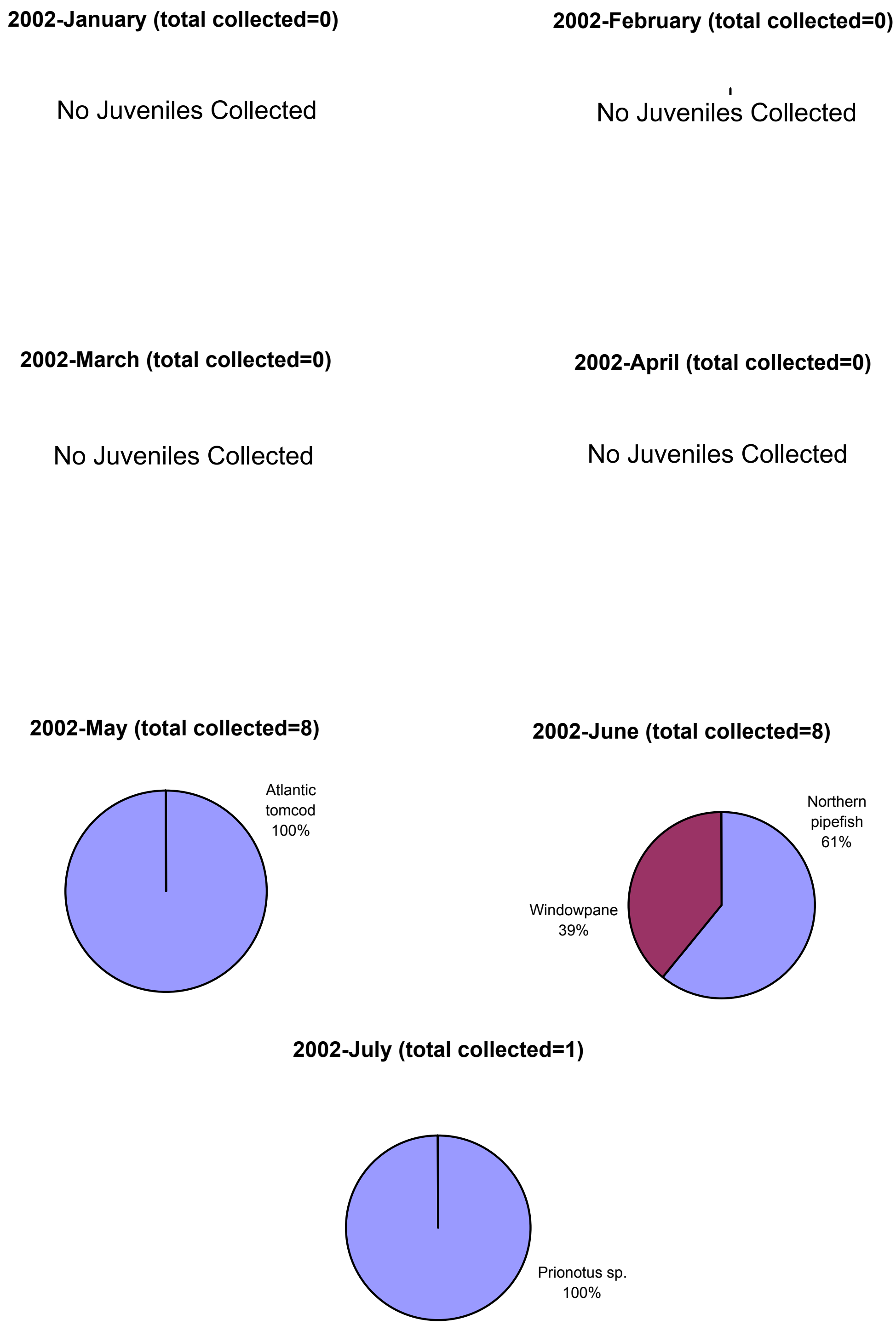


Figure 3-19 **Species composition of juveniles collected at the Upper Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

2002-January (total collected=0)

No Juveniles Collected

2002-February (total collected=0)

No Juveniles Collected

2002-March (total collected=0)

No Juveniles Collected

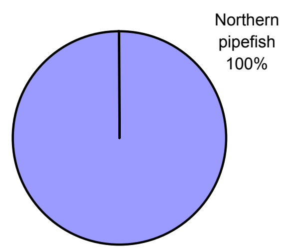
2002-April (total collected=0)

No Juveniles Collected

2002-May (total collected=0)

No Juveniles Collected

2002-June (total collected=1)



2002-July (total collected=2)

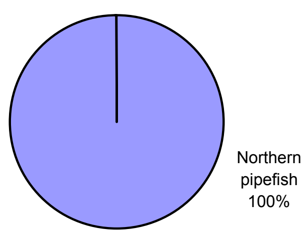


Figure 3-20 **Species composition of juveniles collected at the Lower Bay stations during the 2001-2002 Aquatic Biological Sampling Program. Density data were used to determine species composition.**

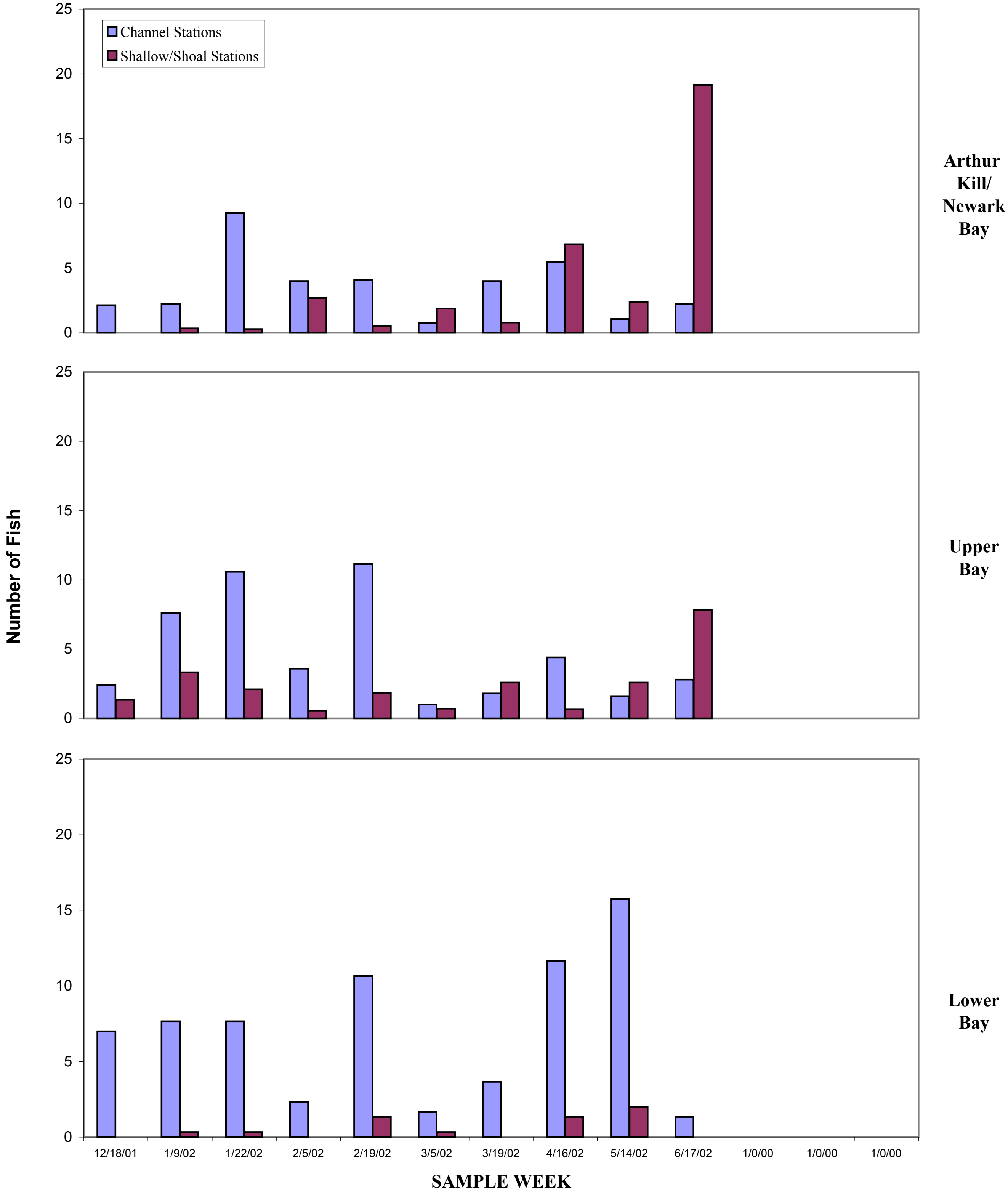


Figure 3-21 **Average weekly winter flounder trawl CPUE at navigation channel and shallow/shoal stations in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.**

note(s): Dates listed indicate the first day of each sample week.

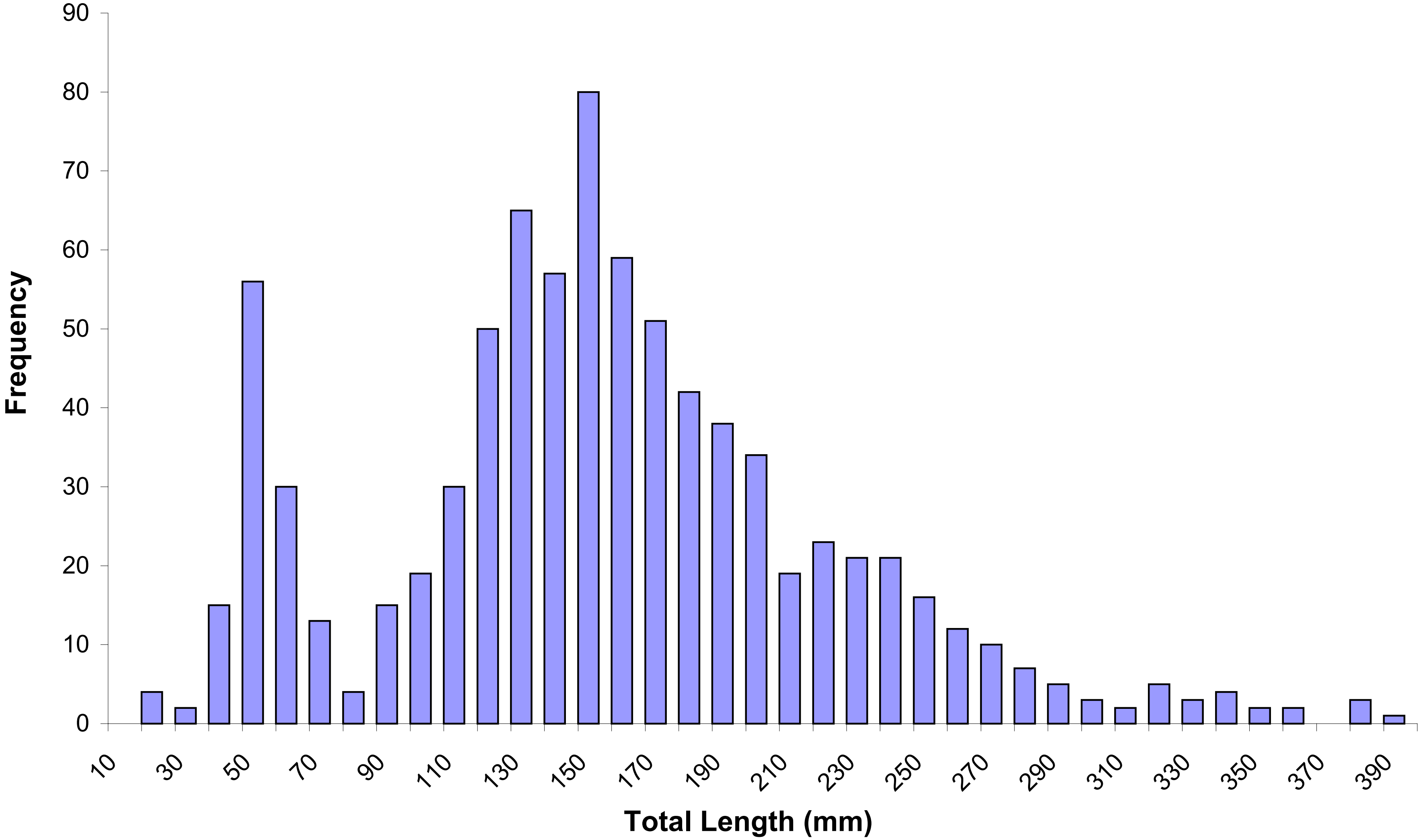


Figure 3-22 **Length frequency distrtibution of all winter flounder collected by bottom trawl during the 2001-2002 Aquatic Biological Sampling Program.**

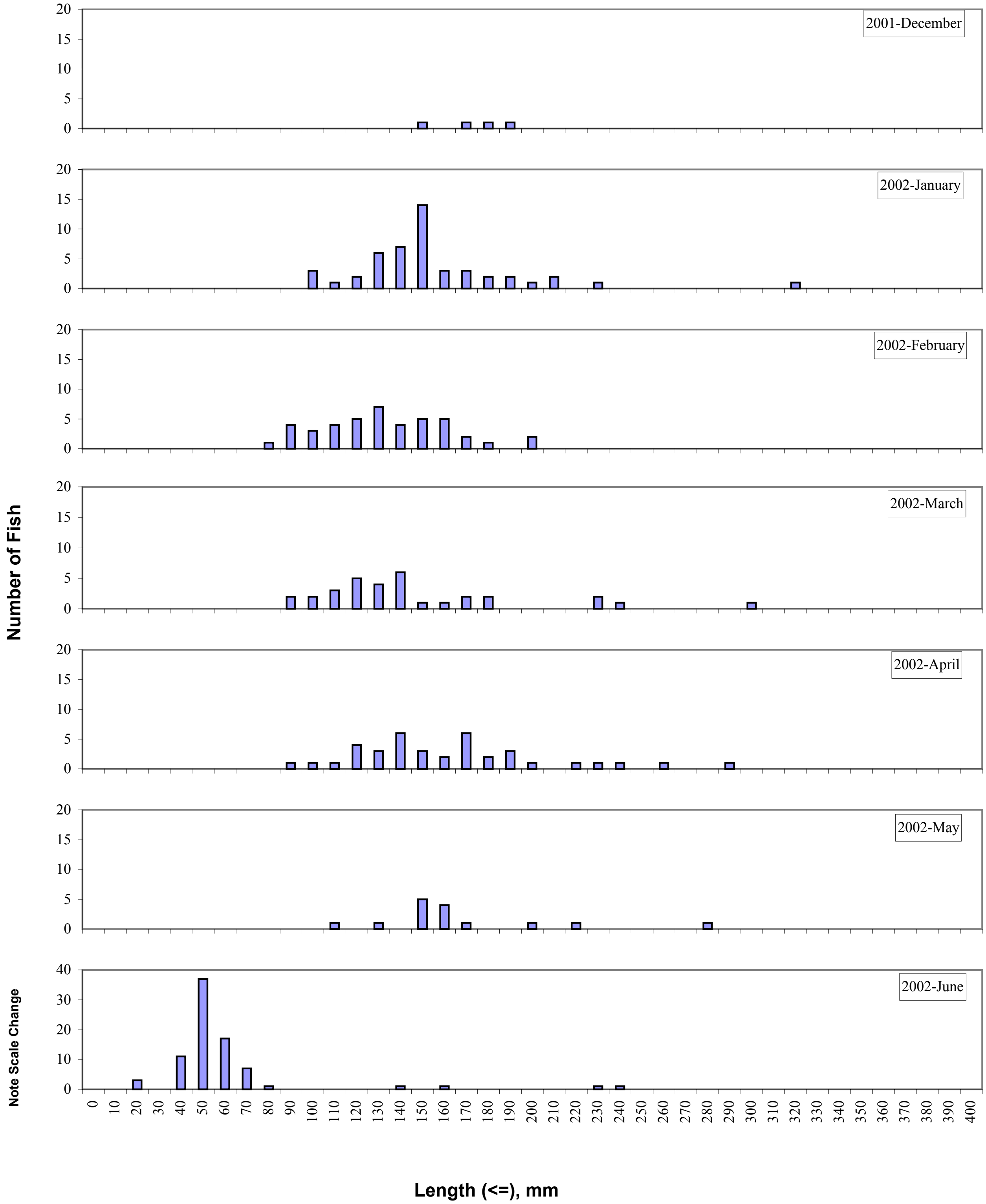


Figure 3-23 **Length frequency distribution for winter flounder collected by bottom trawl at the Arthur Kill/Newark Bay stations during the 2001-2002 Aquatic Biological Sampling Program.**

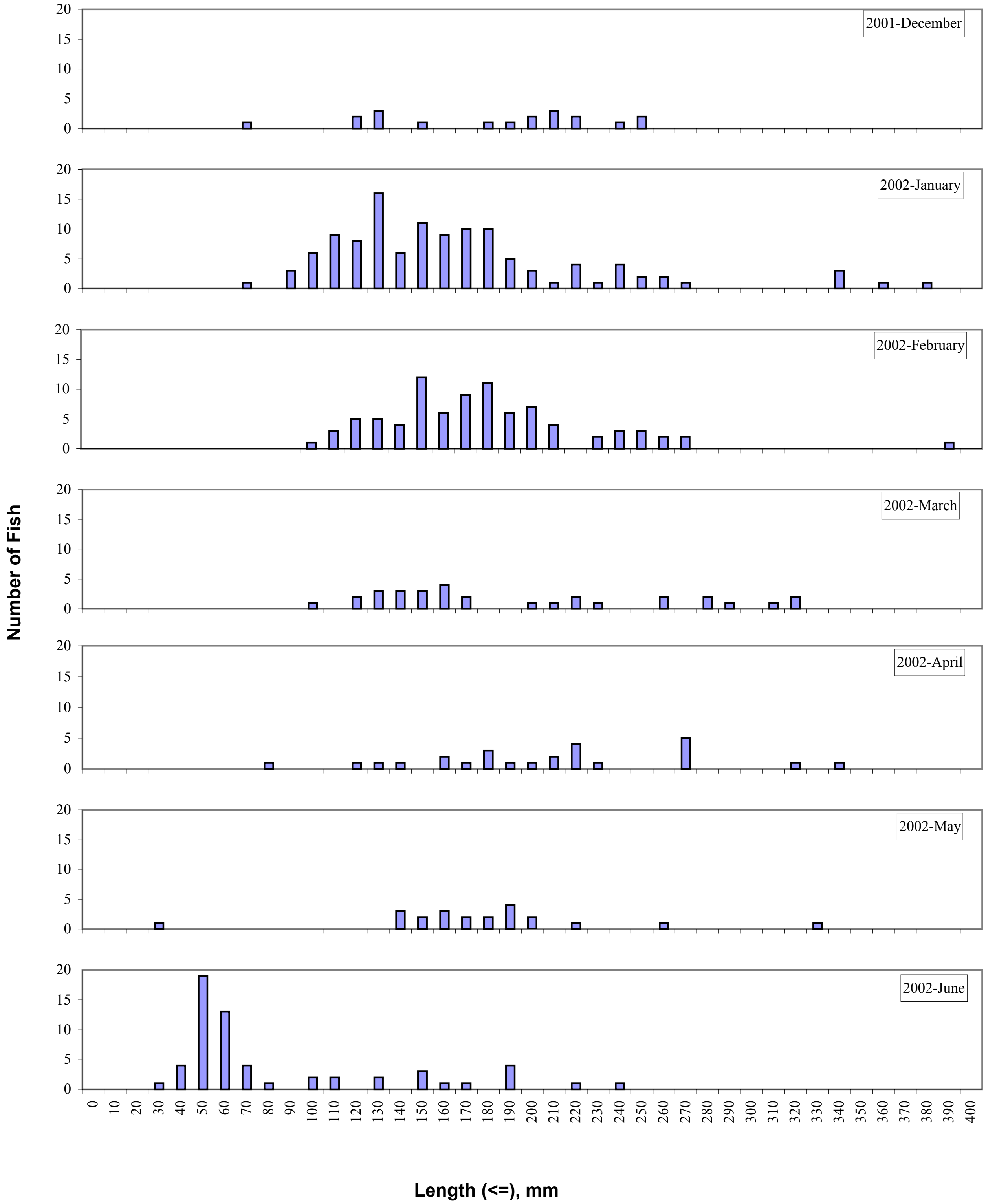


Figure 3-24 Length frequency distribution for winter flounder collected by bottom trawl at the Upper Bay stations during the 2001-2002 Aquatic Biological Sampling Program.

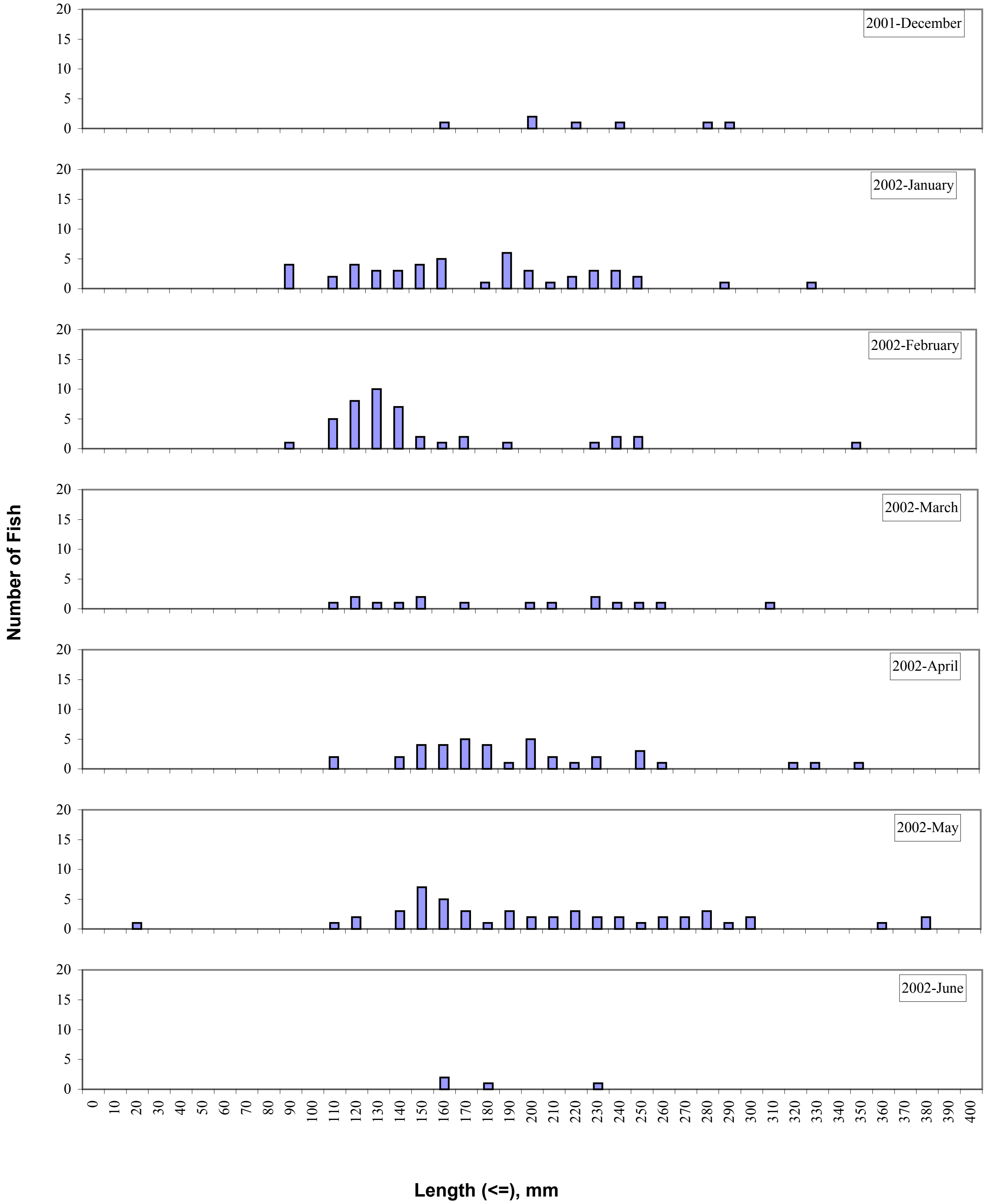


Figure 3-25 **Length frequency distribution for winter flounder collected by bottom trawl at the Lower Bay stations during the 2001-2002 Aquatic Biological Sampling Program.**

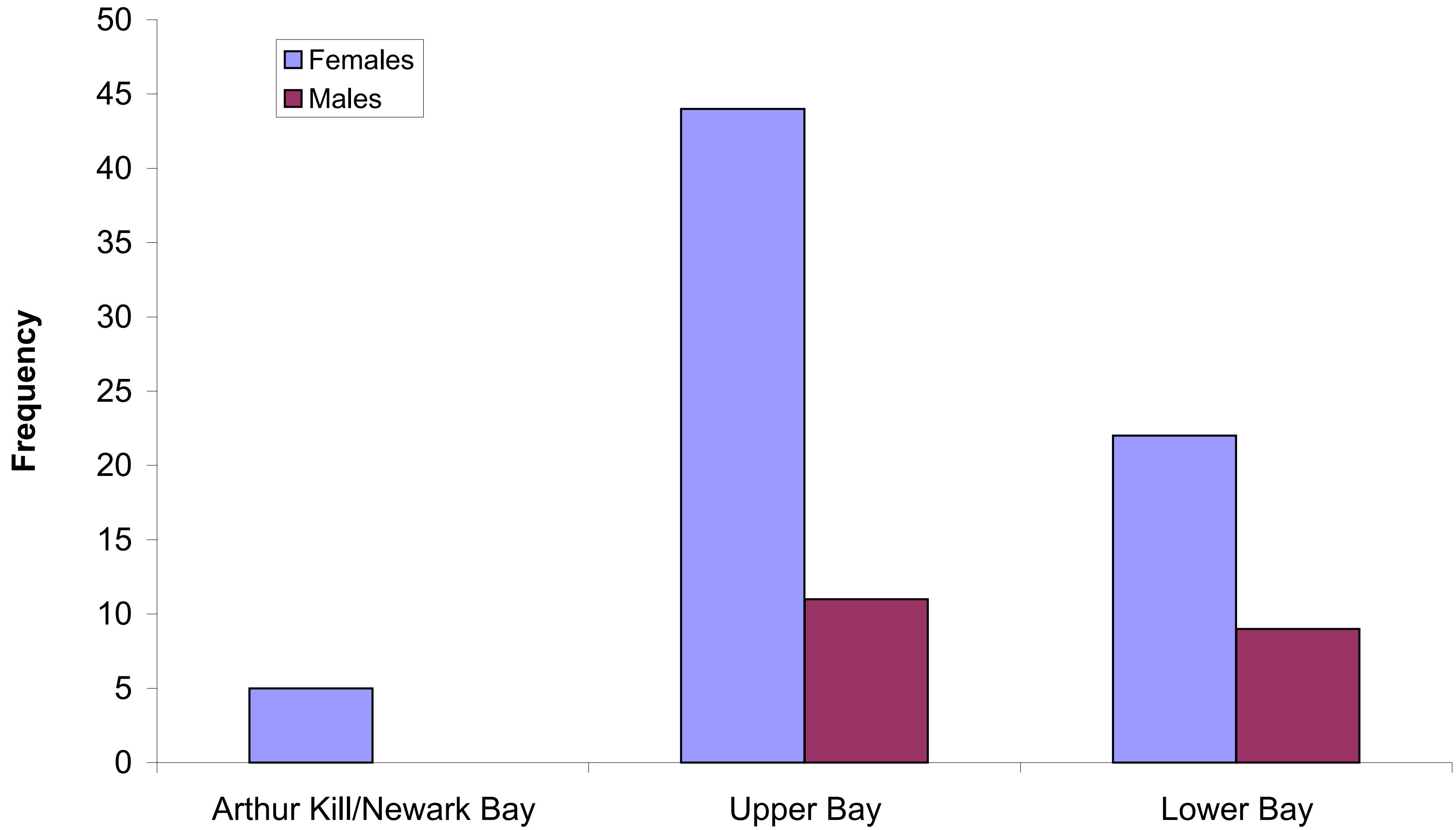


Figure 3-26 **Winter flounder sex frequency of adult fish collected in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.**

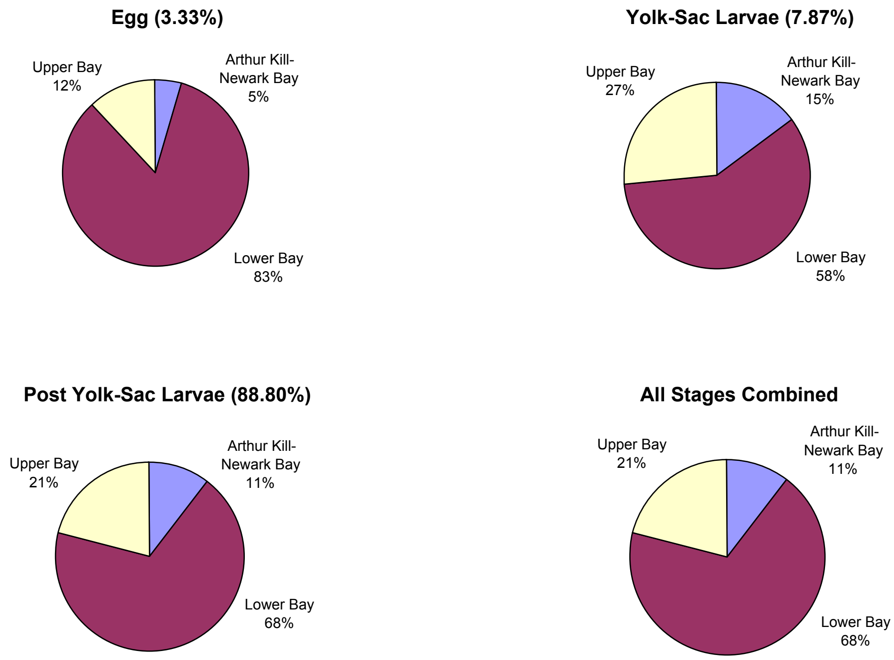


Figure 3-27 Percent composition of winter flounder early life stages in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.

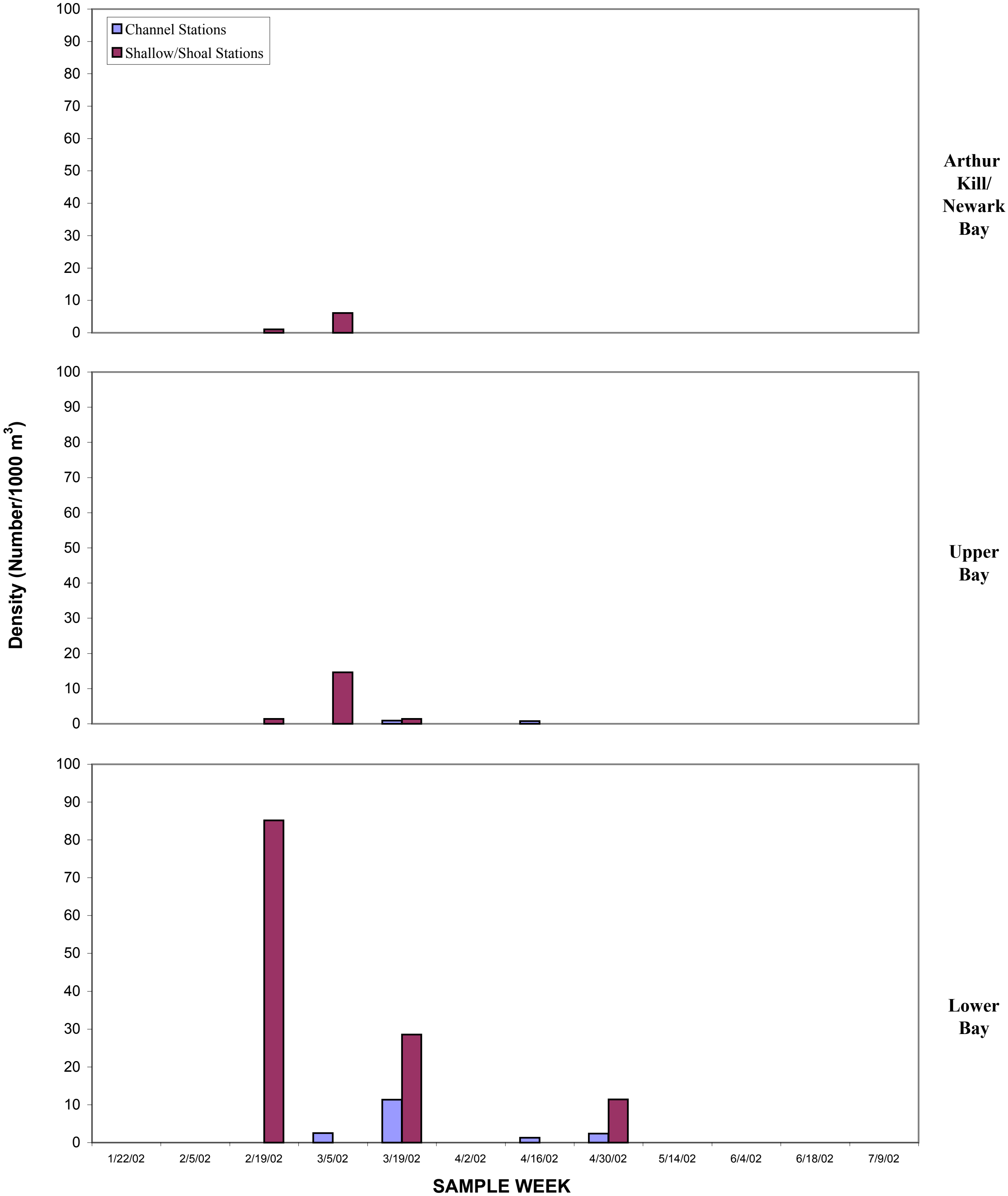


Figure 3-28 Average weekly winter flounder egg density at navigation channel and shallow/shoal stations in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.

Note(s): Dates listed indicate the first day of each sample week.

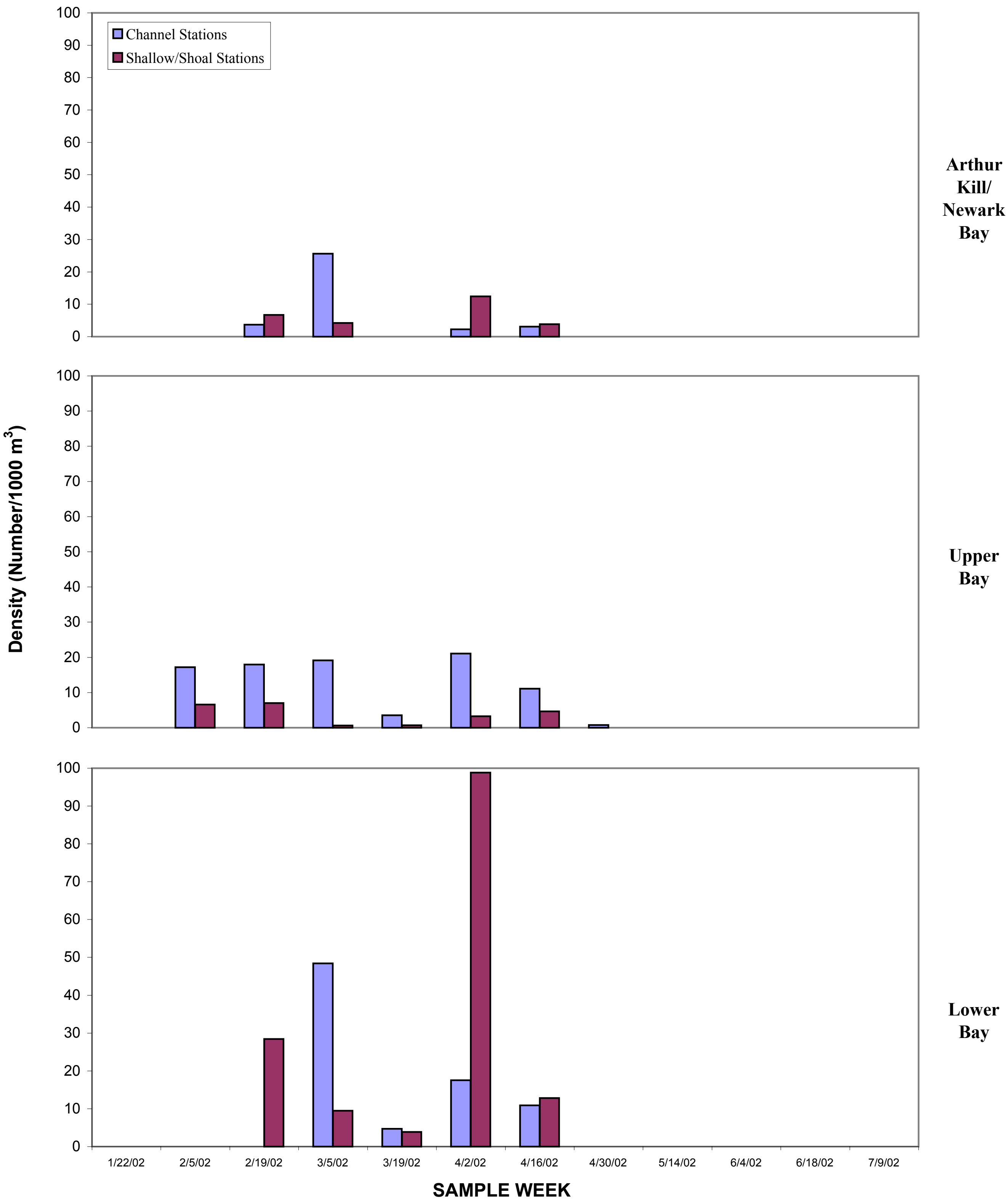


Figure 3-29 Average weekly winter flounder yolk-sac density at navigation channel and shallow/shoal stations in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.

Note(s): Dates listed indicate the first day of each sample week.

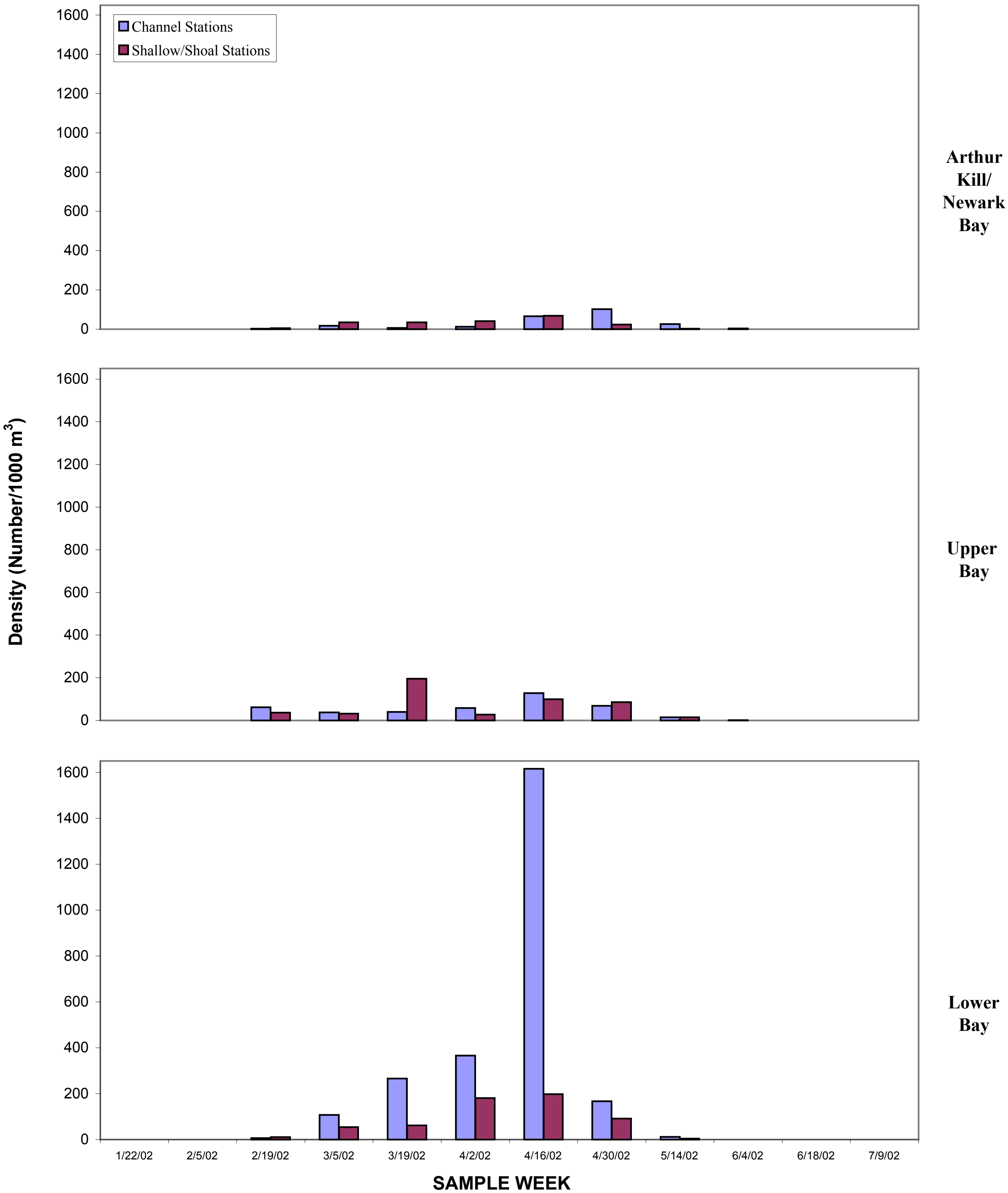


Figure 3-30 **Average weekly winter flounder post yolk-sac density at navigation channel and shallow/shoal stations in the three study areas during the 2001-2002 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week.

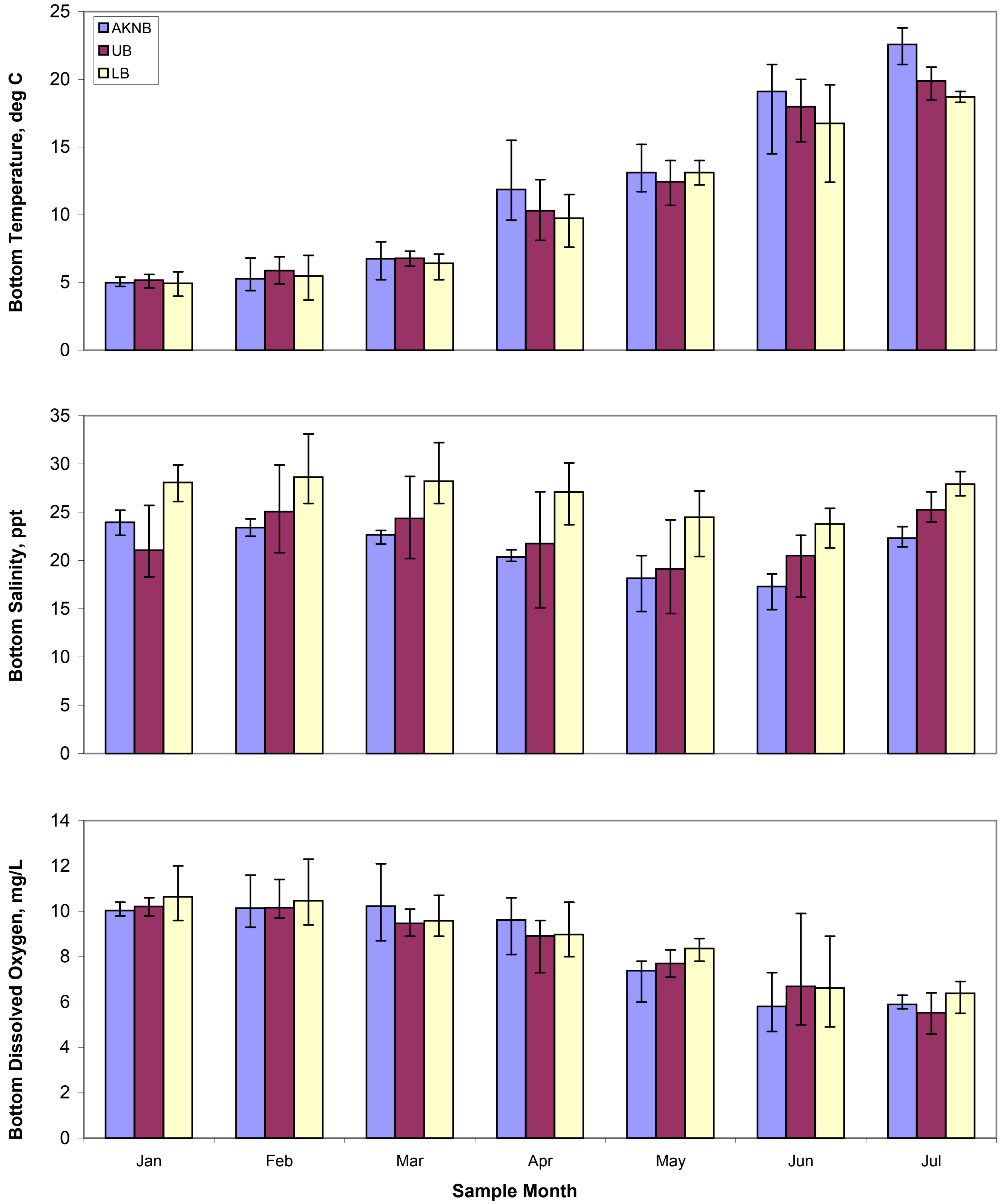


Figure 3-31 Average monthly water quality measurements by area in the three sampling areas during the 2001-2002 Aquatic Biological Sampling Program.

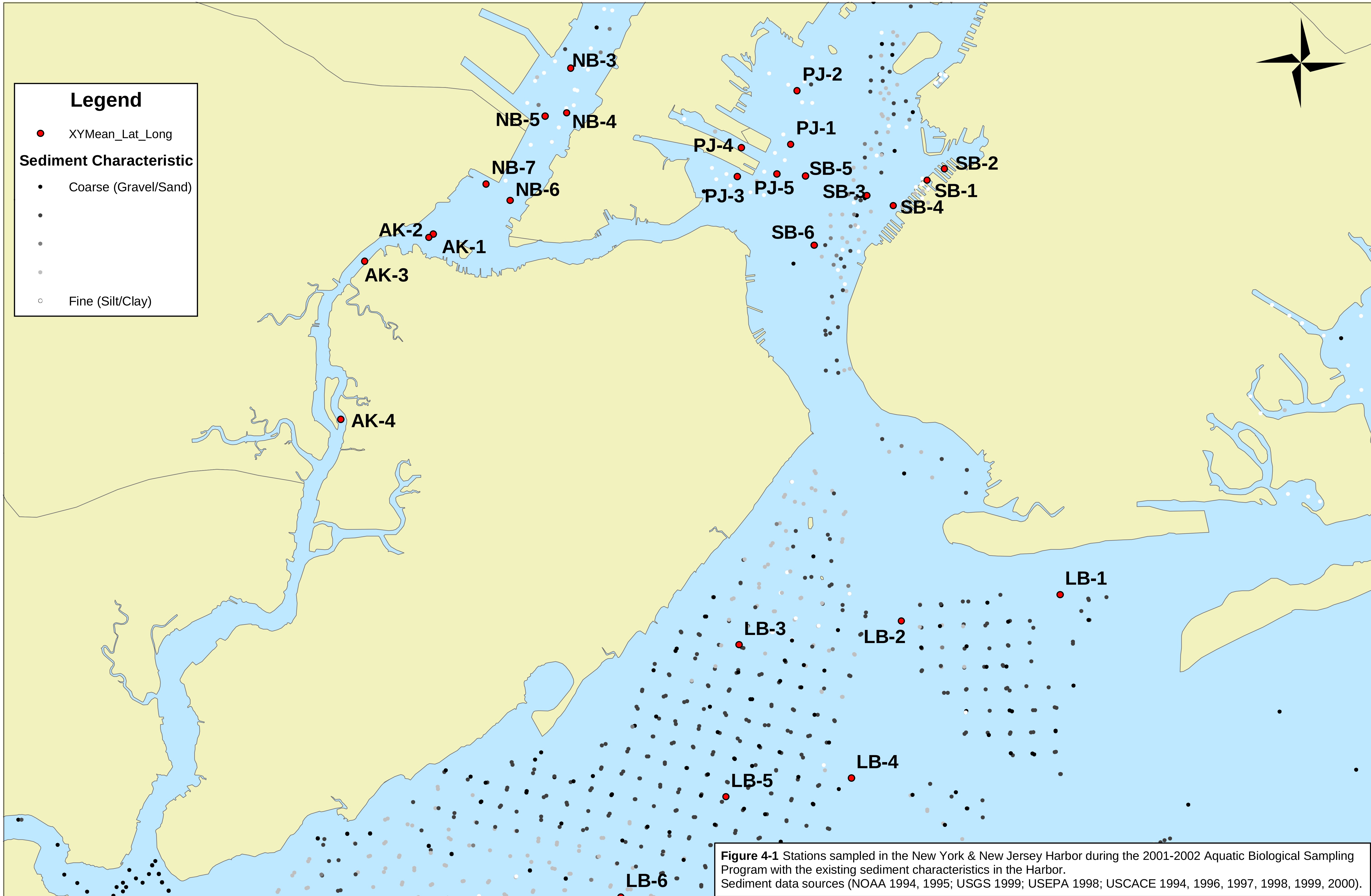


Figure 4-1 Stations sampled in the New York & New Jersey Harbor during the 2001-2002 Aquatic Biological Sampling Program with the existing sediment characteristics in the Harbor.
Sediment data sources (NOAA 1994, 1995; USGS 1999; USEPA 1998; USCACE 1994, 1996, 1997, 1998, 1999, 2000).

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 2 of 31)

Date	Station	Common Name	CPUE
12/18/2001	SB-1	Striped Bass	1
12/18/2001	SB-2	Clearnose Skate	2
12/18/2001	SB-2	Smallmouth Flounder	1
12/18/2001	SB-2	Spot	30
12/18/2001	SB-2	Spotted Hake	5
12/18/2001	SB-2	Striped Bass	1
12/18/2001	SB-2	Winter Flounder	1
12/19/2001	AK-3	Alewife	1
12/19/2001	AK-3	American Shad	1
12/19/2001	AK-3	Bay Anchovy	1
12/19/2001	AK-3	Blueback Herring	18
12/19/2001	AK-3	Spotted Hake	5
12/19/2001	AK-3	Striped Bass	8
12/19/2001	AK-3	Weakfish	2
12/19/2001	AK-3	White Perch	3
12/19/2001	AK-3	Winter Flounder	3
12/19/2001	AK-4	Blueback Herring	4
12/19/2001	NB-5	Blueback Herring	3
12/19/2001	SB-3	Red Hake	1
12/19/2001	SB-3	Smallmouth Flounder	2
12/19/2001	SB-3	Spotted Hake	2
12/19/2001	SB-3	Striped Bass	3
12/19/2001	SB-3	Winter Flounder	3
12/19/2001	SB-4	American Shad	1
12/19/2001	SB-4	Blueback Herring	5
12/19/2001	SB-4	Clearnose Skate	5
12/19/2001	SB-4	Silver Hake	1
12/19/2001	SB-4	Spot	1
12/19/2001	SB-4	Spotted Hake	27
12/19/2001	SB-4	Weakfish	8
12/19/2001	SB-4	Windowpane	13
12/19/2001	SB-4	Winter Flounder	4
12/19/2001	SB-5	Blueback Herring	1
12/19/2001	SB-5	Spotted Hake	2
12/19/2001	SB-5	Windowpane	1
12/19/2001	SB-5	Winter Flounder	6
12/19/2001	SB-6	Red Hake	1
12/20/2001	AK-2	Spotted Hake	2
12/20/2001	AK-2	Windowpane	2
12/20/2001	AK-2	Winter Flounder	1
12/21/2001	LB-1	Spotted Hake	1
12/21/2001	LB-2	Alewife	2
12/21/2001	LB-2	Black Sea Bass	3
12/21/2001	LB-2	Cunner	2
12/21/2001	LB-2	Fourspot Flounder	1
12/21/2001	LB-2	Grubby	1
12/21/2001	LB-2	Naked Goby	1
12/21/2001	LB-2	Northern Pipefish	1
12/21/2001	LB-2	Northern Searobin	2
12/21/2001	LB-2	Red Hake	2

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 3 of 31)

Date	Station	Common Name	CPUE
12/21/2001	LB-2	Smallmouth Flounder	12
12/21/2001	LB-2	Spotted Hake	9
12/21/2001	LB-2	Summer Flounder	1
12/21/2001	LB-2	Winter Flounder	7
1/9/2002	LB-1	Alewife	1
1/9/2002	LB-1	Atlantic Silverside	2
1/9/2002	LB-1	Blueback Herring	1
1/9/2002	LB-1	Clearnose Skate	5
1/9/2002	LB-1	Grubby	2
1/9/2002	LB-1	Smallmouth Flounder	19
1/9/2002	LB-1	Spotted Hake	2
1/9/2002	LB-1	Windowpane	4
1/9/2002	LB-2	Blueback Herring	1
1/9/2002	LB-2	Clearnose Skate	15
1/9/2002	LB-2	Conger Eel	5
1/9/2002	LB-2	Fourspot Flounder	11
1/9/2002	LB-2	Grubby	2
1/9/2002	LB-2	Red Hake	4
1/9/2002	LB-2	Smallmouth Flounder	57
1/9/2002	LB-2	Spotted Hake	119
1/9/2002	LB-2	Striped Cuskeel	4
1/9/2002	LB-2	Summer Flounder	1
1/9/2002	LB-2	Windowpane	10
1/9/2002	LB-2	Winter Flounder	8
1/9/2002	LB-3	Clearnose Skate	1
1/9/2002	LB-3	Grubby	6
1/9/2002	LB-3	Smallmouth Flounder	19
1/9/2002	LB-4	Alewife	13
1/9/2002	LB-4	American Shad	2
1/9/2002	LB-4	Blueback Herring	5
1/9/2002	LB-4	Clearnose Skate	4
1/9/2002	LB-4	Grubby	2
1/9/2002	LB-4	Smallmouth Flounder	12
1/9/2002	LB-4	Spotted Hake	1
1/9/2002	LB-5	Clearnose Skate	2
1/9/2002	LB-5	Smallmouth Flounder	11
1/9/2002	LB-5	Windowpane	1
1/9/2002	LB-5	Winter Flounder	1
1/9/2002	LB-6	Alewife	1
1/9/2002	LB-6	Clearnose Skate	53
1/9/2002	LB-6	Smallmouth Flounder	7
1/9/2002	LB-6	Spotted Hake	4
1/9/2002	LB-6	Striped Bass	1
1/9/2002	LB-6	Tautog	1
1/9/2002	LB-6	Windowpane	13
1/9/2002	LB-6	Winter Flounder	15
1/10/2002	NB-3	Smallmouth Flounder	1
1/10/2002	NB-3	White Perch	2
1/10/2002	NB-4	Alewife	17
1/10/2002	NB-4	American Shad	3

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 4 of 31)

Date	Station	Common Name	CPUE
1/10/2002	NB-4	Atherinid unidentified	17
1/10/2002	NB-4	Bay Anchovy	2
1/10/2002	NB-4	Blueback Herring	1
1/10/2002	NB-4	Striped Bass	22
1/10/2002	NB-4	White Perch	167
1/10/2002	NB-4	Windowpane	1
1/10/2002	NB-5	Blueback Herring	6
1/10/2002	NB-5	Cunner	1
1/10/2002	NB-5	Gizzard Shad	1
1/10/2002	NB-5	Smallmouth Flounder	2
1/10/2002	NB-5	Spotted Hake	6
1/10/2002	NB-5	Striped Bass	85
1/10/2002	NB-5	White Perch	143
1/10/2002	NB-5	Windowpane	3
1/10/2002	NB-5	Winter Flounder	1
1/10/2002	PJ-1	Alewife	6
1/10/2002	PJ-1	American Shad	1
1/10/2002	PJ-1	Blueback Herring	1
1/10/2002	PJ-1	Clearnose Skate	8
1/10/2002	PJ-1	Smallmouth Flounder	4
1/10/2002	PJ-1	Striped Bass	6
1/10/2002	PJ-1	Tautog	1
1/10/2002	PJ-1	Windowpane	4
1/10/2002	PJ-1	Winter Flounder	11
1/10/2002	PJ-4	Alewife	19
1/10/2002	PJ-4	American Shad	1
1/10/2002	PJ-4	Atlantic Menhaden	1
1/10/2002	PJ-4	Blueback Herring	14
1/10/2002	PJ-4	Northern Pipefish	1
1/10/2002	PJ-4	Smallmouth Flounder	1
1/10/2002	PJ-4	Spot	4
1/10/2002	PJ-4	Spotted Hake	12
1/10/2002	PJ-4	Striped Bass	6
1/10/2002	PJ-4	Summer Flounder	1
1/10/2002	PJ-4	Windowpane	3
1/10/2002	PJ-4	Winter Flounder	5
1/10/2002	SB-1	Alewife	7
1/10/2002	SB-1	American Shad	1
1/10/2002	SB-1	Atherinid unidentified	1
1/10/2002	SB-1	Blueback Herring	3
1/10/2002	SB-1	Red Hake	1
1/10/2002	SB-1	Smallmouth Flounder	1
1/10/2002	SB-1	Spot	6
1/10/2002	SB-1	Striped Bass	24
1/10/2002	SB-2	Blueback Herring	9
1/10/2002	SB-2	Spot	16
1/10/2002	SB-2	Striped Bass	3
1/10/2002	SB-3	Alewife	10
1/10/2002	SB-3	American Shad	1
1/10/2002	SB-3	Bay Anchovy	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 5 of 31)

Date	Station	Common Name	CPUE
1/10/2002	SB-3	Blueback Herring	4
1/10/2002	SB-3	Clearnose Skate	4
1/10/2002	SB-3	Grubby	1
1/10/2002	SB-3	Smallmouth Flounder	11
1/10/2002	SB-3	Striped Bass	29
1/10/2002	SB-3	Windowpane	3
1/10/2002	SB-3	Winter Flounder	9
1/10/2002	SB-4	Alewife	1
1/10/2002	SB-4	American Shad	3
1/10/2002	SB-4	Atlantic Menhaden	2
1/10/2002	SB-4	Blueback Herring	11
1/10/2002	SB-4	Clearnose Skate	8
1/10/2002	SB-4	Spot	4
1/10/2002	SB-4	Spotted Hake	5
1/10/2002	SB-4	Striped Bass	5
1/10/2002	SB-4	Windowpane	3
1/10/2002	SB-4	Winter Flounder	3
1/10/2002	SB-5	Alewife	21
1/10/2002	SB-5	Bay Anchovy	1
1/10/2002	SB-5	Blueback Herring	65
1/10/2002	SB-5	Clearnose Skate	12
1/10/2002	SB-5	Cunner	1
1/10/2002	SB-5	Northern Pipefish	4
1/10/2002	SB-5	Red Hake	4
1/10/2002	SB-5	Smallmouth Flounder	2
1/10/2002	SB-5	Spot	12
1/10/2002	SB-5	Spotted Hake	58
1/10/2002	SB-5	Striped Bass	1
1/10/2002	SB-5	Weakfish	114
1/10/2002	SB-5	Windowpane	5
1/10/2002	SB-6	Alewife	2
1/10/2002	SB-6	Blueback Herring	9
1/10/2002	SB-6	Clearnose Skate	16
1/10/2002	SB-6	Northern Pipefish	4
1/10/2002	SB-6	Smallmouth Flounder	6
1/10/2002	SB-6	Spot	1
1/10/2002	SB-6	Spotted Hake	36
1/10/2002	SB-6	Striped Bass	1
1/10/2002	SB-6	Windowpane	45
1/10/2002	SB-6	Winter Flounder	6
1/11/2002	AK-1	Alewife	5
1/11/2002	AK-1	Blueback Herring	1
1/11/2002	AK-1	Striped Bass	10
1/11/2002	AK-1	White Perch	60
1/11/2002	AK-2	Alewife	5
1/11/2002	AK-2	Atlantic Menhaden	1
1/11/2002	AK-2	Blueback Herring	1
1/11/2002	AK-2	Striped Bass	1
1/11/2002	AK-2	White Perch	1
1/11/2002	AK-3	Blueback Herring	2

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 6 of 31)

Date	Station	Common Name	CPUE
1/11/2002	AK-3	Smallmouth Flounder	1
1/11/2002	AK-3	Spotted Hake	5
1/11/2002	AK-3	Striped Bass	12
1/11/2002	AK-3	White Perch	1
1/11/2002	AK-3	Windowpane	2
1/11/2002	AK-3	Winter Flounder	1
1/11/2002	AK-4	American Shad	1
1/11/2002	AK-4	Atherinid unidentified	1
1/11/2002	AK-4	Blueback Herring	1
1/11/2002	AK-4	Smallmouth Flounder	1
1/11/2002	AK-4	Spot	1
1/11/2002	AK-4	Spotted Hake	1
1/11/2002	AK-4	Striped Bass	3
1/11/2002	AK-4	Striped Killifish	1
1/11/2002	AK-4	White Perch	1
1/11/2002	AK-4	Windowpane	1
1/11/2002	NB-6	Alewife	2
1/11/2002	NB-6	American Eel	1
1/11/2002	NB-6	Blueback Herring	4
1/11/2002	NB-6	Northern Pipefish	1
1/11/2002	NB-6	Striped Bass	28
1/11/2002	NB-6	White Perch	47
1/11/2002	NB-6	Windowpane	2
1/11/2002	NB-6	Winter Flounder	7
1/11/2002	NB-7	Alewife	1
1/11/2002	NB-7	Spotted Hake	2
1/11/2002	NB-7	Striped Bass	23
1/11/2002	NB-7	White Perch	24
1/11/2002	NB-7	Winter Flounder	1
1/11/2002	PJ-2	Alewife	1
1/11/2002	PJ-2	American Shad	1
1/11/2002	PJ-2	Blueback Herring	2
1/11/2002	PJ-2	Striped Bass	1
1/11/2002	PJ-5	Blueback Herring	1
1/11/2002	PJ-5	Clearnose Skate	7
1/11/2002	PJ-5	Northern Pipefish	2
1/11/2002	PJ-5	Smallmouth Flounder	2
1/11/2002	PJ-5	Spotted Hake	5
1/11/2002	PJ-5	Striped Bass	2
1/11/2002	PJ-5	Windowpane	8
1/11/2002	PJ-5	Winter Flounder	24
1/22/2002	AK-2	Striped Bass	11
1/22/2002	AK-2	Striped Bass	11
1/22/2002	AK-2	White Perch	43
1/22/2002	AK-2	White Perch	43
1/22/2002	AK-2	Windowpane	1
1/22/2002	AK-2	Windowpane	1
1/22/2002	AK-2	Winter Flounder	1
1/22/2002	AK-2	Winter Flounder	1
1/22/2002	NB-3	Atherinid unidentified	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 7 of 31)

Date	Station	Common Name	CPUE
1/22/2002	NB-3	Striped Bass	1
1/22/2002	NB-3	White Perch	1
1/22/2002	NB-4	Alewife	2
1/22/2002	NB-4	American Shad	2
1/22/2002	NB-4	Atherinid unidentified	6
1/22/2002	NB-4	Gizzard Shad	1
1/22/2002	NB-4	Smallmouth Flounder	1
1/22/2002	NB-4	Striped Bass	14
1/22/2002	NB-4	White Perch	21
1/22/2002	NB-5	Blueback Herring	2
1/22/2002	NB-5	Spotted Hake	1
1/22/2002	NB-5	Striped Bass	18
1/22/2002	NB-5	White Perch	59
1/22/2002	NB-6	Gizzard Shad	3
1/22/2002	NB-6	Grubby	2
1/22/2002	NB-6	Spotted Hake	1
1/22/2002	NB-6	Striped Bass	145
1/22/2002	NB-6	White Perch	111
1/22/2002	NB-6	Windowpane	8
1/22/2002	NB-6	Winter Flounder	36
1/22/2002	NB-7	Gizzard Shad	1
1/22/2002	NB-7	Striped Bass	19
1/22/2002	NB-7	White Perch	16
1/22/2002	NB-7	Windowpane	1
1/23/2002	AK-1	Gizzard Shad	1
1/23/2002	AK-1	Striped Bass	14
1/23/2002	AK-1	White Perch	7
1/23/2002	AK-1	Windowpane	1
1/23/2002	AK-1	Winter Flounder	1
1/23/2002	LB-1	Blueback Herring	1
1/23/2002	LB-1	Clearnose Skate	10
1/23/2002	LB-1	Grubby	8
1/23/2002	LB-1	Northern Pipefish	1
1/23/2002	LB-1	Smallmouth Flounder	25
1/23/2002	LB-1	Spotted Hake	9
1/23/2002	LB-1	Tautog	1
1/23/2002	LB-1	Windowpane	10
1/23/2002	LB-2	Clearnose Skate	18
1/23/2002	LB-2	Cunner	4
1/23/2002	LB-2	Fourspot Flounder	5
1/23/2002	LB-2	Grubby	4
1/23/2002	LB-2	Longhorn Sculpin	1
1/23/2002	LB-2	Northern Pipefish	5
1/23/2002	LB-2	Red Hake	6
1/23/2002	LB-2	Smallmouth Flounder	81
1/23/2002	LB-2	Spotted Hake	61
1/23/2002	LB-2	Summer Flounder	1
1/23/2002	LB-2	Windowpane	1
1/23/2002	LB-2	Winter Flounder	20
1/23/2002	LB-3	Grubby	2

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 8 of 31)

Date	Station	Common Name	CPUE
1/23/2002	LB-3	Smallmouth Flounder	1
1/23/2002	LB-4	Atlantic Herring	2
1/23/2002	LB-4	Clearnose Skate	2
1/23/2002	LB-4	Conger Eel	1
1/23/2002	LB-4	Red Hake	5
1/23/2002	LB-4	Smallmouth Flounder	1
1/23/2002	LB-4	Spotted Hake	15
1/23/2002	LB-5	Atlantic Herring	1
1/23/2002	LB-5	Clearnose Skate	2
1/23/2002	LB-5	Smallmouth Flounder	1
1/23/2002	LB-5	Winter Flounder	1
1/23/2002	LB-6	Alewife	13
1/23/2002	LB-6	Blueback Herring	18
1/23/2002	LB-6	Clearnose Skate	4
1/23/2002	LB-6	Smallmouth Flounder	2
1/23/2002	LB-6	Spotted Hake	1
1/23/2002	LB-6	Striped Bass	1
1/23/2002	LB-6	Windowpane	2
1/23/2002	LB-6	Winter Flounder	3
1/24/2002	AK-3	Alewife	4
1/24/2002	AK-3	Blueback Herring	1
1/24/2002	AK-3	Grubby	1
1/24/2002	AK-3	Spotted Hake	1
1/24/2002	AK-3	Striped Bass	12
1/24/2002	PJ-1	Alewife	47
1/24/2002	PJ-1	American Shad	4
1/24/2002	PJ-1	Atlantic Menhaden	1
1/24/2002	PJ-1	Bay Anchovy	1
1/24/2002	PJ-1	Blueback Herring	20
1/24/2002	PJ-1	Clearnose Skate	2
1/24/2002	PJ-1	Smallmouth Flounder	4
1/24/2002	PJ-1	Striped Bass	1
1/24/2002	PJ-1	Tautog	1
1/24/2002	PJ-1	Windowpane	3
1/24/2002	PJ-1	Winter Flounder	6
1/24/2002	PJ-2	Alewife	6
1/24/2002	PJ-2	American Shad	1
1/24/2002	PJ-2	Blueback Herring	6
1/24/2002	PJ-3	Clupeid unidentified	2
1/24/2002	PJ-4	Alewife	31
1/24/2002	PJ-4	American Shad	2
1/24/2002	PJ-4	Atherinid unidentified	1
1/24/2002	PJ-4	Atlantic Menhaden	2
1/24/2002	PJ-4	Blueback Herring	48
1/24/2002	PJ-4	Smallmouth Flounder	1
1/24/2002	PJ-4	Spot	3
1/24/2002	PJ-4	Striped Bass	2
1/24/2002	PJ-4	Winter Flounder	4
1/24/2002	PJ-5	Alewife	1
1/24/2002	PJ-5	Blueback Herring	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 9 of 31)

Date	Station	Common Name	CPUE
1/24/2002	PJ-5	Northern Pipefish	1
1/24/2002	PJ-5	Red Hake	1
1/24/2002	PJ-5	Smallmouth Flounder	1
1/24/2002	PJ-5	Spotted Hake	3
1/24/2002	PJ-5	Striped Bass	4
1/24/2002	PJ-5	Windowpane	3
1/24/2002	PJ-5	Winter Flounder	8
1/24/2002	SB-1	Alewife	1
1/24/2002	SB-1	American Shad	1
1/24/2002	SB-1	Seaboard Goby	1
1/24/2002	SB-1	Spot	5
1/24/2002	SB-1	Striped Bass	1
1/24/2002	SB-2	Alewife	18
1/24/2002	SB-2	American Shad	3
1/24/2002	SB-2	Atlantic Herring	1
1/24/2002	SB-2	Blueback Herring	2
1/24/2002	SB-2	Spot	13
1/24/2002	SB-2	Striped Bass	1
1/24/2002	SB-3	Alewife	1
1/24/2002	SB-3	Blueback Herring	4
1/24/2002	SB-3	Clearnose Skate	1
1/24/2002	SB-3	Smallmouth Flounder	1
1/24/2002	SB-3	Winter Flounder	4
1/24/2002	SB-4	Alewife	1
1/24/2002	SB-4	American Shad	1
1/24/2002	SB-4	Blueback Herring	2
1/24/2002	SB-6	Blueback Herring	2
1/24/2002	SB-6	Clearnose Skate	1
1/24/2002	SB-6	Windowpane	2
1/24/2002	SB-6	Winter Flounder	4
1/25/2002	SB-5	Blueback Herring	2
1/25/2002	SB-5	Clearnose Skate	4
1/25/2002	SB-5	Northern Pipefish	8
1/25/2002	SB-5	Red Hake	4
1/25/2002	SB-5	Spotted Hake	8
1/25/2002	SB-5	Tautog	10
1/25/2002	SB-5	Windowpane	10
1/25/2002	SB-5	Winter Flounder	33
2/5/2002	AK-2	Alewife	4
2/5/2002	AK-2	Blueback Herring	15
2/5/2002	AK-2	Gizzard Shad	1
2/5/2002	AK-2	Grubby	1
2/5/2002	AK-2	Spotted Hake	1
2/5/2002	AK-2	Striped Bass	28
2/5/2002	AK-2	White Perch	22
2/5/2002	AK-2	Windowpane	2
2/5/2002	AK-2	Winter Flounder	2
2/5/2002	AK-3	Alewife	2
2/5/2002	AK-3	American Shad	1
2/5/2002	AK-3	Atlantic Silverside	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 10 of 31)

Date	Station	Common Name	CPUE
2/5/2002	AK-3	Blueback Herring	7
2/5/2002	AK-3	Smallmouth Flounder	1
2/5/2002	AK-3	Spotted Hake	4
2/5/2002	AK-3	Striped Bass	28
2/5/2002	AK-3	White Perch	11
2/5/2002	AK-3	Windowpane	1
2/5/2002	AK-3	Winter Flounder	1
2/5/2002	NB-3	Alewife	1
2/5/2002	NB-3	American Shad	1
2/5/2002	NB-3	Atlantic Silverside	2
2/5/2002	NB-3	Spotted Hake	1
2/5/2002	NB-3	Striped Bass	7
2/5/2002	NB-3	White Perch	4
2/5/2002	NB-3	Windowpane	2
2/5/2002	NB-3	Winter Flounder	8
2/5/2002	NB-4	Alewife	5
2/5/2002	NB-4	American Shad	1
2/5/2002	NB-4	Atlantic Silverside	10
2/5/2002	NB-4	Striped Bass	18
2/5/2002	NB-4	White Perch	28
2/5/2002	NB-4	Winter Flounder	2
2/5/2002	NB-5	Alewife	3
2/5/2002	NB-5	American Shad	2
2/5/2002	NB-5	Blueback Herring	3
2/5/2002	NB-5	Spotted Hake	9
2/5/2002	NB-5	Striped Bass	8
2/5/2002	NB-5	White Perch	73
2/5/2002	NB-5	Windowpane	3
2/5/2002	NB-5	Winter Flounder	10
2/5/2002	NB-6	Alewife	5
2/5/2002	NB-6	Blueback Herring	18
2/5/2002	NB-6	Gizzard Shad	1
2/5/2002	NB-6	Spotted Hake	2
2/5/2002	NB-6	Striped Bass	14
2/5/2002	NB-6	Striped Cuskeel	1
2/5/2002	NB-6	White Perch	58
2/5/2002	NB-6	Winter Flounder	3
2/6/2002	AK-4	Alewife	1
2/6/2002	AK-4	Smallmouth Flounder	1
2/6/2002	AK-4	Striped Bass	2
2/6/2002	AK-4	Windowpane	1
2/6/2002	LB-1	Alewife	1
2/6/2002	LB-1	Atlantic Silverside	4
2/6/2002	LB-1	Clearnose Skate	1
2/6/2002	LB-1	Smallmouth Flounder	1
2/6/2002	LB-1	Spotted Hake	1
2/6/2002	LB-2	Alewife	2
2/6/2002	LB-2	Clearnose Skate	3
2/6/2002	LB-2	Red Hake	2
2/6/2002	LB-2	Silver Hake	12

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 11 of 31)

Date	Station	Common Name	CPUE
2/6/2002	LB-2	Smallmouth Flounder	24
2/6/2002	LB-2	Spotted Hake	109
2/6/2002	LB-2	Windowpane	4
2/6/2002	LB-2	Winter Flounder	6
2/6/2002	LB-3	Atlantic Silverside	2
2/6/2002	LB-3	Spotted Hake	1
2/6/2002	LB-4	Alewife	10
2/6/2002	LB-4	Clearnose Skate	3
2/6/2002	LB-4	Smallmouth Flounder	8
2/6/2002	LB-4	Spotted Hake	13
2/6/2002	LB-4	Winter Flounder	1
2/6/2002	LB-5	Atlantic Silverside	1
2/6/2002	LB-5	Smallmouth Flounder	2
2/6/2002	LB-6	Alewife	5
2/6/2002	LB-6	Blueback Herring	5
2/6/2002	LB-6	Red Hake	3
2/6/2002	LB-6	Spotted Hake	16
2/6/2002	LB-6	Windowpane	2
2/6/2002	NB-7	Blueback Herring	6
2/6/2002	NB-7	Clearnose Skate	1
2/6/2002	NB-7	Striped Bass	47
2/6/2002	NB-7	White Perch	4
2/6/2002	NB-7	Winter Flounder	1
2/6/2002	SB-2	Alewife	2
2/6/2002	SB-2	American Shad	4
2/6/2002	SB-2	Blueback Herring	1
2/6/2002	SB-2	Spot	4
2/7/2002	AK-1	Alewife	1
2/7/2002	AK-1	Striped Bass	2
2/7/2002	PJ-1	Alewife	2
2/7/2002	PJ-1	Blueback Herring	6
2/7/2002	PJ-1	Grubby	2
2/7/2002	PJ-1	Smallmouth Flounder	2
2/7/2002	PJ-1	Windowpane	1
2/7/2002	PJ-1	Winter Flounder	2
2/7/2002	PJ-2	Alewife	4
2/7/2002	PJ-2	American Shad	1
2/7/2002	PJ-2	Blueback Herring	12
2/7/2002	PJ-2	Cunner	1
2/7/2002	PJ-2	Striped Bass	4
2/7/2002	PJ-3	Alewife	6
2/7/2002	PJ-3	Blueback Herring	2
2/7/2002	PJ-3	Striped Bass	1
2/7/2002	PJ-3	Winter Flounder	1
2/7/2002	PJ-4	Alewife	8
2/7/2002	PJ-4	American Shad	3
2/7/2002	PJ-4	Atlantic Silverside	3
2/7/2002	PJ-4	Blueback Herring	43
2/7/2002	PJ-4	Northern Pipefish	1
2/7/2002	PJ-4	Spotted Hake	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 12 of 31)

Date	Station	Common Name	CPUE
2/7/2002	PJ-4	Windowpane	2
2/7/2002	PJ-4	Winter Flounder	4
2/7/2002	PJ-5	Alewife	17
2/7/2002	PJ-5	American Shad	4
2/7/2002	PJ-5	Blueback Herring	53
2/7/2002	PJ-5	Clearnose Skate	1
2/7/2002	PJ-5	Spotted Hake	1
2/7/2002	PJ-5	Windowpane	2
2/7/2002	PJ-5	Winter Flounder	7
2/7/2002	SB-3	Blueback Herring	2
2/7/2002	SB-3	Spotted Hake	1
2/7/2002	SB-3	Striped Bass	3
2/7/2002	SB-4	Alewife	1
2/7/2002	SB-4	Blueback Herring	3
2/7/2002	SB-4	Spot	1
2/7/2002	SB-4	Spotted Hake	4
2/7/2002	SB-4	Striped Bass	1
2/7/2002	SB-4	Winter Flounder	1
2/7/2002	SB-5	Alewife	1
2/7/2002	SB-5	Blueback Herring	80
2/7/2002	SB-5	Clearnose Skate	1
2/7/2002	SB-5	Spotted Hake	16
2/7/2002	SB-5	Windowpane	3
2/7/2002	SB-5	Winter Flounder	4
2/7/2002	SB-6	Alewife	2
2/7/2002	SB-6	Blueback Herring	7
2/7/2002	SB-6	Clearnose Skate	1
2/7/2002	SB-6	Spotted Hake	3
2/7/2002	SB-6	Windowpane	2
2/7/2002	SB-6	Winter Flounder	2
2/19/2002	LB-1	Atlantic Herring	8
2/19/2002	LB-1	Clearnose Skate	1
2/19/2002	LB-1	Grubby	1
2/19/2002	LB-1	Smallmouth Flounder	6
2/19/2002	LB-1	Smallmouth Flounder	10
2/19/2002	LB-1	Spotted Hake	5
2/19/2002	LB-1	Windowpane	1
2/19/2002	LB-1	Winter Flounder	3
2/19/2002	LB-2	Alewife	3
2/19/2002	LB-2	Clearnose Skate	6
2/19/2002	LB-2	Cunner	5
2/19/2002	LB-2	Grubby	2
2/19/2002	LB-2	Northern Pipefish	9
2/19/2002	LB-2	Northern Searobin	5
2/19/2002	LB-2	Red Hake	23
2/19/2002	LB-2	Rock Gunnel	1
2/19/2002	LB-2	Silver Hake	8
2/19/2002	LB-2	Smallmouth Flounder	104
2/19/2002	LB-2	Spotted Hake	119
2/19/2002	LB-2	Winter Flounder	30

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 13 of 31)

Date	Station	Common Name	CPUE
2/19/2002	LB-3	Alewife	1
2/19/2002	LB-3	Atlantic Herring	5
2/19/2002	LB-3	Atlantic Silverside	1
2/19/2002	LB-3	Smallmouth Flounder	4
2/19/2002	LB-3	Windowpane	1
2/19/2002	LB-4	Alewife	3
2/19/2002	LB-4	Blueback Herring	1
2/19/2002	LB-4	Clearnose Skate	3
2/19/2002	LB-4	Northern Pipefish	1
2/19/2002	LB-4	Red Hake	3
2/19/2002	LB-4	Smallmouth Flounder	1
2/19/2002	LB-4	Spotted Hake	49
2/19/2002	LB-4	Windowpane	1
2/19/2002	LB-4	Winter Flounder	1
2/19/2002	LB-5	Atlantic Herring	2
2/19/2002	LB-5	Atlantic Silverside	1
2/19/2002	LB-5	Smallmouth Flounder	3
2/19/2002	LB-5	Windowpane	3
2/19/2002	LB-5	Winter Flounder	1
2/19/2002	LB-6	Clearnose Skate	1
2/19/2002	LB-6	Winter Flounder	1
2/20/2002	NB-3	Blueback Herring	1
2/20/2002	NB-3	White Perch	1
2/20/2002	NB-4	Alewife	1
2/20/2002	NB-4	American Shad	1
2/20/2002	NB-4	Striped Bass	3
2/20/2002	NB-4	White Perch	13
2/20/2002	NB-5	Alewife	2
2/20/2002	NB-5	American Shad	1
2/20/2002	NB-5	Blueback Herring	7
2/20/2002	NB-5	Spotted Hake	16
2/20/2002	NB-5	Striped Bass	30
2/20/2002	NB-5	White Perch	214
2/20/2002	NB-5	Windowpane	7
2/20/2002	NB-5	Winter Flounder	6
2/20/2002	NB-6	Alewife	3
2/20/2002	NB-6	Blueback Herring	8
2/20/2002	NB-6	Fourspot Flounder	1
2/20/2002	NB-6	Smallmouth Flounder	1
2/20/2002	NB-6	Spotted Hake	4
2/20/2002	NB-6	Striped Bass	179
2/20/2002	NB-6	White Perch	239
2/20/2002	NB-6	Windowpane	6
2/20/2002	NB-6	Winter Flounder	7
2/20/2002	NB-7	Alewife	1
2/20/2002	NB-7	Alewife	1
2/20/2002	NB-7	Blueback Herring	1
2/20/2002	NB-7	Spotted Hake	1
2/20/2002	NB-7	Striped Bass	56
2/20/2002	NB-7	Winter Flounder	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 14 of 31)

Date	Station	Common Name	CPUE
2/21/2002	AK-1	Blueback Herring	1
2/21/2002	AK-1	Cunner	1
2/21/2002	AK-1	Striped Bass	1
2/21/2002	AK-2	Alewife	1
2/21/2002	AK-2	Blueback Herring	6
2/21/2002	AK-3	Alewife	1
2/21/2002	AK-3	Atlantic Herring	1
2/21/2002	AK-3	Blueback Herring	3
2/21/2002	AK-3	Spotted Hake	4
2/21/2002	AK-3	Striped Bass	7
2/21/2002	AK-3	Windowpane	1
2/21/2002	AK-3	Winter Flounder	2
2/21/2002	PJ-1	Alewife	17
2/21/2002	PJ-1	American Shad	2
2/21/2002	PJ-1	Blueback Herring	26
2/21/2002	PJ-1	Clearnose Skate	1
2/21/2002	PJ-1	Grubby	1
2/21/2002	PJ-1	Red Hake	1
2/21/2002	PJ-1	Smallmouth Flounder	4
2/21/2002	PJ-1	Spotted Hake	4
2/21/2002	PJ-1	Striped Bass	2
2/21/2002	PJ-1	Windowpane	1
2/21/2002	PJ-1	Winter Flounder	7
2/21/2002	PJ-4	Alewife	3
2/21/2002	PJ-4	American Shad	2
2/21/2002	PJ-4	Blueback Herring	3
2/21/2002	PJ-4	Windowpane	1
2/21/2002	PJ-5	Alewife	3
2/21/2002	PJ-5	Blueback Herring	26
2/21/2002	PJ-5	Spotted Hake	11
2/21/2002	PJ-5	Windowpane	3
2/21/2002	PJ-5	Winter Flounder	3
2/21/2002	SB-5	Blueback Herring	3
2/21/2002	SB-5	Clearnose Skate	4
2/21/2002	SB-5	Northern Pipefish	17
2/21/2002	SB-5	Red Hake	14
2/21/2002	SB-5	Silver Hake	1
2/21/2002	SB-5	Smallmouth Flounder	2
2/21/2002	SB-5	Spotted Hake	63
2/21/2002	SB-5	Windowpane	12
2/21/2002	SB-5	Winter Flounder	45
2/22/2002	PJ-2	Alewife	1
2/22/2002	PJ-2	Blueback Herring	1
2/22/2002	PJ-2	Cunner	1
2/22/2002	PJ-3	Alewife	1
2/22/2002	SB-1	American Shad	1
2/22/2002	SB-1	Atlantic Silverside	2
2/22/2002	SB-2	Alewife	1
2/22/2002	SB-2	American Shad	6
2/22/2002	SB-2	Blueback Herring	3

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 15 of 31)

Date	Station	Common Name	CPUE
2/22/2002	SB-3	Windowpane	1
2/22/2002	SB-3	Winter Flounder	4
2/22/2002	SB-4	Alewife	1
2/22/2002	SB-4	American Shad	1
2/22/2002	SB-4	Blueback Herring	12
2/22/2002	SB-4	Spotted Hake	1
2/22/2002	SB-6	Blueback Herring	4
2/22/2002	SB-6	Cunner	48
2/22/2002	SB-6	Red Hake	3
2/22/2002	SB-6	Spotted Hake	10
2/22/2002	SB-6	Windowpane	7
2/22/2002	SB-6	Winter Flounder	7
3/5/2002	AK-1	Blueback Herring	5
3/5/2002	AK-1	Striped Bass	8
3/5/2002	AK-1	White Perch	6
3/5/2002	AK-1	Winter Flounder	3
3/5/2002	AK-2	Alewife	1
3/5/2002	AK-2	Blueback Herring	3
3/5/2002	AK-2	Smallmouth Flounder	1
3/5/2002	AK-3	Blueback Herring	5
3/5/2002	AK-3	Spotted Hake	2
3/5/2002	AK-3	Striped Bass	3
3/5/2002	AK-3	Windowpane	1
3/5/2002	AK-3	Winter Flounder	3
3/5/2002	AK-4	Alewife	2
3/5/2002	AK-4	Atlantic Silverside	1
3/5/2002	AK-4	Blueback Herring	3
3/5/2002	AK-4	Striped Bass	1
3/5/2002	AK-4	Winter Flounder	2
3/5/2002	NB-3	Atlantic Menhaden	1
3/5/2002	NB-3	Spotted Hake	3
3/5/2002	NB-3	Striped Bass	3
3/5/2002	NB-3	White Perch	2
3/5/2002	NB-3	Windowpane	1
3/5/2002	NB-3	Winter Flounder	4
3/5/2002	NB-4	Alewife	1
3/5/2002	NB-4	Striped Bass	2
3/5/2002	NB-5	Alewife	1
3/5/2002	NB-5	Atlantic Herring	1
3/5/2002	NB-5	Bay Anchovy	1
3/5/2002	NB-5	Blueback Herring	9
3/5/2002	NB-5	Spotted Hake	1
3/5/2002	NB-5	Striped Bass	1
3/5/2002	NB-5	White Perch	5
3/5/2002	NB-6	Alewife	1
3/5/2002	NB-6	Blueback Herring	7
3/5/2002	NB-6	Naked Goby	1
3/5/2002	NB-6	Spotted Hake	1
3/6/2002	PJ-1	Alewife	1
3/6/2002	PJ-1	Atlantic Silverside	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 16 of 31)

Date	Station	Common Name	CPUE
3/6/2002	PJ-1	Blueback Herring	1
3/6/2002	PJ-4	Alewife	2
3/6/2002	PJ-4	American Shad	1
3/6/2002	PJ-4	Atlantic Menhaden	1
3/6/2002	PJ-4	Blueback Herring	14
3/6/2002	PJ-4	Clearnose Skate	1
3/6/2002	PJ-4	Conger Eel	1
3/6/2002	PJ-4	Red Hake	1
3/6/2002	PJ-4	Spotted Hake	25
3/6/2002	PJ-4	Windowpane	2
3/6/2002	PJ-4	Winter Flounder	1
3/6/2002	PJ-5	Alewife	4
3/6/2002	PJ-5	American Shad	2
3/6/2002	PJ-5	Atlantic Menhaden	1
3/6/2002	PJ-5	Blueback Herring	20
3/6/2002	PJ-5	Cunner	1
3/6/2002	PJ-5	Northern Pipefish	1
3/6/2002	PJ-5	Smallmouth Flounder	1
3/6/2002	PJ-5	Spotted Hake	1
3/6/2002	PJ-5	Striped Cuskeel	1
3/6/2002	PJ-5	Striped Searobin	1
3/6/2002	SB-1	American Shad	1
3/6/2002	SB-1	Striped Bass	1
3/6/2002	SB-2	Alewife	1
3/6/2002	SB-2	American Shad	3
3/6/2002	SB-2	Striped Bass	1
3/6/2002	SB-3	Alewife	1
3/6/2002	SB-3	Smallmouth Flounder	3
3/6/2002	SB-3	Spotted Hake	1
3/6/2002	SB-3	Windowpane	2
3/6/2002	SB-3	Winter Flounder	3
3/6/2002	SB-4	Blueback Herring	2
3/6/2002	SB-4	Cunner	1
3/6/2002	SB-4	Silver Hake	1
3/6/2002	SB-4	Spotted Hake	4
3/6/2002	SB-4	Striped Bass	1
3/6/2002	SB-5	Blueback Herring	29
3/6/2002	SB-5	Naked Goby	1
3/6/2002	SB-5	Northern Pipefish	1
3/6/2002	SB-6	Alewife	6
3/6/2002	SB-6	Blueback Herring	23
3/6/2002	SB-6	Cunner	1
3/6/2002	SB-6	Northern Pipefish	1
3/6/2002	SB-6	Red Hake	1
3/6/2002	SB-6	Spotted Hake	2
3/6/2002	SB-6	Tautog	1
3/6/2002	SB-6	Winter Flounder	4
3/7/2002	LB-1	Smallmouth Flounder	4
3/7/2002	LB-1	Spotted Hake	5
3/7/2002	LB-1	Striped Cuskeel	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 17 of 31)

Date	Station	Common Name	CPUE
3/7/2002	LB-1	Windowpane	1
3/7/2002	LB-2	Alewife	22
3/7/2002	LB-2	Blueback Herring	10
3/7/2002	LB-2	Clearnose Skate	1
3/7/2002	LB-2	Northern Pipefish	1
3/7/2002	LB-2	Silver Hake	7
3/7/2002	LB-2	Smallmouth Flounder	4
3/7/2002	LB-2	Spotted Hake	39
3/7/2002	LB-2	Striped Cuskeel	2
3/7/2002	LB-2	Windowpane	1
3/7/2002	LB-2	Winter Flounder	1
3/7/2002	LB-3	Feather Blenny	1
3/7/2002	LB-4	Conger Eel	2
3/7/2002	LB-4	Northern Pipefish	1
3/7/2002	LB-4	Red Hake	5
3/7/2002	LB-4	Spotted Hake	14
3/7/2002	LB-4	Winter Flounder	1
3/7/2002	LB-5	Smallmouth Flounder	3
3/7/2002	LB-5	Spotted Hake	1
3/7/2002	LB-5	Winter Flounder	1
3/7/2002	LB-6	Blueback Herring	1
3/7/2002	LB-6	Cunner	1
3/7/2002	LB-6	Northern Pipefish	1
3/7/2002	LB-6	Spotted Hake	10
3/7/2002	LB-6	Winter Flounder	3
3/19/2002	AK-4	Alewife	2
3/19/2002	AK-4	American Shad	19
3/19/2002	AK-4	Atlantic Menhaden	3
3/19/2002	AK-4	Bay Anchovy	1
3/19/2002	AK-4	Blueback Herring	1
3/19/2002	AK-4	Spotted Hake	20
3/19/2002	AK-4	Striped Bass	21
3/19/2002	AK-4	White Perch	7
3/19/2002	LB-1	Atlantic Herring	1
3/19/2002	LB-1	Lined Seahorse	1
3/19/2002	LB-1	Northern Pipefish	2
3/19/2002	LB-1	Northern Searobin	1
3/19/2002	LB-1	Red Hake	1
3/19/2002	LB-1	Smallmouth Flounder	10
3/19/2002	LB-1	Spotted Hake	1
3/19/2002	LB-2	Blueback Herring	19
3/19/2002	LB-2	Clearnose Skate	3
3/19/2002	LB-2	Northern Searobin	1
3/19/2002	LB-2	Silver Hake	2
3/19/2002	LB-2	Spotted Hake	12
3/19/2002	LB-2	Striped Cuskeel	1
3/19/2002	LB-2	Windowpane	2
3/19/2002	LB-2	Winter Flounder	1
3/19/2002	LB-4	Blueback Herring	5
3/19/2002	LB-4	Clearnose Skate	8

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 18 of 31)

Date	Station	Common Name	CPUE
3/19/2002	LB-4	Conger Eel	1
3/19/2002	LB-4	Northern Pipefish	4
3/19/2002	LB-4	Red Hake	7
3/19/2002	LB-4	Rock Gunnel	1
3/19/2002	LB-4	Silver Hake	1
3/19/2002	LB-4	Smallmouth Flounder	9
3/19/2002	LB-4	Spotted Hake	100
3/19/2002	LB-4	Striped Searobin	1
3/19/2002	LB-4	Summer Flounder	1
3/19/2002	LB-4	Windowpane	4
3/19/2002	LB-4	Winter Flounder	10
3/19/2002	LB-5	Alewife	1
3/19/2002	LB-5	Blueback Herring	1
3/19/2002	LB-5	Naked Goby	1
3/19/2002	LB-5	Northern Pipefish	1
3/19/2002	LB-6	Alewife	1
3/19/2002	LB-6	Blueback Herring	12
3/19/2002	LB-6	Spotted Hake	16
3/19/2002	LB-6	Striped Cuskeel	1
3/20/2002	AK-1	American Shad	1
3/20/2002	AK-1	Blueback Herring	18
3/20/2002	AK-1	Spotted Hake	70
3/20/2002	AK-1	Striped Bass	19
3/20/2002	AK-1	White Perch	4
3/20/2002	AK-1	Windowpane	1
3/20/2002	AK-1	Winter Flounder	1
3/20/2002	AK-2	Alewife	1
3/20/2002	AK-2	Atlantic Menhaden	1
3/20/2002	AK-2	Bay Anchovy	1
3/20/2002	AK-2	Blueback Herring	11
3/20/2002	AK-2	Spotted Hake	10
3/20/2002	AK-2	Striped Bass	27
3/20/2002	AK-2	White Perch	6
3/20/2002	AK-3	American Shad	1
3/20/2002	AK-3	Blueback Herring	6
3/20/2002	AK-3	Spotted Hake	14
3/20/2002	AK-3	Striped Bass	7
3/20/2002	AK-3	Summer Flounder	1
3/20/2002	AK-3	White Perch	4
3/20/2002	AK-3	Windowpane	1
3/20/2002	AK-3	Winter Flounder	1
3/20/2002	NB-3	Spotted Hake	1
3/20/2002	NB-3	Striped Bass	3
3/20/2002	NB-3	White Perch	3
3/20/2002	NB-3	Windowpane	1
3/20/2002	NB-3	Winter Flounder	3
3/20/2002	NB-4	White Perch	1
3/20/2002	NB-5	Blueback Herring	2
3/20/2002	NB-5	Spotted Hake	6
3/20/2002	NB-5	White Perch	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 19 of 31)

Date	Station	Common Name	CPUE
3/20/2002	NB-6	Alewife	2
3/20/2002	NB-6	Blueback Herring	7
3/20/2002	NB-6	Cunner	2
3/20/2002	NB-6	Northern Pipefish	1
3/20/2002	NB-6	Red Hake	1
3/20/2002	NB-6	Spotted Hake	21
3/20/2002	NB-6	Striped Bass	1
3/20/2002	NB-6	White Perch	8
3/20/2002	NB-6	Windowpane	1
3/20/2002	NB-6	Winter Flounder	15
3/20/2002	NB-7	Alewife	1
3/20/2002	NB-7	Blueback Herring	5
3/20/2002	NB-7	Striped Bass	8
3/20/2002	NB-7	White Perch	2
3/20/2002	PJ-1	Naked Goby	1
3/20/2002	PJ-1	Northern Searobin	1
3/20/2002	PJ-1	Rock Gunnel	1
3/20/2002	PJ-1	Smallmouth Flounder	1
3/20/2002	PJ-1	Spotted Hake	7
3/20/2002	PJ-1	Windowpane	4
3/20/2002	PJ-1	Winter Flounder	6
3/20/2002	PJ-5	Alewife	2
3/20/2002	PJ-5	Atlantic Menhaden	1
3/20/2002	PJ-5	Blueback Herring	4
3/20/2002	PJ-5	Lined Seahorse	1
3/20/2002	PJ-5	Spotted Hake	4
3/20/2002	SB-5	Alewife	1
3/20/2002	SB-5	Atlantic Menhaden	1
3/20/2002	SB-5	Blueback Herring	27
3/20/2002	SB-5	Clearnose Skate	1
3/20/2002	SB-5	Naked Goby	1
3/20/2002	SB-5	Northern Pipefish	8
3/20/2002	SB-5	Northern Searobin	2
3/20/2002	SB-5	Red Hake	3
3/20/2002	SB-5	Smallmouth Flounder	1
3/20/2002	SB-5	Spotted Hake	82
3/20/2002	SB-5	Striped Cuskeel	1
3/20/2002	SB-5	Windowpane	6
3/20/2002	SB-5	Winter Flounder	5
3/21/2002	PJ-2	Alewife	5
3/21/2002	PJ-2	American Shad	1
3/21/2002	PJ-2	Atlantic Menhaden	1
3/21/2002	PJ-2	Atlantic Silverside	2
3/21/2002	PJ-2	Blueback Herring	7
3/21/2002	PJ-2	Spotted Hake	3
3/21/2002	PJ-2	Striped Bass	4
3/21/2002	PJ-2	Windowpane	3
3/21/2002	PJ-2	Winter Flounder	2
3/21/2002	PJ-3	Alewife	19
3/21/2002	PJ-3	American Shad	2

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 20 of 31)

Date	Station	Common Name	CPUE
3/21/2002	PJ-3	Atlantic Menhaden	1
3/21/2002	PJ-3	Atlantic Silverside	2
3/21/2002	PJ-3	Blueback Herring	15
3/21/2002	PJ-3	Spotted Hake	7
3/21/2002	PJ-3	Striped Bass	1
3/21/2002	PJ-3	Winter Flounder	2
3/21/2002	PJ-4	Alewife	5
3/21/2002	PJ-4	Atlantic Menhaden	1
3/21/2002	PJ-4	Blueback Herring	11
3/21/2002	SB-1	Alewife	2
3/21/2002	SB-1	American Shad	1
3/21/2002	SB-1	Spotted Hake	4
3/21/2002	SB-1	Striped Bass	6
3/21/2002	SB-1	Windowpane	2
3/21/2002	SB-1	Winter Flounder	1
3/21/2002	SB-2	Alewife	13
3/21/2002	SB-2	Atlantic Tomcod	1
3/21/2002	SB-2	Spotted Hake	1
3/21/2002	SB-3	Clearnose Skate	3
3/21/2002	SB-3	Grubby	1
3/21/2002	SB-3	Northern Searobin	2
3/21/2002	SB-3	Smallmouth Flounder	1
3/21/2002	SB-3	Spotted Hake	14
3/21/2002	SB-3	Striped Bass	5
3/21/2002	SB-3	Windowpane	2
3/21/2002	SB-3	Winter Flounder	2
3/21/2002	SB-4	Alewife	3
3/21/2002	SB-4	Blueback Herring	20
3/21/2002	SB-4	Cunner	1
3/21/2002	SB-4	Northern Pipefish	3
3/21/2002	SB-4	Northern Searobin	1
3/21/2002	SB-4	Red Hake	1
3/21/2002	SB-4	Smallmouth Flounder	1
3/21/2002	SB-4	Spotted Hake	105
3/21/2002	SB-4	Windowpane	5
3/21/2002	SB-4	Winter Flounder	4
3/21/2002	SB-6	Alewife	4
3/21/2002	SB-6	Blueback Herring	24
4/16/2002	PJ-1	Alewife	1
4/16/2002	PJ-1	Atlantic Herring	1
4/16/2002	PJ-1	Blueback Herring	1
4/16/2002	PJ-1	Clupeid unidentified	4
4/16/2002	PJ-1	Striped Bass	3
4/16/2002	PJ-2	Alewife	1
4/16/2002	PJ-2	Atlantic Menhaden	1
4/16/2002	PJ-2	Blueback Herring	1
4/16/2002	PJ-2	Spotted Hake	2
4/16/2002	PJ-2	Striped Bass	1
4/16/2002	PJ-3	Bay Anchovy	1
4/16/2002	PJ-3	Blueback Herring	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 21 of 31)

Date	Station	Common Name	CPUE
4/16/2002	PJ-3	Naked Goby	2
4/16/2002	PJ-3	Spotted Hake	1
4/16/2002	PJ-3	Striped Bass	5
4/16/2002	PJ-4	Blueback Herring	1
4/16/2002	PJ-4	Northern Pipefish	1
4/16/2002	PJ-4	Red Hake	1
4/16/2002	PJ-4	Smallmouth Flounder	1
4/16/2002	PJ-4	Spotted Hake	25
4/16/2002	PJ-4	Windowpane	2
4/16/2002	PJ-4	Winter Flounder	1
4/17/2002	AK-1	American Eel	2
4/17/2002	AK-1	Conger Eel	1
4/17/2002	AK-1	Spotted Hake	3
4/17/2002	AK-1	Striped Bass	8
4/17/2002	AK-1	Summer Flounder	1
4/17/2002	AK-1	Windowpane	14
4/17/2002	AK-1	Winter Flounder	1
4/17/2002	AK-2	Alewife	1
4/17/2002	AK-2	Blueback Herring	2
4/17/2002	AK-2	Clupeid unidentified	1
4/17/2002	AK-2	Northern Pipefish	1
4/17/2002	AK-2	Red Hake	1
4/17/2002	AK-2	Smallmouth Flounder	1
4/17/2002	AK-2	Spotted Hake	557
4/17/2002	AK-2	Striped Cuskeel	2
4/17/2002	AK-2	Tautog	1
4/17/2002	AK-2	Windowpane	8
4/17/2002	AK-2	Winter Flounder	9
4/17/2002	AK-3	Spotted Hake	69
4/17/2002	AK-3	Striped Bass	1
4/17/2002	AK-3	Windowpane	1
4/17/2002	LB-1	Black Sea Bass	1
4/17/2002	LB-1	Clearnose Skate	6
4/17/2002	LB-1	Smallmouth Flounder	1
4/17/2002	LB-1	Spotted Hake	4
4/17/2002	LB-1	Windowpane	1
4/17/2002	LB-1	Winter Flounder	3
4/17/2002	LB-2	Black Sea Bass	1
4/17/2002	LB-2	Clearnose Skate	2
4/17/2002	LB-2	Cunner	3
4/17/2002	LB-2	Northern Pipefish	1
4/17/2002	LB-2	Red Hake	8
4/17/2002	LB-2	Smallmouth Flounder	7
4/17/2002	LB-2	Spotted Hake	30
4/17/2002	LB-2	Windowpane	7
4/17/2002	LB-2	Winter Flounder	25
4/17/2002	LB-3	Alewife	1
4/17/2002	LB-3	Lined Seahorse	1
4/17/2002	LB-3	Smallmouth Flounder	1
4/17/2002	LB-3	Spotted Hake	22

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 22 of 31)

Date	Station	Common Name	CPUE
4/17/2002	LB-3	Winter Flounder	1
4/17/2002	LB-4	Spotted Hake	1
4/17/2002	LB-5	Black Sea Bass	1
4/17/2002	LB-5	Blueback Herring	1
4/17/2002	LB-5	Spotted Hake	10
4/17/2002	LB-5	Windowpane	4
4/17/2002	LB-6	Clearnose Skate	1
4/17/2002	LB-6	Northern Pipefish	1
4/17/2002	LB-6	Northern Searobin	1
4/17/2002	LB-6	Red Hake	1
4/17/2002	LB-6	Spotted Hake	59
4/17/2002	LB-6	Summer Flounder	1
4/17/2002	LB-6	Windowpane	5
4/17/2002	LB-6	Winter Flounder	10
4/18/2002	AK-4	Spotted Hake	3
4/18/2002	AK-4	Striped Bass	24
4/18/2002	AK-4	Windowpane	3
4/18/2002	AK-4	Winter Flounder	1
4/18/2002	NB-3	Alewife	1
4/18/2002	NB-3	Bay Anchovy	1
4/18/2002	NB-3	Spotted Hake	5
4/18/2002	NB-3	Striped Bass	11
4/18/2002	NB-3	Winter Flounder	5
4/18/2002	NB-4	Spotted Hake	16
4/18/2002	NB-4	Striped Bass	10
4/18/2002	NB-4	Windowpane	1
4/18/2002	NB-4	Winter Flounder	4
4/18/2002	NB-5	Atlantic Herring	19
4/18/2002	NB-5	Spotted Hake	59
4/18/2002	NB-5	Striped Bass	1
4/18/2002	NB-5	Windowpane	1
4/18/2002	NB-6	Clupeid unidentified	1
4/18/2002	NB-6	Grubby	2
4/18/2002	NB-6	Rock Gunnel	1
4/18/2002	NB-6	Spotted Hake	103
4/18/2002	NB-6	Windowpane	2
4/18/2002	NB-6	Winter Flounder	9
4/18/2002	NB-7	Alewife	2
4/18/2002	NB-7	Black Sea Bass	1
4/18/2002	NB-7	Blueback Herring	3
4/18/2002	NB-7	Clupeid unidentified	1
4/18/2002	NB-7	Northern Pipefish	1
4/18/2002	NB-7	Rock Gunnel	1
4/18/2002	NB-7	Smallmouth Flounder	3
4/18/2002	NB-7	Spotted Hake	28
4/18/2002	NB-7	Striped Bass	41
4/18/2002	NB-7	Summer Flounder	1
4/18/2002	NB-7	Tautog	1
4/18/2002	NB-7	Windowpane	5
4/18/2002	NB-7	Winter Flounder	9

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 23 of 31)

Date	Station	Common Name	CPUE
4/18/2002	PJ-5	Clearnose Skate	3
4/18/2002	PJ-5	Northern Pipefish	1
4/18/2002	PJ-5	Northern Searobin	2
4/18/2002	PJ-5	Spotted Hake	149
4/18/2002	PJ-5	Summer Flounder	1
4/18/2002	PJ-5	Tautog	1
4/18/2002	PJ-5	Windowpane	4
4/18/2002	PJ-5	Winter Flounder	7
4/18/2002	SB-1	Clearnose Skate	1
4/18/2002	SB-1	Northern Pipefish	1
4/18/2002	SB-1	Northern Searobin	1
4/18/2002	SB-1	Spotted Hake	16
4/18/2002	SB-1	Striped Bass	4
4/18/2002	SB-1	Striped Cuskeel	2
4/18/2002	SB-1	Windowpane	1
4/18/2002	SB-2	Clearnose Skate	1
4/18/2002	SB-2	Cunner	1
4/18/2002	SB-2	Northern Pipefish	1
4/18/2002	SB-2	Spotted Hake	11
4/18/2002	SB-2	Striped Bass	5
4/18/2002	SB-2	Striped Cuskeel	1
4/18/2002	SB-2	Windowpane	1
4/18/2002	SB-3	Grubby	1
4/18/2002	SB-3	Northern Searobin	8
4/18/2002	SB-3	Smallmouth Flounder	1
4/18/2002	SB-3	Spotted Hake	62
4/18/2002	SB-3	Striped Bass	1
4/18/2002	SB-3	Striped Searobin	1
4/18/2002	SB-3	Summer Flounder	1
4/18/2002	SB-3	Windowpane	4
4/18/2002	SB-3	Winter Flounder	4
4/18/2002	SB-4	Atlantic Herring	1
4/18/2002	SB-4	Bay Anchovy	1
4/18/2002	SB-4	Blueback Herring	1
4/18/2002	SB-4	Clearnose Skate	1
4/18/2002	SB-4	Northern Pipefish	1
4/18/2002	SB-4	Northern Searobin	2
4/18/2002	SB-4	Spotted Hake	45
4/18/2002	SB-4	Striped Bass	4
4/18/2002	SB-4	Windowpane	1
4/18/2002	SB-4	Winter Flounder	2
4/18/2002	SB-5	Blueback Herring	3
4/18/2002	SB-5	Clearnose Skate	2
4/18/2002	SB-5	Northern Searobin	1
4/18/2002	SB-5	Red Hake	3
4/18/2002	SB-5	Spotted Hake	15
4/18/2002	SB-5	Summer Flounder	1
4/18/2002	SB-5	Windowpane	2
4/18/2002	SB-5	Winter Flounder	9
4/18/2002	SB-6	Black Sea Bass	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 24 of 31)

Date	Station	Common Name	CPUE
4/18/2002	SB-6	Blueback Herring	1
4/18/2002	SB-6	Clearnose Skate	1
4/18/2002	SB-6	Cunner	2
4/18/2002	SB-6	Red Hake	1
4/18/2002	SB-6	Silver Hake	1
4/18/2002	SB-6	Spotted Hake	15
4/18/2002	SB-6	Striped Cuskeel	1
4/18/2002	SB-6	Windowpane	5
4/18/2002	SB-6	Winter Flounder	3
5/14/2002	AK-3	American Eel	3
5/14/2002	AK-3	Bay Anchovy	1
5/14/2002	AK-3	Blueback Herring	5
5/14/2002	AK-3	Grubby	1
5/14/2002	AK-3	Northern Searobin	1
5/14/2002	AK-3	Spotted Hake	157
5/14/2002	AK-3	Windowpane	2
5/14/2002	AK-3	Winter Flounder	1
5/14/2002	AK-4	American Eel	1
5/14/2002	AK-4	Bay Anchovy	5
5/14/2002	AK-4	Spotted Hake	2
5/14/2002	AK-4	Striped Bass	16
5/14/2002	AK-4	Summer Flounder	1
5/14/2002	NB-3	Bay Anchovy	5
5/14/2002	NB-3	Northern Searobin	1
5/14/2002	NB-3	Spotted Hake	16
5/14/2002	NB-3	Striped Bass	3
5/14/2002	NB-3	Striped Searobin	1
5/14/2002	NB-3	Summer Flounder	1
5/14/2002	NB-3	Tautog	1
5/14/2002	NB-3	Winter Flounder	8
5/14/2002	NB-4	Bay Anchovy	10
5/14/2002	NB-4	Black Sea Bass	1
5/14/2002	NB-4	Blueback Herring	1
5/14/2002	NB-4	Spotted Hake	25
5/14/2002	NB-4	Striped Bass	2
5/14/2002	NB-4	Summer Flounder	1
5/14/2002	NB-4	Winter Flounder	1
5/14/2002	NB-5	Bay Anchovy	10
5/14/2002	NB-5	Blueback Herring	23
5/14/2002	NB-5	Northern Searobin	2
5/14/2002	NB-5	Spotted Hake	24
5/14/2002	NB-5	Summer Flounder	1
5/15/2002	AK-1	Atlantic Herring	1
5/15/2002	AK-1	Bay Anchovy	1
5/15/2002	AK-1	Blueback Herring	2
5/15/2002	AK-1	Spotted Hake	1
5/15/2002	AK-2	American Eel	1
5/15/2002	AK-2	Bay Anchovy	2
5/15/2002	AK-2	Blueback Herring	6
5/15/2002	AK-2	Northern Pipefish	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 25 of 31)

Date	Station	Common Name	CPUE
5/15/2002	AK-2	Northern Searobin	3
5/15/2002	AK-2	Spotted Hake	106
5/15/2002	AK-2	Striped Searobin	1
5/15/2002	AK-2	Windowpane	2
5/15/2002	AK-2	Winter Flounder	1
5/15/2002	LB-1	Bay Anchovy	1
5/15/2002	LB-1	Clearnose Skate	1
5/15/2002	LB-1	Cunner	1
5/15/2002	LB-1	Grubby	1
5/15/2002	LB-1	Scup	54
5/15/2002	LB-1	Spotted Hake	15
5/15/2002	LB-1	Striped Bass	1
5/15/2002	LB-1	Tautog	1
5/15/2002	LB-1	Winter Flounder	2
5/15/2002	LB-3	Scup	6
5/15/2002	LB-3	Smallmouth Flounder	1
5/15/2002	LB-3	Spotted Hake	42
5/15/2002	LB-3	Striped Searobin	2
5/15/2002	LB-3	Summer Flounder	2
5/15/2002	LB-3	Windowpane	2
5/15/2002	LB-3	Winter Flounder	4
5/15/2002	LB-4	Clearnose Skate	1
5/15/2002	LB-4	Northern Puffer	1
5/15/2002	LB-4	Red Hake	1
5/15/2002	LB-4	Scup	1
5/15/2002	LB-4	Spotted Hake	31
5/15/2002	LB-4	Striped Searobin	2
5/15/2002	LB-4	Summer Flounder	1
5/15/2002	LB-4	Windowpane	2
5/15/2002	LB-4	Winter Flounder	9
5/15/2002	LB-5	Bay Anchovy	1
5/15/2002	LB-5	Spotted Hake	3
5/15/2002	LB-6	Bay Anchovy	1
5/15/2002	LB-6	Scup	4
5/15/2002	LB-6	Smallmouth Flounder	1
5/15/2002	LB-6	Spotted Hake	29
5/15/2002	LB-6	Striped Searobin	99
5/15/2002	LB-6	Summer Flounder	1
5/15/2002	LB-6	Weakfish	1
5/15/2002	LB-6	Windowpane	4
5/15/2002	LB-6	Winter Flounder	6
5/15/2002	NB-6	American Eel	1
5/15/2002	NB-6	Atlantic Herring	1
5/15/2002	NB-6	Atlantic Menhaden	1
5/15/2002	NB-6	Bay Anchovy	8
5/15/2002	NB-6	Blueback Herring	46
5/15/2002	NB-6	Hogchocker	1
5/15/2002	NB-6	Northern Searobin	4
5/15/2002	NB-6	Oyster Toadfish	1
5/15/2002	NB-6	Spotted Hake	28

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 26 of 31)

Date	Station	Common Name	CPUE
5/15/2002	NB-6	Summer Flounder	1
5/15/2002	NB-6	Winter Flounder	2
5/15/2002	NB-7	Bay Anchovy	1
5/15/2002	NB-7	Blueback Herring	2
5/15/2002	NB-7	Northern Searobin	1
5/15/2002	NB-7	Smallmouth Flounder	2
5/15/2002	NB-7	Spotted Hake	50
5/15/2002	NB-7	Striped Bass	8
5/15/2002	NB-7	Summer Flounder	6
5/15/2002	NB-7	Weakfish	1
5/15/2002	NB-7	Windowpane	1
5/15/2002	NB-7	Winter Flounder	2
5/15/2002	PJ-4	Atlantic Menhaden	1
5/15/2002	PJ-4	Atlantic Tomcod	3
5/15/2002	PJ-4	Bay Anchovy	4
5/15/2002	PJ-4	Butterfish	3
5/15/2002	PJ-4	Northern Pipefish	1
5/15/2002	PJ-4	Rock Gunnel	1
5/15/2002	PJ-4	Spotted Hake	98
5/15/2002	PJ-4	Striped Cuskeel	1
5/15/2002	PJ-5	Alewife	2
5/15/2002	PJ-5	Atlantic Menhaden	2
5/15/2002	PJ-5	Bay Anchovy	26
5/15/2002	PJ-5	Blueback Herring	1
5/15/2002	PJ-5	Spotted Hake	31
5/15/2002	PJ-5	Winter Flounder	2
5/16/2002	LB-2	Atlantic Menhaden	1
5/16/2002	LB-2	Black Sea Bass	1
5/16/2002	LB-2	Clearnose Skate	4
5/16/2002	LB-2	Northern Pipefish	1
5/16/2002	LB-2	Northern Searobin	6
5/16/2002	LB-2	Red Hake	4
5/16/2002	LB-2	Rock Gunnel	1
5/16/2002	LB-2	Scup	122
5/16/2002	LB-2	Smallmouth Flounder	15
5/16/2002	LB-2	Spotted Hake	182
5/16/2002	LB-2	Striped Searobin	4
5/16/2002	LB-2	Summer Flounder	5
5/16/2002	LB-2	Windowpane	3
5/16/2002	LB-2	Winter Flounder	30
5/16/2002	PJ-1	Atlantic Menhaden	5
5/16/2002	PJ-1	Atlantic Tomcod	4
5/16/2002	PJ-1	Bay Anchovy	3
5/16/2002	PJ-1	Northern Pipefish	2
5/16/2002	PJ-1	Northern Puffer	1
5/16/2002	PJ-1	Scup	2
5/16/2002	PJ-1	Smallmouth Flounder	6
5/16/2002	PJ-1	Spotted Hake	148
5/16/2002	PJ-1	Summer Flounder	2
5/16/2002	PJ-1	Windowpane	6

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 27 of 31)

Date	Station	Common Name	CPUE
5/16/2002	PJ-1	Winter Flounder	8
5/16/2002	PJ-2	Atlantic Menhaden	1
5/16/2002	PJ-2	Atlantic Tomcod	7
5/16/2002	PJ-2	Bay Anchovy	28
5/16/2002	PJ-2	Spotted Hake	19
5/16/2002	PJ-2	Summer Flounder	8
5/16/2002	PJ-2	Windowpane	3
5/16/2002	PJ-2	Winter Flounder	2
5/16/2002	PJ-3	Atlantic Menhaden	3
5/16/2002	PJ-3	Bay Anchovy	217
5/16/2002	PJ-3	Hickory Shad	1
5/16/2002	PJ-3	Scup	1
5/16/2002	PJ-3	Smallmouth Flounder	4
5/16/2002	PJ-3	Spotted Hake	12
5/16/2002	PJ-3	Striped Bass	4
5/16/2002	PJ-3	Summer Flounder	2
5/16/2002	PJ-3	Windowpane	1
5/16/2002	SB-1	Atlantic Tomcod	7
5/16/2002	SB-1	Bay Anchovy	1
5/16/2002	SB-1	Spotted Hake	12
5/16/2002	SB-1	Striped Bass	5
5/16/2002	SB-2	American Eel	1
5/16/2002	SB-2	Blueback Herring	2
5/16/2002	SB-2	Butterfish	1
5/16/2002	SB-2	Cunner	1
5/16/2002	SB-2	Smallmouth Flounder	1
5/16/2002	SB-2	Spotted Hake	17
5/16/2002	SB-2	Summer Flounder	1
5/16/2002	SB-2	Windowpane	2
5/16/2002	SB-2	Winter Flounder	1
5/16/2002	SB-3	Atlantic Menhaden	1
5/16/2002	SB-3	Black Sea Bass	1
5/16/2002	SB-3	Northern Searobin	1
5/16/2002	SB-3	Scup	7
5/16/2002	SB-3	Smallmouth Flounder	2
5/16/2002	SB-3	Spotted Hake	18
5/16/2002	SB-3	Striped Bass	1
5/16/2002	SB-3	Striped Searobin	1
5/16/2002	SB-3	Summer Flounder	5
5/16/2002	SB-3	Weakfish	1
5/16/2002	SB-3	Windowpane	6
5/16/2002	SB-3	Winter Flounder	3
5/16/2002	SB-4	American Eel	1
5/16/2002	SB-4	Bay Anchovy	1
5/16/2002	SB-4	Blueback Herring	1
5/16/2002	SB-4	Clearnose Skate	2
5/16/2002	SB-4	Northern Pipefish	3
5/16/2002	SB-4	Red Hake	2
5/16/2002	SB-4	Spotted Hake	46
5/16/2002	SB-4	Striped Bass	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 28 of 31)

Date	Station	Common Name	CPUE
5/16/2002	SB-4	Striped Searobin	2
5/16/2002	SB-4	Summer Flounder	1
5/16/2002	SB-4	Windowpane	6
5/16/2002	SB-4	Winter Flounder	3
5/16/2002	SB-5	Clearnose Skate	3
5/16/2002	SB-5	Northern Searobin	4
5/16/2002	SB-5	Red Hake	14
5/16/2002	SB-5	Spotted Hake	95
5/16/2002	SB-5	Weakfish	1
5/16/2002	SB-5	Windowpane	6
5/16/2002	SB-6	Bay Anchovy	1
5/16/2002	SB-6	Clearnose Skate	3
5/16/2002	SB-6	Fourspot Flounder	1
5/16/2002	SB-6	Northern Searobin	3
5/16/2002	SB-6	Red Hake	2
5/16/2002	SB-6	Scup	2
5/16/2002	SB-6	Smallmouth Flounder	1
5/16/2002	SB-6	Spotted Hake	76
5/16/2002	SB-6	Striped Cuskeel	1
5/16/2002	SB-6	Striped Searobin	2
5/16/2002	SB-6	Summer Flounder	2
5/16/2002	SB-6	Weakfish	1
5/16/2002	SB-6	Windowpane	13
5/16/2002	SB-6	Winter Flounder	3
6/17/2002	LB-3	Atlantic Menhaden	1
6/17/2002	LB-3	Bay Anchovy	32
6/17/2002	LB-3	Bluefish	1
6/17/2002	LB-4	American Eel	1
6/17/2002	LB-4	Clearnose Skate	1
6/17/2002	LB-4	Smallmouth Flounder	1
6/17/2002	LB-4	Spotted Hake	6
6/17/2002	LB-4	Striped Searobin	26
6/17/2002	LB-4	Windowpane	5
6/17/2002	LB-4	Winter Flounder	4
6/17/2002	LB-5	Bay Anchovy	2
6/17/2002	LB-6	Bay Anchovy	3
6/17/2002	LB-6	Spotted Hake	3
6/17/2002	LB-6	Striped Searobin	5
6/18/2002	AK-1	Atlantic Menhaden	1
6/18/2002	AK-1	Bay Anchovy	11
6/18/2002	AK-1	Smallmouth Flounder	1
6/18/2002	AK-1	Winter Flounder	1
6/18/2002	AK-2	Atlantic Menhaden	3
6/18/2002	AK-2	Bay Anchovy	22
6/18/2002	AK-2	Spotted Hake	3
6/18/2002	AK-2	Striped Bass	1
6/18/2002	AK-2	Striped Cuskeel	1
6/18/2002	AK-2	Summer Flounder	1
6/18/2002	AK-2	Winter Flounder	3
6/18/2002	AK-3	Atlantic Menhaden	2

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 29 of 31)

Date	Station	Common Name	CPUE
6/18/2002	AK-3	Bay Anchovy	5
6/18/2002	AK-3	Butterfish	1
6/18/2002	AK-3	Conger Eel	1
6/18/2002	AK-3	Grubby	3
6/18/2002	AK-3	Spotted Hake	65
6/18/2002	AK-3	Striped Searobin	2
6/18/2002	AK-3	Weakfish	2
6/18/2002	AK-3	Windowpane	4
6/18/2002	AK-3	Winter Flounder	5
6/18/2002	LB-1	Bay Anchovy	1
6/18/2002	LB-1	Clearnose Skate	1
6/18/2002	LB-1	Scup	37
6/18/2002	LB-1	Smooth Dogfish	4
6/18/2002	LB-1	Spotted Hake	1
6/18/2002	LB-2	Northern Searobin	1
6/18/2002	NB-5	Bay Anchovy	9
6/18/2002	NB-5	Blueback Herring	1
6/18/2002	NB-5	Clupeid unidentified	2
6/18/2002	NB-5	Spotted Hake	6
6/18/2002	PJ-1	Atlantic Tomcod	13
6/18/2002	PJ-1	Black Sea Bass	2
6/18/2002	PJ-1	Grubby	2
6/18/2002	PJ-1	Northern Searobin	1
6/18/2002	PJ-1	Scup	17
6/18/2002	PJ-1	Smallmouth Flounder	1
6/18/2002	PJ-1	Spotted Hake	25
6/18/2002	PJ-1	Summer Flounder	9
6/18/2002	PJ-1	Windowpane	1
6/18/2002	PJ-1	Winter Flounder	38
6/18/2002	PJ-2	Atlantic Tomcod	3
6/18/2002	PJ-2	Cunner	1
6/18/2002	PJ-2	Northern Searobin	1
6/18/2002	PJ-2	Smallmouth Flounder	1
6/18/2002	PJ-2	Spotted Hake	15
6/18/2002	PJ-2	Summer Flounder	35
6/18/2002	PJ-2	Weakfish	1
6/18/2002	PJ-2	Windowpane	1
6/18/2002	PJ-2	Winter Flounder	2
6/18/2002	PJ-3	Atlantic Menhaden	7
6/18/2002	PJ-3	Bay Anchovy	5
6/18/2002	PJ-3	Bluefish	1
6/18/2002	PJ-3	Northern Pipefish	1
6/18/2002	PJ-3	Smallmouth Flounder	1
6/18/2002	PJ-3	Spotted Hake	2
6/18/2002	PJ-3	Summer Flounder	10
6/18/2002	PJ-3	Windowpane	1
6/18/2002	PJ-3	Winter Flounder	1
6/18/2002	PJ-4	Bay Anchovy	2
6/18/2002	PJ-4	Blueback Herring	1
6/18/2002	PJ-4	Scup	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 30 of 31)

Date	Station	Common Name	CPUE
6/18/2002	PJ-4	Spotted Hake	22
6/18/2002	PJ-4	Windowpane	5
6/18/2002	PJ-4	Winter Flounder	4
6/18/2002	PJ-5	American Eel	1
6/18/2002	PJ-5	Smallmouth Flounder	1
6/18/2002	PJ-5	Spotted Hake	6
6/18/2002	PJ-5	Striped Searobin	1
6/18/2002	PJ-5	Summer Flounder	3
6/18/2002	PJ-5	Windowpane	11
6/18/2002	PJ-5	Winter Flounder	4
6/19/2002	AK-4	Northern Pipefish	1
6/19/2002	AK-4	Striped Bass	18
6/19/2002	AK-4	Summer Flounder	5
6/19/2002	AK-4	Winter Flounder	21
6/19/2002	NB-3	Bay Anchovy	11
6/19/2002	NB-3	Grubby	1
6/19/2002	NB-3	Striped Bass	11
6/19/2002	NB-3	Summer Flounder	5
6/19/2002	NB-3	Windowpane	1
6/19/2002	NB-3	Winter Flounder	2
6/19/2002	NB-4	Bay Anchovy	9
6/19/2002	NB-4	Bluefish	1
6/19/2002	NB-4	Spotted Hake	1
6/19/2002	NB-4	Striped Bass	4
6/19/2002	NB-4	Summer Flounder	2
6/19/2002	NB-4	Weakfish	1
6/19/2002	NB-4	Winter Flounder	11
6/19/2002	NB-6	American Eel	1
6/19/2002	NB-6	Atlantic Menhaden	3
6/19/2002	NB-6	Bay Anchovy	7
6/19/2002	NB-6	Northern Searobin	4
6/19/2002	NB-6	Spotted Hake	43
6/19/2002	NB-6	Striped Searobin	3
6/19/2002	NB-6	Summer Flounder	2
6/19/2002	NB-6	Winter Flounder	1
6/19/2002	NB-7	Atlantic Menhaden	3
6/19/2002	NB-7	Bay Anchovy	3
6/19/2002	NB-7	Black Sea Bass	2
6/19/2002	NB-7	Cunner	1
6/19/2002	NB-7	Grubby	1
6/19/2002	NB-7	Naked Goby	1
6/19/2002	NB-7	Northern Pipefish	3
6/19/2002	NB-7	Northern Searobin	6
6/19/2002	NB-7	Scup	1
6/19/2002	NB-7	Smallmouth Flounder	4
6/19/2002	NB-7	Spotted Hake	5
6/19/2002	NB-7	Striped Bass	2
6/19/2002	NB-7	Summer Flounder	3
6/19/2002	NB-7	Windowpane	2
6/19/2002	NB-7	Winter Flounder	36

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 1 of 31)

Date	Station	Common Name	CPUE
12/18/2001	PJ-1	Alewife	1
12/18/2001	PJ-1	Bay Anchovy	1
12/18/2001	PJ-1	Blueback Herring	13
12/18/2001	PJ-2	Alewife	2
12/18/2001	PJ-2	American Shad	5
12/18/2001	PJ-2	Blueback Herring	1
12/18/2001	PJ-2	Smallmouth Flounder	1
12/18/2001	PJ-3	Alewife	1
12/18/2001	PJ-3	Alewife	1
12/18/2001	PJ-3	American Shad	6
12/18/2001	PJ-3	American Shad	6
12/18/2001	PJ-3	Blueback Herring	8
12/18/2001	PJ-3	Blueback Herring	8
12/18/2001	PJ-3	Clearnose Skate	1
12/18/2001	PJ-3	Clearnose Skate	1
12/18/2001	PJ-3	Naked Goby	1
12/18/2001	PJ-3	Naked Goby	1
12/18/2001	PJ-3	Spotted Hake	1
12/18/2001	PJ-3	Spotted Hake	1
12/18/2001	PJ-3	Striped Bass	4
12/18/2001	PJ-3	Striped Bass	4
12/18/2001	PJ-3	Tautog	1
12/18/2001	PJ-3	Tautog	1
12/18/2001	PJ-3	Weakfish	1
12/18/2001	PJ-3	Weakfish	1
12/18/2001	PJ-3	Winter Flounder	3
12/18/2001	PJ-3	Winter Flounder	3
12/18/2001	PJ-4	Alewife	1
12/18/2001	PJ-4	American Shad	1
12/18/2001	PJ-4	Bay Anchovy	1
12/18/2001	PJ-4	Blueback Herring	5
12/18/2001	PJ-4	Clearnose Skate	1
12/18/2001	PJ-4	Unidentified	1
12/18/2001	PJ-5	Alewife	6
12/18/2001	PJ-5	American Shad	2
12/18/2001	PJ-5	Atlantic Menhaden	1
12/18/2001	PJ-5	Blueback Herring	23
12/18/2001	PJ-5	Clearnose Skate	4
12/18/2001	PJ-5	Smallmouth Flounder	2
12/18/2001	PJ-5	Spot	1
12/18/2001	PJ-5	Spotted Hake	9
12/18/2001	PJ-5	Striped Bass	1
12/18/2001	PJ-5	Weakfish	3
12/18/2001	PJ-5	Windowpane	6
12/18/2001	PJ-5	Winter Flounder	2
12/18/2001	SB-1	Alewife	1
12/18/2001	SB-1	Red Hake	2
12/18/2001	SB-1	Smallmouth Flounder	5
12/18/2001	SB-1	Spot	15
12/18/2001	SB-1	Spotted Hake	1

Appendix A. Adult finfish (trawl) CPUE by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 31 of 31)

Date	Station	Common Name	CPUE
6/19/2002	SB-1	Bay Anchovy	1
6/19/2002	SB-1	Spotted Hake	9
6/19/2002	SB-1	Summer Flounder	5
6/19/2002	SB-1	Windowpane	18
6/19/2002	SB-1	Winter Flounder	2
6/19/2002	SB-2	Atlantic Tomcod	2
6/19/2002	SB-2	Bay Anchovy	1
6/19/2002	SB-2	Cunner	2
6/19/2002	SB-2	Oyster Toadfish	1
6/19/2002	SB-2	Spotted Hake	2
6/19/2002	SB-2	Windowpane	1
6/19/2002	SB-3	Bay Anchovy	2
6/19/2002	SB-3	Northern Searobin	2
6/19/2002	SB-3	Scup	10
6/19/2002	SB-3	Spotted Hake	2
6/19/2002	SB-3	Summer Flounder	1
6/19/2002	SB-3	Winter Flounder	1
6/19/2002	SB-4	Atlantic Menhaden	1
6/19/2002	SB-4	Bay Anchovy	3
6/19/2002	SB-4	Blueback Herring	3
6/19/2002	SB-4	Spotted Hake	3
6/19/2002	SB-4	Windowpane	1
6/19/2002	SB-6	Bay Anchovy	1
6/19/2002	SB-6	Bluefish	1
6/19/2002	SB-6	Scup	2
6/19/2002	SB-6	Spotted Hake	12
6/19/2002	SB-6	Striped Searobin	3
6/19/2002	SB-6	Summer Flounder	1
6/19/2002	SB-6	Tautog	1
6/19/2002	SB-6	Windowpane	3
6/19/2002	SB-6	Winter Flounder	1
6/20/2002	SB-5	Bluefish	1
6/20/2002	SB-5	Clearnose Skate	2
6/20/2002	SB-5	Fourspot Flounder	6
6/20/2002	SB-5	Northern Searobin	2
6/20/2002	SB-5	Spotted Hake	75
6/20/2002	SB-5	Striped Searobin	6
6/20/2002	SB-5	Summer Flounder	7
6/20/2002	SB-5	Windowpane	11
6/20/2002	SB-5	Winter Flounder	5

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 1 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
1/22/2002	LB-1	Rock gunnel	PYS	3	16.7
1/22/2002	PJ-5	Rock gunnel	PYS	3	19.9
1/22/2002	PJ-5	Summer flounder	PYS	1	6.6
1/22/2002	SB-1	Rock gunnel	PYS	2	23.3
1/22/2002	SB-2	Rock gunnel	PYS	1	9.5
1/22/2002	SB-3	Rock gunnel	PYS	1	13.3
1/22/2002	SB-4	Rock gunnel	PYS	10	57.0
1/22/2002	SB-4	Unidentified	Egg	1	5.7
1/22/2002	SB-5	Rock gunnel	PYS	1	13.0
1/22/2002	SB-6	Rock gunnel	PYS	1	23.5
1/23/2002	AK-1	Rock gunnel	PYS	2	13.2
1/23/2002	AK-2	Rock gunnel	PYS	1	5.9
1/23/2002	AK-3	Rock gunnel	PYS	1	8.4
1/23/2002	LB-3	Rock gunnel	PYS	3	17.6
1/23/2002	LB-4	Rock gunnel	PYS	4	17.6
1/23/2002	LB-6	Rock gunnel	PYS	9	52.6
1/24/2002	NB-5	Atlantic menhaden	PYS	1	6.7
1/24/2002	NB-6	Rock gunnel	PYS	4	24.9
2/5/2002	AK-1	Grubby	YS	1	5.7
2/5/2002	AK-1	Rock gunnel	PYS	1	5.7
2/5/2002	AK-2	Rock gunnel	PYS	1	4.1
2/5/2002	AK-2	Spot	PYS	1	4.1
2/5/2002	NB-3	Rock gunnel	PYS	2	11.9
2/5/2002	NB-5	Rock gunnel	PYS	2	10.8
2/5/2002	NB-5	Summer flounder	PYS	1	5.4
2/5/2002	NB-7	Grubby	YS	1	6.4
2/5/2002	NB-7	Rock gunnel	PYS	2	12.8
2/6/2002	LB-2	Rock gunnel	PYS	1	6.6
2/6/2002	LB-3	Grubby	YS	1	9.3
2/6/2002	LB-4	Grubby	YS	1	9.2
2/6/2002	LB-4	Rock gunnel	PYS	3	27.7
2/6/2002	LB-5	Rock gunnel	PYS	1	5.9
2/6/2002	SB-1	Grubby	PYS	1	10.7
2/6/2002	SB-1	Grubby	YS	3	32.1
2/6/2002	SB-1	Rock gunnel	PYS	1	10.7
2/6/2002	SB-1	Unidentified	PYS	1	10.7
2/6/2002	SB-2	Grubby	YS	1	7.9
2/6/2002	SB-2	Rock gunnel	PYS	2	15.9
2/6/2002	SB-2	Winter flounder	YS	5	39.7
2/6/2002	SB-4	Grubby	YS	1	4.8
2/6/2002	SB-4	Rock gunnel	PYS	1	4.8
2/6/2002	SB-4	Winter flounder	YS	18	86.2
2/7/2002	PJ-1	Rock gunnel	PYS	1	6.1
2/7/2002	PJ-2	Rock gunnel	PYS	1	8.4
2/7/2002	PJ-3	Rock gunnel	PYS	3	16.9
2/7/2002	PJ-4	Grubby	YS	1	5.4
2/7/2002	PJ-4	Spot	PYS	1	5.4
2/7/2002	PJ-5	Grubby	YS	1	4.7
2/7/2002	SB-5	Spot	PYS	1	12.9
2/7/2002	SB-6	Grubby	PYS	2	10.3

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 2 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
2/7/2002	SB-6	Rock gunnel	PYS	3	15.4
2/19/2002	LB-1	Grubby	PYS	2	11.1
2/19/2002	LB-1	Grubby	YS	1	5.5
2/19/2002	LB-1	Winter flounder	Egg	4	22.2
2/19/2002	LB-1	Winter flounder	PYS	2	11.1
2/19/2002	LB-2	Grubby	PYS	2	7.2
2/19/2002	LB-2	Grubby	YS	1	3.6
2/19/2002	LB-2	Rock gunnel	PYS	2	7.2
2/19/2002	LB-2	Winter flounder	PYS	5	18.1
2/19/2002	LB-3	Grubby	PYS	7	34.0
2/19/2002	LB-3	Grubby	YS	2	9.7
2/19/2002	LB-3	Rock gunnel	PYS	2	9.7
2/19/2002	LB-3	Winter flounder	PYS	1	4.9
2/19/2002	LB-4	Grubby	PYS	4	26.1
2/19/2002	LB-4	Grubby	YS	3	19.6
2/19/2002	LB-4	Rock gunnel	PYS	4	26.1
2/19/2002	LB-4	Spot	PYS	1	6.5
2/19/2002	LB-5	American sandlance	PYS	1	5.7
2/19/2002	LB-5	Grubby	PYS	6	34.1
2/19/2002	LB-5	Grubby	YS	3	17.1
2/19/2002	LB-5	Winter flounder	Egg	41	233.2
2/19/2002	LB-5	Winter flounder	PYS	3	17.1
2/19/2002	LB-5	Winter flounder	YS	15	85.3
2/19/2002	PJ-1	Grubby	Egg	1	6.9
2/19/2002	PJ-1	Grubby	PYS	1	6.9
2/19/2002	PJ-1	Grubby	YS	1	6.9
2/19/2002	PJ-2	Rock gunnel	PYS	1	6.5
2/19/2002	PJ-2	Winter flounder	PYS	1	6.5
2/19/2002	PJ-3	Grubby	PYS	1	8.2
2/19/2002	PJ-3	Winter flounder	Egg	1	8.2
2/19/2002	PJ-3	Winter flounder	PYS	4	32.9
2/19/2002	PJ-3	Winter flounder	YS	1	8.2
2/19/2002	SB-5	Grubby	PYS	5	26.4
2/19/2002	SB-5	Grubby	YS	1	5.3
2/19/2002	SB-5	Rock gunnel	PYS	2	10.6
2/19/2002	SB-5	Winter flounder	PYS	1	5.3
2/20/2002	AK-1	Grubby	PYS	12	66.0
2/20/2002	AK-1	Grubby	YS	4	22.0
2/20/2002	AK-1	Rock gunnel	PYS	1	5.5
2/20/2002	AK-1	Winter flounder	PYS	1	5.5
2/20/2002	AK-2	Grubby	PYS	6	30.4
2/20/2002	AK-2	Grubby	YS	4	20.3
2/20/2002	AK-2	Rock gunnel	PYS	1	5.1
2/20/2002	AK-2	Winter flounder	PYS	1	5.1
2/20/2002	AK-3	Grubby	PYS	9	56.7
2/20/2002	AK-3	Grubby	YS	7	44.1
2/20/2002	AK-3	Rock gunnel	PYS	1	6.3
2/20/2002	AK-4	Grubby	YS	2	11.7
2/20/2002	AK-4	Winter flounder	PYS	2	11.7
2/20/2002	AK-4	Winter flounder	YS	3	17.5

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 3 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
2/20/2002	NB-3	Grubby	PYS	1	5.2
2/20/2002	NB-3	Winter flounder	Egg	1	5.2
2/20/2002	NB-3	Winter flounder	PYS	1	5.2
2/20/2002	NB-3	Winter flounder	YS	2	10.4
2/20/2002	NB-4	Winter flounder	YS	1	5.5
2/20/2002	NB-5	Grubby	PYS	4	19.3
2/20/2002	NB-5	Grubby	YS	4	19.3
2/20/2002	NB-5	Spot	PYS	1	4.8
2/20/2002	NB-6	Grubby	PYS	9	44.4
2/20/2002	NB-6	Grubby	YS	5	24.7
2/20/2002	NB-6	Spot	PYS	1	4.9
2/20/2002	NB-6	Winter flounder	PYS	1	4.9
2/20/2002	NB-6	Winter flounder	YS	3	14.8
2/20/2002	NB-7	Grubby	PYS	5	39.1
2/20/2002	PJ-4	Grubby	PYS	5	25.3
2/20/2002	PJ-4	Grubby	YS	2	10.1
2/20/2002	PJ-4	Winter flounder	PYS	5	25.3
2/20/2002	PJ-4	Winter flounder	YS	4	20.3
2/20/2002	PJ-5	Grubby	PYS	5	25.3
2/20/2002	PJ-5	Grubby	YS	3	15.2
2/20/2002	PJ-5	Winter flounder	PYS	1	5.1
2/20/2002	PJ-5	Winter flounder	YS	2	10.1
2/21/2002	SB-1	Grubby	PYS	18	203.4
2/21/2002	SB-1	Grubby	YS	5	56.5
2/21/2002	SB-1	Rock gunnel	PYS	2	22.6
2/21/2002	SB-1	Winter flounder	PYS	21	237.3
2/21/2002	SB-1	Winter flounder	YS	3	33.9
2/21/2002	SB-2	Grubby	PYS	7	59.0
2/21/2002	SB-2	Grubby	YS	2	16.9
2/21/2002	SB-2	Rock gunnel	PYS	2	16.9
2/21/2002	SB-2	Winter flounder	PYS	1	8.4
2/21/2002	SB-3	Bothid unidentified	Egg	1	4.0
2/21/2002	SB-3	Grubby	PYS	6	24.2
2/21/2002	SB-3	Grubby	YS	1	4.0
2/21/2002	SB-3	Winter flounder	PYS	3	12.1
2/21/2002	SB-4	Atlantic menhaden	Egg	2	9.8
2/21/2002	SB-4	Four beard rockling	Egg	1	4.9
2/21/2002	SB-4	Grubby	PYS	1	4.9
2/21/2002	SB-4	Winter flounder	PYS	69	339.7
2/21/2002	SB-4	Winter flounder	YS	10	49.2
2/21/2002	SB-6	Grubby	PYS	1	3.3
2/21/2002	SB-6	Winter flounder	PYS	17	56.9
2/21/2002	SB-6	Winter flounder	YS	3	10.0
3/5/2002	AK-1	Grubby	PYS	16	74.2
3/5/2002	AK-1	Grubby	YS	3	13.9
3/5/2002	AK-1	Winter flounder	PYS	4	18.5
3/5/2002	AK-2	Grubby	PYS	9	46.2
3/5/2002	AK-2	Grubby	YS	3	15.4
3/5/2002	AK-2	Winter flounder	PYS	6	30.8
3/5/2002	AK-2	Winter flounder	YS	13	66.8

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 4 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
3/5/2002	AK-3	Grubby	PYS	15	74.4
3/5/2002	AK-3	Grubby	YS	7	34.7
3/5/2002	AK-3	Rock gunnel	PYS	1	5.0
3/5/2002	AK-3	Winter flounder	PYS	4	19.8
3/5/2002	AK-3	Winter flounder	YS	4	19.8
3/5/2002	AK-4	Grubby	PYS	6	30.5
3/5/2002	AK-4	Grubby	YS	3	15.3
3/5/2002	AK-4	Spot	PYS	1	5.1
3/5/2002	NB-3	Grubby	PYS	2	8.9
3/5/2002	NB-3	Winter flounder	PYS	12	53.1
3/5/2002	NB-4	American sandlance	PYS	1	5.0
3/5/2002	NB-4	Grubby	PYS	5	25.2
3/5/2002	NB-4	Winter flounder	PYS	24	120.7
3/5/2002	NB-4	Winter flounder	YS	3	15.1
3/5/2002	NB-5	Grubby	PYS	4	23.0
3/5/2002	NB-5	Grubby	YS	1	5.7
3/5/2002	NB-5	Winter flounder	PYS	1	5.7
3/5/2002	NB-5	Winter flounder	YS	1	5.7
3/5/2002	NB-6	Grubby	PYS	5	25.1
3/5/2002	NB-6	Grubby	YS	1	5.0
3/5/2002	NB-6	Rock gunnel	PYS	1	5.0
3/5/2002	NB-6	Winter flounder	PYS	6	30.1
3/5/2002	NB-6	Winter flounder	YS	2	10.0
3/5/2002	NB-7	Grubby	PYS	1	6.1
3/5/2002	NB-7	Winter flounder	Egg	5	30.4
3/5/2002	NB-7	Winter flounder	PYS	9	54.6
3/5/2002	NB-7	Winter flounder	YS	1	6.1
3/6/2002	LB-1	American sandlance	PYS	1	4.2
3/6/2002	LB-1	Grubby	PYS	8	33.5
3/6/2002	LB-1	Grubby	YS	2	8.4
3/6/2002	LB-1	Winter flounder	PYS	18	75.4
3/6/2002	LB-1	Winter flounder	YS	3	12.6
3/6/2002	LB-2	Atlantic menhaden	Egg	3	22.5
3/6/2002	LB-2	Grubby	PYS	7	52.5
3/6/2002	LB-2	Grubby	YS	2	15.0
3/6/2002	LB-2	Winter flounder	Egg	1	7.5
3/6/2002	LB-2	Winter flounder	PYS	3	22.5
3/6/2002	LB-3	Grubby	PYS	4	17.6
3/6/2002	LB-3	Winter flounder	PYS	16	70.5
3/6/2002	LB-3	Winter flounder	YS	2	8.8
3/6/2002	LB-4	American sandlance	PYS	1	7.1
3/6/2002	LB-4	Four beard rockling	Egg	1	7.1
3/6/2002	LB-4	Grubby	PYS	55	390.7
3/6/2002	LB-4	Grubby	YS	3	21.3
3/6/2002	LB-4	Rock gunnel	PYS	1	7.1
3/6/2002	LB-4	Winter flounder	PYS	35	248.6
3/6/2002	LB-4	Winter flounder	YS	2	14.2
3/6/2002	LB-5	Grubby	PYS	25	174.4
3/6/2002	LB-5	Grubby	YS	4	27.9
3/6/2002	LB-5	Winter flounder	PYS	10	69.7

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 5 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
3/6/2002	LB-5	Winter flounder	YS	1	7.0
3/6/2002	LB-6	Grubby	PYS	3	39.3
3/6/2002	LB-6	Grubby	YS	1	13.1
3/6/2002	LB-6	Winter flounder	PYS	4	52.4
3/6/2002	LB-6	Winter flounder	YS	10	131.1
3/6/2002	PJ-2	Grubby	PYS	3	11.4
3/6/2002	PJ-2	Grubby	YS	1	3.8
3/6/2002	PJ-2	Rock gunnel	PYS	1	3.8
3/6/2002	PJ-2	Winter flounder	Egg	23	87.8
3/6/2002	PJ-2	Winter flounder	PYS	14	53.4
3/6/2002	PJ-2	Winter flounder	YS	1	3.8
3/6/2002	PJ-3	Four beard rockling	PYS	2	9.8
3/6/2002	PJ-3	Grubby	PYS	2	9.8
3/6/2002	PJ-4	Grubby	PYS	4	17.8
3/6/2002	PJ-4	Winter flounder	PYS	14	62.3
3/6/2002	PJ-4	Winter flounder	YS	3	13.3
3/6/2002	PJ-5	Atlantic menhaden	PYS	1	3.8
3/6/2002	PJ-5	Four beard rockling	Egg	1	3.8
3/6/2002	PJ-5	Grubby	PYS	6	22.7
3/6/2002	PJ-5	Winter flounder	PYS	19	71.8
3/6/2002	PJ-5	Winter flounder	YS	2	7.6
3/6/2002	SB-6	Grubby	PYS	39	224.3
3/6/2002	SB-6	Grubby	YS	10	57.5
3/6/2002	SB-6	Winter flounder	PYS	18	103.5
3/6/2002	SB-6	Winter flounder	YS	13	74.8
3/7/2002	PJ-1	American sandlance	PYS	1	6.1
3/7/2002	PJ-1	Grubby	PYS	2	12.2
3/7/2002	PJ-1	Grubby	YS	1	6.1
3/7/2002	PJ-1	Winter flounder	PYS	10	60.9
3/7/2002	SB-1	Grubby	PYS	12	115.8
3/7/2002	SB-1	Grubby	YS	2	19.3
3/7/2002	SB-1	Winter flounder	PYS	11	106.1
3/7/2002	SB-2	Grubby	PYS	9	65.9
3/7/2002	SB-2	Grubby	YS	4	29.3
3/7/2002	SB-3	Grubby	PYS	1	6.2
3/7/2002	SB-3	Winter flounder	PYS	1	6.2
3/7/2002	SB-4	Grubby	PYS	12	40.5
3/7/2002	SB-4	Grubby	YS	3	10.1
3/7/2002	SB-4	Winter flounder	PYS	9	30.3
3/7/2002	SB-6	Grubby	PYS	32	207.0
3/7/2002	SB-6	Grubby	YS	15	97.0
3/19/2002	LB-1	Atlantic menhaden	Egg	4	15.5
3/19/2002	LB-1	Grubby	PYS	35	135.5
3/19/2002	LB-1	Grubby	YS	4	15.5
3/19/2002	LB-1	Winter flounder	Egg	19	73.6
3/19/2002	LB-1	Winter flounder	PYS	19	73.6
3/19/2002	LB-2	Grubby	PYS	2	6.0
3/19/2002	LB-2	Winter flounder	Egg	1	3.0
3/19/2002	LB-2	Winter flounder	PYS	39	116.3
3/19/2002	LB-3	American sandlance	PYS	1	3.4

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 6 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
3/19/2002	LB-3	Grubby	PYS	13	44.2
3/19/2002	LB-3	Grubby	YS	1	3.4
3/19/2002	LB-3	Rock gunnel	PYS	1	3.4
3/19/2002	LB-3	Winter flounder	PYS	35	119.0
3/19/2002	LB-3	Winter flounder	YS	1	3.4
3/19/2002	LB-4	Atlantic menhaden	Egg	3	10.3
3/19/2002	LB-4	Grubby	PYS	39	134.5
3/19/2002	LB-4	Grubby	YS	6	20.7
3/19/2002	LB-4	Winter flounder	Egg	9	31.0
3/19/2002	LB-4	Winter flounder	PYS	36	124.1
3/19/2002	LB-4	Winter flounder	YS	3	10.3
3/19/2002	LB-5	Grubby	PYS	4	16.3
3/19/2002	LB-5	Winter flounder	Egg	3	12.2
3/19/2002	LB-5	Winter flounder	PYS	29	118.0
3/19/2002	LB-5	Winter flounder	YS	2	8.1
3/19/2002	LB-6	American sandlance	PYS	1	3.7
3/19/2002	LB-6	Atlantic menhaden	Egg	10	37.1
3/19/2002	LB-6	Grubby	PYS	4	14.8
3/19/2002	LB-6	Grubby	YS	1	3.7
3/19/2002	LB-6	Striped cuskeel	PYS	2	7.4
3/19/2002	LB-6	Winter flounder	PYS	150	556.3
3/19/2002	LB-6	Winter flounder	YS	1	3.7
3/19/2002	PJ-1	Grubby	PYS	15	76.7
3/19/2002	PJ-1	Grubby	YS	5	25.6
3/19/2002	PJ-1	Winter flounder	PYS	23	117.5
3/19/2002	PJ-2	Grubby	PYS	2	8.3
3/19/2002	PJ-2	Winter flounder	Egg	1	4.1
3/19/2002	PJ-2	Winter flounder	PYS	1	4.1
3/19/2002	PJ-3	Atlantic menhaden	Egg	1	4.0
3/19/2002	PJ-3	Grubby	PYS	22	88.1
3/19/2002	PJ-3	Grubby	YS	1	4.0
3/19/2002	PJ-3	Summer flounder	PYS	1	4.0
3/19/2002	PJ-3	Winter flounder	Egg	1	4.0
3/19/2002	PJ-3	Winter flounder	PYS	25	100.1
3/19/2002	PJ-3	Winter flounder	YS	1	4.0
3/19/2002	PJ-4	Grubby	PYS	18	69.0
3/19/2002	PJ-4	Grubby	YS	3	11.5
3/19/2002	PJ-4	Winter flounder	PYS	18	69.0
3/19/2002	PJ-5	Atlantic menhaden	Egg	3	10.8
3/19/2002	PJ-5	Grubby	PYS	24	86.4
3/19/2002	PJ-5	Grubby	YS	3	10.8
3/19/2002	PJ-5	Winter flounder	PYS	11	39.6
3/20/2002	AK-1	Grubby	PYS	34	201.0
3/20/2002	AK-1	Grubby	YS	8	47.3
3/20/2002	AK-2	Atlantic menhaden	Egg	1	5.3
3/20/2002	AK-2	Grubby	PYS	9	47.3
3/20/2002	AK-2	Grubby	YS	2	10.5
3/20/2002	AK-3	Atlantic menhaden	Egg	1	4.3
3/20/2002	AK-3	Grubby	PYS	3	12.9
3/20/2002	AK-3	Grubby	YS	1	4.3

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 7 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
3/20/2002	AK-3	Winter flounder	PYS	2	8.6
3/20/2002	AK-4	Grubby	PYS	2	12.3
3/20/2002	AK-4	Winter flounder	PYS	4	24.7
3/20/2002	NB-3	Grubby	PYS	3	16.4
3/20/2002	NB-3	Winter flounder	PYS	10	54.6
3/20/2002	NB-4	Grubby	PYS	16	82.5
3/20/2002	NB-4	Grubby	YS	5	25.8
3/20/2002	NB-4	Winter flounder	PYS	6	30.9
3/20/2002	NB-5	Grubby	PYS	9	39.1
3/20/2002	NB-5	Grubby	YS	2	8.7
3/20/2002	NB-5	Winter flounder	PYS	4	17.4
3/20/2002	NB-6	Four beard rockling	Egg	1	5.5
3/20/2002	NB-6	Grubby	PYS	5	27.6
3/20/2002	NB-6	Grubby	YS	6	33.2
3/20/2002	NB-7	Grubby	PYS	9	69.7
3/20/2002	NB-7	Grubby	YS	2	15.5
3/20/2002	NB-7	Winter flounder	PYS	8	62.0
3/21/2002	SB-1	Grubby	PYS	20	226.6
3/21/2002	SB-1	Grubby	YS	4	45.3
3/21/2002	SB-1	Winter flounder	PYS	28	317.2
3/21/2002	SB-2	Grubby	PYS	7	52.7
3/21/2002	SB-2	Grubby	YS	1	7.5
3/21/2002	SB-2	Winter flounder	PYS	73	549.5
3/21/2002	SB-3	Atlantic menhaden	Egg	2	13.5
3/21/2002	SB-3	Four beard rockling	Egg	1	6.8
3/21/2002	SB-3	Grubby	PYS	9	61.0
3/21/2002	SB-3	Grubby	YS	3	20.3
3/21/2002	SB-3	Winter flounder	PYS	42	284.5
3/21/2002	SB-4	Atlantic menhaden	Egg	11	48.4
3/21/2002	SB-4	Atlantic tomcod	PYS	1	4.4
3/21/2002	SB-4	Four beard rockling	Egg	2	8.8
3/21/2002	SB-4	Grubby	PYS	19	83.7
3/21/2002	SB-4	Grubby	YS	4	17.6
3/21/2002	SB-4	Winter flounder	Egg	1	4.4
3/21/2002	SB-4	Winter flounder	PYS	15	66.0
3/21/2002	SB-4	Winter flounder	YS	4	17.6
3/21/2002	SB-5	Atlantic menhaden	Egg	2	16.1
3/21/2002	SB-5	Grubby	PYS	8	64.4
3/21/2002	SB-5	Grubby	YS	3	24.2
3/21/2002	SB-5	Winter flounder	PYS	1	8.1
3/21/2002	SB-6	Atlantic menhaden	Egg	3	22.8
3/21/2002	SB-6	Grubby	PYS	19	144.6
3/21/2002	SB-6	Grubby	YS	3	22.8
3/21/2002	SB-6	Winter flounder	PYS	8	60.9
4/2/2002	LB-1	Atlantic menhaden	Egg	1	3.4
4/2/2002	LB-1	Grubby	PYS	1	3.4
4/2/2002	LB-1	Winter flounder	PYS	92	317.1
4/2/2002	LB-1	Winter flounder	YS	9	31.0
4/2/2002	LB-2	Grubby	PYS	2	4.8
4/2/2002	LB-2	Winter flounder	PYS	20	47.8

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 8 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
4/2/2002	LB-3	Atlantic menhaden	Egg	2	8.7
4/2/2002	LB-3	Four beard rockling	Egg	1	4.3
4/2/2002	LB-3	Grubby	PYS	1	4.3
4/2/2002	LB-3	Winter flounder	PYS	69	299.1
4/2/2002	LB-3	Winter flounder	YS	10	43.3
4/2/2002	LB-4	Atlantic menhaden	Egg	1	3.5
4/2/2002	LB-4	Winter flounder	PYS	54	189.2
4/2/2002	LB-4	Winter flounder	YS	7	24.5
4/2/2002	LB-5	Atlantic menhaden	Egg	13	61.5
4/2/2002	LB-5	Four beard rockling	Egg	1	4.7
4/2/2002	LB-5	Grubby	PYS	1	4.7
4/2/2002	LB-5	Grubby	YS	2	9.5
4/2/2002	LB-5	Winter flounder	PYS	99	468.1
4/2/2002	LB-5	Winter flounder	YS	47	222.2
4/2/2002	LB-6	Grubby	PYS	3	12.0
4/2/2002	LB-6	Rock gunnel	PYS	1	4.0
4/2/2002	LB-6	Weakfish	Egg	5	20.0
4/2/2002	LB-6	Winter flounder	PYS	215	860.4
4/2/2002	LB-6	Winter flounder	YS	7	28.0
4/2/2002	PJ-1	Grubby	PYS	8	52.3
4/2/2002	PJ-1	Grubby	YS	4	26.1
4/2/2002	PJ-1	Winter flounder	PYS	17	111.0
4/2/2002	PJ-1	Winter flounder	YS	3	19.6
4/2/2002	PJ-2	Grubby	PYS	3	15.2
4/2/2002	PJ-2	Winter flounder	PYS	5	25.3
4/2/2002	PJ-4	Grubby	PYS	12	49.1
4/2/2002	PJ-4	Grubby	YS	2	8.2
4/2/2002	PJ-4	Winter flounder	PYS	38	155.6
4/2/2002	PJ-4	Winter flounder	YS	1	4.1
4/2/2002	PJ-5	American sandlance	PYS	1	4.9
4/2/2002	PJ-5	Four beard rockling	Egg	1	4.9
4/2/2002	PJ-5	Grubby	PYS	16	78.2
4/2/2002	PJ-5	Grubby	YS	1	4.9
4/2/2002	PJ-5	Rock gunnel	PYS	1	4.9
4/2/2002	PJ-5	Winter flounder	PYS	10	48.9
4/2/2002	PJ-5	Winter flounder	YS	3	14.7
4/3/2002	AK-1	Bay anchovy	PYS	1	4.8
4/3/2002	AK-1	Grubby	PYS	7	33.6
4/3/2002	AK-1	Grubby	YS	2	9.6
4/3/2002	AK-1	Winter flounder	PYS	7	33.6
4/3/2002	AK-1	Winter flounder	YS	11	52.9
4/3/2002	AK-2	Four beard rockling	Egg	1	4.4
4/3/2002	AK-2	Grubby	PYS	4	17.8
4/3/2002	AK-2	Grubby	YS	2	8.9
4/3/2002	AK-2	Winter flounder	PYS	2	8.9
4/3/2002	AK-2	Winter flounder	YS	1	4.4
4/3/2002	AK-3	Atlantic menhaden	PYS	3	12.5
4/3/2002	AK-3	Grubby	PYS	1	4.2
4/3/2002	AK-3	Grubby	YS	1	4.2
4/3/2002	AK-3	Winter flounder	PYS	4	16.6

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 9 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
4/3/2002	AK-4	Atlantic menhaden	PYS	1	4.6
4/3/2002	AK-4	Grubby	PYS	3	13.7
4/3/2002	AK-4	Winter flounder	PYS	23	105.1
4/3/2002	AK-4	Winter flounder	YS	2	9.1
4/3/2002	NB-3	Grubby	PYS	2	10.8
4/3/2002	NB-4	Grubby	YS	1	4.5
4/3/2002	NB-4	Winter flounder	PYS	23	103.7
4/3/2002	NB-5	Grubby	PYS	3	14.0
4/3/2002	NB-5	Grubby	YS	1	4.7
4/3/2002	NB-6	Grubby	PYS	12	53.8
4/3/2002	NB-6	Grubby	YS	4	17.9
4/3/2002	NB-6	Winter flounder	PYS	5	22.4
4/3/2002	NB-6	Winter flounder	YS	1	4.5
4/3/2002	NB-7	Grubby	PYS	9	63.4
4/3/2002	NB-7	Grubby	YS	1	7.0
4/3/2002	NB-7	Winter flounder	PYS	1	7.0
4/4/2002	SB-1	Grubby	PYS	4	29.2
4/4/2002	SB-1	Grubby	YS	2	14.6
4/4/2002	SB-1	Winter flounder	PYS	6	43.7
4/4/2002	SB-2	Grubby	PYS	5	46.1
4/4/2002	SB-2	Winter flounder	PYS	3	27.7
4/4/2002	SB-3	Grubby	PYS	3	10.4
4/4/2002	SB-3	Grubby	YS	1	3.5
4/4/2002	SB-3	Winter flounder	PYS	4	13.9
4/4/2002	SB-4	Atlantic menhaden	Egg	2	8.2
4/4/2002	SB-4	Atlantic menhaden	PYS	1	4.1
4/4/2002	SB-4	Bothid unidentified	Egg	3	12.3
4/4/2002	SB-4	Grubby	PYS	24	98.4
4/4/2002	SB-4	Grubby	YS	7	28.7
4/4/2002	SB-4	Winter flounder	PYS	21	86.1
4/4/2002	SB-4	Winter flounder	YS	19	77.9
4/4/2002	SB-5	Atlantic menhaden	Egg	3	16.4
4/4/2002	SB-5	Grubby	PYS	2	11.0
4/4/2002	SB-5	Winter flounder	PYS	6	32.9
4/4/2002	SB-6	Atlantic menhaden	Egg	1	4.3
4/4/2002	SB-6	Grubby	PYS	13	56.0
4/4/2002	SB-6	Grubby	YS	3	12.9
4/4/2002	SB-6	Winter flounder	PYS	34	146.5
4/4/2002	SB-6	Winter flounder	YS	2	8.6
4/16/2002	LB-1	American sandlance	PYS	1	4.9
4/16/2002	LB-1	Gadid unidentified	Egg	1	4.9
4/16/2002	LB-1	Grubby	PYS	2	9.8
4/16/2002	LB-1	Weakfish	Egg	34	165.9
4/16/2002	LB-1	Winter flounder	PYS	19	92.7
4/16/2002	LB-2	Gadid unidentified	Egg	1	4.1
4/16/2002	LB-2	Grubby	PYS	18	73.3
4/16/2002	LB-2	Weakfish	Egg	95	387.0
4/16/2002	LB-2	Winter flounder	PYS	229	932.8
4/16/2002	LB-2	Winter flounder	YS	2	8.1
4/16/2002	LB-3	Weakfish	Egg	64	263.3

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 10 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
4/16/2002	LB-3	Winter flounder	PYS	52	213.9
4/16/2002	LB-3	Winter flounder	YS	1	4.1
4/16/2002	LB-4	Gadid unidentified	Egg	1	3.8
4/16/2002	LB-4	Grubby	PYS	7	26.8
4/16/2002	LB-4	Grubby	YS	1	3.8
4/16/2002	LB-4	Spotted hake	Egg	2	7.7
4/16/2002	LB-4	Weakfish	Egg	63	241.2
4/16/2002	LB-4	Winter flounder	Egg	1	3.8
4/16/2002	LB-4	Winter flounder	PYS	379	1450.9
4/16/2002	LB-5	Weakfish	Egg	63	270.8
4/16/2002	LB-5	Winter flounder	PYS	113	485.8
4/16/2002	LB-5	Winter flounder	YS	8	34.4
4/16/2002	LB-6	American sandlance	PYS	3	18.4
4/16/2002	LB-6	Gadid unidentified	Egg	1	6.1
4/16/2002	LB-6	Grubby	PYS	1	6.1
4/16/2002	LB-6	Weakfish	Egg	165	1013.5
4/16/2002	LB-6	Winter flounder	PYS	401	2463.1
4/16/2002	LB-6	Winter flounder	YS	4	24.6
4/16/2002	PJ-2	Grubby	PYS	2	12.0
4/16/2002	PJ-2	Winter flounder	PYS	8	47.8
4/16/2002	PJ-3	Winter flounder	PYS	20	103.5
4/16/2002	SB-5	Grubby	PYS	1	3.0
4/16/2002	SB-5	Weakfish	Egg	22	66.0
4/16/2002	SB-5	Winter flounder	PYS	21	63.0
4/16/2002	SB-6	Grubby	PYS	2	6.5
4/16/2002	SB-6	Weakfish	Egg	42	136.7
4/16/2002	SB-6	Winter flounder	PYS	75	244.1
4/17/2002	AK-1	Grubby	YS	1	4.3
4/17/2002	AK-1	Weakfish	Egg	1	4.3
4/17/2002	AK-1	Winter flounder	PYS	40	170.6
4/17/2002	AK-2	Grubby	PYS	3	10.9
4/17/2002	AK-2	Grubby	YS	1	3.6
4/17/2002	AK-2	Weakfish	Egg	2	7.3
4/17/2002	AK-2	Winter flounder	PYS	16	58.1
4/17/2002	AK-3	Grubby	PYS	3	12.5
4/17/2002	AK-3	Weakfish	Egg	3	12.5
4/17/2002	AK-3	Winter flounder	PYS	20	83.1
4/17/2002	AK-3	Winter flounder	YS	3	12.5
4/17/2002	AK-4	Grubby	PYS	1	4.7
4/17/2002	AK-4	Weakfish	Egg	5	23.4
4/17/2002	AK-4	Winter flounder	PYS	23	107.7
4/17/2002	AK-4	Winter flounder	YS	3	14.0
4/17/2002	NB-3	Grubby	PYS	1	4.9
4/17/2002	NB-3	Winter flounder	PYS	11	53.8
4/17/2002	NB-4	Grubby	PYS	4	21.3
4/17/2002	NB-4	Weakfish	Egg	1	5.3
4/17/2002	NB-4	Winter flounder	PYS	21	112.0
4/17/2002	NB-4	Winter flounder	YS	1	5.3
4/17/2002	NB-5	Grubby	PYS	2	8.7
4/17/2002	NB-5	Grubby	YS	2	8.7

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 11 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
4/17/2002	NB-5	Weakfish	Egg	1	4.4
4/17/2002	NB-5	Winter flounder	PYS	17	74.3
4/17/2002	NB-6	Grubby	PYS	2	10.0
4/17/2002	NB-6	Weakfish	Egg	3	14.9
4/17/2002	NB-6	Winter flounder	PYS	10	49.8
4/17/2002	NB-7	Weakfish	Egg	1	7.6
4/17/2002	NB-7	Winter flounder	PYS	5	37.8
4/17/2002	PJ-4	Grubby	PYS	4	17.5
4/17/2002	PJ-4	Weakfish	Egg	49	214.7
4/17/2002	PJ-4	Winter flounder	PYS	27	118.3
4/17/2002	PJ-4	Winter flounder	YS	3	13.1
4/17/2002	PJ-5	Grubby	PYS	6	23.9
4/17/2002	PJ-5	Grubby	YS	1	4.0
4/17/2002	PJ-5	Weakfish	Egg	42	167.2
4/17/2002	PJ-5	Winter flounder	Egg	1	4.0
4/17/2002	PJ-5	Winter flounder	PYS	20	79.6
4/17/2002	PJ-5	Winter flounder	YS	1	4.0
4/18/2002	PJ-1	Grubby	PYS	1	8.2
4/18/2002	PJ-1	Grubby	YS	2	16.3
4/18/2002	PJ-1	Winter flounder	PYS	22	179.8
4/18/2002	PJ-1	Winter flounder	YS	2	16.3
4/18/2002	SB-1	Weakfish	Egg	4	46.6
4/18/2002	SB-1	Winter flounder	PYS	10	116.6
4/18/2002	SB-1	Winter flounder	YS	1	11.7
4/18/2002	SB-2	Weakfish	Egg	5	35.4
4/18/2002	SB-2	Winter flounder	PYS	7	49.6
4/18/2002	SB-3	Four beard rockling	Egg	2	18.0
4/18/2002	SB-3	Grubby	PYS	6	54.1
4/18/2002	SB-3	Grubby	YS	4	36.1
4/18/2002	SB-3	Weakfish	Egg	36	324.7
4/18/2002	SB-3	Winter flounder	PYS	11	99.2
4/18/2002	SB-4	Grubby	PYS	9	43.2
4/18/2002	SB-4	Grubby	YS	1	4.8
4/18/2002	SB-4	Labridae	Egg	1	4.8
4/18/2002	SB-4	Weakfish	Egg	220	1056.1
4/18/2002	SB-4	Windowpane	Egg	7	33.6
4/18/2002	SB-4	Winter flounder	PYS	28	134.4
4/18/2002	SB-4	Winter flounder	YS	8	38.4
4/30/2002	LB-1	Atlantic menhaden	Egg	10	48.5
4/30/2002	LB-1	Grubby	PYS	1	4.9
4/30/2002	LB-1	Labridae	Egg	31	150.4
4/30/2002	LB-1	Weakfish	Egg	101	490.1
4/30/2002	LB-1	Windowpane	Egg	9	43.7
4/30/2002	LB-1	Winter flounder	PYS	40	194.1
4/30/2002	LB-2	Atlantic menhaden	Egg	2	9.1
4/30/2002	LB-2	Grubby	PYS	5	22.9
4/30/2002	LB-2	Labridae	Egg	28	128.0
4/30/2002	LB-2	Weakfish	Egg	72	329.1
4/30/2002	LB-2	Windowpane	Egg	31	141.7
4/30/2002	LB-2	Winter flounder	PYS	74	338.2

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 12 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
4/30/2002	LB-3	Atlantic menhaden	Egg	5	21.9
4/30/2002	LB-3	Weakfish	Egg	41	179.8
4/30/2002	LB-3	Winter flounder	Egg	3	13.2
4/30/2002	LB-3	Winter flounder	PYS	22	96.5
4/30/2002	LB-4	Atlantic menhaden	Egg	7	28.8
4/30/2002	LB-4	Atlantic menhaden	PYS	4	16.5
4/30/2002	LB-4	Atlantic menhaden	YS	1	4.1
4/30/2002	LB-4	Labridae	Egg	12	49.4
4/30/2002	LB-4	Weakfish	Egg	56	230.6
4/30/2002	LB-4	White perch	Egg	1	4.1
4/30/2002	LB-4	White perch	PYS	34	140.0
4/30/2002	LB-4	White perch	YS	3	12.4
4/30/2002	LB-4	Windowpane	Egg	2	8.2
4/30/2002	LB-4	Windowpane	PYS	1	4.1
4/30/2002	LB-5	Atlantic menhaden	Egg	3	12.7
4/30/2002	LB-5	Hogchocker	Egg	1	4.2
4/30/2002	LB-5	Weakfish	Egg	174	734.7
4/30/2002	LB-5	Winter flounder	Egg	5	21.1
4/30/2002	LB-5	Winter flounder	PYS	39	164.7
4/30/2002	LB-6	Atlantic menhaden	Egg	1	3.6
4/30/2002	LB-6	Labridae	Egg	22	79.2
4/30/2002	LB-6	Weakfish	Egg	405	1458.3
4/30/2002	LB-6	Windowpane	PYS	1	3.6
4/30/2002	LB-6	Winter flounder	Egg	2	7.2
4/30/2002	LB-6	Winter flounder	PYS	45	162.0
4/30/2002	PJ-1	Atlantic menhaden	Egg	4	21.1
4/30/2002	PJ-1	Grubby	PYS	2	10.5
4/30/2002	PJ-1	Labridae	Egg	2	10.5
4/30/2002	PJ-1	Weakfish	Egg	35	184.5
4/30/2002	PJ-1	Winter flounder	PYS	10	52.7
4/30/2002	PJ-2	Weakfish	Egg	4	19.1
4/30/2002	PJ-2	Winter flounder	PYS	6	28.7
4/30/2002	PJ-3	Labridae	Egg	1	4.2
4/30/2002	PJ-3	Winter flounder	PYS	4	16.8
4/30/2002	PJ-4	Labridae	Egg	3	12.3
4/30/2002	PJ-4	Weakfish	Egg	47	192.1
4/30/2002	PJ-4	Winter flounder	PYS	6	24.5
4/30/2002	PJ-5	Atlantic menhaden	Egg	8	39.2
4/30/2002	PJ-5	Grubby	PYS	2	9.8
4/30/2002	PJ-5	Labridae	Egg	22	107.7
4/30/2002	PJ-5	Weakfish	Egg	81	396.5
4/30/2002	PJ-5	Winter flounder	PYS	29	142.0
5/1/2002	AK-1	Grubby	PYS	1	4.9
5/1/2002	AK-1	Weakfish	Egg	2	9.8
5/1/2002	AK-1	Winter flounder	PYS	13	63.8
5/1/2002	AK-2	Grubby	PYS	2	9.2
5/1/2002	AK-2	Weakfish	Egg	1	4.6
5/1/2002	AK-2	Winter flounder	PYS	36	164.9
5/1/2002	AK-3	Labridae	Egg	2	8.5
5/1/2002	AK-3	Weakfish	Egg	2	8.5

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 13 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
5/1/2002	AK-3	Winter flounder	PYS	24	101.9
5/1/2002	AK-4	Labridae	Egg	2	8.3
5/1/2002	NB-3	Weakfish	Egg	3	15.0
5/1/2002	NB-3	Winter flounder	PYS	8	40.1
5/1/2002	NB-4	Labridae	Egg	2	10.7
5/1/2002	NB-4	Windowpane	PYS	1	5.3
5/1/2002	NB-4	Winter flounder	PYS	3	16.0
5/1/2002	NB-5	Atlantic menhaden	YS	2	7.8
5/1/2002	NB-5	Winter flounder	PYS	23	89.6
5/1/2002	NB-6	Labridae	Egg	4	15.3
5/1/2002	NB-6	Weakfish	Egg	2	7.7
5/1/2002	NB-6	Winter flounder	PYS	14	53.6
5/2/2002	SB-1	Weakfish	Egg	7	76.3
5/2/2002	SB-1	Winter flounder	PYS	8	87.2
5/2/2002	SB-2	Atlantic menhaden	YS	1	9.3
5/2/2002	SB-2	Weakfish	Egg	37	344.8
5/2/2002	SB-2	Winter flounder	PYS	5	46.6
5/2/2002	SB-3	Labridae	Egg	2	15.7
5/2/2002	SB-3	Weakfish	Egg	11	86.4
5/2/2002	SB-3	Winter flounder	PYS	36	282.8
5/2/2002	SB-4	Weakfish	Egg	14	51.1
5/2/2002	SB-4	Winter flounder	PYS	13	47.4
5/2/2002	SB-4	Winter flounder	YS	1	3.6
5/2/2002	SB-5	Hogchocker	Egg	1	4.7
5/2/2002	SB-5	Labridae	Egg	2	9.3
5/2/2002	SB-5	Weakfish	Egg	49	228.6
5/2/2002	SB-5	Winter flounder	PYS	8	37.3
5/2/2002	SB-6	Labridae	Egg	5	23.3
5/2/2002	SB-6	Weakfish	Egg	39	181.6
5/2/2002	SB-6	Winter flounder	PYS	34	158.3
5/14/2002	AK-1	Atlantic mackerel	PYS	1	6.0
5/14/2002	AK-1	Atlantic menhaden	Egg	37	222.7
5/14/2002	AK-1	Atlantic silverside	PYS	1	6.0
5/14/2002	AK-1	Hogchocker	Egg	1	6.0
5/14/2002	AK-1	Labridae	Egg	25	150.5
5/14/2002	AK-1	Weakfish	Egg	6	36.1
5/14/2002	AK-1	Winter flounder	PYS	1	6.0
5/14/2002	AK-2	Atlantic menhaden	Egg	89	478.6
5/14/2002	AK-2	Labridae	Egg	13	69.9
5/14/2002	AK-2	Weakfish	Egg	17	91.4
5/14/2002	AK-2	Windowpane	PYS	1	5.4
5/14/2002	AK-2	Winter flounder	PYS	9	48.4
5/14/2002	AK-3	Atlantic menhaden	Egg	25	170.9
5/14/2002	AK-3	Labridae	Egg	14	95.7
5/14/2002	AK-3	Spot	PYS	1	6.8
5/14/2002	AK-3	Weakfish	Egg	9	61.5
5/14/2002	AK-3	Winter flounder	PYS	6	41.0
5/14/2002	AK-4	Atlantic silverside	PYS	7	29.6
5/14/2002	AK-4	Bay anchovy	Egg	18	76.1
5/14/2002	AK-4	Labridae	Egg	25	105.7

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 14 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
5/14/2002	AK-4	Weakfish	Egg	3	12.7
5/14/2002	AK-4	Windowpane	PYS	2	8.5
5/14/2002	NB-3	Atlantic menhaden	Egg	2	8.6
5/14/2002	NB-3	Atlantic silverside	PYS	1	4.3
5/14/2002	NB-3	Labridae	Egg	16	68.5
5/14/2002	NB-3	Northern pipefish	PYS	1	4.3
5/14/2002	NB-3	Weakfish	Egg	2	8.6
5/14/2002	NB-4	Atlantic menhaden	Egg	1	3.8
5/14/2002	NB-4	Labridae	Egg	19	72.4
5/14/2002	NB-4	Weakfish	Egg	2	7.6
5/14/2002	NB-4	Windowpane	PYS	1	3.8
5/14/2002	NB-5	Atlantic menhaden	Egg	10	40.2
5/14/2002	NB-5	Labridae	Egg	6	24.1
5/14/2002	NB-5	Weakfish	Egg	2	8.0
5/14/2002	NB-5	Windowpane	PYS	1	4.0
5/14/2002	NB-5	Winter flounder	PYS	3	12.1
5/14/2002	NB-6	Atlantic menhaden	Egg	18	78.1
5/14/2002	NB-6	Atlantic menhaden	PYS	2	8.7
5/14/2002	NB-6	Labridae	Egg	28	121.4
5/14/2002	NB-6	Weakfish	Egg	20	86.7
5/14/2002	NB-6	Windowpane	PYS	2	8.7
5/14/2002	NB-6	Winter flounder	PYS	1	4.3
5/14/2002	NB-7	Atlantic menhaden	Egg	27	217.0
5/14/2002	NB-7	Labridae	Egg	6	48.2
5/14/2002	NB-7	Weakfish	Egg	2	16.1
5/14/2002	NB-7	Winter flounder	PYS	1	8.0
5/14/2002	PJ-4	Atlantic menhaden	Egg	12	111.4
5/14/2002	PJ-4	Bay anchovy	Egg	3	27.8
5/14/2002	PJ-4	Four beard rockling	Egg	1	9.3
5/14/2002	PJ-4	Labridae	Egg	122	1132.2
5/14/2002	PJ-4	Unidentified	PYS	1	4.6
5/14/2002	PJ-4	Weakfish	Egg	93	863.1
5/14/2002	PJ-4	Windowpane	PYS	1	4.6
5/14/2002	PJ-5	Atlantic mackerel	PYS	7	28.6
5/14/2002	PJ-5	Atlantic menhaden	Egg	183	1495.6
5/14/2002	PJ-5	Hogchocker	Egg	3	24.5
5/14/2002	PJ-5	Labridae	Egg	59	482.2
5/14/2002	PJ-5	Weakfish	Egg	48	392.3
5/14/2002	PJ-5	Windowpane	PYS	1	4.1
5/14/2002	PJ-5	Winter flounder	PYS	2	8.2
5/15/2002	PJ-1	Atlantic mackerel	PYS	1	4.4
5/15/2002	PJ-1	Labridae	Egg	7	31.0
5/15/2002	PJ-1	Windowpane	PYS	1	4.4
5/15/2002	PJ-2	Labridae	Egg	23	111.1
5/15/2002	PJ-2	Windowpane	PYS	1	4.8
5/15/2002	PJ-2	Winter flounder	PYS	10	48.3
5/15/2002	PJ-3	Atlantic menhaden	PYS	1	4.7
5/15/2002	PJ-3	Labridae	Egg	6	27.9
5/15/2002	PJ-3	Weakfish	Egg	1	4.7
5/15/2002	SB-1	Four beard rockling	PYS	1	10.3

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 15 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
5/15/2002	SB-1	Labridae	Egg	2	20.7
5/15/2002	SB-1	Weakfish	Egg	1	10.3
5/15/2002	SB-1	Windowpane	PYS	1	10.3
5/15/2002	SB-2	Atlantic mackerel	PYS	2	19.6
5/15/2002	SB-2	Atlantic menhaden	Egg	3	29.4
5/15/2002	SB-2	Labridae	Egg	11	107.8
5/15/2002	SB-2	Weakfish	Egg	7	68.6
5/15/2002	SB-2	Windowpane	PYS	1	9.8
5/15/2002	SB-2	Winter flounder	PYS	4	39.2
5/15/2002	SB-3	Atlantic menhaden	Egg	14	68.9
5/15/2002	SB-3	Atlantic menhaden	YS	1	4.9
5/15/2002	SB-3	Labridae	Egg	4	19.7
5/15/2002	SB-3	Weakfish	Egg	7	34.5
5/15/2002	SB-4	Atlantic mackerel	PYS	4	17.6
5/15/2002	SB-4	Atlantic menhaden	Egg	102	449.6
5/15/2002	SB-4	Bay anchovy	Egg	1	4.4
5/15/2002	SB-4	Labridae	Egg	70	308.6
5/15/2002	SB-4	Weakfish	Egg	98	432.0
5/15/2002	SB-4	Windowpane	PYS	1	4.4
5/15/2002	SB-4	Winter flounder	PYS	14	61.7
5/15/2002	SB-5	Atlantic menhaden	Egg	63	380.7
5/15/2002	SB-5	Atlantic menhaden	PYS	1	6.0
5/15/2002	SB-5	Atlantic tomcod	JUV	8	48.3
5/15/2002	SB-5	Hogchocker	Egg	2	12.1
5/15/2002	SB-5	Labridae	Egg	76	459.3
5/15/2002	SB-5	Weakfish	Egg	52	314.3
5/15/2002	SB-6	Atlantic mackerel	PYS	10	33.0
5/15/2002	SB-6	Atlantic menhaden	Egg	10	33.0
5/15/2002	SB-6	Labridae	Egg	9	29.7
5/15/2002	SB-6	Weakfish	Egg	2	6.6
5/15/2002	SB-6	Windowpane	PYS	7	23.1
5/15/2002	SB-6	Winter flounder	PYS	2	6.6
5/16/2002	LB-1	Atlantic mackerel	PYS	32	114.3
5/16/2002	LB-1	Atlantic menhaden	Egg	47	167.8
5/16/2002	LB-1	Atlantic menhaden	PYS	3	10.7
5/16/2002	LB-1	Labridae	Egg	37	132.1
5/16/2002	LB-1	Weakfish	Egg	22	78.6
5/16/2002	LB-1	Windowpane	PYS	14	50.0
5/16/2002	LB-1	Winter flounder	PYS	1	3.6
5/16/2002	LB-2	Atlantic mackerel	PYS	3	9.5
5/16/2002	LB-2	Bay anchovy	Egg	2	6.3
5/16/2002	LB-2	Four beard rockling	PYS	1	3.2
5/16/2002	LB-2	Hogchocker	Egg	1	3.2
5/16/2002	LB-2	Labridae	Egg	81	255.7
5/16/2002	LB-2	Weakfish	Egg	47	148.3
5/16/2002	LB-2	Windowpane	PYS	48	151.5
5/16/2002	LB-3	Atlantic mackerel	PYS	2	8.8
5/16/2002	LB-3	Atlantic menhaden	Egg	248	8704.5
5/16/2002	LB-3	Atlantic menhaden	PYS	1	4.4
5/16/2002	LB-3	Atlantic menhaden	YS	158	693.2

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 16 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
5/16/2002	LB-3	Bay anchovy	Egg	11	386.1
5/16/2002	LB-3	Hogchocker	Egg	1	35.1
5/16/2002	LB-3	Labridae	Egg	30	1053.0
5/16/2002	LB-3	Weakfish	Egg	16	561.6
5/16/2002	LB-3	Windowpane	PYS	9	39.5
5/16/2002	LB-4	Atlantic mackerel	PYS	7	28.0
5/16/2002	LB-4	Atlantic menhaden	Egg	16	64.1
5/16/2002	LB-4	Atlantic menhaden	YS	1	4.0
5/16/2002	LB-4	Bay anchovy	Egg	3	12.0
5/16/2002	LB-4	Four beard rockling	PYS	1	4.0
5/16/2002	LB-4	Hogchocker	Egg	1	4.0
5/16/2002	LB-4	Labridae	Egg	49	196.2
5/16/2002	LB-4	Weakfish	Egg	20	80.1
5/16/2002	LB-4	Windowpane	PYS	46	184.2
5/16/2002	LB-4	Winter flounder	PYS	9	36.0
5/16/2002	LB-5	Bay anchovy	Egg	40	379.5
5/16/2002	LB-5	Four beard rockling	PYS	1	4.7
5/16/2002	LB-5	Hogchocker	Egg	7	66.4
5/16/2002	LB-5	Labridae	Egg	95	901.2
5/16/2002	LB-5	Weakfish	Egg	93	882.2
5/16/2002	LB-5	Windowpane	PYS	52	246.6
5/16/2002	LB-5	Winter flounder	PYS	2	9.5
5/16/2002	LB-6	Atlantic mackerel	PYS	2	7.0
5/16/2002	LB-6	Atlantic menhaden	Egg	173	9680.9
5/16/2002	LB-6	Atlantic menhaden	YS	94	328.8
5/16/2002	LB-6	Atlantic silverside	PYS	1	3.5
5/16/2002	LB-6	Bay anchovy	Egg	17	951.3
5/16/2002	LB-6	Hogchocker	Egg	5	279.8
5/16/2002	LB-6	Labridae	Egg	6	335.8
5/16/2002	LB-6	Weakfish	Egg	35	1958.6
5/16/2002	LB-6	Windowpane	PYS	5	17.5
6/4/2002	AK-1	Atlantic menhaden	Egg	10	163.8
6/4/2002	AK-1	Atlantic menhaden	PYS	16	65.5
6/4/2002	AK-1	Bay anchovy	Egg	152	2489.1
6/4/2002	AK-1	Hogchocker	Egg	1	16.4
6/4/2002	AK-1	Labridae	Egg	38	622.3
6/4/2002	AK-1	Windowpane	Egg	96	1572.0
6/4/2002	AK-1	Windowpane	PYS	1	4.1
6/4/2002	AK-2	Atlantic menhaden	Egg	3	44.8
6/4/2002	AK-2	Bay anchovy	Egg	154	2300.6
6/4/2002	AK-2	Hogchocker	Egg	3	44.8
6/4/2002	AK-2	Labridae	Egg	22	328.7
6/4/2002	AK-2	Weakfish	Egg	5	74.7
6/4/2002	AK-2	Windowpane	Egg	125	1867.4
6/4/2002	AK-2	Windowpane	PYS	3	11.2
6/4/2002	AK-3	Atlantic silverside	YS	1	5.1
6/4/2002	AK-3	Bay anchovy	Egg	121	2820.4
6/4/2002	AK-3	Clupeid unidentified	PYS	51	260.0
6/4/2002	AK-3	Hogchocker	Egg	1	23.3
6/4/2002	AK-3	Labridae	Egg	27	629.3

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 17 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/4/2002	AK-3	Northern pipefish	PYS	2	10.2
6/4/2002	AK-3	Windowpane	Egg	66	1538.4
6/4/2002	AK-3	Winter flounder	PYS	1	5.1
6/4/2002	AK-4	Bay anchovy	Egg	163	4168.8
6/4/2002	AK-4	Labridae	Egg	14	358.1
6/4/2002	AK-4	Northern pipefish	PYS	6	38.4
6/4/2002	AK-4	Unidentified	Egg	5	127.9
6/4/2002	AK-4	Unidentified	PYS	1	6.4
6/4/2002	AK-4	Weakfish	Egg	2	51.2
6/4/2002	AK-4	Weakfish	PYS	2	12.8
6/4/2002	AK-4	Windowpane	Egg	19	485.9
6/4/2002	NB-3	Atlantic menhaden	Egg	4	52.6
6/4/2002	NB-3	Bay anchovy	Egg	204	2681.8
6/4/2002	NB-3	Clupeid unidentified	PYS	108	532.4
6/4/2002	NB-3	Labridae	Egg	52	683.6
6/4/2002	NB-3	Northern pipefish	PYS	7	34.5
6/4/2002	NB-3	Weakfish	PYS	1	4.9
6/4/2002	NB-3	Windowpane	Egg	71	933.4
6/4/2002	NB-3	Windowpane	PYS	1	4.9
6/4/2002	NB-4	Atlantic menhaden	Egg	13	216.0
6/4/2002	NB-4	Bay anchovy	Egg	168	2791.0
6/4/2002	NB-4	Clupeid unidentified	PYS	124	515.0
6/4/2002	NB-4	Gobiid unidentified	PYS	1	4.2
6/4/2002	NB-4	Labridae	Egg	56	930.3
6/4/2002	NB-4	Northern pipefish	PYS	18	74.8
6/4/2002	NB-4	Weakfish	PYS	2	8.3
6/4/2002	NB-4	Windowpane	Egg	52	863.9
6/4/2002	NB-5	Atlantic menhaden	Egg	1	8.2
6/4/2002	NB-5	Bay anchovy	Egg	91	746.1
6/4/2002	NB-5	Clupeid unidentified	PYS	2	8.2
6/4/2002	NB-5	Hogchocker	Egg	14	114.8
6/4/2002	NB-5	Labridae	Egg	43	352.5
6/4/2002	NB-5	Weakfish	Egg	13	106.6
6/4/2002	NB-5	Windowpane	Egg	242	1984.0
6/4/2002	NB-5	Winter flounder	PYS	1	4.1
6/4/2002	NB-6	Atlantic menhaden	Egg	3	49.0
6/4/2002	NB-6	Bay anchovy	Egg	154	2514.0
6/4/2002	NB-6	Clupeid unidentified	PYS	2	8.2
6/4/2002	NB-6	Hogchocker	Egg	7	114.3
6/4/2002	NB-6	Labridae	Egg	34	555.0
6/4/2002	NB-6	Northern pipefish	PYS	2	8.2
6/4/2002	NB-6	Unidentified	Egg	1	16.3
6/4/2002	NB-6	Weakfish	Egg	4	65.3
6/4/2002	NB-6	Windowpane	Egg	152	2481.4
6/4/2002	NB-6	Windowpane	PYS	1	4.1
6/4/2002	NB-6	Winter flounder	PYS	1	4.1
6/4/2002	NB-7	Atlantic menhaden	Egg	2	50.5
6/4/2002	NB-7	Bay anchovy	Egg	145	3662.8
6/4/2002	NB-7	Clupeid unidentified	PYS	42	265.2
6/4/2002	NB-7	Hogchocker	Egg	1	25.3

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 18 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/4/2002	NB-7	Labridae	Egg	26	656.8
6/4/2002	NB-7	Northern pipefish	PYS	5	31.6
6/4/2002	NB-7	Tautog	PYS	1	6.3
6/4/2002	NB-7	Weakfish	PYS	1	6.3
6/4/2002	NB-7	Windowpane	Egg	28	707.3
6/4/2002	PJ-2	Atlantic menhaden	Egg	1	37.7
6/4/2002	PJ-2	Bay anchovy	Egg	161	6073.5
6/4/2002	PJ-2	Clupeid unidentified	PYS	34	160.3
6/4/2002	PJ-2	Labridae	Egg	44	1659.8
6/4/2002	PJ-2	Northern pipefish	PYS	9	42.4
6/4/2002	PJ-2	Windowpane	Egg	7	264.1
6/4/2002	PJ-3	Atlantic silverside	PYS	1	4.4
6/4/2002	PJ-3	Bay anchovy	Egg	174	3088.7
6/4/2002	PJ-3	Clupeid unidentified	PYS	17	75.4
6/4/2002	PJ-3	Labridae	Egg	31	550.3
6/4/2002	PJ-3	Windowpane	Egg	7	124.3
6/5/2002	LB-1	Bay anchovy	Egg	77	1673.3
6/5/2002	LB-1	Clupeid unidentified	PYS	1	5.4
6/5/2002	LB-1	Hogchocker	Egg	32	695.4
6/5/2002	LB-1	Labridae	Egg	70	1521.2
6/5/2002	LB-1	Northern pipefish	PYS	6	32.6
6/5/2002	LB-1	Unidentified	PYS	1	5.4
6/5/2002	LB-1	Weakfish	Egg	11	239.0
6/5/2002	LB-1	Windowpane	Egg	51	1108.3
6/5/2002	LB-1	Windowpane	PYS	2	10.9
6/5/2002	LB-2	Atlantic menhaden	Egg	1	23.0
6/5/2002	LB-2	Bay anchovy	Egg	76	1746.7
6/5/2002	LB-2	Clupeid unidentified	PYS	2	17.2
6/5/2002	LB-2	Hogchocker	Egg	19	436.7
6/5/2002	LB-2	Labridae	Egg	36	827.4
6/5/2002	LB-2	Weakfish	Egg	5	114.9
6/5/2002	LB-2	Windowpane	Egg	66	1516.8
6/5/2002	LB-3	Atlantic menhaden	Egg	118	3491.8
6/5/2002	LB-3	Bay anchovy	Egg	610	18051.0
6/5/2002	LB-3	Clupeid unidentified	PYS	77	284.8
6/5/2002	LB-3	Hogchocker	Egg	102	3018.4
6/5/2002	LB-3	Labridae	Egg	116	3432.7
6/5/2002	LB-3	Northern pipefish	PYS	1	3.7
6/5/2002	LB-3	Weakfish	Egg	25	739.8
6/5/2002	LB-3	Weakfish	PYS	1	3.7
6/5/2002	LB-3	Weakfish	YS	1	3.7
6/5/2002	LB-3	Windowpane	Egg	292	8640.8
6/5/2002	LB-3	Windowpane	PYS	3	11.1
6/5/2002	LB-4	Bay anchovy	Egg	147	1242.0
6/5/2002	LB-4	Clupeid unidentified	PYS	1	4.2
6/5/2002	LB-4	Four beard rockling	PYS	1	4.2
6/5/2002	LB-4	Hogchocker	Egg	14	118.3
6/5/2002	LB-4	Labridae	Egg	46	388.7
6/5/2002	LB-4	Northern pipefish	PYS	4	16.9
6/5/2002	LB-4	Weakfish	Egg	5	42.2

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 19 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/5/2002	LB-4	Windowpane	Egg	34	287.3
6/5/2002	LB-4	Windowpane	PYS	28	118.3
6/5/2002	LB-5	Atlantic menhaden	Egg	74	9885.4
6/5/2002	LB-5	Bay anchovy	Egg	55	7347.3
6/5/2002	LB-5	Clupeid unidentified	PYS	959	4003.4
6/5/2002	LB-5	Goosefish	PYS	1	4.2
6/5/2002	LB-5	Goosefish	YS	1	4.2
6/5/2002	LB-5	Hogchocker	Egg	27	3606.8
6/5/2002	LB-5	Labridae	Egg	38	5076.3
6/5/2002	LB-5	Northern pipefish	PYS	3	12.5
6/5/2002	LB-5	Unidentified	PYS	142	592.8
6/5/2002	LB-5	Weakfish	Egg	8	1068.7
6/5/2002	LB-5	Weakfish	YS	4	16.7
6/5/2002	LB-5	Windowpane	Egg	54	7213.7
6/5/2002	LB-5	Windowpane	PYS	4	16.7
6/5/2002	LB-6	Atlantic menhaden	Egg	24	2665.9
6/5/2002	LB-6	Bay anchovy	Egg	253	28102.7
6/5/2002	LB-6	Clupeid unidentified	PYS	60	416.5
6/5/2002	LB-6	Four beard rockling	PYS	1	6.9
6/5/2002	LB-6	Hogchocker	Egg	9	999.7
6/5/2002	LB-6	Labridae	Egg	2	222.2
6/5/2002	LB-6	Windowpane	Egg	5	555.4
6/5/2002	LB-6	Windowpane	PYS	14	97.2
6/5/2002	PJ-5	Bay anchovy	Egg	52	1518.0
6/5/2002	PJ-5	Clupeid unidentified	PYS	1	3.6
6/5/2002	PJ-5	Hogchocker	Egg	17	496.3
6/5/2002	PJ-5	Labridae	Egg	61	1780.7
6/5/2002	PJ-5	Northern pipefish	PYS	1	3.6
6/5/2002	PJ-5	Weakfish	Egg	12	350.3
6/5/2002	PJ-5	Windowpane	Egg	64	1868.3
6/5/2002	SB-5	Bay anchovy	Egg	55	1092.2
6/5/2002	SB-5	Hogchocker	Egg	29	575.9
6/5/2002	SB-5	Labridae	Egg	58	1151.8
6/5/2002	SB-5	Weakfish	Egg	13	258.2
6/5/2002	SB-5	Windowpane	Egg	66	1310.7
6/5/2002	SB-5	Windowpane	PYS	7	52.1
6/5/2002	SB-5	Winter flounder	PYS	1	7.4
6/5/2002	SB-5	Yellowtail flounder	PYS	1	7.4
6/5/2002	SB-6	Atlantic menhaden	Egg	62	534.7
6/5/2002	SB-6	Bay anchovy	Egg	49	1690.2
6/5/2002	SB-6	Clupeid unidentified	PYS	60	517.4
6/5/2002	SB-6	Hogchocker	Egg	36	1241.8
6/5/2002	SB-6	Labridae	Egg	72	2483.5
6/5/2002	SB-6	Unidentified	PYS	1	8.6
6/5/2002	SB-6	Weakfish	Egg	22	758.9
6/5/2002	SB-6	Windowpane	Egg	46	1586.7
6/5/2002	SB-6	Windowpane	PYS	2	17.2
6/6/2002	PJ-1	Atlantic menhaden	Egg	26	915.2
6/6/2002	PJ-1	Bay anchovy	Egg	91	3203.0
6/6/2002	PJ-1	Clupeid unidentified	PYS	144	633.6

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 20 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/6/2002	PJ-1	Clupeid unidentified	YS	9	39.6
6/6/2002	PJ-1	Labridae	Egg	47	1654.3
6/6/2002	PJ-1	Northern pipefish	PYS	9	39.6
6/6/2002	PJ-1	Unidentified	PYS	23	101.2
6/6/2002	PJ-1	Weakfish	Egg	2	70.4
6/6/2002	PJ-1	Weakfish	PYS	1	4.4
6/6/2002	PJ-1	Weakfish	YS	1	4.4
6/6/2002	PJ-1	Windowpane	Egg	89	3132.6
6/6/2002	PJ-1	Windowpane	PYS	3	13.2
6/6/2002	PJ-4	Atlantic menhaden	Egg	181	621.7
6/6/2002	PJ-4	Bay anchovy	Egg	43	1181.7
6/6/2002	PJ-4	Clupeid unidentified	PYS	11	37.8
6/6/2002	PJ-4	Goosefish	YS	1	3.4
6/6/2002	PJ-4	Hogchocker	Egg	44	1209.1
6/6/2002	PJ-4	Labridae	Egg	80	2198.4
6/6/2002	PJ-4	Northern pipefish	PYS	2	6.9
6/6/2002	PJ-4	Weakfish	Egg	23	632.1
6/6/2002	PJ-4	Windowpane	Egg	43	1181.7
6/6/2002	PJ-4	Windowpane	PYS	2	6.9
6/6/2002	SB-1	Atlantic menhaden	Egg	24	1746.7
6/6/2002	SB-1	Bay anchovy	Egg	137	9970.9
6/6/2002	SB-1	Clupeid unidentified	PYS	48	436.7
6/6/2002	SB-1	Goosefish	YS	1	9.1
6/6/2002	SB-1	Labridae	Egg	43	3129.5
6/6/2002	SB-1	Northern pipefish	JUV	1	9.1
6/6/2002	SB-1	Northern pipefish	PYS	4	36.4
6/6/2002	SB-1	Weakfish	Egg	4	291.1
6/6/2002	SB-1	Windowpane	Egg	11	800.6
6/6/2002	SB-1	Windowpane	PYS	2	18.2
6/6/2002	SB-2	Atlantic menhaden	Egg	13	725.9
6/6/2002	SB-2	Bay anchovy	Egg	89	4969.5
6/6/2002	SB-2	Clupeid unidentified	PYS	9	62.8
6/6/2002	SB-2	Goosefish	PYS	1	7.0
6/6/2002	SB-2	Hogchocker	Egg	4	223.4
6/6/2002	SB-2	Labridae	Egg	62	3461.9
6/6/2002	SB-2	Northern pipefish	PYS	3	20.9
6/6/2002	SB-2	Weakfish	Egg	10	558.4
6/6/2002	SB-2	Windowpane	Egg	46	2568.5
6/6/2002	SB-2	Windowpane	PYS	2	14.0
6/6/2002	SB-3	Atlantic menhaden	Egg	178	1531.7
6/6/2002	SB-3	Bay anchovy	Egg	129	17760.7
6/6/2002	SB-3	Clupeid unidentified	PYS	41	352.8
6/6/2002	SB-3	Goosefish	YS	1	8.6
6/6/2002	SB-3	Labridae	Egg	24	3304.3
6/6/2002	SB-3	Northern pipefish	PYS	2	17.2
6/6/2002	SB-3	Weakfish	Egg	3	413.0
6/6/2002	SB-3	Windowpane	Egg	47	6471.0
6/6/2002	SB-3	Windowpane	JUV	1	8.6
6/6/2002	SB-3	Windowpane	YS	1	8.6
6/6/2002	SB-4	Atlantic menhaden	Egg	61	209.9

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 21 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/6/2002	SB-4	Bay anchovy	Egg	97	1335.3
6/6/2002	SB-4	Clupeid unidentified	PYS	132	454.3
6/6/2002	SB-4	Hogchocker	Egg	23	316.6
6/6/2002	SB-4	Labridae	Egg	39	536.9
6/6/2002	SB-4	Northern pipefish	PYS	5	17.2
6/6/2002	SB-4	Weakfish	Egg	16	220.3
6/6/2002	SB-4	Weakfish	PYS	1	3.4
6/6/2002	SB-4	Windowpane	Egg	37	509.4
6/18/2002	AK-1	Bay anchovy	Egg	218	5446.5
6/18/2002	AK-1	Bay anchovy	PYS	53	165.5
6/18/2002	AK-1	Clupeid unidentified	PYS	1	3.1
6/18/2002	AK-1	Gobiid unidentified	PYS	63	196.7
6/18/2002	AK-1	Northern pipefish	PYS	17	53.1
6/18/2002	AK-1	Unidentified	PYS	3	9.4
6/18/2002	AK-1	Weakfish	PYS	6	18.7
6/18/2002	AK-2	Bay anchovy	Egg	297	3993.6
6/18/2002	AK-2	Bay anchovy	PYS	31	104.2
6/18/2002	AK-2	Gobiid unidentified	PYS	9	30.3
6/18/2002	AK-2	Hogchocker	Egg	1	13.4
6/18/2002	AK-2	Northern pipefish	JUV	1	3.4
6/18/2002	AK-2	Northern pipefish	PYS	9	30.3
6/18/2002	AK-2	Northern puffer	PYS	1	3.4
6/18/2002	AK-2	Unidentified	PYS	1	3.4
6/18/2002	AK-2	Weakfish	PYS	6	20.2
6/18/2002	AK-3	Bay anchovy	Egg	251	3292.0
6/18/2002	AK-3	Bay anchovy	PYS	137	449.2
6/18/2002	AK-3	Clupeid unidentified	PYS	14	45.9
6/18/2002	AK-3	Gobiid unidentified	PYS	67	219.7
6/18/2002	AK-3	Northern pipefish	PYS	11	36.1
6/18/2002	AK-3	Northern puffer	PYS	1	3.3
6/18/2002	AK-3	Unidentified	PYS	2	6.6
6/18/2002	AK-3	Weakfish	PYS	6	19.7
6/18/2002	AK-3	Windowpane	Egg	5	65.6
6/18/2002	AK-4	Bay anchovy	Egg	168	1123.5
6/18/2002	AK-4	Bay anchovy	PYS	137	1221.6
6/18/2002	AK-4	Clupeid unidentified	PYS	10	89.2
6/18/2002	AK-4	Gobiid unidentified	PYS	68	606.3
6/18/2002	AK-4	Northern pipefish	PYS	10	89.2
6/18/2002	AK-4	Unidentified	PYS	3	26.8
6/18/2002	AK-4	Weakfish	PYS	4	35.7
6/18/2002	NB-3	Bay anchovy	Egg	241	2157.8
6/18/2002	NB-3	Bay anchovy	PYS	228	1020.7
6/18/2002	NB-3	Clupeid unidentified	PYS	19	85.1
6/18/2002	NB-3	Gobiid unidentified	PYS	94	420.8
6/18/2002	NB-3	Northern pipefish	JUV	4	17.9
6/18/2002	NB-3	Northern pipefish	PYS	8	35.8
6/18/2002	NB-3	Tautog	PYS	1	4.5
6/18/2002	NB-3	Unidentified	PYS	11	49.2
6/18/2002	NB-3	Weakfish	PYS	18	80.6
6/18/2002	NB-4	Bay anchovy	Egg	207	3591.6

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 22 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/18/2002	NB-4	Bay anchovy	PYS	172	1492.1
6/18/2002	NB-4	Bay anchovy	YS	5	43.4
6/18/2002	NB-4	Clupeid unidentified	PYS	11	95.4
6/18/2002	NB-4	Cunner	YS	2	17.4
6/18/2002	NB-4	Gobiid unidentified	PYS	158	1370.7
6/18/2002	NB-4	Northern pipefish	PYS	24	208.2
6/18/2002	NB-4	Unidentified	PYS	4	34.7
6/18/2002	NB-4	Weakfish	PYS	30	260.3
6/18/2002	NB-5	Bay anchovy	Egg	191	144.1
6/18/2002	NB-5	Bay anchovy	PYS	56	211.3
6/18/2002	NB-5	Clupeid unidentified	PYS	13	49.1
6/18/2002	NB-5	Gobiid unidentified	PYS	2	7.5
6/18/2002	NB-5	Northern pipefish	JUV	1	3.8
6/18/2002	NB-5	Northern pipefish	PYS	6	22.6
6/18/2002	NB-5	Unidentified	PYS	5	18.9
6/18/2002	NB-5	Weakfish	Egg	11	83.0
6/18/2002	NB-5	Weakfish	PYS	7	26.4
6/18/2002	NB-5	Windowpane	Egg	3	22.6
6/18/2002	NB-5	Windowpane	JUV	1	3.8
6/18/2002	NB-5	Windowpane	PYS	1	3.8
6/18/2002	NB-6	Bay anchovy	Egg	235	1957.4
6/18/2002	NB-6	Bay anchovy	PYS	36	149.9
6/18/2002	NB-6	Clupeid unidentified	PYS	26	108.3
6/18/2002	NB-6	Gobiid unidentified	PYS	26	108.3
6/18/2002	NB-6	Labridae	Egg	19	158.3
6/18/2002	NB-6	Northern pipefish	PYS	6	25.0
6/18/2002	NB-6	Unidentified	PYS	4	16.7
6/18/2002	NB-6	Weakfish	PYS	1	4.2
6/18/2002	NB-6	Windowpane	Egg	3	25.0
6/18/2002	NB-7	Bay anchovy	Egg	205	2744.4
6/18/2002	NB-7	Bay anchovy	PYS	73	488.6
6/18/2002	NB-7	Bay anchovy	YS	1	6.7
6/18/2002	NB-7	Clupeid unidentified	PYS	15	100.4
6/18/2002	NB-7	Gobiid unidentified	PYS	45	301.2
6/18/2002	NB-7	Goosefish	PYS	1	6.7
6/18/2002	NB-7	Northern pipefish	JUV	1	6.7
6/18/2002	NB-7	Northern pipefish	PYS	5	33.5
6/18/2002	NB-7	Unidentified	PYS	9	60.2
6/18/2002	NB-7	Weakfish	PYS	2	13.4
6/18/2002	PJ-2	Bay anchovy	Egg	139	854.3
6/18/2002	PJ-2	Bay anchovy	PYS	33	202.8
6/18/2002	PJ-2	Clupeid unidentified	PYS	7	43.0
6/18/2002	PJ-2	Cunner	PYS	1	6.1
6/18/2002	PJ-2	Gobiid unidentified	PYS	1	6.1
6/18/2002	PJ-2	Labridae	Egg	65	399.5
6/18/2002	PJ-2	Northern pipefish	PYS	2	12.3
6/18/2002	PJ-2	Weakfish	PYS	2	12.3
6/18/2002	PJ-2	Windowpane	Egg	4	24.6
6/18/2002	PJ-2	Windowpane	PYS	1	6.1
6/18/2002	PJ-3	Bay anchovy	Egg	213	3772.5

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 23 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/18/2002	PJ-3	Bay anchovy	PYS	71	314.4
6/18/2002	PJ-3	Clupeid unidentified	PYS	12	53.1
6/18/2002	PJ-3	Gobiid unidentified	PYS	1	4.4
6/18/2002	PJ-3	Labridae	Egg	9	159.4
6/18/2002	PJ-3	Northern pipefish	PYS	9	39.9
6/18/2002	PJ-3	Tautog	PYS	1	4.4
6/18/2002	PJ-3	Unidentified	PYS	3	13.3
6/18/2002	PJ-3	Weakfish	Egg	5	88.6
6/18/2002	PJ-3	Weakfish	PYS	2	8.9
6/19/2002	LB-1	Bay anchovy	Egg	121	4470.8
6/19/2002	LB-1	Bay anchovy	PYS	19	175.5
6/19/2002	LB-1	Clupeid unidentified	PYS	6	55.4
6/19/2002	LB-1	Gobiid unidentified	PYS	2	18.5
6/19/2002	LB-1	Goosefish	YS	1	9.2
6/19/2002	LB-1	Hogchocker	Egg	11	406.4
6/19/2002	LB-1	Labridae	Egg	40	1477.9
6/19/2002	LB-1	Northern pipefish	PYS	3	27.7
6/19/2002	LB-1	Weakfish	Egg	15	554.2
6/19/2002	LB-1	Windowpane	Egg	31	1145.4
6/19/2002	LB-2	Atlantic menhaden	Egg	11	263.8
6/19/2002	LB-2	Bay anchovy	Egg	57	1366.9
6/19/2002	LB-2	Bay anchovy	PYS	4	95.9
6/19/2002	LB-2	Clupeid unidentified	PYS	2	48.0
6/19/2002	LB-2	Hogchocker	Egg	61	1462.8
6/19/2002	LB-2	Labridae	Egg	53	1271.0
6/19/2002	LB-2	Northern pipefish	PYS	1	24.0
6/19/2002	LB-2	Weakfish	Egg	49	1175.0
6/19/2002	LB-2	Windowpane	Egg	37	887.3
6/19/2002	LB-2	Windowpane	PYS	2	48.0
6/19/2002	LB-3	Bay anchovy	Egg	159	1684.7
6/19/2002	LB-3	Bay anchovy	PYS	213	2256.9
6/19/2002	LB-3	Clupeid unidentified	PYS	4	42.4
6/19/2002	LB-3	Gobiid unidentified	PYS	1	10.6
6/19/2002	LB-3	Hogchocker	Egg	9	95.4
6/19/2002	LB-3	Labridae	Egg	33	349.7
6/19/2002	LB-3	Unidentified	PYS	5	53.0
6/19/2002	LB-3	Weakfish	Egg	15	158.9
6/19/2002	LB-3	Weakfish	PYS	5	53.0
6/19/2002	LB-3	Windowpane	Egg	7	74.2
6/19/2002	LB-4	Bay anchovy	Egg	96	1553.0
6/19/2002	LB-4	Bay anchovy	PYS	24	194.1
6/19/2002	LB-4	Clupeid unidentified	PYS	11	89.0
6/19/2002	LB-4	Gobiid unidentified	PYS	1	8.1
6/19/2002	LB-4	Hogchocker	Egg	51	825.1
6/19/2002	LB-4	Labridae	Egg	29	469.1
6/19/2002	LB-4	Northern pipefish	JUV	1	8.1
6/19/2002	LB-4	Northern pipefish	PYS	1	8.1
6/19/2002	LB-4	Unidentified	PYS	7	56.6
6/19/2002	LB-4	Weakfish	Egg	12	194.1
6/19/2002	LB-4	Windowpane	Egg	28	453.0

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 24 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/19/2002	LB-4	Windowpane	PYS	2	16.2
6/19/2002	LB-5	Bay anchovy	Egg	154	3931.9
6/19/2002	LB-5	Bay anchovy	PYS	251	25634.1
6/19/2002	LB-5	Clupeid unidentified	PYS	15	1531.9
6/19/2002	LB-5	Gobiid unidentified	PYS	24	2451.1
6/19/2002	LB-5	Labridae	Egg	35	893.6
6/19/2002	LB-5	Northern pipefish	PYS	3	306.4
6/19/2002	LB-5	Unidentified	PYS	29	2961.7
6/19/2002	LB-5	Weakfish	PYS	4	408.5
6/19/2002	LB-5	Windowpane	Egg	17	434.0
6/19/2002	LB-6	Bay anchovy	Egg	154	2035.4
6/19/2002	LB-6	Bay anchovy	PYS	211	2788.8
6/19/2002	LB-6	Clupeid unidentified	PYS	33	436.2
6/19/2002	LB-6	Hogchocker	Egg	47	621.2
6/19/2002	LB-6	Labridae	Egg	6	79.3
6/19/2002	LB-6	Northern pipefish	PYS	2	26.4
6/19/2002	LB-6	Unidentified	PYS	17	224.7
6/19/2002	LB-6	Weakfish	Egg	11	14.5
6/19/2002	LB-6	Weakfish	PYS	12	158.6
6/19/2002	LB-6	Windowpane	Egg	3	39.7
6/19/2002	LB-6	Windowpane	PYS	1	13.2
6/19/2002	PJ-1	Bay anchovy	Egg	103	4750.1
6/19/2002	PJ-1	Bay anchovy	PYS	31	178.7
6/19/2002	PJ-1	Clupeid unidentified	PYS	79	455.4
6/19/2002	PJ-1	Gobiid unidentified	PYS	23	132.6
6/19/2002	PJ-1	Gobiid unidentified	YS	2	11.5
6/19/2002	PJ-1	Hogchocker	Egg	1	46.1
6/19/2002	PJ-1	Labridae	Egg	52	2398.1
6/19/2002	PJ-1	Northern pipefish	JUV	2	11.5
6/19/2002	PJ-1	Northern pipefish	PYS	9	51.9
6/19/2002	PJ-1	Tautog	PYS	2	11.5
6/19/2002	PJ-1	Unidentified	PYS	29	167.2
6/19/2002	PJ-1	Unidentified	YS	2	11.5
6/19/2002	PJ-1	Weakfish	Egg	12	553.4
6/19/2002	PJ-1	Weakfish	PYS	7	40.4
6/19/2002	PJ-1	Weakfish	YS	1	5.8
6/19/2002	PJ-1	Windowpane	Egg	39	1798.6
6/19/2002	PJ-1	Windowpane	PYS	1	5.8
6/19/2002	SB-5	Bay anchovy	Egg	27	1338.8
6/19/2002	SB-5	Bay anchovy	PYS	10	62.0
6/19/2002	SB-5	Clupeid unidentified	PYS	13	80.6
6/19/2002	SB-5	Hogchocker	Egg	23	1140.5
6/19/2002	SB-5	Labridae	Egg	32	1586.8
6/19/2002	SB-5	Weakfish	Egg	37	1834.7
6/19/2002	SB-5	Weakfish	PYS	1	6.2
6/19/2002	SB-5	Windowpane	Egg	93	4611.5
6/19/2002	SB-5	Windowpane	JUV	2	12.4
6/19/2002	SB-5	Windowpane	PYS	4	24.8
6/19/2002	SB-6	Bay anchovy	Egg	73	2948.3
6/19/2002	SB-6	Bay anchovy	PYS	19	95.9

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 25 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/19/2002	SB-6	Clupeid unidentified	PYS	97	489.7
6/19/2002	SB-6	Hogchocker	Egg	33	1332.8
6/19/2002	SB-6	Labridae	Egg	32	1292.4
6/19/2002	SB-6	Northern pipefish	PYS	2	10.1
6/19/2002	SB-6	Unidentified	PYS	22	111.1
6/19/2002	SB-6	Weakfish	Egg	21	848.1
6/19/2002	SB-6	Weakfish	PYS	4	20.2
6/19/2002	SB-6	Windowpane	Egg	54	2181.0
6/19/2002	SB-6	Windowpane	PYS	10	50.5
6/20/2002	PJ-4	Bay anchovy	Egg	131	2342.5
6/20/2002	PJ-4	Bay anchovy	PYS	53	236.9
6/20/2002	PJ-4	Clupeid unidentified	PYS	5	22.4
6/20/2002	PJ-4	Gobiid unidentified	PYS	3	13.4
6/20/2002	PJ-4	Hogchocker	Egg	14	250.3
6/20/2002	PJ-4	Labridae	Egg	36	643.7
6/20/2002	PJ-4	Northern pipefish	PYS	2	8.9
6/20/2002	PJ-4	Striped bass	PYS	1	4.5
6/20/2002	PJ-4	Unidentified	PYS	7	31.3
6/20/2002	PJ-4	Weakfish	Egg	4	71.5
6/20/2002	PJ-4	Weakfish	PYS	4	17.9
6/20/2002	PJ-4	Windowpane	Egg	61	1090.8
6/20/2002	PJ-5	Bay anchovy	Egg	169	2609.6
6/20/2002	PJ-5	Bay anchovy	PYS	60	231.6
6/20/2002	PJ-5	Clupeid unidentified	PYS	28	108.1
6/20/2002	PJ-5	Gobiid unidentified	PYS	5	19.3
6/20/2002	PJ-5	Gobiid unidentified	YS	1	3.9
6/20/2002	PJ-5	Labridae	Egg	13	200.7
6/20/2002	PJ-5	Northern pipefish	PYS	3	11.6
6/20/2002	PJ-5	Tautog	PYS	1	3.9
6/20/2002	PJ-5	Unidentified	PYS	31	119.7
6/20/2002	PJ-5	Weakfish	Egg	7	108.1
6/20/2002	PJ-5	Weakfish	PYS	8	30.9
6/20/2002	PJ-5	Windowpane	Egg	21	324.3
6/20/2002	SB-1	Bay anchovy	Egg	107	4348.6
6/20/2002	SB-1	Bay anchovy	PYS	20	203.2
6/20/2002	SB-1	Clupeid unidentified	PYS	8	81.3
6/20/2002	SB-1	Gobiid unidentified	PYS	1	10.2
6/20/2002	SB-1	Labridae	Egg	69	2804.2
6/20/2002	SB-1	Northern pipefish	PYS	1	10.2
6/20/2002	SB-1	Unidentified	PYS	8	81.3
6/20/2002	SB-1	Weakfish	Egg	1	40.6
6/20/2002	SB-1	Weakfish	PYS	1	10.2
6/20/2002	SB-1	Windowpane	Egg	24	975.4
6/20/2002	SB-1	Windowpane	PYS	1	10.2
6/20/2002	SB-2	Bay anchovy	Egg	111	6583.4
6/20/2002	SB-2	Bay anchovy	PYS	14	103.8
6/20/2002	SB-2	Clupeid unidentified	PYS	6	44.5
6/20/2002	SB-2	Gobiid unidentified	PYS	1	7.4
6/20/2002	SB-2	Labridae	Egg	79	4685.5
6/20/2002	SB-2	Northern pipefish	PYS	1	7.4

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 26 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
6/20/2002	SB-2	Unidentified	PYS	13	96.4
6/20/2002	SB-2	Weakfish	PYS	1	7.4
6/20/2002	SB-2	Windowpane	Egg	27	1601.4
6/20/2002	SB-3	Bay anchovy	Egg	127	3078.0
6/20/2002	SB-3	Bay anchovy	PYS	60	363.5
6/20/2002	SB-3	Clupeid unidentified	PYS	30	181.8
6/20/2002	SB-3	Gobiid unidentified	PYS	13	78.8
6/20/2002	SB-3	Hogchocker	Egg	7	169.7
6/20/2002	SB-3	Labridae	Egg	58	1405.7
6/20/2002	SB-3	Northern pipefish	JUV	2	12.1
6/20/2002	SB-3	Northern pipefish	PYS	13	78.8
6/20/2002	SB-3	Tautog	PYS	3	18.2
6/20/2002	SB-3	Unidentified	PYS	25	151.5
6/20/2002	SB-3	Weakfish	Egg	9	218.1
6/20/2002	SB-3	Weakfish	PYS	2	12.1
6/20/2002	SB-3	Windowpane	Egg	9	218.1
6/20/2002	SB-3	Windowpane	PYS	3	18.2
6/20/2002	SB-4	Bay anchovy	Egg	107	1859.5
6/20/2002	SB-4	Bay anchovy	PYS	229	994.9
6/20/2002	SB-4	Clupeid unidentified	PYS	92	399.7
6/20/2002	SB-4	Gobiid unidentified	Egg	1	17.4
6/20/2002	SB-4	Gobiid unidentified	PYS	8	34.8
6/20/2002	SB-4	Hogchocker	Egg	6	104.3
6/20/2002	SB-4	Labridae	Egg	47	816.8
6/20/2002	SB-4	Northern pipefish	PYS	5	21.7
6/20/2002	SB-4	Unidentified	PYS	19	82.5
6/20/2002	SB-4	Weakfish	Egg	4	69.5
6/20/2002	SB-4	Weakfish	PYS	5	21.7
6/20/2002	SB-4	Windowpane	Egg	41	712.5
7/9/2002	AK-1	Bay anchovy	Egg	9	60.9
7/9/2002	AK-1	Bay anchovy	PYS	2	13.5
7/9/2002	AK-1	Gobiid unidentified	PYS	414	2800.5
7/9/2002	AK-1	Hogchocker	Egg	1	6.8
7/9/2002	AK-1	Labridae	Egg	15	101.5
7/9/2002	AK-1	Weakfish	PYS	2	13.5
7/9/2002	AK-2	Bay anchovy	Egg	27	149.2
7/9/2002	AK-2	Bay anchovy	PYS	8	44.2
7/9/2002	AK-2	Blennidae	PYS	1	5.5
7/9/2002	AK-2	Clupeid unidentified	PYS	6	33.2
7/9/2002	AK-2	Gobiid unidentified	PYS	152	840.2
7/9/2002	AK-2	Labridae	Egg	11	60.8
7/9/2002	AK-2	Northern pipefish	PYS	2	11.1
7/9/2002	AK-2	Unidentified	PYS	5	27.6
7/9/2002	AK-2	Weakfish	PYS	2	11.1
7/9/2002	AK-3	Bay anchovy	Egg	17	136.0
7/9/2002	AK-3	Bay anchovy	PYS	2	32.0
7/9/2002	AK-3	Clupeid unidentified	PYS	3	48.0
7/9/2002	AK-3	Gobiid unidentified	PYS	209	3343.2
7/9/2002	AK-3	Labridae	Egg	2	16.0
7/9/2002	AK-3	Northern pipefish	JUV	1	16.0

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 27 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
7/9/2002	AK-3	Unidentified	PYS	27	431.9
7/9/2002	AK-3	Weakfish	PYS	6	96.0
7/9/2002	AK-4	Bay anchovy	Egg	2	9.7
7/9/2002	AK-4	Bay anchovy	PYS	6	29.2
7/9/2002	AK-4	Clupeid unidentified	PYS	10	48.7
7/9/2002	AK-4	Gobiid unidentified	PYS	693	3372.7
7/9/2002	AK-4	Northern pipefish	PYS	9	43.8
7/9/2002	AK-4	Unidentified	PYS	104	506.1
7/9/2002	AK-4	Weakfish	Egg	1	4.9
7/9/2002	NB-3	Bay anchovy	Egg	185	1496.4
7/9/2002	NB-3	Bay anchovy	PYS	74	598.6
7/9/2002	NB-3	Gobiid unidentified	PYS	83	671.4
7/9/2002	NB-4	Bay anchovy	Egg	84	771.1
7/9/2002	NB-4	Bay anchovy	PYS	29	266.2
7/9/2002	NB-4	Gobiid unidentified	PYS	381	3497.5
7/9/2002	NB-4	Northern pipefish	PYS	3	27.5
7/9/2002	NB-5	Bay anchovy	Egg	136	711.9
7/9/2002	NB-5	Bay anchovy	PYS	18	94.2
7/9/2002	NB-5	Gobiid unidentified	PYS	58	303.6
7/9/2002	NB-5	Labridae	Egg	1	5.2
7/9/2002	NB-5	Northern pipefish	PYS	5	26.2
7/9/2002	NB-5	Weakfish	PYS	6	31.4
7/9/2002	NB-6	Bay anchovy	Egg	72	426.7
7/9/2002	NB-6	Bay anchovy	PYS	16	94.8
7/9/2002	NB-6	Butterfish	PYS	1	5.9
7/9/2002	NB-6	Gobiid unidentified	PYS	230	1363.0
7/9/2002	NB-6	Hogchocker	Egg	2	11.9
7/9/2002	NB-6	Labridae	Egg	19	112.6
7/9/2002	NB-6	Northern pipefish	PYS	1	5.9
7/9/2002	NB-6	Weakfish	PYS	4	23.7
7/9/2002	NB-7	Bay anchovy	Egg	87	761.4
7/9/2002	NB-7	Bay anchovy	PYS	13	113.8
7/9/2002	NB-7	Blennidae	PYS	2	17.5
7/9/2002	NB-7	Gobiid unidentified	PYS	130	1137.7
7/9/2002	NB-7	Labridae	Egg	5	43.8
7/9/2002	NB-7	Northern pipefish	PYS	1	8.8
7/9/2002	PJ-4	Bay anchovy	Egg	7	45.0
7/9/2002	PJ-4	Bay anchovy	PYS	2	51.5
7/9/2002	PJ-4	Gobiid unidentified	PYS	325	8363.0
7/9/2002	PJ-4	Hogchocker	Egg	1	6.4
7/9/2002	PJ-4	Labridae	Egg	18	115.8
7/9/2002	PJ-4	Northern pipefish	PYS	2	51.5
7/9/2002	PJ-4	Weakfish	PYS	19	488.9
7/9/2002	PJ-4	Windowpane	Egg	2	12.9
7/10/2002	LB-2	Bay anchovy	Egg	1	13.9
7/10/2002	LB-2	Butterfish	PYS	1	13.9
7/10/2002	LB-2	Cunner	PYS	1	13.9
7/10/2002	LB-2	Hogchocker	Egg	1	13.9
7/10/2002	LB-2	Labridae	Egg	1	13.9
7/10/2002	LB-2	Weakfish	Egg	4	55.7

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 28 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
7/10/2002	LB-3	Bay anchovy	Egg	1	5.8
7/10/2002	LB-3	Butterfish	PYS	3	17.3
7/10/2002	LB-3	Hogchocker	Egg	2	11.5
7/10/2002	LB-3	Labridae	Egg	3	17.3
7/10/2002	LB-3	Northern pipefish	PYS	2	11.5
7/10/2002	LB-4	Bay anchovy	Egg	2	12.8
7/10/2002	LB-4	Butterfish	PYS	1	6.4
7/10/2002	LB-4	Gobiid unidentified	PYS	20	127.8
7/10/2002	LB-4	Hogchocker	Egg	11	70.3
7/10/2002	LB-4	Unidentified	PYS	5	31.9
7/10/2002	LB-4	Weakfish	Egg	5	31.9
7/10/2002	LB-4	Weakfish	PYS	3	19.2
7/10/2002	LB-4	Windowpane	PYS	1	6.4
7/10/2002	LB-5	Bay anchovy	Egg	4	61.5
7/10/2002	LB-5	Gobiid unidentified	PYS	14	139.9
7/10/2002	LB-5	Gobiid unidentified	PYS	1	15.4
7/10/2002	LB-5	Hogchocker	Egg	10	153.7
7/10/2002	LB-5	Northern pipefish	PYS	1	10.0
7/10/2002	LB-6	Bay anchovy	Egg	3	20.8
7/10/2002	LB-6	Bay anchovy	PYS	3	20.8
7/10/2002	LB-6	Gobiid unidentified	PYS	20	138.7
7/10/2002	LB-6	Hogchocker	Egg	14	97.1
7/10/2002	LB-6	Labridae	Egg	13	90.2
7/10/2002	LB-6	Northern pipefish	JUV	2	13.9
7/10/2002	LB-6	Prionotus sp.	PYS	1	6.9
7/10/2002	LB-6	Tautog	PYS	3	20.8
7/10/2002	LB-6	Weakfish	PYS	19	131.8
7/10/2002	LB-6	Windowpane	PYS	1	6.9
7/10/2002	PJ-1	Bay anchovy	PYS	10	108.1
7/10/2002	PJ-1	Cunner	PYS	1	10.8
7/10/2002	PJ-1	Gobiid unidentified	PYS	191	2064.6
7/10/2002	PJ-1	Hogchocker	Egg	1	10.8
7/10/2002	PJ-1	Labridae	Egg	24	259.4
7/10/2002	PJ-1	Northern pipefish	PYS	1	10.8
7/10/2002	PJ-1	Weakfish	Egg	8	86.5
7/10/2002	PJ-1	Weakfish	PYS	1	10.8
7/10/2002	PJ-5	Bay anchovy	Egg	1	7.2
7/10/2002	PJ-5	Bay anchovy	PYS	115	825.6
7/10/2002	PJ-5	Gobiid unidentified	PYS	304	2182.6
7/10/2002	PJ-5	Hogchocker	Egg	8	57.4
7/10/2002	PJ-5	Labridae	Egg	51	366.2
7/10/2002	PJ-5	Tautog	PYS	1	7.2
7/10/2002	PJ-5	Weakfish	Egg	13	93.3
7/10/2002	PJ-5	Weakfish	PYS	6	43.1
7/10/2002	SB-3	Bay anchovy	Egg	1	12.6
7/10/2002	SB-3	Bay anchovy	PYS	1	12.6
7/10/2002	SB-3	Gobiid unidentified	PYS	518	6542.6
7/10/2002	SB-3	Hogchocker	Egg	3	37.9
7/10/2002	SB-3	Labridae	Egg	8	101.0
7/10/2002	SB-3	Northern pipefish	PYS	1	12.6

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 29 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
7/10/2002	SB-3	Windowpane	Egg	5	63.2
7/10/2002	SB-5	Bay anchovy	PYS	3	21.0
7/10/2002	SB-5	Butterfish	PYS	2	14.0
7/10/2002	SB-5	Gobiid unidentified	PYS	53	371.1
7/10/2002	SB-5	Hogchocker	Egg	3	21.0
7/10/2002	SB-5	Labridae	Egg	19	133.0
7/10/2002	SB-5	Northern pipefish	PYS	1	7.0
7/10/2002	SB-5	Weakfish	PYS	1	7.0
7/10/2002	SB-5	Windowpane	Egg	6	42.0
7/10/2002	SB-6	Bay anchovy	Egg	1	7.0
7/10/2002	SB-6	Bay anchovy	PYS	1	7.0
7/10/2002	SB-6	Butterfish	PYS	2	13.9
7/10/2002	SB-6	Gobiid unidentified	PYS	32	222.4
7/10/2002	SB-6	Hogchocker	Egg	4	27.8
7/10/2002	SB-6	Labridae	Egg	22	152.9
7/10/2002	SB-6	Weakfish	Egg	1	7.0
7/10/2002	SB-6	Weakfish	PYS	4	27.8
7/11/2002	PJ-2	Bay anchovy	Egg	5	79.4
7/11/2002	PJ-2	Bay anchovy	PYS	7	111.2
7/11/2002	PJ-2	Butterfish	PYS	2	31.8
7/11/2002	PJ-2	Cunner	PYS	1	15.9
7/11/2002	PJ-2	Gobiid unidentified	PYS	180	2858.4
7/11/2002	PJ-2	Hogchocker	Egg	1	15.9
7/11/2002	PJ-2	Labridae	Egg	32	508.2
7/11/2002	PJ-2	Northern pipefish	PYS	5	79.4
7/11/2002	PJ-2	Weakfish	Egg	2	31.8
7/11/2002	PJ-2	Weakfish	PYS	1	15.9
7/11/2002	PJ-3	Bay anchovy	Egg	1	13.6
7/11/2002	PJ-3	Bay anchovy	PYS	15	203.4
7/11/2002	PJ-3	Butterfish	PYS	2	27.1
7/11/2002	PJ-3	Gobiid unidentified	PYS	644	8731.0
7/11/2002	PJ-3	Labridae	Egg	27	366.1
7/11/2002	PJ-3	Northern pipefish	PYS	6	81.3
7/11/2002	PJ-3	Windowpane	Egg	2	27.1
7/11/2002	SB-1	Bay anchovy	PYS	1	11.3
7/11/2002	SB-1	Gobiid unidentified	PYS	53	596.7
7/11/2002	SB-1	Hogchocker	Egg	8	90.1
7/11/2002	SB-1	Labridae	Egg	47	529.2
7/11/2002	SB-1	Northern pipefish	PYS	2	22.5
7/11/2002	SB-1	Weakfish	PYS	1	11.3
7/11/2002	SB-1	Windowpane	Egg	9	101.3
7/11/2002	SB-2	Bay anchovy	Egg	1	12.0
7/11/2002	SB-2	Blennidae	PYS	1	12.0
7/11/2002	SB-2	Cunner	PYS	1	12.0
7/11/2002	SB-2	Gobiid unidentified	PYS	36	430.4
7/11/2002	SB-2	Hogchocker	Egg	1	12.0
7/11/2002	SB-2	Labridae	Egg	67	801.0
7/11/2002	SB-2	Windowpane	Egg	16	191.3
7/11/2002	SB-4	Bay anchovy	Egg	2	24.8
7/11/2002	SB-4	Bay anchovy	PYS	19	235.3

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 30 of 30)

Date	Station	Common Name	Life Stage	Number Caught	Density (#/1000m^3)
7/11/2002	SB-4	Blennidae	PYS	1	12.4
7/11/2002	SB-4	Butterfish	PYS	1	12.4
7/11/2002	SB-4	Clupeid unidentified	PYS	6	74.3
7/11/2002	SB-4	Cunner	PYS	1	12.4
7/11/2002	SB-4	Gobiid unidentified	PYS	777	9621.7
7/11/2002	SB-4	Hogchocker	Egg	2	24.8
7/11/2002	SB-4	Labridae	Egg	45	557.2
7/11/2002	SB-4	Northern pipefish	PYS	8	99.1
7/11/2002	SB-4	Prionotus sp.	JUV	1	12.4
7/11/2002	SB-4	Weakfish	Egg	14	173.4
7/11/2002	SB-4	Weakfish	PYS	9	111.4

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 1 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
1/22/2002	LB-1	4.9	10.0	41540	26.1
1/22/2002	LB-2	5.8	9.6	46200	29.9
1/22/2002	PJ-1	5.2	10.2	30680	18.8
1/22/2002	PJ-2	5.4	10.6	29970	18.3
1/22/2002	PJ-3	4.9	10.6	31320	19.2
1/22/2002	PJ-4	5.6	9.8	34530	21.4
1/22/2002	PJ-5	5.5	9.9	33190	20.5
1/22/2002	SB-1	4.8	10.4	34350	21.3
1/22/2002	SB-2	5.1	10.5	34920	21.7
1/22/2002	SB-3	5.0	10.2	34670	21.5
1/22/2002	SB-4	5.2	9.9	40500	25.7
1/22/2002	SB-5	5.5	9.9	35080	21.7
1/22/2002	SB-6	4.6	10.3	34780	21.5
1/23/2002	AK-1	5.0	10.0	39520	24.8
1/23/2002	AK-2	4.9	9.9	39400	24.6
1/23/2002	AK-3	5.4	9.8	37960	23.5
1/23/2002	AK-4	5.2	9.9	39030	24.4
1/23/2002	LB-3	4.7	11.2	41520	26.4
1/23/2002	LB-4	5.3	10.1	46200	29.9
1/23/2002	LB-5	4.9	10.9	43550	27.8
1/23/2002	LB-6	4.0	12.0	44510	28.4
1/24/2002	NB-3	4.7	10.1	36360	22.6
1/24/2002	NB-4	4.8	10.1	37070	23.0
1/24/2002	NB-5	4.8	10.1	38900	24.4
1/24/2002	NB-6	5.2	10.0	40150	25.2
1/24/2002	NB-7	4.9	10.4	36900	23.0
2/5/2002	AK-1	4.6	9.3	37940	23.6
2/5/2002	AK-2	4.6	9.3	37930	23.6
2/5/2002	AK-3	4.6	9.5	38520	24.0
2/5/2002	AK-4	4.4	9.7	37610	23.4
2/5/2002	NB-3	4.6	9.6	37110	23.1
2/5/2002	NB-4	4.4	9.7	36640	22.7
2/5/2002	NB-5	5.2	9.3	37830	23.6
2/5/2002	NB-6	5.1	9.3	38190	23.9
2/5/2002	NB-7	5.2	9.3	38810	24.3
2/6/2002	LB-1	5.6	10.1	41630	26.2
2/6/2002	LB-2	5.5	10.1	41060	25.9
2/6/2002	LB-3	5.5	10.3	43290	27.3
2/6/2002	LB-4	5.8	9.9	45820	29.2
2/6/2002	LB-5	3.7	12.3	43670	27.5
2/6/2002	LB-6	4.6	11.1	43910	27.8
2/6/2002	SB-1	5.7	9.9	39950	25.1
2/6/2002	SB-2	5.7	10.0	40650	25.6
2/6/2002	SB-4	5.8	10.0	41840	26.7
2/7/2002	PJ-1	5.1	10.1	35250	21.9
2/7/2002	PJ-2	5.2	10.0	35400	22.0
2/7/2002	PJ-3	4.9	9.9	38400	23.9
2/7/2002	PJ-4	5.5	9.7	41740	26.4
2/7/2002	PJ-5	5.3	9.8	39050	24.4
2/7/2002	SB-3	5.3	9.8	40510	25.5
2/7/2002	SB-5	5.5	9.7	40700	25.6

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 2 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
2/7/2002	SB-6	5.2	9.9	39500	24.7
2/19/2002	LB-1	6.5	9.6	49730	32.1
2/19/2002	LB-2	7.0	9.4	51000	33.1
2/19/2002	LB-3	5.1	11.6	42740	27.0
2/19/2002	LB-4	6.3	10.0	40400	31.2
2/19/2002	LB-5	4.7	11.0	43610	27.5
2/19/2002	LB-6	5.3	10.2	45410	28.8
2/19/2002	PJ-1	6.1	11.2	36420	22.7
2/19/2002	PJ-2	5.7	11.4	33930	20.8
2/19/2002	PJ-3	6.3	11.3	35200	21.9
2/19/2002	SB-5	6.3	10.2	44400	28.3
2/20/2002	AK-1	5.7	10.4	37890	23.5
2/20/2002	AK-2	5.9	10.4	37800	24.0
2/20/2002	AK-3	6.0	10.5	37480	23.3
2/20/2002	AK-4	6.8	11.6	36570	22.9
2/20/2002	NB-3	5.5	11.0	36220	22.5
2/20/2002	NB-4	5.4	11.5	36250	22.8
2/20/2002	NB-5	5.5	10.8	37050	23.1
2/20/2002	NB-6	5.9	10.4	37960	23.6
2/20/2002	NB-7	5.5	10.8	36940	23.3
2/20/2002	PJ-4	6.4	9.7	45100	28.8
2/20/2002	PJ-5	6.0	11.0	34440	21.4
2/21/2002	SB-1	6.7	10.3	41180	26.4
2/21/2002	SB-2	6.9	9.8	43230	27.1
2/21/2002	SB-3	6.3	10.0	41160	25.3
2/21/2002	SB-4	6.8	9.7	45510	29.9
2/21/2002	SB-6	6.5	10.1	42400	26.8
3/5/2002	AK-1	6.2	9.0	36750	22.9
3/5/2002	AK-2	6.1	8.9	36740	22.9
3/5/2002	AK-3	5.9	9.1	36620	22.8
3/5/2002	AK-4	5.2	9.0	36450	22.7
3/5/2002	NB-3	6.2	9.3	34940	21.7
3/5/2002	NB-4	6.0	9.4	35470	22.1
3/5/2002	NB-5	5.8	9.0	36800	22.9
3/5/2002	NB-5	5.8	9.0	36800	22.9
3/5/2002	NB-6	5.8	8.7	36940	23.1
3/5/2002	NB-6	5.8	8.7	36940	23.1
3/5/2002	NB-7	6.2	9.9	36290	22.6
3/5/2002	NB-7	6.2	9.9	36290	22.6
3/6/2002	LB-1	5.9	9.4	42070	26.5
3/6/2002	LB-1	5.9	9.4	42070	26.5
3/6/2002	LB-2	6.4	8.9	47200	30.3
3/6/2002	LB-2	6.4	8.9	47200	30.3
3/6/2002	LB-3	5.8	9.4	41800	26.4
3/6/2002	LB-3	5.8	9.4	41800	26.4
3/6/2002	LB-4	5.8	9.6	41070	25.9
3/6/2002	LB-4	5.8	9.6	41070	25.9
3/6/2002	LB-5	5.2	10.7	42690	26.9
3/6/2002	LB-5	5.2	10.7	42690	26.9
3/6/2002	LB-6	5.8	9.6	46360	29.6
3/6/2002	LB-6	5.8	9.6	46360	29.6

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 3 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
3/6/2002	PJ-2	6.4	9.7	33630	20.8
3/6/2002	PJ-2	6.4	9.7	33630	20.8
3/6/2002	PJ-3	6.6	9.9	35860	22.4
3/6/2002	PJ-3	6.6	9.9	35860	22.4
3/6/2002	PJ-4	6.6	9.1	41500	26.2
3/6/2002	PJ-4	6.6	9.1	41500	26.2
3/6/2002	PJ-5	6.6	9.2	40100	25.2
3/6/2002	PJ-5	6.6	9.2	40100	25.2
3/6/2002	SB-6	6.3	9.3	41610	26.4
3/6/2002	SB-6	6.3	9.3	41610	26.4
3/7/2002	PJ-1	6.9	9.8	34180	20.9
3/7/2002	PJ-1	6.9	9.8	34180	20.9
3/7/2002	SB-1	6.4	9.4	40040	25.4
3/7/2002	SB-2	6.4	9.3	41640	26.3
3/7/2002	SB-3	6.2	9.6	38590	24.2
3/7/2002	SB-3	6.2	9.6	38590	24.2
3/7/2002	SB-4	6.4	9.5	40540	25.6
3/7/2002	SB-4	6.4	9.5	40540	25.6
3/7/2002	SB-6	7.1	9.0	37550	23.5
3/7/2002	SB-6	7.1	9.0	37550	23.5
3/19/2002	LB-1	6.9	9.2	48329	31.1
3/19/2002	LB-1	6.9	9.2	48329	31.1
3/19/2002	LB-2	6.9	9.2	49910	32.2
3/19/2002	LB-2	6.9	9.2	49910	32.2
3/19/2002	LB-3	7.0	9.4	41700	26.4
3/19/2002	LB-3	7.0	9.4	41700	26.4
3/19/2002	LB-4	7.1	9.3	46530	29.8
3/19/2002	LB-4	7.1	9.3	46530	29.8
3/19/2002	LB-5	7.1	9.7	41900	26.5
3/19/2002	LB-5	7.1	9.7	41900	26.5
3/19/2002	LB-6	7.1	10.6	42090	26.7
3/19/2002	LB-6	7.1	10.6	42090	26.7
3/19/2002	PJ-1	7.0	9.9	35010	21.8
3/19/2002	PJ-1	7.0	9.9	35010	21.8
3/19/2002	PJ-2	6.9	10.1	32670	20.2
3/19/2002	PJ-2	6.9	10.1	32670	20.2
3/19/2002	PJ-3				
3/19/2002	PJ-3				
3/19/2002	PJ-4	7.3	9.1	44940	28.7
3/19/2002	PJ-4	7.3	9.1	44940	28.7
3/19/2002	PJ-5	7.3	9.2	43830	28.0
3/19/2002	PJ-5	7.3	9.2	43830	28.0
3/20/2002	AK-1	7.4	11.5	36150	22.6
3/20/2002	AK-2	7.4	11.2	36080	22.6
3/20/2002	AK-3	7.7	11.3	36130	22.6
3/20/2002	AK-4	8.0	12.1	36490	22.9
3/20/2002	NB-3	7.6	11.3	36050	22.6
3/20/2002	NB-3	7.6	11.3	36050	22.6
3/20/2002	NB-4	7.5	11.0	36230	22.7
3/20/2002	NB-4	7.5	11.0	36230	22.7
3/20/2002	NB-5	7.5	11.1	36500	22.9

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 4 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
3/20/2002	NB-5	7.5	11.1	36500	22.9
3/20/2002	NB-6	7.6	11.0	35940	22.5
3/20/2002	NB-7	7.2	10.9	35340	22.1
3/20/2002	NB-7	7.2	10.9	35340	22.1
3/21/2002	SB-1	6.9	9.8	37930	23.8
3/21/2002	SB-1	6.9	9.8	37930	23.8
3/21/2002	SB-2	7.1	9.3	39550	25.0
3/21/2002	SB-2	7.1	9.3	39550	25.0
3/21/2002	SB-3	7.0	9.4	38600	24.3
3/21/2002	SB-3	7.0	9.4	38600	24.3
3/21/2002	SB-4	7.0	9.5	39560	24.9
3/21/2002	SB-4	7.0	9.5	39560	24.9
3/21/2002	SB-5	6.9	9.7	39370	24.8
3/21/2002	SB-5	6.9	9.7	39370	24.8
3/21/2002	SB-6	6.8	8.9	38630	24.3
3/21/2002	SB-6	6.8	8.9	38630	24.3
4/2/2002	LB-1	7.7	8.6	42251	26.9
4/2/2002	LB-1	7.7	8.6	42251	26.9
4/2/2002	LB-2	7.8	8.8	43367	27.7
4/2/2002	LB-2	7.8	8.8	43367	27.7
4/2/2002	LB-3	7.6	10.4	42237	26.9
4/2/2002	LB-3	7.6	10.4	42237	26.9
4/2/2002	LB-4	7.9	8.7	46035	29.6
4/2/2002	LB-4	7.9	8.7	46035	29.6
4/2/2002	LB-5	8.8	9.9	40676	25.8
4/2/2002	LB-5	8.8	9.9	40676	25.8
4/2/2002	LB-6	9.0	10.2	41849	26.6
4/2/2002	LB-6	9.0	10.2	41849	26.6
4/2/2002	PJ-1	8.4	9.4	35440	22.1
4/2/2002	PJ-1	8.4	9.4	35440	22.1
4/2/2002	PJ-2	9.0	9.6	24942	15.1
4/2/2002	PJ-2	9.0	9.6	24942	15.1
4/2/2002	PJ-3	8.5	9.6	28035	17.2
4/2/2002	PJ-3	8.5	9.6	28035	17.2
4/2/2002	PJ-4	8.1	9.1	36237	22.5
4/2/2002	PJ-4	8.1	9.1	36237	22.5
4/2/2002	PJ-5	8.2	9.3	36459	22.8
4/2/2002	PJ-5	8.2	9.3	36459	22.8
4/3/2002	AK-1	9.6	10.2	31975	19.9
4/3/2002	AK-2	9.7	10.3	32850	20.3
4/3/2002	AK-3	9.6	10.2	32740	20.3
4/3/2002	AK-4	11.8	10.6	32144	20.0
4/3/2002	NB-3	10.1	10.3	32750	20.3
4/3/2002	NB-3	10.1	10.3	32750	20.3
4/3/2002	NB-4	10.1	10.3	32750	20.3
4/3/2002	NB-4	10.1	10.3	32750	20.3
4/3/2002	NB-5	9.7	10.3	32002	19.9
4/3/2002	NB-5	9.7	10.3	32002	19.9
4/3/2002	NB-6	9.7	10.3	32002	20.0
4/3/2002	NB-6	9.7	10.3	32002	20.0
4/3/2002	NB-7	9.6	9.9	32358	20.1

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 5 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
4/3/2002	NB-7	9.6	9.9	32358	20.1
4/4/2002	SB-1	8.5	9.3	34022	21.3
4/4/2002	SB-1	8.5	9.3	34022	21.3
4/4/2002	SB-2	9.0	9.3	32993	20.5
4/4/2002	SB-2	9.0	9.3	32993	20.5
4/4/2002	SB-3	8.5	9.5	30956	19.1
4/4/2002	SB-3	8.5	9.5	30956	19.1
4/4/2002	SB-4	8.3	9.5	33229	20.7
4/4/2002	SB-4	8.3	9.5	33229	20.7
4/4/2002	SB-5	8.2	9.6	34986	21.9
4/4/2002	SB-5	8.2	9.6	34986	21.9
4/4/2002	SB-6	8.5	9.6	34168	21.3
4/4/2002	SB-6	8.5	9.6	34168	21.3
4/16/2002	LB-1	11.1	9.1	44710	28.7
4/16/2002	LB-1	11.1	9.1	44710	28.7
4/16/2002	LB-2	10.0	9.2	46530	30.1
4/16/2002	LB-2	10.0	9.2	46530	30.1
4/16/2002	LB-3	11.3	8.8	42260	26.9
4/16/2002	LB-3	11.3	8.8	42260	26.9
4/16/2002	LB-4	10.7	9.3	43340	27.6
4/16/2002	LB-4	10.7	9.3	43340	27.6
4/16/2002	LB-5	11.5	9.6	40990	25.9
4/16/2002	LB-5	11.5	9.6	40990	25.9
4/16/2002	LB-6	11.1	9.1	41640	26.4
4/16/2002	LB-6	11.1	9.1	41640	26.4
4/16/2002	PJ-2	12.0	9.1	29630	18.4
4/16/2002	PJ-2	12.0	9.1	29630	18.4
4/16/2002	PJ-3	11.7	9.2	31340	19.6
4/16/2002	PJ-3	11.7	9.2	31340	19.6
4/16/2002	SB-5	11.3	9.1	39520	25.2
4/16/2002	SB-5	11.3	9.1	39520	25.2
4/16/2002	SB-6	11.2	9.0	42670	27.1
4/16/2002	SB-6	11.2	9.0	42670	27.1
4/17/2002	AK-1	13.0	9.1	33750	21.1
4/17/2002	AK-2	13.3	9.0	33420	20.8
4/17/2002	AK-3	13.7	8.8	33200	20.8
4/17/2002	AK-4	15.5	8.1	32980	20.5
4/17/2002	NB-3	14.1	9.0	32800	20.6
4/17/2002	NB-3	14.1	9.0	32800	20.6
4/17/2002	NB-4	14.0	9.0	32850	20.7
4/17/2002	NB-4	14.0	9.0	32850	20.7
4/17/2002	NB-5	13.5	9.1	32850	20.7
4/17/2002	NB-5	13.5	9.1	32850	20.7
4/17/2002	NB-6	13.3	9.0	32010	20.1
4/17/2002	NB-6	13.3	9.0	32010	20.1
4/17/2002	NB-7	14.0	9.3	32700	20.5
4/17/2002	NB-7	14.0	9.3	32700	20.5
4/17/2002	PJ-4	12.0	8.8	39070	24.7
4/17/2002	PJ-4	12.0	8.8	39070	24.7
4/17/2002	PJ-5	11.7	9.2	42040	26.5
4/17/2002	PJ-5	11.7	9.2	42040	26.5

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 6 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
4/18/2002	PJ-1	12.6	9.1	30295	18.6
4/18/2002	PJ-1	12.6	9.1	30295	18.6
4/18/2002	SB-1	11.7	8.9	33916	21.1
4/18/2002	SB-1	11.7	8.9	33916	21.1
4/18/2002	SB-2	11.5	9.0	30897	19.0
4/18/2002	SB-2	11.5	9.0	30897	19.0
4/18/2002	SB-3	12.5	8.7	31724	19.6
4/18/2002	SB-4	11.5	8.9	39278	24.9
4/18/2002	SB-4	11.5	8.9	39278	24.9
4/30/2002	LB-1	10.3	8.4	43680	28.0
4/30/2002	LB-1	10.3	8.4	43680	28.0
4/30/2002	LB-2				
4/30/2002	LB-2				
4/30/2002	LB-3	10.1	8.0	38180	23.7
4/30/2002	LB-3	10.1	8.0	38180	23.7
4/30/2002	LB-4	10.3	8.1	41720	26.7
4/30/2002	LB-4	10.3	8.1	41720	26.7
4/30/2002	LB-5	10.2	8.3	41620	26.4
4/30/2002	LB-5	10.2	8.3	41620	26.4
4/30/2002	LB-6	10.3	8.1	41020	26.2
4/30/2002	LB-6	10.3	8.1	41020	26.2
4/30/2002	PJ-1	11.0	7.6	39640	24.9
4/30/2002	PJ-1	11.0	7.6	39640	24.9
4/30/2002	PJ-2	11.3	7.5	33520	21.0
4/30/2002	PJ-2	11.3	7.5	33520	21.0
4/30/2002	PJ-3	12.1	7.8	33260	20.8
4/30/2002	PJ-3	12.1	7.8	33260	20.8
4/30/2002	PJ-4	11.0	7.3	39850	25.3
4/30/2002	PJ-4	11.0	7.3	39850	25.3
4/30/2002	PJ-5	11.0	7.7	39650	25.2
4/30/2002	PJ-5	11.0	7.7	39650	25.2
5/1/2002	AK-1	11.9	7.1	32400	20.2
5/1/2002	AK-2	11.7	7.0	32650	20.4
5/1/2002	AK-3	12.4	7.4	32740	20.5
5/1/2002	AK-4	13.5	7.8	31920	20.0
5/1/2002	NB-3	13.1	7.5	30700	19.1
5/1/2002	NB-3	13.1	7.5	30700	19.1
5/1/2002	NB-4	13.1	7.5	30700	19.1
5/1/2002	NB-4	13.1	7.5	30700	19.1
5/1/2002	NB-5	11.8	7.4	30820	19.2
5/1/2002	NB-5	11.8	7.4	30820	19.2
5/1/2002	NB-6	12.1	7.5	31570	19.7
5/1/2002	NB-6	12.1	7.5	31570	19.7
5/1/2002	NB-7	12.5	7.5	31230	19.4
5/1/2002	NB-7	12.5	7.5	31230	19.4
5/2/2002	SB-1	11.2	7.6	35610	22.4
5/2/2002	SB-1	11.2	7.6	35610	22.4
5/2/2002	SB-2	10.7	7.5	38240	24.2
5/2/2002	SB-2	10.7	7.5	38240	24.2
5/2/2002	SB-3	11.0	7.7	34930	21.9
5/2/2002	SB-3	11.0	7.7	34930	21.9

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 7 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
5/2/2002	SB-4	11.0	7.7	36420	23.0
5/2/2002	SB-4	11.0	7.7	36420	23.0
5/2/2002	SB-5	11.6	8.3	26740	16.4
5/2/2002	SB-5	11.6	8.3	26740	16.4
5/2/2002	SB-6	11.0	7.8	34670	21.9
5/2/2002	SB-6	11.0	7.8	34670	21.9
5/14/2002	AK-1	13.9	7.3	28910	17.8
5/14/2002	AK-2	13.8	7.4	28620	17.7
5/14/2002	AK-3	14.2	7.2	28600	17.7
5/14/2002	AK-4	15.2	6.0	24080	14.7
5/14/2002	NB-3	13.7	7.4	24080	14.8
5/14/2002	NB-3	13.7	7.4	24080	14.8
5/14/2002	NB-4	13.7	7.4	24800	14.8
5/14/2002	NB-4	13.7	7.4	24800	14.8
5/14/2002	NB-5	13.5	7.6	29220	18.1
5/14/2002	NB-5	13.5	7.6	29220	18.1
5/14/2002	NB-6	13.5	7.6	29220	18.1
5/14/2002	NB-7	14.0	7.6	26350	16.2
5/14/2002	PJ-4	12.2	7.1	33150	20.8
5/14/2002	PJ-4	12.2	7.1	33150	20.8
5/14/2002	PJ-5	13.4	8.1	33430	20.9
5/14/2002	PJ-5	13.4	8.1	33430	20.9
5/15/2002	PJ-1	14.0	7.8	23690	14.5
5/15/2002	PJ-1	14.0	7.8	23690	14.5
5/15/2002	PJ-2	13.6	8.0	26360	16.2
5/15/2002	PJ-2	13.6	8.0	26360	16.2
5/15/2002	PJ-3	13.7	8.1	26160	16.1
5/15/2002	PJ-3	13.7	8.1	26160	16.1
5/15/2002	SB-1	13.5	7.9	27810	17.0
5/15/2002	SB-1	13.5	7.9	27810	17.0
5/15/2002	SB-2	13.0	7.5	28240	17.3
5/15/2002	SB-2	13.0	7.5	28240	17.3
5/15/2002	SB-3	12.9	7.4	28270	17.4
5/15/2002	SB-3	12.9	7.4	28270	17.4
5/15/2002	SB-4	13.1	8.1	29520	18.3
5/15/2002	SB-5	12.9	7.2	29260	18.2
5/15/2002	SB-5	12.9	7.2	29260	18.2
5/15/2002	SB-6	13.0	7.4	29340	18.2
5/15/2002	SB-6	13.0	7.4	29340	18.2
5/16/2002	LB-1	13.2	7.8	41520	26.7
5/16/2002	LB-1	13.2	7.8	41520	26.7
5/16/2002	LB-2	12.2	8.2	42220	27.2
5/16/2002	LB-2	12.2	8.2	42220	27.2
5/16/2002	LB-3	14.0	8.8	32720	20.4
5/16/2002	LB-3	14.0	8.8	32720	20.4
5/16/2002	LB-4	13.2	8.1	39650	25.2
5/16/2002	LB-4	13.2	8.1	39650	25.2
5/16/2002	LB-5	13.0	8.6	36630	23.4
5/16/2002	LB-5	13.0	8.6	36630	23.4
5/16/2002	LB-6	13.1	8.7	37700	23.9
5/16/2002	LB-6	13.1	8.7	37700	23.9

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 8 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
6/4/2002	AK-1	17.6	6.8	32097	-999.0
6/4/2002	AK-2	18.4	7.0	29760	-999.0
6/4/2002	AK-3	18.2	6.9	30938	-999.0
6/4/2002	AK-4	19.1	6.2	29550	-999.0
6/4/2002	NB-3	19.2	6.2	27910	-999.0
6/4/2002	NB-4	19.2	6.2	27910	-999.0
6/4/2002	NB-5	17.5	6.4	33010	-999.0
6/4/2002	NB-6	17.6	6.9	32450	-999.0
6/4/2002	NB-7	14.5	7.3	28890	-999.0
6/4/2002	PJ-2	17.6	7.6	28010	-999.0
6/4/2002	PJ-3	19.0	8.7	22640	-999.0
6/5/2002	LB-1	15.8	8.7	38270	-999.0
6/5/2002	LB-2	12.4	7.3	45500	-999.0
6/5/2002	LB-3	15.8	6.4	38850	-999.0
6/5/2002	LB-4	13.8	7.0	43260	-999.0
6/5/2002	LB-5	15.9	8.9	39070	-999.0
6/5/2002	LB-6	13.9	6.0	43480	-999.0
6/5/2002	PJ-5	16.4	7.2	35930	-999.0
6/5/2002	SB-5	16.4	7.2	35870	-999.0
6/5/2002	SB-6	15.5	7.7	39590	-999.0
6/6/2002	PJ-1	16.2	7.5	35740	-999.0
6/6/2002	PJ-4	18.6	9.9	29370	-999.0
6/6/2002	SB-1	16.0	7.8	37120	-999.0
6/6/2002	SB-2	15.5	7.4	38220	-999.0
6/6/2002	SB-3	15.4	8.7	40000	-999.0
6/6/2002	SB-4	17.1	8.4	32950	-999.0
6/18/2002	AK-1	19.8	5.1	28280	17.5
6/18/2002	AK-2	19.7	4.9	29630	18.4
6/18/2002	AK-3	19.8	5.1	29690	18.4
6/18/2002	AK-4	20.6	4.9	29120	18.1
6/18/2002	NB-3	21.1	4.7	24500	14.9
6/18/2002	NB-4	21.1	4.7	24500	14.9
6/18/2002	NB-5	20.0	5.0	28930	17.9
6/18/2002	NB-6	19.6	5.1	29970	18.6
6/18/2002	NB-7	20.8	5.2	27600	17.0
6/18/2002	PJ-2	19.5	5.5	26860	16.5
6/18/2002	PJ-3	19.3	5.5	28870	18.0
6/19/2002	LB-1	19.0	5.7	33890	21.3
6/19/2002	LB-2	18.6	6.0	39090	24.9
6/19/2002	LB-3	19.6	6.9	35940	22.8
6/19/2002	LB-4	18.6	6.1	39700	25.4
6/19/2002	LB-5	18.7	5.5	37000	23.5
6/19/2002	LB-6	18.8	4.9	38800	24.7
6/19/2002	PJ-1	20.0	5.5	26470	16.2
6/19/2002	SB-5	19.4	5.4	32080	20.1
6/19/2002	SB-6	19.0	5.4	35650	22.5
6/20/2002	PJ-4	18.9	5.5	35300	22.3
6/20/2002	PJ-5	19.0	5.6	35620	22.6
6/20/2002	SB-1	19.0	5.2	35250	22.3
6/20/2002	SB-2	19.0	5.0	35680	22.5
6/20/2002	SB-3	19.4	5.4	32510	20.4

Appendix C. Water quality data by date and station sampled collected during the 2001-2002 Aquatic Biological Sampling Program. (page 9 of 9)

Date	Station	Temperature (°C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
6/20/2002	SB-4	19.2	5.2	35020	22.1
7/9/2002	AK-1	21.9	5.7	35770	22.6
7/9/2002	AK-2	22.2	5.9	35470	22.4
7/9/2002	AK-3	22.5	5.8	35930	22.3
7/9/2002	AK-4	23.4	5.7	34700	21.8
7/9/2002	NB-3	23.7	6.0	34070	21.7
7/9/2002	NB-4	23.8	6.0	33990	21.4
7/9/2002	NB-5	21.9	5.7	35690	22.5
7/9/2002	NB-6	21.1	5.9	36970	23.5
7/9/2002	NB-7	22.7	6.3	25690	22.5
7/9/2002	PJ-4	18.5	4.6	42100	27.1
7/10/2002	LB-2	18.5	6.9	43900	28.4
7/10/2002	LB-3	18.9	6.2	42720	27.5
7/10/2002	LB-4	18.3	6.8	43950	28.4
7/10/2002	LB-5	19.1	6.3	42220	27.2
7/10/2002	LB-5	18.4	6.6	44950	29.2
7/10/2002	LB-6	19.1	5.5	42020	26.7
7/10/2002	PJ-1	20.8	5.6	37730	24.0
7/10/2002	PJ-5	19.4	5.6	39880	25.5
7/10/2002	SB-3	20.9	5.8	38460	24.5
7/10/2002	SB-5	19.3	6.3	40690	26.1
7/10/2002	SB-6	20.8	6.4	37910	24.1
7/11/2002	PJ-2	19.9	5.5	38040	24.3
7/11/2002	PJ-3	20.2	5.5	37840	24.1
7/11/2002	SB-1	19.7	5.1	40270	25.8
7/11/2002	SB-2	19.6	5.0	40810	26.2
7/11/2002	SB-4	19.5	5.4	40610	26.0

Environmental Assessment
Appendix C2:
2002 - 2003 Biological Sampling

U.S. Army Corps of Engineers
New York District

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NEW YORK AND NEW JERSEY HARBOR NAVIGATION PROJECT

AQUATIC BIOLOGICAL SURVEY REPORT 2002–2003

Draft Report

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1.0 INTRODUCTION

1.1 BACKGROUND

This report summarizes and presents results of a biological sampling program conducted in the New York and New Jersey Harbor (Harbor) from December 2002 though July 2003 (2002–2003 Aquatic Biological Sampling Program). The program's focus was the collection of adult and early life stages of finfish, with an emphasis on winter flounder *(Pseudopleuronectes americanus).*

The 2002–2003 Biological Sampling Program supplements data gathered in the baseline 1998–1999 New York and New Jersey Harbor Navigation (NYNJHN) Study, 2000–2001 Supplemental Sampling Program and the 2001-2002 Aquatic Biological Sampling Program. Collectively, the four studies comprise the NYNJHN Project. A primary goal of the NYNJHN investigation is to collect biological data on Harbor finfish, shellfish, and macroinvertebrate distribution patterns, community structure, and seasonal patterns of habitat use, as well as data about water quality. The information collected is used in determining the potential biological impacts of deepening existing Harbor navigation channels, anchorages, and berthing areas to depths of 50 ft or greater.

The 1998–1999 NYNJHN Study found that the Harbor finfish community consists of a variety of resident and migratory fish species typical of large coastal estuaries and inshore waterways along the Mid-Atlantic Bight. The Harbor estuary serves as a spawning ground, migratory pathway, and nursery/foraging area for many fish and macroinvertebrate species. To obtain more information the use of Harbor habitats by early life stages of fish, particularly winter flounder, the NYNJHN Supplemental Sampling Program was conducted during 2000–2001.

Although both the 1998–1999 NYNJHN baseline program and the 2000–2001 Supplemental Sampling Program provided extensive information about adult and early life stages of winter flounder in the Harbor, it was determined that additional data were needed to further understand the species' spatial and temporal occurrence patterns within the Harbor, its use of Harbor navigation channels and shallow/shoal areas, and the role played by Lower New York Bay (Lower Bay) with respect to winter flounder overwintering and spawning. Furthermore, it was determined that data for multiple years are needed to understand whether the use of navigation channels and shallow/shoal areas by winter flounder is consistent over time. The 2001-2002 Aquatic Biological Sampling Program was conducted to meet the need for additional data about how finfish use the Harbor.

The 2001-2002 Aquatic Biological Sampling Program provided additional support to the findings of the Supplemental Sampling Program (2000-2001) that winter flounder disperse into the New York and New Jersey Harbor Estuary after hatching. These results suggested that winter flounder eggs are laid primarily in the Lower Bay and to a lesser degree in other areas of the Harbor. After hatching and developing into larvae, winter flounder move from the Lower Bay into the Upper Harbor. These movement patterns may be important to winter flounder population dynamics because larvae that move directly to the ocean without using the nursery habitat could be lost to the population (Chant et al. 2000).

Although there is some indication from the 2000-2001 and 2001-2002 sampling programs that winter flounder in the New York and New Jersey Harbor Estuary exhibit these movement patterns, more data are required to determine if this pattern is repeated multiple years. As a result, additional sampling was conducted in 2002-2003 to expand the temporal coverage of the Biological Monitoring Program Database, especially with respect to the Lower Bay. To allow for direct comparisons across years, the sample objectives in the 2002-2003 Aquatic Biological Sampling Program remained the same as the 2001-2002 Aquatic Biological Sampling Program.

1.2 STUDY OBJECTIVES

During the 2002–2003 Aquatic Biological Sampling Program data were collected on adult and early life stages of finfish in the Harbor with an emphasis on winter flounder between the months of December and July. This is typically the period when winter flounder spawning and early lifestages occur in the Harbor.

The specific objectives were to:

- Determine the utilization and significance of Harbor habitat designated as essential fish habitat (EFH) for adults for the months of December through June.

- Determine the utilization and significance of Harbor habitat designated as essential fish habitat (EFH) for early life stages (eggs and larvae) from January through July.

- Determine spawning areas and periodicity by analyzing the sex ratio of adults in the Harbor.

To meet program objectives, two sampling methodologies were employed. Bottom trawling was conducted to address the objectives related to adult finfish, and an epibenthic sled-mounted plankton net was used to target early life stages.

1.3 REPORT ORGANIZATION

This report describes the 2002–2003 Aquatic Biological Sampling Program and presents results. This report is organized as follows: Chapter 2 describes sampling stations and summarizes the methods used to sample adult finfish and ichthyoplankton in the Harbor. Chapter 3 presents the results of bottom-trawl and epibenthic-sled sampling. Chapter 4 discusses how the data collected relate to program objectives as well as to previous NYNJHN investigations

2.0 METHODS

2.1 SAMPLING LOCATIONS

The same twenty-six (26) sampling locations that were selected for the 2001–2002 Aquatic Biological Sampling Program were sampled throughout the 2002-2003 Aquatic Biological Sampling Program to optimize the evaluation of different Harbor areas and habitat (Table 2-1 and Figure 2-1). Of these, 14 were located in shallow/shoal or interpier areas, and 12 were located in navigation channels.

For the Biological Sampling Program, the Harbor was divided into three study areas based on geography: Arthur Kill/Newark Bay (AKNB), Upper Bay (UB), and Lower Bay (LB). Among the study areas, stations were established as follows:

- Arthur Kill and Newark Bay (AK and NB)
  Nine stations were located in this area. Of these, two were in Arthur Kill shallow/shoal areas (AK-1 and AK-4) and two were in channels at the Arthur Kill/Kill Van Kull confluence area (AK-2 and AK-3). Two other stations were located in the navigation channel in Newark Bay (NB-5, and NB-6), while the shallow/shoal areas were represented by the three remaining Arthur Kill/Newark Bay stations: NB-3, NB-4, and NB-7.

- Upper New York Bay
  In the Upper Bay, which includes South Brooklyn (SB) and Port Jersey (PJ), 11 stations were sampled. Two were in the South Brooklyn interpier areas (shallow/shoal area stations SB-1 and SB-2) and one was on the Bay Ridge Flats (SB-3). Three stations were located in navigation channels—one (1) in Bay Ridge Channel (SB-4) and two (2) in the Anchorage Channel (SB-5 and SB-6). Three (3) shallow/shoal area stations were located in Port Jersey (PJ-l, PJ-2, PJ-3) and two (2) were located in Port Jersey Channel (PJ-4 and PJ-5).

- Lower New York Bay

  Six (6) stations were located in this area—three (3) in channels (LB-2, LB-4 and LB-6) and three (3) in shallow/shoal areas (LB-1, LB-3, and LB-5). The Lower Bay sites were added in the 2001–2002 Biological Sampling Program to provide better spatial coverage for the evaluation of winter flounder EFH in the Harbor.

2.2 ADULT FINFISH SAMPLING (BOTTOM TRAWLS)

Adult finfish were sampled via bottom trawl surveys conducted from 15 December 2002 to 15 June 2003. Trawls were conducted on a stratified sampling schedule to target the period when adult winter flounder historically are present in the Harbor to spawn. Sampling was conducted twice monthly on an alternating-week schedule from January through March and once monthly during December and April through June.

Bottom trawl surveys were conducted using a 30-foot (9.1 m) otter trawl (Table 2-2), the same trawl used during previous years of the NYNJHNP. A minimum ratio of tow cable length to maximum station water depth of 5:1 was maintained to ensure that the trawl was in contact with the bottom.

Bottom trawls were conducted during the night hours (from one hour after sunset to one hour before sunrise) against the prevailing current at a bottom speed of approximately 4.9 feet/sec (150 cm/sec). Target tow duration was ten minutes, although tow times were adjusted as needed to account for obstructions, limited interpier distances, commercial traffic, and several other factors.

A total of 258 bottom trawls where conducted (Table 2-3) —118 at navigation channel stations and 140 at shallow/shoal stations.

All fish were identified and enumerated directly on the research vessel. Total lengths of each winter flounder caught were recorded to the nearest millimeter (mm). When available, a total of 10 winter flounder per trawl that measured greater than 250 mm were preserved on ice and returned to the laboratory for sex determination. A 250-mm total length was established to limit the number of immature fish kept for analysis. Winter flounder typically exhibit adult gonad development at 250 mm total length and reach sexual maturity between 280 mm and 300 mm (Witherell 1993).

For each non-target species, total length was measured for a minimum of 25 individuals in each trawl sample. An unbiased selection of 25 specimens was made for non-target species when the number of fish collected exceeded 25. Except for winter flounder preserved for laboratory analysis, all fish collected were released after on-board examination.

2.3 ICHTHYOPLANKTON SAMPLING (EPIBENTHIC SLED TOWS)

Ichthyoplankton sampling was conducted from 19 January to 6 July 2003. A stratified sampling schedule was used to target winter flounder spawning and early development in the Harbor. The 26 sampling stations were sampled twice monthly from February through June and once monthly during January and July.

Samples were collected with an epibenthic sled-mounted 0.5-m mouth diameter plankton net with 0.5-mm mesh (Table 2-4). Typically, a 4:1 ratio of cable length to bottom depth was used. An inclinometer was used to determine the warp angle from the boat to confirm that the sled was on the bottom. The net was fitted with a General Oceanics flowmeter (Model 2030R) to calculate sample volume.

All samples were collected during daylight hours (from one hour after sunrise to one hour before sunset). Whenever possible, each tow was conducted against the prevailing current or tide for ten minutes. Tow direction and duration were adjusted as needed to account for obstructions, limited transect distances, and commercial traffic.

A total of 312 epibenthic sled tows were conducted—144 at navigation channel stations and 168 at shallow/shoal stations (Table 2-3). Each sample was washed from the plankton net into containers and preserved with 5% buffered formalin containing the vital stain rose bengal. Samples were retuned to the laboratory for sorting and identification.

All specimens were identified to the lowest taxonomic level practicable, assigned a life stage based on morphometric characteristics (egg, yolk-sack larvae, post yolk-sac larvae, or juvenile), and enumerated. Data about unidentified species were recorded when eggs or larvae could not be identified to species. For some larvae, it was not possible to discern between yolk-sac and post yolk-sac life stages because specimens were damaged. Indiscernible larval life stages were combined with the yolk-sac larvae life stage during analysis. Unidentified specimens were a small percentage of the total larval catch (2%).

Strict quality control (QC) procedures consisting of a continuous sampling plan (CSP) to assure an average outgoing quality limit (AOQL) of ≥90% were followed during sample sorting, enumeration, life-stage designation, and identification.

2.4 WATER QUALITY MEASUREMENTS

On each sampling date at each station, dissolved oxygen (DO), temperature, and conductivity and salinity were measured after each trawl and epibenthic sled tow (Table 2-5). Water quality parameters were recorded one foot (0.3 m) above the substrate using calibrated meters.

2.5 DATA ANALYSIS

2.5.1 Trawl

Catch per unit effort (CPUE), defined as number per 10 minute trawl tow, was determined for each trawl tow based on the time each net sampled on the bottom. When tow times were less than 10 minutes, catch data were multiplied by the appropriate factor to standardize for a ten minute tow.

2.5.2 Ichthyoplankton

Ichthyoplankton densities (Number per 1000 cubic meters [m^3]) were determined for each epibenthic sled tow. The volume of water sampled was determined using the area of the net mouth and the velocity meter revolutions.

3.0 RESULTS

Adult finfish and ichthyoplankton data were analyzed for the two general habitat types (navigation channels and shallow/shoal areas), and the three Harbor areas (Upper New York Bay, Arthur Kill / Newark Bay, and Lower New York Bay). Following is a summary of results for all species combined and for winter flounder. Detailed station data for adult finfish, ichthyoplankton, and water quality are provided in Appendices A through C, respectively.

Note that the following data-unit definitions apply in the figures accompanying the main report text and in Appendices A and B:

- Trawl: Catch per unit effort (CPUE), defined as number caught per 10 minute trawl tow.

- Epibenthic sled tow: Ichthyoplankton density (number per 1000 cubic meters).

3.1 ALL SPECIES

3.1.1 Adults (Trawl Sampling)

A total of 51 fish species were identified during the bottom trawl survey. Tables 3-1a and 3-1b report average trawl CPUEs by species for all navigation channel stations combined and for all shallow/shoal stations combined for each month of the 2002–2003 Aquatic Biological Sampling Program. The greatest fish abundance occurred in the Arthur Kill/Newark Bay and the most common species (e.g., spotted hake and bay anchovy) were collected throughout the Harbor, regardless of sample area or station depth (Tables 3-2a to 3-2c). As shown in Figure 3-1, which plots weekly abundance by station type (navigation channel vs. shallow/shoal) in the three Harbor areas examined, fish abundance ranged from less than 10 to greater than 250. Two peaks in abundance, one early in the program from December to January and another during May were observed at shallow/shoal stations in the Arthur Kill/Newark Bay and at navigation channel stations in the Lower Bay stations, where the CPUEs exceeded 150. The highest CPUE (268 fish) was observed at the Arthur Kill/Newark Bay shallow/shoal stations during December.

Figures 3-2 through 3-4 present monthly species composition collected via trawl sampling in the three Harbor areas. Monthly species composition was inconsistent across the harbor. From December through March, white perch and striped bass dominated the Arthur Kill/Newark Bay species composition, combining for 75% of the catch, and spotted hake and bay anchovy were most common from April to June. White perch were not as abundant in the Upper or Lower Bays. In the Upper Bay, striped bass (December-January), winter flounder (February), windowpane flounder (February-March), spotted hake (April) and bay anchovy (May-June) dominated monthly species composition, representing 28% to 50% of the catch. Spotted hake (December-January, April), little skate (February), bay anchovy (March) and Atlantic herring (May-June) dominated the monthly catch in the Lower Bay, representing 45% to 63% of the catch.

As can be seen in Figures 3-2 to 3-4, composition of flounder species was inconsistent across sampling areas and months. In the Arthur Kill/Newark Bay and Lower Bay, flounder species did not dominate any catches. Winter flounder and windowpane flounder dominated the catch in the Upper Bay during February, and combined, they comprised 56% of the catch.

In general, fish were collected in greater abundance at the navigation channel stations in the Lower Bay and at shallow/shoal stations in the Arthur Kill/Newark Bay and Upper Bay. Spotted hake and white perch had higher CPUEs at navigation channel stations, while bay anchovy and striped bass were more common at shallow/shoal stations (Tables 3-2a through 3-2c).

3.1.2 Ichthyoplankton (Epibenthic Sled Sampling)

Among the eggs, larvae, and juveniles collected throughout the 2002–2003 Aquatic Biological Sampling Program, 31 species were identified.

The greatest Ichthyoplankton densities were recorded during June and July in all three study areas regardless of station depth, except shallow/shoal stations in the Lower Bay when the greatest densities were collected during June and April (Tables 3-3a through 3-3f). Throughout the Harbor, fish eggs were the most abundant ichthyoplankton life stage collected during the sampling program, followed by post yolk-sac larvae; except at shallow/shoal stations in the Arthur Kill/Newark Bay where post yolk-sac larvae was the most abundant lifestage. The highest egg densities were collected in the Lower Bay at shallow/shoal stations, and the highest post yolk-sac larvae densities were collected in the Lower Bay at navigation channel stations.

3.1.2.1 Eggs

Eggs were collected in the Harbor from February to July, with the greatest densities collected in the Lower Bay during early and late June (Figure 3-5). In each of the areas sampled, the highest egg densities were collected in late-June, including the peak density of 24,171/1000 m^3 at shallow/shoal stations in the Lower Bay. Peak densities were greater at navigation channel stations in the Arthur Kill/Newark Bay and Upper Bay and at shallow/shoal stations in the Lower Bay.

No eggs were collected during January and February in the Arthur Kill/Newark Bay and during January in the Upper Bay and Lower Bay (Figures 3-6 through 3-8). Winter flounder dominated overall ichthyoplankton densities in the Arthur Kill/Newark Bay during March and April, and in the Upper Bay and Lower Bay during February and March. Windowpane flounder dominated catches during June in the Arthur Kill/Newark Bay, from April through June in the Upper Bay, and during April and May in the Lower Bay. Bay anchovy dominated ichthyoplankton densities during July in the Arthur Kill/Newark Bay and Upper Bay, while Prionotus sp. (i.e. searobin) dominated in the Lower Bay.

3.1.2.2 Yolk-sac Larvae

Yolk-sac larvae were collected from February to June and ranged in density from 1/1000 m^3 to 453/1000 m^3 (Figure 3-9). The highest average yolk-sac larvae density (453/1000 m^3) was observed at shallow/shoal stations in the Lower Bay during early April. Peaks in yolk-sac larvae abundance in the Arthur Kill/Newark Bay and Upper Bay areas also occurred during the early-April sampling period at shallow/shoal stations.

Yolk-sac larvae were not collected during January or February, except for one American sandlance collected in the Lower Bay during February (Figures 3-10 through 3-12). During March and April, winter flounder and grubby were the only species collected in the Arthur Kill/Newark Bay, while four species (rock gunnel, grubby, winter flounder and longhorn sculpin) contributed to the catch in the Lower Bay. Species diversity increased in the Arthur Kill/Newark Bay during May and June, while it decreased in the Lower Bay where only two species (Atlantic menhaden and windowpane flounder) were present in catches. Species diversity was low (≤ 2 species) during each sampling month in the Upper Bay; winter flounder dominated catches from March through May and Atlantic menhaden dominated the catch in June. Fourspot flounder was the only species caught during July and was collected from the Upper Bay.

3.1.2.3 Post Yolk-sac Larvae

Post yolk-sac larvae were the most diverse early lifestage collected. Post yolk-sac larvae densities were relatively low (<50/1000 m^3) from December through March (Figure 3-13). During April, densities increased throughout the Harbor, especially in the Lower Bay where the highest density (3,795/1000 m^3) was recorded at shallow/shoal stations. The greatest densities collected from the Arthur Kill/Newark Bay (1,581/1000 m^3) and the Upper Bay (815/1000 m^3) were recorded during July.

Species composition varied by Harbor area during January where Atlantic croaker (Arthur Kill/Newark Bay), summer flounder (Upper Bay) and rock gunnel (Lower Bay) dominated the catches (Figures 3-14 through 3-16). During February, rock gunnel dominated catches throughout the Harbor. Rock gunnel dominated ichthyoplankton densities again in the Lower Bay during March, while Atlantic herring dominated in the Arthur Kill/Newark Bay and Upper Bay. Winter flounder dominated catches throughout the Harbor (>88% of the catch) during April and May. Species composition shifted during June when Atlantic menhaden dominated the catch in the Arthur Kill/Newark Bay (40%) and was common (36%) in the Upper Bay. Windowpane flounder was common in the Upper Bay (36%) and dominated catches in the Lower Bay (54%) during June. Species composition was similar throughout the Harbor in July when bay anchovy (≥ 64%) was the most common species recorded.

3.1.2.4 Juveniles

Juveniles represented the lowest densities of all ichthyoplankton life stages collected. Juvenile densities ranged from 1/1000 m^3 to 14/1000 m^3 and were more common at navigation channel stations (Figure 3-17). The peak juvenile density (14/1000 m^3) was recorded during July in the Arthur Kill/Newark Bay at navigation channel stations.

Species composition of juveniles by Harbor area is shown in Figures 3-18 through 3-20. Bay anchovy and Atlantic croaker were the only species recorded during January in the Arthur Kill/Newark Bay and Upper Bay; no juveniles were collected during January in the Lower Bay (Figures 3-18 through 3-20). No juveniles were collected during February and March at any of the study areas. Atlantic tomcod was the only species caught during April (Upper Bay) and May (Arthur Kill/Newark Bay). During June, windowpane flounder and winter flounder were the only species collected throughout the harbor. Juveniles collected during July in the Arthur Kill/Newark Bay were represented by three species: northern pipefish (56%), winter flounder (33%) and windowpane flounder (11%).

3.2 WINTER FLOUNDER

3.2.1 Adults (Trawl Sampling)

3.2.1.1 Densities

Winter flounder were collected in trawls from December to June throughout the Harbor (Table 3-2a to 3-2c). Winter flounder were caught monthly across the Arthur Kill/Newark Bay and Upper Bay stations, whereas catches in the Lower Bay were more sporadic. The highest winter flounder CPUE (20) was recorded in mid-June at navigation channel stations in the Upper Bay. Overall winter flounder CPUEs were higher at navigation channel stations in the Arthur Kill/Newark Bay and Lower Bay, while CPUEs were similar at both navigation channel and shallow/shoal stations in the Upper Bay. When CPUE data were analyzed on a temporal scale by sampling week, no tends in habitat preference were observed (Figure 3-21).

3.2.1.2 Size Distribution

All winter flounder caught in the trawl were measured. Of the 508 winter flounder measured; total lengths ranged from 20 mm to 390 mm (Figure 3-22). A length frequency plot of winter flounder lengths from all Harbor areas combined exhibited a bimodal distribution pattern, with an initial length frequency cluster ranging from 30 to 50 mm – representative of young-of-year fish – and a second larger cluster with lengths ranging from 90 mm to 150 mm. The greatest frequencies of winter flounder were collected between 110 mm and 130 mm.

Temporal occurrence of winter flounder length frequencies in the three Harbor areas is shown in Figures 3-23 through 3-25. Winter flounder collected in the Arthur Kill/Newark Bay area generally were less than 250 mm. Winter flounder were typically less than 250 mm in the Upper Bay from December through February, whereas larger individuals (greater than 250 mm) were more abundant during April and May. Most winter flounder in June samples in the Arthur Kill/Newark Bay and Upper Bay areas ranged from 20 mm to 50 mm, and are likely young-of-year individuals. In the Lower Bay, winter flounder were generally greater than 250 mm across all sampling months. Since relatively few individuals were collected from the Lower Bay, trends in size distribution are unclear. There were no peaks in density of small winter flounder (between 20 mm and 50 mm) in June in the Lower Bay.

3.2.1.3 Sex Ratio

Of the 108 winter flounder analyzed for sex determination ranging in preserved length from 235 mm to 385 mm 85 were female and 23 were male. Mature winter flounder were collected in greater numbers in the Upper Bay and Lower Bay than at Arthur Kill/Newark Bay stations (Figure 3-26). More females than males were collected in each area; the sex ratio was 1.6:1 females to males in the Arthur Kill/Newark Bay, 8.6:1 females to males in the Upper Bay and 2.6:1 females to males in the Lower Bay.

3.2.2 Ichthyoplankton (Epibenthic Sled Sampling)

The winter flounder egg, yolk-sac and post yolk-sac larvae life stages were collected throughout the Harbor: the greatest abundance of each life stage was collected from the Lower Bay, followed by the Upper Bay and then the Arthur Kill/Newark Bay (Figure 3-27). Post yolk-sac larvae were the dominant life stage collected (80.9%), followed by yolk-sac larvae, eggs and then juveniles. Winter flounder eggs were collected in greater densities in the Lower Bay than any other area, constituting 74% of the winter flounder eggs. The Upper Bay had the second highest percentage of winter flounder eggs (25%). In the Arthur Kill/Newark Bay area, representing the lowest percentage (1%) of the total winter flounder eggs collected, eggs were collected on only three sampling weeks.

Winter flounder eggs were collected in the Harbor from mid-February through late April (Figure 3-28). Peak egg densities (331/1000 m^3) were collected in mid-February at the Lower Bay navigation channel stations; high egg densities (325/1000 m^3) were also collected at shallow/shoal stations in the Lower Bay. In the Upper Bay, winter flounder egg densities were greater at the navigation channel stations.

Winter flounder yolk-sac larvae densities were greatest in the Lower Bay, where a peak density (450/1000 m³) was observed at the shallow/shoal stations during early April (Figure 3-29). Yolk-sac larvae were collected in the lowest densities in the Arthur Kill/Newark Bay area. They were collected over the longest time frame (early March to late April in the Upper Bay. In general, peak yolk-sac larvae densities occurred throughout the Harbor at shallow/shoal stations during early-April.

Post yolk-sac larvae were the most abundant winter flounder life stage; it was collected in the Harbor from mid-March to early June (Figure 3-30). Densities were highest at Lower Bay shallow/shoal stations, where density gradually increased during the sample program to a late-April peak (3782/1000 m³). Post yolk-sac larvae densities were similar to each other (≤ 430/1000 m³) in the Arthur Kill/Newark Bay and Upper Bay areas.

Winter flounder juveniles were collected June at navigation channel stations in the Upper Bay and during July at shallow/shoal stations in the Arthur Kill/Newark Bay. Station depth preference (i.e., navigation channel vs. shallow/shoal station) could not be determined among Harbor areas because too few winter flounder juveniles were collected throughout the sampling program.

3.3.3 Annual Comparison

In this section, comparisons are made between the winter flounder CPUE and density data presented above and data from the 2001-2002 Biological Monitoring Program (USACE 2002) to identify trends across years. Because the 2001-2002 program was conducted over a similar temporal scale and at the same stations using the same gear as the 2002-2003 program, direct comparison were made by month.

Winter flounder CPUE was lower during 2002-2003 than in 2001-2002 (Figure 3-31). This was especially true in the Arthur Kill/Newark Bay and Lower Bay areas. The highest abundance of winter flounder in the Arthur Kill/Newark Bay occurred during June 2001-2002. This catch was dominated by small (<90 mm), likely young-of-year fish (Figure 3-32). Similarly, the winter flounder catch in the Upper Bay during June

2001-2002 was dominated by young-of year fish (Figure 3-33). Although June winter flounder CPUE was lower in 2002-2003, the same trend of young-of year fish using the Arthur Kill/Newark Bay and the Upper Bay areas during June was observed. In both program years, the winter flounder that are expected to be sexually mature (>250 mm) were collected throughout the Harbor from February -May (Figure 3-32 to 3-34). The majority of these sexually mature fish were collected in the Upper Bay and Lower Bay.

Egg densities were greater throughout the Harbor in 2002-2003 than in 2001-2002 especially in the Lower and Upper bays (Figure 3-35). In both program years, few eggs were collected in the Arthur Kill/Newark Bay, while the greatest egg densities were observed in the Lower Bay during February and March and to a lesser degree in the Upper Bay.

Larval densities (YS and PYS combined) were generally greater in 2002-2003 than in 2001-2002 in all three areas (Figure 3-36). The temporal occurrence of winter flounder shifted between years. In 2001-2002 larvae were first collected in February, whereas larvae were not collected until March in 2002-2003 and did not peak until April. The greatest larval densities collected during both program years were in the Lower Bay.

3.3 WATER QUALITY

Average bottom water temperatures ranged from a low of 1.6°C in the Arthur Kill/Newark Bay during January to a high of 23.3°C during July also in the Arthur Kill/Newark Bay (Figure 3-37). Water temperatures were lowest at the Arthur Kill/Newark Bay and highest at the Lower Bay stations from January through February. During March, water temperatures shifted when warmer temperatures were measured at the Arthur Kill/Newark Bay and cooler temperatures were measured at the Lower Bay stations throughout the remaining sampling periods.

Salinity recorded from near bottom depth during ichthyoplankton surveys ranged between 13.4 ppt and 29.3 ppt over the course of the program (Figure 3-37). Salinities were consistently lowest in the Arthur Kill/Newark Bay and highest in the Lower Bay.

Dissolved oxygen concentration in water is largely dependent on the water temperature, and to a lesser degree, the salinity. As temperature increases, the amount of oxygen capable of being held in solution decreases. Similarly, as salinity increases, the amount of oxygen that can be held in solution decreases. Trends in dissolved oxygen levels were similar across the three Harbor areas, remaining between 10 mg/L and 12.3 mg/L from January through March and decreasing throughout the program to between 5.5 mg/L and 6.7 mg/L during July. From May through July, dissolved oxygen levels were inversely proportional to temperatures throughout the Harbor, that is, when temperatures were highest in the Arthur Kill/Newark Bay and lowest in the Lower Bay, then dissolved oxygen levels were lowest in the Arthur Kill/Newark Bay and highest in the Lower Bay. All water quality sampling data are presented in Appendix C.

4.0 DISCUSSION

The water quality and habitat characteristics of the areas sampled may affect the spatial and temporal occurrence of finfish in the Harbor, particularly winter flounder. The Lower Bay is more characteristic of the marine/oceanic environment (i.e., exhibit the least variability, more stable environment) than the Arthur Kill/Newark Bay and the Upper Bay (USACE 2002) while the Arthur Kill/Newark Bay and Upper Bay areas are more characteristic of a nearshore, estuarine environment. Based on the water quality data it appears that the Upper Bay may be more ocean-like than the Arthur Kill/Newark Bay by virtue of the relatively broad connection between Lower Bay and Upper Bay through The Narrows. As identified in previous reports (USACE 2002, USACE 2003) the predominance of fine bottom sediments in the Arthur Kill/Newark Bay area suggests that there is limited tidal exchange and the area is depositional area with a greater potential for biological, chemical, and sediment oxygen demand.

4.1 ALL SPECIES

The finfish composition is typical of Atlantic seaboard estuaries within the Middle Atlantic Bight. White perch, spotted hake and bay anchovy dominated the species composition in the Harbor during the bottom trawl survey. White perch are semi-anadramous and can tolerate a range of salinities, typically preferring higher salinities in during the winter (Able and Fahay 1998). Spotted hake and bay anchovy were more common in the Lower and Upper bays. These species are common in shallow estuaries; using the habitat as a nursery and for foraging (Able and Fahay 1998).

Many species spawn in the harbor seasonally, while others spawn offshore on the continental shelf or in the Harbor tributaries. This seasonality and preference for different spawning habitat influenced the occurrence and relative density of species collected during the sampling program. Species that spawn in the Harbor such as Atlantic menhaden, bay anchovy, windowpane, and winter flounder were present in high densities during their seasonal spawning period (March through July). Other species - American shad, bay anchovy, striped bass and white perch were less abundant because they do not typically spawn in the harbor proper.

4.2 WINTER FLOUNDER

Spatial and temporal trends observed in winter flounder abundance in 2002-2003 support that different areas of the Harbor are important to winter flounder at different stages of their life history. Of the three Harbor areas sampled, adult winter flounder were most common in the Upper and Lower Bays during January to March, the peak spawning period in the study area (Able and Fahay 1998).

Sexually mature winter flounder were collected in larger numbers in the Upper Bay and the Lower Bay than in the Arthur Kill/Newark Bay. Sex ratios varied slightly among the main sampling areas. The sex ratio favored females at all sites but the difference was most pronounced in the Upper Bay and Lower Bay. Stoner et al. (1999) identified in the

Navesink River estuary that females outnumbered males in the middle and upper reaches of the estuary, with males more abundant in the lower estuary.

Winter flounder adults were collected in both the shallow/shoals and navigation channel habitats; consistent with previous Harbor studies (NMFS 1994; USACE 1999). In the 2001–2002 program, however, winter flounder adults were more common in the navigation channels (USACE 2002). Winter flounder can spawn over depths ranging from 2 to 80 m (NMFS 1999), thus the potential for spawning in both habitat types throughout the Harbor exists. The differences in the depth at which eggs were found across years may result from multiple factors (e.g. temperature, flow, sediment) acting either alone or in combination.

The predominance of winter flounder eggs from February to March in the Lower Bay and to a lesser degree in the Upper Bay in both the 2001-2002 and 2002-2003 programs provides further support for the view that the Lower Bay provides important winter flounder spawning habitat. Alternatively, few winter flounder eggs were collected in the Arthur Kill/Newark Bay. Because winter flounder produce demersal eggs that adhere to the substrate it is assumed that the location in which the eggs are collected is primary spawning habitat.

Winter flounder juveniles seek nursery habitat in estuaries of the Middle Atlantic Bight to feed and grow (Able and Fahay 1998). Juvenile winter flounder were most common in the upper sections of the Harbor (Arthur Kill/Newark Bay and parts of the Upper Bay), where little spawning occurred. The previous sampling programs in the Harbor identified that young winter flounder move from the primary spawning area in the Lower Bay and the lower reached of the Upper Bay to areas further into the Harbor estuary (USACE 2001, USACE 2002). The 2002–2003 Aquatic Biological Survey provides additional support to these findings, which indicate that winter flounder move or disperse further into the New York and New Jersey Harbor Estuary after hatching. This pattern suggests that winter flounder eggs are laid primarily in the Lower Bay and to a lesser degree in other areas of the Harbor. After hatching and developing into larvae, winter flounder move from the spawning areas further into the Harbor seeking nursery habitat.

5.0 LITERATURE CITED

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Table 2-1 Description of stations sampled during the 2002–2003 Aquatic Biological Sampling Program.

Area	Station Name	Type	Station Location	Average Depth (ft)	GPS Coordinates (deg., min., sec.)			
					Start		End	
					North	West	North	West
South Brooklyn/ Upper Bay	SB–1*	Shallow/shoal	Gowanus Bay Interpier South	27	40:39.45	74:00.86	40:39.56	74:01.05
	SB–2 **	Shallow/shoal	Gowanus Bay Interpier	30	40:39.60	74:00.48	40:39.75	74:00.75
	SB–3*	Shallow/shoal	Bay Ridge Flats	22	40:39.36	74:02.26	40:38.91	74:02.36
	SB–4 **	Navigation Channel	Bay Ridge Channel	42	40:39.28	74:01.52	40:38.98	74:01.79
	SB–5*	Navigation Channel	Anchorage Channel Middle	57	40:39.53	74:03.30	40:39.69	74:03.19
	SB–6 **	Navigation Channel	Anchorage Channel South	49	40:38.76	74:03.11	40:38.48	74:02.98
Port Jersey	PJ–1 **	Shallow/shoal	Jersey Flats	12	40:39.91	74:03.57	40:40.17	74:03.45
	PJ–2*	Shallow/shoal	Caven Point	10	40:40.62	74:03.44	40:41.02	74:03.35
	PJ–3 **	Shallow/shoal	Constable Hook	13	40:39.75	74:04.75	40:39.53	74:04.19
	PJ–4 **	Navigation Channel	Port Jersey Channel	39	40:39.91	74:04.11	40:40.07	74:04.51
	PJ–5*	Navigation Channel	Port Jersey Channel East	42	40:39.48	74:03.64	40:39.78	74:03.96
Newark Bay	NB–3*	Shallow/shoal	Newark Bay Flats Middle	10	40:41.06	74:07.61	40:41.40	74:07.44
	NB–4*	Shallow/shoal	Newark Bay Flats South	16	40:40.72	74:07.76	40:40.38	74:07.92
	NB–5 **	Navigation Channel	Newark Bay Middle Reach	42	40:40.59	74:07.96	40:40.19	74:08.26
	NB–6 **	Navigation Channel	Newark Bay South Reach	46	40:39.44	74:08.52	40:39.15	74:08.75
	NB–7*	Shallow/shoal	Elizabeth Flats North	13	40:39.62	74:09.29	40:39.51	74:08.99
Lower Bay	LB–1	Shallow/shoal	East Bank	13	40:33.45	74:00.24	40:33.94	74:00.52
	LB–2	Navigation Channel	North End Ambrose Channel	50	40:33.23	74:01.54	40:33.40	74:01.55
	LB–3	Shallow/shoal	Swash Channel Range	17	40:33.34	74:04.46	40 33.00	74 04.44
	LB–4	Navigation Channel	Chapel Hill South Channel	30	40:31.06	74:02.41	40:30.64	74:02.39
	LB–5	Shallow/shoal	Old Orchard Shoals	13	40:30.59	74:04.72	40:30.75	74:05.22
	LB–6	Navigation Channel	Raritan Bay East Reach	41	40 29.41	74 06.39	40 29.53	74 06.90
Arthur Kill	AK-1	Shallow/shoal	Elizabeth Flats South	19	40:38.84	74:10.58	40:38.85	74:10.13
	AK-2	Navigation Channel	North of Shooter Island Reach	39	40:38.80	74:10.75	40:38.77	74:10.26
	AK-3	Navigation Channel	Elizabeth Reach	42	40:38.32	74:11.59	40:38.53	74:11.30
	AK-4	Shallow/shoal	Prall's Island	20	40:36.83	74:11.91	40:36.24	74:11.82

* Also sampled during the 2000 - 2001 Supplemental Sampling Program
** Also sampled during the NYNJHN 1998 – 1999 Baseline Program and 2000-2001 Supplemental Sampling Program

Table 2-2 Specifications of bottom trawl used to collect adult finfish during the 2001-2002 Aquatic Biological Sampling Program.

Part	Specification
Headrope	25.9 ft. (7.9 m)
Footrope	27.9 ft (8.5 m)
Wing height	3.6 ft. (1.1 m)
Total length	35.1 ft (10.7 m)
Wing mesh (square)	2.0-in. (5.1 cm)
Body mesh (square)	2.0-in. (5.1 cm)
Cod end mesh (square)	0.75-in. (1.9 cm)
Cod end liner mesh (square)	0.25-in. (0.6 cm)
Trawl doors	32.0 x 17.0 x 0.75-in (79.2 x 39.6 x 3.1 cm)
Tow line length	5 times maximum station water depth

Table 2-3 Specifications of epibenthic sled and plankton net used to collect early life stages of finfish during the 2001-2002 Aquatic Biological Sampling Program.

Part	Specification
Mouth diameter	0.5 m
Overall length	3.0 m
Mesh size	0.5 mm
Cod-end diameter	10.1 cm
Cod-end mesh	0.5 mm (PVC cod-end bucket)
Epibenthic sled	Constructed of PVC pipe

Table 2-4 Water quality and velocity measurements made during the 2001-2002 Aquatic Biological Sampling Program.

Water Quality Parameter	Units and Accuracy	Sample Depths
Temperature	+/- 0.2	Bottom
Dissolved oxygen	+/- 0.5 mg/L	Bottom
Conductivity	+/- 100 microseimens	Bottom

Table 3-1a Monthly average trawl CPUE by species for all navigation channel stations combined during the 2002-2003 Aquatic Biological Sampling Program.

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03
Alewife	2.50	1.68					
Alosa sp.		0.04					
American Eel	0.08					0.09	0.25
American Sandlance	0.08						
American Shad	0.42	0.30	0.14	0.30			
Atlantic Croaker	0.83	1.38					
Atlantic Herring		0.17			1.33	28.19	18.75
Atlantic Menhaden	1.58	0.08					0.12
Atlantic Silverside		0.04	0.15				
Atlantic Tomcod			0.04				3.64
Bay Anchovy	2.46	0.54		1.74		5.46	8.98
Black Sea Bass		0.04			0.08		
Blueback Herring	3.77	2.33	0.61	0.30	0.08	0.17	0.17
Bluefish							0.12
Butterfish	0.08						0.25
Clearnose Skate		0.04					
Conger Eel	0.17	0.04					
Cunner	0.08	0.13		0.13	0.25		0.08
Gadid unidentified						0.08	
Gizzard Shad	0.17	0.04		0.05			
Grubby			0.04	0.09		0.09	
Hogchocker			0.04				
Little Skate	2.40	4.17	0.51	0.61	0.67	0.50	
Naked Goby		0.04		0.09			
Northern Pipefish	0.25	0.29		0.09			
Northern Puffer					0.25		
Northern Searobin	0.08					0.08	0.08
Northern Stargazer						0.08	
Oyster Toadfish							0.08
Red Hake	0.60	3.46	0.29	0.39	0.33	1.42	0.25
Scup						0.33	0.83
Seaboard Goby	0.08						
Silver Hake	3.00	0.54					
Smallmouth Flounder		0.21			0.25	0.09	0.32
Spiny Dogfish							0.08
Spotted Hake	29.25	20.67		0.29	35.25	51.28	16.81
Striped Bass	9.60	7.67	2.83	1.00	1.25	0.45	
Striped Cuskeel					0.67		
Striped Mullet		0.04					
Striped Searobin						1.01	0.42
Summer Flounder	0.48	0.21			0.33	1.09	0.50
Tautog		0.13	0.04			0.08	
Weakfish	0.50						0.08
White Mullet	0.08						
White Perch	28.25	24.54	3.98	0.44	0.08		
Windowpane	0.98	2.31	1.75	1.87	3.75	2.09	0.95
Winter Flounder	1.42	4.02	2.61	0.90	1.67	2.92	1.87

Table 3-1b Monthly average trawl CPUE by species for all shallow/shoal stations combined during the 2002-2003 Aquatic Biological Sampling Program.

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03
Alewife	8.36	0.86			1.99	0.45	
American Eel					0.08		
American Sandlance	4.92						
American Shad	0.62	0.04	0.06	0.04			0.09
Atlantic Cod	1.67						
Atlantic Croaker	1.96	2.24					
Atlantic Herring			0.04		2.94	2.64	
Atlantic Menhaden	0.14					0.07	
Atlantic Silverside		1.41	0.07	0.10			
Atlantic Tomcod						8.48	14.50
Bay Anchovy	0.74	0.19		0.46		78.25	29.52
Black Sea Bass						0.07	
Blueback Herring	6.71	0.11	0.07	0.04	0.60	0.07	0.14
Bluefish							0.07
Conger Eel		0.04	0.12				
Cunner	0.31	0.12	0.07	0.04	0.07	0.07	
Gadid unidentified						0.07	
Gizzard Shad	0.65	0.04					
Grubby		0.19	0.04	0.04	0.14	0.07	
Little Skate	0.89	0.07	0.50		0.29	0.21	
Naked Goby	0.21	0.06	0.09				
Northern Pipefish	0.07	0.04		0.13			0.07
Northern Puffer					0.36		
Northern Searobin					0.43		
Pollock					0.14	0.14	
Red Hake				0.07	0.21	0.14	0.07
Scup						0.07	0.21
Seaboard Goby		0.11		0.04			
Silver Hake	0.34	0.05					
Smallmouth Flounder		0.64	0.07		3.64	0.21	0.24
Spiny Dogfish							0.07
Spotted Hake	2.68	0.65	0.04	0.04	21.86	10.79	2.24
Striped Bass	37.07	15.24	0.29	1.61	23.31	2.05	0.99
Striped Cuskeel					0.43		0.07
Striped Killifish		0.07	0.04				
Striped Mullet		0.06					
Striped Searobin						1.00	
Summer Flounder	0.97	0.14			0.08	2.50	0.66
Tautog						0.07	
Weakfish							0.14
White Mullet	0.18						
White Perch	73.46	19.53	0.74	0.26	4.83	0.45	
Windowpane	0.38	0.36	0.46	0.75	1.36	1.40	0.67
Winter Flounder	1.73	3.27	0.49	0.42	6.21	3.38	0.74

Table 3-2 a Monthly average CPUE by species for all navigation channel and shallow/shoal stations combined at Arthur Kill/Newark Bay during the 2002-2003 Aquatic Biological Sampling Program.

Navigation Channel Stations

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03
Alewife	3.75	0.41					
American Eel						0.28	0.75
American Shad		0.16					
Atlantic Croaker		0.13					
Atlantic Herring					3.00	3.50	0.25
Atlantic Menhaden	1.50						0.36
Atlantic Tomcod							9.68
Bay Anchovy	0.25	0.25				7.22	6.18
Black Sea Bass					0.25		
Blueback Herring	2.50	0.25		0.43		0.50	
Bluefish							0.36
Cunner	0.25	0.13					0.25
Gizzard Shad	0.50	0.13					
Hogchocker			0.13				
Northern Pipefish				0.14			
Northern Searobin	0.25					0.25	0.25
Northern Stargazer						0.25	
Oyster Toadfish							0.25
Red Hake	0.25		0.21			0.50	0.25
Smallmouth Flounder						0.28	0.96
Spotted Hake	0.50	0.13		0.14	21.00	70.33	41.43
Striped Bass	21.25	17.13	4.46	2.59	2.25	1.36	
Striped Searobin						0.53	
Summer Flounder					0.50	0.28	0.75
Tautog		0.13					
White Perch	83.00	73.63	11.68	1.44	0.25		
Windowpane		0.44	0.21	0.29		1.28	1.36
Winter Flounder	0.75	5.94	2.20	0.71	1.00	0.25	3.86

Shallow/Shoal Stations

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03
Alewife	9.09	1.19			0.84	0.60	
American Eel					0.22		
American Sandlance	0.20						
American Shad			0.17	0.10			0.25
Atlantic Croaker		0.10					
Atlantic Herring					8.24	0.80	
Atlantic Menhaden	0.40						
Atlantic Silverside		2.20					
Atlantic Tomcod						1.20	0.60
Bay Anchovy	0.49	0.43		0.10		170.02	10.26
Blueback Herring					1.00		
Cunner					0.20		
Gizzard Shad	1.83	0.10					
Naked Goby	0.20	0.17					
Northern Pipefish	0.20	0.10					0.20
Northern Puffer					0.20		
Red Hake					0.20		
Seaboard Goby				0.10			
Silver Hake	0.29	0.14					
Smallmouth Flounder					8.60		
Spotted Hake	0.57	0.10	0.10		27.27	5.80	0.54
Striped Bass	45.60	28.90	0.43	3.22	17.47	2.60	2.58
Striped Cuskeel					1.20		
Striped Killifish		0.20	0.10				
Striped Mullet		0.17					
Summer Flounder					0.22	1.80	0.86
Tautog						0.20	
White Perch	205.49	54.69	1.97	0.73	13.51	0.60	
Windowpane					1.00		
Winter Flounder	3.20	3.91	0.56	0.57	2.18	1.00	0.89

Table 3-2 b Monthly average CPUE by species for all navigation channel and shallow/shoal stations combined at Upper Bay during the 2002-2003 Aquatic Biological Sampling Program.

Navigation Channel Stations

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03
Alewife	1.60	1.30					
Alosa sp.		0.10					
American Shad	0.80		0.33	0.60			
Atlantic Croaker	1.40	3.20					
Atlantic Herring		0.30			0.80	8.44	
Atlantic Menhaden	0.60	0.10					
Atlantic Silverside			0.17				
Atlantic Tomcod			0.10				1.00
Bay Anchovy	1.10	0.70		0.90		7.13	4.40
Black Sea Bass		0.10					
Blueback Herring	6.85	1.30	1.37	0.40	0.20		0.40
Clearnose Skate		0.10					
Conger Eel		0.10					
Cunner		0.20		0.20	0.60		
Gizzard Shad				0.11			
Grubby			0.10	0.20		0.22	
Little Skate	1.15	4.00	0.33	0.80	1.60	0.60	
Naked Goby		0.10		0.20			
Northern Pipefish	0.40	0.10		0.10			
Northern Puffer					0.60		
Red Hake	0.65	0.80	0.53	0.80	0.60	2.40	0.40
Silver Hake		0.10					
Smallmouth Flounder		0.40			0.60		
Spotted Hake	11.80	6.10		0.57	66.60	21.20	6.00
Striped Bass	5.05	4.50	3.23	0.50	1.20		
Striped Cuskeel					1.60		
Striped Mullet		0.10					
Striped Searobin						2.00	0.20
Summer Flounder	0.75	0.10			0.40	1.20	0.40
Tautog		0.20				0.20	
Weakfish	0.60						0.20
White Perch	1.00		0.20				
Windowpane	0.95	4.10	3.93	3.30	8.80	2.60	0.40
Winter Flounder	1.80	4.10	4.40	1.58	2.20	1.20	1.00

Shallow/Shoal Stations

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03
Alewife	11.11	0.93			3.94	0.56	
American Sandlance	1.97						
American Shad	1.28						
Atlantic Cod	3.89						
Atlantic Croaker	4.58	5.14					
Atlantic Herring						4.83	
Atlantic Menhaden						0.17	
Atlantic Silverside		0.79		0.22			
Atlantic Tomcod						18.78	33.33
Bay Anchovy	0.17	0.09		1.00		39.89	40.67
Black Sea Bass						0.17	
Blueback Herring	15.67	0.08		0.08	0.56	0.17	
Conger Eel		0.08	0.28				
Cunner	0.56	0.28	0.17	0.08		0.17	
Grubby		0.44	0.08	0.08	0.33	0.17	
Little Skate	1.25	0.08			0.17	0.17	
Naked Goby	0.33		0.21				
Northern Pipefish				0.29			
Northern Puffer					0.17		
Northern Searobin					0.83		
Pollock					0.33	0.33	
Red Hake				0.17		0.33	0.17
Scup						0.17	
Seaboard Goby		0.25					
Silver Hake	0.56						
Smallmouth Flounder		1.50	0.08		1.17	0.50	0.56
Spotted Hake	3.61	1.28		0.08	20.78	13.33	3.44
Striped Bass	48.50	11.49	0.33	1.08	39.83	2.61	0.17
Striped Searobin						2.00	
Summer Flounder	1.60					4.00	0.83
Weakfish							0.33
White Mullet	0.42						
White Perch	0.17		0.08			0.56	
Windowpane	0.21	0.33	1.00	1.25	1.83	2.61	1.56
Winter Flounder	1.21	4.28	0.59	0.42	10.50	6.89	0.83

Table 3-2 c Monthly average CPUE by species for all navigation channel and shallow/shoal stations combined at Lower Bay during the 2002-2003 Aquatic Biological Sampling Program.

Navigation Channel Stations

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03
Alewife	2.33	4.00					
American Eel	0.33						
American Sandlance	0.33						
American Shad	0.33	1.00		0.17			
Atlantic Croaker	1.00						
Atlantic Herring		0.17				94.00	74.67
Atlantic Menhaden	3.33	0.17					
Atlantic Silverside		0.17	0.33				
Bay Anchovy	7.67	0.67		5.17		0.33	20.33
Blueback Herring	0.33	6.83	0.17				
Butterfish	0.33						1.00
Conger Eel	0.67						
Cunner				0.17			
Gadid unidentified						0.33	
Little Skate	7.67	10.00	1.50	1.00		1.00	
Northern Pipefish	0.33	1.00					
Red Hake	1.00	12.50		0.17	0.33	1.00	
Scup						1.33	3.33
Seaboard Goby	0.33						
Silver Hake	12.00	2.00					
Smallmouth Flounder		0.17					
Spiny Dogfish							0.33
Spotted Hake	96.67	72.33			2.00	76.00	2.00
Striped Bass	1.67	0.33					
Striped Searobin							1.33
Summer Flounder	0.67	0.67				2.00	0.33
Tautog			0.17				
Weakfish	1.00						
White Mullet	0.33						
White Perch	0.67						
Windowpane	2.33	1.83	0.17	1.33	0.33	2.33	1.33
Winter Flounder	1.67	1.33	0.17		1.67	9.33	0.67

Shallow/Shoal Stations

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03
Alewife	1.67	0.17					
American Sandlance	18.67						
American Shad	0.33	0.17					
Atlantic Herring			0.17			1.33	
Atlantic Silverside		1.33	0.33				
Bay Anchovy	2.33					2.00	39.33
Blueback Herring		0.33	0.33				0.67
Bluefish							0.33
Cunner	0.33						
Gadid unidentified						0.33	
Little Skate	1.67	0.17	2.33		1.00	0.67	
Northern Puffer					1.00		
Northern Searobin					0.33		
Red Hake					0.67		
Scup							1.00
Smallmouth Flounder			0.17		0.33		
Spiny Dogfish							0.33
Spotted Hake	4.33	0.33			15.00	14.00	2.67
Striped Cuskeel							0.33
Striped Searobin						0.67	
Summer Flounder	1.33	0.67				0.67	
Windowpane	1.33	1.00	0.17	1.00	1.00	1.33	
Winter Flounder	0.33	0.17	0.17	0.17	4.33	0.33	0.33

Table 3-3 a Monthly average ichthyoplankton density (Number/1000 m³) by species for all navigation channel stations in Arthur Kill/Newark Bay, 2002-2003 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic menhaden					82.29	255.78	
Bay anchovy						189.68	966.27
Fourbeard rockling				0.87			
Labridae					10.32	16.55	89.00
Prionotus sp.						33.29	
Unidentified			0.53				
Weakfish							56.54
Windowpane					41.34	304.21	
Winter flounder				0.91			

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Grubby				0.68			
Winter flounder			0.53	63.10			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance			0.53	1.86			
Atlantic croaker	2.24						
Atlantic herring			7.05	2.16	1.58		
Atlantic mackerel						3.61	
Atlantic menhaden						0.53	
Atlantic silverside					0.75	0.69	
Atlantic tomcod				1.53			
Bay anchovy						4.80	1524.12
Clupeid unidentified						3.27	1.72
Gobiid unidentified							40.23
Grubby			1.29	26.23	1.64		
Northern pipefish						2.14	
Rock gunnel	1.10						
Striped bass						0.53	
Summer flounder		0.70					
Tautog							2.55
Unidentified						5.96	
Weakfish							10.12
Windowpane						2.96	2.55
Winter flounder			1.06	40.73	170.74	23.96	

Juvenile

Species	January	February	March	April	May	June	July
Atlantic croaker	2.11						
Atlantic tomcod					1.58		
Bay anchovy	0.99						
Northern pipefish							8.55
Windowpane						1.43	1.72

Table 3-3 b Monthly average ichthyoplankton density (Number/1000 m³) by species for all shallow/shoal stations in Arthur Kill/Newark Bay, 2002-2003 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic menhaden					5.19	219.05	
Bay anchovy						127.23	41.02
Hogchocker						21.93	
Labridae					2.67	8.95	59.79
Weakfish							4.17
Windowpane					9.45	315.64	
Winter flounder			1.15	0.55			

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Atlantic menhaden						1.28	
Atlantic silverside						0.78	
Grubby			0.56		0.87		
Unidentified						0.53	
White perch						8.39	
Windowpane					0.73	0.53	
Winter flounder				97.65	1.60		

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance				1.80			
Atlantic croaker	2.46						
Atlantic herring			1.81			0.60	
Atlantic menhaden	2.99				0.56	37.48	13.46
Atlantic silverside					1.03	0.95	
Bay anchovy							1221.90
Clupeid unidentified						0.47	
Fourspot flounder				0.46			
Gobiid unidentified					0.50		166.44
Grubby			1.87	12.54	1.68		
Longhorn sculpin			1.87				
Northern pipefish						3.32	15.55
Rock gunnel		1.18		0.45			
Striped bass						5.68	
Unidentified						5.27	
Weakfish						0.49	9.60
Windowpane					2.31	1.15	
Winter flounder			0.63	298.46	89.06	3.72	

Lifestage: Juvenile

Species	January	February	March	April	May	June	July
Bay anchovy	2.35						
Winter flounder							1.23

Table 3-3 c Monthly average ichthyoplankton density (Number/1000 m³) by species for all navigation channel stations in Upper Bay, 2002-2003 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic mackerel					26.43		
Atlantic menhaden					4.87	1715.34	
Bay anchovy						917.16	146.96
Fourbeard rockling				13.16	0.57		
Hogchocker						41.06	2.16
Labridae					3.57	1977.62	926.87
Prionotus sp.						1132.56	479.08
Weakfish						103.69	526.45
Windowpane				11.83	233.84	4035.46	
Winter flounder		2.72	121.43	1.31	0.43		

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Grubby				3.11			
Winter flounder			1.16	55.29	4.11		

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance			0.62	2.99	2.14		
Atlantic herring			8.05	7.99			
Atlantic mackerel						9.54	
Atlantic menhaden					0.53	7.86	9.98
Atlantic silverside						0.76	
Bay anchovy							377.84
Clupeid unidentified							22.14
Conger eel						0.59	
Fourbeard rockling						0.52	
Gobiid unidentified							122.44
Grubby			1.27	12.47	10.44		
Northern pipefish							11.58
Northern puffer							0.82
Rock gunnel		0.36	0.84	4.09	7.59		
Striped bass						0.59	
Summer flounder	2.07						
Tautog							5.05
Unidentified						4.75	
Weakfish							33.40
Windowpane					1.60	50.54	12.90
Winter flounder				240.91	450.17	15.07	

Juvenile

Species	January	February	March	April	May	June	July
Atlantic croaker	8.71						
Atlantic tomcod				0.37			
Windowpane						3.59	

Table 3-3 d Monthly average ichthyoplankton density (Number/1000 m³) by species for all shallow/shoal stations in Upper Bay, 2002-2003 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic mackerel					10.93		
Atlantic menhaden						2417.75	23.11
Bay anchovy						987.23	3047.74
Fourbeard rockling				7.29			
Hogchocker						11.51	
Labridae					8.55	544.01	2137.47
Prionotus sp.						169.56	335.47
Unidentified			0.42				
Weakfish							1003.26
Windowpane				25.92	168.69	2144.11	
Winter flounder		0.83	26.91	1.18			

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Atlantic menhaden						2.88	
Fourspot flounder							1.44
Grubby				5.39			
Longhorn sculpin			0.53				
Windowpane						1.23	
Winter flounder			9.78	90.62			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance				0.87			
Atlantic croaker	1.12						
Atlantic herring				3.85			
Atlantic mackerel						2.68	
Atlantic menhaden						54.04	11.00
Bay anchovy						1.00	517.86
Gobiid unidentified							233.04
Grubby			2.64	28.45			
Northern pipefish						3.98	31.70
Northern puffer							2.34
Rock gunnel		1.84		2.09			
Striped bass						0.96	
Tautog							4.19
Unidentified						12.35	
Walleye							2.89
Weakfish							10.71
Windowpane						17.99	1.69
Winter flounder			2.38	270.79	111.60	4.77	

Juvenile

Species	January	February	March	April	May	June	July
Atlantic croaker	3.96						
Atlantic tomcod				0.28			

Table 3-3 e Monthly average ichthyoplankton density (Number/1000 m³) by species for all navigation channel stations in Lower Bay, 2002-2003 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic mackerel					134.97		
Atlantic menhaden					24.83	3412.38	
Bay anchovy						1769.95	127.66
Gadid unidentified			0.84				
Labridae					16.69	1363.57	122.58
Prionotus sp.						740.13	91.53
Weakfish						176.86	130.49
Windowpane				29.62	209.02	1640.39	
Winter flounder		165.72	14.78	6.46			

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
Atlantic menhaden					1.55		
Grubby			0.84	2.95			
Rock gunnel			1.68				
Windowpane					3.10	0.76	
Winter flounder				82.21			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance			1.42	7.53			
Atlantic herring			1.12				
Atlantic mackerel						86.22	
Atlantic menhaden					4.66	8.80	
Atlantic tomcod					1.55		
Bay anchovy						12.45	1119.90
Clupeid unidentified				0.86			66.38
Gobiid unidentified							147.20
Grubby			1.55	103.02			
Northern pipefish						5.94	53.89
Rock gunnel		1.61	3.51	12.22			
Unidentified							3.84
Walleye						1.38	
Weakfish							34.73
Windowpane					33.14	153.13	11.21
Winter flounder				347.19	676.87	5.40	

Juvenile

Species	January	February	March	April	May	June	July
Windowpane						1.17	

Table 3-3 f Monthly average ichthyoplankton density (Number/1000 m³) by species for all shallow/shoal stations in Lower Bay, 2002-2003 Aquatic Biological Sampling Program.

Egg

Species	January	February	March	April	May	June	July
Atlantic mackerel					104.74		
Atlantic menhaden					38.12	10353.47	1.82
Bay anchovy						5263.38	38.60
Labridae					13.20	5264.90	62.35
Prionotus sp.						448.61	257.82
Unidentified							8.25
Weakfish						168.81	149.16
Windowpane				89.06	172.50	2173.57	
Winter flounder		8.14	168.00	3.20			

Yolk-sac Larvae

Species	January	February	March	April	May	June	July
American sandlance		0.78					
Atlantic menhaden					3.49		
Grubby				5.98			
Longhorn sculpin			0.91				
Windowpane						1.13	
Winter flounder			1.26	153.51			

Post-yolk sac Larvae

Species	January	February	March	April	May	June	July
American sandlance				3.79			
Atlantic mackerel						25.08	
Atlantic menhaden					22.67	9.33	
Bay anchovy						14.25	271.36
Fourbeard rockling					1.62	0.74	2.84
Gobiid unidentified							56.27
Grubby				36.77	3.59		
Northern pipefish						8.70	14.46
Rock gunnel	1.48	3.19	0.94	2.24			
Tautog							2.56
Unidentified						8.51	
Weakfish						0.97	8.77
Windowpane					22.67	72.44	
Winter flounder				1889.01	406.16	3.35	

Juvenile

Species	January	February	March	April	May	June	July

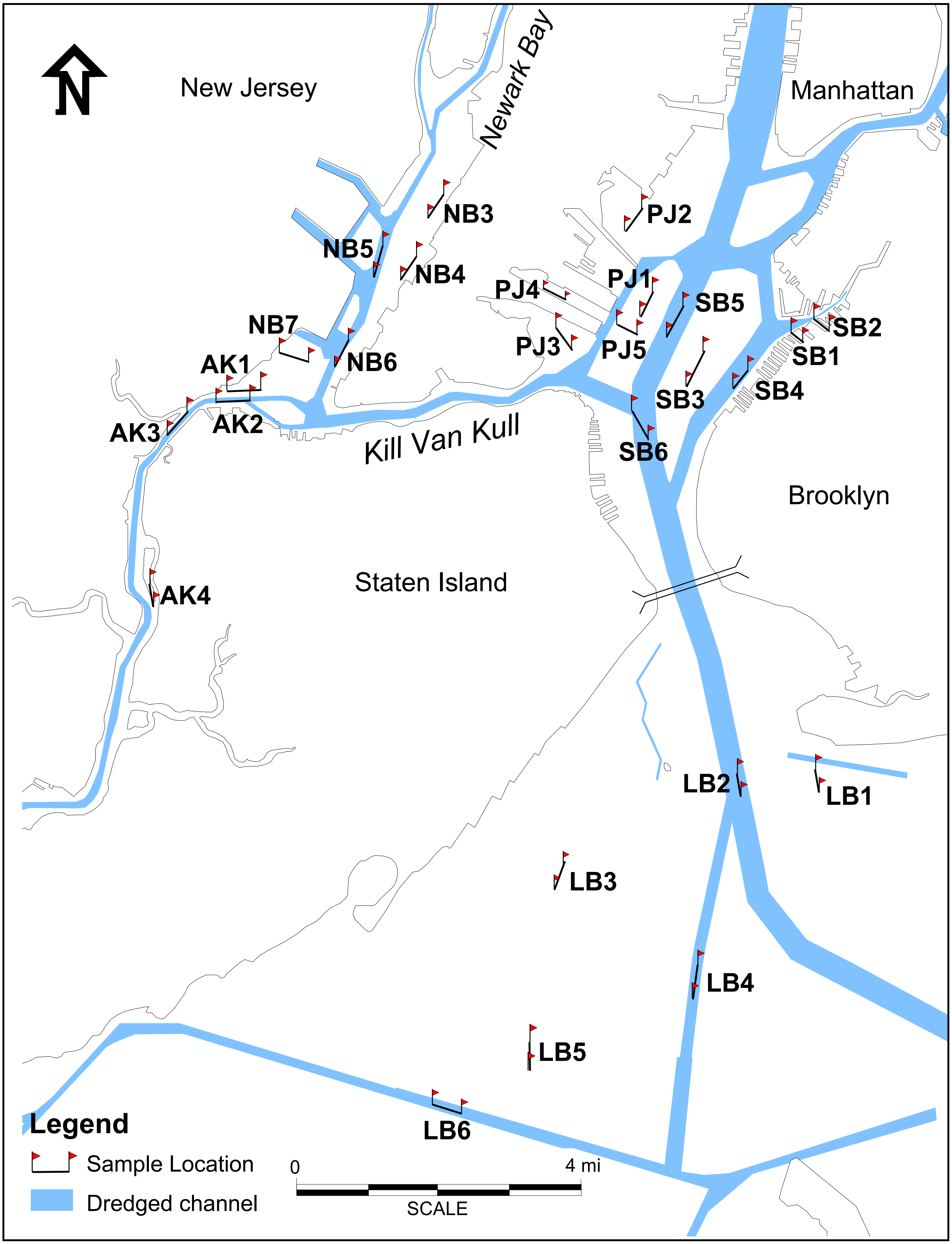


Figure 2-1. Map of sampling stations during the 2001-2002 Aquatic Biological Sampling Program.

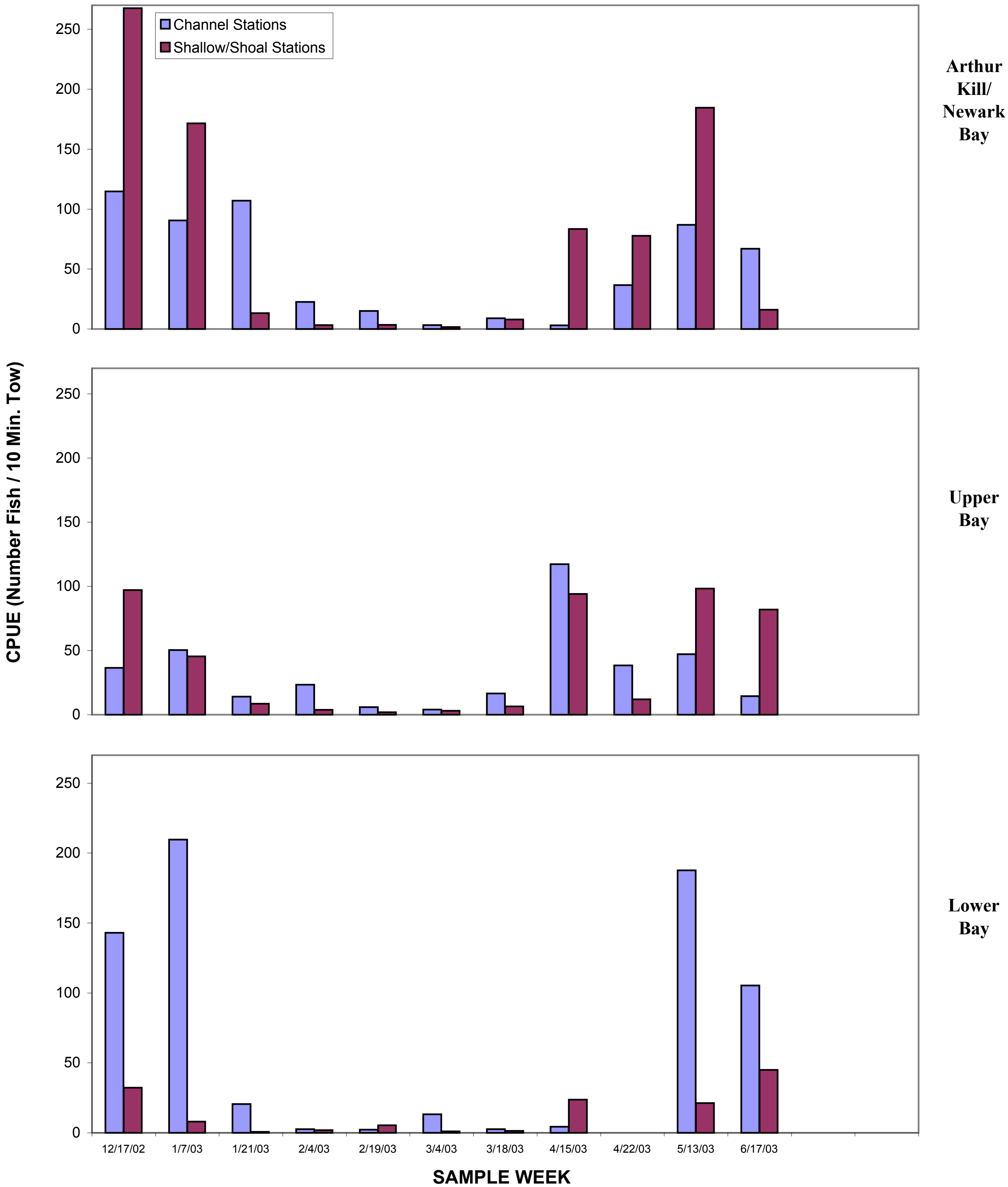


Figure 3-1 **Average weekly trawl CPUE for all species combined at navigation channel and shallow/shoal stations in the three study areas, 2002-2003 Aquatic Biological Sampling Program.**

Note(s) Dates listed indicate the first day of each sample week.

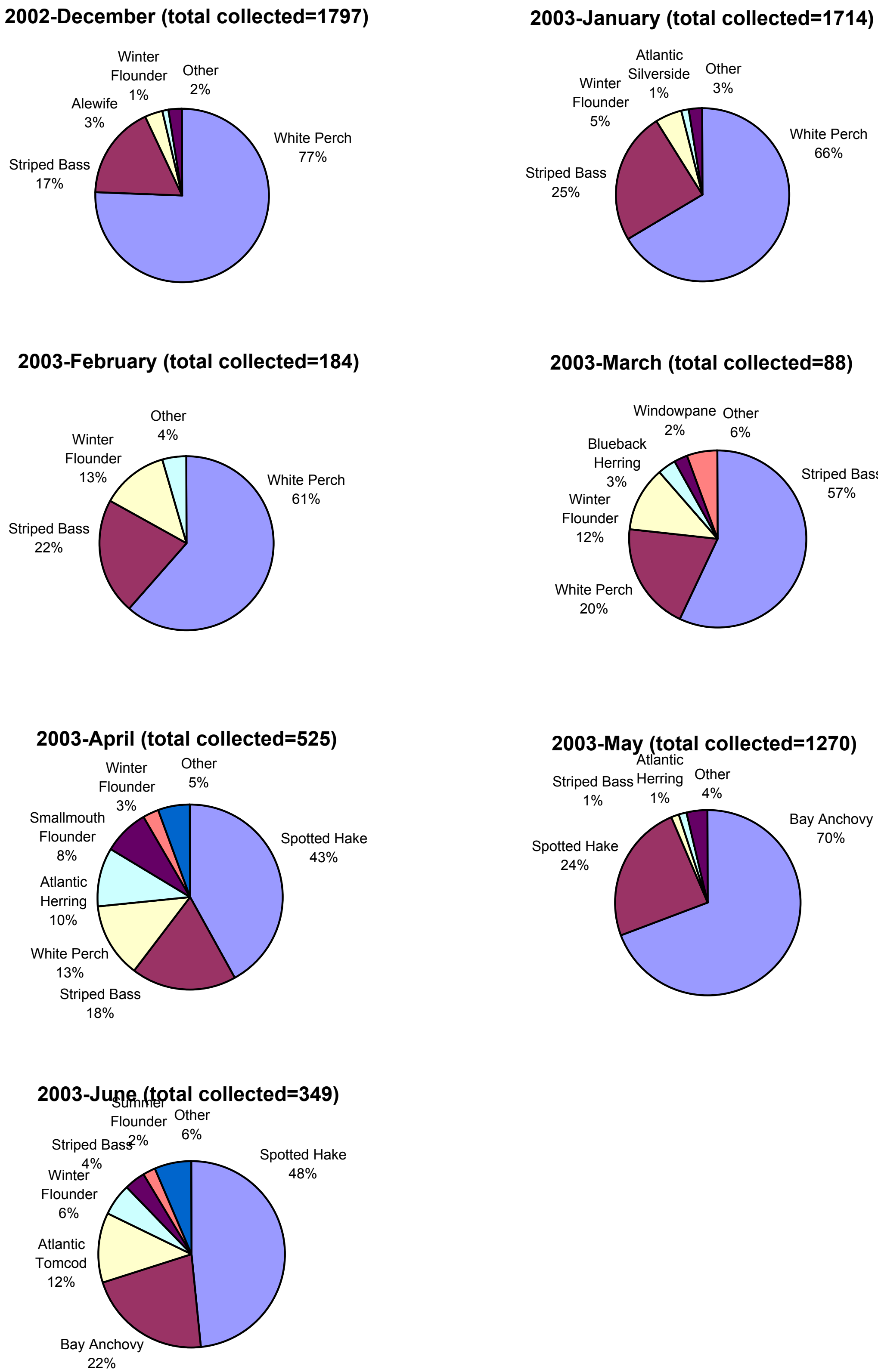


Figure 3-2 **Species composition of trawl catches from Arthur Kill/ Newark Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

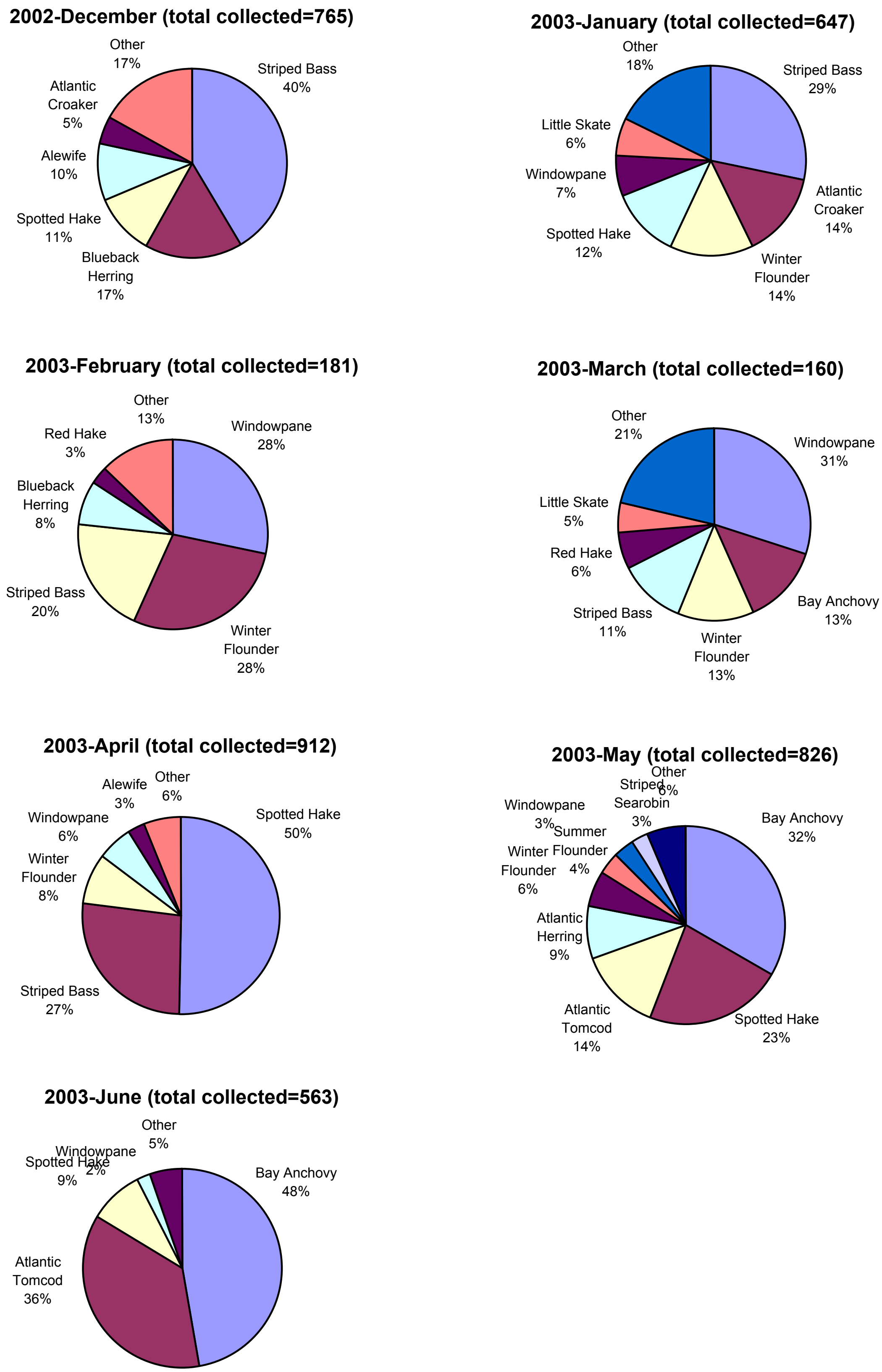


Figure 3-3 **Species composition of trawl catches from Upper Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

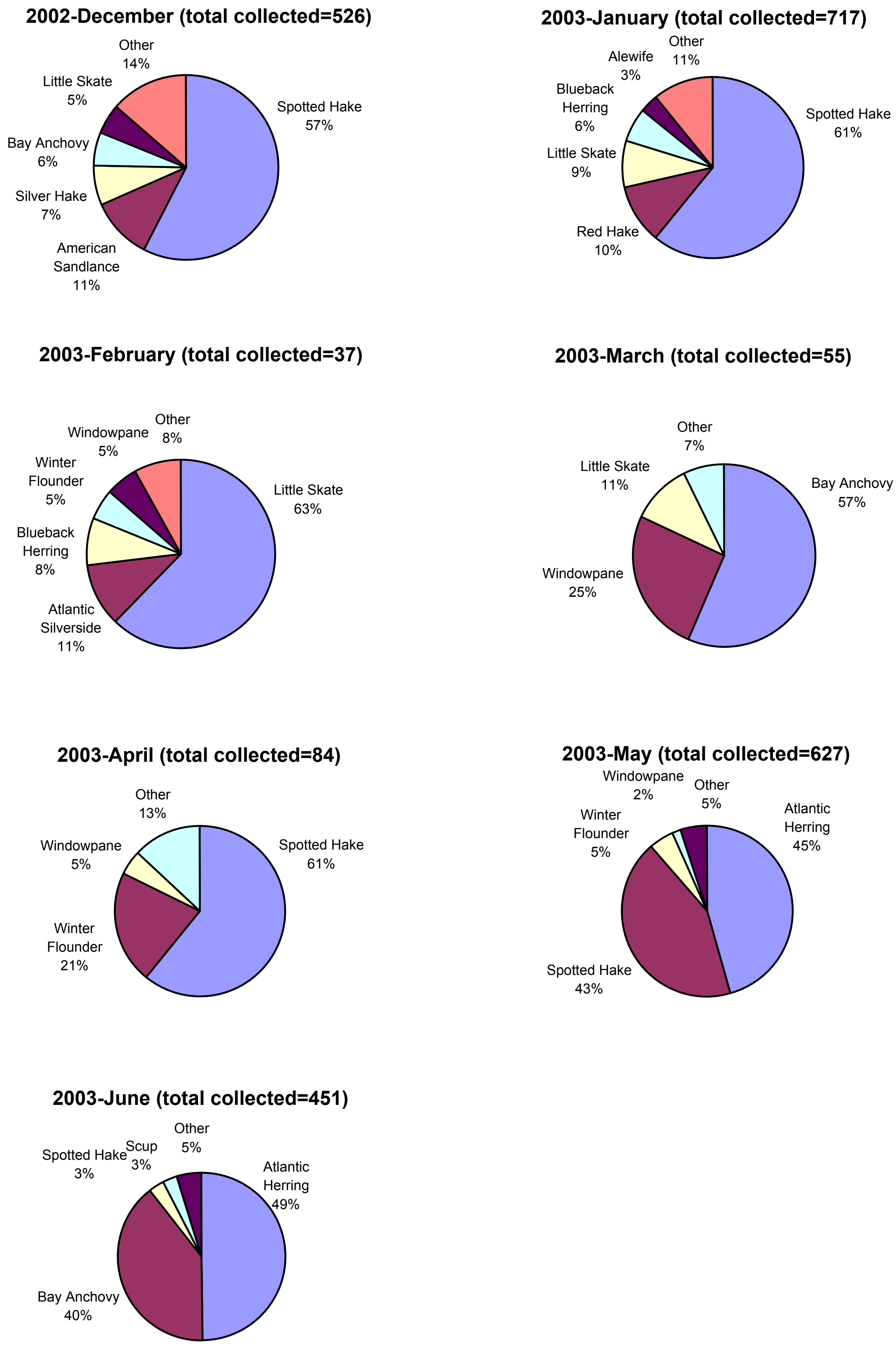


Figure 3-4 **Species composition of trawl catches from Lower Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

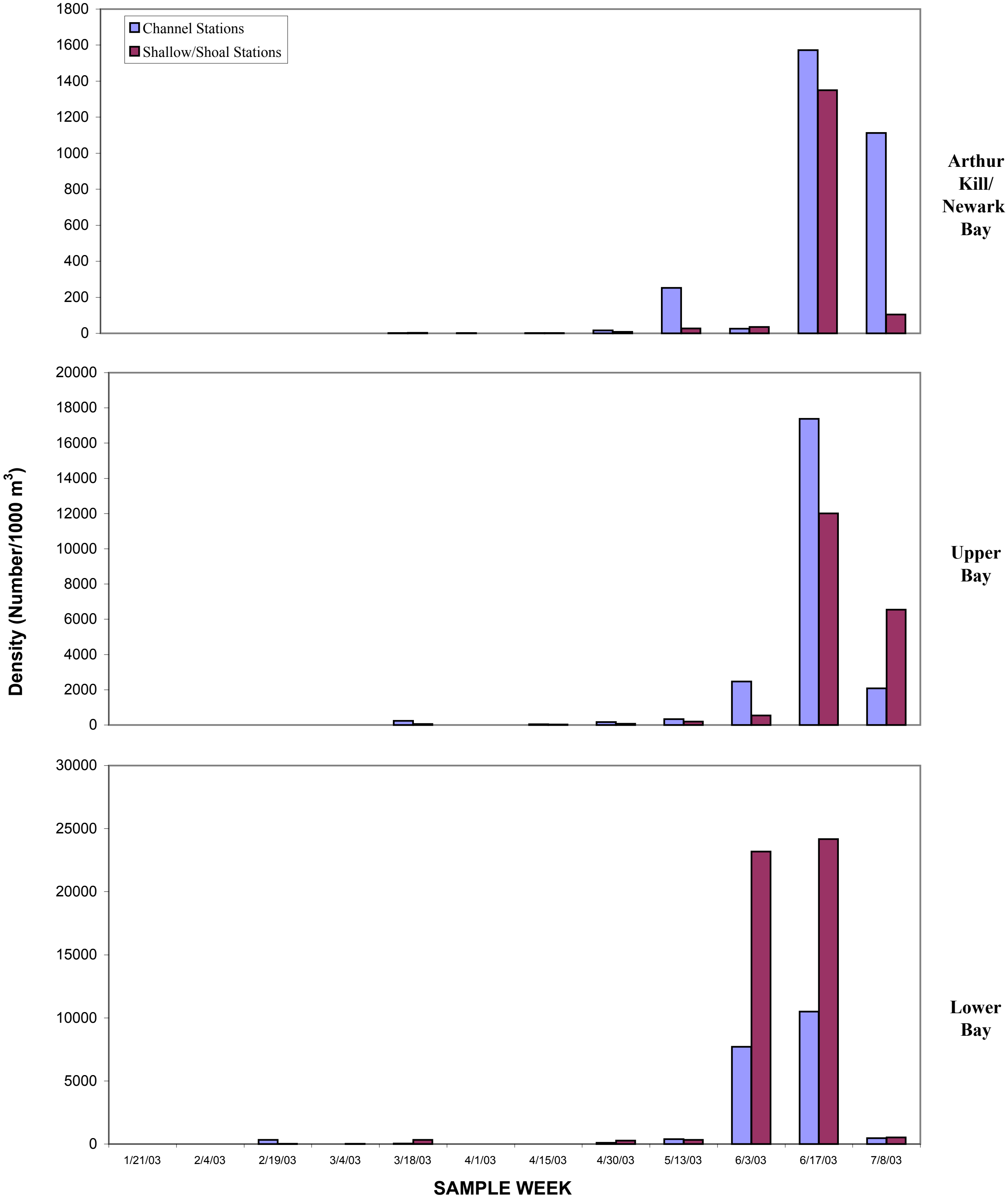


Figure 3-5 **Average weekly egg density of all species combined at navigation channel and shallow/shoal stations in the three study areas, 2002-2003 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week. Note scale change for the three study areas.

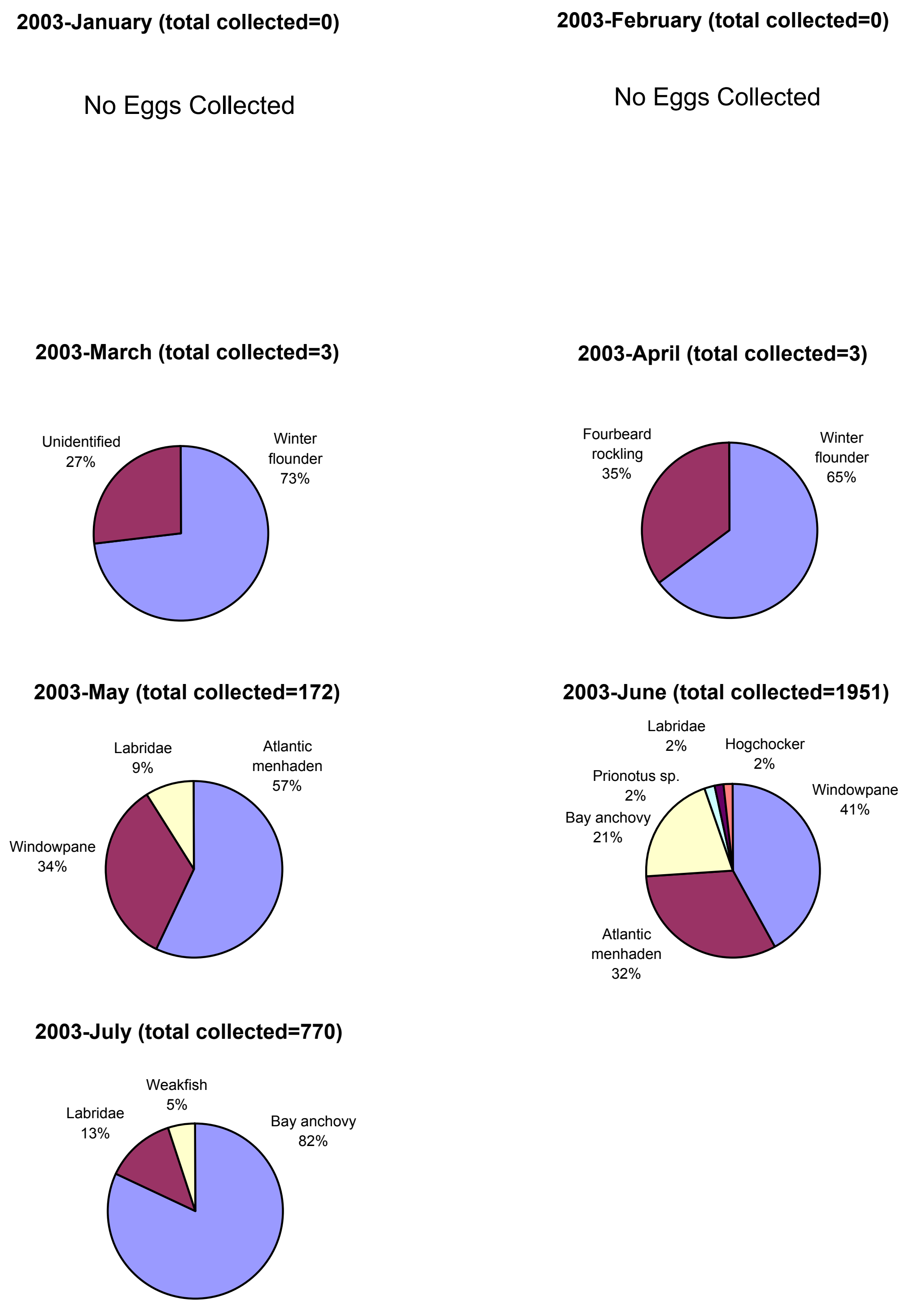


Figure 3-6 **Species composition of eggs collected at Arthur Kill/Newark Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

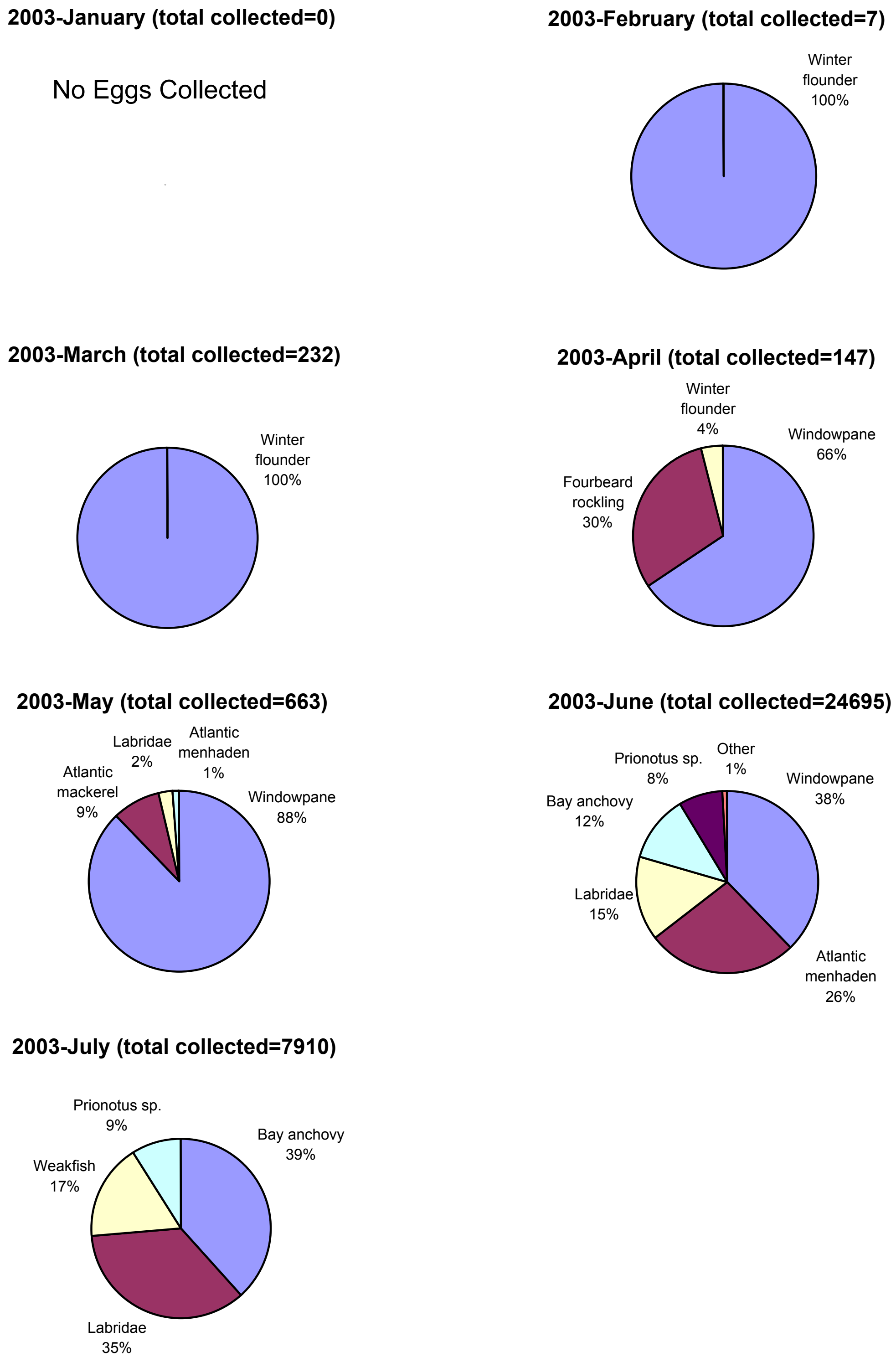


Figure 3-7 **Species composition of eggs collected at Upper Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

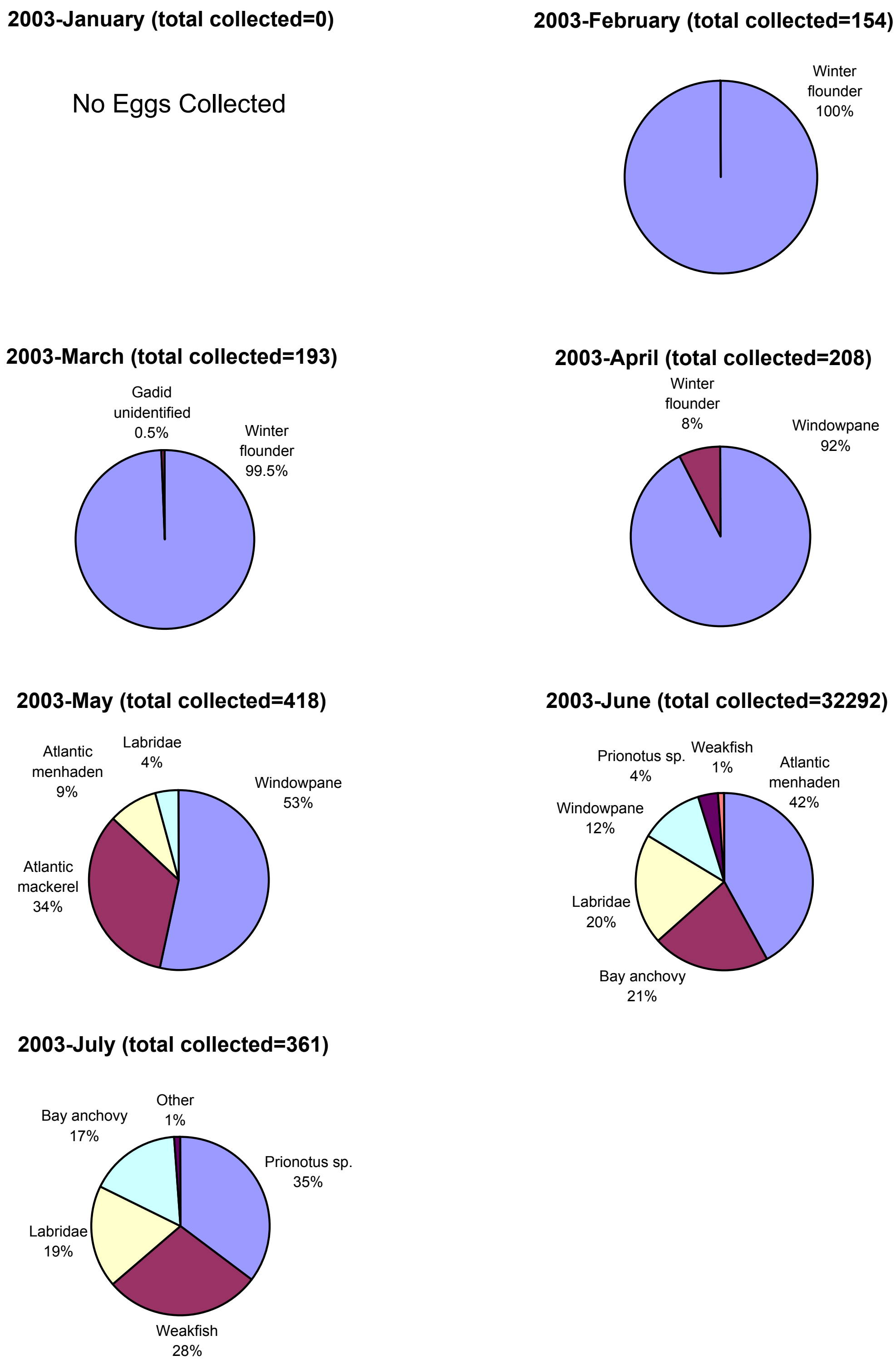


Figure 3-8 **Species composition of eggs collected at Lower Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

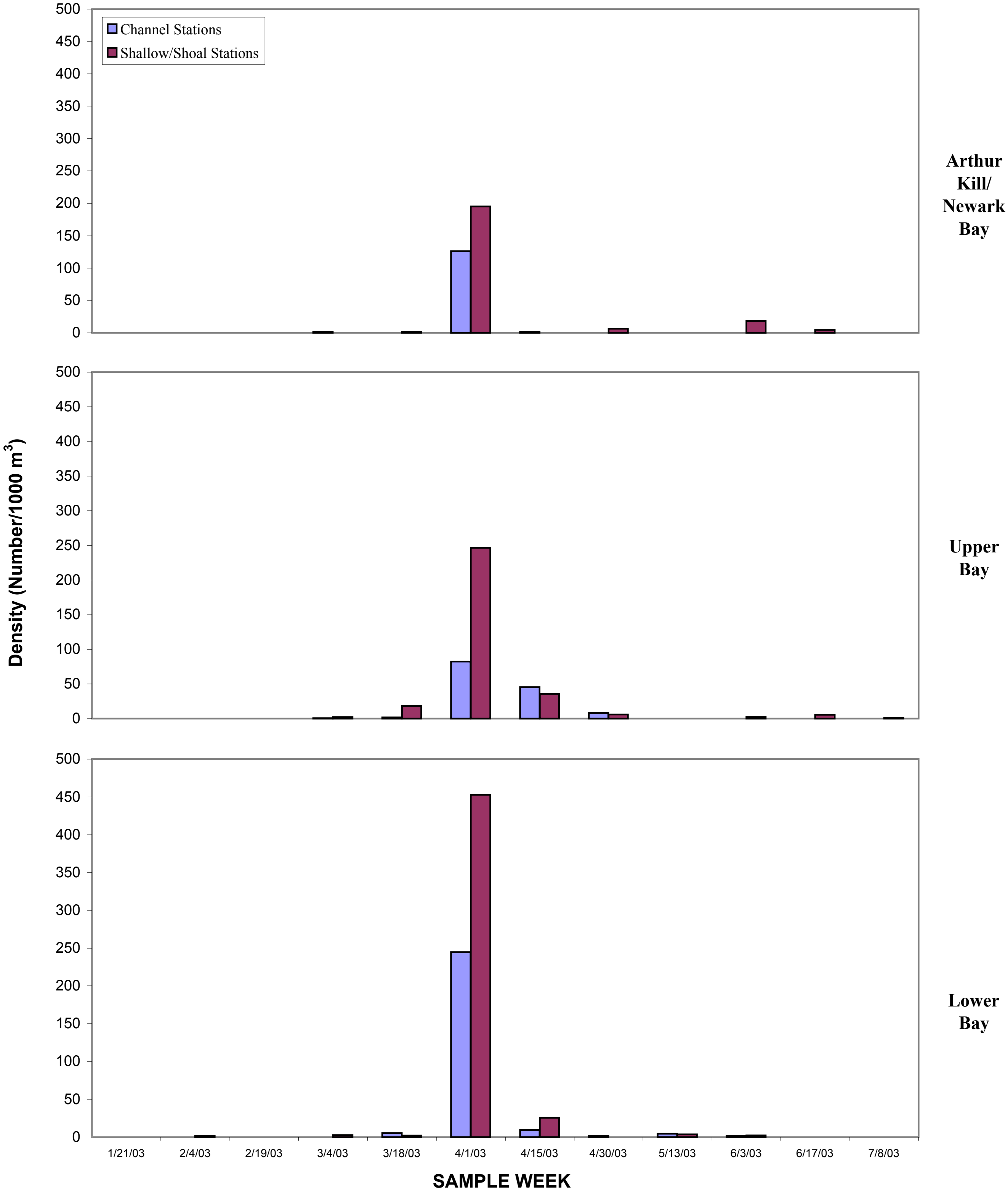


Figure 3-9 **Average weekly yolk-sac larvae density of all species combined at navigation channel and shallow/shoal sampling stations in the three study areas, 2002-2003 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week.

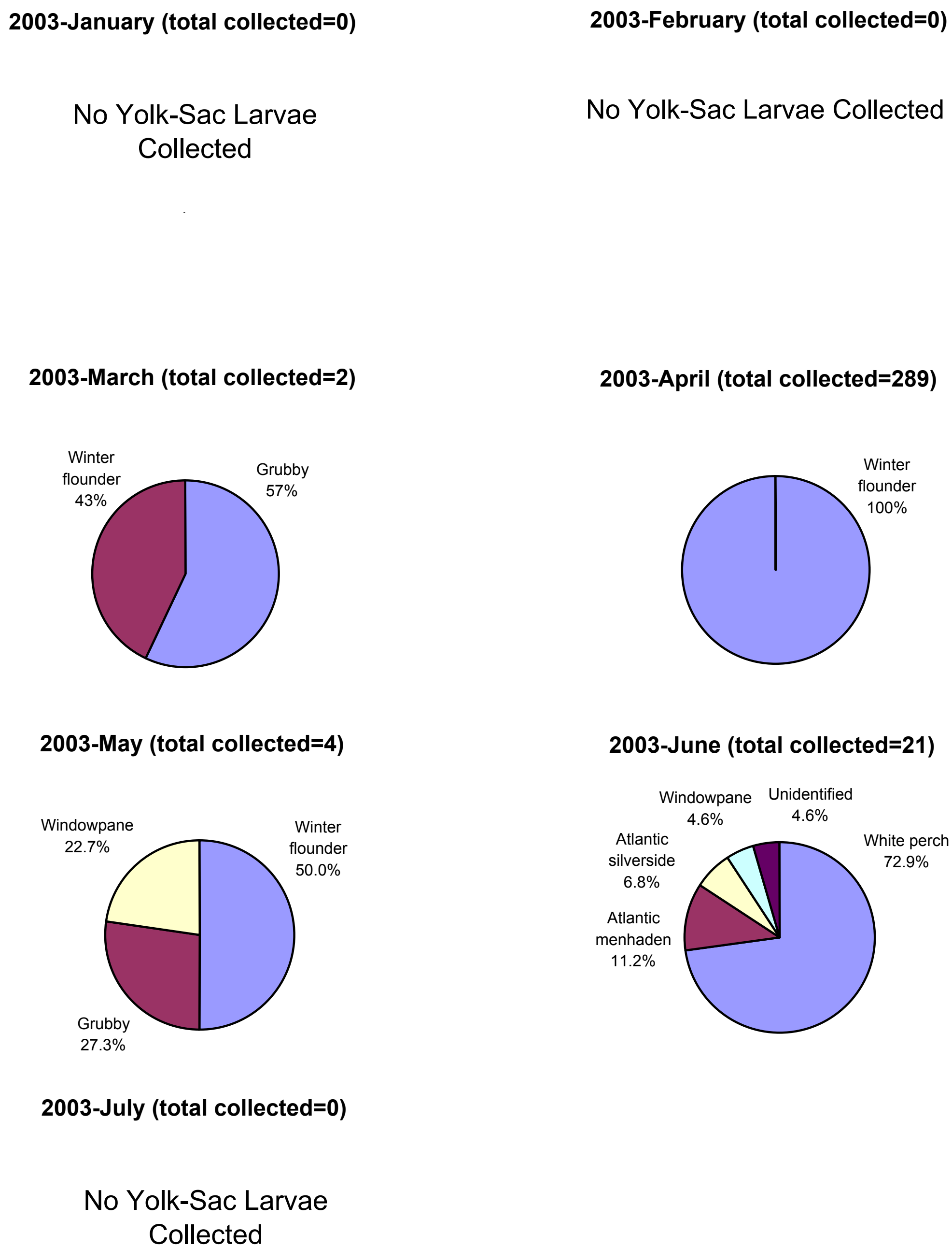


Figure 3-10 **Species composition of yolk-sac larvae collected at Arthur Kill/ Newark Bay during the 2002-2003 Aquatic Biological Sampling Program.**

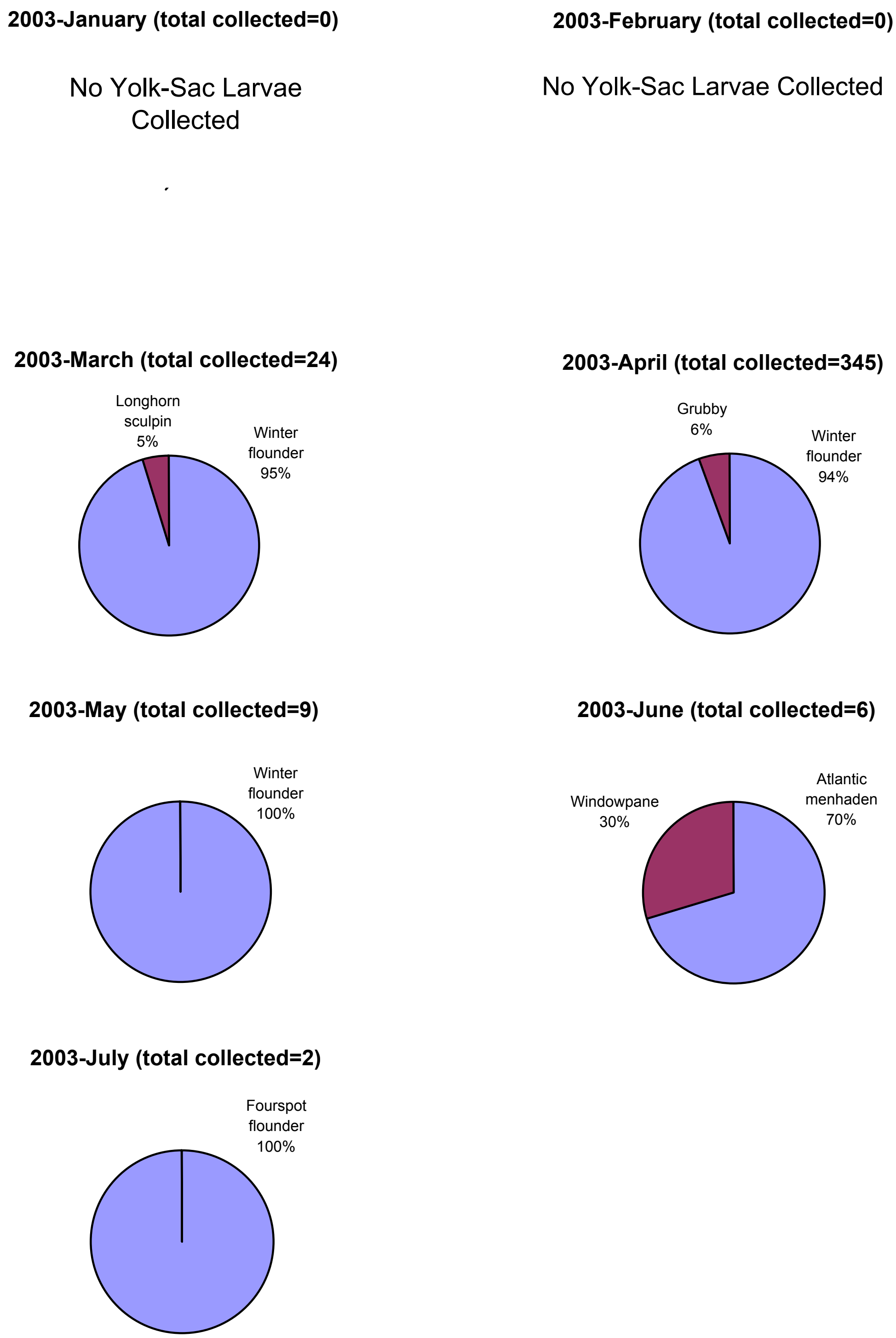


Figure 3-11 **Species composition of yolk-sac larvae collected at Upper Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

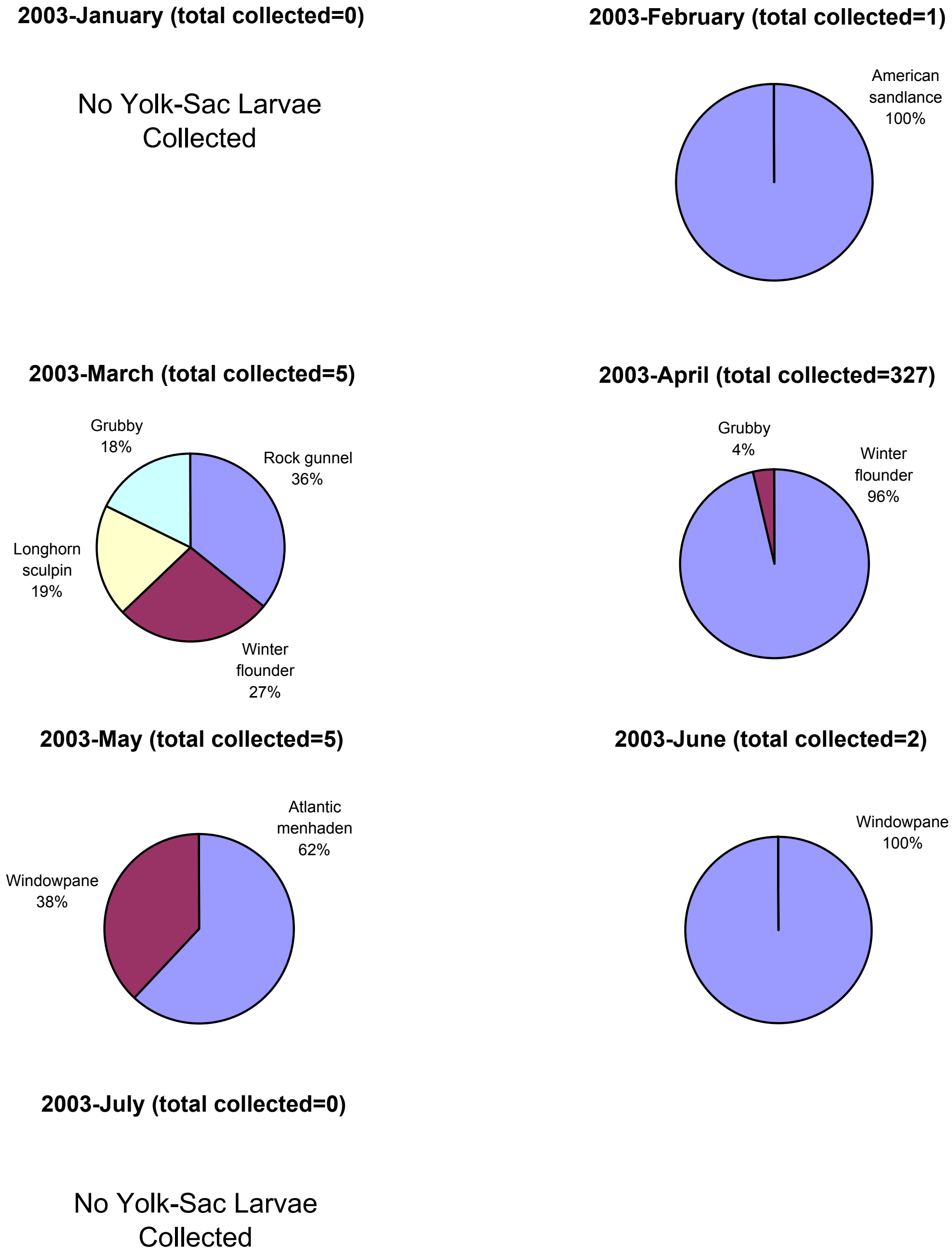


Figure 3-12 **Species composition of yolk-sac larvae collected at Lower Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

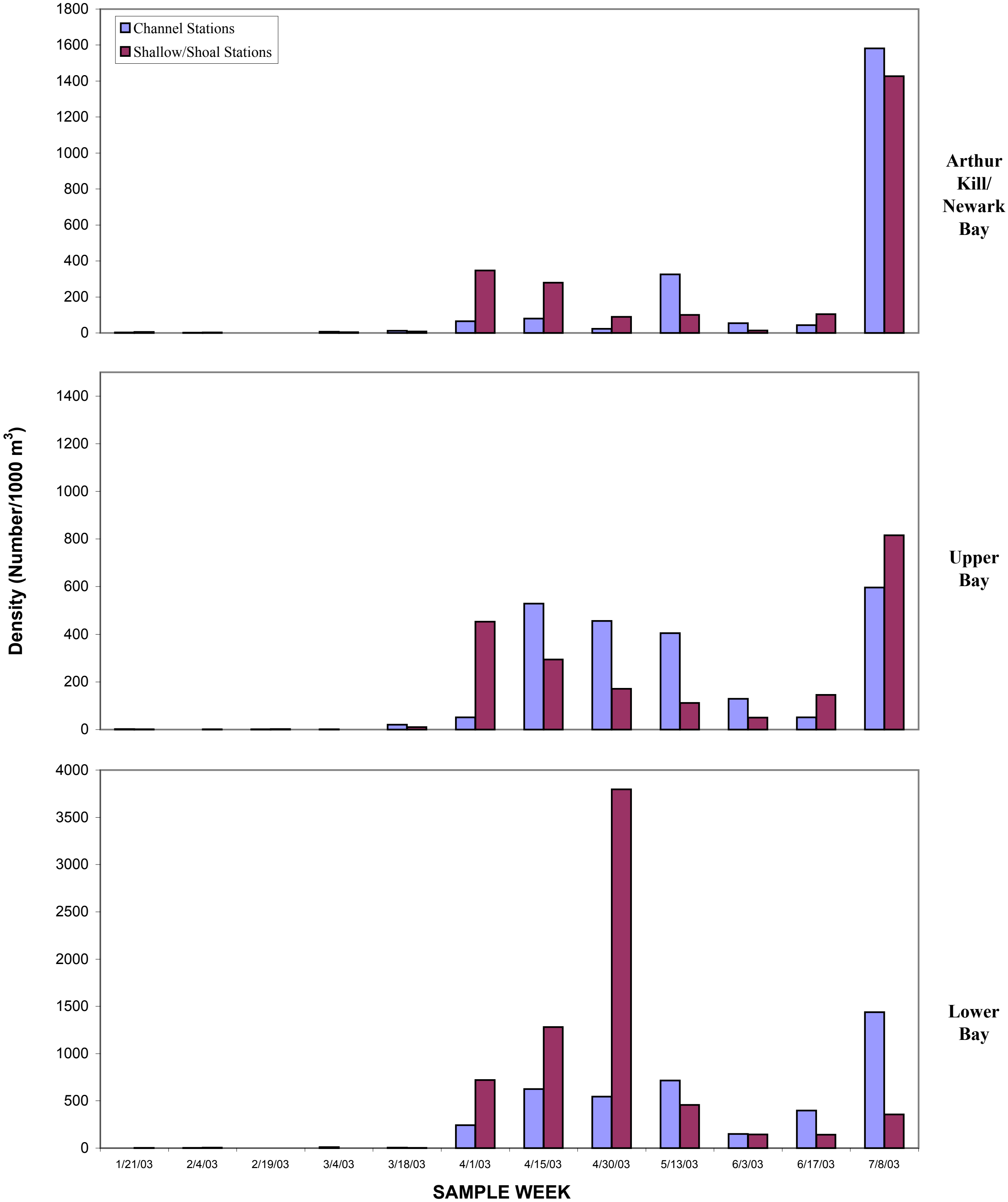


Figure 3-13 **Average weekly post yolk-sac larvae density of all species combined at navigation channel and shallow/shoal stations in the three study areas, 2002-2003 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week.

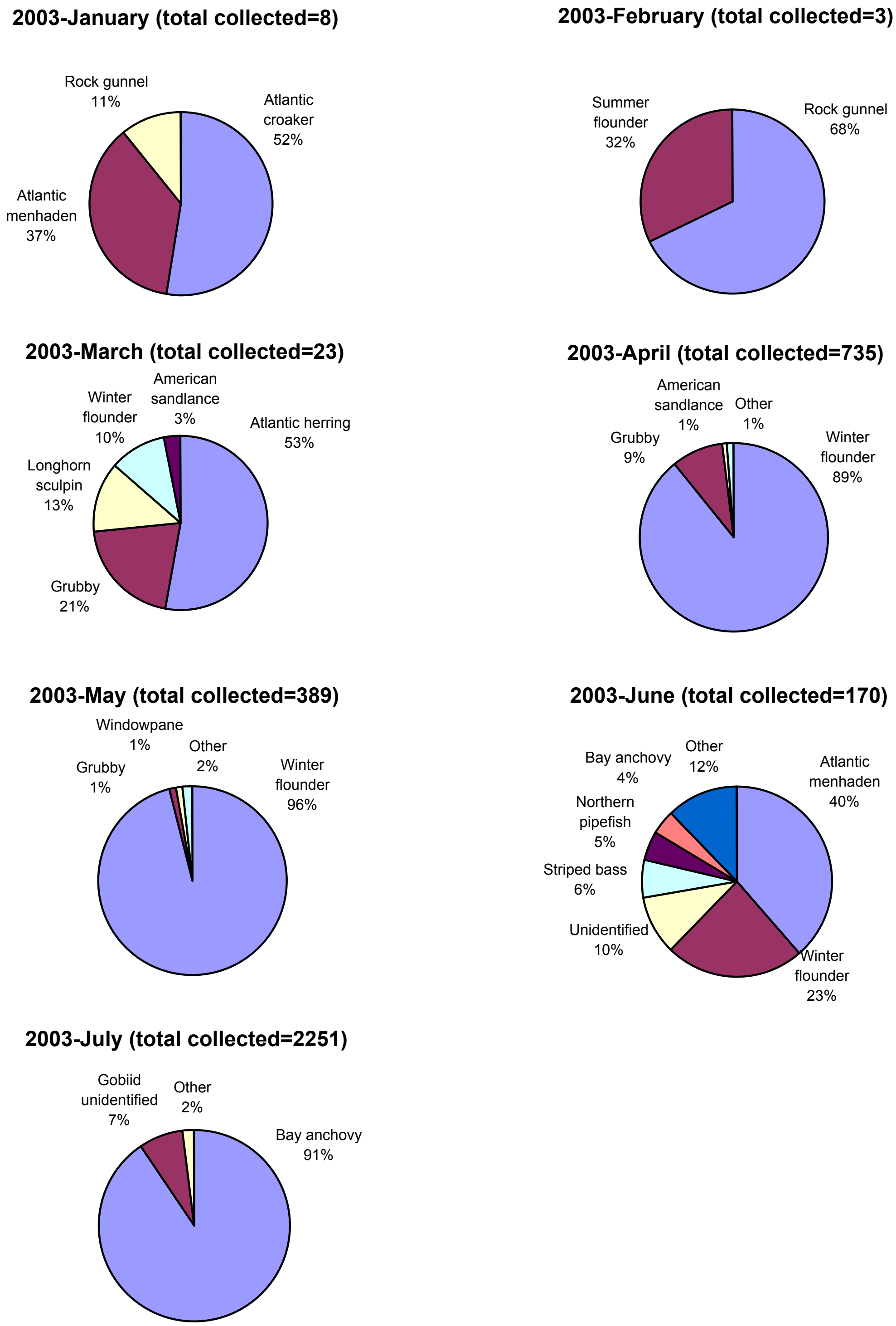


Figure 3-14 **Species composition of post yolk-sac larvae collected at Arthur Kill/Newark Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

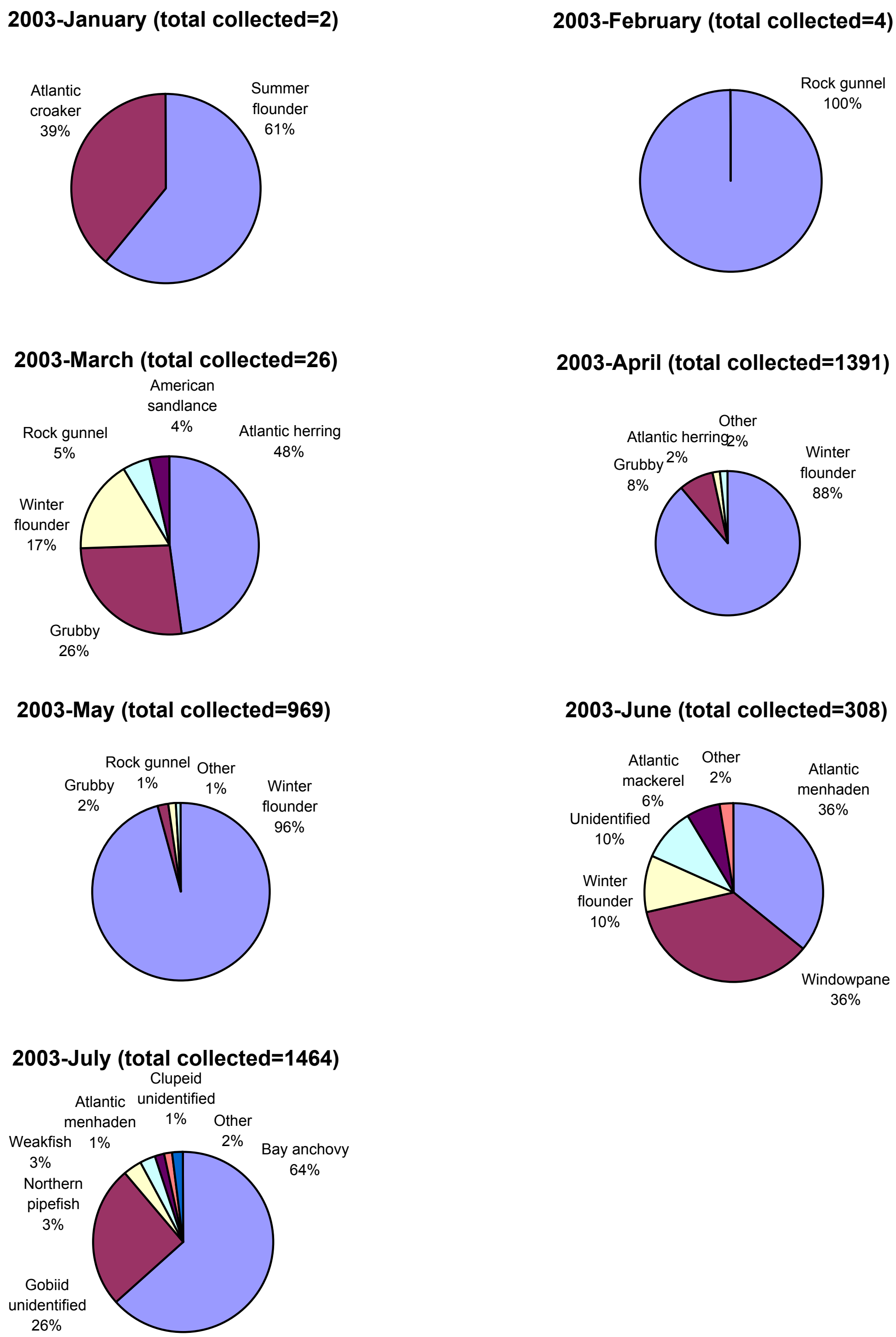


Figure 3-15 **Species composition of post yolk-sac larvae collected at Upper Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

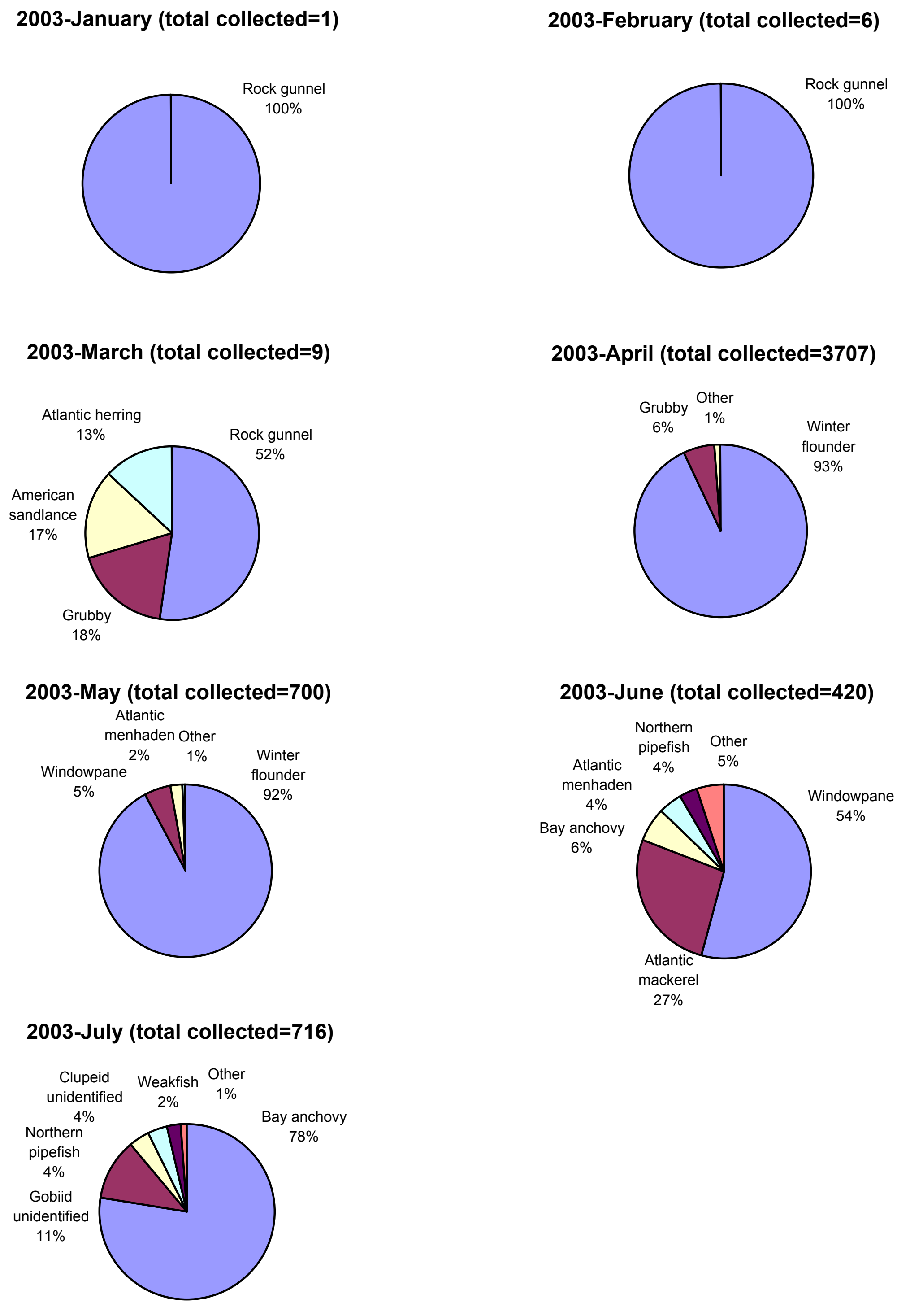


Figure 3-16 **Species composition of post yolk-sac larvae collected at Lower Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

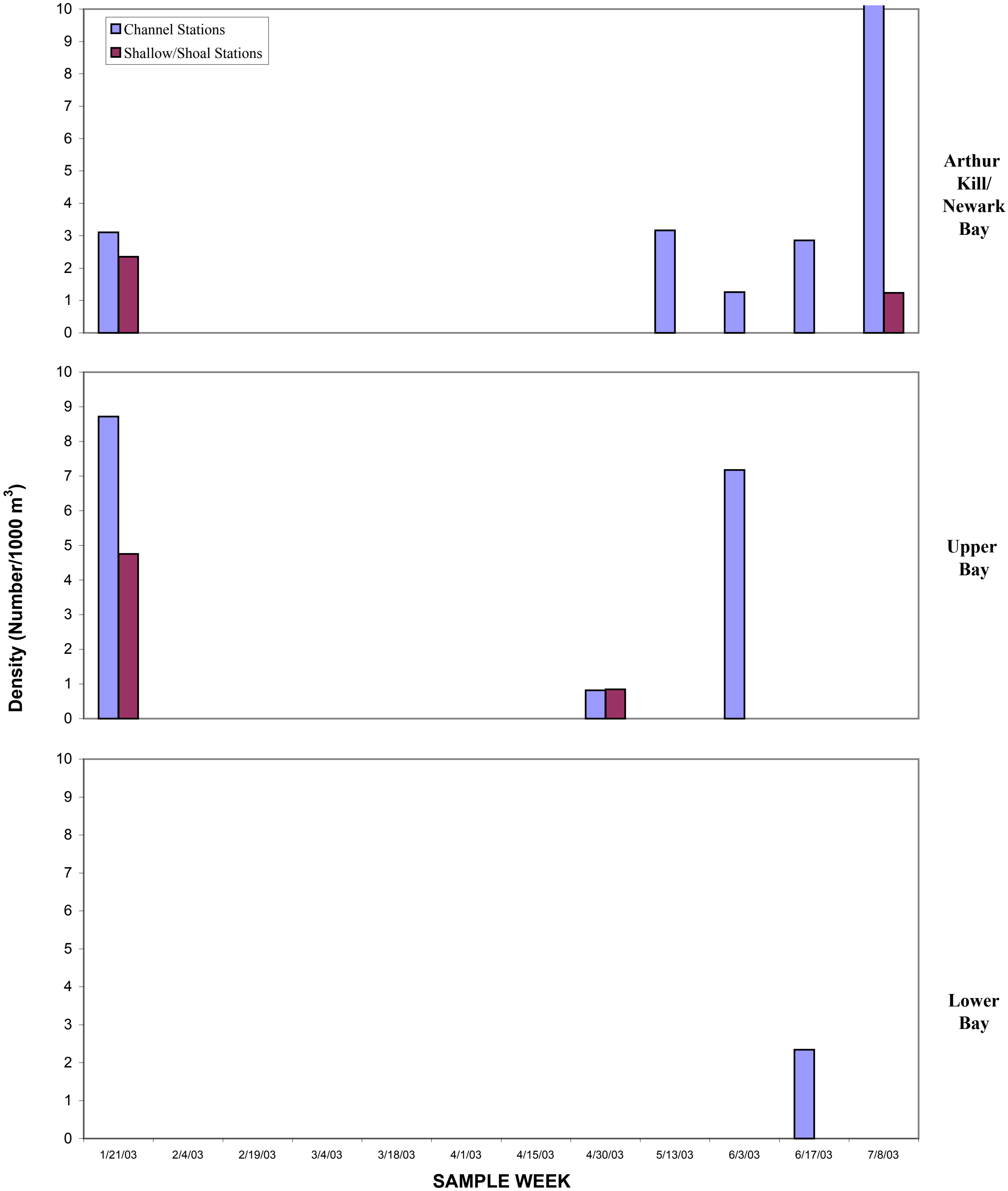


Figure 3-17 **Average weekly juvenile density of all species combined at navigation channel and shallow/shoal stations in the three sampling areas, 2002-2003 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week.

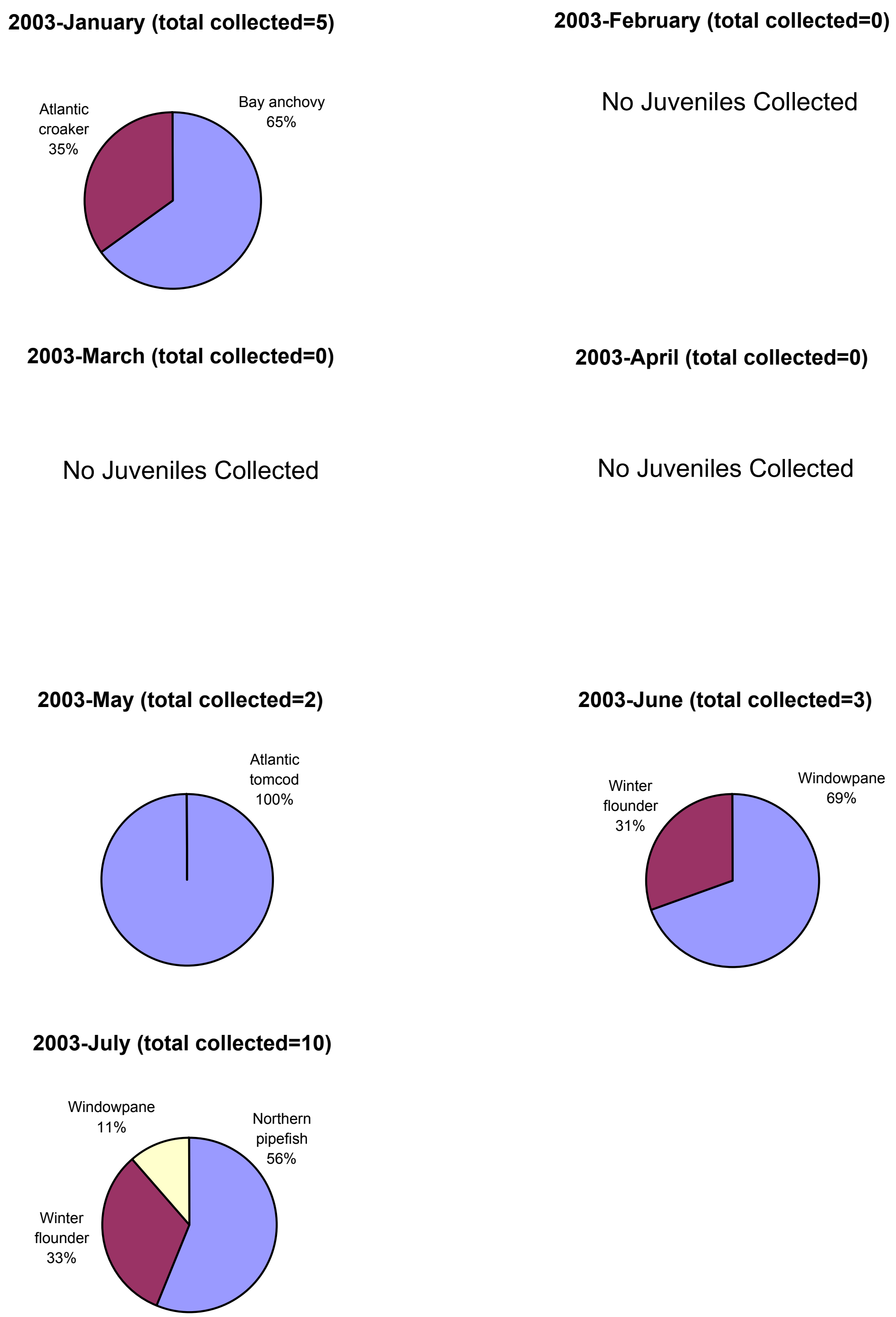
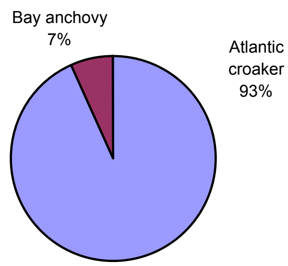


Figure 3-18 **Species composition of juveniles collected at Arthur Kill/Newark Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

2003-January (total collected=12)



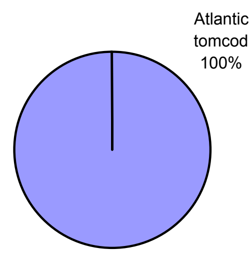
2003-February (total collected=0)

No Juveniles Collected

2003-March (total collected=0)

No Juveniles Collected

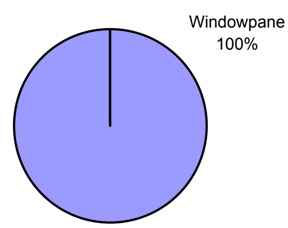
2003-April (total collected=2)



2003-May (total collected=0)

No Juveniles Collected

2003-June (total collected=4)



2003-July (total collected=0)

No Juveniles Collected

Figure 3-19 **Species composition of juveniles collected at Upper Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

2003-January (total collected=0)

No Juveniles Collected

2003-February (total collected=0)

No Juveniles Collected

2003-March (total collected=0)

No Juveniles Collected

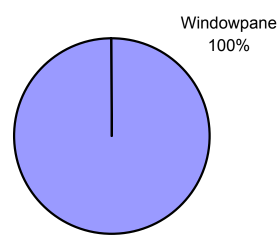
2003-April (total collected=0)

No Juveniles Collected

2003-May (total collected=0)

No Juveniles Collected

2003-June (total collected=1)



2003-July (total collected=0)

No Juveniles Collected

Figure 3-20 **Species composition of juveniles collected at Lower Bay stations during the 2002-2003 Aquatic Biological Sampling Program.**

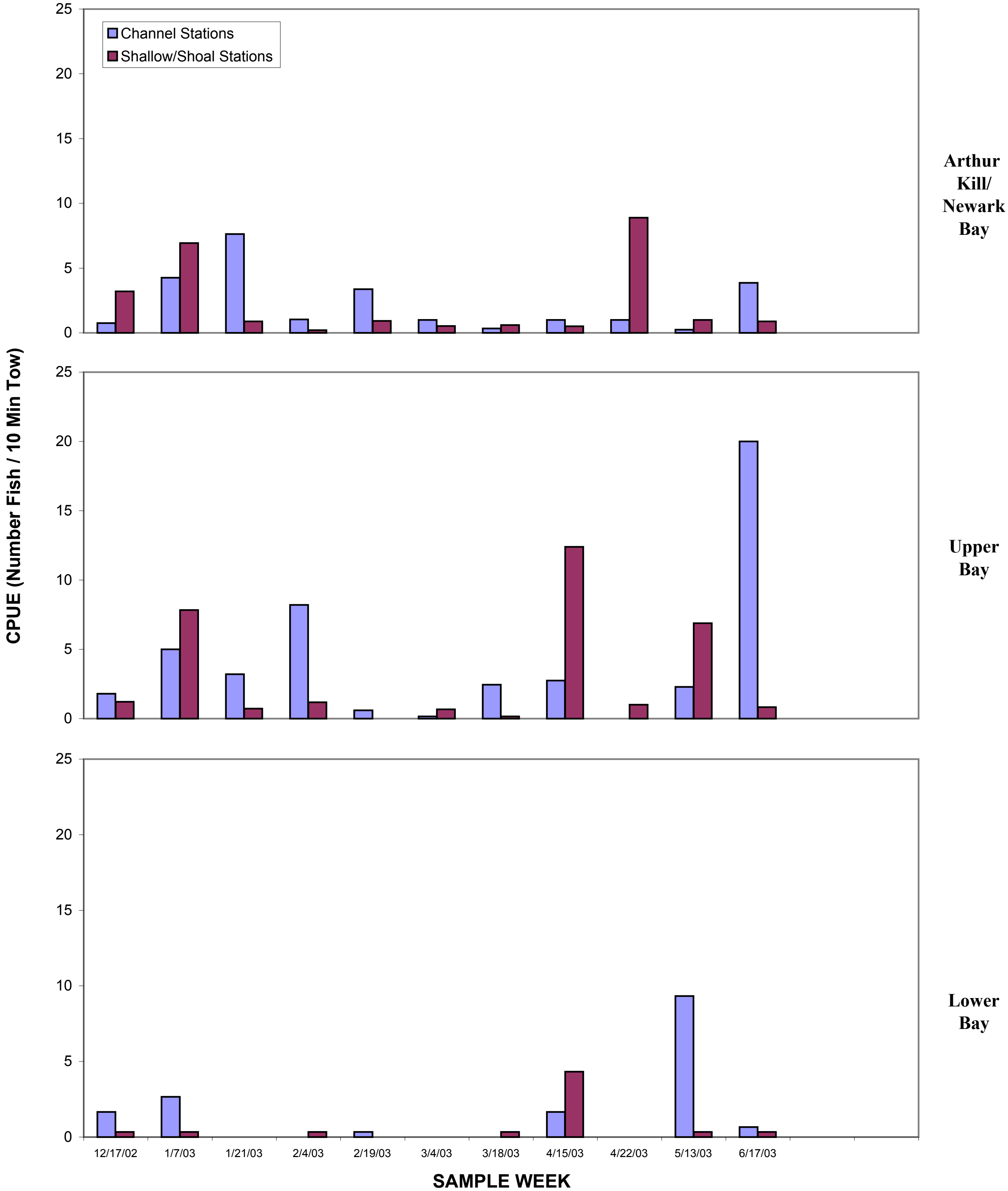


Figure 3-21 **Average weekly winter flounder trawl CPUE at navigation channel and shallow/shoal stations in the three study areas during 2002-2003 Aquatic Biological Sampling Program.**

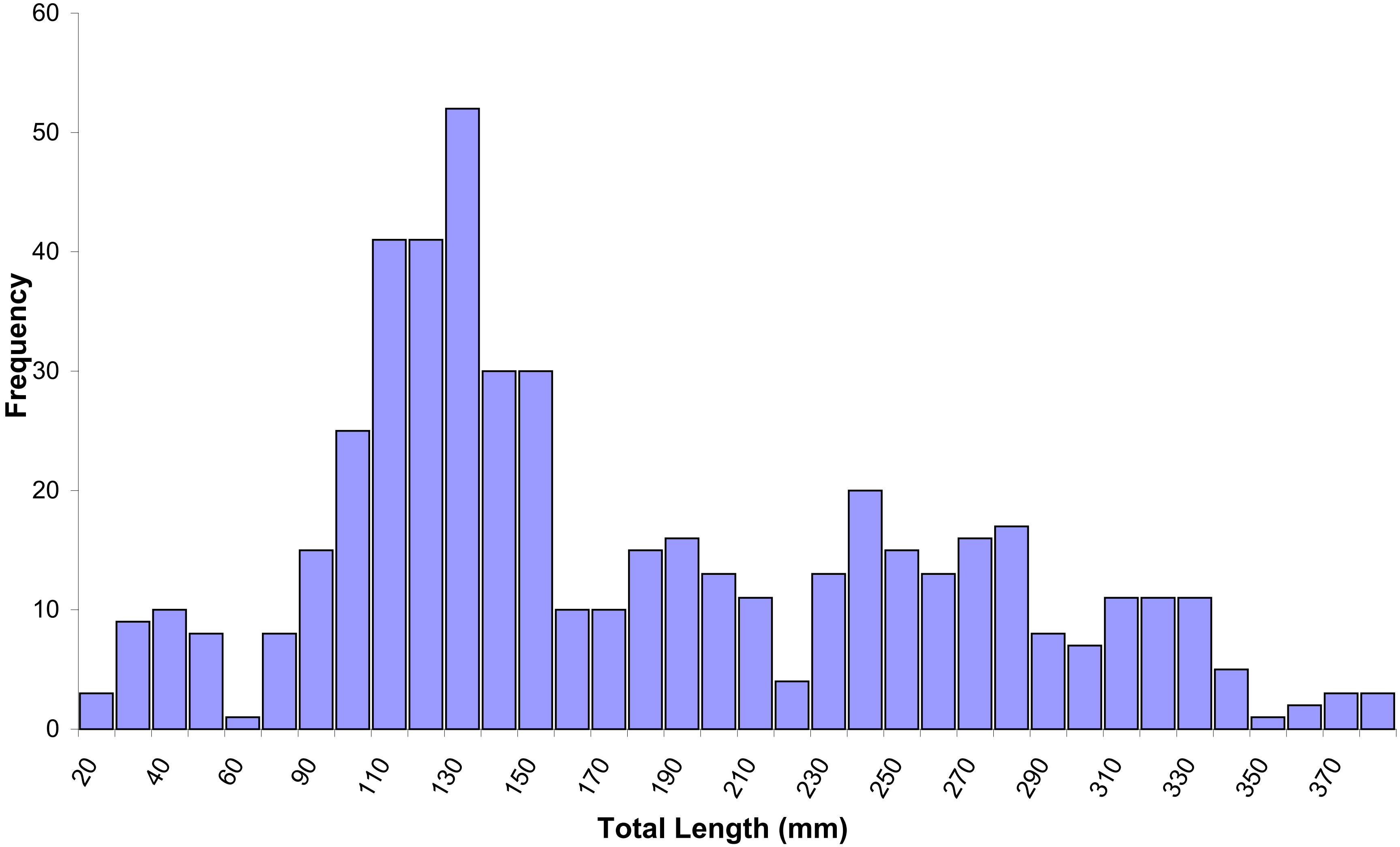


Figure 3-22 **Length frequency distribution of all winter flounder collected during trawl sampling during 2002-2003 Aquatic Biological Sampling Program.**

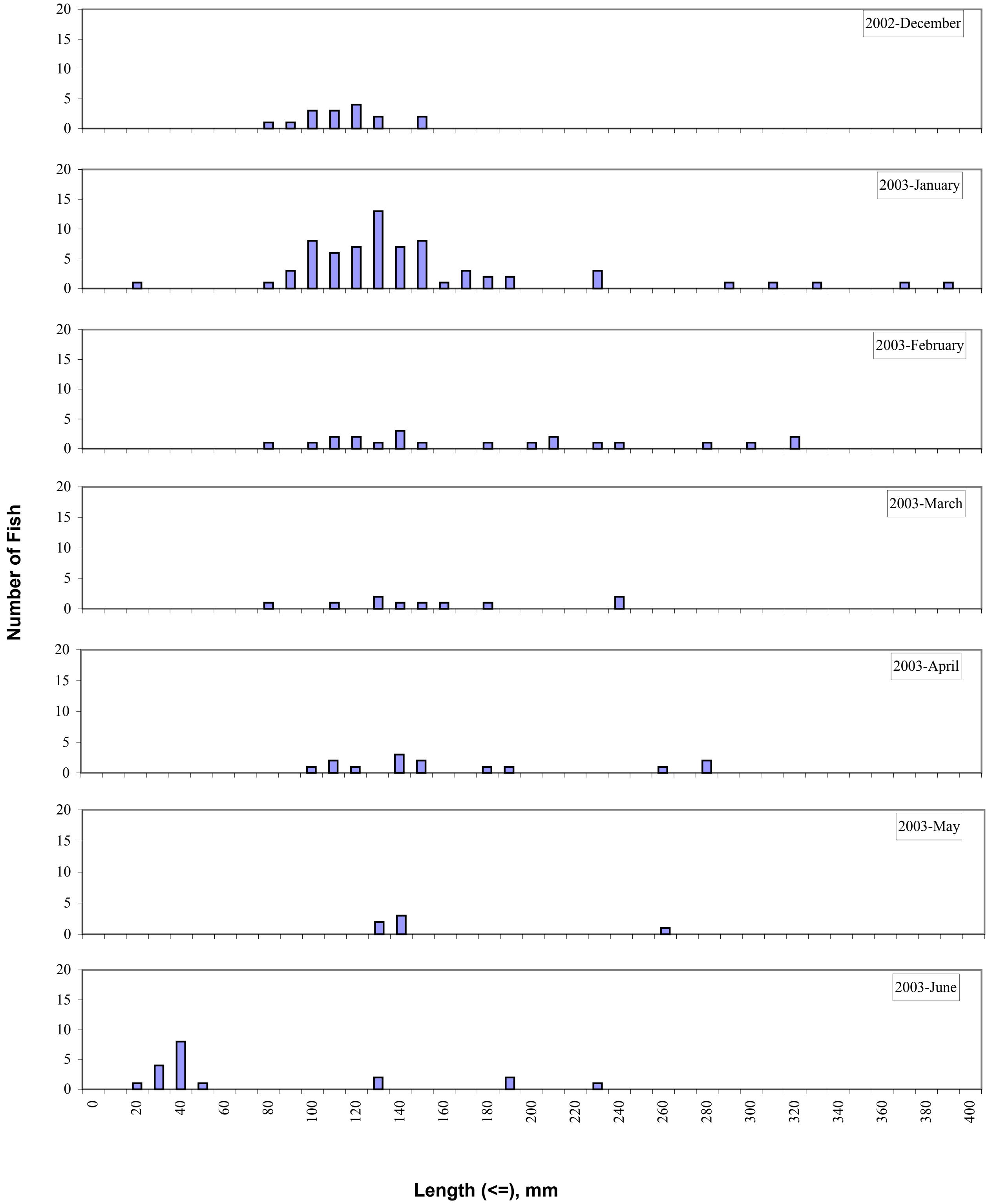


Figure 3-23 Length frequency distribution of winter flounder collected during trawl sampling at Arthur Kill/Newark Bay stations, 2002-2003 Aquatic Biological Sampling Program.

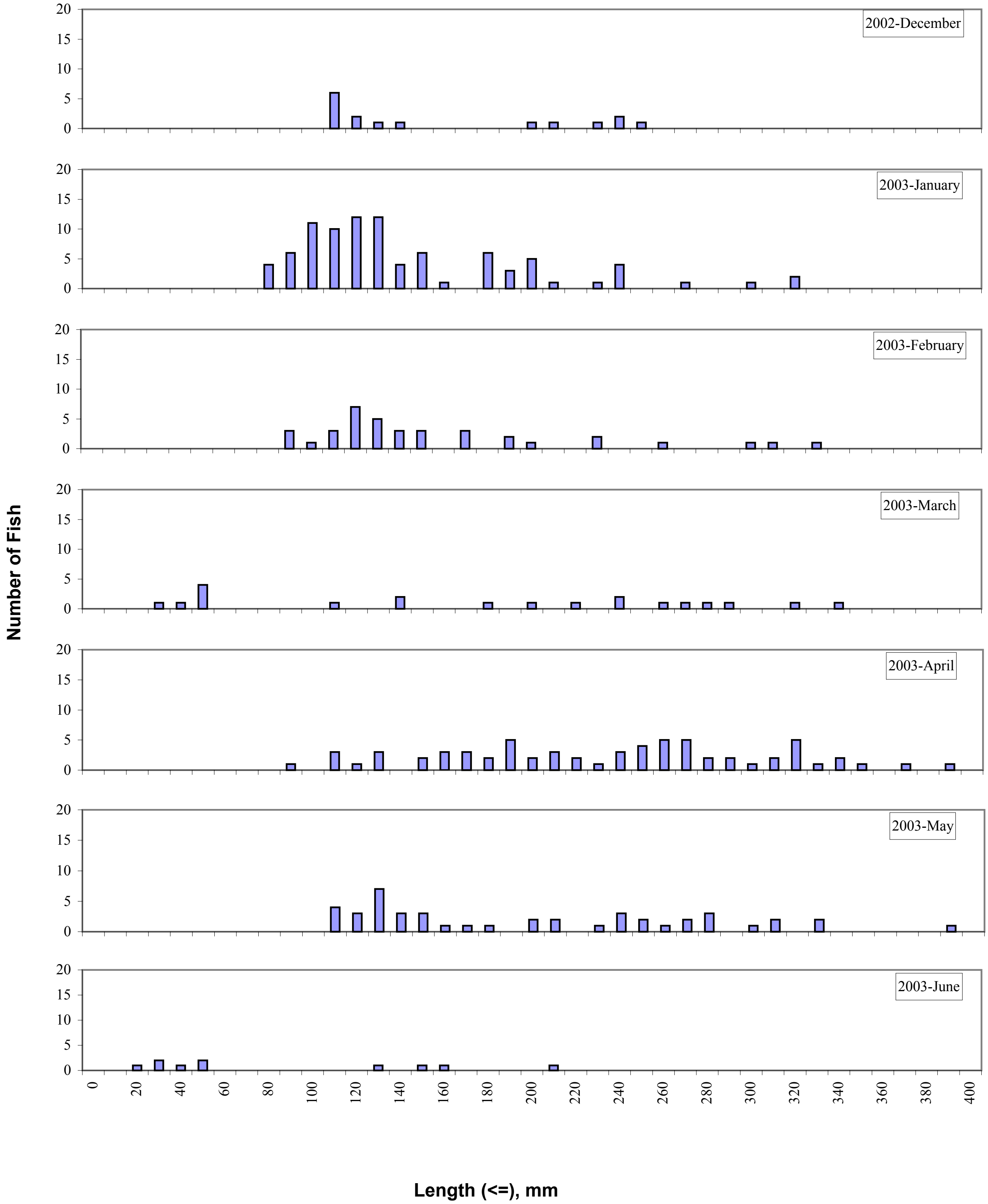


Figure 3-24 **Length frequency distribution of winter flounder collected during trawl sampling at Upper Bay stations, 2002-2003 Aquatic Biological Sampling Program.**

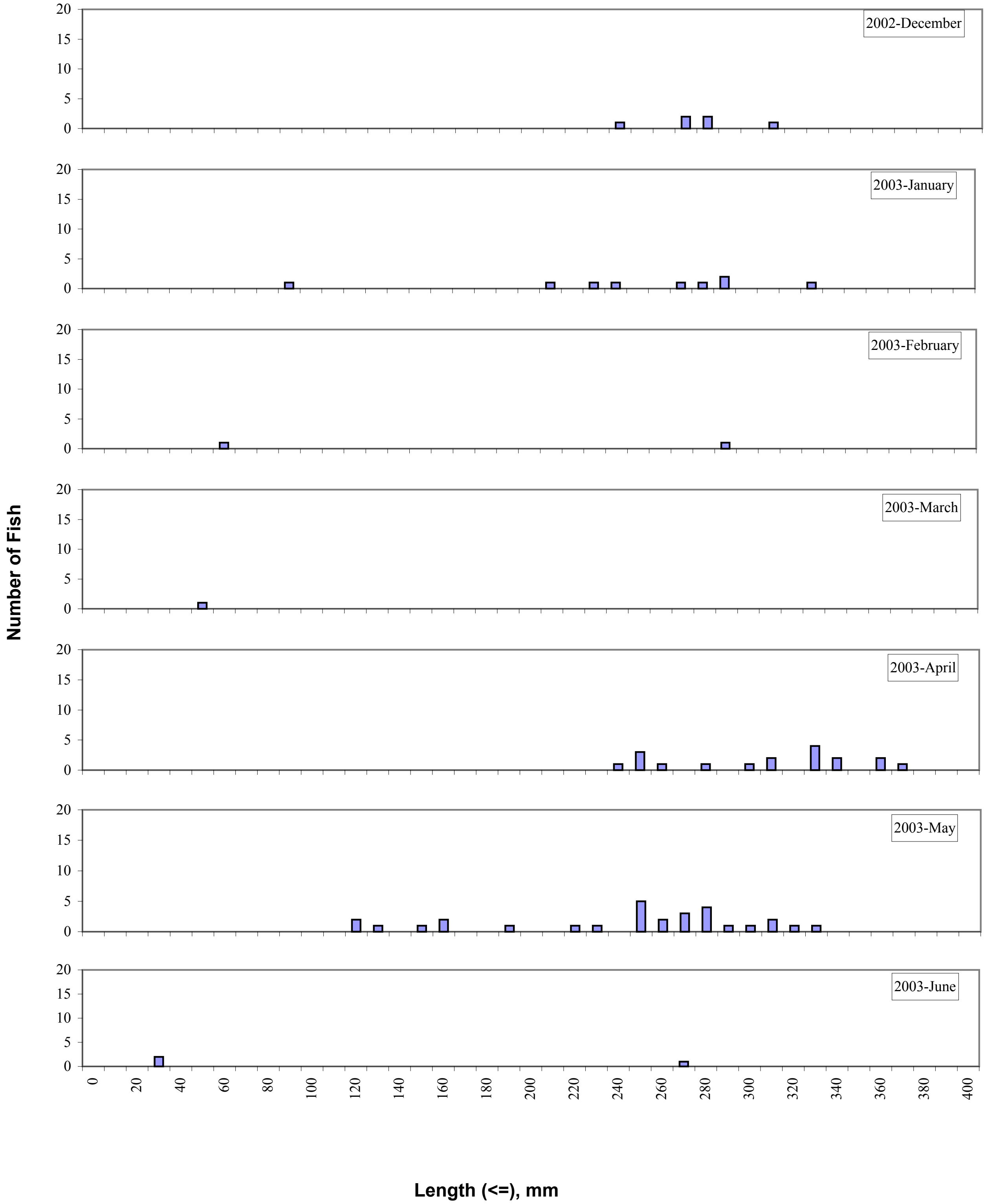


Figure 3-25 **Length frequency distribution of winter flounder collected during trawl sampling at Lower Bay stations, 2002-2003 Aquatic Biological Sampling Program.**

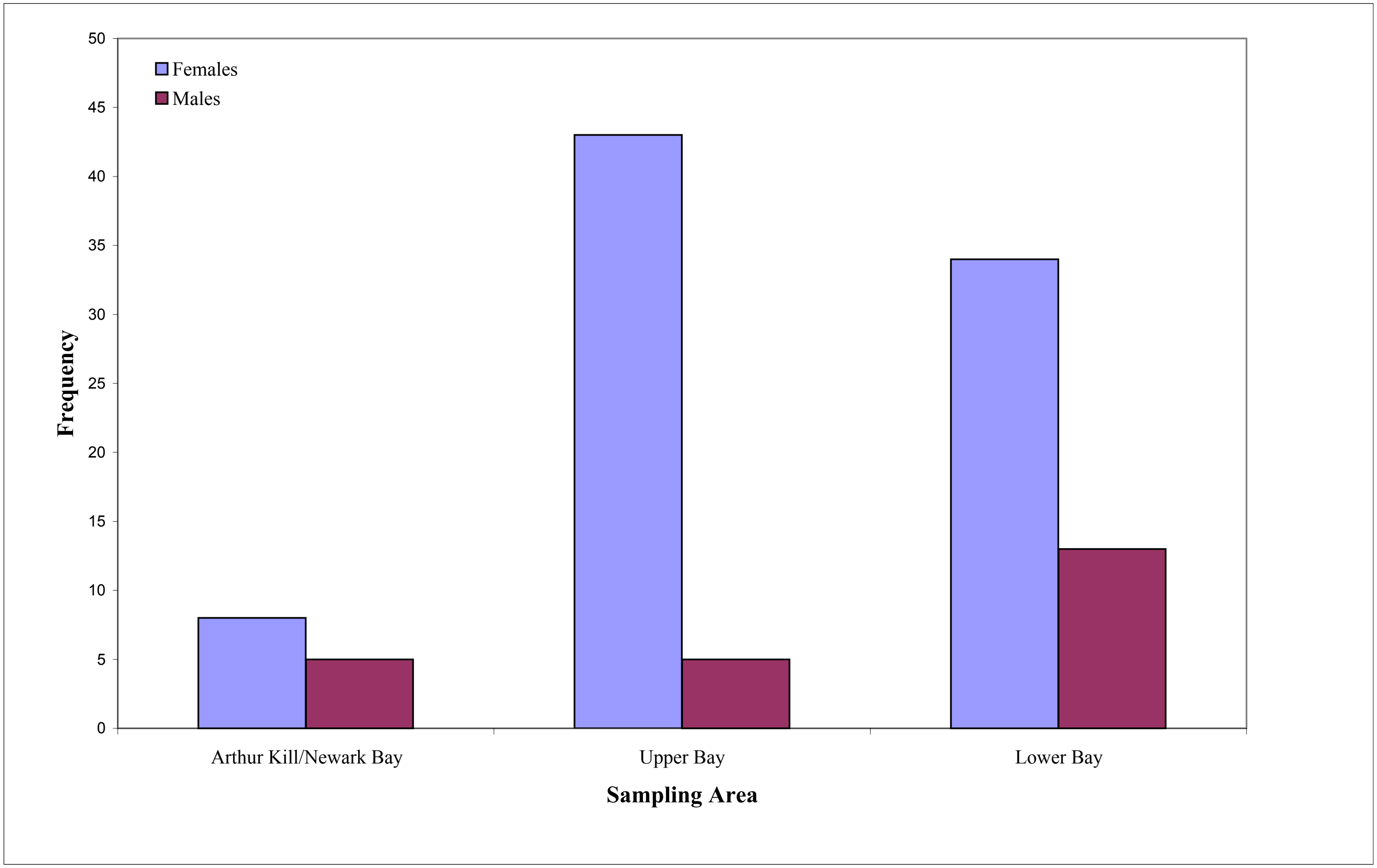


Figure 3-26 **Sex Frequency of 108 Winter Flounder (Total length ≤ 235 mm) Collected in Trawls During 2002-2003 Aquatic Biological Sampling Program.**

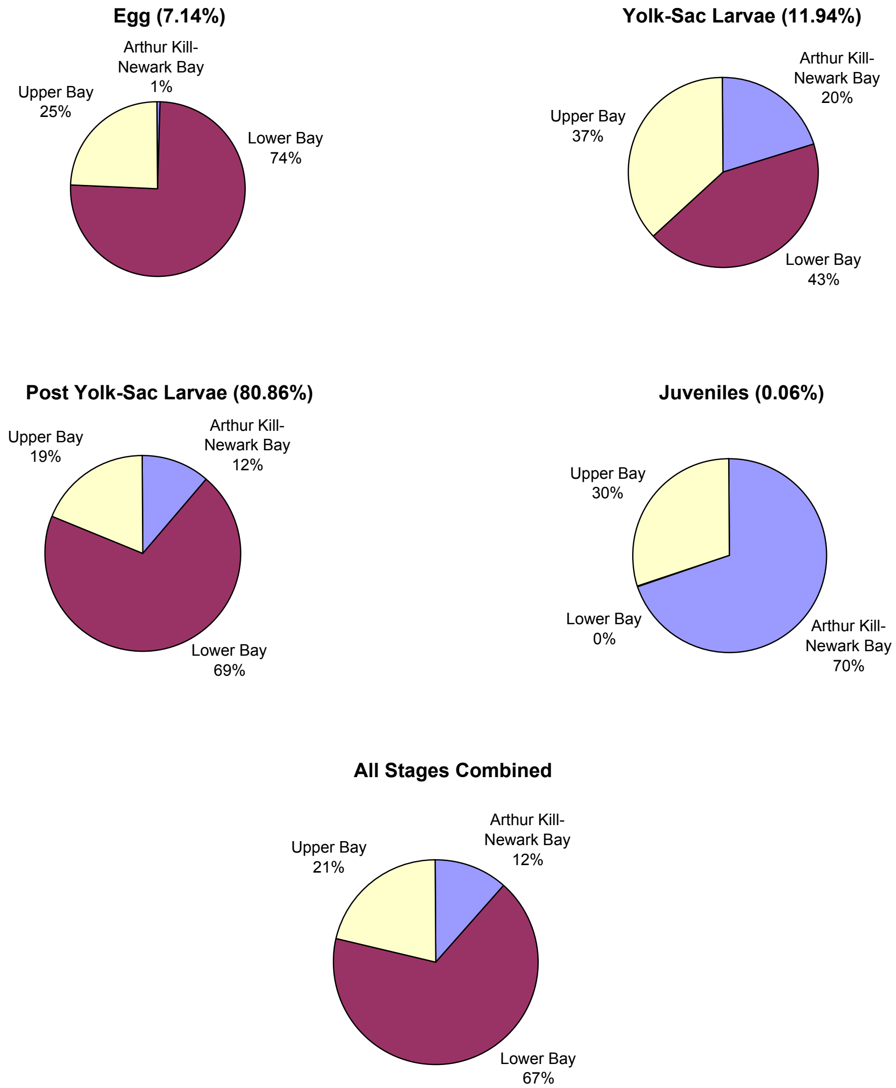


Figure 3-27 Distribution of winter flounder lifestages collected in the three study areas, 2002-2003 Aquatic Biological Sampling Program.

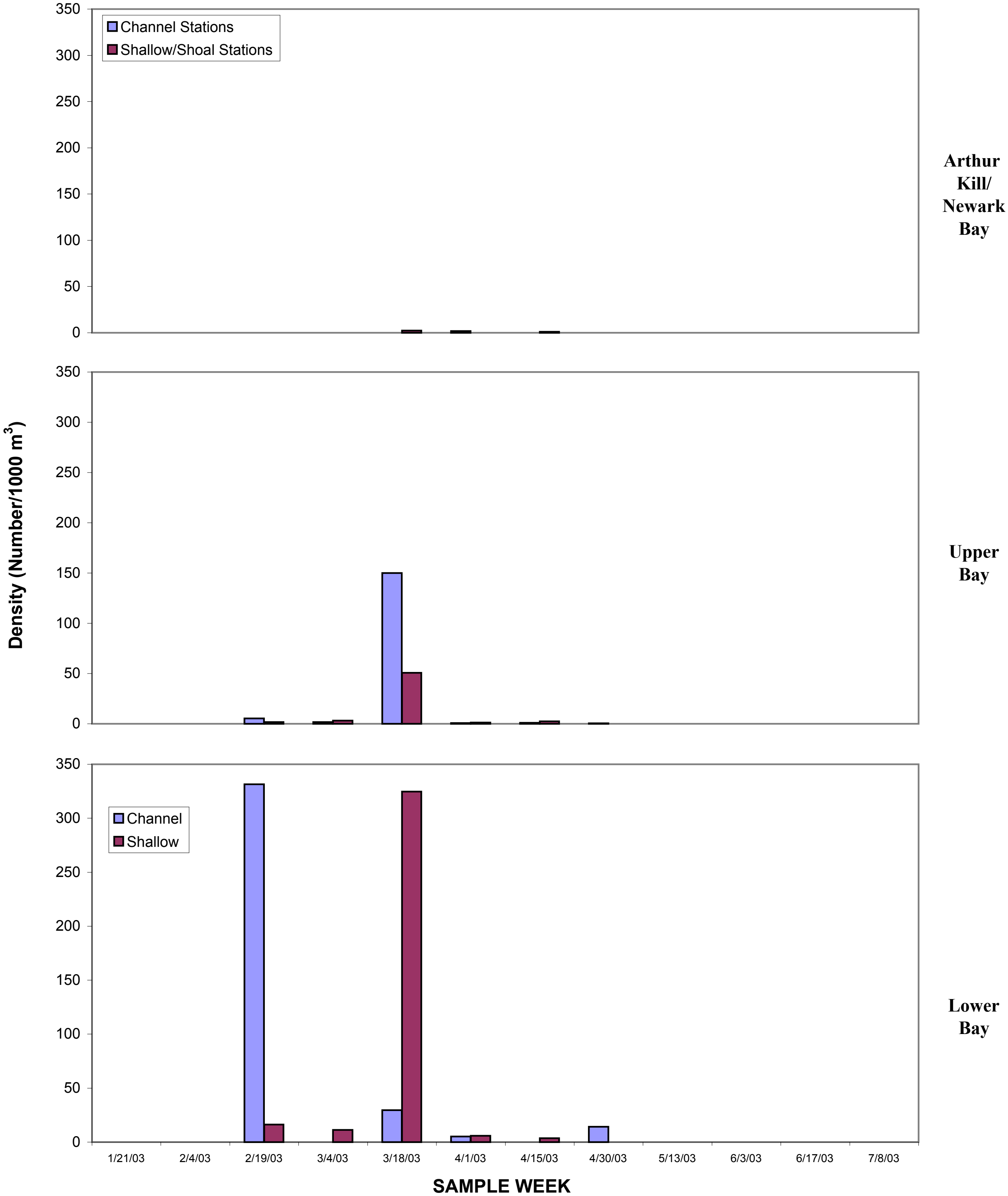


Figure 3-28 **Average weekly winter flounder egg density at navigation channel and shallow/shoal stations in the three study areas, 2002-2003 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week.

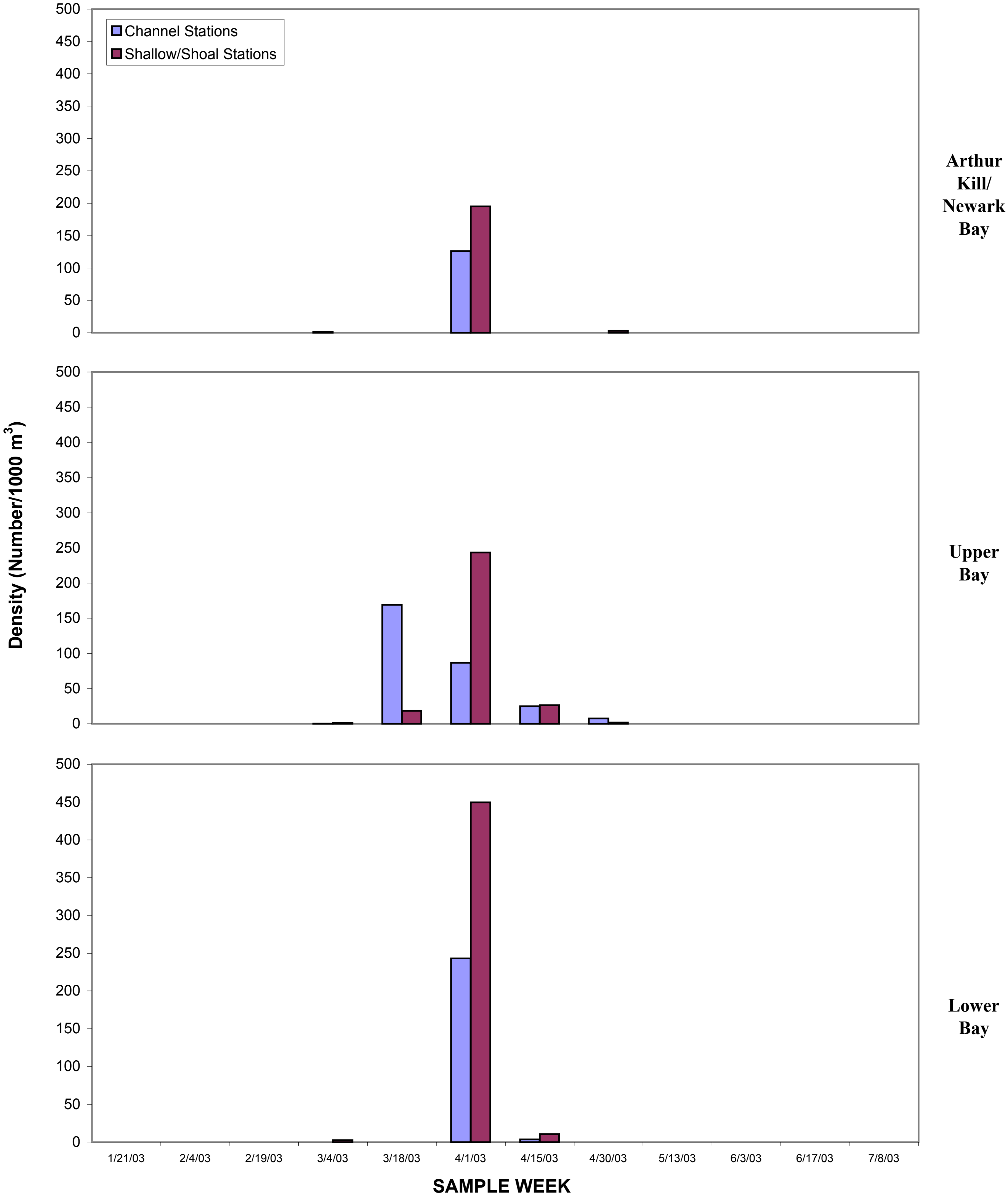


Figure 3-29 **Average weekly winter flounder yolk-sac density at navigation channel and shallow/shoal stations in the three study areas, 2002-2003 Aquatic Biological Sampling Program.**

Note(s): Dates listed indicate the first day of each sample week.

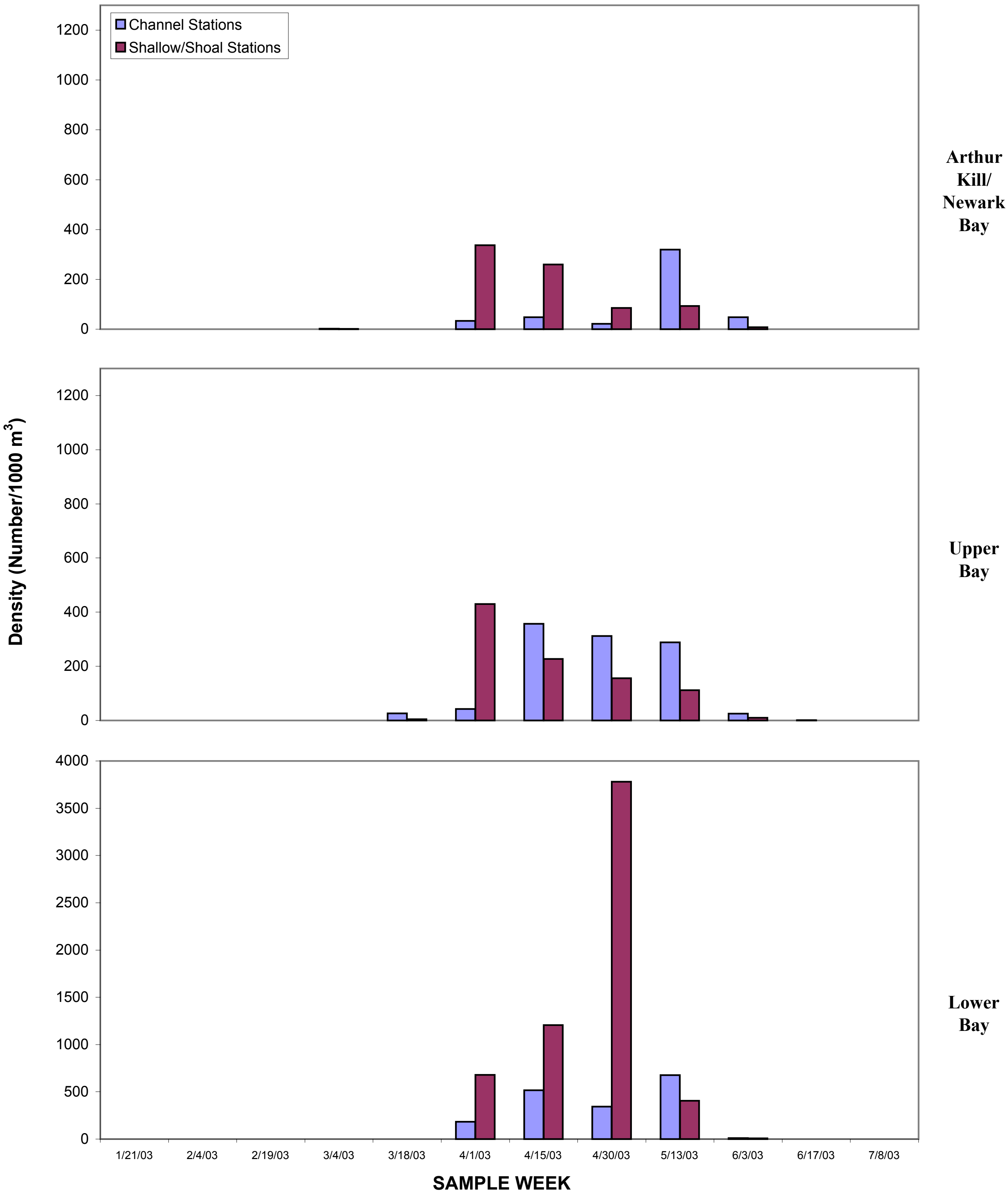


Figure 3-30 Average weekly winter flounder post yolk-sac density at navigation channel and shallow/shoal stations in the three study areas, 2002-2003 Aquatic Biological Sampling Program.

Note(s): Dates listed indicate the first day of each sample week. Note scale change for Lower Bay.

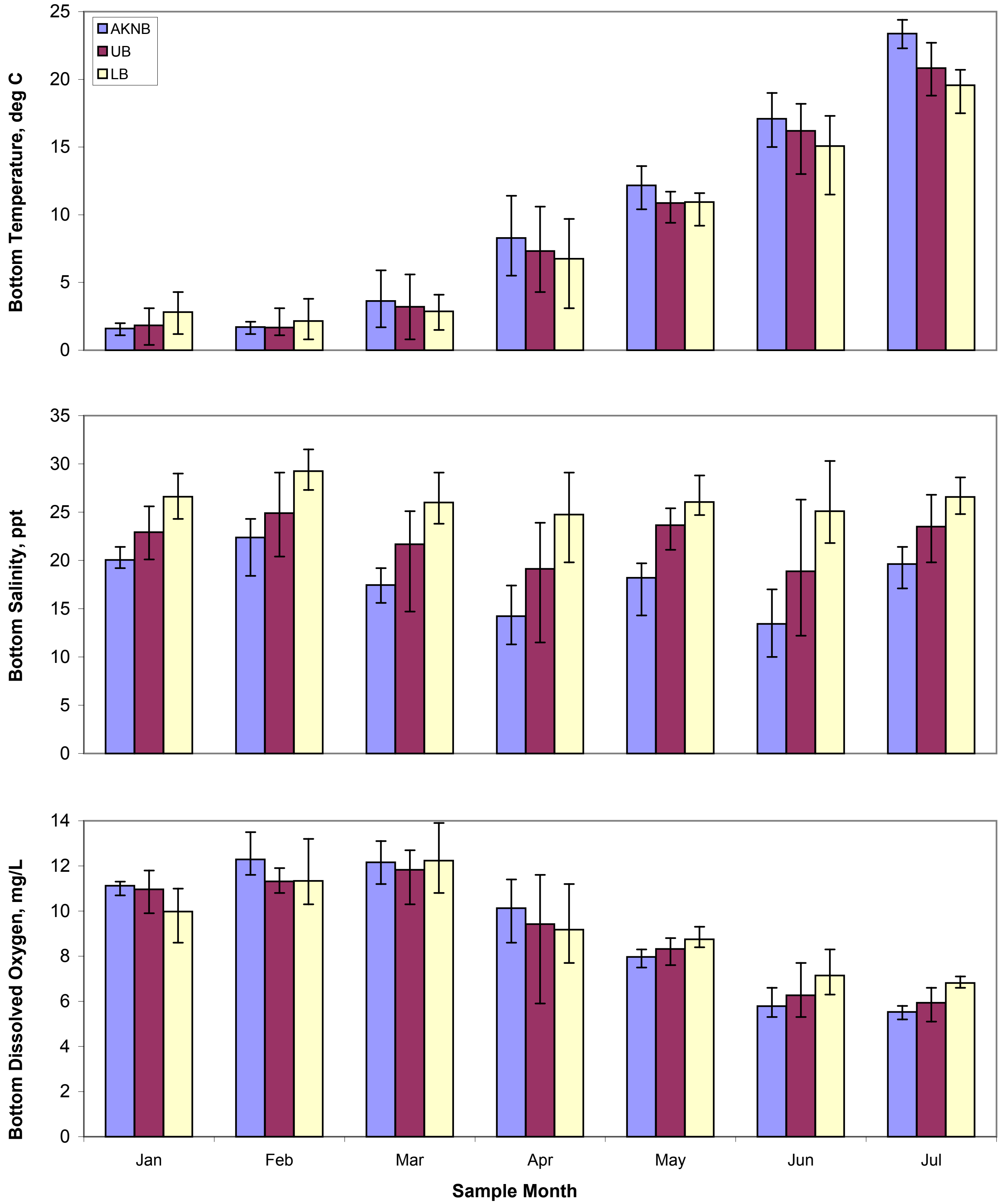


Figure 3-37 Average monthly water quality measurements by area in the three sampling areas during the 2002-2003 Aquatic Biological Sampling Program.

Date	Station	Common Name	CPUE
12/17/2002	LB-1	Alewife	3.0
12/17/2002	LB-1	American Sandlance	4.0
12/17/2002	LB-1	Bay Anchovy	3.0
12/17/2002	LB-1	Cunner	1.0
12/17/2002	LB-1	Little Skate	3.0
12/17/2002	LB-1	Spotted Hake	3.0
12/17/2002	LB-1	Winter Flounder	1.0
12/17/2002	LB-2	American Shad	1.0
12/17/2002	LB-2	Bay Anchovy	6.0
12/17/2002	LB-2	Butterfish	1.0
12/17/2002	LB-2	Conger Eel	1.0
12/17/2002	LB-2	Little Skate	3.0
12/17/2002	LB-2	Silver Hake	22.0
12/17/2002	LB-2	Spotted Hake	22.0
12/17/2002	LB-2	Summer Flounder	2.0
12/17/2002	LB-2	Weakfish	1.0
12/17/2002	LB-2	Windowpane	1.0
12/17/2002	LB-3	Alewife	1.0
12/17/2002	LB-3	American Sandlance	47.0
12/17/2002	LB-3	American Shad	1.0
12/17/2002	LB-3	Bay Anchovy	4.0
12/17/2002	LB-3	Spotted Hake	3.0
12/17/2002	LB-3	Summer Flounder	1.0
12/17/2002	LB-3	Windowpane	2.0
12/17/2002	LB-4	Alewife	7.0
12/17/2002	LB-4	Atlantic Croaker	3.0
12/17/2002	LB-4	Atlantic Menhaden	10.0
12/17/2002	LB-4	Bay Anchovy	15.0
12/17/2002	LB-4	Blueback Herring	1.0
12/17/2002	LB-4	Little Skate	10.0
12/17/2002	LB-4	Northern Pipefish	1.0
12/17/2002	LB-4	Red Hake	3.0
12/17/2002	LB-4	Seaboard Goby	1.0
12/17/2002	LB-4	Silver Hake	14.0
12/17/2002	LB-4	Spotted Hake	171.0
12/17/2002	LB-4	Striped Bass	5.0
12/17/2002	LB-4	Weakfish	2.0
12/17/2002	LB-4	White Mullet	1.0
12/17/2002	LB-4	Windowpane	2.0
12/17/2002	LB-4	Winter Flounder	1.0
12/17/2002	LB-5	Alewife	1.0
12/17/2002	LB-5	American Sandlance	5.0
12/17/2002	LB-5	Little Skate	2.0
12/17/2002	LB-5	Spotted Hake	7.0
12/17/2002	LB-5	Summer Flounder	3.0
12/17/2002	LB-5	Windowpane	2.0
12/17/2002	LB-6	American Eel	1.0
12/17/2002	LB-6	American Sandlance	1.0
12/17/2002	LB-6	Bay Anchovy	2.0
12/17/2002	LB-6	Conger Eel	1.0

Date	Station	Common Name	CPUE
12/17/2002	LB-6	Little Skate	10.0
12/17/2002	LB-6	Spotted Hake	97.0
12/17/2002	LB-6	White Perch	2.0
12/17/2002	LB-6	Windowpane	4.0
12/17/2002	LB-6	Winter Flounder	4.0
12/17/2002	SB-3	Bay Anchovy	1.0
12/17/2002	SB-3	Blueback Herring	92.0
12/17/2002	SB-3	Naked Goby	2.0
12/17/2002	SB-4	Alewife	3.0
12/17/2002	SB-4	Atlantic Croaker	1.0
12/17/2002	SB-4	Bay Anchovy	1.0
12/17/2002	SB-4	Blueback Herring	3.0
12/17/2002	SB-4	Little Skate	1.0
12/17/2002	SB-4	Spotted Hake	9.0
12/17/2002	SB-4	Striped Bass	7.0
12/17/2002	SB-4	Winter Flounder	1.0
12/17/2002	SB-6	Bay Anchovy	2.5
12/17/2002	SB-6	Blueback Herring	1.3
12/17/2002	SB-6	Little Skate	3.8
12/17/2002	SB-6	Red Hake	1.3
12/17/2002	SB-6	Spotted Hake	15.0
12/17/2002	SB-6	Striped Bass	1.3
12/17/2002	SB-6	Summer Flounder	3.8
12/17/2002	SB-6	Windowpane	3.8
12/18/2002	AK-1	Bay Anchovy	1.4
12/18/2002	AK-1	Gizzard Shad	2.9
12/18/2002	AK-1	Striped Bass	157.1
12/18/2002	AK-1	White Perch	864.3
12/18/2002	AK-2	Alewife	8.0
12/18/2002	AK-2	Atlantic Menhaden	1.0
12/18/2002	AK-2	Bay Anchovy	1.0
12/18/2002	AK-2	Blueback Herring	5.0
12/18/2002	AK-2	Cunner	1.0
12/18/2002	AK-2	Northern Searobin	1.0
12/18/2002	AK-2	Red Hake	1.0
12/18/2002	AK-2	Spotted Hake	1.0
12/18/2002	AK-2	Striped Bass	1.0
12/18/2002	AK-2	White Perch	11.0
12/18/2002	AK-3	White Perch	3.0
12/18/2002	AK-4	Alewife	1.0
12/18/2002	AK-4	Northern Pipefish	1.0
12/18/2002	AK-4	Striped Bass	13.0
12/18/2002	AK-4	White Perch	2.0
12/18/2002	NB-3	Alewife	4.0
12/18/2002	NB-3	American Sandlance	1.0
12/18/2002	NB-3	Atlantic Menhaden	1.0
12/18/2002	NB-3	Bay Anchovy	1.0
12/18/2002	NB-3	Striped Bass	11.0
12/18/2002	NB-3	White Perch	72.0
12/18/2002	NB-3	Winter Flounder	5.0

Date	Station	Common Name	CPUE
12/18/2002	NB-4	Alewife	9.0
12/18/2002	NB-4	Atlantic Menhaden	1.0
12/18/2002	NB-4	Gizzard Shad	2.0
12/18/2002	NB-4	Naked Goby	1.0
12/18/2002	NB-4	Striped Bass	24.0
12/18/2002	NB-4	White Perch	22.0
12/18/2002	NB-4	Winter Flounder	1.0
12/18/2002	NB-5	Alewife	2.0
12/18/2002	NB-5	Blueback Herring	1.0
12/18/2002	NB-5	Gizzard Shad	2.0
12/18/2002	NB-5	Striped Bass	28.0
12/18/2002	NB-5	White Perch	96.0
12/18/2002	NB-5	Winter Flounder	1.0
12/18/2002	NB-7	Alewife	31.4
12/18/2002	NB-7	Gizzard Shad	4.3
12/18/2002	NB-7	Silver Hake	1.4
12/18/2002	NB-7	Spotted Hake	2.9
12/18/2002	NB-7	Striped Bass	22.9
12/18/2002	NB-7	White Perch	67.1
12/18/2002	NB-7	Winter Flounder	10.0
12/18/2002	SB-1	Alewife	46.7
12/18/2002	SB-1	American Sandlance	3.3
12/18/2002	SB-1	American Shad	6.7
12/18/2002	SB-1	Atlantic Cod	23.3
12/18/2002	SB-1	Cunner	3.3
12/18/2002	SB-1	Silver Hake	3.3
12/18/2002	SB-1	Spotted Hake	6.7
12/18/2002	SB-1	Striped Bass	100.0
12/18/2002	SB-1	Summer Flounder	3.3
12/18/2002	SB-2	Alewife	10.0
12/18/2002	SB-2	American Sandlance	5.0
12/18/2002	SB-2	Atlantic Croaker	27.5
12/18/2002	SB-2	Little Skate	7.5
12/18/2002	SB-2	Spotted Hake	15.0
12/18/2002	SB-2	Striped Bass	110.0
12/18/2002	SB-2	White Mullet	2.5
12/19/2002	NB-6	Alewife	5.0
12/19/2002	NB-6	Atlantic Menhaden	5.0
12/19/2002	NB-6	Blueback Herring	4.0
12/19/2002	NB-6	Spotted Hake	1.0
12/19/2002	NB-6	Striped Bass	56.0
12/19/2002	NB-6	White Perch	222.0
12/19/2002	NB-6	Winter Flounder	2.0
12/19/2002	PJ-1	Alewife	2.0
12/19/2002	PJ-1	Striped Bass	18.0
12/19/2002	PJ-1	Summer Flounder	5.0
12/19/2002	PJ-2	Alewife	8.0
12/19/2002	PJ-2	American Sandlance	1.0
12/19/2002	PJ-2	American Shad	1.0
12/19/2002	PJ-2	Blueback Herring	2.0

Date	Station	Common Name	CPUE
12/19/2002	PJ-2	Striped Bass	53.0
12/19/2002	PJ-2	White Perch	1.0
12/19/2002	PJ-2	Winter Flounder	6.0
12/19/2002	PJ-3	American Sandlance	2.5
12/19/2002	PJ-3	Striped Bass	10.0
12/19/2002	PJ-3	Summer Flounder	1.3
12/19/2002	PJ-3	Windowpane	1.3
12/19/2002	PJ-3	Winter Flounder	1.3
12/19/2002	PJ-4	Alewife	2.0
12/19/2002	PJ-4	American Shad	4.0
12/19/2002	PJ-4	Atlantic Croaker	5.0
12/19/2002	PJ-4	Blueback Herring	7.0
12/19/2002	PJ-4	Northern Pipefish	1.0
12/19/2002	PJ-4	Spotted Hake	12.0
12/19/2002	PJ-4	Striped Bass	5.0
12/19/2002	PJ-4	White Perch	4.0
12/19/2002	PJ-4	Winter Flounder	1.0
12/19/2002	PJ-5	Alewife	1.0
12/19/2002	PJ-5	Atlantic Croaker	1.0
12/19/2002	PJ-5	Atlantic Menhaden	1.0
12/19/2002	PJ-5	Bay Anchovy	2.0
12/19/2002	PJ-5	Blueback Herring	5.0
12/19/2002	PJ-5	Northern Pipefish	1.0
12/19/2002	PJ-5	Spotted Hake	18.0
12/19/2002	PJ-5	Striped Bass	12.0
12/19/2002	PJ-5	Weakfish	3.0
12/19/2002	PJ-5	White Perch	1.0
12/19/2002	PJ-5	Winter Flounder	6.0
12/19/2002	SB-5	Alewife	2.0
12/19/2002	SB-5	Atlantic Menhaden	2.0
12/19/2002	SB-5	Blueback Herring	18.0
12/19/2002	SB-5	Little Skate	1.0
12/19/2002	SB-5	Red Hake	2.0
12/19/2002	SB-5	Spotted Hake	5.0
12/19/2002	SB-5	Windowpane	1.0
12/19/2002	SB-5	Winter Flounder	1.0
1/7/2003	AK-4	Striped Bass	19.0
1/7/2003	NB-3	Atlantic Silverside	4.0
1/7/2003	NB-3	Gizzard Shad	1.0
1/7/2003	NB-3	Striped Bass	13.0
1/7/2003	NB-3	White Perch	55.0
1/7/2003	NB-3	Winter Flounder	3.0
1/7/2003	NB-4	Alewife	2.0
1/7/2003	NB-4	Atlantic Silverside	9.0
1/7/2003	NB-4	Striped Bass	13.0
1/7/2003	NB-4	White Perch	81.0
1/7/2003	NB-4	Winter Flounder	2.0
1/7/2003	NB-5	Bay Anchovy	1.0
1/7/2003	NB-5	Blueback Herring	2.0
1/7/2003	NB-5	Spotted Hake	1.0

Appendix A. Adult finfish (trawl) CPUEs by date and sample location. (page 5 of 22)

Date	Station	Common Name	CPUE
1/7/2003	NB-5	Striped Bass	17.0
1/7/2003	NB-5	White Perch	103.0
1/7/2003	NB-5	Winter Flounder	2.0
1/7/2003	NB-6	Alewife	1.0
1/7/2003	NB-6	Gizzard Shad	1.0
1/7/2003	NB-6	Striped Bass	31.0
1/7/2003	NB-6	White Perch	60.0
1/7/2003	NB-6	Winter Flounder	7.0
1/7/2003	NB-7	Striped Bass	86.0
1/7/2003	NB-7	White Perch	92.0
1/7/2003	NB-7	Winter Flounder	28.0
1/8/2003	AK-1	Naked Goby	1.7
1/8/2003	AK-1	Striped Bass	150.0
1/8/2003	AK-1	Striped Mullet	1.7
1/8/2003	AK-1	White Perch	295.0
1/8/2003	AK-1	Winter Flounder	1.7
1/8/2003	AK-2	Striped Bass	12.0
1/8/2003	AK-2	White Perch	23.0
1/8/2003	AK-2	Windowpane	1.0
1/8/2003	AK-2	Winter Flounder	7.0
1/8/2003	AK-3	Striped Bass	26.0
1/8/2003	AK-3	White Perch	66.0
1/8/2003	AK-3	Winter Flounder	1.0
1/8/2003	LB-1	Atlantic Silverside	1.0
1/8/2003	LB-1	Little Skate	1.0
1/8/2003	LB-1	Summer Flounder	3.0
1/8/2003	LB-1	Windowpane	5.0
1/8/2003	LB-1	Winter Flounder	1.0
1/8/2003	LB-2	Alewife	4.0
1/8/2003	LB-2	American Shad	6.0
1/8/2003	LB-2	Blueback Herring	1.0
1/8/2003	LB-2	Little Skate	3.0
1/8/2003	LB-2	Northern Pipefish	1.0
1/8/2003	LB-2	Red Hake	7.0
1/8/2003	LB-2	Silver Hake	2.0
1/8/2003	LB-2	Spotted Hake	37.0
1/8/2003	LB-2	Summer Flounder	3.0
1/8/2003	LB-3	Alewife	1.0
1/8/2003	LB-3	American Shad	1.0
1/8/2003	LB-3	Atlantic Silverside	6.0
1/8/2003	LB-3	Blueback Herring	2.0
1/8/2003	LB-3	Spotted Hake	2.0
1/8/2003	LB-3	Windowpane	1.0
1/8/2003	LB-4	Alewife	11.0
1/8/2003	LB-4	Atlantic Menhaden	1.0
1/8/2003	LB-4	Bay Anchovy	4.0
1/8/2003	LB-4	Blueback Herring	10.0
1/8/2003	LB-4	Little Skate	26.0
1/8/2003	LB-4	Northern Pipefish	4.0
1/8/2003	LB-4	Red Hake	68.0

Appendix A. Adult finfish (trawl) CPUEs by date and sample location. (page 6 of 22)

Date	Station	Common Name	CPUE
1/8/2003	LB-4	Silver Hake	10.0
1/8/2003	LB-4	Smallmouth Flounder	1.0
1/8/2003	LB-4	Spotted Hake	313.0
1/8/2003	LB-4	Striped Bass	1.0
1/8/2003	LB-4	Windowpane	4.0
1/8/2003	LB-4	Winter Flounder	2.0
1/8/2003	LB-6	Little Skate	21.0
1/8/2003	LB-6	Northern Pipefish	1.0
1/8/2003	LB-6	Spotted Hake	76.0
1/8/2003	LB-6	Windowpane	6.0
1/8/2003	LB-6	Winter Flounder	6.0
1/8/2003	PJ-2	Atlantic Silverside	2.0
1/8/2003	PJ-2	Smallmouth Flounder	1.0
1/8/2003	PJ-2	Striped Bass	25.0
1/8/2003	PJ-2	Windowpane	2.0
1/8/2003	PJ-2	Winter Flounder	24.0
1/8/2003	PJ-3	Atlantic Silverside	1.0
1/8/2003	PJ-3	Striped Bass	10.0
1/8/2003	PJ-3	Winter Flounder	9.0
1/9/2003	PJ-1	Blueback Herring	1.0
1/9/2003	PJ-1	Striped Bass	14.0
1/9/2003	PJ-1	Winter Flounder	1.0
1/9/2003	PJ-4	Alewife	1.0
1/9/2003	PJ-4	Atlantic Croaker	18.0
1/9/2003	PJ-4	Atlantic Menhaden	1.0
1/9/2003	PJ-4	Bay Anchovy	1.0
1/9/2003	PJ-4	Blueback Herring	1.0
1/9/2003	PJ-4	Conger Eel	1.0
1/9/2003	PJ-4	Little Skate	1.0
1/9/2003	PJ-4	Red Hake	1.0
1/9/2003	PJ-4	Spotted Hake	6.0
1/9/2003	PJ-4	Striped Bass	9.0
1/9/2003	PJ-4	Striped Mullet	1.0
1/9/2003	PJ-4	Windowpane	1.0
1/9/2003	PJ-4	Winter Flounder	7.0
1/9/2003	PJ-5	Alewife	2.0
1/9/2003	PJ-5	Atlantic Croaker	9.0
1/9/2003	PJ-5	Bay Anchovy	1.0
1/9/2003	PJ-5	Cunner	1.0
1/9/2003	PJ-5	Little Skate	5.0
1/9/2003	PJ-5	Smallmouth Flounder	1.0
1/9/2003	PJ-5	Spotted Hake	11.0
1/9/2003	PJ-5	Striped Bass	25.0
1/9/2003	PJ-5	Windowpane	2.0
1/9/2003	PJ-5	Winter Flounder	10.0
1/9/2003	SB-1	Alewife	3.3
1/9/2003	SB-1	Atlantic Croaker	36.7
1/9/2003	SB-1	Spotted Hake	3.3
1/9/2003	SB-1	Striped Bass	23.3
1/9/2003	SB-2	Alewife	2.5

Date	Station	Common Name	CPUE
1/9/2003	SB-2	Atlantic Croaker	25.0
1/9/2003	SB-2	Atlantic Silverside	2.5
1/9/2003	SB-2	Striped Bass	12.5
1/9/2003	SB-3	Alewife	2.0
1/9/2003	SB-3	Grubby	2.0
1/9/2003	SB-3	Seaboard Goby	3.0
1/9/2003	SB-3	Smallmouth Flounder	16.0
1/9/2003	SB-3	Spotted Hake	2.0
1/9/2003	SB-3	Striped Bass	34.0
1/9/2003	SB-3	Windowpane	2.0
1/9/2003	SB-3	Winter Flounder	13.0
1/9/2003	SB-4	Alewife	1.0
1/9/2003	SB-4	Atlantic Croaker	1.0
1/9/2003	SB-4	Bay Anchovy	1.0
1/9/2003	SB-4	Spotted Hake	2.0
1/9/2003	SB-4	Striped Bass	1.0
1/9/2003	SB-5	Alewife	1.0
1/9/2003	SB-5	Atlantic Croaker	1.0
1/9/2003	SB-5	Blueback Herring	2.0
1/9/2003	SB-5	Little Skate	11.0
1/9/2003	SB-5	Northern Pipefish	1.0
1/9/2003	SB-5	Spotted Hake	7.0
1/9/2003	SB-5	Striped Bass	5.0
1/9/2003	SB-5	Windowpane	1.0
1/9/2003	SB-5	Winter Flounder	5.0
1/9/2003	SB-6	Alosa sp.	1.0
1/9/2003	SB-6	Atlantic Croaker	2.0
1/9/2003	SB-6	Black Sea Bass	1.0
1/9/2003	SB-6	Blueback Herring	7.0
1/9/2003	SB-6	Cunner	1.0
1/9/2003	SB-6	Little Skate	15.0
1/9/2003	SB-6	Naked Goby	1.0
1/9/2003	SB-6	Red Hake	7.0
1/9/2003	SB-6	Smallmouth Flounder	3.0
1/9/2003	SB-6	Spotted Hake	28.0
1/9/2003	SB-6	Striped Bass	2.0
1/9/2003	SB-6	Summer Flounder	1.0
1/9/2003	SB-6	Tautog	1.0
1/9/2003	SB-6	Windowpane	23.0
1/9/2003	SB-6	Winter Flounder	3.0
1/21/2003	LB-1	Summer Flounder	1.0
1/21/2003	LB-2	Alewife	1.0
1/21/2003	LB-2	Blueback Herring	1.0
1/21/2003	LB-2	Spotted Hake	6.0
1/21/2003	LB-2	Summer Flounder	1.0
1/21/2003	LB-4	Alewife	4.0
1/21/2003	LB-4	Atlantic Herring	1.0
1/21/2003	LB-4	Atlantic Silverside	1.0
1/21/2003	LB-4	Blueback Herring	29.0
1/21/2003	LB-4	Little Skate	1.0

Date	Station	Common Name	CPUE
1/21/2003	LB-4	Spotted Hake	2.0
1/21/2003	LB-5	Atlantic Silverside	1.0
1/21/2003	LB-6	Alewife	4.0
1/21/2003	LB-6	Little Skate	9.0
1/21/2003	LB-6	Striped Bass	1.0
1/21/2003	LB-6	Windowpane	1.0
1/21/2003	PJ-2	Bay Anchovy	1.1
1/22/2003	AK-4	Alewife	5.0
1/22/2003	AK-4	Atlantic Silverside	1.0
1/22/2003	AK-4	Striped Bass	1.0
1/22/2003	AK-4	Striped Killifish	2.0
1/22/2003	AK-4	White Perch	1.0
1/22/2003	NB-7	Alewife	2.9
1/22/2003	NB-7	Bay Anchovy	4.3
1/22/2003	NB-7	Silver Hake	1.4
1/22/2003	NB-7	White Perch	2.9
1/22/2003	NB-7	Winter Flounder	1.4
1/22/2003	PJ-1	Conger Eel	1.0
1/22/2003	PJ-1	Striped Bass	9.0
1/22/2003	PJ-1	Winter Flounder	1.0
1/22/2003	PJ-3	Atlantic Silverside	4.0
1/22/2003	PJ-4	Atlantic Croaker	1.0
1/22/2003	PJ-4	Bay Anchovy	4.0
1/22/2003	PJ-4	Blueback Herring	1.0
1/22/2003	PJ-4	Striped Bass	2.0
1/22/2003	PJ-5	Alewife	3.0
1/22/2003	PJ-5	Little Skate	2.0
1/22/2003	PJ-5	Spotted Hake	3.0
1/22/2003	PJ-5	Windowpane	1.0
1/22/2003	PJ-5	Winter Flounder	9.0
1/22/2003	SB-1	Spotted Hake	10.0
1/22/2003	SB-1	Striped Bass	3.3
1/22/2003	SB-2	Alewife	3.3
1/22/2003	SB-2	Cunner	3.3
1/22/2003	SB-2	Grubby	3.3
1/22/2003	SB-2	Striped Bass	6.7
1/22/2003	SB-2	Winter Flounder	3.3
1/22/2003	SB-3	Little Skate	1.0
1/22/2003	SB-3	Smallmouth Flounder	1.0
1/22/2003	SB-4	Alewife	5.0
1/22/2003	SB-4	Atlantic Herring	2.0
1/22/2003	SB-4	Windowpane	1.0
1/22/2003	SB-6	Atlantic Herring	1.0
1/22/2003	SB-6	Blueback Herring	2.0
1/22/2003	SB-6	Windowpane	1.0
1/23/2003	AK-1	Alewife	2.0
1/23/2003	AK-1	Striped Bass	4.0
1/23/2003	AK-1	White Perch	10.0
1/23/2003	AK-2	Atlantic Croaker	1.0
1/23/2003	AK-2	Striped Bass	19.0

Date	Station	Common Name	CPUE
1/23/2003	AK-2	Tautog	1.0
1/23/2003	AK-2	White Perch	31.0
1/23/2003	AK-2	Winter Flounder	18.0
1/23/2003	AK-3	Alewife	1.3
1/23/2003	AK-3	American Shad	1.3
1/23/2003	AK-3	Striped Bass	5.0
1/23/2003	AK-3	White Perch	50.0
1/23/2003	AK-3	Windowpane	2.5
1/23/2003	AK-3	Winter Flounder	7.5
1/23/2003	NB-3	Atlantic Silverside	4.0
1/23/2003	NB-3	Northern Pipefish	1.0
1/23/2003	NB-3	Spotted Hake	1.0
1/23/2003	NB-3	Striped Bass	2.0
1/23/2003	NB-3	White Perch	10.0
1/23/2003	NB-3	Winter Flounder	2.0
1/23/2003	NB-4	Atlantic Croaker	1.0
1/23/2003	NB-4	Atlantic Silverside	4.0
1/23/2003	NB-4	Striped Bass	1.0
1/23/2003	NB-4	Winter Flounder	1.0
1/23/2003	NB-5	Cunner	1.0
1/23/2003	NB-5	Striped Bass	24.0
1/23/2003	NB-5	White Perch	247.0
1/23/2003	NB-5	Winter Flounder	5.0
1/23/2003	NB-6	Alewife	1.0
1/23/2003	NB-6	Bay Anchovy	1.0
1/23/2003	NB-6	Striped Bass	3.0
1/23/2003	NB-6	White Perch	9.0
1/23/2003	SB-5	Clearnose Skate	1.0
1/23/2003	SB-5	Little Skate	6.0
1/23/2003	SB-5	Silver Hake	1.0
1/23/2003	SB-5	Spotted Hake	4.0
1/23/2003	SB-5	Striped Bass	1.0
1/23/2003	SB-5	Tautog	1.0
1/23/2003	SB-5	Windowpane	11.0
1/23/2003	SB-5	Winter Flounder	7.0
2/4/2003	AK-3	Striped Bass	3.3
2/4/2003	AK-3	White Perch	7.8
2/4/2003	AK-3	Winter Flounder	1.1
2/4/2003	AK-4	White Perch	1.0
2/4/2003	NB-3	Striped Killifish	1.0
2/4/2003	NB-3	White Perch	4.0
2/4/2003	NB-3	Winter Flounder	1.0
2/4/2003	NB-4	Striped Bass	1.0
2/4/2003	NB-4	White Perch	5.0
2/4/2003	NB-5	Red Hake	1.7
2/4/2003	NB-5	Striped Bass	8.3
2/4/2003	NB-5	White Perch	56.7
2/4/2003	NB-5	Windowpane	1.7
2/4/2003	NB-6	Striped Bass	2.0
2/4/2003	NB-6	White Perch	3.0

Appendix A. Adult finfish (trawl) CPUEs by date and sample location. (page 10 of 22)

Date	Station	Common Name	CPUE
2/4/2003	NB-6	Winter Flounder	1.0
2/5/2003	AK-1	American Shad	1.7
2/5/2003	AK-1	White Perch	1.7
2/5/2003	AK-2	Striped Bass	1.0
2/5/2003	AK-2	White Perch	1.0
2/5/2003	AK-2	Winter Flounder	2.0
2/5/2003	LB-2	Tautog	1.0
2/5/2003	LB-3	Little Skate	3.0
2/5/2003	LB-3	Smallmouth Flounder	1.0
2/5/2003	LB-3	Windowpane	1.0
2/5/2003	LB-3	Winter Flounder	1.0
2/5/2003	LB-6	Atlantic Silverside	2.0
2/5/2003	LB-6	Little Skate	4.0
2/5/2003	LB-6	Windowpane	1.0
2/5/2003	SB-6	American Shad	3.3
2/5/2003	SB-6	Blueback Herring	6.7
2/5/2003	SB-6	Little Skate	3.3
2/5/2003	SB-6	Red Hake	3.3
2/5/2003	SB-6	Windowpane	16.7
2/5/2003	SB-6	Winter Flounder	13.3
2/6/2003	PJ-1	Windowpane	1.0
2/6/2003	PJ-2	Winter Flounder	1.1
2/6/2003	PJ-4	Striped Bass	10.0
2/6/2003	PJ-4	Winter Flounder	6.7
2/6/2003	PJ-5	Striped Bass	4.0
2/6/2003	PJ-5	Winter Flounder	8.0
2/6/2003	SB-2	Naked Goby	2.5
2/6/2003	SB-3	Grubby	1.0
2/6/2003	SB-3	Striped Bass	1.0
2/6/2003	SB-3	Windowpane	10.0
2/6/2003	SB-3	Winter Flounder	6.0
2/6/2003	SB-4	Blueback Herring	7.0
2/6/2003	SB-4	Grubby	1.0
2/6/2003	SB-4	White Perch	1.0
2/6/2003	SB-5	Striped Bass	1.0
2/6/2003	SB-5	Windowpane	19.0
2/6/2003	SB-5	Winter Flounder	13.0
2/19/2003	LB-1	Atlantic Herring	1.0
2/19/2003	LB-1	Atlantic Silverside	1.0
2/19/2003	LB-1	Blueback Herring	1.0
2/19/2003	LB-1	Little Skate	10.0
2/19/2003	LB-3	Atlantic Silverside	1.0
2/19/2003	LB-3	Blueback Herring	1.0
2/19/2003	LB-3	Little Skate	1.0
2/19/2003	LB-4	Blueback Herring	1.0
2/19/2003	LB-4	Little Skate	4.0
2/19/2003	LB-4	Winter Flounder	1.0
2/19/2003	LB-6	Little Skate	1.0
2/19/2003	PJ-2	Striped Bass	2.0
2/20/2003	AK-1	Striped Bass	1.3

Appendix A. Adult finfish (trawl) CPUEs by date and sample location. (page 11 of 22)

Date	Station	Common Name	CPUE
2/20/2003	AK-1	White Perch	5.0
2/20/2003	AK-1	Winter Flounder	2.5
2/20/2003	AK-2	Hogchocker	1.0
2/20/2003	AK-2	Striped Bass	19.0
2/20/2003	AK-2	White Perch	18.0
2/20/2003	AK-2	Winter Flounder	10.0
2/20/2003	AK-4	White Perch	1.0
2/20/2003	NB-5	Striped Bass	2.0
2/20/2003	NB-5	White Perch	7.0
2/20/2003	NB-5	Winter Flounder	1.0
2/20/2003	PJ-1	Cunner	2.0
2/20/2003	PJ-1	Smallmouth Flounder	1.0
2/20/2003	PJ-1	Striped Bass	1.0
2/20/2003	PJ-3	White Perch	1.0
2/20/2003	PJ-5	Atlantic Tomcod	1.0
2/20/2003	PJ-5	Striped Bass	5.0
2/20/2003	PJ-5	Windowpane	1.0
2/20/2003	PJ-5	Winter Flounder	2.0
2/21/2003	NB-3	Spotted Hake	1.0
2/21/2003	NB-3	White Perch	1.0
2/21/2003	NB-3	Winter Flounder	1.0
2/21/2003	NB-4	Striped Bass	2.0
2/21/2003	NB-4	White Perch	1.0
2/21/2003	NB-6	Winter Flounder	2.5
2/21/2003	NB-7	Winter Flounder	1.1
2/21/2003	PJ-4	Atlantic Silverside	1.7
2/21/2003	PJ-4	Striped Bass	8.3
2/21/2003	PJ-4	Windowpane	1.7
2/21/2003	SB-2	Conger Eel	3.3
2/21/2003	SB-3	Windowpane	1.0
2/21/2003	SB-4	Red Hake	2.0
2/21/2003	SB-4	Striped Bass	3.0
2/21/2003	SB-4	Windowpane	1.0
2/21/2003	SB-4	Winter Flounder	1.0
2/21/2003	SB-6	Striped Bass	1.0
2/21/2003	SB-6	White Perch	1.0
3/4/2003	LB-2	Bay Anchovy	18.0
3/4/2003	LB-2	Windowpane	1.0
3/4/2003	LB-4	American Shad	1.0
3/4/2003	LB-4	Bay Anchovy	13.0
3/4/2003	LB-4	Cunner	1.0
3/4/2003	LB-4	Little Skate	2.0
3/4/2003	LB-4	Windowpane	2.0
3/4/2003	LB-5	Windowpane	3.0
3/4/2003	LB-6	Little Skate	1.0
3/4/2003	LB-6	Windowpane	1.0
3/4/2003	PJ-2	Atlantic Silverside	1.7
3/5/2003	AK-3	Striped Bass	1.1
3/5/2003	AK-3	White Perch	1.1
3/5/2003	NB-6	Striped Bass	6.0

Appendix A. Adult finfish (trawl) CPUEs by date and sample location. (page 12 of 22)

Date	Station	Common Name	CPUE
3/5/2003	NB-6	White Perch	1.0
3/5/2003	NB-6	Winter Flounder	4.0
3/5/2003	NB-7	Striped Bass	1.7
3/5/2003	NB-7	Winter Flounder	1.7
3/5/2003	PJ-4	Gizzard Shad	1.1
3/5/2003	PJ-5	Winter Flounder	1.1
3/6/2003	AK-1	Striped Bass	3.0
3/6/2003	AK-1	White Perch	1.0
3/6/2003	AK-1	Winter Flounder	1.0
3/7/2003	HR-1	Naked Goby	4.0
3/7/2003	PJ-1	Atlantic Silverside	1.0
3/7/2003	PJ-1	Grubby	1.0
3/7/2003	PJ-1	Winter Flounder	2.0
3/7/2003	SB-3	Red Hake	1.0
3/7/2003	SB-3	Windowpane	10.0
3/7/2003	SB-3	Winter Flounder	2.0
3/7/2003	SB-4	Blueback Herring	2.0
3/7/2003	SB-4	Little Skate	1.0
3/7/2003	SB-4	Red Hake	1.0
3/7/2003	SB-4	Windowpane	6.0
3/7/2003	SB-6	Cunner	1.0
3/7/2003	SB-6	Little Skate	1.0
3/7/2003	SB-6	Windowpane	4.0
3/8/2003	HR-2	Striped Killifish	5.0
3/8/2003	SB-5	Blueback Herring	1.0
3/8/2003	SB-5	Grubby	1.0
3/18/2003	LB-1	Winter Flounder	1.0
3/18/2003	LB-2	Windowpane	1.0
3/18/2003	LB-3	Windowpane	2.0
3/18/2003	LB-4	Windowpane	1.0
3/18/2003	LB-5	Windowpane	1.0
3/18/2003	LB-6	Little Skate	3.0
3/18/2003	LB-6	Red Hake	1.0
3/18/2003	LB-6	Windowpane	2.0
3/18/2003	SB-4	Bay Anchovy	3.0
3/18/2003	SB-4	Cunner	1.0
3/18/2003	SB-4	Grubby	1.0
3/18/2003	SB-4	Little Skate	1.0
3/18/2003	SB-4	Naked Goby	1.0
3/18/2003	SB-4	Red Hake	4.0
3/18/2003	SB-4	Spotted Hake	1.0
3/18/2003	SB-4	Windowpane	5.0
3/18/2003	SB-4	Winter Flounder	4.0
3/19/2003	AK-4	Bay Anchovy	1.0
3/19/2003	AK-4	Seaboard Goby	1.0
3/19/2003	AK-4	Striped Bass	1.0
3/19/2003	AK-4	White Perch	1.0
3/19/2003	SB-1	Bay Anchovy	5.0
3/19/2003	SB-2	Northern Pipefish	2.5
3/19/2003	SB-3	Bay Anchovy	7.0

Date	Station	Common Name	CPUE
3/19/2003	SB-3	Blueback Herring	1.0
3/19/2003	SB-3	Cunner	1.0
3/19/2003	SB-3	Northern Pipefish	1.0
3/19/2003	SB-3	Red Hake	1.0
3/19/2003	SB-3	Windowpane	4.0
3/19/2003	SB-3	Winter Flounder	1.0
3/19/2003	SB-6	Blueback Herring	1.0
3/19/2003	SB-6	Little Skate	2.0
3/19/2003	SB-6	Naked Goby	1.0
3/19/2003	SB-6	Red Hake	3.0
3/19/2003	SB-6	Spotted Hake	2.0
3/19/2003	SB-6	Windowpane	17.0
3/19/2003	SB-6	Winter Flounder	3.0
3/21/2003	NB-3	American Shad	1.0
3/21/2003	NB-3	Striped Bass	2.0
3/21/2003	NB-3	White Perch	1.0
3/21/2003	NB-4	Striped Bass	2.0
3/21/2003	NB-4	White Perch	1.0
3/21/2003	NB-4	Winter Flounder	3.0
3/21/2003	NB-5	Striped Bass	2.0
3/21/2003	NB-5	White Perch	3.0
3/21/2003	NB-6	Striped Bass	3.0
3/22/2003	AK-1	Striped Bass	10.0
3/22/2003	AK-1	White Perch	3.3
3/22/2003	AK-3	Blueback Herring	3.0
3/22/2003	AK-3	Northern Pipefish	1.0
3/22/2003	AK-3	Spotted Hake	1.0
3/22/2003	AK-3	Striped Bass	6.0
3/22/2003	AK-3	White Perch	5.0
3/22/2003	AK-3	Windowpane	2.0
3/22/2003	AK-3	Winter Flounder	1.0
3/22/2003	NB-7	Striped Bass	12.5
3/22/2003	PJ-2	Spotted Hake	1.0
3/22/2003	PJ-2	Striped Bass	10.0
3/22/2003	PJ-2	Windowpane	1.0
3/23/2003	HR-1	Bay Anchovy	2.0
3/23/2003	HR-1	Conger Eel	4.0
3/23/2003	HR-1	Striped Bass	4.0
3/23/2003	PJ-1	Striped Bass	1.0
3/23/2003	PJ-3	Striped Bass	2.0
3/23/2003	PJ-4	Spotted Hake	1.7
3/23/2003	PJ-4	Striped Bass	5.0
3/23/2003	PJ-4	Winter Flounder	1.7
3/23/2003	PJ-5	Bay Anchovy	5.0
3/23/2003	PJ-5	Northern Pipefish	1.0
3/23/2003	SB-5	American Shad	6.0
3/23/2003	SB-5	Bay Anchovy	1.0
3/23/2003	SB-5	Little Skate	3.0
3/23/2003	SB-5	Spotted Hake	1.0
3/23/2003	SB-5	Windowpane	1.0

Date	Station	Common Name	CPUE
3/23/2003	SB-5	Winter Flounder	6.0
4/15/2003	LB-6	Winter Flounder	3.0
4/16/2003	LB-1	Little Skate	2.0
4/16/2003	LB-1	Northern Puffer	2.0
4/16/2003	LB-1	Northern Searobin	1.0
4/16/2003	LB-1	Smallmouth Flounder	1.0
4/16/2003	LB-1	Spotted Hake	4.0
4/16/2003	LB-1	Windowpane	2.0
4/16/2003	LB-1	Winter Flounder	11.0
4/16/2003	LB-2	Windowpane	1.0
4/16/2003	LB-3	Little Skate	1.0
4/16/2003	LB-3	Northern Puffer	1.0
4/16/2003	LB-3	Red Hake	2.0
4/16/2003	LB-3	Spotted Hake	41.0
4/16/2003	LB-3	Windowpane	1.0
4/16/2003	LB-3	Winter Flounder	2.0
4/16/2003	LB-4	Red Hake	1.0
4/16/2003	LB-4	Spotted Hake	6.0
4/16/2003	LB-4	Winter Flounder	2.0
4/16/2003	SB-6	Cunner	2.0
4/16/2003	SB-6	Little Skate	5.0
4/16/2003	SB-6	Northern Puffer	2.0
4/16/2003	SB-6	Red Hake	1.0
4/16/2003	SB-6	Smallmouth Flounder	3.0
4/16/2003	SB-6	Spotted Hake	89.0
4/16/2003	SB-6	Striped Cuskeel	4.0
4/16/2003	SB-6	Summer Flounder	1.0
4/16/2003	SB-6	Windowpane	34.0
4/17/2003	AK-1	Atlantic Herring	6.0
4/17/2003	AK-1	Blueback Herring	2.0
4/17/2003	AK-1	Smallmouth Flounder	8.0
4/17/2003	AK-1	Spotted Hake	118.0
4/17/2003	AK-1	Striped Bass	34.0
4/17/2003	AK-1	Striped Cuskeel	6.0
4/17/2003	AK-1	White Perch	18.0
4/17/2003	AK-1	Windowpane	4.0
4/17/2003	AK-3	Striped Bass	1.0
4/17/2003	AK-3	Summer Flounder	1.0
4/17/2003	AK-3	Winter Flounder	1.0
4/17/2003	AK-4	Alewife	2.0
4/17/2003	AK-4	Atlantic Herring	13.0
4/17/2003	AK-4	Blueback Herring	2.0
4/17/2003	HR-2	Atlantic Herring	5.0
4/17/2003	HR-2	Silver Hake	5.0
4/17/2003	HR-2	Spotted Hake	30.0
4/17/2003	HR-2	Striped Bass	10.0
4/17/2003	PJ-1	Grubby	2.0
4/17/2003	PJ-1	Striped Bass	14.0
4/17/2003	PJ-1	Windowpane	2.0
4/17/2003	PJ-1	Winter Flounder	33.0

Date	Station	Common Name	CPUE
4/17/2003	PJ-2	Pollock	2.0
4/17/2003	PJ-2	Spotted Hake	1.0
4/17/2003	PJ-2	Striped Bass	3.0
4/17/2003	PJ-2	Winter Flounder	4.0
4/17/2003	SB-1	Alewife	15.0
4/17/2003	SB-1	Northern Searobin	5.0
4/17/2003	SB-1	Smallmouth Flounder	5.0
4/17/2003	SB-1	Spotted Hake	35.0
4/17/2003	SB-1	Striped Bass	170.0
4/17/2003	SB-1	Windowpane	5.0
4/17/2003	SB-1	Winter Flounder	10.0
4/17/2003	SB-2	Alewife	6.7
4/17/2003	SB-2	Blueback Herring	3.3
4/17/2003	SB-2	Spotted Hake	76.7
4/17/2003	SB-2	Striped Bass	30.0
4/17/2003	SB-3	Little Skate	1.0
4/17/2003	SB-3	Northern Puffer	1.0
4/17/2003	SB-3	Smallmouth Flounder	2.0
4/17/2003	SB-3	Spotted Hake	10.0
4/17/2003	SB-3	Striped Bass	15.0
4/17/2003	SB-3	Windowpane	4.0
4/17/2003	SB-3	Winter Flounder	15.0
4/17/2003	SB-4	Little Skate	3.0
4/17/2003	SB-4	Northern Puffer	1.0
4/17/2003	SB-4	Spotted Hake	161.0
4/17/2003	SB-4	Striped Bass	4.0
4/17/2003	SB-4	Striped Cuskeel	2.0
4/17/2003	SB-4	Summer Flounder	1.0
4/17/2003	SB-4	Windowpane	9.0
4/17/2003	SB-4	Winter Flounder	8.0
4/17/2003	SB-5	Red Hake	2.0
4/17/2003	SB-5	Spotted Hake	14.0
4/17/2003	SB-5	Striped Cuskeel	2.0
4/17/2003	SB-5	Windowpane	1.0
4/17/2003	SB-5	Winter Flounder	3.0
4/18/2003	NB-3	Atlantic Herring	9.0
4/18/2003	NB-3	Blueback Herring	1.0
4/18/2003	NB-3	Cunner	1.0
4/18/2003	NB-3	Northern Puffer	1.0
4/18/2003	NB-3	Red Hake	1.0
4/18/2003	NB-3	Smallmouth Flounder	35.0
4/18/2003	NB-3	Spotted Hake	13.0
4/18/2003	NB-3	Striped Bass	10.0
4/18/2003	NB-3	White Perch	30.0
4/18/2003	NB-3	Windowpane	1.0
4/18/2003	NB-3	Winter Flounder	2.0
4/18/2003	NB-4	Atlantic Herring	1.0
4/18/2003	NB-4	Spotted Hake	2.0
4/18/2003	NB-4	Striped Bass	10.0
4/18/2003	NB-4	White Perch	4.0

Date	Station	Common Name	CPUE
4/22/2003	NB-5	Spotted Hake	33.0
4/22/2003	NB-5	Striped Bass	5.0
4/22/2003	NB-5	White Perch	1.0
4/22/2003	NB-7	Alewife	2.2
4/22/2003	NB-7	American Eel	1.1
4/22/2003	NB-7	Atlantic Herring	12.2
4/22/2003	NB-7	Spotted Hake	3.3
4/22/2003	NB-7	Striped Bass	33.3
4/22/2003	NB-7	Summer Flounder	1.1
4/22/2003	NB-7	White Perch	15.6
4/22/2003	NB-7	Winter Flounder	8.9
4/23/2003	AK-2	Spotted Hake	7.0
4/23/2003	AK-2	Striped Bass	1.0
4/23/2003	AK-2	Winter Flounder	2.0
4/23/2003	HR-1	Atlantic Herring	5.0
4/23/2003	HR-1	Spotted Hake	15.0
4/23/2003	NB-6	Atlantic Herring	12.0
4/23/2003	NB-6	Black Sea Bass	1.0
4/23/2003	NB-6	Spotted Hake	44.0
4/23/2003	NB-6	Striped Bass	2.0
4/23/2003	NB-6	Summer Flounder	1.0
4/23/2003	NB-6	Winter Flounder	1.0
4/23/2003	PJ-3	Alewife	2.0
4/23/2003	PJ-3	Spotted Hake	2.0
4/23/2003	PJ-3	Striped Bass	7.0
4/23/2003	PJ-3	Winter Flounder	1.0
4/23/2003	PJ-4	Atlantic Herring	2.0
4/23/2003	PJ-4	Blueback Herring	1.0
4/23/2003	PJ-4	Cunner	1.0
4/23/2003	PJ-4	Spotted Hake	68.0
4/23/2003	PJ-4	Striped Bass	2.0
4/23/2003	PJ-5	Atlantic Herring	2.0
4/23/2003	PJ-5	Spotted Hake	1.0
5/13/2003	LB-1	Bay Anchovy	2.0
5/13/2003	LB-1	Little Skate	1.0
5/13/2003	LB-1	Winter Flounder	1.0
5/13/2003	LB-2	Little Skate	2.0
5/13/2003	LB-2	Scup	4.0
5/13/2003	LB-2	Spotted Hake	15.0
5/13/2003	LB-2	Summer Flounder	1.0
5/13/2003	LB-2	Windowpane	2.0
5/13/2003	LB-2	Winter Flounder	7.0
5/13/2003	LB-4	Atlantic Herring	20.0
5/13/2003	LB-4	Bay Anchovy	1.0
5/13/2003	LB-4	Gadid unidentified	1.0
5/13/2003	LB-4	Little Skate	1.0
5/13/2003	LB-4	Red Hake	1.0
5/13/2003	LB-4	Spotted Hake	198.0
5/13/2003	LB-4	Summer Flounder	3.0
5/13/2003	LB-4	Windowpane	3.0

Date	Station	Common Name	CPUE
5/13/2003	LB-4	Winter Flounder	14.0
5/13/2003	LB-5	Bay Anchovy	2.0
5/13/2003	LB-5	Spotted Hake	29.0
5/13/2003	LB-5	Striped Searobin	2.0
5/13/2003	LB-5	Summer Flounder	1.0
5/13/2003	LB-5	Windowpane	4.0
5/14/2003	AK-1	Bay Anchovy	1.1
5/14/2003	AK-2	Bay Anchovy	2.0
5/14/2003	AK-2	Blueback Herring	1.0
5/14/2003	AK-2	Northern Searobin	1.0
5/14/2003	AK-2	Red Hake	2.0
5/14/2003	AK-2	Spotted Hake	45.0
5/14/2003	AK-2	Windowpane	3.0
5/14/2003	AK-3	American Eel	1.1
5/14/2003	AK-3	Bay Anchovy	18.9
5/14/2003	AK-3	Smallmouth Flounder	1.1
5/14/2003	AK-3	Spotted Hake	63.3
5/14/2003	AK-3	Striped Bass	4.4
5/14/2003	AK-3	Striped Searobin	1.1
5/14/2003	AK-3	Summer Flounder	1.1
5/14/2003	AK-3	Windowpane	1.1
5/14/2003	AK-4	Atlantic Herring	1.0
5/14/2003	AK-4	Bay Anchovy	5.0
5/14/2003	AK-4	Spotted Hake	4.0
5/14/2003	AK-4	Striped Bass	3.0
5/14/2003	AK-4	White Perch	1.0
5/14/2003	AK-4	Winter Flounder	1.0
5/14/2003	LB-3	Atlantic Herring	4.0
5/14/2003	LB-3	Bay Anchovy	2.0
5/14/2003	LB-3	Gadid unidentified	1.0
5/14/2003	LB-3	Little Skate	1.0
5/14/2003	LB-3	Spotted Hake	13.0
5/14/2003	LB-3	Summer Flounder	1.0
5/14/2003	LB-6	Atlantic Herring	262.0
5/14/2003	LB-6	Red Hake	2.0
5/14/2003	LB-6	Spotted Hake	15.0
5/14/2003	LB-6	Summer Flounder	2.0
5/14/2003	LB-6	Windowpane	2.0
5/14/2003	LB-6	Winter Flounder	7.0
5/15/2003	HR-1	Atlantic Tomcod	35.0
5/15/2003	HR-1	Bay Anchovy	45.0
5/15/2003	HR-1	Naked Goby	5.0
5/15/2003	HR-1	Spotted Hake	60.0
5/15/2003	HR-1	Striped Searobin	30.0
5/15/2003	HR-1	Summer Flounder	5.0
5/15/2003	HR-1	Windowpane	5.0
5/15/2003	HR-1	Winter Flounder	10.0
5/15/2003	HR-2	Atlantic Herring	7.5
5/15/2003	HR-2	Bay Anchovy	15.0
5/15/2003	HR-2	Spotted Hake	10.0

Appendix A. Adult finfish (trawl) CPUEs by date and sample location. (page 18 of 22)

Date	Station	Common Name	CPUE
5/15/2003	NB-3	Bay Anchovy	6.0
5/15/2003	NB-3	Spotted Hake	7.0
5/15/2003	NB-3	Striped Bass	5.0
5/15/2003	NB-3	Summer Flounder	1.0
5/15/2003	NB-3	White Perch	1.0
5/15/2003	NB-3	Winter Flounder	1.0
5/15/2003	NB-4	Alewife	2.0
5/15/2003	NB-4	Atlantic Herring	2.0
5/15/2003	NB-4	Bay Anchovy	53.0
5/15/2003	NB-4	Spotted Hake	6.0
5/15/2003	NB-4	Striped Bass	2.0
5/15/2003	NB-4	Summer Flounder	1.0
5/15/2003	NB-4	Tautog	1.0
5/15/2003	NB-4	White Perch	1.0
5/15/2003	NB-4	Winter Flounder	1.0
5/15/2003	NB-5	Atlantic Herring	3.0
5/15/2003	NB-5	Bay Anchovy	6.0
5/15/2003	NB-5	Spotted Hake	166.0
5/15/2003	NB-5	Striped Bass	1.0
5/15/2003	NB-5	Windowpane	1.0
5/15/2003	NB-6	Atlantic Herring	11.0
5/15/2003	NB-6	Bay Anchovy	2.0
5/15/2003	NB-6	Blueback Herring	1.0
5/15/2003	NB-6	Northern Stargazer	1.0
5/15/2003	NB-6	Spotted Hake	7.0
5/15/2003	NB-6	Striped Searobin	1.0
5/15/2003	NB-6	Winter Flounder	1.0
5/15/2003	NB-7	Alewife	1.0
5/15/2003	NB-7	Atlantic Herring	1.0
5/15/2003	NB-7	Atlantic Tomcod	6.0
5/15/2003	NB-7	Bay Anchovy	785.0
5/15/2003	NB-7	Spotted Hake	12.0
5/15/2003	NB-7	Striped Bass	3.0
5/15/2003	NB-7	Summer Flounder	7.0
5/15/2003	NB-7	Winter Flounder	2.0
5/15/2003	PJ-2	Atlantic Tomcod	100.0
5/15/2003	PJ-2	Bay Anchovy	35.0
5/15/2003	PJ-2	Cunner	1.0
5/15/2003	PJ-2	Pollock	1.0
5/15/2003	PJ-2	Spotted Hake	9.0
5/15/2003	PJ-2	Striped Bass	5.0
5/15/2003	PJ-2	Striped Searobin	2.0
5/15/2003	PJ-2	Summer Flounder	4.0
5/15/2003	PJ-2	Windowpane	2.0
5/15/2003	PJ-2	Winter Flounder	2.0
5/15/2003	PJ-3	Atlantic Herring	5.0
5/15/2003	PJ-3	Atlantic Tomcod	2.0
5/15/2003	PJ-3	Bay Anchovy	31.0
5/15/2003	PJ-3	Pollock	1.0
5/15/2003	PJ-3	Spotted Hake	9.0

Appendix A. Adult finfish (trawl) CPUEs by date and sample location. (page 19 of 22)

Date	Station	Common Name	CPUE
5/15/2003	PJ-3	Striped Bass	2.0
5/15/2003	PJ-3	Summer Flounder	3.0
5/15/2003	PJ-3	Windowpane	1.0
5/15/2003	PJ-3	Winter Flounder	5.0
5/15/2003	PJ-4	Atlantic Herring	17.0
5/15/2003	PJ-4	Bay Anchovy	2.0
5/15/2003	PJ-4	Spotted Hake	23.0
5/15/2003	PJ-4	Striped Searobin	1.0
5/15/2003	PJ-4	Summer Flounder	3.0
5/15/2003	PJ-4	Windowpane	1.0
5/15/2003	SB-1	Alewife	3.3
5/15/2003	SB-1	Atlantic Tomcod	3.3
5/15/2003	SB-1	Bay Anchovy	80.0
5/15/2003	SB-1	Spotted Hake	10.0
5/15/2003	SB-1	Striped Bass	6.7
5/15/2003	SB-1	White Perch	3.3
5/15/2003	SB-1	Windowpane	6.7
5/15/2003	SB-1	Winter Flounder	3.3
5/15/2003	SB-2	Atlantic Herring	20.0
5/15/2003	SB-2	Atlantic Tomcod	3.3
5/15/2003	SB-2	Bay Anchovy	63.3
5/15/2003	SB-3	Atlantic Herring	1.0
5/15/2003	SB-3	Atlantic Menhaden	1.0
5/15/2003	SB-3	Atlantic Tomcod	1.0
5/15/2003	SB-3	Bay Anchovy	19.0
5/15/2003	SB-3	Black Sea Bass	1.0
5/15/2003	SB-3	Little Skate	1.0
5/15/2003	SB-3	Red Hake	2.0
5/15/2003	SB-3	Scup	1.0
5/15/2003	SB-3	Smallmouth Flounder	2.0
5/15/2003	SB-3	Spotted Hake	28.0
5/15/2003	SB-3	Striped Searobin	6.0
5/15/2003	SB-3	Summer Flounder	12.0
5/15/2003	SB-3	Windowpane	4.0
5/15/2003	SB-3	Winter Flounder	5.0
5/15/2003	SB-4	Atlantic Herring	7.0
5/15/2003	SB-4	Bay Anchovy	13.0
5/15/2003	SB-4	Little Skate	1.0
5/15/2003	SB-4	Spotted Hake	48.0
5/15/2003	SB-4	Striped Searobin	8.0
5/15/2003	SB-4	Windowpane	2.0
5/15/2003	SB-4	Winter Flounder	3.0
5/16/2003	PJ-1	Atlantic Herring	3.0
5/16/2003	PJ-1	Atlantic Tomcod	3.0
5/16/2003	PJ-1	Bay Anchovy	11.0
5/16/2003	PJ-1	Blueback Herring	1.0
5/16/2003	PJ-1	Grubby	1.0
5/16/2003	PJ-1	Smallmouth Flounder	1.0
5/16/2003	PJ-1	Spotted Hake	24.0
5/16/2003	PJ-1	Striped Bass	2.0

Date	Station	Common Name	CPUE
5/16/2003	PJ-1	Striped Searobin	4.0
5/16/2003	PJ-1	Summer Flounder	5.0
5/16/2003	PJ-1	Windowpane	2.0
5/16/2003	PJ-1	Winter Flounder	26.0
5/16/2003	PJ-5	Atlantic Herring	12.2
5/16/2003	PJ-5	Bay Anchovy	16.7
5/16/2003	PJ-5	Grubby	1.1
5/16/2003	SB-5	Red Hake	12.0
5/16/2003	SB-5	Spotted Hake	23.0
5/16/2003	SB-5	Tautog	1.0
5/16/2003	SB-5	Windowpane	3.0
5/16/2003	SB-5	Winter Flounder	2.0
5/16/2003	SB-6	Atlantic Herring	6.0
5/16/2003	SB-6	Bay Anchovy	4.0
5/16/2003	SB-6	Little Skate	2.0
5/16/2003	SB-6	Spotted Hake	12.0
5/16/2003	SB-6	Striped Searobin	1.0
5/16/2003	SB-6	Summer Flounder	3.0
5/16/2003	SB-6	Windowpane	7.0
5/16/2003	SB-6	Winter Flounder	1.0
6/17/2003	LB-3	Bay Anchovy	81.0
6/17/2003	LB-3	Blueback Herring	1.0
6/17/2003	LB-3	Bluefish	1.0
6/17/2003	LB-3	Scup	3.0
6/17/2003	LB-3	Spotted Hake	4.0
6/17/2003	LB-3	Striped Cuskeel	1.0
6/17/2003	PJ-2	Atlantic Tomcod	6.0
6/17/2003	PJ-2	Bay Anchovy	67.0
6/17/2003	PJ-2	Spotted Hake	1.0
6/17/2003	PJ-2	Summer Flounder	1.0
6/17/2003	PJ-2	Windowpane	1.0
6/18/2003	AK-1	American Shad	1.3
6/18/2003	AK-1	Bay Anchovy	20.0
6/18/2003	AK-1	Spotted Hake	1.3
6/18/2003	AK-1	Striped Bass	3.8
6/18/2003	AK-2	American Eel	2.0
6/18/2003	AK-2	Atlantic Tomcod	5.0
6/18/2003	AK-2	Bay Anchovy	3.0
6/18/2003	AK-2	Smallmouth Flounder	1.0
6/18/2003	AK-2	Spotted Hake	35.0
6/18/2003	AK-2	Summer Flounder	1.0
6/18/2003	AK-2	Windowpane	1.0
6/18/2003	AK-2	Winter Flounder	12.0
6/18/2003	AK-3	Atlantic Tomcod	7.1
6/18/2003	AK-3	Bay Anchovy	2.9
6/18/2003	AK-3	Bluefish	1.4
6/18/2003	AK-3	Smallmouth Flounder	2.9
6/18/2003	AK-3	Spotted Hake	42.9
6/18/2003	AK-3	Windowpane	1.4
6/18/2003	AK-3	Winter Flounder	1.4

Date	Station	Common Name	CPUE
6/18/2003	AK-4	Bay Anchovy	4.0
6/18/2003	AK-4	Northern Pipefish	1.0
6/18/2003	HR-1	Atlantic Tomcod	125.0
6/18/2003	HR-1	Bay Anchovy	105.0
6/18/2003	HR-1	Blueback Herring	5.0
6/18/2003	HR-1	Red Hake	5.0
6/18/2003	HR-1	Shortnose Sturgeon	10.0
6/18/2003	HR-1	Spotted Hake	75.0
6/18/2003	HR-1	Summer Flounder	5.0
6/18/2003	HR-1	Weakfish	10.0
6/18/2003	HR-1	Winter Flounder	115.0
6/18/2003	PJ-3	Atlantic Tomcod	10.0
6/18/2003	PJ-3	Bay Anchovy	71.0
6/18/2003	PJ-3	Red Hake	1.0
6/18/2003	PJ-3	Spotted Hake	2.0
6/18/2003	PJ-3	Striped Bass	1.0
6/18/2003	PJ-3	Summer Flounder	3.0
6/18/2003	PJ-3	Weakfish	1.0
6/18/2003	PJ-3	Winter Flounder	4.0
6/18/2003	PJ-4	Atlantic Tomcod	1.0
6/18/2003	PJ-4	Bay Anchovy	18.0
6/18/2003	PJ-4	Blueback Herring	2.0
6/18/2003	PJ-4	Spotted Hake	2.0
6/18/2003	PJ-5	Atlantic Tomcod	4.0
6/18/2003	PJ-5	Bay Anchovy	4.0
6/18/2003	PJ-5	Red Hake	2.0
6/18/2003	PJ-5	Spotted Hake	25.0
6/18/2003	PJ-5	Striped Searobin	1.0
6/18/2003	PJ-5	Summer Flounder	1.0
6/18/2003	PJ-5	Weakfish	1.0
6/18/2003	PJ-5	Windowpane	2.0
6/18/2003	PJ-5	Winter Flounder	5.0
6/18/2003	SB-1	Atlantic Tomcod	85.0
6/18/2003	SB-1	Bay Anchovy	75.0
6/18/2003	SB-1	Spotted Hake	5.0
6/18/2003	SB-1	Windowpane	5.0
6/18/2003	SB-2	Atlantic Tomcod	60.0
6/18/2003	SB-2	Bay Anchovy	10.0
6/18/2003	SB-2	Smallmouth Flounder	3.3
6/18/2003	SB-2	Spotted Hake	6.7
6/18/2003	SB-2	Windowpane	3.3
6/18/2003	SB-3	Atlantic Tomcod	11.0
6/18/2003	SB-3	Spotted Hake	3.0
6/19/2003	NB-3	Atlantic Tomcod	3.0
6/19/2003	NB-3	Bay Anchovy	2.0
6/19/2003	NB-3	Striped Bass	2.0
6/19/2003	NB-3	Winter Flounder	1.0
6/19/2003	NB-4	Bay Anchovy	1.0
6/19/2003	NB-4	Winter Flounder	2.0
6/19/2003	NB-5	Atlantic Menhaden	1.4

Appendix A. Adult finfish (trawl) CPUEs by date and sample location. (page 22 of 22)

Date	Station	Common Name	CPUE
6/19/2003	NB-5	Atlantic Tomcod	8.6
6/19/2003	NB-5	Bay Anchovy	12.9
6/19/2003	NB-5	Spotted Hake	2.9
6/19/2003	NB-6	American Eel	1.0
6/19/2003	NB-6	Atlantic Herring	1.0
6/19/2003	NB-6	Atlantic Tomcod	18.0
6/19/2003	NB-6	Bay Anchovy	6.0
6/19/2003	NB-6	Cunner	1.0
6/19/2003	NB-6	Northern Searobin	1.0
6/19/2003	NB-6	Oyster Toadfish	1.0
6/19/2003	NB-6	Red Hake	1.0
6/19/2003	NB-6	Spotted Hake	85.0
6/19/2003	NB-6	Summer Flounder	2.0
6/19/2003	NB-6	Windowpane	3.0
6/19/2003	NB-6	Winter Flounder	2.0
6/19/2003	NB-7	Bay Anchovy	24.3
6/19/2003	NB-7	Spotted Hake	1.4
6/19/2003	NB-7	Striped Bass	7.1
6/19/2003	NB-7	Summer Flounder	4.3
6/19/2003	NB-7	Winter Flounder	1.4
6/19/2003	PJ-1	Atlantic Tomcod	28.0
6/19/2003	PJ-1	Bay Anchovy	21.0
6/19/2003	PJ-1	Spotted Hake	3.0
6/19/2003	PJ-1	Summer Flounder	1.0
6/19/2003	PJ-1	Weakfish	1.0
6/19/2003	PJ-1	Winter Flounder	1.0
6/19/2003	SB-5	Spotted Hake	3.0
6/19/2003	SB-5	Summer Flounder	1.0
6/20/2003	LB-1	Bay Anchovy	6.0
6/20/2003	LB-1	Spiny Dogfish	1.0
6/20/2003	LB-2	Butterfish	2.0
6/20/2003	LB-4	Atlantic Herring	48.0
6/20/2003	LB-4	Bay Anchovy	34.0
6/20/2003	LB-4	Butterfish	1.0
6/20/2003	LB-4	Scup	10.0
6/20/2003	LB-4	Spiny Dogfish	1.0
6/20/2003	LB-4	Spotted Hake	6.0
6/20/2003	LB-4	Striped Searobin	4.0
6/20/2003	LB-4	Summer Flounder	1.0
6/20/2003	LB-4	Windowpane	2.0
6/20/2003	LB-5	Bay Anchovy	31.0
6/20/2003	LB-5	Blueback Herring	1.0
6/20/2003	LB-5	Spotted Hake	4.0
6/20/2003	LB-5	Winter Flounder	1.0
6/20/2003	LB-6	Atlantic Herring	176.0
6/20/2003	LB-6	Bay Anchovy	27.0
6/20/2003	LB-6	Windowpane	2.0
6/20/2003	LB-6	Winter Flounder	2.0

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 1 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
1/21/2003	LB-3	Rock gunnel	PYS	1	4.4
1/22/2003	NB-3	Atlantic croaker	PYS	1	7.9
1/22/2003	NB-3	Atlantic menhaden	PYS	1	7.9
1/22/2003	NB-4	Atlantic croaker	PYS	1	4.4
1/22/2003	NB-5	Atlantic croaker	PYS	2	4.5
1/22/2003	NB-6	Atlantic croaker	PYS	1	4.5
1/22/2003	NB-6	Atlantic croaker	JUV	1	4.5
1/22/2003	NB-7	Atlantic menhaden	PYS	1	7.0
1/22/2003	NB-7	Bay anchovy	JUV	1	7.0
1/22/2003	AK-2	Atlantic croaker	JUV	1	4.0
1/22/2003	AK-2	Bay anchovy	JUV	1	4.0
1/22/2003	AK-3	Rock gunnel	PYS	1	4.4
1/22/2003	AK-4	Bay anchovy	JUV	1	4.8
1/23/2003	PJ-4	Atlantic croaker	JUV	3	31.1
1/23/2003	PJ-4	Summer flounder	PYS	1	10.4
1/23/2003	PJ-5	Atlantic croaker	JUV	2	8.5
1/23/2003	SB-5	Atlantic croaker	JUV	1	4.0
1/23/2003	PJ-1	Atlantic croaker	PYS	1	6.7
1/23/2003	PJ-2	Atlantic croaker	JUV	5	23.8
1/23/2003	PJ-2	Bay anchovy	JUV	1	4.8
2/4/2003	LB-5	American sandlance	YS	1	4.7
2/4/2003	LB-4	Rock gunnel	PYS	1	5.2
2/4/2003	LB-3	Rock gunnel	PYS	1	5.0
2/4/2003	LB-2	Rock gunnel	PYS	1	4.4
2/4/2003	LB-1	Rock gunnel	PYS	3	14.1
2/5/2003	AK-3	Summer flounder	PYS	1	5.6
2/5/2003	AK-4	Rock gunnel	PYS	1	5.0
2/5/2003	NB-7	Rock gunnel	PYS	1	6.8
2/6/2003	SB-2	Rock gunnel	PYS	1	9.1
2/19/2003	LB-5	Winter flounder	Egg	7	43.4
2/19/2003	LB-4	Winter flounder	Egg	146	994.3
2/19/2003	LB-1	Winter flounder	Egg	1	5.4
2/19/2003	SB-6	Winter flounder	Egg	3	15.0
2/19/2003	SB-3	Winter flounder	Egg	2	9.9
2/19/2003	SB-4	Winter flounder	Egg	2	12.2
2/21/2003	SB-5	Rock gunnel	PYS	1	3.6
2/21/2003	PJ-3	Rock gunnel	PYS	1	6.4
2/21/2003	PJ-2	Rock gunnel	PYS	1	6.6
3/4/2003	PJ-2	Winter flounder	YS	1	7.4
3/4/2003	LB-3	Winter flounder	YS	1	7.6
3/4/2003	LB-5	Winter flounder	Egg	3	17.3
3/4/2003	LB-6	Atlantic herring	PYS	1	6.7
3/4/2003	LB-4	American sandlance	PYS	2	8.5
3/4/2003	LB-4	Grubby	PYS	1	4.3
3/4/2003	LB-2	Rock gunnel	PYS	1	8.1
3/4/2003	LB-1	Winter flounder	Egg	2	16.6
3/4/2003	PJ-5	Winter flounder	Egg	3	14.0
3/4/2003	PJ-1	Longhorn sculpin	YS	1	6.3
3/4/2003	PJ-1	Winter flounder	Egg	3	19.0
3/6/2003	SB-6	Rock gunnel	PYS	1	3.2

Date	Station	Common Name	Life Stage	Number Caught	Density
3/6/2003	SB-6	Winter flounder	YS	1	3.2
3/6/2003	HR-1	Grubby	PYS	1	15.4
3/7/2003	AK-3	Atlantic herring	PYS	2	11.1
3/7/2003	AK-1	Grubby	PYS	1	6.3
3/7/2003	AK-1	Longhorn sculpin	PYS	1	6.3
3/7/2003	AK-1	Winter flounder	PYS	1	6.3
3/7/2003	AK-2	American sandlance	PYS	1	4.2
3/7/2003	AK-2	Grubby	PYS	1	4.2
3/7/2003	AK-2	Winter flounder	YS	1	4.2
3/7/2003	AK-2	Winter flounder	PYS	2	8.5
3/18/2003	LB-3	Longhorn sculpin	YS	1	5.5
3/18/2003	LB-3	Winter flounder	Egg	2	10.9
3/18/2003	LB-5	Grubby	UID	1	5.6
3/18/2003	LB-5	Rock gunnel	PYS	1	5.6
3/18/2003	LB-5	Winter flounder	Egg	166	933.5
3/18/2003	LB-6	Winter flounder	Egg	1	7.2
3/18/2003	LB-4	Gadid unidentified	Egg	1	5.0
3/18/2003	LB-4	Grubby	YS	1	5.0
3/18/2003	LB-4	Grubby	PYS	1	5.0
3/18/2003	LB-4	Rock gunnel	YS	2	10.1
3/18/2003	LB-4	Rock gunnel	PYS	1	5.0
3/18/2003	LB-4	Winter flounder	Egg	13	65.6
3/18/2003	LB-1	Winter flounder	Egg	3	29.7
3/18/2003	LB-2	Rock gunnel	PYS	1	7.9
3/18/2003	LB-2	Winter flounder	Egg	2	15.8
3/18/2003	SB-6	Grubby	PYS	1	6.5
3/18/2003	SB-6	Winter flounder	Egg	159	1031.6
3/18/2003	SB-3	Winter flounder	Egg	15	174.7
3/18/2003	SB-4	American sandlance	PYS	1	6.2
3/18/2003	SB-4	Atlantic herring	PYS	3	18.7
3/18/2003	SB-4	Grubby	PYS	1	6.2
3/18/2003	SB-4	Winter flounder	Egg	27	168.7
3/18/2003	SB-1	Grubby	PYS	2	25.8
3/19/2003	AK-1	Atlantic herring	PYS	1	12.3
3/19/2003	AK-1	Grubby	PYS	1	12.3
3/19/2003	AK-1	Longhorn sculpin	PYS	1	12.3
3/19/2003	AK-4	Atlantic herring	PYS	1	5.8
3/19/2003	AK-4	Winter flounder	Egg	2	11.5
3/19/2003	AK-3	Atlantic herring	PYS	5	21.3
3/19/2003	AK-3	Unidentified	Egg	1	4.3
3/19/2003	NB-3	Grubby	YS	1	5.6
3/19/2003	NB-5	Atlantic herring	PYS	1	5.6
3/19/2003	NB-6	Atlantic herring	PYS	3	18.4
3/19/2003	NB-6	Grubby	PYS	1	6.1
3/19/2003	SB-5	Atlantic herring	PYS	6	44.1
3/21/2003	PJ-3	Winter flounder	Egg	23	124.2
3/21/2003	PJ-4	Atlantic herring	PYS	1	5.1
3/21/2003	PJ-4	Rock gunnel	PYS	1	5.1
3/21/2003	PJ-5	Atlantic herring	PYS	3	12.5
3/21/2003	PJ-5	Winter flounder	YS	2	8.4

Date	Station	Common Name	Life Stage	Number Caught	Density
3/21/2003	PJ-1	Winter flounder	Egg	1	5.1
3/21/2003	PJ-1	Winter flounder	YS	2	10.2
3/21/2003	PJ-1	Winter flounder	PYS	1	5.1
3/21/2003	PJ-1	Unidentified	Egg	1	5.1
3/21/2003	PJ-2	Grubby	PYS	1	5.9
3/21/2003	PJ-2	Winter flounder	YS	17	99.7
3/21/2003	PJ-2	Winter flounder	PYS	4	23.5
3/21/2003	HR-3	Winter flounder	YS	23	612.1
3/21/2003	HR-3	Winter flounder	PYS	5	133.1
3/21/2003	HR-3	Unidentified	Egg	1	26.6
3/21/2003	HR-2	Grubby	YS	1	18.3
3/21/2003	HR-2	Winter flounder	YS	40	733.3
3/21/2003	HR-2	Winter flounder	PYS	4	73.3
3/21/2003	HR-2	Winter flounder	UID	5	91.7
4/1/2003	LB-3	Grubby	YS	1	9.9
4/1/2003	LB-3	Grubby	PYS	6	59.3
4/1/2003	LB-3	Winter flounder	YS	103	1018.7
4/1/2003	LB-3	Winter flounder	PYS	93	919.8
4/1/2003	LB-3	Winter flounder	UID	153	1513.2
4/1/2003	LB-5	Grubby	PYS	8	46.3
4/1/2003	LB-5	Rock gunnel	PYS	2	11.6
4/1/2003	LB-5	Winter flounder	YS	54	312.8
4/1/2003	LB-5	Winter flounder	PYS	156	903.7
4/1/2003	LB-5	Winter flounder	UID	7	40.6
4/1/2003	LB-6	Clupeid unidentified	PYS	1	7.8
4/1/2003	LB-6	Windowpane	Egg	1	7.8
4/1/2003	LB-6	Winter flounder	Egg	2	15.6
4/1/2003	LB-6	Winter flounder	YS	10	77.8
4/1/2003	LB-6	Unidentified	UID	3	23.3
4/1/2003	LB-4	Grubby	YS	1	4.7
4/1/2003	LB-4	Grubby	PYS	33	154.7
4/1/2003	LB-4	Rock gunnel	PYS	4	18.8
4/1/2003	LB-4	Winter flounder	YS	139	651.8
4/1/2003	LB-4	Winter flounder	PYS	110	515.8
4/1/2003	LB-4	Winter flounder	UID	30	140.7
4/1/2003	LB-1	American sandlance	PYS	1	8.8
4/1/2003	LB-1	Winter flounder	Egg	2	17.7
4/1/2003	LB-1	Winter flounder	YS	2	17.7
4/1/2003	LB-1	Winter flounder	PYS	24	212.0
4/1/2003	LB-1	Winter flounder	UID	1	8.8
4/1/2003	LB-2	Winter flounder	PYS	4	30.9
4/1/2003	LB-2	Winter flounder	UID	3	23.2
4/1/2003	SB-6	American sandlance	PYS	1	5.5
4/1/2003	SB-6	Rock gunnel	PYS	1	5.5
4/1/2003	SB-6	Winter flounder	YS	41	226.7
4/1/2003	SB-6	Winter flounder	PYS	16	88.5
4/1/2003	SB-6	Winter flounder	UID	12	66.4
4/1/2003	SB-3	Grubby	YS	1	7.0
4/1/2003	SB-3	Grubby	PYS	1	7.0
4/1/2003	SB-3	Rock gunnel	PYS	1	7.0

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 4 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
4/1/2003	SB-3	Winter flounder	Egg	1	7.0
4/1/2003	SB-3	Winter flounder	YS	78	546.9
4/1/2003	SB-3	Winter flounder	PYS	194	1360.3
4/1/2003	SB-3	Winter flounder	UID	11	77.1
4/1/2003	SB-4	Grubby	PYS	3	14.9
4/1/2003	SB-4	Windowpane	Egg	2	9.9
4/1/2003	SB-4	Winter flounder	PYS	9	44.6
4/1/2003	SB-1	Grubby	YS	1	9.6
4/1/2003	SB-1	Grubby	PYS	3	28.9
4/1/2003	SB-1	Winter flounder	YS	87	837.6
4/1/2003	SB-1	Winter flounder	PYS	107	1030.1
4/1/2003	SB-1	Winter flounder	UID	23	221.4
4/1/2003	SB-2	Grubby	PYS	4	35.4
4/1/2003	SB-2	Rock gunnel	PYS	1	8.9
4/1/2003	SB-2	Winter flounder	YS	2	17.7
4/1/2003	SB-2	Winter flounder	PYS	11	97.4
4/1/2003	SB-2	Winter flounder	UID	5	44.3
4/1/2003	PJ-1	Grubby	PYS	3	17.7
4/1/2003	PJ-1	Windowpane	Egg	1	5.9
4/1/2003	PJ-1	Winter flounder	PYS	5	29.5
4/2/2003	AK-4	Grubby	PYS	2	9.8
4/2/2003	AK-4	Winter flounder	YS	154	757.5
4/2/2003	AK-4	Winter flounder	PYS	154	757.5
4/2/2003	AK-4	Winter flounder	UID	28	137.7
4/2/2003	NB-7	Winter flounder	PYS	2	11.2
4/2/2003	NB-7	Winter flounder	UID	2	11.2
4/2/2003	NB-6	Atlantic herring	PYS	1	5.6
4/2/2003	NB-6	Grubby	PYS	2	11.1
4/2/2003	NB-6	Winter flounder	YS	18	100.3
4/2/2003	NB-6	Winter flounder	PYS	7	39.0
4/2/2003	NB-6	Winter flounder	UID	4	22.3
4/2/2003	NB-4	Winter flounder	YS	32	161.8
4/2/2003	NB-4	Winter flounder	PYS	139	702.8
4/2/2003	NB-4	Winter flounder	UID	39	197.2
4/2/2003	NB-3	Winter flounder	PYS	23	120.5
4/2/2003	NB-3	Winter flounder	UID	68	356.3
4/2/2003	NB-5	Atlantic herring	PYS	2	11.7
4/2/2003	NB-5	Grubby	PYS	2	11.7
4/2/2003	NB-5	Winter flounder	YS	6	35.1
4/2/2003	NB-5	Winter flounder	PYS	1	5.9
4/2/2003	NB-5	Winter flounder	UID	2	11.7
4/2/2003	AK-3	Atlantic tomcod	PYS	1	5.3
4/2/2003	AK-3	Grubby	PYS	4	21.1
4/2/2003	AK-3	Winter flounder	YS	70	369.4
4/2/2003	AK-3	Winter flounder	PYS	17	89.7
4/2/2003	AK-3	Winter flounder	UID	3	15.8
4/2/2003	AK-2	Grubby	PYS	8	58.4
4/2/2003	AK-2	Winter flounder	Egg	1	7.3
4/2/2003	AK-2	Winter flounder	UID	4	29.2
4/2/2003	AK-1	Grubby	PYS	6	42.9

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 5 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
4/2/2003	AK-1	Winter flounder	YS	8	57.2
4/2/2003	AK-1	Winter flounder	PYS	13	93.0
4/2/2003	AK-1	Winter flounder	UID	2	14.3
4/2/2003	SB-5	Winter flounder	Egg	1	6.4
4/2/2003	SB-5	Winter flounder	YS	18	115.0
4/2/2003	SB-5	Winter flounder	PYS	7	44.7
4/2/2003	SB-5	Winter flounder	UID	11	70.3
4/2/2003	PJ-5	Grubby	PYS	5	21.7
4/2/2003	PJ-5	Rock gunnel	PYS	1	4.3
4/2/2003	PJ-5	Winter flounder	PYS	2	8.7
4/3/2003	PJ-3	Grubby	PYS	2	10.1
4/3/2003	PJ-3	Winter flounder	YS	2	10.1
4/3/2003	PJ-3	Winter flounder	PYS	10	50.7
4/3/2003	PJ-3	Winter flounder	UID	10	50.7
4/3/2003	PJ-2	Grubby	PYS	3	16.4
4/3/2003	PJ-2	Rock gunnel	PYS	1	5.5
4/3/2003	PJ-2	Winter flounder	YS	9	49.1
4/3/2003	PJ-2	Winter flounder	PYS	2	10.9
4/3/2003	PJ-2	Winter flounder	UID	13	71.0
4/3/2003	HR-1	Grubby	PYS	2	21.6
4/3/2003	HR-1	Winter flounder	YS	16	172.6
4/3/2003	HR-1	Winter flounder	PYS	14	151.0
4/3/2003	HR-1	Winter flounder	UID	2	21.6
4/3/2003	PJ-4	Atlantic herring	PYS	1	4.4
4/3/2003	PJ-4	Grubby	YS	1	4.4
4/3/2003	PJ-4	Grubby	PYS	3	13.1
4/3/2003	PJ-4	Winter flounder	YS	15	65.4
4/3/2003	PJ-4	Winter flounder	UID	5	21.8
4/3/2003	HR-2	Winter flounder	YS	6	114.4
4/3/2003	HR-2	Winter flounder	UID	2	38.1
4/15/2003	PJ-3	Fourbeard rockling	Egg	1	4.9
4/15/2003	PJ-3	Grubby	YS	1	4.9
4/15/2003	PJ-3	Grubby	PYS	3	14.7
4/15/2003	PJ-3	Winter flounder	PYS	76	373.4
4/15/2003	PJ-3	Winter flounder	UID	26	127.7
4/15/2003	LB-3	American sandlance	PYS	2	14.2
4/15/2003	LB-3	Grubby	YS	5	35.4
4/15/2003	LB-3	Grubby	PYS	16	113.2
4/15/2003	LB-3	Winter flounder	YS	3	21.2
4/15/2003	LB-3	Winter flounder	PYS	134	948.4
4/15/2003	LB-3	Winter flounder	UID	4	28.3
4/15/2003	LB-5	Grubby	YS	1	8.6
4/15/2003	LB-5	Grubby	PYS	5	42.8
4/15/2003	LB-5	Rock gunnel	PYS	1	8.6
4/15/2003	LB-5	Windowpane	Egg	2	17.1
4/15/2003	LB-5	Winter flounder	PYS	131	1122.5
4/15/2003	LB-6	American sandlance	PYS	1	7.5
4/15/2003	LB-6	Grubby	PYS	3	22.6
4/15/2003	LB-6	Windowpane	Egg	1	7.5
4/15/2003	LB-6	Winter flounder	PYS	100	753.0

Date	Station	Common Name	Life Stage	Number Caught	Density
4/15/2003	LB-6	Winter flounder	UID	4	30.1
4/15/2003	LB-4	Grubby	YS	2	10.3
4/15/2003	LB-4	Grubby	PYS	31	159.1
4/15/2003	LB-4	Rock gunnel	PYS	7	35.9
4/15/2003	LB-4	Windowpane	Egg	1	5.1
4/15/2003	LB-4	Winter flounder	YS	2	10.3
4/15/2003	LB-4	Winter flounder	PYS	109	559.5
4/15/2003	LB-4	Winter flounder	UID	1	5.1
4/15/2003	LB-2	American sandlance	PYS	6	43.4
4/15/2003	LB-2	Grubby	YS	1	7.2
4/15/2003	LB-2	Grubby	PYS	7	50.6
4/15/2003	LB-2	Rock gunnel	PYS	1	7.2
4/15/2003	LB-2	Winter flounder	PYS	33	238.5
4/15/2003	LB-1	American sandlance	PYS	2	11.2
4/15/2003	LB-1	Grubby	PYS	5	27.9
4/15/2003	LB-1	Winter flounder	Egg	2	11.2
4/15/2003	LB-1	Winter flounder	YS	2	11.2
4/15/2003	LB-1	Winter flounder	PYS	278	1550.0
4/15/2003	LB-1	Winter flounder	UID	2	11.2
4/15/2003	SB-3	Fourbeard rockling	Egg	7	33.3
4/15/2003	SB-3	Grubby	PYS	10	47.6
4/15/2003	SB-3	Windowpane	Egg	1	4.8
4/15/2003	SB-3	Winter flounder	Egg	3	14.3
4/15/2003	SB-3	Winter flounder	YS	19	90.5
4/15/2003	SB-3	Winter flounder	PYS	37	176.3
4/15/2003	SB-4	American sandlance	PYS	1	4.9
4/15/2003	SB-4	Atlantic herring	PYS	5	24.4
4/15/2003	SB-4	Fourbeard rockling	Egg	16	78.1
4/15/2003	SB-4	Grubby	YS	1	4.9
4/15/2003	SB-4	Grubby	PYS	12	58.6
4/15/2003	SB-4	Rock gunnel	PYS	2	9.8
4/15/2003	SB-4	Windowpane	Egg	2	9.8
4/15/2003	SB-4	Winter flounder	YS	37	180.7
4/15/2003	SB-4	Winter flounder	PYS	146	713.1
4/15/2003	SB-4	Winter flounder	UID	6	29.3
4/15/2003	SB-1	Fourbeard rockling	Egg	1	11.2
4/15/2003	SB-1	Grubby	PYS	7	78.5
4/15/2003	SB-1	Winter flounder	PYS	12	134.5
4/15/2003	SB-1	Winter flounder	UID	1	11.2
4/15/2003	SB-2	American sandlance	PYS	1	9.4
4/15/2003	SB-2	Fourbeard rockling	Egg	8	75.6
4/15/2003	SB-2	Grubby	YS	1	9.4
4/15/2003	SB-2	Grubby	PYS	7	66.1
4/15/2003	SB-2	Winter flounder	YS	4	37.8
4/15/2003	SB-2	Winter flounder	PYS	55	519.7
4/15/2003	PJ-1	Atlantic herring	PYS	12	63.0
4/15/2003	PJ-1	Grubby	YS	3	15.7
4/15/2003	PJ-1	Grubby	PYS	4	21.0
4/15/2003	PJ-1	Rock gunnel	PYS	2	10.5
4/15/2003	PJ-1	Windowpane	Egg	1	5.2

Date	Station	Common Name	Life Stage	Number Caught	Density
4/15/2003	PJ-1	Winter flounder	YS	1	5.2
4/15/2003	PJ-1	Winter flounder	PYS	17	89.2
4/16/2003	AK-4	Grubby	PYS	1	5.8
4/16/2003	AK-4	Winter flounder	PYS	18	105.1
4/16/2003	AK-3	Grubby	PYS	1	6.4
4/16/2003	AK-3	Winter flounder	PYS	10	64.5
4/16/2003	AK-3	Winter flounder	UID	1	6.4
4/16/2003	NB-3	Fourspot flounder	PYS	1	4.6
4/16/2003	NB-3	Grubby	PYS	6	27.5
4/16/2003	NB-3	Winter flounder	PYS	57	261.4
4/16/2003	NB-3	Winter flounder	UID	2	9.2
4/16/2003	NB-4	Grubby	PYS	2	10.4
4/16/2003	NB-4	Winter flounder	PYS	37	192.1
4/16/2003	NB-4	Winter flounder	UID	11	57.1
4/16/2003	NB-5	American sandlance	PYS	2	10.9
4/16/2003	NB-5	Grubby	YS	1	5.5
4/16/2003	NB-5	Grubby	PYS	7	38.3
4/16/2003	NB-5	Winter flounder	PYS	5	27.3
4/16/2003	NB-6	Atlantic tomcod	PYS	1	7.0
4/16/2003	NB-6	Fourbeard rockling	Egg	1	7.0
4/16/2003	NB-6	Grubby	PYS	9	62.8
4/16/2003	NB-6	Unidentified	UID	1	7.0
4/16/2003	NB-7	Grubby	PYS	2	10.9
4/16/2003	NB-7	Winter flounder	Egg	1	5.5
4/16/2003	NB-7	Winter flounder	PYS	36	196.7
4/16/2003	AK-2	American sandlance	PYS	1	4.0
4/16/2003	AK-2	Winter flounder	PYS	25	99.5
4/16/2003	AK-1	American sandlance	PYS	4	18.0
4/16/2003	AK-1	Grubby	PYS	4	18.0
4/16/2003	AK-1	Rock gunnel	PYS	1	4.5
4/16/2003	AK-1	Winter flounder	PYS	121	544.3
4/16/2003	AK-1	Unidentified	UID	19	85.5
4/16/2003	SB-5	American sandlance	PYS	1	7.0
4/16/2003	SB-5	Atlantic herring	PYS	3	21.1
4/16/2003	SB-5	Grubby	PYS	1	7.0
4/16/2003	SB-5	Rock gunnel	PYS	1	7.0
4/16/2003	SB-5	Windowpane	Egg	1	7.0
4/16/2003	SB-5	Winter flounder	PYS	14	98.6
4/16/2003	SB-5	Winter flounder	UID	3	21.1
4/17/2003	SB-6	American sandlance	PYS	1	4.0
4/17/2003	SB-6	Atlantic herring	PYS	3	12.0
4/17/2003	SB-6	Grubby	PYS	2	8.0
4/17/2003	SB-6	Winter flounder	Egg	2	8.0
4/17/2003	SB-6	Winter flounder	PYS	318	1270.7
4/17/2003	SB-6	Winter flounder	UID	146	583.4
4/17/2003	PJ-5	Atlantic herring	PYS	4	20.3
4/17/2003	PJ-5	Fourbeard rockling	Egg	3	15.2
4/17/2003	PJ-5	Grubby	YS	3	15.2
4/17/2003	PJ-5	Rock gunnel	PYS	2	10.1
4/17/2003	PJ-5	Winter flounder	YS	4	20.3

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 8 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
4/17/2003	PJ-5	Winter flounder	PYS	42	213.1
4/17/2003	PJ-5	Winter flounder	UID	4	20.3
4/17/2003	PJ-4	American sandlance	PYS	2	11.4
4/17/2003	PJ-4	Atlantic herring	PYS	1	5.7
4/17/2003	PJ-4	Fourbeard rockling	Egg	9	51.4
4/17/2003	PJ-4	Grubby	YS	1	5.7
4/17/2003	PJ-4	Grubby	PYS	1	5.7
4/17/2003	PJ-4	Windowpane	Egg	1	5.7
4/17/2003	PJ-4	Winter flounder	PYS	23	131.5
4/17/2003	PJ-4	Winter flounder	UID	3	17.1
4/17/2003	HR-1	Atlantic herring	PYS	1	14.2
4/17/2003	HR-1	Fourbeard rockling	Egg	1	14.2
4/17/2003	HR-1	Grubby	YS	1	14.2
4/17/2003	HR-1	Grubby	PYS	6	85.4
4/17/2003	HR-1	Rock gunnel	PYS	2	28.5
4/17/2003	HR-1	Winter flounder	PYS	1	14.2
4/17/2003	PJ-2	American sandlance	PYS	1	6.2
4/17/2003	PJ-2	Atlantic herring	PYS	1	6.2
4/17/2003	PJ-2	Fourbeard rockling	Egg	1	6.2
4/17/2003	PJ-2	Grubby	YS	4	24.9
4/17/2003	PJ-2	Grubby	PYS	13	81.1
4/17/2003	PJ-2	Winter flounder	YS	4	24.9
4/17/2003	PJ-2	Winter flounder	PYS	11	68.6
4/17/2003	PJ-2	Winter flounder	UID	1	6.2
4/17/2003	HR-2	Atlantic herring	PYS	1	14.0
4/17/2003	HR-2	Winter flounder	PYS	13	181.9
4/17/2003	HR-3	Winter flounder	PYS	6	230.3
4/30/2003	PJ-2	Grubby	PYS	1	5.9
4/30/2003	PJ-2	Rock gunnel	PYS	1	5.9
4/30/2003	PJ-2	Winter flounder	PYS	4	23.5
4/30/2003	PJ-3	Grubby	PYS	1	6.8
4/30/2003	PJ-3	Winter flounder	PYS	20	137.0
4/30/2003	LB-3	Windowpane	Egg	44	251.7
4/30/2003	LB-3	Winter flounder	PYS	752	4302.3
4/30/2003	LB-5	Grubby	PYS	4	20.7
4/30/2003	LB-5	Windowpane	Egg	88	455.6
4/30/2003	LB-5	Winter flounder	PYS	42	217.4
4/30/2003	LB-6	Windowpane	Egg	8	39.0
4/30/2003	LB-4	Grubby	YS	1	4.4
4/30/2003	LB-4	Grubby	PYS	90	396.4
4/30/2003	LB-4	Rock gunnel	PYS	9	39.6
4/30/2003	LB-4	Windowpane	Egg	24	105.7
4/30/2003	LB-4	Winter flounder	Egg	2	8.8
4/30/2003	LB-4	Winter flounder	PYS	47	207.0
4/30/2003	LB-2	American sandlance	PYS	2	16.9
4/30/2003	LB-2	Grubby	PYS	17	143.7
4/30/2003	LB-2	Rock gunnel	PYS	1	8.5
4/30/2003	LB-2	Windowpane	Egg	12	101.4
4/30/2003	LB-2	Winter flounder	Egg	4	33.8
4/30/2003	LB-2	Winter flounder	PYS	97	820.0

Date	Station	Common Name	Life Stage	Number Caught	Density
4/30/2003	LB-1	Grubby	PYS	4	20.6
4/30/2003	LB-1	Windowpane	Egg	15	77.1
4/30/2003	LB-1	Winter flounder	PYS	1328	6824.9
4/30/2003	SB-3	Atlantic tomcod	JUV	1	5.1
4/30/2003	SB-3	Grubby	YS	5	25.3
4/30/2003	SB-3	Grubby	PYS	2	10.1
4/30/2003	SB-3	Windowpane	Egg	25	126.5
4/30/2003	SB-3	Winter flounder	PYS	22	111.3
4/30/2003	SB-4	Atlantic tomcod	JUV	1	4.1
4/30/2003	SB-4	Grubby	YS	1	4.1
4/30/2003	SB-4	Grubby	PYS	2	8.1
4/30/2003	SB-4	Rock gunnel	PYS	2	8.1
4/30/2003	SB-4	Windowpane	Egg	24	97.7
4/30/2003	SB-4	Winter flounder	PYS	9	36.6
4/30/2003	SB-1	Grubby	PYS	5	56.2
4/30/2003	SB-1	Windowpane	Egg	10	112.4
4/30/2003	SB-1	Winter flounder	YS	1	11.2
4/30/2003	SB-1	Winter flounder	PYS	34	382.3
4/30/2003	SB-2	Grubby	PYS	1	8.4
4/30/2003	SB-2	Windowpane	Egg	23	193.5
4/30/2003	SB-2	Winter flounder	PYS	26	218.8
4/30/2003	PJ-1	Windowpane	Egg	3	18.2
4/30/2003	PJ-1	Winter flounder	PYS	10	60.8
5/1/2003	AK-4	Gobiid unidentified	PYS	1	5.0
5/1/2003	AK-4	Windowpane	Egg	1	5.0
5/1/2003	AK-4	Winter flounder	PYS	9	44.6
5/1/2003	AK-3	Winter flounder	PYS	5	28.3
5/1/2003	AK-1	Grubby	PYS	1	8.0
5/1/2003	AK-1	Windowpane	Egg	2	16.1
5/1/2003	AK-1	Winter flounder	PYS	8	64.3
5/1/2003	AK-2	Grubby	PYS	1	7.7
5/1/2003	AK-2	Windowpane	Egg	7	54.2
5/1/2003	AK-2	Winter flounder	PYS	2	15.5
5/1/2003	NB-7	Grubby	YS	1	8.7
5/1/2003	NB-7	Grubby	PYS	1	8.7
5/1/2003	NB-7	Windowpane	Egg	2	17.5
5/1/2003	NB-7	Winter flounder	YS	1	8.7
5/1/2003	NB-7	Winter flounder	PYS	7	61.1
5/1/2003	NB-4	Winter flounder	PYS	9	58.5
5/1/2003	NB-3	Windowpane	YS	1	7.3
5/1/2003	NB-3	Winter flounder	YS	1	7.3
5/1/2003	NB-3	Winter flounder	PYS	27	196.0
5/1/2003	NB-5	Winter flounder	PYS	3	32.5
5/1/2003	NB-6	Windowpane	Egg	1	10.3
5/1/2003	NB-6	Winter flounder	PYS	1	10.3
5/1/2003	PJ-5	Fourbeard rockling	Egg	1	5.1
5/1/2003	PJ-5	Grubby	PYS	1	5.1
5/1/2003	PJ-5	Windowpane	Egg	45	229.1
5/1/2003	PJ-5	Winter flounder	PYS	8	40.7
5/1/2003	PJ-4	Grubby	PYS	1	8.5

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 10 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
5/1/2003	PJ-4	Windowpane	Egg	16	135.8
5/1/2003	PJ-4	Winter flounder	PYS	8	67.9
5/2/2003	HR-1	Windowpane	Egg	10	120.7
5/2/2003	HR-1	Winter flounder	YS	2	24.1
5/2/2003	HR-1	Winter flounder	PYS	19	229.3
5/2/2003	SB-6	American sandlance	PYS	4	19.3
5/2/2003	SB-6	Atlantic menhaden	PYS	1	4.8
5/2/2003	SB-6	Grubby	PYS	11	53.0
5/2/2003	SB-6	Rock gunnel	PYS	2	9.6
5/2/2003	SB-6	Windowpane	Egg	24	115.5
5/2/2003	SB-6	Winter flounder	YS	2	9.6
5/2/2003	SB-6	Winter flounder	PYS	256	1232.5
5/2/2003	SB-5	Grubby	PYS	7	27.4
5/2/2003	SB-5	Rock gunnel	PYS	15	58.7
5/2/2003	SB-5	Windowpane	Egg	66	258.3
5/2/2003	SB-5	Winter flounder	Egg	1	3.9
5/2/2003	SB-5	Winter flounder	YS	7	27.4
5/2/2003	SB-5	Winter flounder	PYS	179	700.6
5/2/2003	HR-2	Windowpane	Egg	5	62.2
5/2/2003	HR-2	Winter flounder	PYS	10	124.5
5/2/2003	HR-3	Winter flounder	PYS	2	63.6
5/13/2003	PJ-2	Windowpane	Egg	34	140.5
5/13/2003	PJ-2	Winter flounder	PYS	53	219.1
5/13/2003	PJ-3	Windowpane	Egg	12	48.7
5/13/2003	PJ-3	Winter flounder	PYS	15	60.9
5/13/2003	PJ-3	Labridae	Egg	1	4.1
5/13/2003	PJ-4	Atlantic menhaden	Egg	12	39.7
5/13/2003	PJ-4	Atlantic menhaden	UID	5	16.6
5/13/2003	PJ-4	Windowpane	Egg	82	271.6
5/13/2003	PJ-4	Windowpane	PYS	2	6.6
5/13/2003	PJ-4	Winter flounder	PYS	9	29.8
5/13/2003	PJ-4	Labridae	Egg	2	6.6
5/13/2003	PJ-5	Atlantic mackerel	Egg	3	11.2
5/13/2003	PJ-5	Windowpane	Egg	41	152.9
5/13/2003	PJ-5	Windowpane	PYS	1	3.7
5/13/2003	PJ-5	Winter flounder	PYS	25	93.2
5/13/2003	SB-5	Atlantic mackerel	Egg	20	116.1
5/13/2003	SB-5	Windowpane	Egg	43	249.6
5/13/2003	SB-5	Winter flounder	PYS	75	435.3
5/13/2003	SB-5	Labridae	Egg	3	17.4
5/13/2003	SB-6	Atlantic mackerel	Egg	6	24.4
5/13/2003	SB-6	Atlantic menhaden	Egg	1	4.1
5/13/2003	SB-6	Atlantic menhaden	UID	1	4.1
5/13/2003	SB-6	Windowpane	Egg	46	186.8
5/13/2003	SB-6	Windowpane	PYS	1	4.1
5/13/2003	SB-6	Winter flounder	PYS	39	158.4
5/13/2003	SB-6	Labridae	Egg	2	8.1
5/13/2003	SB-3	Atlantic mackerel	Egg	3	26.0
5/13/2003	SB-3	Windowpane	Egg	26	225.6
5/13/2003	SB-3	Winter flounder	PYS	6	52.1

Date	Station	Common Name	Life Stage	Number Caught	Density
5/13/2003	SB-3	Labridae	Egg	3	26.0
5/13/2003	SB-4	Atlantic mackerel	Egg	14	86.2
5/13/2003	SB-4	Windowpane	Egg	82	504.9
5/13/2003	SB-4	Winter flounder	PYS	210	1293.1
5/13/2003	SB-1	Atlantic mackerel	Egg	1	10.6
5/13/2003	SB-1	Windowpane	Egg	26	275.5
5/13/2003	SB-1	Winter flounder	PYS	11	116.6
5/13/2003	SB-1	Labridae	Egg	2	21.2
5/13/2003	SB-2	Windowpane	Egg	18	155.3
5/13/2003	SB-2	Winter flounder	PYS	8	69.0
5/13/2003	PJ-1	Atlantic mackerel	Egg	4	29.0
5/13/2003	PJ-1	Windowpane	Egg	23	166.5
5/13/2003	PJ-1	Winter flounder	PYS	21	152.0
5/14/2003	NB-7	Atlantic menhaden	Egg	4	24.4
5/14/2003	NB-7	Windowpane	Egg	3	18.3
5/14/2003	NB-7	Windowpane	PYS	2	12.2
5/14/2003	NB-7	Winter flounder	PYS	39	237.7
5/14/2003	NB-4	Atlantic silverside	PYS	1	4.9
5/14/2003	NB-4	Windowpane	Egg	2	9.8
5/14/2003	NB-4	Winter flounder	PYS	16	78.4
5/14/2003	NB-4	Labridae	Egg	1	4.9
5/14/2003	NB-3	Winter flounder	PYS	6	30.6
5/14/2003	NB-3	Labridae	Egg	1	5.1
5/14/2003	AK-4	Atlantic menhaden	Egg	2	10.8
5/14/2003	AK-4	Atlantic silverside	PYS	1	5.4
5/14/2003	AK-4	Windowpane	PYS	1	5.4
5/14/2003	AK-4	Winter flounder	PYS	16	86.0
5/14/2003	AK-3	Atlantic herring	PYS	1	5.3
5/14/2003	AK-3	Atlantic tomcod	JUV	1	5.3
5/14/2003	AK-3	Grubby	PYS	1	5.3
5/14/2003	AK-3	Windowpane	Egg	3	16.0
5/14/2003	AK-3	Winter flounder	PYS	164	877.1
5/14/2003	AK-3	Labridae	Egg	1	5.3
5/14/2003	AK-2	Atlantic menhaden	Egg	1	6.0
5/14/2003	AK-2	Atlantic silverside	PYS	1	6.0
5/14/2003	AK-2	Windowpane	Egg	8	48.2
5/14/2003	AK-2	Winter flounder	PYS	35	210.8
5/14/2003	AK-1	Atlantic menhaden	Egg	3	16.7
5/14/2003	AK-1	Atlantic menhaden	PYS	1	5.6
5/14/2003	AK-1	Windowpane	Egg	5	27.9
5/14/2003	AK-1	Windowpane	PYS	1	5.6
5/14/2003	AK-1	Winter flounder	PYS	6	33.5
5/14/2003	AK-1	Labridae	Egg	3	16.7
5/14/2003	NB-6	Atlantic herring	PYS	1	7.3
5/14/2003	NB-6	Atlantic menhaden	Egg	86	630.1
5/14/2003	NB-6	Atlantic tomcod	JUV	1	7.3
5/14/2003	NB-6	Windowpane	Egg	20	146.5
5/14/2003	NB-6	Winter flounder	PYS	11	80.6
5/14/2003	NB-6	Labridae	Egg	6	44.0
5/14/2003	NB-5	Atlantic menhaden	Egg	2	22.2

Date	Station	Common Name	Life Stage	Number Caught	Density
5/14/2003	NB-5	Windowpane	Egg	5	55.4
5/14/2003	NB-5	Winter flounder	PYS	10	110.8
5/14/2003	NB-5	Labridae	Egg	3	33.3
5/15/2003	HR-2	Atlantic mackerel	YS	5	62.0
5/15/2003	HR-2	Atlantic mackerel	PYS	3	37.2
5/15/2003	HR-2	Atlantic mackerel	UID	7	86.8
5/15/2003	HR-2	Atlantic menhaden	Egg	26	322.5
5/15/2003	HR-2	Atlantic menhaden	YS	8	99.2
5/15/2003	HR-2	Atlantic menhaden	UID	6	74.4
5/15/2003	HR-2	Windowpane	Egg	7	86.8
5/15/2003	HR-2	Windowpane	PYS	2	24.8
5/15/2003	HR-2	Winter flounder	PYS	7	86.8
5/15/2003	HR-2	Labridae	Egg	1	12.4
5/15/2003	HR-3	Atlantic mackerel	Egg	1	69.7
5/15/2003	HR-3	Atlantic menhaden	Egg	2	139.4
5/15/2003	HR-3	Windowpane	Egg	2	139.4
5/15/2003	HR-3	Winter flounder	PYS	3	209.0
5/15/2003	LB-3	Atlantic mackerel	Egg	5	26.2
5/15/2003	LB-3	Atlantic menhaden	Egg	20	104.6
5/15/2003	LB-3	Atlantic menhaden	YS	2	10.5
5/15/2003	LB-3	Atlantic menhaden	PYS	13	68.0
5/15/2003	LB-3	Atlantic menhaden	UID	9	47.1
5/15/2003	LB-3	Windowpane	Egg	42	219.7
5/15/2003	LB-3	Windowpane	PYS	13	68.0
5/15/2003	LB-3	Winter flounder	PYS	126	659.2
5/15/2003	LB-3	Labridae	Egg	2	10.5
5/15/2003	LB-5	Atlantic mackerel	Egg	6	35.5
5/15/2003	LB-5	Grubby	PYS	1	5.9
5/15/2003	LB-5	Windowpane	Egg	29	171.4
5/15/2003	LB-5	Winter flounder	PYS	19	112.3
5/15/2003	LB-6	Windowpane	Egg	36	226.3
5/15/2003	LB-6	Windowpane	PYS	1	6.3
5/15/2003	LB-6	Winter flounder	PYS	41	257.8
5/15/2003	LB-6	Labridae	Egg	5	31.4
5/15/2003	LB-4	Atlantic mackerel	Egg	68	316.6
5/15/2003	LB-4	Atlantic menhaden	Egg	16	74.5
5/15/2003	LB-4	Atlantic menhaden	YS	1	4.7
5/15/2003	LB-4	Atlantic menhaden	PYS	3	14.0
5/15/2003	LB-4	Atlantic tomcod	PYS	1	4.7
5/15/2003	LB-4	Windowpane	Egg	82	381.8
5/15/2003	LB-4	Windowpane	YS	2	9.3
5/15/2003	LB-4	Windowpane	PYS	20	93.1
5/15/2003	LB-4	Winter flounder	PYS	332	1545.8
5/15/2003	LB-4	Labridae	Egg	4	18.6
5/15/2003	LB-2	Atlantic mackerel	Egg	14	88.3
5/15/2003	LB-2	Windowpane	Egg	3	18.9
5/15/2003	LB-2	Winter flounder	PYS	36	227.0
5/15/2003	LB-1	Atlantic mackerel	Egg	52	252.6
5/15/2003	LB-1	Atlantic menhaden	Egg	2	9.7
5/15/2003	LB-1	Fourbeard rockling	PYS	1	4.9

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 13 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
5/15/2003	LB-1	Grubby	PYS	1	4.9
5/15/2003	LB-1	Windowpane	Egg	26	126.3
5/15/2003	LB-1	Winter flounder	PYS	92	446.9
5/15/2003	LB-1	Labridae	Egg	6	29.1
5/15/2003	HR-1	Windowpane	Egg	16	181.5
6/3/2003	LB-3	Atlantic menhaden	Egg	1376	9330.5
6/3/2003	LB-3	Bay anchovy	Egg	768	5207.7
6/3/2003	LB-3	Windowpane	Egg	176	1193.4
6/3/2003	LB-3	Windowpane	YS	1	6.8
6/3/2003	LB-3	Windowpane	PYS	15	101.7
6/3/2003	LB-3	Winter flounder	PYS	1	6.8
6/3/2003	LB-3	Labridae	Egg	352	2386.9
6/3/2003	LB-5	Atlantic menhaden	Egg	4416	31269.8
6/3/2003	LB-5	Bay anchovy	Egg	320	2265.9
6/3/2003	LB-5	Prionotus sp.	Egg	64	453.2
6/3/2003	LB-5	Weakfish	Egg	128	906.4
6/3/2003	LB-5	Windowpane	Egg	576	4078.7
6/3/2003	LB-5	Windowpane	PYS	24	169.9
6/3/2003	LB-5	Unidentified	PYS	1	7.1
6/3/2003	LB-5	Labridae	Egg	1600	11329.6
6/3/2003	LB-6	Atlantic menhaden	Egg	32	163.3
6/3/2003	LB-6	Atlantic menhaden	PYS	4	20.4
6/3/2003	LB-6	Bay anchovy	Egg	192	979.9
6/3/2003	LB-6	Prionotus sp.	Egg	16	81.7
6/3/2003	LB-6	Weakfish	Egg	64	326.6
6/3/2003	LB-6	Windowpane	Egg	32	163.3
6/3/2003	LB-6	Windowpane	PYS	2	10.2
6/3/2003	LB-6	Labridae	Egg	352	1796.4
6/3/2003	LB-4	Atlantic menhaden	Egg	3136	14724.0
6/3/2003	LB-4	Atlantic menhaden	PYS	4	18.8
6/3/2003	LB-4	Bay anchovy	Egg	32	150.2
6/3/2003	LB-4	Prionotus sp.	Egg	128	601.0
6/3/2003	LB-4	Weakfish	Egg	96	450.7
6/3/2003	LB-4	Windowpane	Egg	160	751.2
6/3/2003	LB-4	Windowpane	PYS	33	154.9
6/3/2003	LB-4	Winter flounder	PYS	4	18.8
6/3/2003	LB-4	Labridae	Egg	448	2103.4
6/3/2003	LB-2	Atlantic menhaden	Egg	40	181.7
6/3/2003	LB-2	Atlantic menhaden	PYS	3	13.6
6/3/2003	LB-2	Bay anchovy	Egg	16	72.7
6/3/2003	LB-2	Prionotus sp.	Egg	12	54.5
6/3/2003	LB-2	Weakfish	Egg	24	109.0
6/3/2003	LB-2	Windowpane	Egg	40	181.7
6/3/2003	LB-2	Windowpane	YS	1	4.5
6/3/2003	LB-2	Windowpane	PYS	43	195.3
6/3/2003	LB-2	Winter flounder	PYS	3	13.6
6/3/2003	LB-2	Labridae	Egg	56	254.3
6/3/2003	LB-1	Atlantic menhaden	Egg	80	354.9
6/3/2003	LB-1	Bay anchovy	Egg	8	35.5
6/3/2003	LB-1	Fourbeard rockling	PYS	1	4.4

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 14 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
6/3/2003	LB-1	Prionotus sp.	Egg	4	17.7
6/3/2003	LB-1	Weakfish	Egg	24	106.5
6/3/2003	LB-1	Windowpane	Egg	64	283.9
6/3/2003	LB-1	Windowpane	PYS	29	128.6
6/3/2003	LB-1	Winter flounder	PYS	3	13.3
6/3/2003	LB-1	Labridae	Egg	68	301.6
6/3/2003	PJ-2	Windowpane	YS	2	14.7
6/3/2003	PJ-2	Windowpane	PYS	5	36.8
6/3/2003	PJ-3	Atlantic menhaden	PYS	1	6.2
6/3/2003	PJ-3	Bay anchovy	Egg	3	18.6
6/3/2003	PJ-3	Windowpane	PYS	9	55.9
6/3/2003	SB-6	Atlantic menhaden	Egg	16	82.7
6/3/2003	SB-6	Bay anchovy	Egg	48	248.0
6/3/2003	SB-6	Fourbeard rockling	PYS	1	5.2
6/3/2003	SB-6	Prionotus sp.	Egg	32	165.4
6/3/2003	SB-6	Windowpane	Egg	288	1488.2
6/3/2003	SB-6	Windowpane	PYS	29	149.9
6/3/2003	SB-6	Winter flounder	PYS	16	82.7
6/3/2003	SB-6	Labridae	Egg	464	2397.7
6/3/2003	SB-4	Atlantic menhaden	Egg	16	72.1
6/3/2003	SB-4	Atlantic menhaden	PYS	6	27.0
6/3/2003	SB-4	Bay anchovy	Egg	64	288.3
6/3/2003	SB-4	Windowpane	Egg	80	360.4
6/3/2003	SB-4	Windowpane	PYS	20	90.1
6/3/2003	SB-4	Winter flounder	PYS	1	4.5
6/3/2003	SB-4	Labridae	Egg	200	901.0
6/3/2003	SB-3	Windowpane	PYS	2	10.9
6/4/2003	NB-6	Windowpane	Egg	1	5.0
6/4/2003	NB-6	Winter flounder	PYS	1	5.0
6/4/2003	NB-6	Winter flounder	JUV	1	5.0
6/4/2003	NB-6	Labridae	Egg	1	5.0
6/4/2003	NB-3	Atlantic silverside	PYS	1	4.9
6/4/2003	NB-3	Bay anchovy	Egg	2	9.7
6/4/2003	NB-3	Northern pipefish	PYS	1	4.9
6/4/2003	NB-3	Weakfish	PYS	1	4.9
6/4/2003	NB-3	White perch	YS	9	43.8
6/4/2003	NB-3	Windowpane	PYS	1	4.9
6/4/2003	NB-4	Atlantic menhaden	Egg	2	9.2
6/4/2003	NB-4	Atlantic silverside	PYS	1	4.6
6/4/2003	NB-4	Bay anchovy	Egg	1	4.6
6/4/2003	NB-4	White perch	YS	3	13.8
6/4/2003	NB-4	Labridae	Egg	1	4.6
6/4/2003	NB-5	Winter flounder	PYS	3	15.9
6/4/2003	NB-7	White perch	YS	1	6.7
6/4/2003	NB-7	Windowpane	PYS	1	6.7
6/4/2003	AK-4	Bay anchovy	Egg	6	35.8
6/4/2003	AK-4	White perch	YS	2	11.9
6/4/2003	AK-4	Winter flounder	PYS	1	6.0
6/4/2003	AK-4	Labridae	Egg	6	35.8
6/4/2003	AK-3	Bay anchovy	Egg	7	48.8

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 15 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
6/4/2003	AK-3	Windowpane	PYS	2	14.0
6/4/2003	AK-3	Winter flounder	PYS	4	27.9
6/4/2003	AK-3	Labridae	Egg	2	14.0
6/4/2003	AK-2	Atlantic silverside	PYS	1	5.5
6/4/2003	AK-2	Bay anchovy	Egg	2	11.0
6/4/2003	AK-2	Windowpane	PYS	1	5.5
6/4/2003	AK-2	Winter flounder	PYS	26	142.8
6/4/2003	AK-2	Labridae	Egg	4	22.0
6/4/2003	AK-1	Atlantic silverside	YS	1	7.8
6/4/2003	AK-1	Bay anchovy	Egg	6	46.8
6/4/2003	AK-1	White perch	YS	1	7.8
6/4/2003	AK-1	Winter flounder	PYS	4	31.2
6/4/2003	AK-1	Labridae	Egg	4	31.2
6/5/2003	HR-1	Atlantic menhaden	Egg	184	2691.9
6/5/2003	HR-1	Bay anchovy	Egg	96	1404.5
6/5/2003	HR-1	Weakfish	Egg	40	585.2
6/5/2003	HR-1	Windowpane	Egg	56	819.3
6/5/2003	HR-1	Windowpane	PYS	1	14.6
6/5/2003	HR-1	Winter flounder	PYS	2	29.3
6/5/2003	HR-1	Labridae	Egg	176	2574.9
6/5/2003	PJ-4	Atlantic menhaden	Egg	280	2117.2
6/5/2003	PJ-4	Atlantic menhaden	PYS	2	15.1
6/5/2003	PJ-4	Atlantic silverside	PYS	1	7.6
6/5/2003	PJ-4	Bay anchovy	Egg	12	90.7
6/5/2003	PJ-4	Prionotus sp.	Egg	8	60.5
6/5/2003	PJ-4	Windowpane	Egg	96	725.9
6/5/2003	PJ-4	Windowpane	PYS	11	83.2
6/5/2003	PJ-4	Winter flounder	PYS	1	7.6
6/5/2003	PJ-4	Labridae	Egg	148	1119.1
6/5/2003	PJ-5	Atlantic menhaden	Egg	56	330.9
6/5/2003	PJ-5	Atlantic menhaden	PYS	1	5.9
6/5/2003	PJ-5	Bay anchovy	Egg	24	141.8
6/5/2003	PJ-5	Conger eel	PYS	1	5.9
6/5/2003	PJ-5	Prionotus sp.	Egg	16	94.5
6/5/2003	PJ-5	Striped bass	PYS	1	5.9
6/5/2003	PJ-5	Windowpane	Egg	56	330.9
6/5/2003	PJ-5	Windowpane	PYS	7	41.4
6/5/2003	PJ-5	Winter flounder	PYS	7	41.4
6/5/2003	PJ-5	Labridae	Egg	112	661.8
6/5/2003	SB-5	Atlantic menhaden	Egg	8	71.7
6/5/2003	SB-5	Bay anchovy	Egg	2	17.9
6/5/2003	SB-5	Prionotus sp.	Egg	8	71.7
6/5/2003	SB-5	Windowpane	Egg	28	251.1
6/5/2003	SB-5	Windowpane	PYS	7	62.8
6/5/2003	SB-5	Windowpane	JUV	4	35.9
6/5/2003	SB-5	Winter flounder	PYS	1	9.0
6/5/2003	SB-5	Labridae	Egg	28	251.1
6/5/2003	PJ-1	Atlantic menhaden	Egg	4	46.1
6/5/2003	PJ-1	Bay anchovy	Egg	64	738.2
6/5/2003	PJ-1	Striped bass	PYS	1	11.5

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 16 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
6/5/2003	PJ-1	Windowpane	PYS	2	23.1
6/5/2003	PJ-1	Unidentified	PYS	1	11.5
6/5/2003	PJ-1	Labridae	Egg	8	92.3
6/5/2003	HR-2	Atlantic menhaden	Egg	6	108.1
6/5/2003	HR-2	Bay anchovy	Egg	10	180.2
6/5/2003	HR-2	Windowpane	PYS	1	18.0
6/5/2003	HR-2	Labridae	Egg	8	144.2
6/5/2003	HR-3	Bay anchovy	Egg	6	166.0
6/5/2003	HR-3	Windowpane	Egg	1	27.7
6/5/2003	HR-3	Windowpane	PYS	4	110.6
6/5/2003	HR-3	Winter flounder	PYS	1	27.7
6/5/2003	HR-3	Labridae	Egg	8	221.3
6/5/2003	SB-1	Atlantic menhaden	Egg	10	106.9
6/5/2003	SB-1	Bay anchovy	Egg	100	1069.0
6/5/2003	SB-1	Windowpane	Egg	6	64.1
6/5/2003	SB-1	Windowpane	PYS	3	32.1
6/5/2003	SB-1	Labridae	Egg	26	277.9
6/5/2003	SB-2	Atlantic menhaden	Egg	32	305.1
6/5/2003	SB-2	Bay anchovy	Egg	8	76.3
6/5/2003	SB-2	Windowpane	PYS	6	57.2
6/5/2003	SB-2	Winter flounder	PYS	6	57.2
6/5/2003	SB-2	Labridae	Egg	48	457.7
6/17/2003	LB-6	Atlantic mackerel	PYS	3	24.9
6/17/2003	LB-6	Atlantic menhaden	Egg	528	4381.5
6/17/2003	LB-6	Bay anchovy	Egg	560	4647.1
6/17/2003	LB-6	Bay anchovy	PYS	9	74.7
6/17/2003	LB-6	Northern pipefish	PYS	1	8.3
6/17/2003	LB-6	Prionotus sp.	Egg	16	132.8
6/17/2003	LB-6	Walleye	PYS	1	8.3
6/17/2003	LB-6	Windowpane	Egg	416	3452.1
6/17/2003	LB-6	Windowpane	PYS	4	33.2
6/17/2003	LB-6	Unidentified	UID	2	16.6
6/17/2003	LB-6	Labridae	Egg	64	531.1
6/17/2003	LB-5	Atlantic mackerel	PYS	4	22.0
6/17/2003	LB-5	Atlantic menhaden	Egg	2560	14064.5
6/17/2003	LB-5	Atlantic menhaden	PYS	7	38.5
6/17/2003	LB-5	Bay anchovy	Egg	1728	9493.5
6/17/2003	LB-5	Bay anchovy	PYS	6	33.0
6/17/2003	LB-5	Northern pipefish	PYS	1	5.5
6/17/2003	LB-5	Prionotus sp.	Egg	64	351.6
6/17/2003	LB-5	Windowpane	Egg	512	2812.9
6/17/2003	LB-5	Windowpane	PYS	2	11.0
6/17/2003	LB-5	Unidentified	PYS	8	44.0
6/17/2003	LB-5	Labridae	Egg	2688	14767.7
6/17/2003	LB-4	Atlantic mackerel	PYS	31	169.4
6/17/2003	LB-4	Atlantic menhaden	Egg	64	349.7
6/17/2003	LB-4	Bay anchovy	Egg	544	2972.1
6/17/2003	LB-4	Northern pipefish	PYS	5	27.3
6/17/2003	LB-4	Prionotus sp.	Egg	160	874.1
6/17/2003	LB-4	Weakfish	Egg	32	174.8

Date	Station	Common Name	Life Stage	Number Caught	Density
6/17/2003	LB-4	Windowpane	Egg	352	1923.1
6/17/2003	LB-4	Windowpane	PYS	1	5.5
6/17/2003	LB-4	Labridae	Egg	352	1923.1
6/17/2003	LB-3	Atlantic menhaden	Egg	1216	7101.2
6/17/2003	LB-3	Atlantic menhaden	PYS	3	17.5
6/17/2003	LB-3	Bay anchovy	Egg	1408	8222.4
6/17/2003	LB-3	Bay anchovy	PYS	9	52.6
6/17/2003	LB-3	Prionotus sp.	Egg	32	186.9
6/17/2003	LB-3	Weakfish	PYS	1	5.8
6/17/2003	LB-3	Windowpane	Egg	288	1681.9
6/17/2003	LB-3	Windowpane	PYS	1	5.8
6/17/2003	LB-3	Unidentified	UID	6	35.0
6/17/2003	LB-3	Labridae	Egg	128	747.5
6/17/2003	LB-2	Atlantic mackerel	PYS	46	323.0
6/17/2003	LB-2	Atlantic menhaden	Egg	96	674.2
6/17/2003	LB-2	Bay anchovy	Egg	256	1797.8
6/17/2003	LB-2	Prionotus sp.	Egg	384	2696.7
6/17/2003	LB-2	Windowpane	Egg	480	3370.9
6/17/2003	LB-2	Windowpane	PYS	74	519.7
6/17/2003	LB-2	Windowpane	JUV	1	7.0
6/17/2003	LB-2	Labridae	Egg	224	1573.1
6/17/2003	LB-1	Atlantic mackerel	PYS	22	128.5
6/17/2003	LB-1	Bay anchovy	Egg	1088	6355.2
6/17/2003	LB-1	Northern pipefish	PYS	8	46.7
6/17/2003	LB-1	Prionotus sp.	Egg	288	1682.3
6/17/2003	LB-1	Windowpane	Egg	512	2990.7
6/17/2003	LB-1	Windowpane	PYS	3	17.5
6/17/2003	LB-1	Labridae	Egg	352	2056.1
6/17/2003	PJ-3	Atlantic menhaden	Egg	12	71.7
6/17/2003	PJ-3	Atlantic menhaden	PYS	5	29.9
6/17/2003	PJ-3	Bay anchovy	Egg	80	478.2
6/17/2003	PJ-3	Bay anchovy	PYS	2	12.0
6/17/2003	PJ-3	Northern pipefish	PYS	2	12.0
6/17/2003	PJ-3	Windowpane	Egg	4	23.9
6/17/2003	PJ-3	Unidentified	UID	4	23.9
6/17/2003	HR-1	Atlantic menhaden	Egg	76	1208.3
6/17/2003	HR-1	Bay anchovy	Egg	12	190.8
6/17/2003	HR-1	Prionotus sp.	Egg	1	15.9
6/17/2003	HR-1	Weakfish	Egg	2	31.8
6/17/2003	HR-1	Windowpane	Egg	80	1271.9
6/17/2003	HR-1	Winter flounder	JUV	1	15.9
6/17/2003	HR-1	Labridae	Egg	22	349.8
6/17/2003	PJ-2	Atlantic menhaden	Egg	64	434.8
6/17/2003	PJ-2	Atlantic menhaden	PYS	34	231.0
6/17/2003	PJ-2	Bay anchovy	Egg	136	924.0
6/17/2003	PJ-2	Northern pipefish	PYS	4	27.2
6/17/2003	PJ-2	Windowpane	Egg	8	54.4
6/17/2003	PJ-2	Unidentified	PYS	17	115.5
6/17/2003	PJ-2	Labridae	Egg	32	217.4
6/17/2003	PJ-1	Atlantic menhaden	Egg	39	281.8

Date	Station	Common Name	Life Stage	Number Caught	Density
6/17/2003	PJ-1	Atlantic menhaden	PYS	5	36.1
6/17/2003	PJ-1	Bay anchovy	Egg	13	93.9
6/17/2003	PJ-1	Windowpane	Egg	9	65.0
6/17/2003	PJ-1	Unidentified	UID	3	21.7
6/17/2003	PJ-1	Labridae	Egg	3	21.7
6/17/2003	PJ-5	Atlantic mackerel	PYS	5	29.2
6/17/2003	PJ-5	Atlantic menhaden	Egg	288	1682.3
6/17/2003	PJ-5	Bay anchovy	Egg	112	654.2
6/17/2003	PJ-5	Prionotus sp.	Egg	96	560.8
6/17/2003	PJ-5	Weakfish	Egg	48	280.4
6/17/2003	PJ-5	Windowpane	Egg	752	4392.6
6/17/2003	PJ-5	Windowpane	PYS	1	5.8
6/17/2003	PJ-5	Labridae	Egg	224	1308.4
6/17/2003	PJ-4	Atlantic menhaden	Egg	384	2167.4
6/17/2003	PJ-4	Atlantic menhaden	PYS	2	11.3
6/17/2003	PJ-4	Bay anchovy	Egg	432	2438.4
6/17/2003	PJ-4	Windowpane	Egg	16	90.3
6/17/2003	PJ-4	Winter flounder	PYS	1	5.6
6/17/2003	PJ-4	Unidentified	PYS	2	11.3
6/17/2003	PJ-4	Labridae	Egg	80	451.5
6/17/2003	SB-5	Atlantic mackerel	PYS	8	39.8
6/17/2003	SB-5	Atlantic menhaden	Egg	192	954.3
6/17/2003	SB-5	Bay anchovy	Egg	448	2226.6
6/17/2003	SB-5	Prionotus sp.	Egg	1344	6679.9
6/17/2003	SB-5	Windowpane	Egg	3328	16540.7
6/17/2003	SB-5	Windowpane	PYS	1	5.0
6/17/2003	SB-5	Unidentified	PYS	6	29.8
6/17/2003	SB-5	Labridae	Egg	1600	7952.2
6/18/2003	AK-4	Atlantic menhaden	PYS	1	4.7
6/18/2003	AK-4	Bay anchovy	Egg	56	263.5
6/18/2003	AK-4	Clupeid unidentified	PYS	1	4.7
6/18/2003	AK-4	Northern pipefish	PYS	1	4.7
6/18/2003	AK-4	Striped bass	PYS	1	4.7
6/18/2003	AK-3	Atlantic mackerel	PYS	3	14.9
6/18/2003	AK-3	Bay anchovy	Egg	80	396.9
6/18/2003	AK-3	Unidentified	PYS	1	5.0
6/18/2003	AK-2	Atlantic mackerel	PYS	2	8.5
6/18/2003	AK-2	Atlantic menhaden	Egg	6	25.6
6/18/2003	AK-2	Atlantic menhaden	PYS	1	4.3
6/18/2003	AK-2	Bay anchovy	Egg	38	162.3
6/18/2003	AK-2	Bay anchovy	PYS	9	38.4
6/18/2003	AK-2	Clupeid unidentified	PYS	1	4.3
6/18/2003	AK-2	Northern pipefish	PYS	4	17.1
6/18/2003	AK-2	Striped bass	PYS	1	4.3
6/18/2003	AK-2	Windowpane	Egg	10	42.7
6/18/2003	AK-2	Windowpane	PYS	1	4.3
6/18/2003	AK-2	Unidentified	PYS	10	42.7
6/18/2003	AK-1	Atlantic menhaden	Egg	224	2047.0
6/18/2003	AK-1	Atlantic menhaden	PYS	4	36.6
6/18/2003	AK-1	Bay anchovy	Egg	72	657.9

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 19 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
6/18/2003	AK-1	Hogchocker	Egg	24	219.3
6/18/2003	AK-1	Striped bass	PYS	5	45.7
6/18/2003	AK-1	Windowpane	Egg	344	3143.5
6/18/2003	NB-7	Atlantic menhaden	Egg	20	128.4
6/18/2003	NB-7	Atlantic menhaden	YS	2	12.8
6/18/2003	NB-7	Atlantic menhaden	PYS	37	237.6
6/18/2003	NB-7	Bay anchovy	Egg	16	102.8
6/18/2003	NB-7	Northern pipefish	PYS	1	6.4
6/18/2003	NB-7	Striped bass	PYS	1	6.4
6/18/2003	NB-7	Windowpane	Egg	2	12.8
6/18/2003	NB-4	Atlantic herring	PYS	1	6.0
6/18/2003	NB-4	Atlantic menhaden	Egg	1	6.0
6/18/2003	NB-4	Atlantic menhaden	PYS	9	53.8
6/18/2003	NB-4	Bay anchovy	Egg	20	119.5
6/18/2003	NB-4	Northern pipefish	PYS	2	11.9
6/18/2003	NB-4	Unidentified	UID	4	23.9
6/18/2003	NB-4	Labridae	Egg	3	17.9
6/18/2003	NB-3	Atlantic menhaden	PYS	8	42.2
6/18/2003	NB-3	Bay anchovy	Egg	6	31.6
6/18/2003	NB-3	Northern pipefish	PYS	1	5.3
6/18/2003	NB-3	Windowpane	YS	1	5.3
6/18/2003	NB-3	Unidentified	YS	1	5.3
6/18/2003	NB-3	Unidentified	PYS	10	52.7
6/18/2003	NB-6	Atlantic mackerel	PYS	1	5.5
6/18/2003	NB-6	Atlantic menhaden	Egg	64	349.8
6/18/2003	NB-6	Bay anchovy	Egg	112	612.1
6/18/2003	NB-6	Clupeid unidentified	PYS	4	21.9
6/18/2003	NB-6	Prionotus sp.	Egg	40	218.6
6/18/2003	NB-6	Windowpane	Egg	192	1049.3
6/18/2003	NB-6	Windowpane	JUV	1	5.5
6/18/2003	NB-6	Labridae	Egg	8	43.7
6/18/2003	NB-5	Atlantic menhaden	Egg	280	1670.8
6/18/2003	NB-5	Bay anchovy	Egg	48	286.4
6/18/2003	NB-5	Prionotus sp.	Egg	8	47.7
6/18/2003	NB-5	Windowpane	Egg	224	1336.7
6/18/2003	NB-5	Windowpane	JUV	1	6.0
6/18/2003	NB-5	Labridae	Egg	8	47.7
6/19/2003	SB-2	Atlantic mackerel	PYS	1	10.6
6/19/2003	SB-2	Atlantic menhaden	Egg	2112	22381.7
6/19/2003	SB-2	Bay anchovy	Egg	320	3391.2
6/19/2003	SB-2	Prionotus sp.	Egg	192	2034.7
6/19/2003	SB-2	Windowpane	Egg	1920	20347.0
6/19/2003	SB-2	Unidentified	PYS	2	21.2
6/19/2003	SB-2	Labridae	Egg	320	3391.2
6/19/2003	SB-1	Atlantic mackerel	PYS	1	12.9
6/19/2003	SB-1	Atlantic menhaden	Egg	32	412.6
6/19/2003	SB-1	Bay anchovy	Egg	328	4228.7
6/19/2003	SB-1	Windowpane	Egg	80	1031.4
6/19/2003	SB-1	Labridae	Egg	32	412.6
6/19/2003	SB-4	Atlantic mackerel	PYS	3	19.2

Date	Station	Common Name	Life Stage	Number Caught	Density
6/19/2003	SB-4	Atlantic menhaden	Egg	1472	9444.2
6/19/2003	SB-4	Atlantic menhaden	PYS	3	19.2
6/19/2003	SB-4	Bay anchovy	Egg	352	2258.4
6/19/2003	SB-4	Hogchocker	Egg	64	410.6
6/19/2003	SB-4	Prionotus sp.	Egg	288	1847.8
6/19/2003	SB-4	Weakfish	Egg	64	410.6
6/19/2003	SB-4	Windowpane	Egg	1856	11908.0
6/19/2003	SB-4	Windowpane	PYS	6	38.5
6/19/2003	SB-4	Unidentified	PYS	1	6.4
6/19/2003	SB-4	Labridae	Egg	576	3695.6
6/19/2003	SB-3	Atlantic mackerel	PYS	1	8.6
6/19/2003	SB-3	Atlantic menhaden	Egg	576	4972.2
6/19/2003	SB-3	Atlantic menhaden	YS	4	34.5
6/19/2003	SB-3	Atlantic menhaden	PYS	40	345.3
6/19/2003	SB-3	Bay anchovy	Egg	96	828.7
6/19/2003	SB-3	Hogchocker	Egg	16	138.1
6/19/2003	SB-3	Northern pipefish	PYS	1	8.6
6/19/2003	SB-3	Windowpane	Egg	480	4143.5
6/19/2003	SB-3	Labridae	Egg	192	1657.4
6/19/2003	SB-6	Atlantic mackerel	PYS	1	7.2
6/19/2003	SB-6	Atlantic menhaden	Egg	32	230.6
6/19/2003	SB-6	Bay anchovy	Egg	112	807.2
6/19/2003	SB-6	Prionotus sp.	Egg	256	1845.0
6/19/2003	SB-6	Weakfish	Egg	48	345.9
6/19/2003	SB-6	Windowpane	Egg	592	4266.7
6/19/2003	SB-6	Windowpane	PYS	4	28.8
6/19/2003	SB-6	Labridae	Egg	144	1037.8
6/19/2003	HR-2	Atlantic menhaden	Egg	256	2904.7
6/19/2003	HR-2	Atlantic menhaden	PYS	6	68.1
6/19/2003	HR-2	Bay anchovy	Egg	624	7080.3
6/19/2003	HR-2	Bay anchovy	PYS	1	11.3
6/19/2003	HR-2	Prionotus sp.	Egg	16	181.5
6/19/2003	HR-2	Weakfish	Egg	16	181.5
6/19/2003	HR-2	Windowpane	Egg	64	726.2
6/19/2003	HR-2	Unidentified	PYS	3	34.0
6/19/2003	HR-2	Labridae	Egg	112	1270.8
6/19/2003	HR-3	Atlantic menhaden	Egg	36	967.1
6/19/2003	HR-3	Bay anchovy	Egg	88	2364.0
6/19/2003	HR-3	Windowpane	Egg	16	429.8
6/19/2003	HR-3	Unidentified	PYS	2	53.7
6/19/2003	HR-3	Labridae	Egg	8	214.9
7/8/2003	LB-3	Atlantic menhaden	Egg	1	5.5
7/8/2003	LB-3	Bay anchovy	Egg	9	49.2
7/8/2003	LB-3	Bay anchovy	PYS	75	410.2
7/8/2003	LB-3	Gobiid unidentified	PYS	14	76.6
7/8/2003	LB-3	Northern pipefish	PYS	2	10.9
7/8/2003	LB-3	Prionotus sp.	Egg	40	218.8
7/8/2003	LB-3	Weakfish	Egg	1	5.5
7/8/2003	LB-3	Weakfish	PYS	2	10.9
7/8/2003	LB-3	Labridae	Egg	3	16.4

Date	Station	Common Name	Life Stage	Number Caught	Density
7/8/2003	LB-5	Bay anchovy	Egg	2	15.4
7/8/2003	LB-5	Bay anchovy	PYS	47	361.2
7/8/2003	LB-5	Gobiid unidentified	PYS	12	92.2
7/8/2003	LB-5	Northern pipefish	PYS	2	15.4
7/8/2003	LB-5	Prionotus sp.	Egg	10	76.9
7/8/2003	LB-5	Tautog	PYS	1	7.7
7/8/2003	LB-5	Weakfish	Egg	2	15.4
7/8/2003	LB-5	Weakfish	PYS	2	15.4
7/8/2003	LB-5	Unidentified	Egg	1	7.7
7/8/2003	LB-6	Bay anchovy	Egg	16	184.1
7/8/2003	LB-6	Bay anchovy	PYS	167	1921.8
7/8/2003	LB-6	Bay anchovy	UID	9	103.6
7/8/2003	LB-6	Gobiid unidentified	PYS	10	115.1
7/8/2003	LB-6	Northern pipefish	PYS	4	46.0
7/8/2003	LB-6	Weakfish	PYS	6	69.0
7/8/2003	LB-6	Unidentified	PYS	1	11.5
7/8/2003	LB-4	Bay anchovy	Egg	20	117.1
7/8/2003	LB-4	Bay anchovy	PYS	242	1417.5
7/8/2003	LB-4	Clupeid unidentified	PYS	34	199.2
7/8/2003	LB-4	Gobiid unidentified	PYS	54	316.3
7/8/2003	LB-4	Northern pipefish	PYS	18	105.4
7/8/2003	LB-4	Prionotus sp.	Egg	12	70.3
7/8/2003	LB-4	Weakfish	Egg	18	105.4
7/8/2003	LB-4	Weakfish	PYS	12	35.1
7/8/2003	LB-4	Windowpane	PYS	4	23.4
7/8/2003	LB-1	Bay anchovy	Egg	6	51.2
7/8/2003	LB-1	Bay anchovy	PYS	5	42.7
7/8/2003	LB-1	Fourbeard rockling	PYS	1	8.5
7/8/2003	LB-1	Northern pipefish	PYS	2	17.1
7/8/2003	LB-1	Prionotus sp.	Egg	56	477.8
7/8/2003	LB-1	Weakfish	Egg	50	426.6
7/8/2003	LB-1	Unidentified	Egg	2	17.1
7/8/2003	LB-1	Labridae	Egg	20	170.7
7/8/2003	LB-2	Bay anchovy	Egg	8	81.7
7/8/2003	LB-2	Bay anchovy	PYS	2	20.4
7/8/2003	LB-2	Gobiid unidentified	PYS	1	10.2
7/8/2003	LB-2	Northern pipefish	PYS	1	10.2
7/8/2003	LB-2	Prionotus sp.	Egg	20	204.3
7/8/2003	LB-2	Weakfish	Egg	28	286.0
7/8/2003	LB-2	Windowpane	PYS	1	10.2
7/8/2003	LB-2	Labridae	Egg	36	367.7
7/8/2003	SB-6	Bay anchovy	Egg	12	117.0
7/8/2003	SB-6	Bay anchovy	PYS	3	29.3
7/8/2003	SB-6	Gobiid unidentified	PYS	3	29.3
7/8/2003	SB-6	Prionotus sp.	Egg	128	1248.2
7/8/2003	SB-6	Weakfish	Egg	108	1053.1
7/8/2003	SB-6	Labridae	Egg	184	1794.2
7/8/2003	SB-3	Atlantic menhaden	Egg	32	138.7
7/8/2003	SB-3	Atlantic menhaden	PYS	13	56.3
7/8/2003	SB-3	Bay anchovy	Egg	16	69.3

Date	Station	Common Name	Life Stage	Number Caught	Density
7/8/2003	SB-3	Bay anchovy	PYS	133	576.3
7/8/2003	SB-3	Fourspot flounder	YS	2	8.7
7/8/2003	SB-3	Gobiid unidentified	PYS	23	99.7
7/8/2003	SB-3	Northern pipefish	PYS	1	4.3
7/8/2003	SB-3	Northern puffer	PYS	1	4.3
7/8/2003	SB-3	Prionotus sp.	Egg	120	520.0
7/8/2003	SB-3	Walleye	PYS	4	17.3
7/8/2003	SB-3	Weakfish	Egg	176	762.6
7/8/2003	SB-3	Labridae	Egg	200	866.6
7/8/2003	SB-4	Atlantic menhaden	PYS	6	25.5
7/8/2003	SB-4	Bay anchovy	Egg	112	476.8
7/8/2003	SB-4	Bay anchovy	PYS	272	1157.9
7/8/2003	SB-4	Clupeid unidentified	PYS	26	110.7
7/8/2003	SB-4	Gobiid unidentified	PYS	64	272.5
7/8/2003	SB-4	Northern pipefish	PYS	4	17.0
7/8/2003	SB-4	Prionotus sp.	Egg	136	579.0
7/8/2003	SB-4	Tautog	PYS	4	17.0
7/8/2003	SB-4	Weakfish	Egg	176	749.2
7/8/2003	SB-4	Weakfish	PYS	2	8.5
7/8/2003	SB-4	Windowpane	PYS	4	17.0
7/8/2003	SB-4	Labridae	Egg	368	1566.6
7/8/2003	SB-1	Bay anchovy	Egg	36	365.0
7/8/2003	SB-1	Bay anchovy	PYS	12	121.7
7/8/2003	SB-1	Gobiid unidentified	PYS	8	81.1
7/8/2003	SB-1	Northern pipefish	PYS	1	10.1
7/8/2003	SB-1	Prionotus sp.	Egg	92	932.8
7/8/2003	SB-1	Tautog	PYS	2	20.3
7/8/2003	SB-1	Weakfish	Egg	84	851.7
7/8/2003	SB-1	Windowpane	PYS	1	10.1
7/8/2003	SB-1	Labridae	Egg	304	3082.2
7/8/2003	SB-2	Bay anchovy	Egg	40	329.5
7/8/2003	SB-2	Gobiid unidentified	PYS	1	8.2
7/8/2003	SB-2	Northern pipefish	PYS	1	8.2
7/8/2003	SB-2	Prionotus sp.	Egg	68	560.1
7/8/2003	SB-2	Weakfish	Egg	124	1021.3
7/8/2003	SB-2	Labridae	Egg	344	2833.4
7/8/2003	PJ-3	Atlantic menhaden	PYS	2	9.7
7/8/2003	PJ-3	Bay anchovy	Egg	576	2791.5
7/8/2003	PJ-3	Bay anchovy	PYS	29	140.5
7/8/2003	PJ-3	Gobiid unidentified	PYS	10	48.5
7/8/2003	PJ-3	Northern pipefish	PYS	4	19.4
7/8/2003	PJ-3	Northern puffer	PYS	2	9.7
7/8/2003	PJ-3	Tautog	PYS	1	4.8
7/8/2003	PJ-3	Weakfish	Egg	120	581.6
7/8/2003	PJ-3	Weakfish	PYS	3	14.5
7/8/2003	PJ-3	Labridae	Egg	160	775.4
7/9/2003	NB-7	Atlantic menhaden	PYS	12	67.3
7/9/2003	NB-7	Bay anchovy	PYS	984	5519.4
7/9/2003	NB-7	Gobiid unidentified	PYS	140	785.3
7/9/2003	NB-7	Northern pipefish	PYS	12	67.3

Date	Station	Common Name	Life Stage	Number Caught	Density
7/9/2003	NB-7	Weakfish	PYS	4	22.4
7/9/2003	NB-7	Labridae	Egg	48	269.2
7/9/2003	NB-4	Clupeid unidentified	UID	5	30.9
7/9/2003	NB-4	Winter flounder	JUV	1	6.2
7/9/2003	NB-3	Bay anchovy	PYS	97	505.8
7/9/2003	NB-3	Gobiid unidentified	PYS	9	46.9
7/9/2003	NB-3	Northern pipefish	PYS	2	10.4
7/9/2003	NB-3	Weakfish	Egg	4	20.9
7/9/2003	NB-3	Weakfish	PYS	3	15.6
7/9/2003	NB-5	Bay anchovy	Egg	6	41.3
7/9/2003	NB-5	Bay anchovy	PYS	45	309.8
7/9/2003	NB-5	Clupeid unidentified	PYS	1	6.9
7/9/2003	NB-5	Northern pipefish	JUV	1	6.9
7/9/2003	NB-5	Weakfish	Egg	1	6.9
7/9/2003	NB-5	Windowpane	JUV	1	6.9
7/9/2003	NB-5	Labridae	Egg	4	27.5
7/9/2003	NB-6	Bay anchovy	Egg	3	22.7
7/9/2003	NB-6	Bay anchovy	PYS	402	3040.9
7/9/2003	NB-6	Weakfish	Egg	2	15.1
7/9/2003	NB-6	Weakfish	PYS	4	30.3
7/9/2003	NB-6	Labridae	Egg	2	15.1
7/9/2003	AK-1	Bay anchovy	Egg	1	6.9
7/9/2003	AK-1	Bay anchovy	PYS	5	34.7
7/9/2003	AK-2	Bay anchovy	Egg	92	469.5
7/9/2003	AK-2	Bay anchovy	PYS	360	1837.2
7/9/2003	AK-2	Gobiid unidentified	PYS	14	71.4
7/9/2003	AK-2	Northern pipefish	JUV	4	20.4
7/9/2003	AK-2	Tautog	PYS	2	10.2
7/9/2003	AK-2	Weakfish	Egg	40	204.1
7/9/2003	AK-2	Weakfish	PYS	2	10.2
7/9/2003	AK-2	Windowpane	PYS	2	10.2
7/9/2003	AK-2	Labridae	Egg	56	285.8
7/9/2003	AK-3	Bay anchovy	Egg	484	3331.6
7/9/2003	AK-3	Bay anchovy	PYS	132	908.6
7/9/2003	AK-3	Gobiid unidentified	PYS	13	89.5
7/9/2003	AK-3	Northern pipefish	JUV	1	6.9
7/9/2003	AK-3	Winter flounder	JUV	2	13.8
7/9/2003	AK-3	Labridae	Egg	4	27.5
7/9/2003	AK-4	Bay anchovy	Egg	20	198.1
7/9/2003	AK-4	Bay anchovy	PYS	5	49.5
7/9/2003	AK-4	Weakfish	PYS	1	9.9
7/9/2003	AK-4	Labridae	Egg	3	29.7
7/9/2003	PJ-1	Bay anchovy	Egg	2304	14633.8
7/9/2003	PJ-1	Bay anchovy	PYS	158	1003.5
7/9/2003	PJ-1	Gobiid unidentified	PYS	174	552.6
7/9/2003	PJ-1	Northern pipefish	PYS	8	50.8
7/9/2003	PJ-1	Weakfish	Egg	288	1829.2
7/9/2003	PJ-1	Weakfish	PYS	4	25.4
7/9/2003	PJ-1	Labridae	Egg	768	4877.9
7/10/2003	HR-3	Atlantic menhaden	PYS	2	63.6

Date	Station	Common Name	Life Stage	Number Caught	Density
7/10/2003	HR-3	Bay anchovy	PYS	2	63.6
7/10/2003	HR-3	Gobiid unidentified	PYS	5	159.1
7/10/2003	HR-3	Hogchocker	Egg	8	254.5
7/10/2003	HR-3	Northern pipefish	PYS	5	159.1
7/10/2003	HR-3	Weakfish	Egg	24	763.6
7/10/2003	HR-2	Bay anchovy	Egg	2	53.1
7/10/2003	HR-2	Bay anchovy	PYS	1	26.5
7/10/2003	HR-2	Northern pipefish	PYS	4	106.2
7/10/2003	HR-2	Weakfish	Egg	10	265.5
7/10/2003	HR-2	Weakfish	PYS	1	26.5
7/10/2003	HR-2	Labridae	Egg	15	398.2
7/10/2003	PJ-2	Bay anchovy	Egg	16	97.3
7/10/2003	PJ-2	Bay anchovy	PYS	208	1265.1
7/10/2003	PJ-2	Gobiid unidentified	PYS	100	608.2
7/10/2003	PJ-2	Northern pipefish	PYS	16	97.3
7/10/2003	PJ-2	Weakfish	Egg	160	973.1
7/10/2003	PJ-2	Weakfish	PYS	4	24.3
7/10/2003	PJ-2	Labridae	Egg	64	389.3
7/10/2003	PJ-5	Bay anchovy	Egg	8	43.2
7/10/2003	PJ-5	Gobiid unidentified	PYS	2	10.8
7/10/2003	PJ-5	Hogchocker	Egg	2	10.8
7/10/2003	PJ-5	Prionotus sp.	Egg	36	194.2
7/10/2003	PJ-5	Weakfish	Egg	26	140.2
7/10/2003	PJ-5	Windowpane	PYS	2	10.8
7/10/2003	PJ-5	Labridae	Egg	14	75.5
7/10/2003	PJ-4	Atlantic menhaden	PYS	3	24.4
7/10/2003	PJ-4	Bay anchovy	Egg	8	65.0
7/10/2003	PJ-4	Bay anchovy	PYS	49	398.1
7/10/2003	PJ-4	Gobiid unidentified	PYS	1	8.1
7/10/2003	PJ-4	Northern pipefish	PYS	2	16.2
7/10/2003	PJ-4	Prionotus sp.	Egg	42	341.2
7/10/2003	PJ-4	Weakfish	Egg	4	32.5
7/10/2003	PJ-4	Weakfish	PYS	19	154.4
7/10/2003	PJ-4	Windowpane	PYS	3	24.4
7/10/2003	PJ-4	Labridae	Egg	14	113.7
7/10/2003	HR-1	Bay anchovy	Egg	2	22.6
7/10/2003	HR-1	Bay anchovy	PYS	17	192.5
7/10/2003	HR-1	Gobiid unidentified	PYS	2	22.6
7/10/2003	HR-1	Northern pipefish	PYS	2	22.6
7/10/2003	HR-1	Prionotus sp.	Egg	56	634.0
7/10/2003	HR-1	Weakfish	Egg	16	181.1
7/10/2003	HR-1	Weakfish	PYS	6	67.9
7/10/2003	HR-1	Windowpane	PYS	1	11.3
7/10/2003	HR-1	Unidentified	Egg	2	22.6
7/10/2003	HR-1	Labridae	Egg	20	226.4
7/10/2003	SB-5	Bay anchovy	Egg	8	32.9
7/10/2003	SB-5	Bay anchovy	PYS	74	303.9
7/10/2003	SB-5	Gobiid unidentified	PYS	71	291.6
7/10/2003	SB-5	Northern pipefish	PYS	6	24.6
7/10/2003	SB-5	Northern puffer	PYS	1	4.1

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities by date and station sampled. (page 25 of 25)

Date	Station	Common Name	Life Stage	Number Caught	Density
7/10/2003	SB-5	Prionotus sp.	Egg	8	32.9
7/10/2003	SB-5	Tautog	PYS	2	8.2
7/10/2003	SB-5	Weakfish	Egg	160	657.1
7/10/2003	SB-5	Weakfish	PYS	1	4.1
7/10/2003	SB-5	Windowpane	PYS	3	12.3
7/10/2003	SB-5	Labridae	Egg	264	1084.3

Appendix C. Water quality by date and station sampled. (page 1 of 7)

Date	Station	Temperature (deg C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
1/21/2003	LB-1	2.8	9.9	44700	28.0
1/21/2003	LB-2	4.3	9.6	45760	29.0
1/21/2003	LB-3	3.2	10.1	41230	25.7
1/21/2003	LB-4	2.8	10.7	43630	27.3
1/21/2003	LB-5	2.6	8.6	39250	24.3
1/21/2003	LB-6	1.2	11.0	41051	25.3
1/21/2003	SB-3	2.7	10.2	36790	22.7
1/21/2003	SB-4	3.0	9.9	41080	25.6
1/21/2003	SB-6	3.1	10.0	40030	24.9
1/22/2003	AK-1	1.8	11.3	33706	20.5
1/22/2003	AK-2	1.8	11.1	35896	19.8
1/22/2003	AK-3	2.0	11.0	32905	20.1
1/22/2003	AK-4	1.8	10.9	32808	19.8
1/22/2003	NB-3	1.5	10.7	31570	19.2
1/22/2003	NB-4	1.1	11.2	31738	19.3
1/22/2003	NB-5	1.7	11.3	35227	21.4
1/22/2003	NB-6	1.7	11.3	32606	21.0
1/22/2003	NB-7	1.1	11.3	32235	19.4
1/23/2003	PJ-1	1.3	11.3	38021	23.2
1/23/2003	PJ-2	1.8	11.2	37531	23.0
1/23/2003	PJ-3	0.9	11.6	34464	21.1
1/23/2003	PJ-4	1.7	10.8	37696	23.2
1/23/2003	PJ-5	2.3	11.0	38363	23.7
1/23/2003	SB-1	0.8	11.7	33211	20.1
1/23/2003	SB-2	0.4	11.8	34161	20.4
1/23/2003	SB-5	2.2	11.1	39077	24.3
2/4/2003	LB-1	3.8	10.7	49440	31.5
2/4/2003	LB-2	3.5	10.7	48730	30.9
2/4/2003	LB-3	2.9	11.3	45920	29.0
2/4/2003	LB-4	2.1	12.3	45300	28.3
2/4/2003	LB-5	2.6	11.3	43760	27.4
2/4/2003	LB-6	2.5	11.7	43600	27.3
2/4/2003	PJ-5	3.1	11.2	45840	28.9
2/4/2003	SB-5	2.9	11.2	45190	28.4
2/4/2003	SB-6	3.1	11.2	46010	29.1
2/5/2003	AK-1	1.8	11.8	36561	22.3
2/5/2003	AK-2	1.8	11.7	36507	22.3
2/5/2003	AK-3	1.7	11.6	35461	21.7
2/5/2003	AK-4	1.8	12.0	35340	21.6
2/5/2003	NB-3	1.8	12.2	30545	18.4
2/5/2003	NB-4	1.7	12.2	30614	18.4
2/5/2003	NB-5	1.8	11.8	37153	22.7
2/5/2003	NB-6	1.8	11.8	36378	22.6
2/5/2003	NB-7	1.6	11.9	35385	21.6
2/6/2003	PJ-1	1.6	11.3	35964	22.0
2/6/2003	PJ-2	1.6	11.5	33667	20.5
2/6/2003	PJ-3	1.5	11.7	33621	20.4
2/6/2003	PJ-4	1.8	11.2	38788	23.9
2/6/2003	SB-1	1.2	11.6	34817	21.2
2/6/2003	SB-2	1.8	11.1	37513	23.1
2/6/2003	SB-3	1.5	11.6	34274	20.8
2/6/2003	SB-4	1.8	11.3	39775	24.5
2/19/2003	LB-1	1.6	10.8	49326	31.1

Date	Station	Temperature (deg C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
2/19/2003	LB-2	2.1	10.3	49626	31.3
2/19/2003	LB-3	1.2	10.9	45231	28.3
2/19/2003	LB-4	1.6	11.4	47590	29.8
2/19/2003	LB-5	1.1	11.5	45482	28.3
2/19/2003	SB-1	1.5	10.8	44108	27.5
2/19/2003	SB-2	1.3	10.8	43356	26.8
2/19/2003	SB-3	1.6	10.8	44841	28.0
2/19/2003	SB-4	1.1	10.9	44121	27.4
2/19/2003	SB-6	2.0	10.8	43838	27.4
2/20/2003	AK-1	1.3	12.6	38386	23.5
2/20/2003	AK-2	1.3	12.6	39501	24.3
2/20/2003	AK-3	1.2	12.8	37934	23.1
2/20/2003	AK-4	1.7	13.5	37011	22.7
2/20/2003	LB-6	0.8	13.2	45279	27.9
2/20/2003	NB-3	2.1	12.5	37400	23.1
2/20/2003	NB-4	2.1	12.5	37420	23.1
2/20/2003	NB-5	1.8	12.5	38069	23.4
2/20/2003	NB-6	1.5	12.6	39300	24.1
2/20/2003	NB-7	1.9	12.6	38762	23.7
2/21/2003	PJ-1	1.1	11.8	37644	23.2
2/21/2003	PJ-2	1.4	11.6	38763	23.6
2/21/2003	PJ-3	1.4	11.9	37779	23.8
2/21/2003	PJ-4	1.2	11.4	42408	26.2
2/21/2003	PJ-5	1.1	11.5	41600	25.7
2/21/2003	SB-5	1.2	11.8	41289	25.3
3/4/2003	LB-1	1.7	11.4	43498	27.1
3/4/2003	LB-2	2.2	10.8	46393	29.1
3/4/2003	LB-3	1.5	12.0	39282	24.2
3/4/2003	LB-4	1.8	11.8	42002	26.1
3/4/2003	LB-5	1.7	11.5	38669	23.8
3/4/2003	LB-6	1.8	12.4	28931	23.9
3/4/2003	PJ-1	1.8	11.6	34711	21.2
3/4/2003	PJ-2	1.2	11.8	30931	18.6
3/4/2003	PJ-3	0.8	12.0	31425	18.9
3/4/2003	PJ-4	1.8	11.4	38321	23.5
3/4/2003	PJ-5	2.0	11.4	38368	23.7
3/4/2003	SB-5	1.9	11.2	40659	25.1
3/5/2003	SB-1	2.4	11.3	35982	21.9
3/5/2003	SB-2	2.3	11.3	36192	22.3
3/5/2003	SB-3	1.9	10.3	40301	24.8
3/5/2003	SB-4	2.0	11.4	39968	24.6
3/6/2003	HR-1	1.9	11.9	35433	21.7
3/6/2003	HR-2	1.9	12.2	31658	19.1
3/6/2003	HR-3	1.8	12.1	32161	19.3
3/6/2003	SB-6	2.1	12.4	31670	19.2
3/7/2003	AK-1	2.1	12.7	29200	17.5
3/7/2003	AK-2	1.7	12.8	27660	17.3
3/7/2003	AK-3	1.9	12.7	26504	15.8
3/7/2003	AK-4	2.9	12.5	27400	16.5
3/7/2003	NB-3	2.0	13.1	26280	15.6
3/7/2003	NB-4	2.0	13.1	26280	15.6
3/7/2003	NB-5	2.0	12.5	29340	17.5
3/7/2003	NB-6	1.9	12.9	30244	18.7

Appendix C. Water quality by date and station sampled. (page 3 of 7)

Date	Station	Temperature (deg C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
3/7/2003	NB-7	1.9	13.1	27613	16.4
3/18/2003	LB-1	4.0	12.0	44910	28.2
3/18/2003	LB-2	3.8	12.4	45320	28.6
3/18/2003	LB-3	3.9	12.8	41790	26.1
3/18/2003	LB-4	4.1	13.9	41240	25.9
3/18/2003	LB-5	4.0	12.7	39830	24.9
3/18/2003	LB-6	3.9	13.1	38690	24.2
3/18/2003	SB-1	4.4	12.7	37870	23.5
3/18/2003	SB-2	4.2	12.2	38420	24.0
3/18/2003	SB-3	4.3	12.5	39360	24.7
3/18/2003	SB-4	4.3	12.6	37750	23.6
3/18/2003	SB-6	4.5	12.7	38970	24.3
3/19/2003	AK-1	4.9	11.6	30020	18.3
3/19/2003	AK-2	5.5	11.5	29820	18.2
3/19/2003	AK-3	5.6	11.3	29750	18.2
3/19/2003	AK-4	5.9	11.2	29120	17.8
3/19/2003	NB-3	5.1	11.6	29110	17.7
3/19/2003	NB-4	5.0	11.5	28650	17.4
3/19/2003	NB-5	4.7	11.7	31080	19.0
3/19/2003	NB-6	5.2	11.6	31280	19.2
3/19/2003	NB-7	5.2	11.5	28850	17.5
3/19/2003	SB-5	4.2	12.2	35620	22.1
3/21/2003	HR-1	5.4	11.9	26810	16.2
3/21/2003	HR-2	5.6	11.8	23640	14.2
3/21/2003	HR-3	5.6	11.8	23640	14.2
3/21/2003	PJ-1	4.8	11.9	26220	15.8
3/21/2003	PJ-2	4.8	12.0	24500	14.7
3/21/2003	PJ-3	5.6	12.0	24920	14.9
3/21/2003	PJ-4	4.5	11.4	36680	22.7
3/21/2003	PJ-5	4.8	11.9	36300	22.5
4/1/2003	LB-1	3.8	10.8	41690	26.0
4/1/2003	LB-2	3.1	10.5	46210	29.1
4/1/2003	LB-3	4.8	10.9	34650	21.4
4/1/2003	LB-4	4.2	10.5	40400	25.3
4/1/2003	LB-5	4.7	11.2	32220	19.8
4/1/2003	LB-6	4.6	10.6	37700	23.5
4/1/2003	PJ-1	5.2	11.2	23040	13.8
4/1/2003	SB-1	4.9	10.9	30220	18.4
4/1/2003	SB-2	4.9	10.8	30360	18.5
4/1/2003	SB-3	5.0	11.2	25630	15.4
4/1/2003	SB-4	4.7	10.8	34420	21.3
4/1/2003	SB-6	4.3	10.6	38350	23.8
4/2/2003	AK-1	7.3	11.1	19930	11.8
4/2/2003	AK-2	6.6	11.0	22040	13.2
4/2/2003	AK-3	6.3	11.2	24680	14.9
4/2/2003	AK-4	7.2	11.0	19960	11.8
4/2/2003	NB-3	7.2	10.8	19250	11.3
4/2/2003	NB-4	7.2	10.8	19250	11.3
4/2/2003	NB-5	6.3	11.2	24140	14.5
4/2/2003	NB-6	5.5	11.2	27270	16.6
4/2/2003	NB-7	6.3	11.4	20180	12.0
4/2/2003	PJ-5	4.5	11.3	36980	23.0
4/2/2003	SB-5	4.3	11.3	38390	23.9

Date	Station	Temperature (deg C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
4/3/2003	HR-1	5.3	11.3	29080	17.7
4/3/2003	HR-2	6.0	11.7	18440	10.8
4/3/2003	HR-3	6.0	11.7	18470	10.8
4/3/2003	PJ-2	5.6	11.6	21200	12.6
4/3/2003	PJ-3	6.1	11.5	19560	11.5
4/3/2003	PJ-4	4.9	10.9	34180	21.1
4/15/2003	LB-1	7.1	9.1	37810	24.0
4/15/2003	LB-2	7.6	8.5	44500	28.1
4/15/2003	LB-3	6.9	8.8	37610	23.6
4/15/2003	LB-4	8.4	8.8	39460	24.8
4/15/2003	LB-5	7.0	9.1	35810	22.4
4/15/2003	LB-6	6.6	8.7	38190	24.0
4/15/2003	PJ-1	8.4	9.6	28810	17.7
4/15/2003	PJ-3	7.9	9.8	26910	16.2
4/15/2003	SB-1	8.3	9.2	31350	19.6
4/15/2003	SB-2	7.7	8.9	33720	21.0
4/15/2003	SB-3	9.1	9.0	31494	19.7
4/15/2003	SB-4	7.7	8.5	33020	20.5
4/16/2003	AK-1	11.4	10.5	24940	15.2
4/16/2003	AK-2	9.4	9.0	26770	16.5
4/16/2003	AK-3	10.0	8.8	25390	15.5
4/16/2003	AK-4	10.6	8.6	24350	14.8
4/16/2003	NB-3	9.7	9.1	23340	14.1
4/16/2003	NB-4	9.8	9.5	22570	13.6
4/16/2003	NB-5	9.3	9.0	26780	16.4
4/16/2003	NB-6	9.0	9.1	28280	17.4
4/16/2003	NB-7	10.2	9.0	24650	15.0
4/16/2003	SB-5	8.3	9.2	34340	21.4
4/17/2003	HR-1	8.1	8.4	33590	20.8
4/17/2003	HR-2	7.8	8.9	26570	16.2
4/17/2003	HR-3	7.8	8.9	26590	16.2
4/17/2003	PJ-2	7.9	8.6	29790	18.3
4/17/2003	PJ-4	8.0	8.8	30380	18.7
4/17/2003	PJ-5	7.5	8.7	33610	21.0
4/17/2003	SB-6	8.0	8.9	28840	17.7
4/30/2003	LB-1	9.0	8.0	43040	27.2
4/30/2003	LB-2	7.6	8.1	45150	29.0
4/30/2003	LB-3	9.2	7.7	37370	23.5
4/30/2003	LB-4	8.0	7.7	43190	27.6
4/30/2003	LB-5	9.3	8.0	36500	23.0
4/30/2003	LB-6	9.7	8.1	36360	23.0
4/30/2003	PJ-1	10.6	8.3	27700	17.6
4/30/2003	PJ-2	9.7	5.9	29560	18.4
4/30/2003	PJ-3	10.0	7.7	29190	18.0
4/30/2003	SB-1	9.5	7.1	35710	22.1
4/30/2003	SB-2	9.3	7.5	35590	22.3
4/30/2003	SB-3	9.9	7.6	33080	20.6
4/30/2003	SB-4	10.0	8.0	32900	20.5
5/1/2003	AK-1	11.4	7.9	28590	17.7
5/1/2003	AK-2	10.4	7.8	31200	19.3
5/1/2003	AK-3	11.9	7.8	27860	17.2
5/1/2003	AK-4	12.7	7.5	23670	14.3
5/1/2003	NB-3	11.8	8.0	27780	16.4

Date	Station	Temperature (deg C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
5/1/2003	NB-4	11.8	8.0	27730	16.4
5/1/2003	NB-5	10.6	7.8	31080	19.3
5/1/2003	NB-6	10.6	7.8	31280	19.3
5/1/2003	NB-7	11.0	8.0	29540	18.2
5/1/2003	PJ-4	9.4	7.6	37610	24.0
5/1/2003	PJ-5	9.4	8.0	39850	25.2
5/2/2003	HR-1	10.4	7.7	33200	21.0
5/2/2003	HR-2	10.8	7.4	29000	17.9
5/2/2003	HR-3	10.8	7.4	29000	17.9
5/2/2003	SB-5	9.6	7.9	39000	24.8
5/2/2003	SB-6	9.6	8.0	39600	25.1
5/13/2003	PJ-1	11.7	8.4	34250	21.5
5/13/2003	PJ-2	11.7	8.6	32640	21.5
5/13/2003	PJ-3	11.7	8.5	33700	21.1
5/13/2003	PJ-4	10.9	8.2	39260	25.0
5/13/2003	PJ-5	11.3	8.7	38690	24.6
5/13/2003	SB-1	11.6	8.3	35870	22.6
5/13/2003	SB-2	11.4	8.2	36580	23.1
5/13/2003	SB-3	11.2	8.5	34290	21.5
5/13/2003	SB-4	11.3	8.5	38430	24.4
5/13/2003	SB-5	11.1	8.8	39920	25.4
5/13/2003	SB-6	11.2	8.6	39290	24.9
5/14/2003	AK-1	13.0	8.3	30400	18.9
5/14/2003	AK-2	12.8	8.3	30700	19.1
5/14/2003	AK-3	12.9	8.2	30690	19.0
5/14/2003	AK-4	13.6	8.0	30400	18.9
5/14/2003	NB-3	13.3	7.8	28320	17.5
5/14/2003	NB-4	13.3	7.8	28320	17.5
5/14/2003	NB-5	12.6	8.1	31640	19.7
5/14/2003	NB-6	12.6	8.1	31640	19.7
5/14/2003	NB-7	12.7	8.2	30920	19.2
5/15/2003	HR-1	11.8	8.1	36000	22.7
5/15/2003	HR-2	11.9	7.8	30660	19.0
5/15/2003	HR-3	11.9	7.8	30660	19.0
5/15/2003	LB-1	10.9	8.9	42810	27.4
5/15/2003	LB-2	9.2	9.3	44830	28.8
5/15/2003	LB-3	11.3	8.5	38840	24.7
5/15/2003	LB-4	11.2	8.6	39930	25.4
5/15/2003	LB-5	11.4	8.4	38920	24.8
5/15/2003	LB-6	11.6	8.8	39600	25.2
6/3/2003	LB-1	13.4	7.7	41900	26.9
6/3/2003	LB-2	11.5	8.3	46780	30.3
6/3/2003	LB-3	14.3	7.5	36220	22.9
6/3/2003	LB-4	12.3	7.7	43730	28.2
6/3/2003	LB-5	14.5	7.5	35530	22.5
6/3/2003	LB-6	13.5	7.6	40840	26.1
6/3/2003	PJ-2	15.6	7.0	25100	15.4
6/3/2003	PJ-3	16.0	7.1	24280	14.8
6/3/2003	SB-3	15.0	7.2	29350	18.2
6/3/2003	SB-4	13.5	7.4	38710	24.7
6/3/2003	SB-6	13.0	7.7	41040	26.3
6/4/2003	AK-1	15.5	5.9	22470	13.6
6/4/2003	AK-2	15.2	6.1	24670	15.1

Date	Station	Temperature (deg C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
6/4/2003	AK-3	16.0	5.6	22510	13.6
6/4/2003	AK-4	16.1	5.3	23700	14.4
6/4/2003	NB-3	15.7	6.2	18240	10.8
6/4/2003	NB-4	15.7	6.2	18300	10.9
6/4/2003	NB-5	15.0	6.1	27590	17.0
6/4/2003	NB-6	15.0	6.1	26190	16.1
6/4/2003	NB-7	15.5	6.6	17670	10.5
6/5/2003	HR-1	13.9	6.2	33320	20.9
6/5/2003	HR-2	15.1	6.3	23780	14.5
6/5/2003	HR-3	15.1	6.3	23650	14.4
6/5/2003	PJ-1	15.5	6.8	20180	12.2
6/5/2003	PJ-4	13.3	6.1	35910	22.7
6/5/2003	PJ-5	15.2	6.8	21550	13.0
6/5/2003	SB-1	14.5	6.2	29930	18.6
6/5/2003	SB-2	14.2	6.0	31780	19.9
6/5/2003	SB-5	15.2	6.6	22220	13.4
6/17/2003	HR-1	17.2	5.5	34130	21.5
6/17/2003	LB-1	17.3	6.3	40830	26.2
6/17/2003	LB-2	16.8	6.6	40670	26.1
6/17/2003	LB-3	17.2	6.9	36090	22.9
6/17/2003	LB-4	16.6	6.3	37140	23.6
6/17/2003	LB-5	16.9	6.6	34370	21.8
6/17/2003	LB-6	16.5	6.7	37470	23.8
6/17/2003	PJ-1	17.8	6.0	29580	18.4
6/17/2003	PJ-2	17.8	5.8	28420	17.6
6/17/2003	PJ-3	18.2	5.8	27440	16.8
6/17/2003	PJ-4	17.5	5.8	31700	19.8
6/17/2003	PJ-5	17.1	6.0	34720	21.9
6/17/2003	SB-5	17.4	5.9	36810	23.3
6/18/2003	AK-1	18.3	5.5	24480	14.8
6/18/2003	AK-2	18.3	5.5	24480	14.8
6/18/2003	AK-3	18.7	5.6	19780	11.9
6/18/2003	AK-4	18.9	5.4	20820	12.5
6/18/2003	NB-3	19.0	5.6	19540	11.5
6/18/2003	NB-4	19.0	5.6	19540	11.5
6/18/2003	NB-5	18.5	5.5	26620	16.4
6/18/2003	NB-6	18.5	5.5	26620	16.4
6/18/2003	NB-7	18.8	5.8	16980	10.0
6/19/2003	HR-2	18.3	5.6	27020	16.6
6/19/2003	HR-3	18.3	5.6	27020	16.6
6/19/2003	SB-1	17.9	5.7	31460	19.6
6/19/2003	SB-2	17.7	5.6	33970	21.4
6/19/2003	SB-3	18.1	5.3	30080	18.7
6/19/2003	SB-4	17.9	5.5	30980	19.3
6/19/2003	SB-6	18.0	5.5	30640	19.0
7/8/2003	LB-1	18.5	6.9	42940	27.7
7/8/2003	LB-2	17.5	6.8	44090	28.6
7/8/2003	LB-3	20.5	7.1	39980	25.6
7/8/2003	LB-4	19.7	6.7	42280	27.2
7/8/2003	LB-5	20.7	6.8	38850	24.8
7/8/2003	LB-6	20.5	6.6	39960	25.6
7/8/2003	PJ-3	22.7	6.2	33550	21.1
7/8/2003	SB-1	21.5	5.6	36340	23.0

Date	Station	Temperature (deg C)	DO (mg/L)	Conductivity (SPC@25)	Salinity (ppt)
7/8/2003	SB-2	21.0	5.3	36930	23.4
7/8/2003	SB-3	21.7	5.1	35050	22.1
7/8/2003	SB-4	20.4	6.3	38980	24.9
7/8/2003	SB-6	20.5	6.5	39450	25.2
7/9/2003	AK-1	23.0	5.7	32140	20.1
7/9/2003	AK-2	22.8	5.7	32630	20.4
7/9/2003	AK-3	23.3	5.5	32020	20.0
7/9/2003	AK-4	24.4	5.3	30940	19.2
7/9/2003	NB-3	24.2	5.2	27830	17.1
7/9/2003	NB-4	24.2	5.2	27830	17.1
7/9/2003	NB-5	22.3	5.8	34100	21.4
7/9/2003	NB-6	22.3	5.8	34100	21.4
7/9/2003	NB-7	23.9	5.6	31920	19.9
7/9/2003	PJ-1	22.3	5.8	31690	19.8
7/10/2003	HR-1	20.2	5.5	38320	24.4
7/10/2003	HR-2	21.4	5.7	33320	20.9
7/10/2003	HR-3	21.4	5.7	33320	20.9
7/10/2003	PJ-2	21.5	5.8	32120	20.1
7/10/2003	PJ-4	19.8	5.6	39870	25.5
7/10/2003	PJ-5	18.9	6.6	41430	26.6
7/10/2003	SB-5	18.8	6.5	41710	26.8

Environmental Assessment
Appendix C3:
Temporal-Spatial Distribution Patterns and Habitat Requirements of Fishes of the New York New Jersey Harbor

U.S. Army Corps of Engineers
New York District

January 2004

TEMPORAL-SPATIAL DISTRIBUTION PATTERNS AND HABITAT REQUIREMENTS OF FISHES OF THE NEW YORK/NEW JERSEY HARBOR

DRAFT INTERIM REPORT

OCTOBER 2003

U.S. Army Corps of Engineers - New York District
Environmental Review Section
Jacob K. Javits Federal Building
26 Federal Plaza
New York, New York 10278

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1.0 INTRODUCTION

The U.S. Army Corps of Engineers – New York District (USACE-NYD) was authorized by Congress in the 1996 Water Resources Development Act (WRDA) to conduct a comprehensive study on the navigation needs of the Port of New York and New Jersey. As part of this comprehensive study, a biological monitoring program was begun in 1998 to provide population baseline information to be used in determining potential biological impacts of deepening navigation channels, anchorages and berthing areas in the New York and New Jersey Harbor (Harbor) to depths of 50 ft or greater. The goal of the monitoring program was to collect data on the community structure and seasonal habitat use patterns of finfish, shellfish and macroinvertebrates in the Harbor.

The 1998-1999 program identified that the Harbor finfish community consisted of a variety of resident and migratory fish species typical of large coastal estuaries and inshore waterways along the Mid-Atlantic Bight. As a migratory pathway the Harbor provides access to numerous estuarine and freshwater rivers and streams and to Long Island Sound through the East River. Residents and transients find extensive spawning, nursery and foraging habitat. Supplemental monitoring programs were conducted in 2000-2001 and 2001-2002 to provide data to further understand the biology of the Harbor and to address specific questions related to winter flounder (*Pseudopleuronectes americanus*).

Winter flounder is the focal species for sampling programs as they have experienced population declines along the Eastern United States over the last two decades (ASMFC 1998, Shepherd et al. 1996, ASMFC 1992) and due to their year round presence and use of bottom habitats makes them a good representative species. Furthermore, to determine the potential impacts associated with deepening the Harbor, it was important to collect meaningful population information on a species that is associated with the bottom (i.e. demersal) or near-bottom during each life-stage.

Understanding the spatial and temporal distribution of fish in the Harbor over multiple years helps to provide the necessary information required for determining the potential impact associated with deepening the Harbor. Biological data collected during each year of the monitoring program identified spatial and temporal trends in the relative abundance of the species in the Harbor, especially winter flounder. However trends across years were typically not conducted because the study objectives within each program year were different.

As a result, the USACE-NYD set out to determine if a multiple year database could be developed from the three monitoring programs to determine spatial and temporal distribution patterns of winter flounder and other Essential Fish (EFH species) in the Harbor. The EFH species included: Atlantic herring, Atlantic mackerel, black sea bass, bluefish, butterfish, red hake, scup, summer flounder and windowpane flounder. This analysis was designed to test the temporal and spatial distribution patterns using statistics as a tool for analyzing the fish, habitat, and water quality data collected during 1998-1999, 2000-2001, and 2001-2002. The specific objectives of the analysis were to determine, for early life-stages (egg, yolk-sac, post yolk-sac and juveniles) and adults of winter flounder and selected EFH species, the:

- spatial patterns in distribution in the Harbor
- temporal patterns in distribution in the Harbor
- distribution patterns in the Harbor related to biotic and abiotic habitat variables
- distribution pattern related to depth (i.e. channel vs. shallow/shoal)

To address these study objectives, descriptive analysis, regression analysis, and analysis of variance were employed. In some cases, program specific objectives dictated the ability to analyze the data over multiple years. The following methods section outlines the specific objectives of each program year and provides a description of the statistics used in this report.

2.0 METHODS AND MATERIALS

Statistical analysis was conducted on a combined dataset from the three sampling programs conducted in the Harbor from 1998-2002. The level of statistical analysis conducted was influenced by the availability of data across multiple years. Each program had specific objectives that dictated sampling locations, frequencies and duration. Furthermore, the different program objectives targeted varying depths at different sampling sites. As a result, of the thirty stations sampled throughout the Harbor over the course of the three sampling programs, only eight (8) stations were sampled during each program (**Table 2.0-1**).

2.1 Program Descriptions

The primary objective of the 1998-1999 Harbor Sampling Program was to obtain temporal and spatial population usage information for the navigation channels under consideration for deepening. The secondary objective was to establish any relationships between the navigation channels and the shallow water habitats adjacent to the channels. The program was conducted over a 12-month period to optimize the collection of information on all populations and life-stages. To address the two program objectives, the biological sampling program was conducted in two phases: Phase I incorporated bimonthly sampling at navigation channel locations, and Phase II included navigation channel and shallow water sampling on an every other week schedule at two areas selected to be representative of Harbor habitats. Ichthyoplankton sampling was conducted at Phase I and Phase II locations between February and June, the period projected as the primary reproductive period for fish species in the NY-NJ Harbor.

The 1998-1999 baseline Sampling Program was conducted to obtain information on seasonal occurrence of fish in navigation channels (Harbor-wide or HW stations) and in channel and associated shallow water areas at two representative sites (i.e., interpier areas, approach channels, and flats or shoals). Twenty (20) stations were sampled (10 harbor-wide and 10 site-specific), to target adult and early lifestages of demersal fish species. Two (2) stations (HW-9 and HW-10) were added to the program during March 1999 to provide additional sampling coverage of Newark Bay. Epibenthic sled surveys were conducted monthly from February 1999 through June 1999 (**Table 2.1-1**). Harbor-wide bottom trawl surveys were conducted bi-monthly (i.e., every other month) and site-specific bottom trawl surveys were conducted monthly from October 1998 through September 1999 (**Table 2.1-1**).

Twenty-four (24) sampling locations were sampled during the 2000-2001 Supplemental Sampling Program, maintaining the concept of channel usage. The Supplemental Sampling Program was modified to obtain data and information on the distribution patterns of the egg and larval stages of demersal species, with an emphasis on early life stage winter flounder, a species selected to be the representative species for decisions related to dredging. Ichthyoplankton surveys were conducted over a 7-month period beginning in December 2000 and continuing through June 2001 (**Table 2.1-2**). Sampling was conducted once in December 2000 and June 2001, and twice each month from January 2001 through May 2001. The stratified sampling schedule was selected to bracket the seasonal occurrence of winter flounder eggs and larvae in the Harbor. Bottom trawl surveys were not conducted during the 2000-2001 Supplemental Sampling Program.

Twenty-six (26) stations (14 shallow/shoal or in interpier areas, 12 navigation channels) were sampled during the 2001-2002 Sampling Program. The objective of the 2001-2002 Sampling Program was to determine the utilization and significance of habitat designated as essential fish habitat (EFH) for adult and early life-stages (eggs and larvae) of winter flounder. Six Lower Bay stations were added and two stations were removed from the stations sampled in 2000-2001 to provide better spatial coverage of the Harbor. A stratified sampling schedule was used to target winter flounder spawning and early development lifestages in the Harbor. Epibenthic sled tows were conducted twice a month from February 2002 through June 2002 and once a month during January 2002 and July 2002 (**Table 2.1-3**). Bottom trawl surveys were conducted from December 2001 to June 2002 (**Table 2.1-3**). Trawls were conducted on a stratified sampling schedule to target the period when adult winter flounder are historically present in the Harbor. Sampling was conducted on an alternating week schedule (i.e. two weeks per month) from January through March and once a month during December and April through June.

Sampling techniques and gear were the same for all USACE-NYD sponsored biological sampling programs. The 1998-1999 and 2001-2002 programs were conducted using the R/V Heather MII. The 2001-2002 trawl and ichthyoplankton sampling was conducted using the USACE vessels, Hudson. All deployment techniques were consistent among years. The program changes that affect the ability to determine long-term spatial and temporal distribution patterns are the addition and deletion of sampling stations, and the absence of bottom trawl data from the 2000-2001 Sampling Program. Section 2.3 and 2.4 detail the specific methods used to for the epibenthic and trawl surveys.

2.2 Physical-Chemical Monitoring

Water Chemistry

On each sampling date, at each station, dissolved oxygen (DO), temperature and conductivity were measured after each trawl and epibenthic sled tow. During the 1998-1999 sampling program, water quality measurements were taken at the surface, middle and bottom while measurements were taken at the bottom only during the 2000-2001 and 2001-2002 sampling programs. Water quality parameters were recorded one foot (0.3 m) above the substrate using calibrated meters.

Sediment Data

Several datasets were compiled and analyzed to created figures used in the various analyses. Data used include sampling conducted by the Army Corps of Engineers (USACE), U.S. Environmental Protection Agency (USEPA), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geologic Survey (USGS). Specific sampling was conducted for the following projects. USACE data was gathered for the Feasibility Report for New York and New Jersey Navigation Study. USEPA data was collected as part of the Regional Environmental Monitoring and Assessment Program (REMAP) for the east coast. NOAA data were collected as part of a project that characterized the benthic environment in the NY/NJ Harbor Estuary. Finally, USGS data were originally collected as part of a research project known as "Surficial Sediment Database for the Eastern U.S."

Each dataset was unique, since the goals of each individual project varied. The objective was to use various data collected to characterize the sediment within the NY/NJ Harbor Estuary. Since certain data sets directly collected data of this nature, an index was created to classify the data. Generally, benthic cores and grab samples were analyzed. Some analyses reported percentages of sand, silt or clay. Each grab or core was then ranked from 1 to 5 with one representing coarser sediments (i.e., more sandy) and five representing finer grained sediment (i.e., silty).

Due to the differences in the analyses conducted for the different datasets, there are some inherent biases involved. Since percent sand, silt or clay was indexed to give a universal ranking, some bias will exist, however, due to the size of the total datasets combined, the bias should be somewhat limited. In other words, the large sample size should give an accurate picture of what the general sediment texture is in the areas sampled for this project.

2.3 Ichthyoplankton Surveys

An epibenthic sled-mounted 0.5 m mouth diameter plankton net with 0.5-mm mesh was used to collect early life stages of fish during all three sampling programs. A General Oceanics flowmeter mounted in the mouth of each net was used to calculate the sample volume. All samples were collected during daylight hours. Each tow was conducted against the prevailing current for ten minutes, when possible. Tow direction and duration were adjusted to account for obstructions, limited transect distances and commercial traffic.

Ichthyoplankton samples were preserved with 5% buffered formalin and the vital stain rose bengal and returned to the laboratory for analysis. All specimens were identified to the lowest taxonomic level practicable, assigned a life stage (egg, yolk-sack larvae, post yolk-sac larvae, and juvenile) based on morphometric characteristics and enumerated. Unidentified species were recorded when eggs or larvae could not be identified to species. Actual egg and larval counts were adjusted for subsampling (i.e., splitting) and reported as egg or larval densities (no. / 1000 cubic meters [m^3]) based on sample volumes. Strict quality control (QC) procedures consisting of a Continuous Sampling Plan (CSP) to assure an Average Outgoing Quality Limit (AOQL) of ≥ 90% was followed during sample sorting, enumeration, lifestage designation, and identification.

2.4 Bottom Trawl Surveys

Bottom trawl surveys were conducted with a 30-foot (9.1 m) otter trawl. During the 1998-1999 Sampling Program, trawls were conducted during daylight hours, defined as one hour after sunrise to one hour before sunset. During the 2001-2002 Sampling Program, bottom trawls were conducted at night, one hour after sunset to one hour before sunrise. All tows were conducted against the prevailing current at an adjusted speed over the bottom of 4.9 feet/sec (150 cm/sec). Tow duration was ten minutes; however, tow times were adjusted to account for obstructions, limited interpier distances, commercial traffic, etc.

All fish were analyzed to species, enumerated and a subsample of selected species measured for total length (TL). Numbers of fish collected were adjusted for tow duration and reported as catch-per-unit-effort (CPUE) for a 10-minute tow.

2.5 Statistical Methods

As noted in the Introduction each year of study had unique aspects with respect to sampling design and protocol. This made rigorous statistical analysis of the combined dataset difficult in some cases. Year-to-year changes in sampling dates and the removal and addition of sites lead to non-comparable datasets and biased estimates of occurrence statistics. Throughout this analysis, an effort was made to make datasets as comparable as possible prior to analysis. This generally entailed removing specific locations, dates or habitats from one or more datasets. Once the datasets were made as comparable as possible, the statistical computations were carried out using NCSS (Hintze, 2000). The statistical computations included: descriptive statistics, percentiles, multiple linear regression, randomized and fixed effects analysis of variance (ANOVA) and multiple comparison tests. A detailed description of the different statistical analysis used for this study is provided within Appendix A.

3.0 ANALYSIS RESULTS

3.1 Physical-Chemical Habitat

Physical-chemical habitat data were collected weekly from October 1998 to October 1999 and during weekly sampling in the 2000-2001 and 2001-2002 program years. Because winter flounder are a benthic species, only water chemistry information collected near bottom is presented in the body of this report. Analysis of surface and mid-depth water chemistries and the results tables from the entire physical-chemical habitat data analysis are presented in Appendix B

Temperature

Bottom water temperatures from October 1998 to October 1999 ranged from a low near 5ºC in January 1999 to a high near 24ºC in September 1999 across all areas (**Figure 3.1.1**). During the 2000 to 2002 study period, bottom water temperatures ranged from 2.8ºC in January 2001 to 23.8ºC in July 2002. Graphical comparison of locally weighted robust regression (LOWESS) smoothed trend lines (**Figure 3.1-2**) suggests that winter and early spring temperatures were cooler in 2001 than in 2002. By about mid-May bottom temperatures were similar between the two years. Average temperatures by week and area are given in **Table 3.1-1**.

A randomized block ANOVA was used to test for statistical differences among weeks and areas for the 2001 and 2002 sampling seasons. In 2001, all effects except for the WEEK × AREA × TYPE interaction were statistically significant ($p < 0.05$). Channel temperatures were cooler than shallow stations during the late spring and summer; they were nearly identical during winter and early spring (**Figure 3.1-3**). Throughout most of the sampling season, bottom temperatures in the Arthur Kill/Newark Bay area were significantly warmer than those of the Upper Bay (**Figure 3.1-4**). In 2002, all effects other than TYPE and TYPE × AREA were statistically significant ($p < 0.01$). As observed in mid-depths, shallow station bottom waters were warmer than channel bottom waters during late spring and summer (**Figure 3.1-5**). During the late spring and summer period, bottom temperatures were lowest in the Lower Bay, intermediate in the Upper Bay, and warmest in the Arthur Kill/Newark Bay (**Figure 3.1-6**).

Salinity

Average bottom salinity ranged from a low of 11.7 ppt in April 2001 to a high of 25.7 ppt in February 2002 (**Figure 3.1.1**) **(Table 3.1-2)**. Graphical comparison of LOWESS smoothed trend lines (**Figure 3.1-7**), indicated that salinities during 2001 were generally lower than those observed in 2002. This was particularly the case during late-March through early-May when, in 2001, salinities declined sharply likely from increased precipitation and high freshwater flows.

A randomized block ANOVA was used to test for statistical differences among weeks (WEEK), habitat (TYPE), areas (AREA), and their interactions for the 2001 and 2002 sampling seasons. All tested effects in 2001 except for the WEEK × TYPE and WEEK × AREA interactions were statistically significant ($p < 0.05$). Temporal trends in channel salinity generally followed the pattern observed in the shallows (**Figure 3.1-8**), but averaged approximately 1.8 ppt greater. The higher salinity values found in the channels are consistent with the higher density and sinking nature of saline waters. Similarly, temporal trends within the Arthur Kill/Newark Bay were reflections of temporal trends in the Upper bay, with the Arthur Kill/Newark Bay salinities approximately 4.3 ppt lower (**Figure 3.1-9**). In 2002, all tested main and interaction effects were found to be statistically significant. As observed in 2001, channel salinities roughly paralleled salinities at the shallow stations but averaged 1.6 ppt higher than the shallows (**Figure 3.1-10**). Only during two weeks, when channel and shallow station salinities closely approximated one another, was this pattern broken. During 2002, samples from the Lower Bay were included in the analysis. Over the course of the sampling period, average salinities were the highest in the Lower Bay (27.2 ppt), intermediate in the Upper Bay (22.7 ppt), and lowest in the Arthur Kill/Newark Bay (21.2 ppt). No spring depression in salinity, as seen in 2001, occurred in any of the three areas (**Figure 3.1-11**). Examination of the AREA × TYPE interaction suggests that there is a greater degree of vertical mixing in the Arthur Kill/Newark Bay (**Figure 3.1-12**). Differences between the channel and shallow stations averaged 1.5 ppt in the Lower Bay, 2.5 in the Upper Bay, but only 0.7 in the Arthur Kill/Newark Bay.

Dissolved Oxygen

The dissolved oxygen concentration in water is largely dependent on the water temperature and, to a lesser degree, the salinity. As temperature increases, the amount of oxygen capable of being held in solution decreases. Similarly, as salinity increases, the amount of oxygen that can be held in solution decreases. Dissolved oxygen from October 1998 to October 1999 ranged from a low near 5ºC in January to a high near 24ºC in September across all areas (**Figure 3.1-1**). Using the survey data collected from 2000 through 2002, a strong linear relationship between temperature and dissolved oxygen can be seen (**Figure 3.1-13**). Stepwise multiple linear regression analysis indicates that 77.6% of the variance in the observed DO values can be explained by temperature alone. The addition of salinity explains an additional 1.9% of the variance (total $R^2 = 0.796$).

Because of the dependence on temperature and salinity, it is useful to examine the DO saturation in conjunction with the DO concentration. Dissolved oxygen saturation is the percentage of oxygen in the water relative to the amount of oxygen that the water could contain at the observed temperature and salinity, i.e., 100% saturation. In general, estuarine animals can tolerate short exposures to low levels of dissolved oxygen. However, prolonged exposures to DO levels less than 5 mg/L (about 60% saturation during summer) may cause behavioral changes and alter growth and reproduction. At DO levels less than approximately 2 mg/L (about 30% saturation during summer), death generally occurs within a relatively short time (USEPA 2002).

During the 2000 through 2002 survey periods, average DO concentrations across areas ranged from a low of 5.0 mg/L (61% saturation) in June 2002 to a high of 10.8 mg/L (101% saturation) in February 2002 (**Table 3.1-3**). DO saturation levels generally remained at 90% or greater throughout the winter months and into early spring. During mid May through July, saturation levels were generally less than 80%. Examination of DO concentration (**Figure 3.1-14**) and DO saturation (**Figure 3.1-15**) by day of year with LOWESS smoothing suggests no major differences among sampling years.

ANOVA on DO saturation using AREA and TYPE or AREA and DEPTH (surface, mid-depth, and bottom) as fixed effects indicated that only the main effect of AREA was statistically significant ($p < 0.001$). The AREA × DEPTH interaction plot is shown in **Figure 3.1-16**. The DO saturation in the Lower Bay was highest, 93.2%, intermediate in the Upper Bay, 90.5%, and lowest in the Arthur Kill/Newark Bay, 85.8%. While the results suggest that saturations are highest in surface waters, as might be expected, the differences among depths were not statistically significant.

3.2 Fish Community

The finfish community, as indicated by the ichthyoplankton and trawl surveys (**Table 3.2-1**), is typical of the Atlantic seaboard estuaries within the Mid-Atlantic Bight (from south of Cape Cod to Chesapeake Bay). The following section (Section 3.3) provides results from data analysis on the NY-NJ Harbor fish community based on samples collected under the NYNJHNS and the NYNJHNP. The major species include winter flounder, the target species of the 2000-2001 and 2001-2002 sampling programs, and nine other EFH species (Atlantic herring, Atlantic mackerel, black sea bass, bluefish, butterfish, red hake, scup, summer flounder, windowpane flounder).

Because winter flounder was the target species of the 2000-2001 and 2001-2002 sampling programs, extensive analyses were conducted on the winter flounder ichthyoplankton and trawl data. Substantial analyses were also conducted on windowpane flounder because the occurrence of windowpane flounder in the Harbor coincides significantly with winter flounder. Unfortunately some of the EFH species analyzed, based on their life histories, were not common in the Harbor during months that sampling was conducted. As a result, analyses of these data were limited in some cases to descriptive statistics. Pelagic species data were also analyzed with caution because pelagic species can be underrepresented in epi-benthic sled and trawl catches. A brief life history is provided below for each species to identify the spatial and temporal occurrence of each life-stage in the Harbor with respect to NYNJHNP sampling.

3.3 Winter Flounder

Winter flounder occurs in estuarine and continental shelf waters from Labrador to Georgia in several distinct population segments (EFH Source Document). Winter flounder exhibit small-scale seasonal migrations; spawning occurs in estuaries in the winter months followed by offshore movements in the summer months when estuary water temperatures begin to warm. Eggs are demersal and adhesive and spawning is possibly temperature dependent. Young of the year remain in the estuary most of the first year (Stone et al. 1994).

Temporal Occurrence

In 1999 winter flounder eggs were first collected on March 15 (day 74) of the sampling program and last collected around April 19 (day 109) (**Table 3.3-1**). Eggs were collected earlier and for a longer duration in 2001, beginning on February 27 (day 58) and last on April 14 (day 104). The following year, 2002, eggs were collected even earlier. The date of first occurrence was February 19 (day 50) with the median occurrence on March 6 (day 65). The last occurrence that year was on April 30 (day 120), over two weeks later than seen in 2001. It should be noted, however, that in all three years, yolk-sac larvae were collected on the day of or before the first egg occurrence. This suggests that eggs were likely present prior to when they were first collected in all three years. Although the longest temporal occurrence of eggs was observed in 2002, the February-April timing of egg occurrence appears to be comparable in all years.

Yolk-sac larvae occurred from February (day 48) through April (day 104) in 1999 with greatest numbers occurring in March. The date of median occurrence in 1999 was March 16 (day 75). During the 2001 sampling survey, yolk-sac larvae were first collected on February 27 (day 58) and last collected on April 27 (day 117). The date of median occurrence was April 13 (day 103). As with eggs, the 2002 occurrence period began earlier and lasted longer than that of 1999 and 2001. In 2002 yolk-sac larvae were first collected on February 6 (day 37) and last collected on May 2 (day 122). The median occurrence day was April 2 (day 92).

Post yolk-sac larvae were collected over a short time period in 1999 from April 14 (day 104) to May 25 (Day 145). During 2001, post yolk-sac larvae where collected from February 27 (day 58) through June 5 (day 156), the last day of the study. How long this stage persisted in the harbor after June 5 is unknown, however based on 2002 results, it is unlikely that they occurred much after this date. During 2002, the first occurrence of post yolk-sac larvae was on February 19 (day 50) while the last occurrence was on June 5 (day 156). The dates of median occurrence of winter flounder post yolk-sac larvae were relatively close across three years ranging from April 14 (day 104) April 27 (day 106).

Winter flounder juveniles and adults were collected in every month at each of the sampling areas (i.e., Lower Bay, Upper Bay, and Arthur Kill/Newark Bay). Yearling and adult winter flounder are widely dispersed throughout the entire Harbor during the winter months (December through March) (**Figure 3.3-1**). Alternatively, during the summer months (June - July), adults appear to leave the inshore areas of the Upper Bay and the Arthur Kill/Newark Bay (**Figure 3.3-2**) likely migrating to deeper, offshore waters. This movement is not reflected in the Lower Bay catches during the same period, possibly the results of limited sampling (i.e. four tows) during this period. Young-of-year winter flounder during the summer months are found in both nearshore areas, Upper Bay and the Arthur Kill/Newark Bay (**Figure 3.3-2**). They were almost entirely absent from the Lower Bay. Although this could be a reflection of limited sampling, results from other studies suggest that young winter flounder seek out shallow, inshore habitats during their first summer.

Spatial Occurrence

Winter flounder eggs were collected in every area of the Harbor in 1999. The earliest collections were in the Upper Bay and in the Arthur Kill/Newark Bay. The greatest density was collected in the Lower Bay even though only one site (Ambrose Channel) was sampled. Eggs were collected over the longest duration in the Upper Bay. In 2001, no winter flounder eggs were collected in the Arthur Kill/Newark Bay. Initial collections in the Upper Bay were from the one South Brooklyn channel stations (**Table 3.3-2**). In 2002, eggs were first collected in the Lower Bay at locations not sampled in previous programs. The greatest density of winter flounder eggs were collected in the Lower Bay (**Figure 3.3-3**) followed by the Upper Bay and then the Arthur Kill/Newark Bay.

In 1999, yolk-sac larvae were only collected in the Upper Bay (**Table 3.3-3**). During 2001, yolk-sac larvae winter flounder were first collected in the Upper Bay, both in the Port Jersey (shallow) and South Brooklyn (channel) areas. By Week 13 (March 26), yolk-sac larvae were collected at nearly all stations except those in Newark Bay. During 2002, yolk-sac larvae first occurred in the Upper Bay. By mid-February, they were widely distributed throughout the Lower Bay, Upper Bay, and the Arthur Kill/Newark Bay, but average concentrations were highest in the Lower Bay and lowest in Newark Bay. The greatest mean density of winter flounder yolk-sac larvae occurred in 2002 in the Lower Bay (**Figure 3.3-3**).

Winter flounder post yolk-sac larvae were collected in all three areas sampled in 1999 (**Table 3.3-4; Figure 3.3-3**) with the greatest densities recorded in the Upper Bay. In 2001, post yolk-sac larvae winter flounder were first collected in the Upper Bay. Post yolk-sac larvae were widely dispersed throughout the Upper Bay and Arthur Kill/Newark Bay areas by late-March. Highest concentrations generally occurred in the Upper Bay while lowest average concentrations occurred in the Arthur Kill/Newark Bay. As post yolk-sac larvae were collected on the last 2001 sampling date, it is unknown how long post yolk-sac larvae persisted in the study area. In 2002, post yolk-sac larvae were widely scattered throughout all areas from early-February through mid-May. By late-May, post yolk-sac larvae were found at three locations in Arthur Kill/Newark Bay and one in the Upper Bay, but only in low concentrations. The greatest concentrations of post yolk-sac larvae were collected in the Lower Bay.

Adult/juvenile winter flounder CPUE was highest (11.64) in the Arthur Kill/Newark Bay in June, primarily consisting of yearling fish. This represents the highest monthly CPUE in any area for winter flounder. Peaks in CPUE at Upper Bay stations appeared in late autumn and early summer. Lower Bay stations showed high CPUE in January, April and May.

Channel vs. Shallow

Winter flounder egg concentrations in 1998-1999 were slightly greater at the shallow stations compared to the channel stations (**Figure 3.3-4**). Conversely eggs were slightly greater at the channels in the 2000-2001 Supplemental study. These results need to be interpreted with caution because few eggs we collected in this study and most we collected at one site in the Upper Bay. Higher densities of winter flounder eggs were collected at the shallow stations early in the 2001-2002 in the Lower Bay, but later samples identified no habitat depth difference. These results do not provide conclusive evidence that shallows or channel habitats are more important to winter flounder spawning.

Winter flounder yolk-sac larvae were collected at slightly greater densities at the channels stations across the three sampling programs (**Figure 3.3-4**). Post yolk-sac larvae were not similar across sampling programs. In the 1998-1999 program greater concentrations of post yolk-sac larvae were collected in the shallows, whereas channels produced higher concentrations in 2000-2001 and 2001-2002.

To further explore the depth preference of winter flounder eggs, yolk-sac larvae, and post yolk-sac larvae the overall depth for each area was estimated. Estimates were obtained by computing the cumulative frequency distribution of the station depth weighted by the number caught per tow (**Table 3.3-5**). These results also suggest that depth was not an important factor in determining the distribution of winter flounder eggs and larvae in the Harbor. Observed eggs densities were highest in the Lower Bay, intermediate in the Upper Bay and lowest in the Arthur Kill/Newark Bay. Depth distributions, however, did not reflect this order. While the Lower Bay had the deepest median depth of occurrence, 19 ft (range 13 - 50 ft), the Upper Bay displayed the shallowest depth of occurrence, 8 ft (range 7.5 - 60 ft).

Winter flounder juvenile/adult CPUE varied according to station type (i.e., shallow or channel) over both sampling seasons in which trawls were conducted. During the winter months (January and February), channel regions were strongly preferred over shallows by all size groups (**Figure 3.3-5**). Shallow station CPUE was low throughout the winter months, but increased into June where CPUE was at a high. During the summer, young-of-year winter flounder were found in both shallow and channel habitats with an apparent slight preference for shallows (**Figure 3.3-6**).

ANOVA Results

A rigorous statistical analysis of the winter flounder ichthyoplankton data is difficult due to the short temporal occurrence of some life stages and the year-to-year differences in sampling programs. Eliminating certain time periods and restricting the analysis to the Upper Bay and Arthur Kill/Newark Bay shallow and channel stations during 1999, 2001 and 2002, a statistical comparison for yolk-sac larvae and post yolk-sac larvae was made. For this analysis a fixed-effect ANOVA with YEAR, AREA, and TYPE (shallow vs. channel) as main effects and ln(x+1) transformed data was used. For yolk-sac larvae, the analysis was restricted to Weeks 7-17, while for post yolk-sac larvae Weeks 7-23 were used.

Results for yolk-sac larvae indicate statistically significant relationship to the main effects YEAR ($p < 0.001$), AREA ($p = 0.004$) and Type ($p=0.017$) (**Table 3.3-6, Figure 3.3-7**). Examination of means and interaction plots indicate that catches of yolk-sac larvae were significantly higher in 2002 than in both 2001and 1999, especially in the channels. Catches in the Upper Bay were higher than the Arthur Kill/Newark Bay in all three years. Although not included in the ANOVA, the mean CPUE for 2002 catches in the Lower Bay suggest that Lower Bay catches were statistically greater than those on the Arthur Kill/Newark Bay and Upper Bay.

Results for post yolk-sac larvae winter flounder were similar, but with only the YEAR main effect being statistically significant ($p < 0.001$) (**Table 3.3-8, Figure 3.3-8)**. As with yolk-sac larvae, catches in 2002 were higher than 2001 and 1999, and catches in the Upper Bay were higher than Arthur Kill/Newark Bay. The mean CPUE for 2002 post yolk-sac larvae catches in the Lower Bay suggest that Lower Bay catches were statistically greater than those on the Arthur Kill/Newark Bay and Upper Bay areas.

The ANOVA results identified that the CPUE of adult/juvenile winter flounder CPUE is related to the second order interaction of TIME × TYPE ($p=0.026$) (**Table 3.3-8**) and AREA × TYPE ($p = 0.010$). These second order interactions are driven by the significant relationship between winter flounder CPUE and station type ($p = 0.034$) (**Figure 3.3-9**). Thus the areas of the Harbor that winter flounder adults/juveniles are present in from late-fall to early summer are influenced by the depth of that area.

Physical-chemical Habitat

Based on combined 2000-2002 data, the median occurrence bottom water temperature for winter flounder eggs was 6.4°C (range 4.0 - 11.7°C). Yolk-sac larvae were collected at somewhat higher temperatures, 7.9°C (range 3.8 - 15.5°C), - consistent with their later temporal occurrence. The median bottom temperature for post yolk-sac larvae was even higher; 10°C (range 3.8 - 18.6°C).

Salinity values were relatively consistent for all three life-stages. Median bottom salinity occurrence for eggs was 27.5 ppt (10.4 - 32.2 ppt). For yolk-sac larvae, the median salinity was 25.2 ppt (8.5 - 32.2 ppt) while for post yolk-sac larvae it was 25.2 ppt (6.5 - 33.1 ppt).

Dissolved oxygen levels in water are dependent on temperature, with warmer water supporting lower concentrations. Consequently, DO levels in bottom waters tended to decrease with advancing life stage (as older larval stages occur at progressively warmer temperatures). The median occurrence DO for eggs was 9.7 mg/L (range 8.0 - 11.3 mg/L). For yolk-sac larvae, the median occurrence was similar to that of eggs, 9.7 mg/L (range 7.7 - 13.2 mg/L). For post yolk-sac larvae, the median occurrence bottom DO decreased to 9.2 mg/L (range 4.3 - 13.3 mg/L).

The importance of substrate type cannot be accurately assessed because substrate characterizations were not made for the individual stations sampled. Some broad generalizations may be made, however, from the findings summarized of other studies. Sediment characteristic information presented in **Figure 3.3-10** indicates that coarser sediments (gravel/sand/silt) tend to be found in the lower bay and channels while finer sediments (silt/clay) are found in the shallow harbor areas. As highest egg concentrations are found in the Lower Bay, suggesting that winter flounder may favor the coarser sediments for spawning.

3.4 Windowpane Flounder

Windowpane flounder (*Scophthalmus aquosus*) are commonly distributed from the Gulf of St. Lawrence to Florida, but are most abundant from the Georges Bank to Chesapeake Bay

(Able and Fahay 1998). Spawning generally occurs from April to December, with peaks in May and October in the mid-Atlantic Bight. Fall spawning tends to be located in the coastal shelf waters while spring spawning occurs in inshore and estuarine waters. It is also believed that the inner continental shelf and estuaries serve as nurseries for spring spawned young of year. Both young of year cohorts appear to move offshore into deeper water during the winter (Able and Fahay 1998).

Temporal Occurrence

Windowpane flounder eggs were not collected in 1999. In 2001 eggs were collected from May 10 (day 130) to the last day of sampling on June 5 (day 156) (**Table 3.4-1**). The 2002 results suggest that spawning likely continued for several more weeks beyond the last day of sampling in 2001. Consequently, statistics for 2001 do not present an accurate picture of the temporal occurrence. During the 2002 sampling program, windowpane flounder eggs were first noted on April 18 (day 108) and last noted on July 11 (day 192). The date of median occurrence was June 5 (day 156).

Both yolk-sac larvae and post yolk-sac larvae windowpane flounder were collected on dates prior to the date that eggs were first collected. This suggests that spawning began prior to that indicated by the collection of eggs. As with egg, windowpane yolk-sac larvae were not collected in 1999. In 2001, windowpane flounder yolk-sac larvae were only collected on May 10 (day 130) while during the 2002 sampling this stage was only collected on June 6 (day 157). The low densities and short temporal occurrence of yolk-sac larvae limited the interpretation of these results.

In the 1999 sampling program windowpane flounder post yolk-sac larvae were collected from May 25 (day 145) to June 16 (day 167). The median occurrence date in 1999 was May 27 (day 147). Windowpane flounder post yolk-sac larvae where collected from May 10 (day 130) through June 5 (day 156) in 2001. The duration that post yolk-sac larvae existed in the harbor is unknown, but the 2002 results suggest that they may occur for at least another month. Because the life stage was still occurring on the last sampling date, the median occurrence date of May 25 (day 145) may be too early. During 2002, the first occurrence of post yolk-sac larvae was April 30 (day 120) while the last occurrence was July 10 (day 191). The median occurrence date was May 16 (day 136). Although the July 10 sample date was the last date sampled, catches on that date were low and had clearly decreased from previous weeks.

Windowpane flounder weekly CPUE was lower than winter flounder, but consistent throughout much of the sampling programs. CPUE ranged from 0 to a peak of 6.91 in August 1999. The highest CPUE recorded in the 1999 sampling season was from late April to August. Windowpane CPUE in the 2002 sampling season was consistently low, similar to winter flounder CPUE in 2002 and ranged from 0.31 to 4.00. Peak CPUE during the 2002 sampling season was recorded during early January (2nd week of the year) at 4.00. Analysis of length data in 2002 indicated that yearling and adult windowpane flounder during winter months (December - March) are found throughout the harbor, but were found in greatest concentration in the Upper Bay (**Figure 3.4-1**).

Spatial Occurrence

Windowpane flounder eggs were collected in 2001 in both the Arthur Kill/Newark Bay and Upper Bay (**Table 3.4-2)**. Eggs were seen earlier and in higher concentrations in the Upper Bay, but due to the termination of the sampling program, it is unknown whether or not total egg production in the Arthur Kill/Newark Bay would have been as great as the Upper Bay. In 2002, eggs were collected from all three areas: Arthur Kill/Newark Bay, Upper Bay, and Lower Bay. The earliest collection, Week 16 (April 16), was from the upper bay. The highest weekly concentration, 5,654 /1000m^3, was obtained from the Lower Bay shallows during Week 23 (June 4).

In 1999, windowpane flounder post yolk-sac larvae were collected in all three areas sampled in the Harbor. The post yolk-sac larvae were caught in the greatest abundance in the Upper Bay during two sample weeks (May 26 and June 15). During both 2001 and 2002, the only catch of windowpane flounder yolk-sac larvae was from the Upper Bay (**Table 3.4-3**). Windowpane post yolk-sac larvae where collected in both areas sampled in 2001 and all three areas sampled in 2002 (**Table 3.4-4)**. Based on the 2002 study (using Fixed Effects, ANOVA), catches in the Lower Bay were significantly greater than those of the Upper Bay and Arthur Kill/Newark Bay (AREA effect, $p < 0.001$).

Windowpane adult/juvenile CPUE generally increased in the Arthur Kill/Newark Bay from December to the peak in April. A bi-modal distribution was apparent in the Upper and Lower bays. A small peak in CPUE exists in January in the Upper Bay (2.87), followed by a more pronounced peak in June (6.04). Similarly, CPUE shows a slight peak in January in the Lower Bay (3.42) followed by another smaller peak in CPUE in April (2.83). Overall, CPUE appears to be greatest in the Upper Bay.

Windowpane flounder length data identified that both yearling and adult windowpane leave the nearshore Upper Bay and Arthur Kill/Newark Bay areas during the summer months. Yearling fish move to the Lower Bay during the winter (**Figure 3.4-2**).

Channel vs. Shallow

Two peaks in windowpane flounder CPUE were observed at the channel stations. Yearling and adult life stages CPUE was significantly greater at channel stations from December through March (**Figure 3.4-3**). Shallow stations exhibited low juvenile/adult CPUE through all but the mid-spring through summer months. During the summer months, there was no apparent difference in concentration between channel and shallow habitats for young-of-year (**Figure 3.4-4**). Yearling and adults, however, display a strong preference for channels in the summer months.

Depth does not seem to play an important role in determining the distribution of windowpane eggs and larvae within the harbor area. Observed egg concentrations, at least in 2002, were highest in the Lower Bay, intermediate in the Upper Bay, and lowest in the Arthur Kill/Newark Bay. Depth distributions did not reflect this order. The deepest median depth of capture was in the Upper Bay (38 ft, range 7 - 61 ft) while the shallowest median depth was in the Lower Bay (16 ft, range 12 - 52 ft) (**Table 3.4-5**).

ANOVA Results

The ANOVA results identified significant relationships between windowpane flounder post yolk-sac larvae and the first order variable YEAR ($p=0.040$) (**Table 3.4-6, Figure 3.4-5**). These results indicate that there were significant differences in the density of windowpane flounder collected across year with the greatest density occurring in 1999. No other variable or interaction among variables had a significant effect on windowpane flounder post yolk-sac larvae density.

Significant relationships were also found between windowpane flounder CPUE and first order interactions with the YEAR ($p<0.001$), AREA ($p=0.047$), and TYPE (channel or shallow) ($p=0.003$). These results suggest that the occurrence of windowpane flounder are influenced by several individual variables, but the interactions between and among variables does not affect windowpane flounder CPUE (**Table 3.4-7, Figure 3.4-6**).

Physical-Chemical Habitat

Based on the combined 2000-2002 data, the median occurrence bottom water temperature for windowpane flounder eggs was 16.5ºC (range 10.3 - 20.9ºC). Yolk-sac larvae were only collected twice, once at 12.8ºC and once at 12.9ºC. The median bottom temperature for post yolk-sac larvae was 13.2ºC (range 10.3 - 20.0ºC). The finding of a lower median temperature for post yolk-sac larvae than for eggs indicates that the spawning period may not be correctly characterized by the collection of eggs. This could suggest that the majority of spawning could take place outside the study area.

Median bottom salinity value for windowpane eggs was 20.1 ppt (range 11.5 - 28.0 ppt). The corresponding value for post yolk-sac larvae was slightly higher; 23.4 ppt (range 14.5 - 28.4 ppt). Observed median salinity was highest for yolk-sac larvae, 25.3 ppt (range 25.2 - 25.4 ppt).

As previously described, dissolved oxygen levels are generally inversely related to water temperature. It is not surprising, therefore, that the observed D.O. levels for eggs (6.4 mg/L, range 3.9 - 9.9 mg/L) was lower than for post yolk-sac larvae (8.0 mg/L, range 3.9 - 9.9 mg/L). The D.O. values associated with the two yolk-sac larvae collections were 7.8 and 8.2 mg/L.

3.5 Summer Flounder

Summer flounder or fluke (*Paralichthys dentatus*) are a popular recreational fish that occurs from the Gulf of Maine to South Carolina (EFH source document, 2001). Though most abundant on the continental shelf, it also occurs in estuaries in high numbers (Able and Fahay 1998). Seasonally, summer flounder move into estuaries in the spring where they remain for the summer. In autumn, summer flounder then move out of estuaries and nearshore waters to winter on the edge of the continental shelf (Able and Fahay 1998). Spawning occurs in shelf waters in fall and early winter depending on location/latitude. Larval stages are transported toward coastal areas by prevailing ocean currents. Later development of larvae and juveniles occurs within bays and estuarine areas (NMFS 1999)

Temporal Occurrence

Because spawning typically occurs in the fall, post yolk-sac larvae was the only early lifestage of summer flounder collected in the NYNJHNP. Summer flounder larvae were collected in both the 2001 and 2002 sampling seasons (**Table 3.6-1**). In the 2001 sampling season, summer flounder post yolk-sac larvae were first collected during in the beginning of sampling in late 2000 (December) and were present in collections up to mid-April (day 104), In 2002, the date of first occurrence was 22 January and the date of last occurrence was 14 May. Summer flounder post yolk-sac larvae were only collected during four weeks of sampling in 2002.

Summer flounder juveniles/adults were rarely collected in the winter and spring weeks of the 1999 and 2002 sampling seasons as would be expected by their life history characteristics. Substantial weekly CPUE was recorded during the summer months from mid-June to August in the 1999 sampling season. The 2002 sampling season showed similar trends, though sampling did not occur into the summer. Peak CPUE in the 1999 season was recorded in May (6.87, 22nd week) and in June (3.79, 25th week) in the 2002 sampling season.

Spatial Occurrence

In the 2001 sampling season, summer flounder post yolk-sac larvae were present in both the Upper Bay and Arthur Kill/Newark Bay areas in varying abundance. Collections were more common from the latter and densities were slightly higher as well. Average station densities ranged from 4.7/1000m^3 to 14.1/1000m^3. Catch in the 2002 season was limited to four weeks of sampling. Larvae were collected in the Arthur Kill/Newark Bay area during two weeks, and in the Upper Bay area during two weeks of sampling during 2002. Density was low but similar between Upper Bay and Arthur Kill/Newark Bay stations. Distribution in the 2002 sampling season was sporadic, occurring at one Upper Bay station, and two Arthur Kill/Newark Bay stations.

Juvenile and adult summer flounder were collected in all three areas, with the lowest CPUE in the Lower Bay. Summer flounder adults/juveniles were most common in the Upper Bay from May to August. Summer flounder CPUE was relatively high in May (1.57) and June (2.22) in the Arthur Kill/Newark Bay and Lower Bay area in May (1.56). An increase in CPUE likely occurred in these areas after sampling commenced, because summer flounder peak abundance typically occurs later in the summer. Peak CPUE occurred in the Upper Bay during June (5.32) representing the highest summer flounder CPUE recorded.

Channel vs. Shallow

Summer flounder post yolk-sac larvae were most common in the channel habitats compared to shallow stations in the 2001 sampling effort. Peak density at the channel station was observed in the Arthur Kill/Newark Bay area at 14.3 larvae/1000m^3. In 2002, collections were evenly distributed between shallow and channel stations in both the Upper Bay and Arthur Kill/Newark Bay areas. No distinct difference in density was observed in the 2002 sampling season.

Summer flounder juvenile/adults were collected during more months at channel stations compared to shallow stations, though CPUE was slightly higher in the shallow stations. Distribution of summer flounder in channel and shallow stations occurred roughly during the same time period (April through September). Highest recorded CPUE in shallow and channel stations occurred from May through July. Peak CPUE occurred in June at shallow stations (5.26).

ANOVA Results

Summer flounder were not collected until the last two weeks of the program resulting in a significant relationship between summer flounder CPUE and the variable TIME ($p<0.001$) (**Table 3.5-1**, **Figure 3.5-1**). The interaction between TIME x AREA also had a significant relationship with summer flounder CPUE ($p<0.001$), however this relationship is predominately driven by the TIME effect. If summer flounder were present throughout the Harbor during the entire sampling program a different relationship between CPUE and TIME would likely be observed.

Physical-Chemical Habitat

Summer flounder post yolk-sac larvae were collected over a narrow range of temperature 3 to 9 °C (37.4 – 48.2 °F) but the majority of collections occurred at temperatures less than 6 °C (42.8 °F). Salinity ranged widely (12 – 28 ppt), but the majority of post yolk-sac larvae were collected at salinities ranging from 12 to 22 ppt. Dissolved oxygen and turbidity data were available for summer flounder catches. Post yolk-sac larvae were collected over a narrow range of dissolved oxygen concentrations (8 – 11 mg/L), with the major of collections occurring at the upper end of this range.

3.6 Atlantic Herring

Atlantic herring (*Clupea harengus*) are a common species found in the North Atlantic from west of Greenland to Cape Hatterus (Able and Fahay 1998). Peak spawning activity occurs in the fall when large schools of adults form to deposit demersal eggs in relatively shallow water. Because spawning occurs in the fall, Atlantic Herring eggs and yolk-sac larvae were not collected during any year of the NYNJHNP. It is believed that herring collected in the study region are part of a stock that spawns near the Georges Bank, even though larval fish are collected from the Harbor area south to the inshore waters of New Jersey. Atlantic herring is a pelagic species therefore the bottom orientation of the gear in the NYNJHNP is not the best gear for collecting this species

Temporal Occurrence

In 2001 Atlantic herring post yolk-sac larvae were first collected on February 13 (day 44) and last on May 10 (day 130) (**Table 3.6-1**). The date of median occurrence (50th percentile) was March 30 (day 89). The majority of larvae were collected from 19 March to 9 April. Atlantic herring post yolk-sac larvae were not collected in any other year of sampling. Atlantic herring juveniles/adults were collected in the 1999 and 2002 trawl programs. Peak CPUE occurred in the May (22nd week) of the 1999 season (18.18) with slight peaks in early-January and mid-June 1999. Atlantic herring were collected throughout the 2002 sampling season, but CPUE was typically low (range: 0.0-0.81).

Spatial Occurrence

During the 2001 sampling season, Atlantic herring post yolk-sac larvae were collected in both the Upper Bay and Arthur Kill/Newark Bay. Catch was more frequent in the Newark Bay/Arthur Kill compared to Upper Bay. The highest concentrations were collected during the week of 26 March in the Arthur Kill channel stations (21.2/1000m^3) and South Brooklyn channel (38.5/1000m^3). Atlantic herring post yolk-sac larvae were collected more frequently and at greater densities at the channel stations. Post yolk-sac larvae herring were collected in the shallow stations of Upper Bay and the Arthur Kill/Newark Bay, but concentrations were typically lower than channel stations.

The CPUE of Atlantic Herring juvenile/adults in the Arthur Kill/Newark Bay area was very low (range: 0.0-2.11) except a relatively high peak in April. In the Upper Bay, CPUE was less than 1.0 for January through April, and June. Atlantic herring were most frequently collected in the Lower Bay also (collected from January to June). Peak monthly CPUE occurred in the Lower Bay during May (5.74) at a shallow station. Atlantic herring juveniles/adults were more common at shallow stations compare to channel stations.

ANOVA Results

Sufficient data were available to conduct statistical analysis on Atlantic herring CPUE data. The results from this analysis identified that the interaction among AREA, TIME and TYPE had a significant relationship with Atlantic herring CPUE (p=0.026) (**Figure 3.6-1**, **Table 3.6-2**). Thus on any given date when Atlantic Herring are collected, they typically occur in localized patches (e.g. only in the Lower Bay shallow stations) and not throughout the Harbor.

Physical-Chemical Habitat

Based on data for the 2001 and 2002 sampling seasons combined, Atlantic herring post yolk-sac larvae were collected in water temperatures ranging from 3 to 16 °C (37.4 – 60.8 °F). However, the highest concentrations were collected between 4 and 6 °C (39.2 – 42.8 °F). Salinity (ppt) during collection ranged from 8 and 26 ppt. Highest concentrations were collected at salinities ranging from 18 to 22 ppt. Herring post yolk-sac larvae also occurred in water with dissolved oxygen (mg/L) ranging from 7 to 11 mg/L, with the bulk of collections occurring within the 9 to 11 mg/L range.

3.7 Atlantic Mackerel

Atlantic mackerel (*Scomber scombrus*) is a pelagic, schooling species found primarily in the northwest Atlantic. Extensive seasonal migrations occur between spawning and summering grounds. Spawning occurs in the early spring in coastal shelf waters (Able and Fahay 1998), but early lifestages may use estuaries within the Middle Atlantic Bight as nursery habitat. Post yolk-sac larvae was the only Atlantic mackerel early lifestage collected and only during the 2002 sampling season. Juvenile/adult Atlantic mackerel catch was extremely low (only one individual collected) and therefore meaningful analysis is not possible of this lifestage.

Post yolk-sac larvae were collected during a narrow window of occurrence from May 14 (day 134) to May 16 (day 136) (**Table 3.6-1**). Post yolk-sac larvae were collected in the Upper Bay and Lower Bay, but were absent from samples collected in the Newark Bay/Arthur Kill. Densities were greatest in the Lower Bay (LB-1, LB-2, LB-4: 96.4, 34.0 and 27.3 larvae/1000m^3 respectively). Peak density occurred in the Lower Bay at a shallow station (96.4 larvae/1000m^3), but across all areas densities were not different between shallow and channel stations.

Atlantic mackerel post yolk-sac larvae were present when water temperatures were in the range of 11 to 14 °C (51.8 – 57.2). These post yolk-sac larvae were encountered over wide range of salinities, but the majority occurred from 26 to 28 ppt; salinity concentrations typical in the Lower Bay.

3.8 Black Sea Bass

The stock of black sea bass (*Centropristis striata*) common to the New York Bight winters in the continental shelf waters off North Carolina (NMFS 1999). Eggs and larvae are believed to be pelagic, though juveniles will use estuaries as nursery habitat (Able and Fahay 1998). Six years of weekly ichthyoplankton collections yielded no eggs or larvae in estuaries just south of the project area (Able and Fahay 1998). Furthermore, juvenile and adult black sea bass are almost always associated with hard structure substrates (i.e., rock, reefs, wrecks etc.), areas that are difficult to survey using bottom trawls. Likely the result of these factors, no black sea bass were present in ichthyoplankton samples and few were present juveniles/adults in the trawl surveys.

Black sea bass juvenile/adult CPUE followed an expected seasonal pattern in the 1999 sampling season with the highest CPUE's recorded from late summer into early fall (peak CPUE = 2.96 in September). Black sea bass CPUE was low in the 2002 sampling season (range: 0.0-0.23), however, the sampling program did not extend into the late-summer when black sea bass would be expected to be abundant in the Harbor region

Monthly black sea bass CPUE was very low in the Arthur Kill/Newark Bay (<0.37 in all months). Low CPUE was common in the Upper Bay, except in August and October, which had relatively higher rates (1.62 and 2.68 respectively). Black sea bass CPUE at the shallow stations was substantially greater than channel stations. Peak black seas bass CPUE at shallow stations occurred in October (3.86) and August (2.59).

3.9 Bluefish

Bluefish (*Pomatomus saltatrix*) are a coastal, pelagic species ranging from Nova Scotia to Florida (Able and Fahay 1998). They migrate into the Middle Atlantic Bight during the spring and south or offshore in the fall. Spawning is believed to occur in continental shelf waters south of the Hudson-Raritan Estuary. Larvae gradually move north from the spawning/hatching location. The season of occurrence and reproductive strategy of bluefish are the major factors that resulted in no bluefish eggs or larvae in the ichthyoplankton samples. In addition, low numbers of bluefish were collected in the trawl surveys.

Bluefish trawl CPUE was low throughout both the 1999 and 2002 trawl surveys. In 1999, bluefish were most common in the Upper Bay in late summer to early fall (August through October). Peak CPUE (1.08-1.62) occurred in the Upper Bay during this period. Bluefish were caught only during June in the Arthur Kill/Newark Bay (0.11) and Lower Bay (0.17) areas. Few bluefish were present in the 2002 resulting from the timing of trawl program in relation to bluefish abundance in the study area. The peak bluefish CPUE occurred at a channel station, but no difference in habitat depth selection could be determined from the data.

3.10 Butterfish

Butterfish (*Peprilus triacanthus*) ranges from Nova Scotia to the Carolinas (Able and Fahay 1998). This pelagic species inhabits deeper shelf waters, but migrates seasonally in response to changing water temperatures (NMFS 1999). Butterfish migrate north and inshore in the summer, while the opposite is true during the winter. Spawning of pelagic eggs occurs during spring and summer in coastal and estuarine waters (Able and Fahay 1998). As a result of the pelagic life history, butterfish were only collected as post yolk-sac larvae in NYNJHNP ichthyoplankton surveys.

Butterfish post yolk-sac larvae were collected in 2002 only during the last week of sampling (9 July) and were present in all areas sampled in the Harbor (**Table 3.6-1**). During that week water temperatures ranged from 17 to 22 °C (62.6 – 71.6 °F) and salinities ranging from 20 to 30 ppt. Larvae were collected at only one Arthur Kill/Newark Bay station, thus densities were less than other areas of the Harbor. Greater densities were observed in the Upper Bay, where the peak density (31.8 /1000m^3) occurred, compared to Lower Bay. Post yolk-sac larvae densities were similar between the channel and the shallow stations in the both the Upper and Lower bays.

Juvenile/adult butterfish were collected in both 1999 and 2002. Weekly CPUE was relatively high in the 1999 sampling season compared to 2002. Butterfish CPUE increased dramatically in mid to late summer with weekly CPUE ranging from 5.3 to a high of 37. Peak CPUE was recorded in July (30th week) at 37.11. Butterfish CPUE was recorded in only one month in the Arthur Kill/Newark Bay area (0.11 in June) and absent from the Lower Bay. Almost all of the catch can be attributed to the Upper Bay, from July through October. No butterfish were collected in any area from January to May.

Juvenile and adult butterfish were collected at channel and shallow station during similar periods (July – October). Channel station CPUE was nearly twice the shallow station CPUE in July (53.67) and August (15.12), and approximately 33% greater in September (9.78). Thus, seasonal use of channels and shallows habitats by butterfish is similar.

ANOVA Results

Butterfish were only collected during the last two sampling weeks of the trawl program and only at the Arthur Kill/Newark Bay and Upper Bay (**Figure 3.10-1**). This limited temporal occurrence resulted in a significant relationship (**Table 3.10-1**) between butterfish CPUE and the interaction of TIME x AREA (p=0.015). Because the sampling program ended as the butterfish began using the Harbor we do not have enough data to interpret the meaning of these results.

3.11 Red Hake

The red hake (*Urophycis chuss*) occurs from the Gulf of St. Lawrence to North Carolina, but are most common in the area of the George's Bank and the Middle Atlantic Bight (NMFS 1999). Red hake make seasonal migrations in response to changing water temperatures, inhabiting shallow water in the spring and summer but move to deep offshore water to overwinter. Eggs and larvae are more common east and north of the Harbor, though juveniles may be found in most estuaries (Able and Fahay 1998). Red hake eggs and larvae were not collected in the three years of sampling, likely resulting spawning not occurring the in the Harbor.

Juvenile and adult red hake were collected in the 1999 and 2002 trawl surveys in low numbers. In 1999, red hake CPUE was less than 1.0. Red hake were only collected once in the 2002 sampling season (1.69 in late February, 2002); this date also represents the peak weekly CPUE over both sampling seasons. Red hake were most abundant in the Lower Bay from December through April, with the peak CPUE occurring in February (2.58). Red hake were less common in the Upper Bay and Arthur Kill/Newark Bay with no CPUE recorded in excess of 1.0. Red hake were exclusively collected in channel habitat and were most common in the Lower Bay.

ANOVA Results

Although limited data existed on red hake, statistical analyses were conducted. The variable TIME did not influence the CPUE (**Table 3.11-1, Figure 3.11-1**) because CPUE was consistent on each event that fish were collected. The interaction AREA x TYPE had a significant relationship with red hake CPUE (p=0.004). TYPE and AREA were also both significant first order variables related to the occurrence of red hake. These results suggest that red hake are most common in channel habitat and predominately in the Lower Bay.

3.12 Scup

Scup, or porgy (*Stenotomus chrysops*), is a common in deep estuaries of the eastern seaboard (Able and Fahay 1998). In winter, scup are typically found in offshore waters at depths greater than 200 feet. Scup are believed to spawn once yearly with spawning likely occurring in larger bodies of water such as Long Island Sound, but may take place just outside (seaward) of such places. Eggs and larvae were rare or absent during other sampling programs in the Hudson-Raritan Estuary and other major estuarine systems (Able and Fahay 1998). No scup ichthyoplankton were collected in the NYNJHNP.

Temporal Occurrence

Seasonal occurrence of adult/juvenile scup was concentrated in the mid-summer weeks of the 1999 sampling season. Catch during the 2002 season was limited to two weeks of sampling in early spring and summer; though sampling was not conducted in the late summer and early fall months when scup are more abundant in the study area. CPUE was high in the 1999 sampling season from July (30^{th} week) through October (41^{st} week). Peak CPUE in the 1999 sampling season was recorded in September at 24.93 (week 38).

Spatial Occurrence

Scup CPUE in the Arthur Kill/Newark Bay was low (0.19) and only occurred in June, however, sampling did not occur in the mid to late summer months. Scup CPUE in the Upper Bay was substantial in the summer. Although collections contained scup from May to October, the highest scup CPUE was recorded from July through September in the Upper Bay (12.2, 11.4, and 13.8 respectively). Although not sampled from July through November, CPUE in the Lower Bay was extremely high in May (31.23) and substantial in June (6.17).

Channel vs. Shallow

Scup CPUE was generally higher in shallow stations compared to channel stations during most months. Scup were abundant in channel stations during May, July and August (8.69, 8.33, and 6.59 respectively), however, CPUE at shallow stations was higher during these months. In shallow stations, scup CPUE was high during July through September. No juvenile/adult scup were collected from November to April in either channel or shallow stations.

ANOVA Results

The ANOVA results identified a significant relationship between scup CPUE and the second order interaction TIME x AREA ($p<0.001$) (**Table 3.12-1, Figure 3.12-1**). This interaction must be interpreted cautiously because Scup were only collected during the last two weeks of the sampling period and were primarily located in the Lower Bay. The first order interaction of between scup CPUE and TIME ($p<0.001$) also resulted from scup being collected late in the sampling program.

4.0 DISCUSSION

A critical determinant of fish distribution is the nature of the surrounding physical and chemical habitat, e.g., water temperature, salinity, and substrate type. Within the NYNJHNP numerous differences were noted among areas and years that help explain some of the observed patterns of fish occurrence.

The most notable feature in the observed physical and chemical measures was the difference among the three areas - Lower Bay, Upper Bay, and the Arthur Kill/Newark Bay. In general, water temperatures (surface, mid, and bottom) during the winter months were similar among all three areas sampled. However, as temperatures began to rise in the spring, the temperature increase was greatest and fastest in the Arthur Kill/Newark Bay and least in the Lower Bay. Dissolved oxygen followed the inverse of this pattern, with the highest dissolved oxygen levels in the Lower Bay and lowest in the Arthur Kill/Newark Bay. While this may be expected as dissolved oxygen levels are highly dependent on water temperature, the same pattern was true for dissolved oxygen saturation (the percentage of oxygen that water can be held relative to the maximum that can hold at a given temperature and salinity.). This finding suggests that the Arthur Kill/Newark Bay has a higher oxygen demand (biological, chemical, sediment) that the Lower Bay. Salinity values were, as expected, highest in the Lower Bay and lowest in the Upper Bay and Arthur Kill/Newark Bay where freshwater flow from the Hudson, Hackensack, and Passaic Rivers is received.

Taking the physical-chemical measures together, the offshore Lower Bay may be characterized as having a more marine/oceanic nature (i.e., exhibit the least variability, more stable environment). Average salinities (23 - 31 ppt) in this area approach full strength seawater (35 ppt), are highly oxygenated (near 100% saturation), and are relatively cool in the spring and summer. The Arthur Kill/Newark Bay and Upper Bay areas may be characterized as a nearshore, polyhaline (18-30 ppt) estuarine environment (**REF**). Both areas are within highly industrialized harbor, have been highly modified through dredging and filling operations, and receive pollutants from a variety of sources. It appears that the Upper Bay may be more ocean-like than the Arthur Kill/Newark Bay by virtue of the relatively broad connection between Lower Bay and Upper Bay through The Narrows. This connection can be seen in the salinity measurements. Despite the higher freshwater input from the Hudson and East Rivers into the Upper Bay, the Arthur Kill/Newark Bay has a lower average salinity. The predominance of fine bottom sediments in the Arthur Kill/Newark Bay area also suggests limited tidal exchange. Instead, Arthur Kill/Newark Bay appears to be more of a depositional area with a greater potential for biological, chemical, and sediment oxygen demand.

The overall fish community in the NY-NJ Harbor is typical of Atlantic seaboard estuaries within the Mid-Atlantic region. The most obvious component of the fish community is the seasonal occurrence of various species. Species such as clearnose skate, red hake, silver hake, smallmouth flounder, spotted hake, white perch, windowpane, and winter flounder are abundant late fall through early spring residents. During the warmer month, species such as bay anchovy, butterfish, scup, striped searobin, summer flounder, and weakfish reside in the Harbor. Other species, particularly alewife, blueback herring, American shad and striped bass, are predominantly spring and fall transients. These are anadromous species (marine, but spawn in freshwater) that spawn well up river in freshwaters. The adults migrate through the Harbor region during the spring on their upriver spawning migration. The young-of-year begin their downriver migration during the fall and may overwinter in the lower reaches of estuaries and near-shore coastal waters.

Due to the highly seasonal nature of many fish species, the benthic orientation of the sampling gears to better define navigational channel usage patterns and annual differences in the sampling program, make differences in species composition among areas and through time difficult to discern. Based on the data, several generalizations are suggested. Marine species such as scup, striped searobin, smallmouth flounder, and silver hake appear to prefer the Lower Bay. Our results show that the Lower Bay is the most marine-like area sampled in the NYNJHNP. Striped bass and white perch were found predominately in the Arthur Kill/Newark Bay with few venturing into the Lower Bay. White perch and striped bass typically migrate through estuaries of the Mid-Atlantic Bight to ascend freshwater tributaries to spawn (Able and Fahay 1998).

One of the dominant members of the benthic fish community in the Harbor is the winter flounder. It is an important commercial and recreational species under federal management. Winter flounder was the primary focus of the NYNJHNP because it was selected by NMFS, New York State Department of Environmental Conservation (NYSDEC), New Jersey Department of Environmental Protection (NJDEP), and the USACE as the keystone species for understanding biological impacts related to dredging the Harbor.

Adult winter flounder migrate to shallows estuaries from deeper offshore waters during late fall and early winter (NMFS 1999). In the mid-Atlantic region, spawning takes place from February through April (Howe et al., 1976). Most eggs are laid at night, typically on sandy substrate, especially when eelgrass is present (Thomson et al., 1978). The eggs are demersal and adhesive, sinking to the bottom in sticky clusters. Incubation takes 15-18 days at a temperature of 3ºC. Yolk-sac larvae are non-buoyant and have a strong benthic orientation, often resting on the bottom between swimming efforts. Post-yolk sac larvae spend increasing amounts of time in the water column until metamorphosis at about 72 days after hatching (Jearld et al. 1983). The affinity for bottom waters during the earliest larval stages aids in dispersal to the upper reaches of estuaries where the net currents are slower (Pearcy 1962).

Howell et al. (1992) indicates that the nursery habitat for larvae and juveniles includes littoral and sublittoral saltwater coves, coastal salt ponds, estuaries, and protected embayments. Stoner et al. (1999) found recently settled flounder associated with low temperature (<16ºC) and high sediment organic content, placing them in deep, depositional environments. Curran and Able (2002) suggest that depositional areas, such as coves, may be used as settlement areas but not as primary nursery areas. Once settled, juveniles do not move far. Saucerman and Deegan (1991), in a study of summer age-0 juveniles, found an average home range size of 0.04 to 0.08 km^2.

As water temperature warm in early summer, adult winter flounder begin returning to deeper offshore waters (NMFS 1999). Juveniles, however, remain in the nearshore shallows. They not typically leave these areas until the onset of cold temperatures, usually about November. Tagging and genetic studies indicate that adult winter flounder return to the same spawning location each year (**REF**).

The present study findings are consistent with the literature reports. During the summer and fall, adult winter flounder were largely absent from the two inshore areas, Upper Bay and Arthur Kill/Newark Bay. Although summer trawling in the Lower Bay was conducted at only one site, presumably, adults would have been found throughout the Lower Bay. During late fall and winter, adult flounder catches increased in the inshore areas, especially in the channels. This suggests that adult flounder use the channels as movement corridors from the deeper offshore waters into the shallower nearshore regions.

Based on the presence of eggs, winter flounder spawning occurs from late February through April. However, the occurrence of yolk-sac larvae in early-February and post yolk-sac larvae in mid-February suggests that at least some spawning occurs in late-January. Highest egg concentrations were found in the Lower Bay and, to a lesser extent, in the Upper Bay. Eggs were almost entirely absent from catches in the Arthur Kill/Newark Bay. This suggests that adults may not penetrate far into the estuaries for spawning, but instead spawning in the lowermost reaches of the estuary.

Yolk-sac and post yolk-sac larvae where seen from early-February through mid-May in all three Harbor areas. Highest concentrations were in the Lower Bay, intermediate concentrations in the Upper Bay, and lowest concentrations in the Arthur Kill/Newark Bay. This suggests that winter flounder disperse from the primary spawning areas further into the NY-NJ Harbor Estuary. The low concentrations of larval flounder in the Arthur Kill/Newark Bay may be a reflection of the distance from the primary spawning sites or, possibly, a consequence of the somewhat poorer water quality (inferred from the lower DO and DO saturation).

Based on summer (June - July) trawl catches, young-of-year winter flounder were found in the two nearshore areas, Upper Bay and Arthur Kill/Newark Bay. They were almost entirely absent from the Lower Bay. While this could be a reflection of the limited summer sampling in the Lower Bay, it would be consistent with the observations of other studies that the juveniles are found in very shallow, inshore habitats. Within the Upper Bay and Arthur Kill/Newark Bay, young-of-year winter flounder were found in both shallow and channel habitats. There was a very slight preference for shallows, but statistical significance could not be demonstrated. This is seemingly contrary to the findings of Howe et al. (1976) who reported that during the summer, juvenile winter flounder concentrate along tidal channels at water temperatures below 21ºC.

During the winter (December through March), young-of-year (and now yearling) winter flounder were widely dispersed throughout, Lower Bay, Upper Bay, and Arthur Kill/Newark Bay, but concentrations were highest in the Lower Bay. During this period, the deeper channels were preferred.

Temperature is likely a key trigger in determining the occurrence of winter flounder eggs and larvae. The occurrence of winter flounder eggs and larvae was considerably earlier in 2002 than in 2001 with the median occurrence 24 days earlier for eggs and 11 days earlier for yolk-sac larvae and post-yolk sac larvae. This acceleration in spawning in 2002 may be tied to water temperatures. Throughout the winter and early spring, bottom water temperatures averaged approximately 1-2ºC warmer in 2002 than in 2001. Such an increase in temperature could have resulted in a more rapid maturation of gametes and an earlier spawn.

The NYNJHNP found winter flounder eggs at temperatures ranging from 4 to 11.7ºC with most occurring from about 4 to 8ºC. These values are consistent with those reported in the literature. Spawning has been reported to occur at temperatures ranging from -0.1 to 10.0ºC, with peak spawning at 2 to 5ºC (Pearcy 1962, Buckley 1989). The upper temperature limit for winter flounder spawning has been reported by Bigelow and Schroeder (1953) as 5.6ºC and by Buckley (1989) as 6ºC. Rodgers (1976) found under laboratory conditions that hatching occurred at temperatures ranging from 3 to 14ºC. Hatching success dropped to less than 80% when temperatures exceeded 7ºC (at salinities of 15-30 ppt).

It is possible that elevated water temperatures played a role in the summer distribution of juvenile winter flounder in the Lower Bay and Arthur Kill/Newark Bay areas. Young-of-year and yearling winter flounder are more tolerant of higher water temperatures compared to adults. Huntsman and Sparks (1924) demonstrated that under laboratory conditions, the lethal temperature decreased with increasing fish length. For 100 mm TL flounder, the upper lethal temperature ranged from 29.1 to 30.4ºC while for 300 mm TL fish it ranged from 27.8 to 29.0ºC. Hoff and Westman (1966) using 86-113 mm TL fish found a similar lethal temperature, 29.1ºC for a 72 hr exposure.(acclimated at 28ºC). As avoidance temperatures typically average 2-3ºC cooler than lethal temperatures (**REF**), the expected avoidance temperature for juvenile flounder would be approximately 24.8 to 26ºC. {This is consistent with Olla et al. (1969) observation that adult winter flounder avoided temperatures above 23ºC.}. Bottom temperatures during August exceeded 24.8ºC at six of the 18 sampling stations.

It is unlikely that salinity was an important factor in the temporal or spatial distribution of winter flounder. Various laboratory and field studies indicate that all winter flounder life stages have a broad tolerance to salinity. Grimes et al. (1989) reported the optimal salinity for egg hatching was between 15-25 ppt, but Rodgers (1976) obtain at least some hatching success at salinities ranging from 5 to 40 ppt. Such a broad tolerance zone is consistent with the broad range seen in the NYNJHNP. Eggs were collected at bottom salinities of 10.4 to 32.2 ppt.

Winter flounder juveniles and adults can tolerate a wide range of dissolved oxygen concentrations. Voyer and Morrison (1971), in laboratory studies, found that at concentration above 4.3 mg/L there was sufficient oxygen to meet metabolic demands. Below the value, respiration was increased in an effort to offset the deficit. Haedrich and Haedrich (1974), studying the Mystic River, found that winter flounder were able to successfully complete its life cycle at oxygen levels of 1.0 to 6.8 mg/L and saturation levels generally less than 50%. Minimum dissolved oxygen level in the Harbor was 3.9 mg/L.

The results from the NYNJHNP suggest that the NY-NJ Harbor Estuary does not function as homogenous habitat unit for winter flounder. The Harbor is a dynamic grouping of habitat types that consist of different physical-chemical, depth and substrate characteristics that influence the temporal and spatial occurrence of all life stages of winter flounder. These physical-chemical characteristics provide ideal conditions for different lifestages for winter flounder. The selection of habitat areas in an estuary is consistent with winter flounder life-history as described in the literature (**REF**).

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Table 2.1-3. 2001-2002 biological monitoring program sampling schedule.

Date	Week of Year	Day of Year	Station AK (1–6)	Station LB (1–6)	Station NB (1–7)	Station PJ (1–6)	Station SB (1–6)	Station HW (1 2 3 4 5 6 7 8 9 #)
12/18/2001	51	352					T: 1–2	
12/19/2001	51	353	T: 3–4		T: 3–7		T: 3–6	
12/20/2001	51	354	T: 2	T: 1–2				
1/9/2002	2	9		T: 1–6				
1/10/2002	2	10			T: 3–5	T: 1, 4	T: 1–6	
1/11/2002	2	11	T: 1–4		T: 6–7	T: 2–3, 5		
1/22/2002	4	22	T: 2	I: 1–2	T: 3–7	I: 1–5	I: 1–6	
1/23/2002	4	23	B: 1; I: 2–4	T: 1–2; B: 3–6				
1/24/2002	4	24	T: 3–4		I: 3–7	T: 1–5	T: 1–4, 6	
2/5/2002	6	36	I: 1; B: 2–3; I: 4		B: 3–6; I: 7			
2/6/2002	6	37	T: 4	B: 1–6	T: 7		B: 1–2; I: 4	
2/7/2002	6	38	T: 1			B: 1–5	B: 3; T: 4; B: 5–6	
2/19/2002	8	50		B: 1–6		I: 1–3	I: 5	
2/20/2002	8	51	I: 1–4		I: 3; B: 4–7	I: 4–5		
2/21/2002	8	52	T: 1–4			T: 1, 4–5	I: 1–4; T: 5; I: 6	
2/22/2002	8	53				T: 2–3	T: 1–4, 6	
3/5/2002	10	64	B: 1–4		B: 3–6; I: 7			
3/6/2002	10	65		I: 1–6	T: 7	T: 1; B: 2–5	T: 1–5; B: 6	
3/7/2002	10	66		T: 1–6		I: 1	I: 1–4, 6	
3/19/2002	12	78	T: 4	B: 1–6		I: 1–5		
3/20/2002	12	79	B: 1–3; I: 4		B: 3–7	T: 1, 5	T: 5	
3/21/2002	12	80				T: 2–4	B: 1–4; I: 5; B: 6	
4/2/2002	14	92		I: 1–6		I: 1–5		
4/3/2002	14	93	I: 1–4		I: 3–7			
4/4/2002	14	94					I: 1–6	
4/16/2002	16	106		I: 1–6		T: 1; B: 2–3; T: 4	I: 5–6	
4/17/2002	16	107	B: 1–3; I: 4	T: 1–6	I: 3–7	I: 4–5		
4/18/2002	16	108	T: 4		T: 3–7	I: 1; T: 5	B: 1–4; T: 5–6	
4/30/2002	18	120		I: 1–6		I: 1–5		
5/1/2002	18	121	I: 1–4		I: 3–7			
5/2/2002	18	122					I: 1–6	
5/14/2002	20	134	I: 1–2; B: 3–4		B: 3–5; I: 6–7	I: 4–5		
5/15/2002	20	135	T: 1–2	T: 1, 3–6	T: 6–7	I: 1–3; T: 4–5	I: 1–6	
5/16/2002	20	136		I: 1; B: 2; I: 3–6		T: 1–3	T: 1–6	
6/4/2002	23	155	I: 1–4		I: 3–7	I: 2–3		
6/5/2002	23	156		I: 1–6		I: 5	I: 5–6	
6/6/2002	23	157				I: 1, 4	I: 1–4	
6/17/2002	24	168		T: 3–6				
6/18/2002	25	169	B: 1–3; I: 4	T: 1–2	I: 3–4; B: 5; I: 6–7	T: 1; B: 2–3; T: 4–5		
6/19/2002	25	170	T: 4	I: 1–6	T: 3–4, 6–7	I: 1	T: 1–4; I: 5; B: 6	
6/20/2002	25	171				I: 4–5	I: 1–4; T: 5	
7/9/2002	28	190	I: 1–4		I: 3–7	I: 4		
7/10/2002	28	191		I: 2–6		I: 1, 5	I: 3, 5–6	
7/11/2002	28	192				I: 2–3	I: 1–2, 4	

Legend
- Trawl (T)
- Ichthyoplankton (I)
- Both (B)

Table 2.1-2. 2000-2001 supplemental sampling schedule.

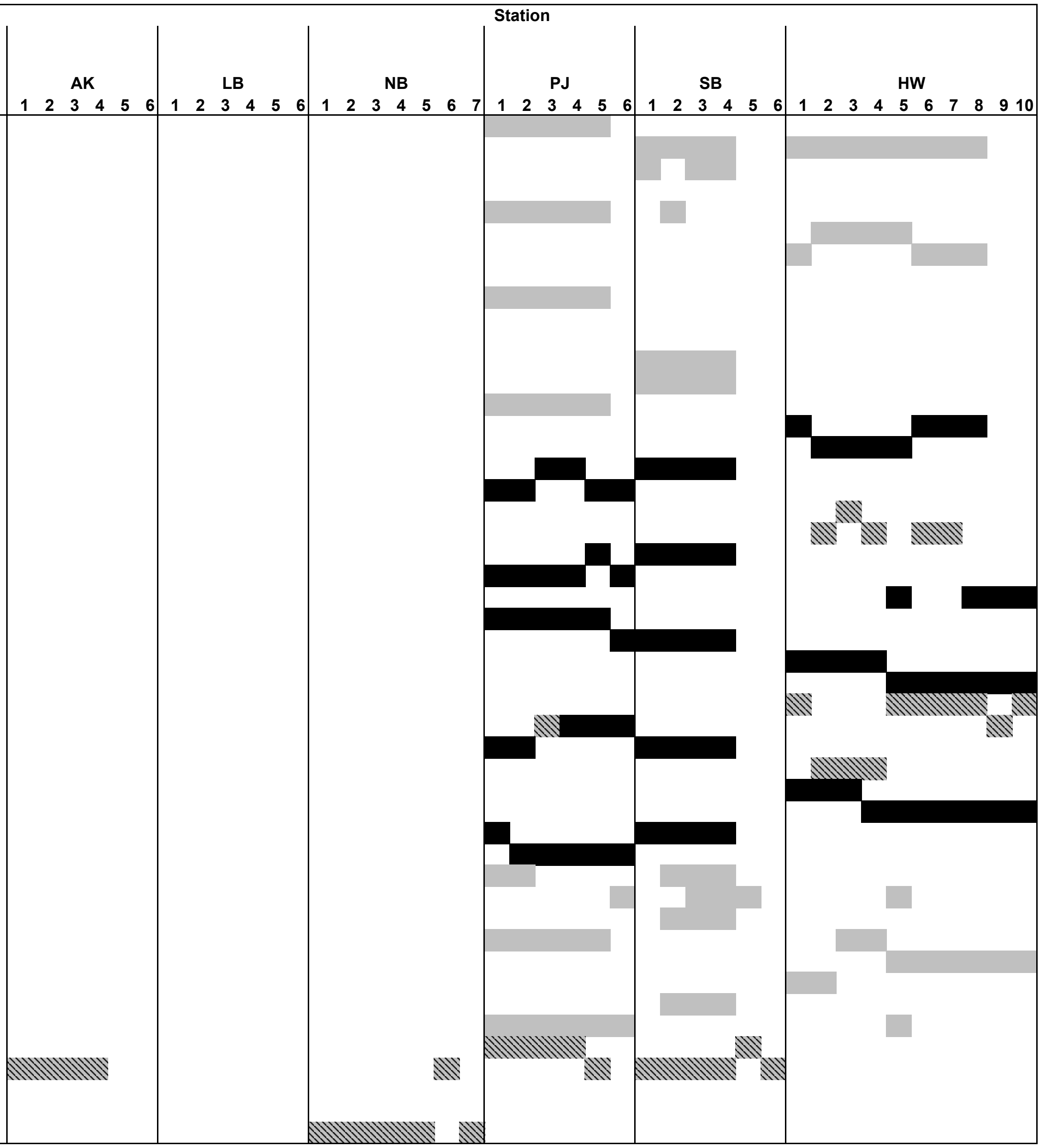
Date	Week of Year	Day of Year	AK 1	AK 2	AK 3	AK 4	AK 5	AK 6	LB 1	LB 2	LB 3	LB 4	LB 5	LB 6	NB 1	NB 2	NB 3	NB 4	NB 5	NB 6	NB 7	PJ 1	PJ 2	PJ 3	PJ 4	PJ 5	PJ 6	SB 1	SB 2	SB 3	SB 4	SB 5	SB 6	HW 1	HW 2	HW 3	HW 4	HW 5	HW 6	HW 7	HW 8	HW 9	HW #
12/14/2000	50	349																				X	X	X	X							X											
12/15/2000	50	350	X	X	X	X														X						X		X	X	X	X		X										
12/16/2000	50	351																																									
12/17/2000	51	352																																									
12/18/2000	51	353													X	X	X	X	X		X																						
1/17/2001	3	17																												X		X											
1/18/2001	3	18	X	X	X	X												X	X	X	X																						
1/19/2001	3	19													X	X	X											X	X		X		X										
1/26/2001	4	26																										X	X	X	X	X	X										
1/29/2001	5	29	X	X	X	X									X	X	X	X	X	X	X																						
2/13/2001	7	44	X	X	X	X									X	X	X	X	X	X	X																						
2/14/2001	7	45																										X	X	X	X	X	X										
2/26/2001	9	57	X	X	X	X									X	X	X	X	X	X	X																						
2/27/2001	9	58																										X	X	X	X	X	X										
3/15/2001	11	74																										X	X	X	X	X	X										
3/16/2001	11	75	X	X	X	X	X	X							X	X	X	X	X	X	X																						
3/29/2001	13	88	X	X	X	X	X	X							X	X	X	X	X	X	X																						
3/30/2001	13	89																										X	X	X	X	X	X										
4/13/2001	15	103	X	X	X	X	X	X							X	X	X	X	X	X	X																						
4/14/2001	15	104																										X	X	X	X	X	X										
4/26/2001	17	116	X	X	X	X	X	X							X	X	X	X	X	X	X																						
4/27/2001	17	117																										X	X	X	X	X	X										
5/9/2001	19	129	X	X	X	X	X	X							X	X	X	X	X	X	X																						
5/10/2001	19	130																										X	X	X	X	X	X										
5/24/2001	21	144	X	X	X	X	X	X							X	X	X	X	X	X	X																						
5/25/2001	21	145																										X	X	X	X	X	X										
6/4/2001	23	155	X	X	X	X	X	X							X	X	X	X	X	X	X																						
6/5/2001	23	156																										X	X	X	X	X	X										

Legend

- Trawl
- Ichthyoplankton
- Both

Table 2.1-1. 1998-1999 harbor navigation study sampling schedule.

Date	Week of Year	Day of Year
10/13/1998	41	286
10/14/1998	41	287
11/17/1998	46	321
11/18/1998	46	322
11/19/1998	47	323
12/15/1998	50	349
12/16/1998	50	350
12/17/1998	51	351
12/18/1998	51	352
12/19/1998	51	353
12/20/1998	51	354
12/21/1998	51	355
1/19/1999	3	19
1/20/1999	3	20
2/16/1999	7	47
2/17/1999	7	48
2/18/1999	7	49
2/19/1999	8	50
3/15/1999	11	74
3/16/1999	11	75
3/17/1999	11	76
3/18/1999	11	77
3/23/1999	12	82
4/14/1999	16	104
4/15/1999	16	105
4/19/1999	16	109
4/21/1999	16	111
5/25/1999	21	145
5/26/1999	21	146
5/27/1999	21	147
5/28/1999	22	148
6/15/1999	24	166
6/16/1999	24	167
6/17/1999	24	168
6/18/1999	25	169
7/21/1999	29	202
7/22/1999	29	203
8/16/1999	33	228
8/17/1999	33	229
8/18/1999	33	230
8/19/1999	33	231
9/22/1999	34	265
9/23/1999	34	266
12/15/1999	50	349
12/16/1999	50	350
12/17/1999	51	351
12/18/1999	51	352
12/19/1999	51	353



Legend

- Trawl
- Ichthyoplankton
- Both

Table 2.0-1. Description (station locations, area, GPS coordinates and nominal depth) of the stations sampled in the New York-New Jersey Harbor Navigation Program (1999-2002).

Area	Station Name	Station Type	Station Location	Average Depth	GPS Coordinates (deg., min., sec.)			
					Start		End	
					North	**West**	**North**	**West**
South Brooklyn/ Upper Bay	SB – 1*	Shallow	Gowanus Bay Interpier South	27	40:39.45	74:00.86	40:39.56	74:01.05
	SB – 2 **	Shallow	Gowanus Bay Interpier	30	40:39.60	74:00.48	40:39.75	74:00.75
	SB – 3*	Shallow	Bay Ridge Flats	22	40:39.36	74:02.26	40:38.91	74:02.36
	SB – 4 **	Channel	Bay Ridge Channel	42	40:39.28	74:01.52	40:38.98	74:01.79
	SB – 5*	Channel	Anchorage Channel Middle	57	40:39.53	74:03.30	40:39.69	74:03.19
	SB – 6 **	Channel	Anchorage Channel South	49	40:38.76	74:03.11	40:38.48	74:02.98
Port Jersey	PJ – 1 **	Shallow	Jersey Flats	12	40:39.91	74:03.57	40:40.17	74:03.45
	PJ – 2*	Shallow	Caven Point	10	40:40.62	74:03.44	40:41.02	74:03.35
	PJ – 3 **	Shallow	Constable Hook	13	40:39.75	74:04.75	40:39.53	74:04.19
	PJ – 4 **	Channel	Port Jersey Channel	39	40:39.91	74:04.11	40:40.07	74:04.51
	PJ – 5*	Channel	Port Jersey Channel East	42	40:39.48	74:03.64	40:39.78	74:03.96
	PJ – 6 ***	Shallow	Claremont Terminal Channel	29	40:40:38	74:03:48	40:40:31	74:03:35
Newark Bay	NB – 3*	Shallow	Newark Bay Flats Middle	10	40:41.06	74:07.61	40:41.40	74:07.44
	NB – 4*	Shallow	Newark Bay Flats South	16	40:40.72	74:07.76	40:40.38	74:07.92
	NB – 5 **	Channel	Newark Bay Middle Reach	42	40:40.59	74:07.96	40:40.19	74:08.26
	NB – 6 **	Channel	Newark Bay South Reach	46	40:39.44	74:08.52	40:39.15	74:08.75
	NB – 7*	Shallow	Elizabeth Flats North	13	40:39.62	74:09.29	40:39.51	74:08.99
Lower Bay [A]	LB – 1	Shallow	East Bank	13	40:33.45	74:00.24	40:33.94	74:00.52
	LB – 2	Channel	North End Ambrose Channel	50	40:33.23	74:01.54	40:33.40	74:01.55
	LB – 3	Shallow	Swash Channel Range	17	40:33.34	74:04.46	40 33.00	74 04.44
	LB – 4	Channel	Chapel Hill South Channel	30	40:31.06	74:02.41	40:30.64	74:02.39
	LB – 5	Shallow	Old Orchard Shoals	13	40:30.59	74:04.72	40:30.75	74:05.22
	LB – 6	Channel	Raritan Bay East Reach	41	40 29.41	74 06.39	40 29.53	74 06.90
Arthur Kill [B]	AK - 1	Shallow	Elizabeth Flats South	19	40:38.84	74:10.58	40:38.85	74:10.13
	AK - 2	Channel	North of Shooter Island Reach	39	40:38.80	74:10.75	40:38.77	74:10.26
	AK – 3	Channel	Elizabeth Reach	42	40:38.32	74:11.59	40:38.53	74:11.30
	AK – 4	Shallow	Prall's Island	20	40:36.83	74:11.91	40:36.24	74:11.82
Harborwide***	HW- 1	Channel	Ambrose Channel North	51	40:33:54	74:01:55	40:33:20	74:01:43
	HW- 2	Channel	Anchorage Channel South	50	40:38:49	74:03:16	40:38:14	74:02:58
	HW- 3	Channel	Red Hook Channel	43	40:40:38	74:01:20	40:40:10	74:01:16
	HW- 4	Channel	Anchorage Channel North	51	40:40:57	74:01:52	40:40:29	74:02:08
	HW- 5	Channel	Bergen Point East Reach	43	40:38:46	74:06:30	40:38:42	74:06:52
	HW- 6	Channel	North of Shooter Island Reach	40	40:38:48	74:10:29	40:38:47	74:09:55
	WH- 7	Channel	Elizabeth Reach	38	40:38:22	74:11:31	40:38:35	74:11:16
	HW- 8	Channel	Middle Reach	41	40:40:23	74:07:58	40:40:50:	74:07:50
	HW- 9	Channel	Newark Bay South Reach	45	40:39:65	74:08:44	40:40:16	74:08:13
	HW- 10	Channel	Newark Bay/Port Elizabeth	41	40:40:06	74:08:19	40:39:75	74:08:40

* Stations sampled under the 2000-2001 Sampling Program

** Stations sampled under the 1998-1999 and 2000-2001 Sampling Programs

*** Stations only sampled under the 1998-1999 sampling program

A Stations only sampled under the 2001-2002 Sampling Program

B Stations sampled during the 2000-2001 and 2001-2002 Sampling Programs,

TABLE 3.1-1

Average bottom water temperature (ºC) and ±1 standard deviation
by week and area.

		AK/NB			Upper Bay		Lower Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**	**Channel**	**Shallow**
50	10 DEC '00				6.3±0.1	6.0±0.3		
51	17 DEC	5.5±0.3	5.3±0.2		6.0±0.2	6.0±0.1		
3	15 JAN '01	3.3±0.1	3.4±0.3		4.1±0.5	3.6±0.5		
4	22 JAN				3.6±0.3	3.6±0.5		
5	29 JAN	3.3±0.2	3.3±0.2					
7	12 FEB	3.8±0.4	4.1±0.6		3.7±0.2	3.6±0.1		
9	26 FEB	4.0±0.2	4.4±0.3		4.0±0.0	3.9±0.1		
11	12 MAR	5.0±0.2	5.2±0.3		4.4±0.1	4.3±0.1		
13	26 MAR	5.5±0.2	5.6±0.3	5.5±0.0	4.9±0.0	4.9±0.1		
15	09 APR	8.6±0.5	9.7±0.5	8.3±0.0	7.4±0.4	7.6±0.6		
17	23 APR	11.5±0.6	12.1±0.7	11.8±0.0	9.1±0.1	10.3±0.3		
19	07 MAY	14.6±0.8	15.6±1.0	13.5±0.0	12.9±0.2	13.5±0.6		
21	21 MAY	16.8±0.3	17.3±0.4	16.5±0.0	14.9±0.1	15.0±0.2		
23	04 JUN	17.6±0.3	18.2±0.4	17.4±0.0	16.4±0.4	17.1±1.0		
4	22 JAN '02	5.1±0.3	4.9±0.2		5.3±0.4	5.1±0.2	5.0±0.9	4.8±0.1
6	05 FEB	4.9±0.3	4.6±0.3		5.5±0.2	5.3±0.3	5.3±0.6	4.9±1.1
8	19 FEB	5.8±0.2	5.8±0.6		6.4±0.3	6.3±0.4	6.2±0.9	5.4±0.9
10	05 MAR	5.9±0.1	6.0±0.4		6.6±0.3	6.5±0.2	6.0±0.3	5.6±0.3
12	19 MAR	7.5±0.1	7.5±0.3		7.1±0.2	7.0±0.1	7.0±0.1	7.0±0.1
14	02 APR	9.7±0.0	10.1±0.7		8.3±0.1	8.6±0.3	8.2±0.6	8.0±0.6
16	16 APR	13.4±0.2	14.1±0.7		11.5±0.3	12.0±0.4	10.6±0.5	11.3±0.2
18	30 APR	12.0±0.3	12.9±0.5		11.1±0.3	11.2±0.5	10.3±0.0	10.2±0.1
20	14 MAY	13.7±0.3	14.0±0.5		12.9±0.4	13.4±0.4	12.8±0.5	13.4±0.5
23	04 JUN	17.9±0.4	17.9±2.0		16.8±1.2	16.6±1.4	13.4±0.8	15.8±0.1
25	18 JUN	19.8±0.2	20.7±0.5		19.1±0.2	19.4±0.4	18.7±0.1	19.1±0.5
28	09 JUL	21.9±0.6	23.1±0.8		19.5±0.8	20.2±0.6	18.6±0.4	18.8±0.4

TABLE 3.1-2

Average bottom salinity (ppt) and ±1 standard deviation by week and area.

		AK/NB			Upper Bay		Lower Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**	**Channel**	**Shallow**
50	10 DEC '00				25.9±2.1	23.4±1.3		
51	17 DEC	20.2±1.5	19.0±2.4		25.0±2.0	24.2±1.2		
3	15 JAN '01	21.2±1.3	20.5±1.1		26.1±1.7	23.6±1.8		
4	22 JAN				25.0±1.2	25.0±1.8		
5	29 JAN	21.2±1.8	19.9±1.4					
7	12 FEB	19.4±0.5	19.2±0.7		23.7±1.9	22.0±1.9		
9	26 FEB	20.0±0.9	18.1±1.6		24.5±1.0	22.2±1.5		
11	12 MAR	18.3±0.5	17.1±1.1		23.6±1.0	20.7±1.8		
13	26 MAR	14.3±1.1	13.2±1.8	15.4±0.0	20.7±1.3	18.2±2.6		
15	09 APR	10.3±0.4	9.4±0.8	11.2±0.0	15.8±5.2	12.1±5.8		
17	23 APR	16.2±0.6	15.9±1.0	16.5±0.0	23.7±1.0	16.5±1.7		
19	07 MAY	19.3±1.0	18.3±0.8	20.5±0.0	25.1±0.2	22.1±1.9		
21	21 MAY	18.7±1.1	18.4±1.3	19.6±0.0	22.9±0.9	21.4±0.7		
23	04 JUN	16.4±1.2	14.4±2.1	16.4±0.0	20.3±1.2	19.3±1.8		
4	22 JAN '02	24.4±0.7	23.6±1.0		22.2±2.0	20.1±1.5	29.4±0.9	26.8±0.9
6	05 FEB	23.8±0.2	23.4±0.6		25.6±1.0	24.0±1.7	27.6±1.7	27.0±0.7
8	19 FEB	23.5±0.4	23.0±0.4		27.0±3.3	24.0±2.6	31.0±2.2	28.9±2.8
10	05 MAR	22.9±0.1	22.4±0.4		25.4±1.1	22.8±2.1	28.6±2.1	26.6±0.2
12	19 MAR	22.7±0.2	22.5±0.3		26.1±1.9	23.0±1.9	29.6±2.5	28.0±2.4
14	02 APR	20.1±0.2	20.2±0.2		21.8±0.8	19.2±2.5	28.0±1.4	26.5±0.6
16	16 APR	20.5±0.3	20.7±0.2		25.7±1.0	19.4±1.0	28.0±1.7	27.2±1.3
18	30 APR	19.8±0.6	19.4±0.4		22.4±3.4	22.5±1.6	26.5±0.3	26.0±1.9
20	14 MAY	17.9±0.2	15.4±1.2		19.4±1.4	16.4±1.0	25.4±1.5	23.5±2.8
23	04 JUN							
25	18 JUN	18.3±0.3	16.5±1.5		21.9±1.0	19.3±2.8	25.0±0.4	22.5±1.1
28	09 JUL	22.7±0.6	22.0±0.5		25.8±1.1	24.8±0.9	27.8±1.0	28.0±1.1

TABLE 3.1-3

Average dissolved oxygen and dissolved oxygen saturation (±1 standard deviation) by week.

Week	Start Date	**Dissolved Oxygen**			**DO Saturation (%)**		
		AK/NB	UB	LB	AK/NB	UB	LB
50	10 DEC ‘00		9.5±0.6			89±5	
51	17 DEC	9.8±0.4	8.9±0.3		88±3	84±3	
3	15 JAN ‘01	10.1±0.2	10.7±0.4		87±2	94±4	
4	22 JAN		10.5±0.3			92±1	
5	29 JAN	10.8±0.2			93±2		
7	12 FEB	10.6±0.2	10.7±0.3		92±2	94±1	
9	26 FEB	10.8±0.3	11.3±0.5		94±2	99±4	
11	12 MAR	10.5±0.2	10.7±0.3		93±2	95±2	
13	26 MAR	10.4±0.4	10.6±0.3		90±2	93±1	
15	09 APR	9.8±0.2	10.6±0.7		91±1	95±5	
17	23 APR	7.8±0.3	11.1±1.4		79±3	111±14	
19	07 MAY	7.4±0.6	7.8±0.3		83±7	86±4	
21	21 MAY	5.0±1.0	6.6±0.3		58±11	74±3	
23	04 JUN	6.1±0.4	6.4±0.3		70±4	75±3	
4	22 JAN ‘02	10.0±0.2	10.2±0.3	10.6±0.9	92±1	92±2	100±7
6	05 FEB	9.4±0.2	9.9±0.1	10.6±0.9	86±1	92±2	100±7
8	19 FEB	10.8±0.5	10.4±0.7	10.3±0.8	101±5	100±4	100±5
10	05 MAR	9.2±0.4	9.4±0.3	9.6±0.6	85±4	90±2	92±4
12	19 MAR	11.2±0.3	9.5±0.4	9.6±0.5	108±4	92±3	95±4
14	02 APR	10.3±0.2	9.4±0.2	9.4±0.8	103±3	92±1	95±8
16	16 APR	9.0±0.3	9.0±0.1	9.2±0.3	99±3	96±2	99±3
18	30 APR	7.4±0.2	7.7±0.2	8.2±0.2	79±3	81±2	86±2
20	14 MAY	7.3±0.4	7.7±0.4	8.4±0.4	78±4	82±4	93±3
23	04 JUN						
25	18 JUN	5.0±0.2	5.4±0.2	5.8±0.7	61±2	66±2	72±9
28	09 JUL	5.9±0.2	5.5±0.5	6.4±0.5	78±3	70±7	81±6

TABLE 3.2-1

Total finfish collected in 1998-1999 and 2001-2002 trawl NY/NJ harbor trawl survey

Common Name	JAN	FEB	MAR	ARP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Acipenser sp.										1			1
Alewife	237	129	109	316	3	3	307	117	56	1	2	48	1,328
American Eel	1			2	8	6		2		1			20
American Sandlance										3			3
American Shad	28	42	48	23		1	3	5	16	1	84	47	298
Atherinid unidentified	27												27
Atlantic Herring	17	18	19	21	32	17							124
Atlantic Mackerel						1							1
Atlantic Menhaden	7	1	12	1	15	21	5	52	12	2	1	2	131
Atlantic Moonfish							1	5	10				16
Atlantic Silverside	25	41	7				570	1	9		44	1	698
Atlantic Tomcod			1	1	209	247	2	5				1	466
Bay Anchovy	7		3	5	368	381	194	1,800	1,196	402	7	27	4,390
Black Sea Bass				5	3	8		9	3	17		4	49
Blueback Herring	251	369	329	29	100	11	8	1	22		226	89	1,435
Bluefish						7		4	9	14			34
Butterfish					8	4	221	152	60	48	9	5	507
Clearnose Skate	126	27	17	18	14	4						14	220
Clupeid unidentified	2			7		2							11
Conger Eel	6		4	1		1		1					13
Crevalle Jack									1				1
Cunner	6	60	8	8	4	11	1	6	1	1		2	108
Feather Blenny			1			1							2
Fourspot Flounder	16	1		2	1	6				3		1	30
Gizzard Shad	7	2	2						1			5	17
Grubby	30	9	8	10	2	11	2	6		3		3	84

TABLE 3.2-1

Total finfish collected in 1998-1999 and 2001-2002 trawl NY/NJ harbor trawl survey

Common Name	JAN	FEB	MAR	ARP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Hickory Shad					1		1			1			3
Hogchocker					1								1
Inshore Lizardfish								2	4				6
Lined Seahorse			2	2				1					5
Little Skate		1		3						1		1	6
Longhorn Sculpin	1												1
Lookdown									1	34			35
Naked Goby			5	2		1					1	3	12
Northern Kingfish									1	8			9
Northern Pipefish	27	30	25	14	9	7	11	4		1		1	129
Northern Puffer					2		2						4
Northern Searobin		5	8	15	26	25		2		1		2	84
Northern Stargazer							1						1
Oyster Toadfish					1	4	1						6
Pollock					1								1
Rainbow Smelt							1						1
Red Hake	25	49	21	15	23	3		1			2	6	145
Rock Gunnel		1	2	2	2	1	1						9
Scup					201	73	103	102	79	13			571
Seaboard Goby	1												1
Silver Hake		32	16	35	4	1						2	90
Smallmouth Flounder	276	174	39	15	33	10				10	1	33	591
Smooth Dogfish						4							4
Spot	65	5				1	1					47	119
Spotted Goatfish							1						1
Spotted Hake	356	476	624	1,769	1,305	423		2				68	5,023
Striped Anchovy								50	29				79

TABLE 3.2-1

Total finfish collected in 1998-1999 and 2001-2002 trawl NY/NJ harbor trawl survey

Common Name	JAN	FEB	MAR	ARP	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Striped Bass	519	469	367	613	44	38	1,505	152	1	8	133	100	3,949
Striped Cuskeel	4	1	7	7	2	1							22
Striped Killifish	1												1
Striped Searobin			2	2	114	55	93	43	4	15	1	1	330
Summer Flounder	3		2	7	60	147	42	20	5	3		1	290
Tautog	14		1	3	4	6		2	5	4		2	41
Unidentified												1	1
Weakfish	114				7	29	2,868	1,111	40	372	4	28	4,573
White Perch	747	798	377	3		1						97	2,023
Windowpane	152	75	45	173	68	121	35	19	1	25		25	739
Winter Flounder	268	185	328	292	97	352	40	56	3	41	12	54	1,728
Number of Species	32	25	31	33	34	40	27	30	25	28	14	32	64
Total Caught	3,366	3,000	2,439	3,421	2,772	2,046	6,020	3,733	1,569	1,034	527	721	30,648

TABLE 3.3-1

Occurrence percentile of winter flounder life stages by day of year for 1999, 2001 and 2002.

Percentile	Day of Year								
	Egg			YSL			PYSL		
	1999	2001	2002	1999	2001	2002	1999	2001	2002
99	109	104	120	104	117	108	145	155	135
95	109	104	120	104	117	107	111	155	122
90	109	104	78	104	117	106	109	145	120
85	105	104	78	104	117	94	109	130	120
80	105	104	78	76	117	93	109	130	107
75	105	104	78	76	117	92	109	129	106
70	104	103	78	75	117	92	109	129	106
65	82	103	65	75	117	92	109	129	106
60	77	89	65	75	117	92	105	117	106
55	76	89	65	75	104	92	104	117	106
50	76	89	64	75	103	65	104	117	106
45	76	89	50	75	103	65	104	117	106
40	76	89	50	75	103	65	104	117	92
35	75	89	50	75	89	65	104	117	92
30	75	89	50	75	89	64	104	117	92
25	74	89	50	75	89	64	104	117	80
20	74	89	50	75	89	52	104	116	80
15	74	58	50	49	89	51	104	116	78
10	74	58	50	49	88	50	104	104	65
5	74	58	50	48	88	37	104	103	64
1	74	58	50	48	58	37	104	88	52

TABLE 3.3-2

Average winter flounder egg concentration (no./1000 m³)
and ±1 standard deviation by week and area.

		AK/NB			Upper Bay		Lower Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**	**Channel**	**Shallow**
8	19 FEB '99	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
12	15 MAR	21.4±14.8			124.1±204.4	59.9±39.8		
16	14 APR	2.90±2.67			32.7±27.32	51.2±49.64	149.5±	
22	26 MAY	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
25	15 JUN	0.00±0.000			0.00±0.00	0.00±0.00	0.00±	
50	10 DEC '00				0.00±0.00	0.00±0.00		
51	17 DEC	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
3	15 JAN '01	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
4	22 JAN							
5	29 JAN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
7	12 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
9	26 FEB	0.00±0.00	0.00±0.00		5.7±5.23	0.00±0.00		
11	12 MAR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
13	26 MAR	0.00±0.00	0.00±0.00	0.00±0.00	2.3±3.17	11.0±26.91		
15	09 APR	0.00±0.00	0.00±0.00	0.00±0.00	12.7±5.80	0.00±0.00		
17	23 APR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
19	07 MAY	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
21	21 MAY	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
23	04 JUN	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
4	22 JAN '02	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
6	05 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

TABLE 3.3-2 (Cont.)

Average winter flounder egg concentration (no./1000 m³)
and ±1 standard deviation by week and area.

8	19 FEB	0.00±0.00	1.0±2.32		0.00±0.00	1.4±3.36	0.00±0.00	85.1±128.7
10	05 MAR	0.00±0.00	6.1±13.58		0.00±0.00	14.6±35.83	2.55±4.33	0.00±0.00
12	19 MAR	0.00±0.00	0.00±0.00		0.9±1.97	1.4±2.10	11.3±17.11	28.6±39.4
14	02 APR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
16	16 APR	0.00±0.00	0.00±0.00		0.8±1.78	0.00±0.00	1.3±2.21	0.00±0.00
18	30 APR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	2.4±4.16	11.4±10.66
20	14 MAY	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
23	04 JUN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
25	18 JUN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
28	09 JUL	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

TABLE 3.3-3

Average winter flounder yolk-sac larvae concentration (no./1000 m³) and ±1 standard deviation by week and area.

		AK/NB			Upper Bay		Lower Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**	**Channel**	**Shallow**
8	19 FEB ‘99	0.00±0.00			2.1±2.74	1.6±3.92	0.00±	
12	15 MAR	0.00±0.00			11.7±16.23	0.00±0.00		
16	14 APR	0.00±0.00			0.00±0.00	3.5±6.55	0.00±	
22	26 MAY	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
25	15 JUN	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
50	10 DEC ‘00				0.00±0.00	0.00±0.00		
51	17 DEC	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
3	15 JAN ‘01	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
4	22 JAN							
5	29 JAN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
7	12 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
9	26 FEB	0.00±0.00	0.00±0.00		2.1±4.77	1.5±3.67		
11	12 MAR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.7±1.70		
13	26 MAR	3.00±4.30	3.7±9.10	0.00±0.00	20.9±41.29	7.9±15.82		
15	09 APR	1.3±2.85	0.00±0.00	0.00±0.00	2.4±5.32	15.1±23.17		
17	23 APR	0.00±0.00	0.00±0.00	0.00±0.00	39.8±83.15	9.7±23.65		
19	07 MAY	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
21	21 MAY	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
23	04 JUN	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
4	22 JAN ‘02	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

TABLE 3.3-3 (Cont.)

Average winter flounder yolk-sac larvae concentration (no./1000 m³)
and ±1 standard deviation by week and area.

6	05 FEB	0.00±0.00	0.00±0.00		17.2±38.53	6.6±16.20	0.00±0.00	0.00±0.00
8	19 FEB	3.7±7.40	6.7±7.44		17.9±18.91	7.0±13.57	0.00±0.00	28.4±49.26
10	05 MAR	25.6±28.09	4.2±6.62		19.1±31.60	0.6±1.56	48.4±71.95	9.5±2.85
12	19 MAR	0.00±0.00	0.00±0.00		3.5±7.88	0.7±1.63	4.7±5.24	3.8±4.09
14	02 APR	2.2±2.58	12.4±22.96		21.1±32.24	3.3±7.80	17.5±15.27	98.9±107.01
16	16 APR	3.1±6.23	3.9±6.14		11.1±16.17	4.7±7.38	10.9±12.51	12.8±18.78
18	30 APR	0.00±0.00	0.00±0.00		0.7±1.63	0.00±0.00	0.00±0.00	0.00±0.00
20	14 MAY	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
23	04 JUN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
25	18 JUN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
28	09 JUL	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

TABLE 3.3-4

Average winter flounder post yolk-sac larvae concentration (no./1000 m³)
and ±1 standard deviation by week and area.

		AK/NB			Upper Bay		Lower Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**	**Channel**	**Shallow**
8	19 FEB '99	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
12	15 MAR	0.00±0.00			2.4±4.64	0.8±2.00		
16	14 APR	44.8±15.69			317.9±445.86	369.7±449.4	46.0±	
22	26 MAY	8.6±13.60			2.1±3.62	3.4±8.45	0.00±	
25	15 JUN	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
50	10 DEC '00				0.00±0.00	0.00±0.00		
51	17 DEC	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
3	15 JAN '01	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
4	22 JAN							
5	29 JAN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
7	12 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
9	26 FEB	0.00±0.00	0.00±0.00		0.8±1.85	3.1±5.71		
11	12 MAR	0.00±0.00	0.00±0.00	0.00±0.00	1.5±3.32	6.0±10.28		
13	26 MAR	6.3±7.76	7.6±12.18	4.3±6.14	27.2±52.72	10.0±6.32		
15	09 APR	2.3±3.15	6.9±9.17	0.00±0.00	27.3±29.02	67.1±51.91		
17	23 APR	97.7±28.17	102.5±53.58	59.8±46.98	560.6±632.41	75.1±89.25		
19	07 MAY	69.9±75.39	40.8±20.32	333.2±304.92	165.6±106.10	22.0±17.55		
21	21 MAY	15.7±15.83	1.2±3.05	6.5±9.12	84.9±38.58	11.9±20.63		
23	04 JUN	85.6±95.69	2.8±4.74	17.5±5.63	12.1±14.59	2.6±6.26		
4	22 JAN '02	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
6	05 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

TABLE 3.3-4 (Cont.)

Average winter flounder post yolk-sac larvae concentration (no./1000 m³) and ±1 standard deviation by week and area.

8	19 FEB	2.5±2.89	4.5±4.83		82.8±141.78	47.0±88.41	6.0±10.45	11.0±6.10
10	05 MAR	20.4±10.73	46.7±47.77		48.4±34.19	15.0±22.22	107.9±122.81	67.3±10.22
12	19 MAR	6.5±8.31	34.4±24.79		46.1±23.86	227.5±197.64	265.6±251.77	98.3±21.99
14	02 APR	12.0±9.73	47.2±47.89		87.3±51.25	34.9±39.31	365.8±434.12	339.3±78.75
16	16 APR	66.3±15.13	92.5±49.08		127.9±71.02	99.4±48.82	1615.6±778.31	257.0±189.5
18	30 APR	102.5±46.35	24.0±27.66		80.3±65.01	85.8±99.46	166.8±169.17	144.6±56.30
20	14 MAY	26.5±21.53	2.8±3.91		15.3±26.22	14.6±22.77	12.0±20.81	4.4±4.79
23	04 JUN	3.3±2.26	0.00±0.00		1.5±3.33	0.00±0.00	0.00±0.00	0.00±0.00
25	18 JUN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
28	09 JUL	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

Table 3.3-5

Depth (ft) distribution of winter flounder ichthyoplankton catch by life stages and area, combined 1999 - 2002.

	Egg			YSL			PYSL		
Percentile	AK/NB	Upper	Lower	AK/NB	Upper	Lower	AK/NB	Upper	Lower
99	45	54	55	45	51	43	48	60	52
95	45	45.47	55	45	51	43	44	51	50
90	41	45	55	42	51	39	43	51	44
85	41	42	55	41	51	39	43	50	43
80	40	42	55	41	50	39	42	50	43
75	40	42	55	41	47	39	40	50	43
70	40	42	38	41	47	34	40	47	41
65	40	42	36	40	46	20	40	44	41
60	40	42	20	40	44	20	40	42	41
55	38	42	20	36	42	20	39	41	41
50	38	38	20	34	42	20	38	30	41
45	38	27	18	33	41	20	36	30	38
40	38	26	18	33	38	20	35	26	36
35	38	25	18	33	38	20	23	24	36
30	36	24	18	23	30	20	21	23	34
25	36	24	18	14	28	18	15	18	20
20	14	23	18	13.5	24	18	10	14	20
15	14	23	18	10	19.99	18	10	10	20
10	14	13	18	8.5	13	16	9	8	17
5	14	7.5	17	7.9	10	16	8	7.5	16
1	6	7.5	16	6	8	12	8	7.5	13

Table 3.3-6. Winter flounder yolk-sac larvae analysis of variance results.

Analysis of Variance Table (Channel and Shallow)

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: Year	1	16.17302	16.17302	10.87	0.001177*	0.906510
B: Area	1	5.117476	5.117476	3.44	0.065275	0.454230
AB	1	1.067056	1.067056	0.72	0.398167	0.134414
C: Type	1	4.158202	4.158202	2.80	0.096290	0.383368
AC	1	4.656719	4.656719	3.13	0.078548	0.420774
BC	1	1.172828	1.172828	0.79	0.375780	0.143019
ABC	1	5.820487	5.820487	3.91	0.049455*	0.503025
S	180	267.7814	1.487674			
Total (Adjusted)	187	307.413				
Total	188					

* Term significant at alpha = 0.05

Analysis of Variance Table (Channel only)

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: Year	2	24.29325	12.14662	8.16	0.000491*	0.955337
B: Area	1	9.884508	9.884508	6.64	0.011278*	0.723850
AB	2	1.30932	0.6546599	0.44	0.645411	0.120007
S	113	168.2934	1.489323			
Total (Adjusted)	118	203.8969				
Total	119					

* Term significant at alpha = 0.05

Table 3.3-7. Winter flounder post yolk-sac larvae analysis of variance results.

Analysis of Variance Table (Channel and Shallow)

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: Year	1	12.26097	12.26097	9.99	0.001747*	0.882871
B: Area	1	6.59746	6.59746	5.37	0.021153*	0.636946
AB	1	1.647125	1.647125	1.34	0.247736	0.211153
C: Type	1	5.115841	5.115841	4.17	0.042146*	0.529687
AC	1	2.808527	2.808527	2.29	0.131532	0.325672
BC	1	2.296584	2.296584	1.87	0.172497	0.275729
ABC	1	3.222811	3.222811	2.62	0.106307	0.365119
S	286	351.158	1.227825			
Total (Adjusted)	293	385.5287				
Total	294					

* Term significant at alpha = 0.05

Analysis of Variance Table (Channel only)

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
A: Year	2	17.01388	8.506941	6.49	0.001908*	0.902607
B: Area	1	11.21886	11.21886	8.56	0.003889*	0.828991
AB	2	0.2135536	0.1067768	0.08	0.921760	0.062233
S	173	226.6304	1.310002			
Total (Adjusted)	178	255.3655				
Total	179					

* Term significant at alpha = 0.05

Table 3.3-8. Winter flounder trawl CPUE analysis of variance results.

Analysis of Variance Table

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Time	6	8.612187	1.435365	1.71	0.119339	
B: Area	2	9.933629E-02	4.966814E-02	0.03	0.967537	0.053926
AB	12	18.01051	1.500876	1.79	0.051172	
C: Type	1	15.40649	15.40649	7.48	0.033948*	0.628488
AC	6	12.35544	2.059239	2.46	0.025607*	
BC	2	9.710626	4.855313	6.94	0.009930*	0.841612
ABC	12	8.393344	0.6994454	0.83	0.614783	
S	213	178.5267	0.8381534			
Total (Adjusted)	254	256.2793				
Total	255					

* Term significant at alpha = 0.05

Table 3.4-1

Occurrence percentile of windowpane flounder life stages
by day of year for 1999, 2001 and 2002.

Percentile	Day of Year								
	Egg			YSL			PYSL		
	1999	2001	2002	1999	2001	2002	1999	2001	2002
99		156	171		130	157	167	156	191
95		156	171		130	157	167	156	170
90		156	170		130	157	167	156	170
85		156	170		130	157	166	156	160.82
80		156	170		130	157	148	156	156
75		156	170		130	157	148	155	156
70		156	157		130	157	148	155	156
65		156	157		130	157	148	145	156
60		156	157		130	157	148	145	156
55		156	156		130	157	147	145	136
50		156	156		130	157	147	145	136
45		156	156		130	157	147	145	136
40		156	156		130	157	147	145	136
35		155	156		130	157	147	145	136
30		155	156		130	157	147	145	136
25		155	156		130	157	146	145	136
20		145	156		130	157	145	144	136
15		145	155		130	157	145	144	136
10		145	155		130	157	145	130	136
5		144	155		130	157	145	130	135
1		130	155		130	157	145	130	134

TABLE 3.4-2

Average windowpane flounder egg concentration (no./1000 m³) and ±1 standard deviation by week and area.

		AK/NB			Upper Bay		Lower Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**	**Channel**	**Shallow**
8	19 FEB ‘99	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
12	15 MAR	0.00±0.00			0.00±0.00	0.00±0.00		
16	14 APR	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
22	26 MAY	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
25	15 JUN	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
50	10 DEC ‘00				0.0±0.0	0.0±0.0		
51	17 DEC	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0		
3	15 JAN ‘01	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0		
4	22 JAN							
5	29 JAN	0.0±0.0	0.0±0.0		0.00±0.00	0.0±0.0		
7	12 FEB	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0		
9	26 FEB	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0		
11	12 MAR	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0		
13	26 MAR	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0		
15	09 APR	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0		
17	23 APR	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0		
19	07 MAY	0.0±0.0	0.0±0.0	0.0±0.0	200.2±179.74	39.0±37.5		
21	21 MAY	331.0±257.4	42.2±25.31	144.9±13.30	786.2±360.7	196.7±206.81		
23	04 JUN	641.0±472.82	19.2±22.13	678.6±169.1	2555.2±1896.4	1535.4±1660.6		
4	22 JAN ‘02	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
6	05 FEB	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
8	19 FEB	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0

TABLE 3.4-2 (Cont.)

Average windowpane flounder egg concentration (no./1000 m³) and ±1 standard deviation by week and area.

10	05 MAR	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
12	19 MAR	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
14	02 APR	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
16	16 APR	0.0±0.0	0.0±0.0		6.7±15.03	0.0±0.0	0.0±0.0	0.0±0.0
18	30 APR	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0	50.0±79.5	14.6±25.21
20	14 MAY	0.0±0.0	0.0±0.0		0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
23	04 JUN	1967.8±390.9	912.5±406.7		1212.6±483.59	1658.2±1414.0	1111.5±1202.9	5654.3±4001.1
25	18 JUN	28.3±27.29	0.0±0.0		1784.0±1725.67	769.7±805.54	460.0±423.85	551.2±545.14
28	09 JUL	0.0±0.0	0.0±0.0		11.0±18.22	63.8±73.69	0.0±0.0	0.0±0.0

TABLE 3.4-3

Average windowpane flounder yolk-sac larvae concentration (no./1000 m³) and ±1 standard deviation by week and area.

		AK/NB			Upper Bay		Lower Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**	**Channel**	**Shallow**
8	19 FEB '99	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
12	15 MAR	0.00±0.00			0.00±0.00	0.00±0.00		
16	14 APR	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
22	26 MAY	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
25	15 JUN	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
50	10 DEC '00				0.00±0.00	0.00±0.00		
51	17 DEC	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
3	15 JAN '01	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
4	22 JAN							
5	29 JAN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
7	12 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
9	26 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
11	12 MAR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
13	26 MAR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
15	09 APR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
17	23 APR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
19	07 MAY	0.00±0.00	0.00±0.00	0.00±0.00	2.0±2.82	0.00±0.00		
21	21 MAY	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
23	04 JUN	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
4	22 JAN '02	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
6	05 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

TABLE 3.4-3 (Cont.)

Average windowpane flounder yolk-sac larvae concentration (no./1000 m³)
and ±1 standard deviation by week and area.

8	19 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
10	05 MAR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
12	19 MAR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
14	02 APR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
16	16 APR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
18	30 APR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
20	14 MAY	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
23	04 JUN	0.00±0.00	0.00±0.00		0.00±0.00	0.7±1.66	0.00±0.00	0.00±0.00
25	18 JUN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
28	09 JUL	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

TABLE 3.4-4

Average windowpane flounder post yolk-sac larvae concentration (no./1000 m³) and ±1 standard deviation by week and area.

		AK/NB			Upper Bay		Lower Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**	**Channel**	**Shallow**
8	19 FEB '99	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
12	15 MAR	0.00±0.00			0.00±0.00	0.00±0.00		
16	14 APR	0.00±0.00			0.00±0.00	0.00±0.00	0.00±	
22	26 MAY	20.6±20.01			30.7±54.03	22.9±20.04	31.9±	
25	15 JUN	12.7±10.62			2.8±7.52	0.00±0.00	7.4±	
50	10 DEC '00				0.00±0.00	0.00±0.00		
51	17 DEC	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
3	15 JAN '01	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
4	22 JAN							
5	29 JAN	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
7	12 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
9	26 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00		
11	12 MAR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
13	26 MAR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
15	09 APR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
17	23 APR	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00		
19	07 MAY	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	11.3±27.74		
21	21 MAY	5.0±5.6	10.95±11.57	0.00±0.00	33.9±18.84	17.0±20.54		
23	04 JUN	11.2±15.29	2.9±7.16	0.00±0.00	20.6±20.47	5.8±6.83		
4	22 JAN '02	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
6	05 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

TABLE 3.4-4 (Cont.)

Average windowpane flounder post yolk-sac larvae concentration (no./1000 m³) and ±1 standard deviation by week and area.

8	19 FEB	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
10	05 MAR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
12	19 MAR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
14	02 APR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
16	16 APR	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
18	30 APR	0.00±0.00	1.1±2.38		0.00±0.00	0.00±0.00	2.6±2.24	0.00±0.00
20	14 MAY	4.5±3.59	2.5±3.74		7.33±9.08	4.9±4.51	117.7±88.33	112.0±116.7
23	04 JUN	3.8±5.28	1.8±2.49		14.4±21.78	7.6±8.45	71.8±63.09	12.9±3.30
25	18 JUN	0.9±1.89	0.00±0.00		15.1±22.53	6.7±6.85	25.8±19.26	0.00±0.00
28	09 JUL	0.00±0.00	0.00±0.00		0.00±0.00	0.00±0.00	4.4±3.86	0.00±0.00

Table 3.4-5

Depth (ft) distribution of windowpane flounder ichthyoplankton catch by life stages and area, combined 1999 - 2002.

	Egg			YSL			PYSL		
Percentile	AK/NB	Upper	Lower	AK/NB	Upper	Lower	AK/NB	Upper	Lower
99	45	61	47		49		46	61	50
95	40	60	42		49		43	60	50
90	38	50	42		49		43	50	50
85	38	48	42		49		41	48	48
80	38	46	32		49		41	48	47
75	38	42	18		49		41	48	42
70	38	40	18		49		41	48	42
65	38	40	18		48.73		41	46	36.71
60	36	40	18		45.67		40	44	36
55	36	38	18		45		40	43	36
50	35	37	18		45		38	42	36
45	35	33	16		45		38	41	32
40	35	30	16		45		38	30	32
35	35	26	16		45		38	28	32
30	32	25	16		33.36		35	24	16
25	31	23	16		17		27	23	15
20	31	17	16		17		27	18.70	15
15	15	11	16		17		10	15	15
10	10	11	16		17		10	10	15
5	8	11	13		17		10	9	15
1	8	9	12		17		8	8	14.46

Table 3.4-6. Windowpane flounder post yolk-sac larvae analysis of variance results.

Analysis of Variance Table (Channel and Shallow)

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Year	1	1.340117	1.340117	0.76	0.386155	0.138660
B: Area	1	18.72696	18.72696	10.57	0.001496*	0.897080
AB	1	2.053198E-02	2.053198E-02	0.01	0.914443	0.051307
C: Type	1	4.474709	4.474709	2.53	0.114632	0.350901
AC	1	0.1080372	0.1080372	0.06	0.805356	0.056903
BC	1	3.872048E-02	3.872048E-02	0.02	0.882709	0.052467
ABC	1	1.057584	1.057584	0.60	0.441230	0.119535
S	118	209.0004	1.77119			
Total (Adjusted)	125	234.3768				
Total	126					

* Term significant at alpha = 0.05

Analysis of Variance Table (Channel only)

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Year	2	4.219153	2.109576	1.01	0.368157	0.220417
B: Area	1	0.67351	0.67351	0.32	0.571323	0.086811
AB	2	15.1939	7.596952	3.65	0.030801*	0.655892
S	75	156.2374	2.083165			
Total (Adjusted)	80	175.5387				
Total	81					

* Term significant at alpha = 0.05

Table 3.4-7. Windowpane flounder trawl CPUE analysis of variance results.

Analysis of Variance Table

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Time	6	15.13177	2.521961	4.48	0.000268*	
B: Area	2	7.057254	3.528627	3.96	0.047897*	0.593807
AB	12	10.70272	0.8918937	1.59	0.097458	
C: Type	1	8.986698	8.986698	21.73	0.003460*	0.969947
AC	6	2.480946	0.413491	0.74	0.621930	
BC	2	1.164039	0.5820194	1.17	0.344229	0.208887
ABC	12	5.984276	0.4986897	0.89	0.561575	
S	213	119.8255	0.5625612			
Total (Adjusted)	254	178.3466				
Total	255					

* Term significant at alpha = 0.05

Table 3.5-1 Summer flounder trawl CPUE analysis of variance results.

Analysis of Variance Table

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Time	1	5.538669E-03	5.538669E-03	0.01	0.923649	
B: Area	2	4.062001	2.031001	1.19	0.457653	0.104655
AB	2	3.427666	1.713833	2.88	0.067948	
C: Type	1	2.423553	2.423553	4.92	0.269601	0.138762
AC	1	0.4924365	0.4924365	0.83	0.368593	
BC	2	3.736885	1.868443	23.99	0.040020*	0.713684
ABC	2	0.1557859	7.789296E-02	0.13	0.877757	
S	40	23.81836	0.595459			
Total (Adjusted)	51	40.86993				
Total	52					

* Term significant at alpha = 0.05

Table 3.6-1

Occurrence percentile of post yolk-sac larvae for four EFH species by day of year for 1999 - 2002 sampling seasons.

Percentile	Day of Year											
	Summer flounder			Atlantic herring			Atlantic mackerel			Butterfish		
	1999	2001	2002	1999	2001	2002	1999	2001	2002	1999	2001	2002
99		353	78	82	130	NC		NC	136		NC	192
95		353	78	82	129	NC		NC	136		NC	192
90		353	78	82	129	NC		NC	136		NC	192
85		350	78	82	129	NC		NC	136		NC	192
80		350	78	75.91	103	NC		NC	136		NC	192
75		350	68.03	75	103	NC		NC	136		NC	192
70		350	36	75	90.35	NC		NC	136		NC	192
65		350	36	75	89	NC		NC	136		NC	192
60		349	36	75	89	NC		NC	136		NC	192
55		104	36	74	89	NC		NC	136		NC	192
50		88	36	56.95	89	NC		NC	136		NC	191.84
45		88	36	49	89	NC		NC	136		NC	191
40		88	33.29	49	89	NC		NC	136		NC	191
35		75	22	49	88	NC		NC	135		NC	191
30		58	22	49	88	NC		NC	135		NC	191
25		58	22	48	88	NC		NC	135		NC	191
20		58	22	48	88	NC		NC	135		NC	191
15		57	22	47	88	NC		NC	135		NC	191
10		57	22	47	58	NC		NC	134		NC	191
5		29	22	47	57	NC		NC	134		NC	191
1		18	22	47	44	NC		NC	134		NC	190

NC – No Catch

Table 3.6-2. Atlantic herring trawl CPUE analysis of variance results.

Analysis of Variance Table

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Time	6	0.8754583	0.1459097	1.74	0.113768	
B: Area	2	0.2327905	0.1163953	0.72	0.508752	0.143556
AB	12	1.952605	0.1627171	1.94	0.031598*	
C: Type	1	1.742502E-06	1.742502E-06	0.00	0.997599	0.050001
AC	6	1.062422	0.1770703	2.11	0.053619	
BC	2	0.5136063	0.2568031	1.54	0.254882	0.263574
ABC	12	2.007322	0.1672769	1.99	0.026311*	
S	213	17.89371	8.400801E-02			
Total (Adjusted)	254	24.50226				
Total	255					

* Term significant at alpha = 0.05

Table 3.10-1. Butterfish trawl CPUE analysis of variance results.

Analysis of Variance Table

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Time	1	3.101782E-02	3.101782E-02	0.40	0.529930	
B: Area	2	0.1230454	6.152269E-02	0.44	0.693398	0.070773
AB	2	0.2782736	0.1391368	1.80	0.178276	
C: Type	1	2.126516E-02	2.126516E-02	6.93	0.231094	0.163813
AC	1	3.068003E-03	3.068003E-03	0.04	0.843056	
BC	2	1.396012E-02	6.980058E-03	0.35	0.738011	0.066713
ABC	2	3.932499E-02	1.966249E-02	0.25	0.776546	
S	40	3.090303	7.725757E-02			
Total (Adjusted)	51	3.626932				
Total	52					

* Term significant at alpha = 0.05

Table 3.11-1. Red hake trawl CPUE analysis of variance results.

Analysis of Variance Table

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Time	6	1.641681	0.2736135	1.21	0.301612	
B: Area	2	4.468219	2.23411	17.91	0.000250*	0.998135
AB	12	1.49664	0.12472	0.55	0.878244	
C: Type	1	6.623718	6.623718	23.97	0.002723*	0.980552
AC	6	1.658308	0.2763846	1.22	0.295322	
BC	2	3.633078	1.816539	8.89	0.004285*	0.921139
ABC	12	2.452718	0.2043932	0.90	0.543006	
S	213	48.11625	0.2258979			
Total (Adjusted)	254	72.72332				
Total	255					

* Term significant at alpha = 0.05

Table 3.12-1. Scup trawl CPUE analysis of variance results.

Analysis of Variance Table

Source Term	**DF**	**Sum of Squares**	**Mean Square**	**F-Ratio**	**Prob Level**	**Power (Alpha=0.05)**
A: Time	1	2.336003	2.336003	2.26	0.140892	
B: Area	2	13.25207	6.626035	1.88	0.346760	0.135397
AB	2	7.034603	3.517301	3.40	0.043358*	
C: Type	1	1.240882	1.240882	0.97	0.504302	0.072421
AC	1	1.27488	1.27488	1.23	0.273725	
BC	2	0.3646462	0.1823231	0.27	0.784723	0.062942
ABC	2	1.329201	0.6646006	0.64	0.531556	
S	40	41.40583	1.035146			
Total (Adjusted)	51	66.34715				
Total	52					

* Term significant at alpha = 0.05

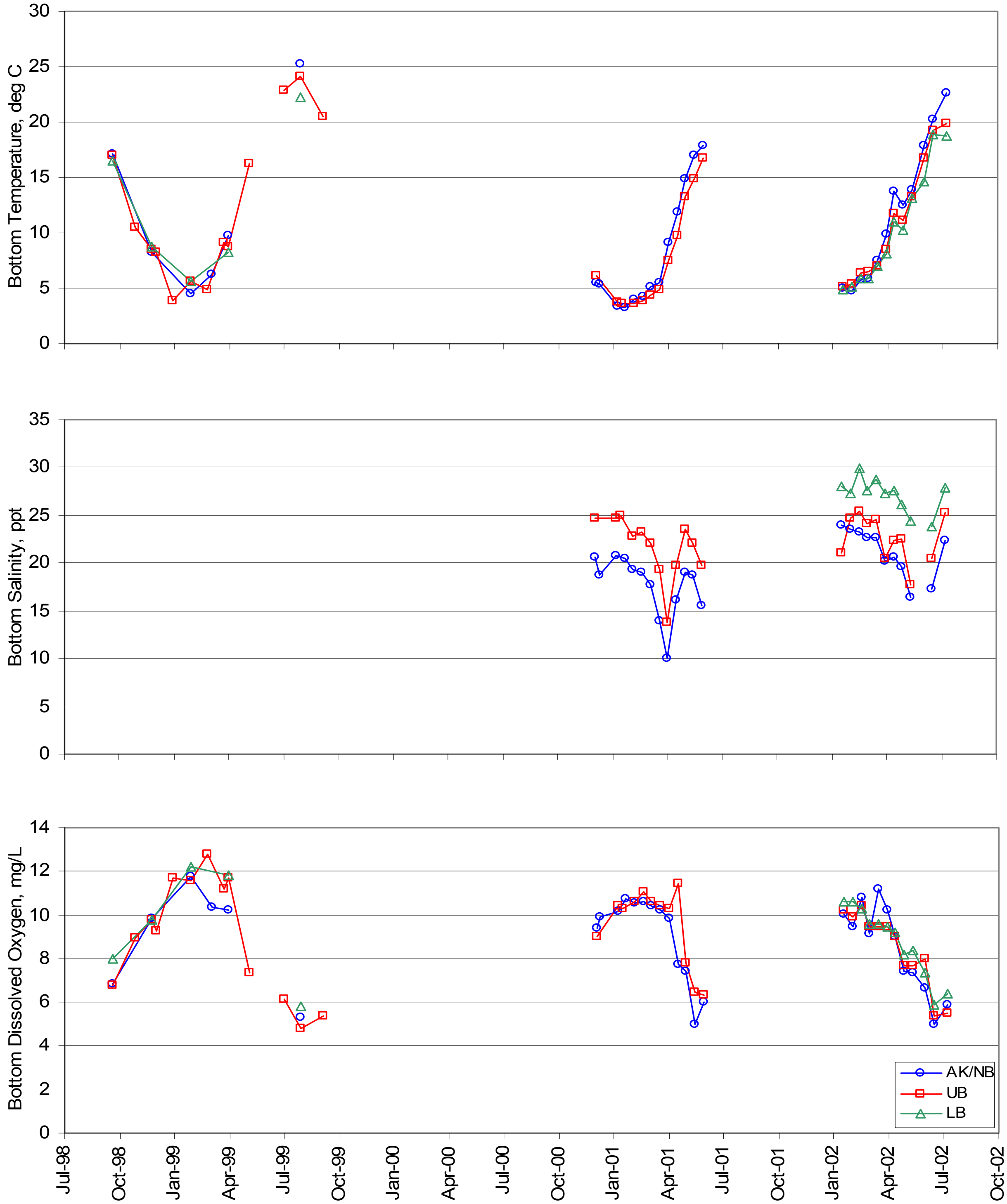


Figure 3.1-1. Average weekly water temperature, salinity and dissolved oxygen collected near bottom in three study areas sampled during the NYNJHNP (1998-1999, 2000-2001, and 2001-2002).

Note(s): AKNB = Arthur Kill / Newark Bay; UB = South Brooklyn and Port Jersey; LB = Lower Bay

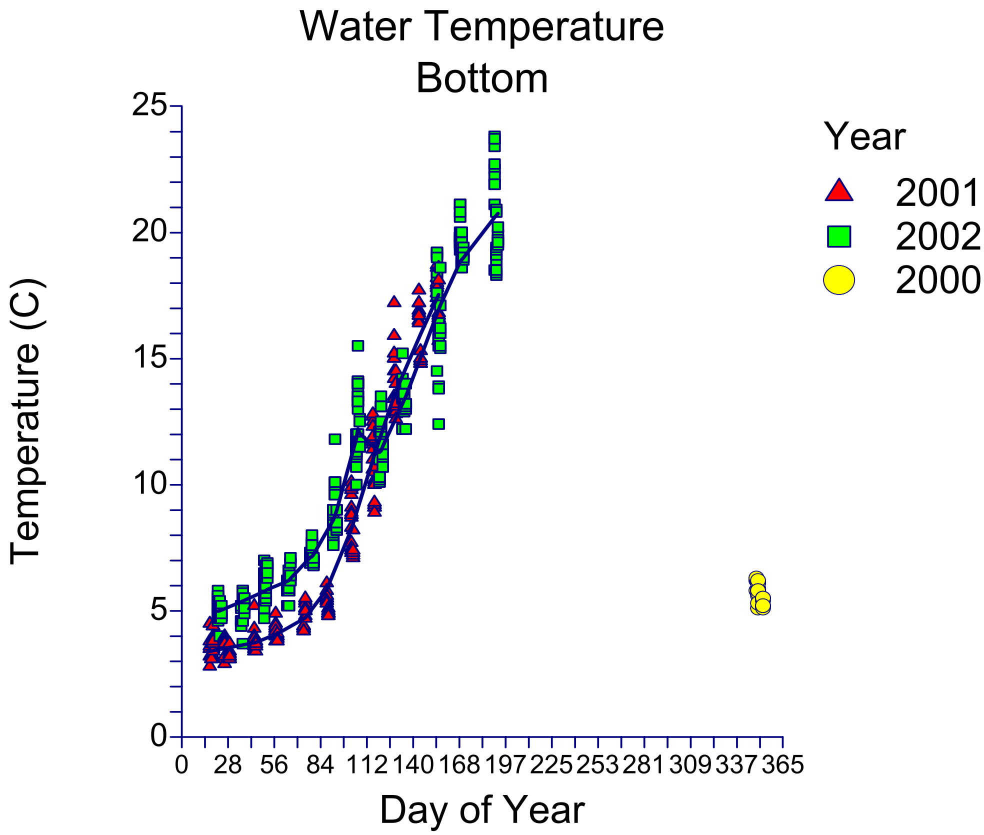


Figure 3.1-2. Average daily bottom water temperature by year. Line indicates LOWESS smoothing.

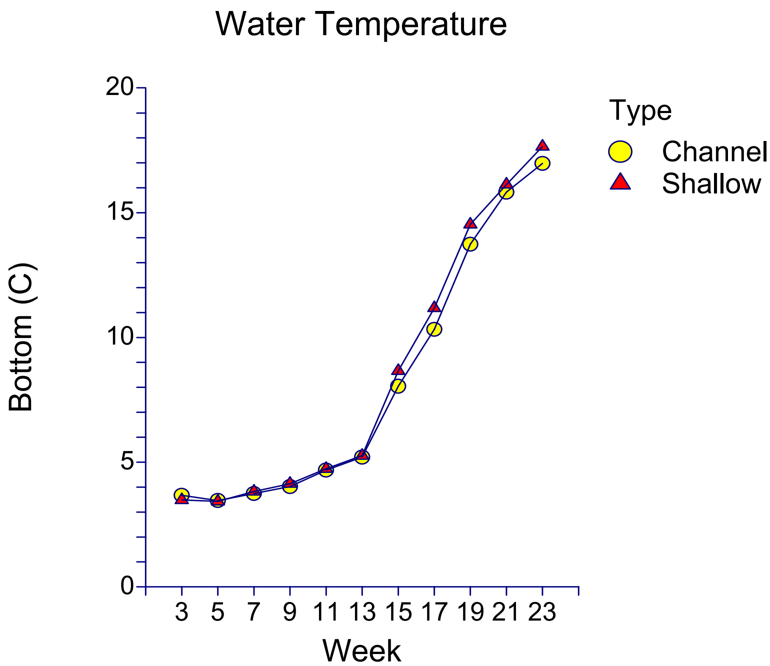


Figure 3.1-3. Bottom water temperature during 2001 sampling period by WEEK × TYPE.

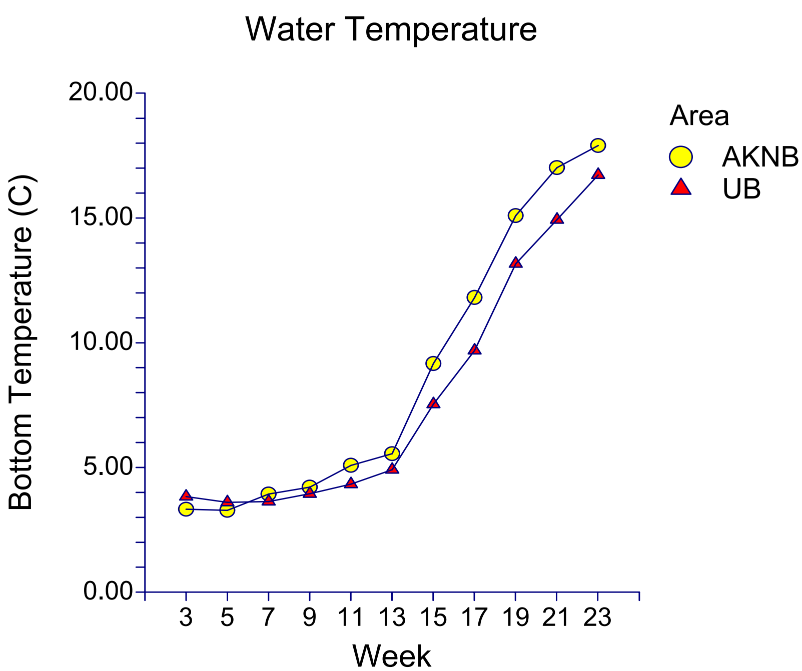


Figure 3.1-4. Bottom water temperature during 2001 sampling WEEK × AREA.

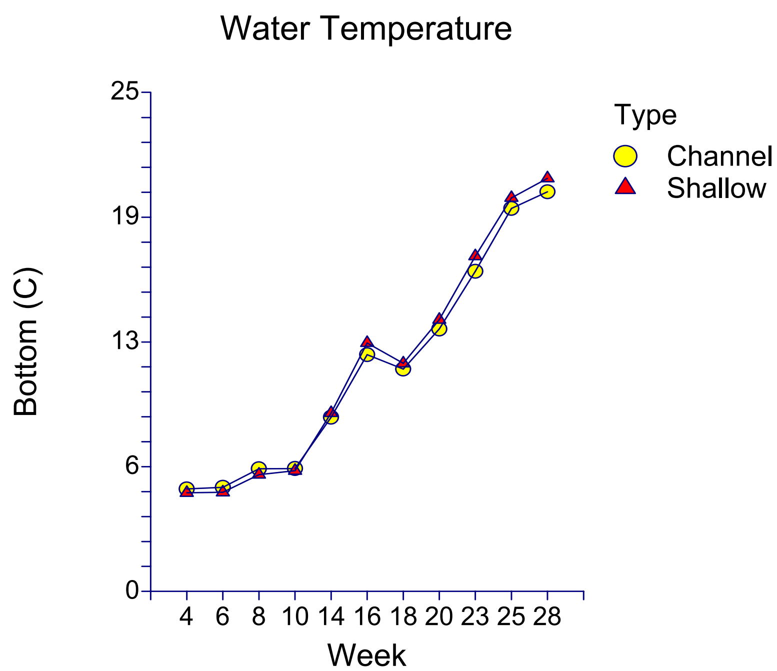


Figure 3.1-5. Bottom water temperature during 2002 sampling period by WEEK × TYPE.

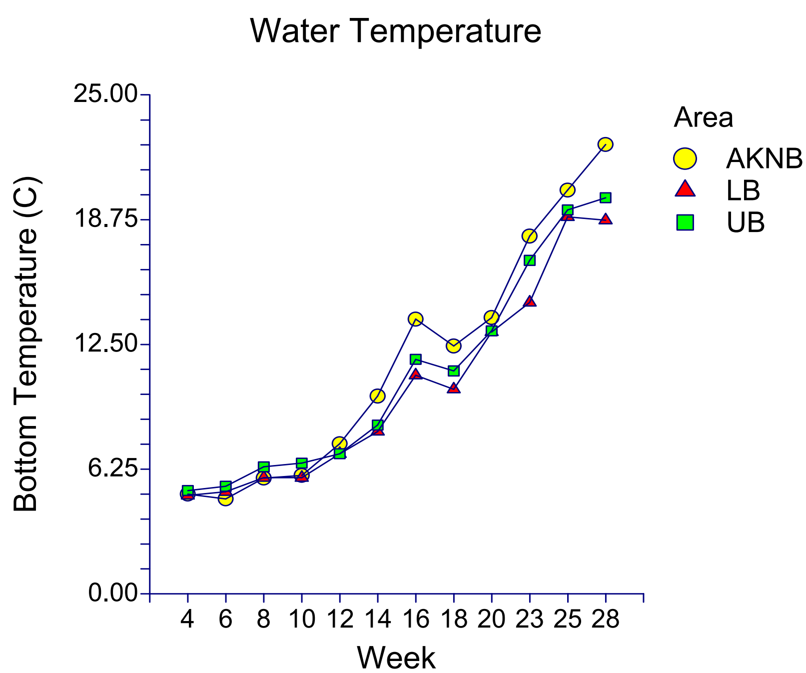


Figure 3.1-6. Bottom water temperature during 2002 sampling period by WEEK × AREA.

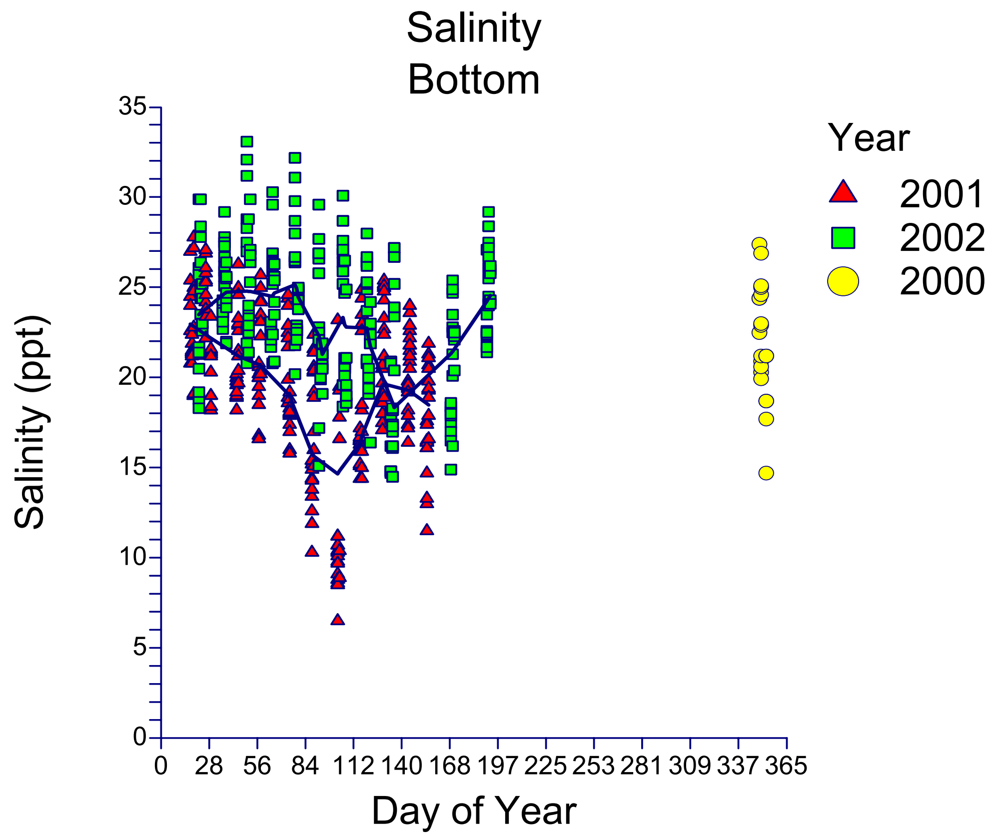


Figure 3.1-7. Average daily bottom salinity by day-of-year for 2000, 2001, and 2002. Line indicates LOWESS smoothing.

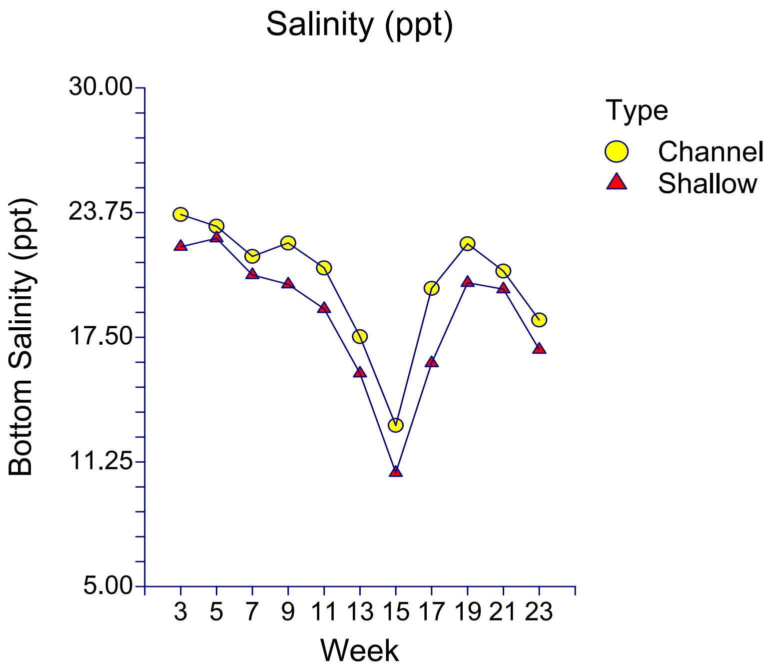


Figure 3.1-8. Bottom salinity during 2001 sampling period by WEEK × TYPE.

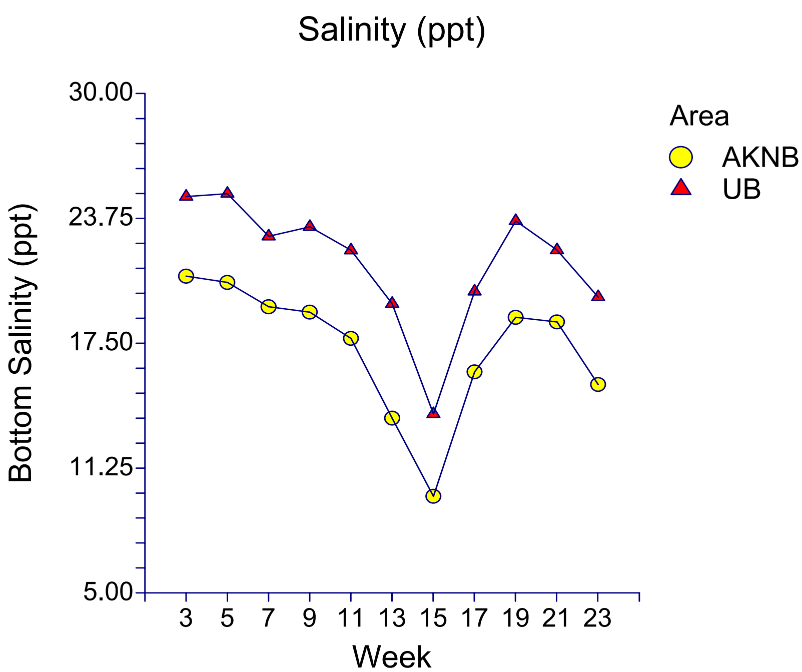


Figure 3.1-9. Bottom salinity during 2001 sampling period by WEEK × AREA.

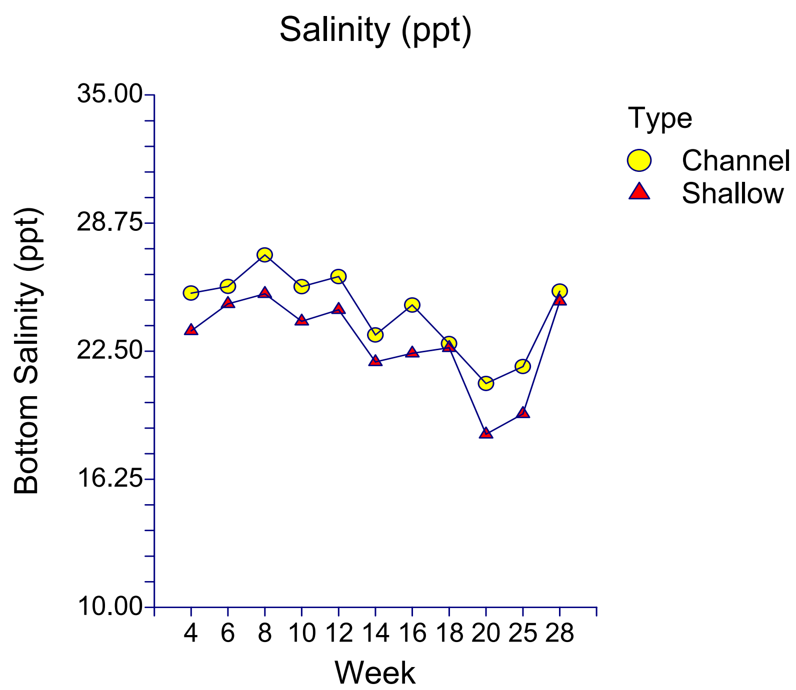


Figure 3.1-10. Bottom salinity during 2002 sampling period by WEEK × TYPE.

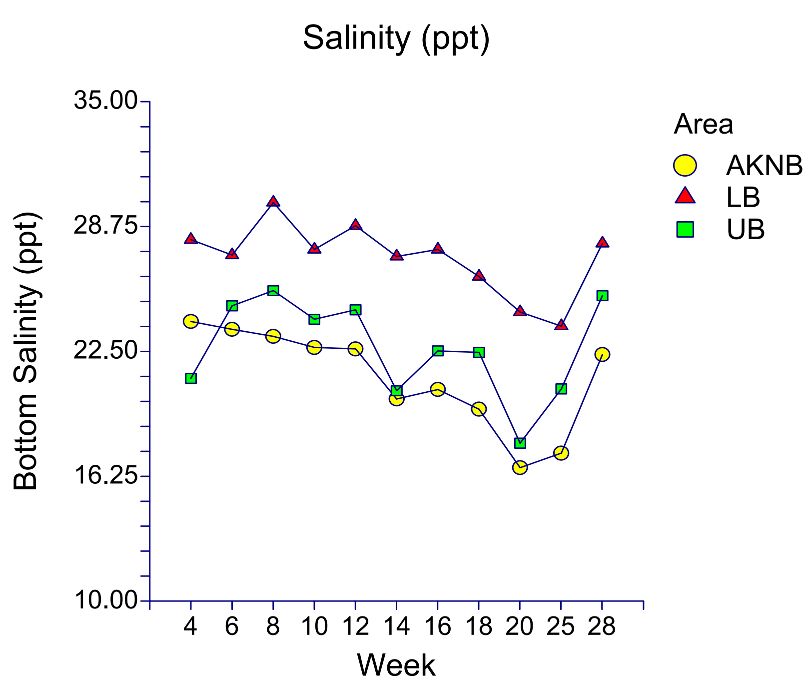


Figure 3.1-11. Bottom salinity during 2002 sampling period by WEEK × AREA.

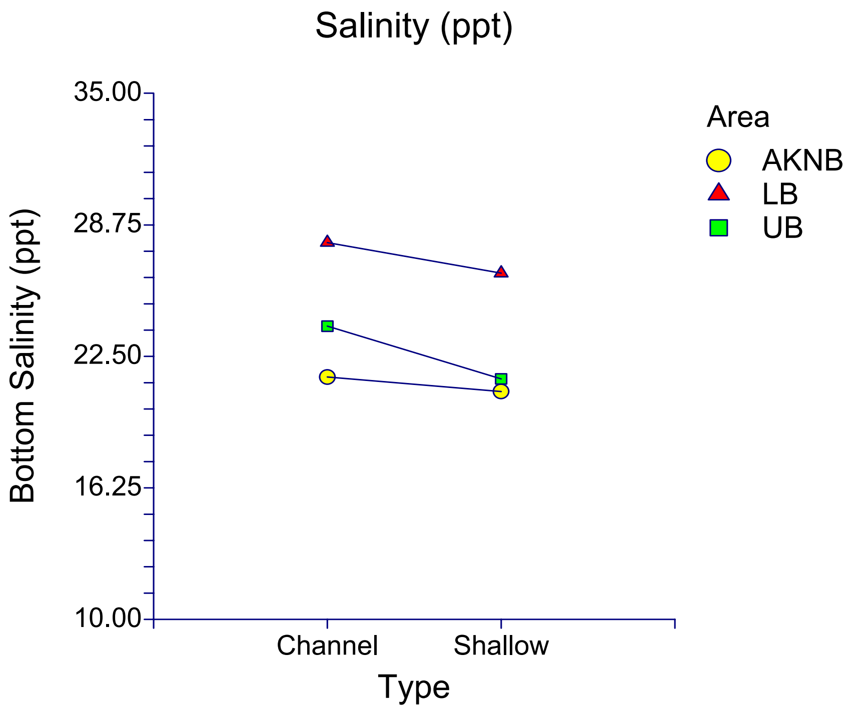


Figure 3.1-12. Bottom salinity during 2002 sampling period by TYPE × AREA.

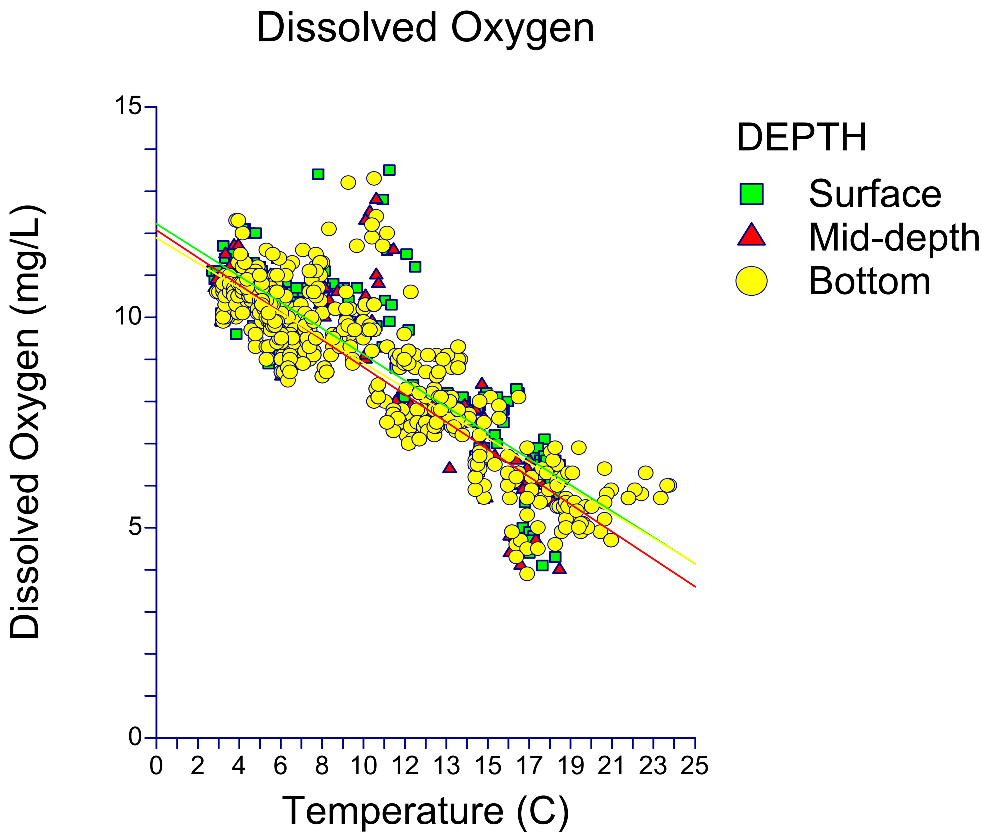


Figure 3.1-13. Dissolved oxygen and water temperature.

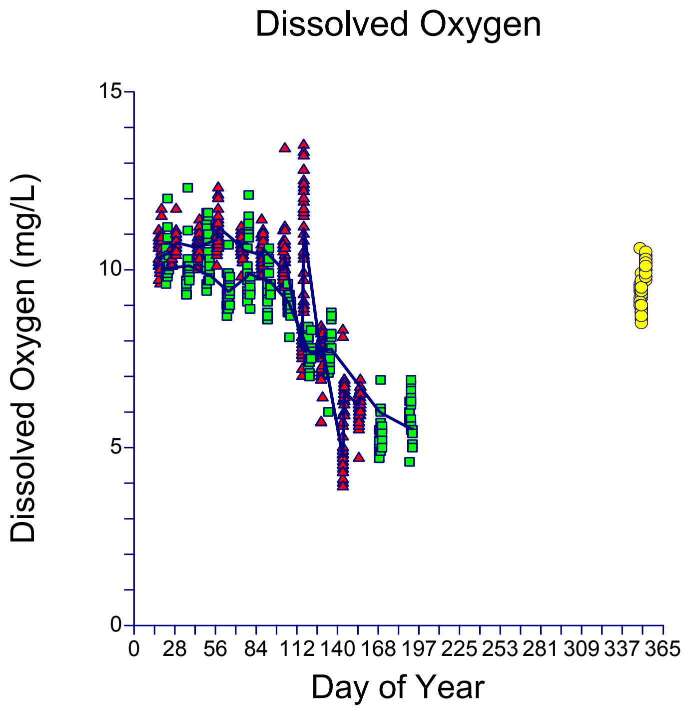


Figure 3.1-14. Average daily dissolved oxygen (mg/L) by day-of-year for 2000, 2001, and 2002. Line indicates LOWESS smoothing.

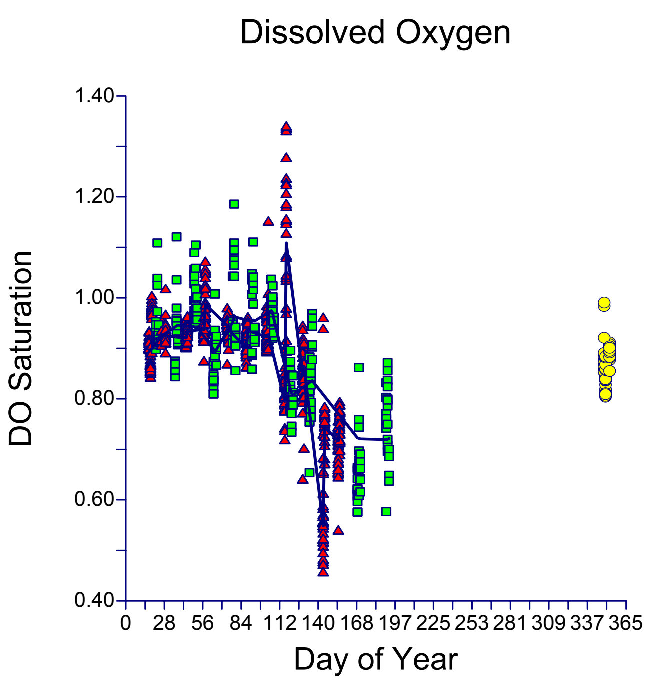


Figure 3.1-15. Average daily dissolved oxygen saturation by day-of-year for 2000, 2001, and 2002. Line indicates LOWESS smoothing.

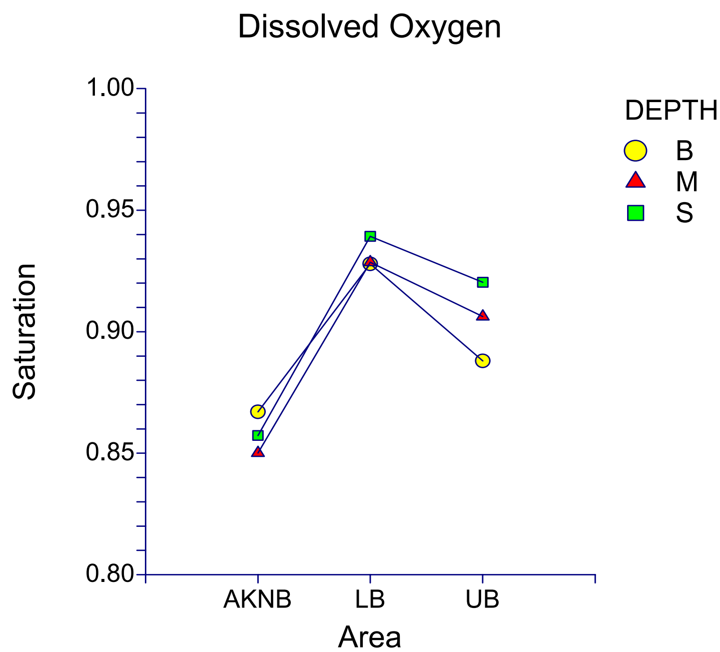


Figure 3.1-16. ANOVA DEPTH × AREA interaction plot for average DO saturation.

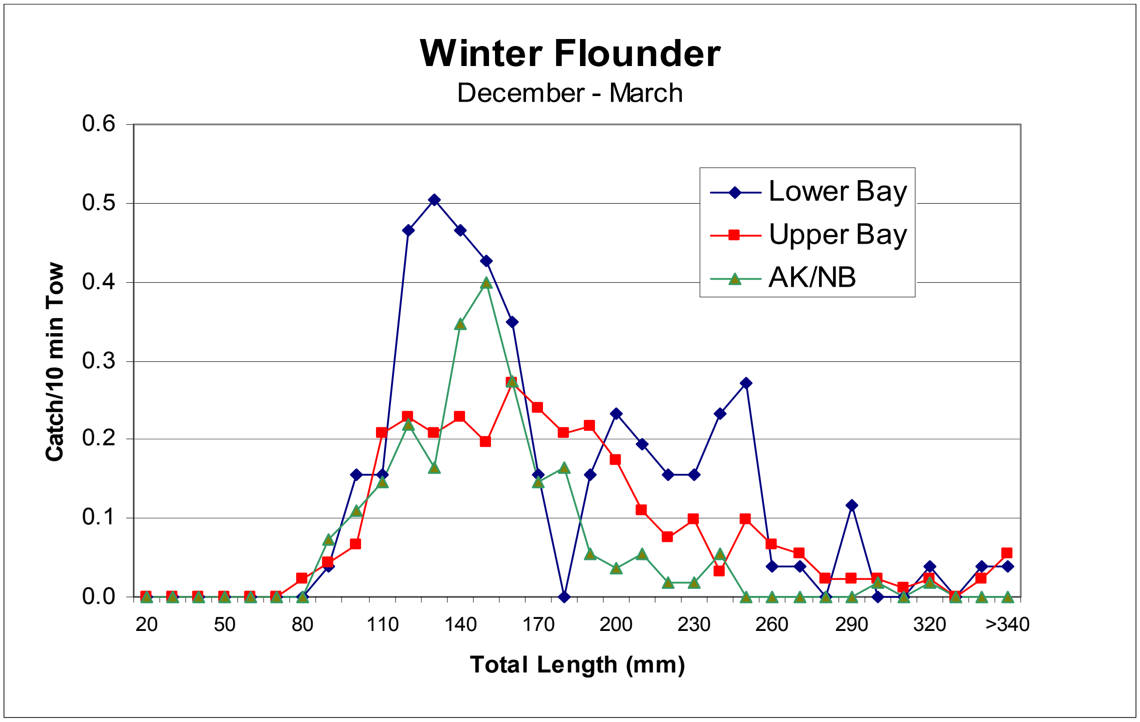


Figure 3.3-1. Winter flounder CPUE (no. / 10 min tow) by Total Length and Area during winter.

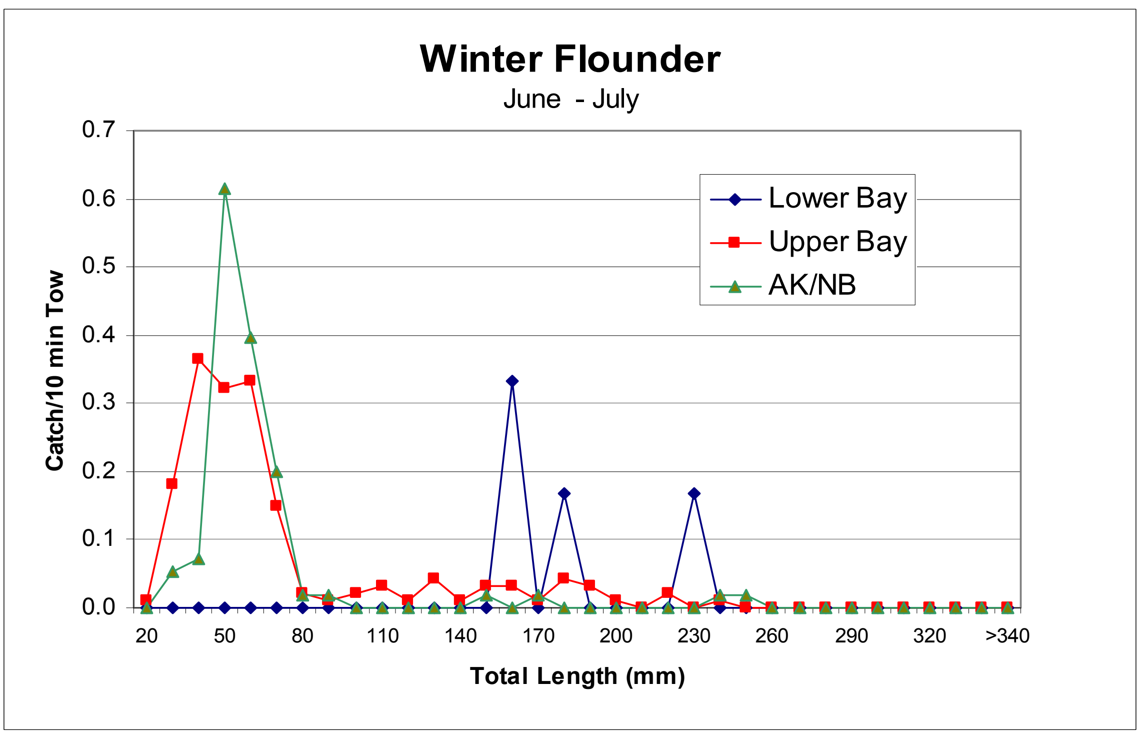


Figure 3.3-2. Winter flounder CPUE (no. / 10 min tow) by Total Length and Area during summer.

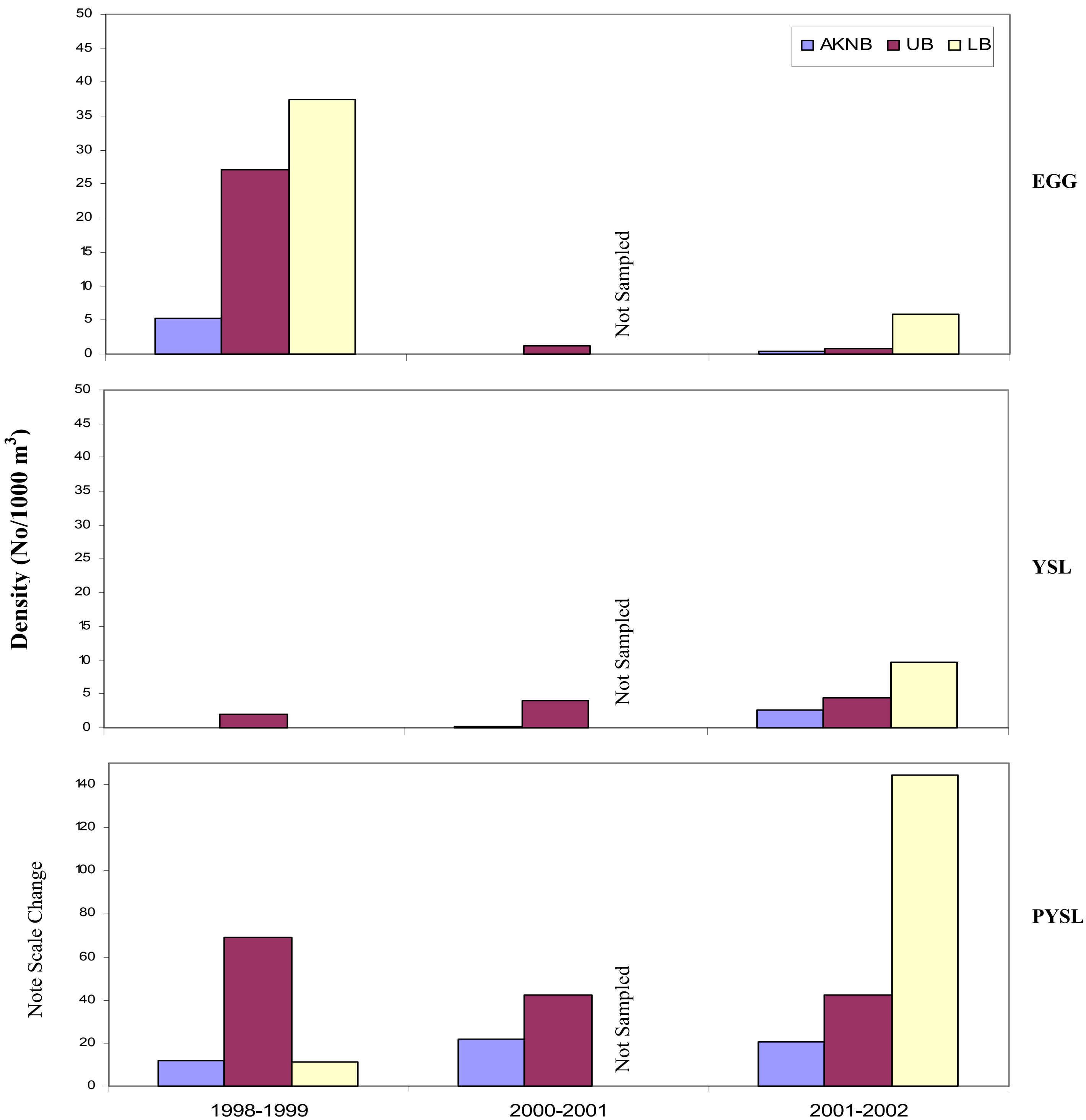


Figure3.3-3. Average winter flounder density by lifestage in three study areas sampled during the three sampling programs (1998-1999, 2000-2001, and 2001-2002) of the NYNJHNP.

Note(s): AKNB = Arthur Kill / Newark Bay; UB = South Brooklyn and Port Jersey; LB = Lower Bay

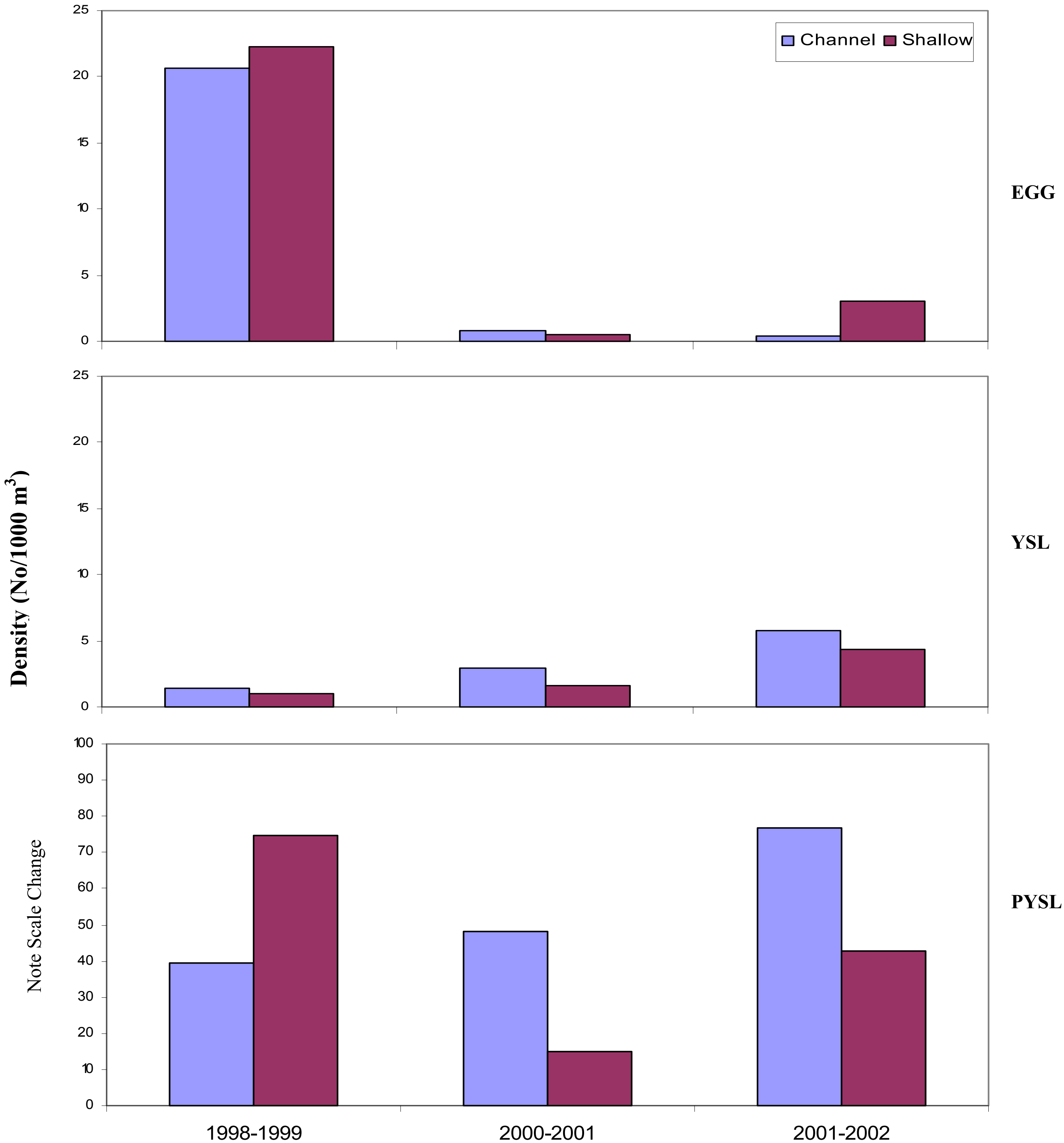


Figure 3.3-4. Average winter flounder density by lifestage at channel and shallow locations sampled during the three sampling programs (1998-1999, 2000-2001, and 2001-2002) of the NYNJHNP.

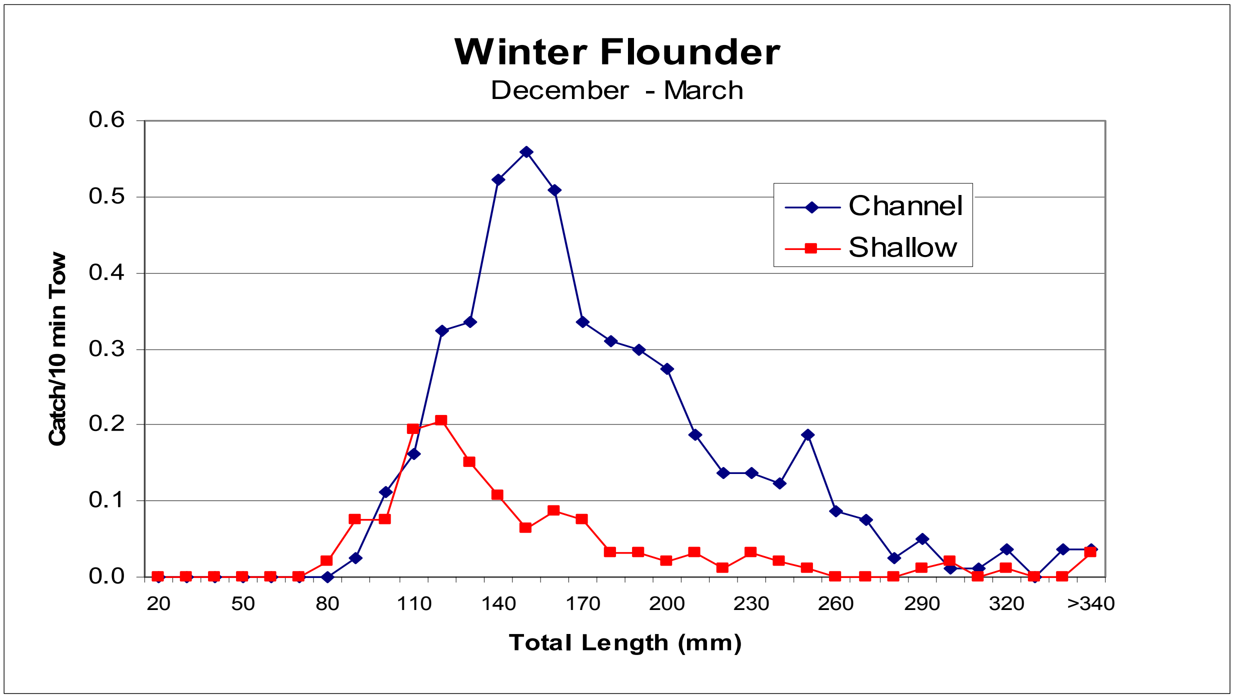


Figure 3.3-5. Winter flounder CPUE (no. / 10 min tow) by Total Length and Habitat during winter.

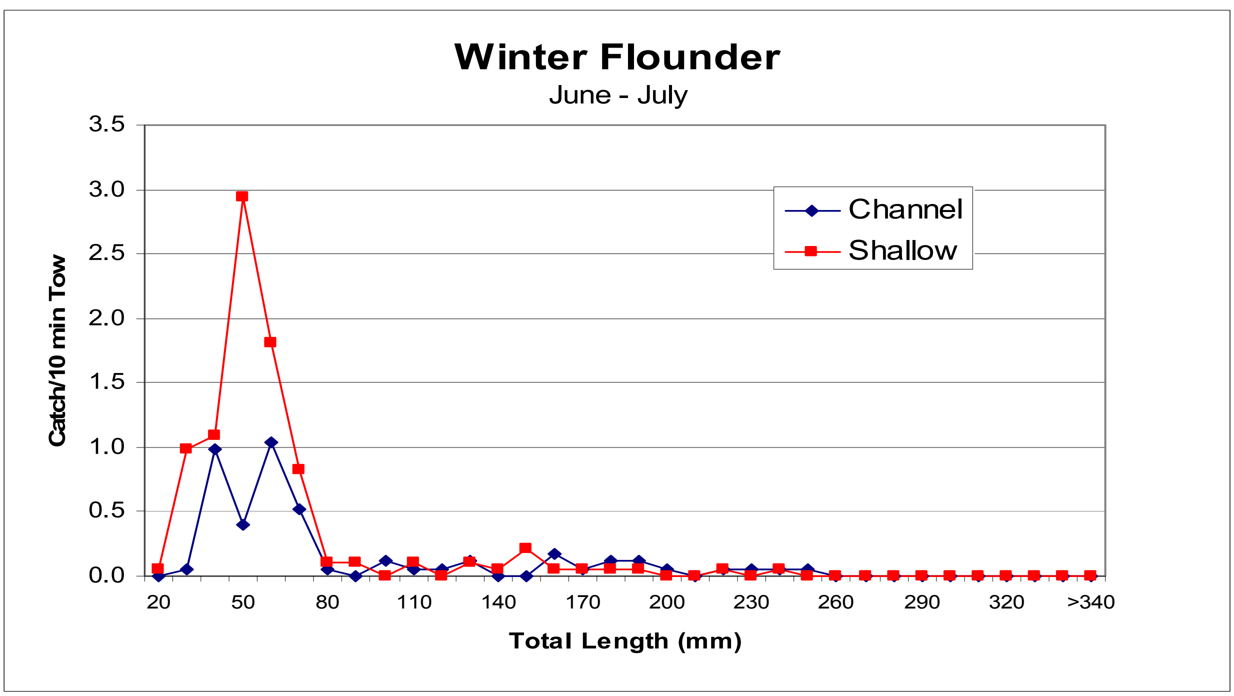


Figure 3.3-6. Winter flounder CPUE (no. / 10 min tow) by Total Length and Habitat during summer.

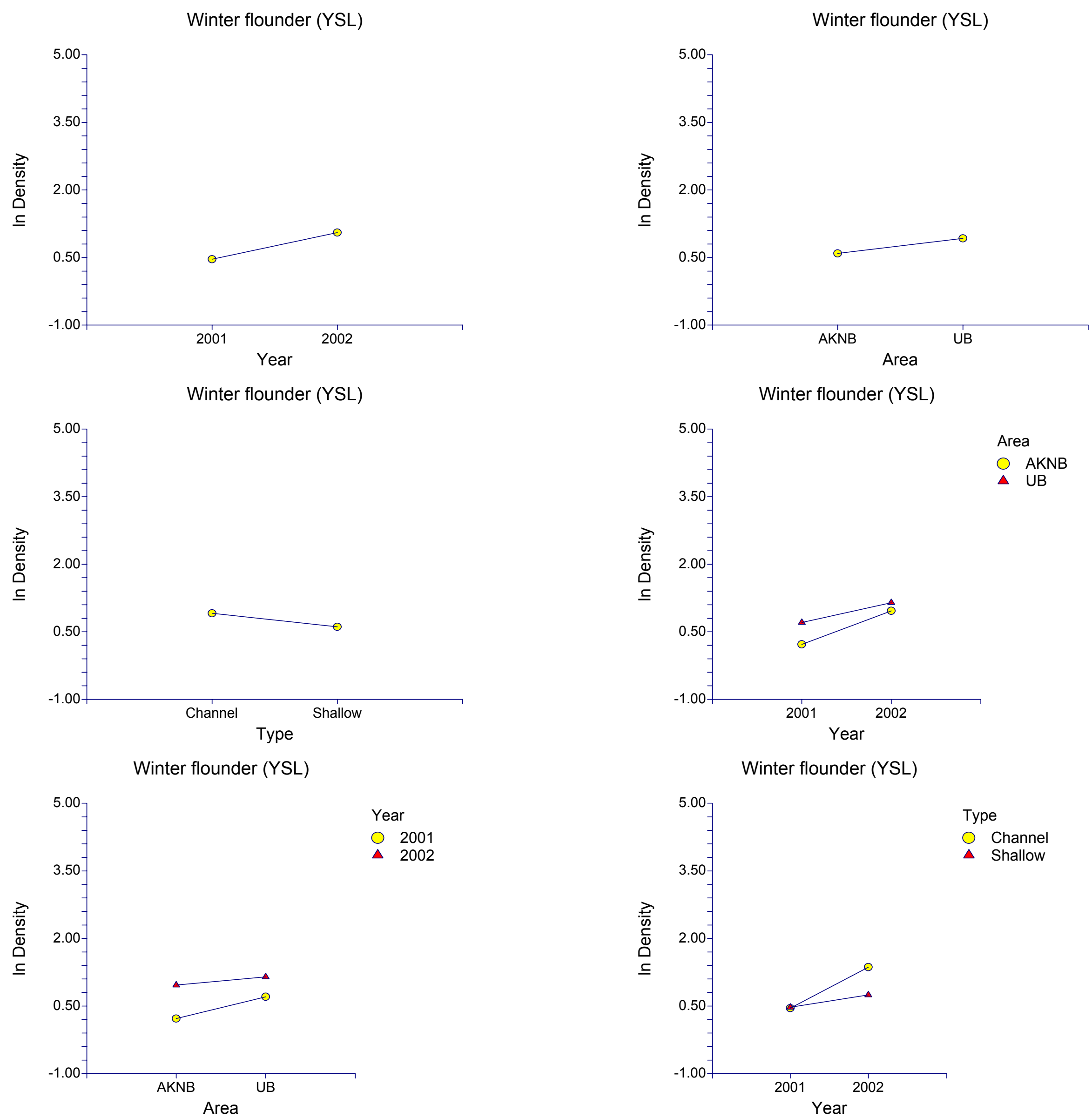


Figure 3.3-7. Winter flounder yolk-sac larvae analysis of variance interaction plots.

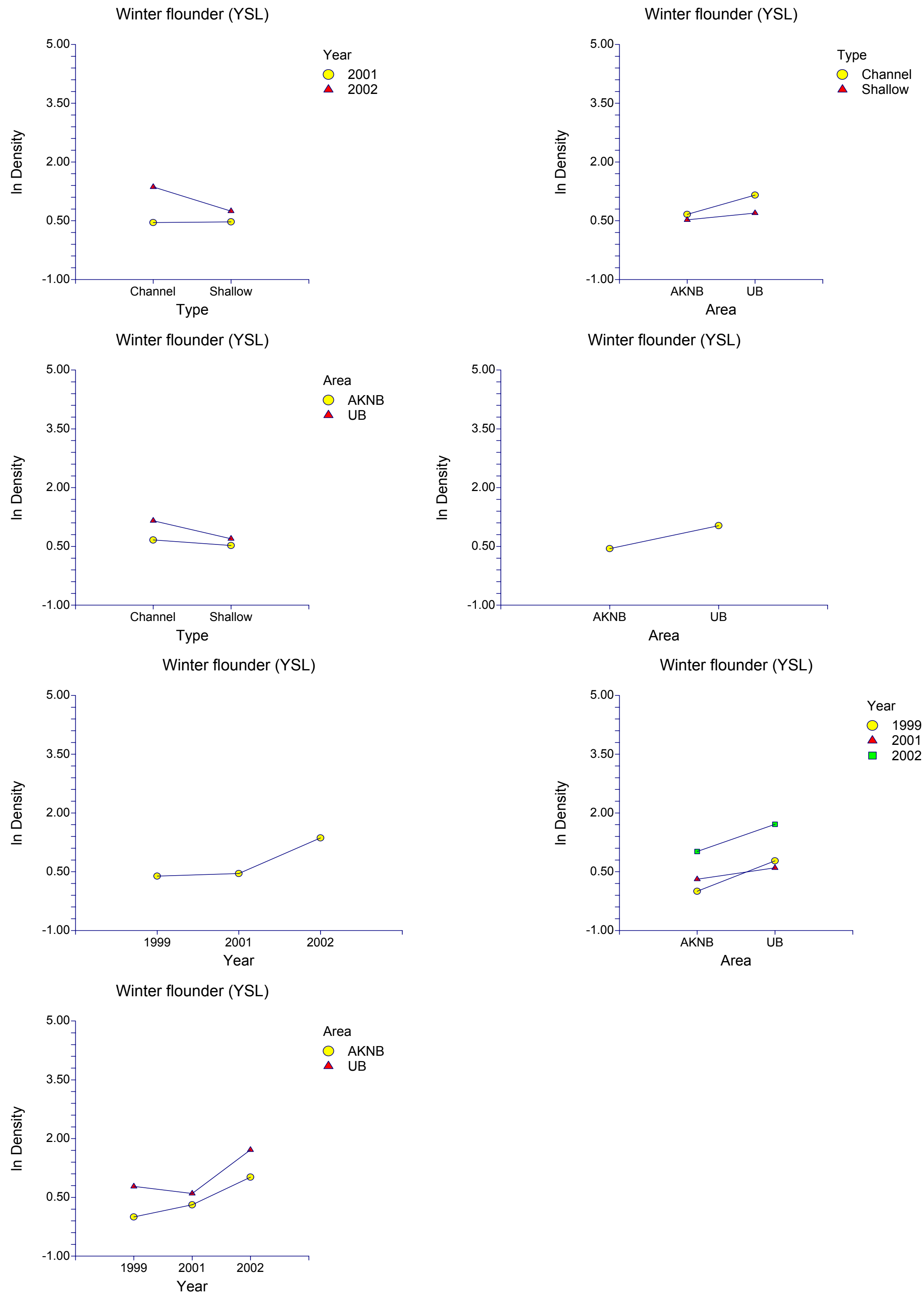


Figure 3.3-7 (Continued). Winter flounder yolk-sac larvae analysis of variance interaction plots.

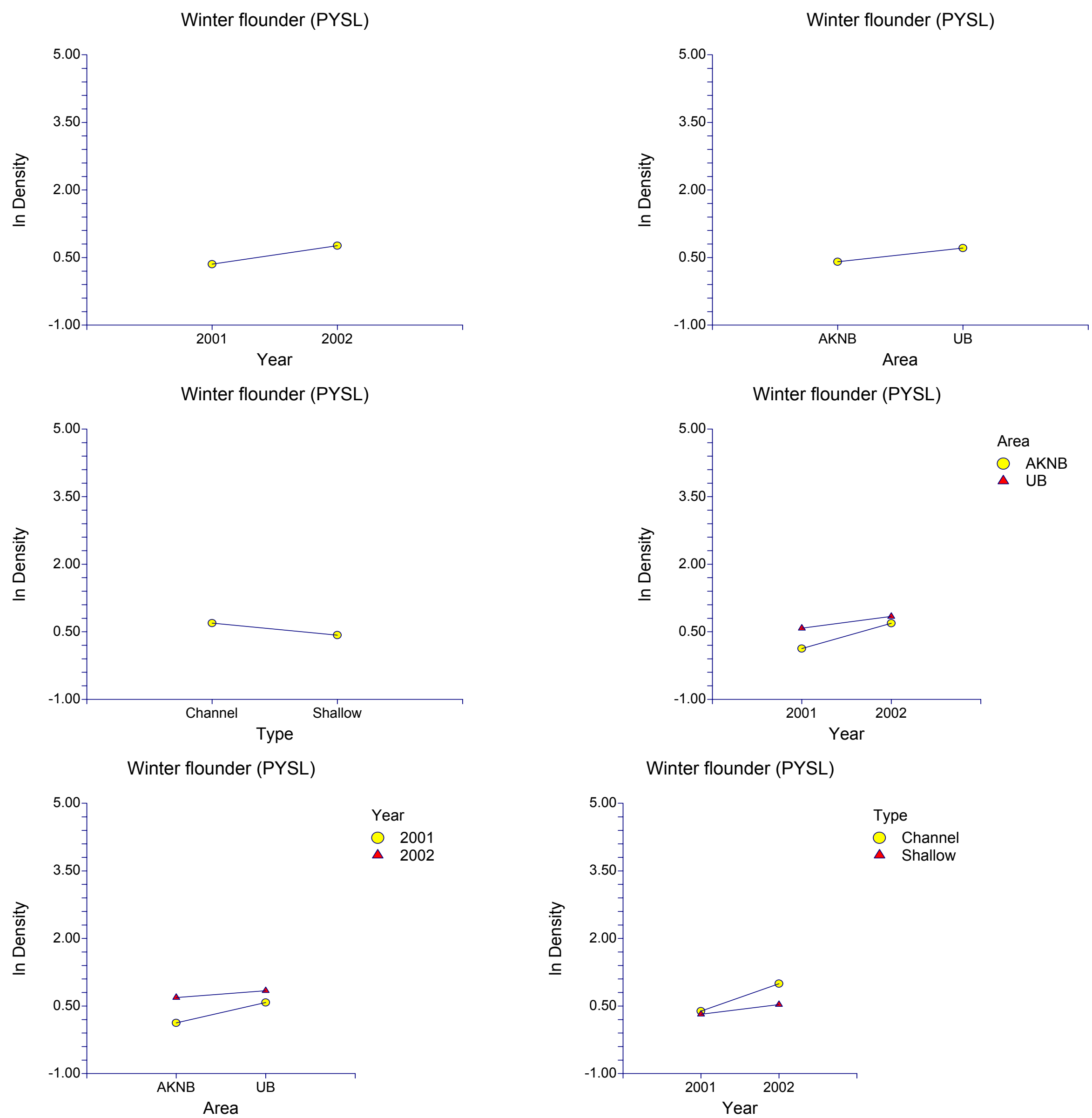


Figure 3.3-8. Winter flounder post yolk-sac larvae analysis of variance interaction plots.

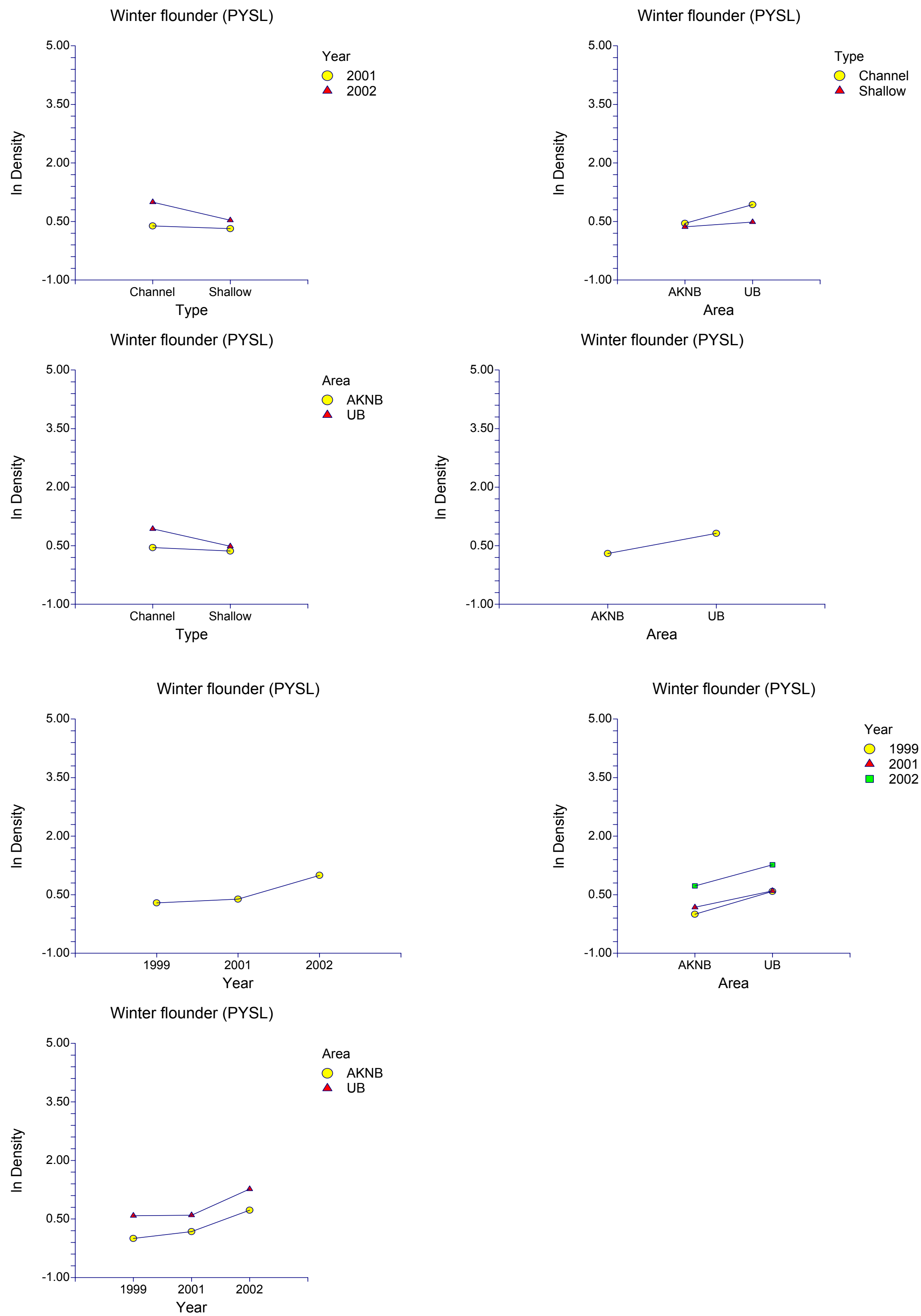


Figure 3.3-8 (Continued). Winter flounder post yolk-sac larvae analysis of variance interaction plots.

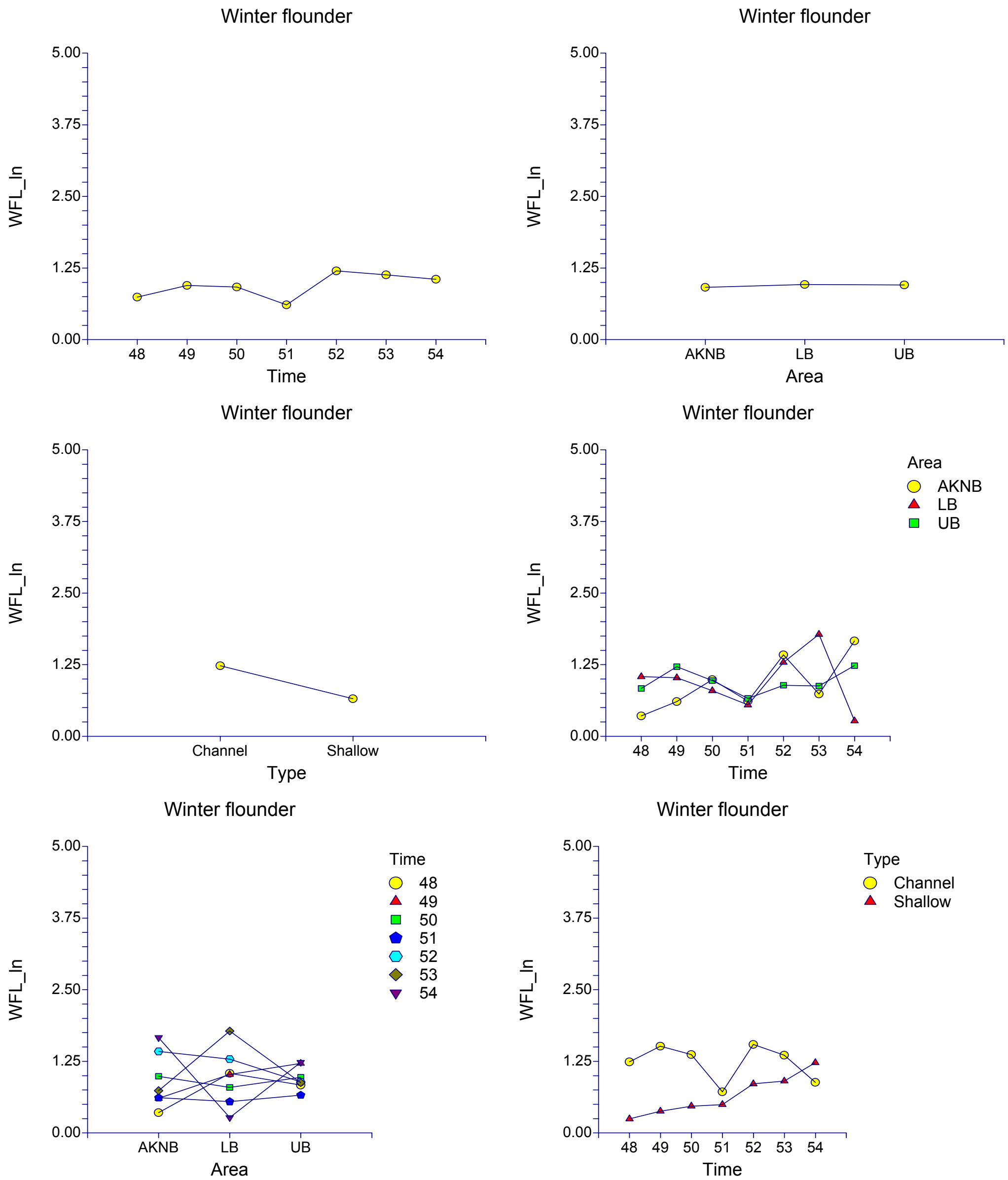


Figure 3.3-9. Winter flounder trawl CPUE analysis of variance interaction plots.

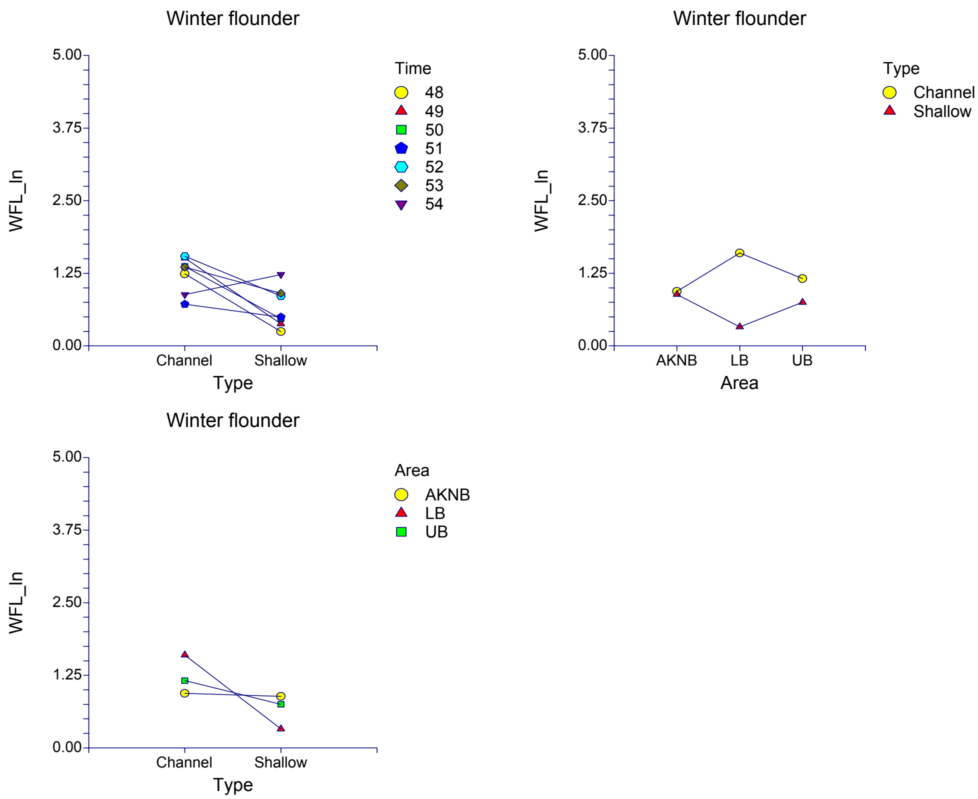


Figure 3.3-9 (Continued). Winter flounder trawl CPUE analysis of variance interaction plots.

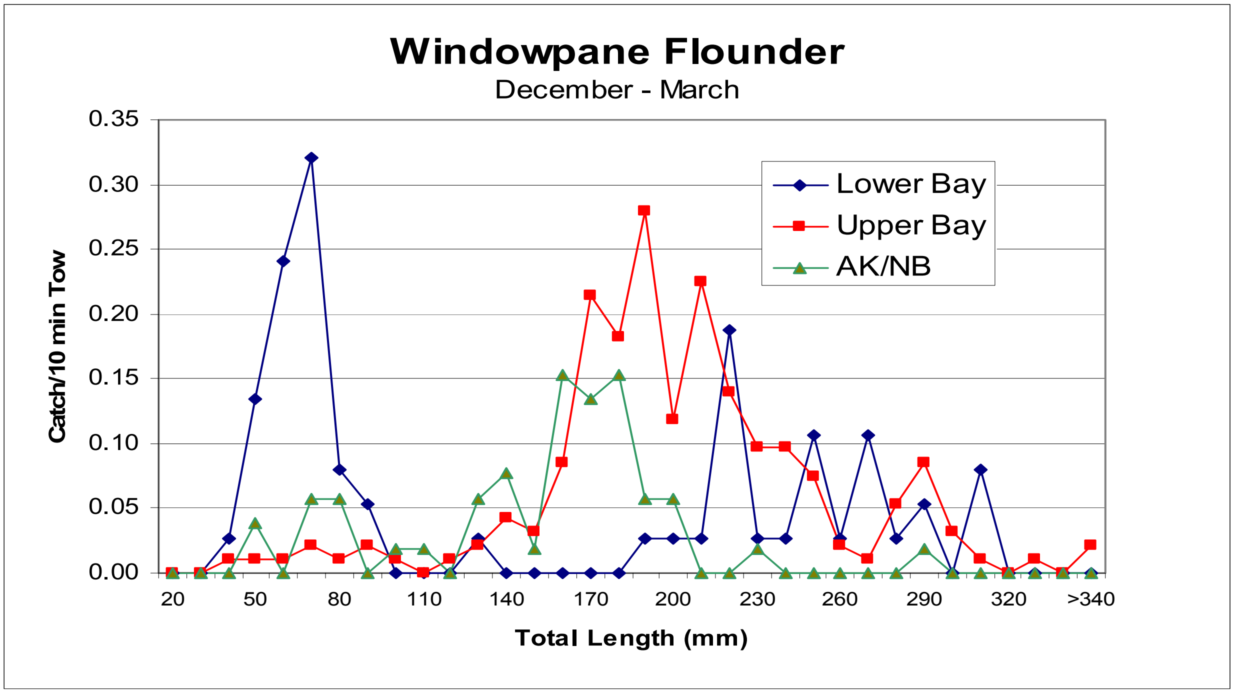


Figure 3.4-1. Windowpane flounder CPUE (no. / 10 min tow) by Total Length and Area during winter.

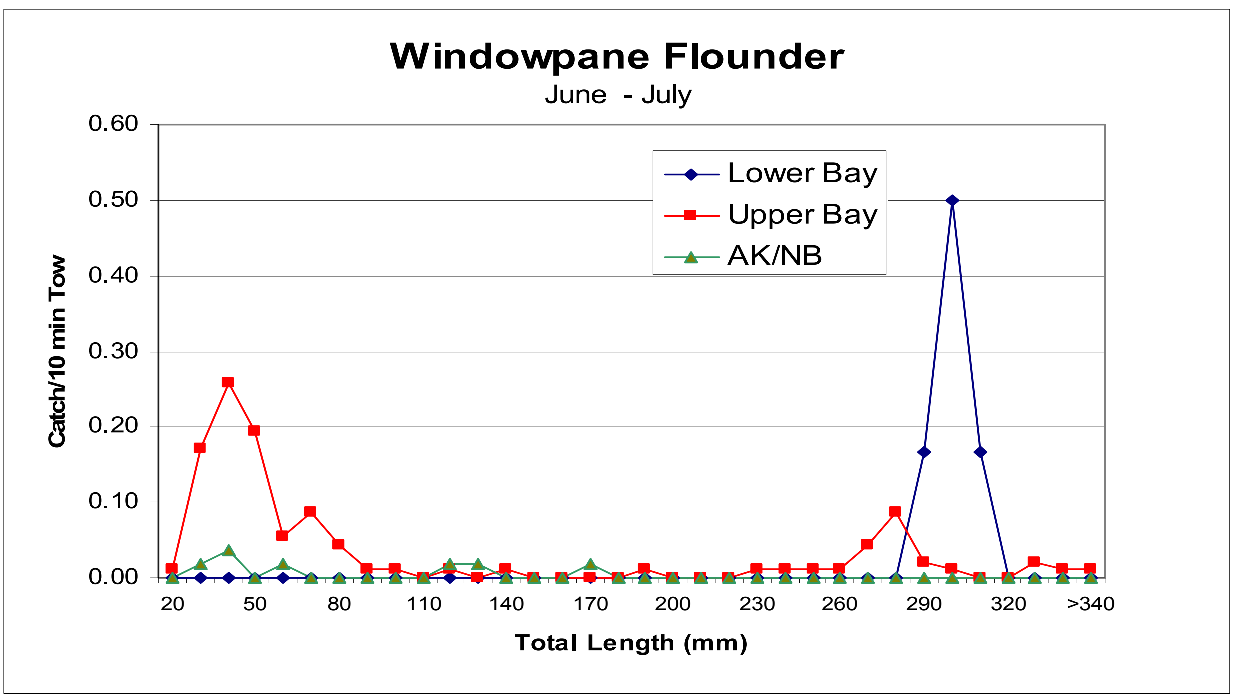


Figure 3.4-2. Windowpane flounder CPUE (no. / 10 min tow) by Total Length and Area during summer.

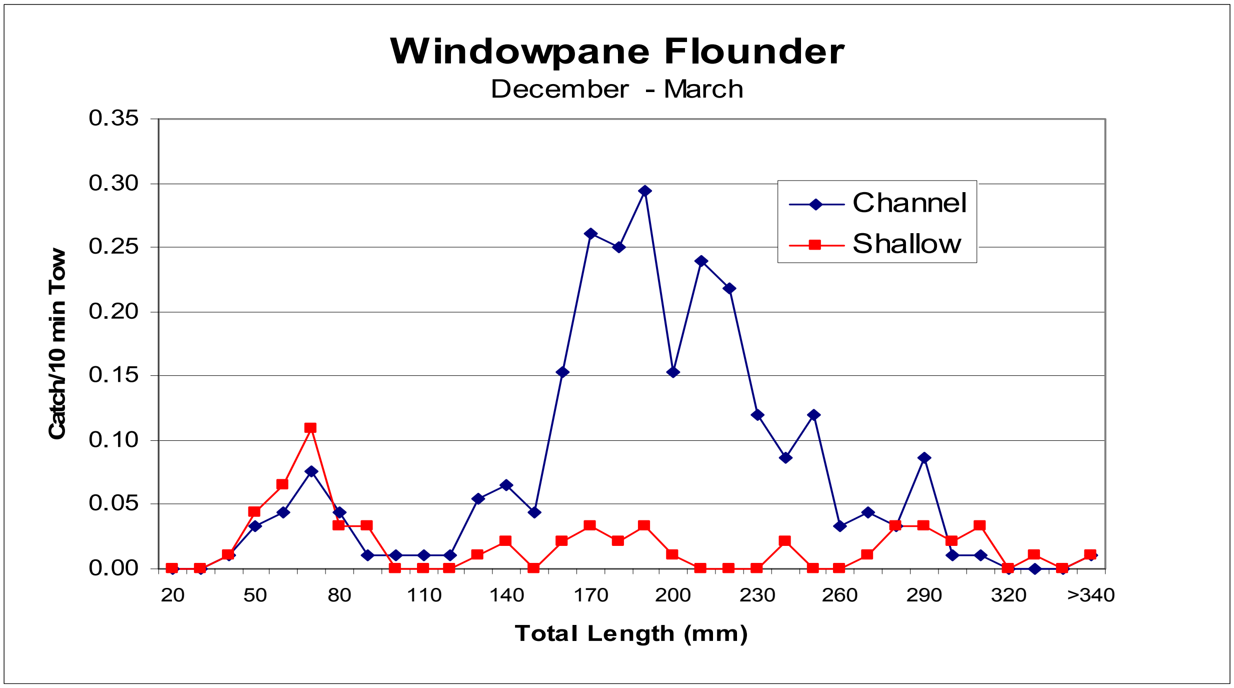


Figure 3.4-3. Windowpane flounder CPUE (no. / 10 min tow) by Total Length and Habitat during winter.

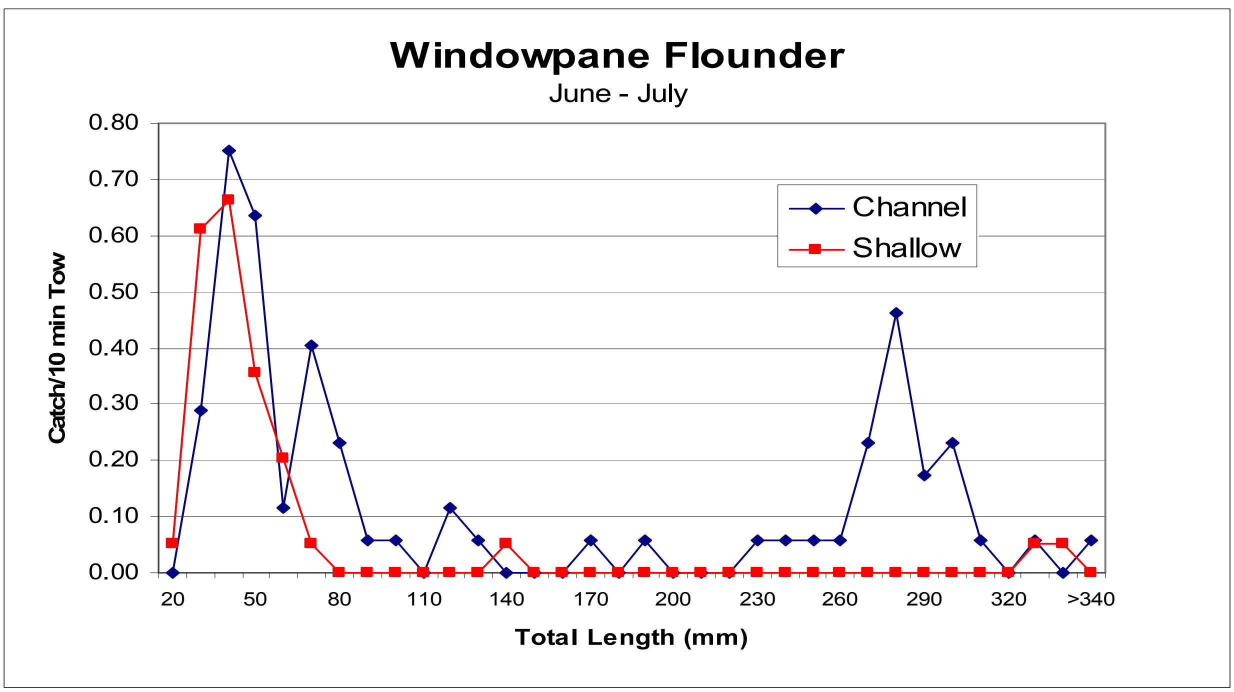


Figure 3.4-4. Windowpane flounder CPUE (no. / 10 min tow) by Total Length and Habitat during summer.

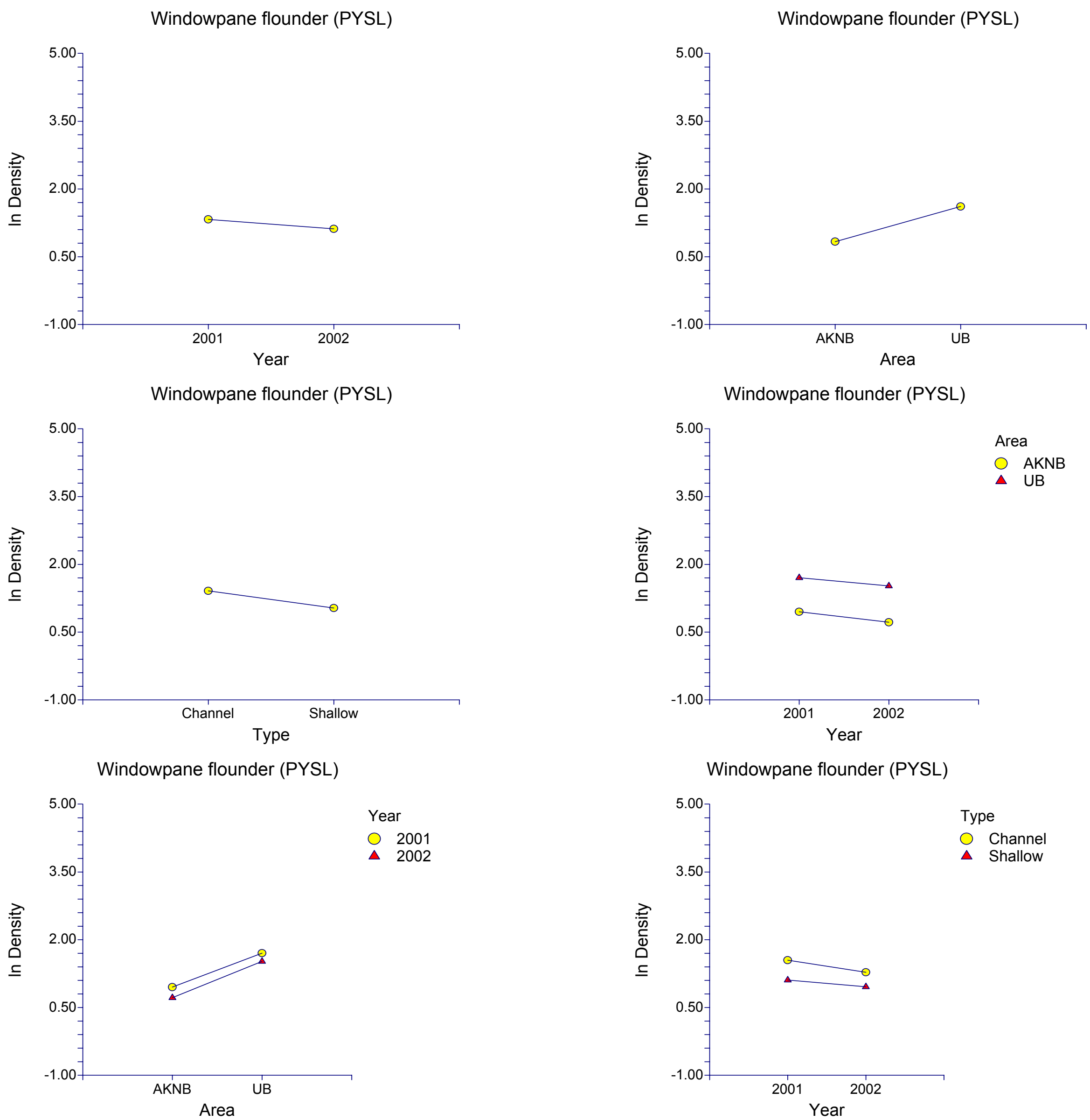


Figure 3.4-5. Windowpane flounder post yolk-sac larvae analysis of variance interaction plots.

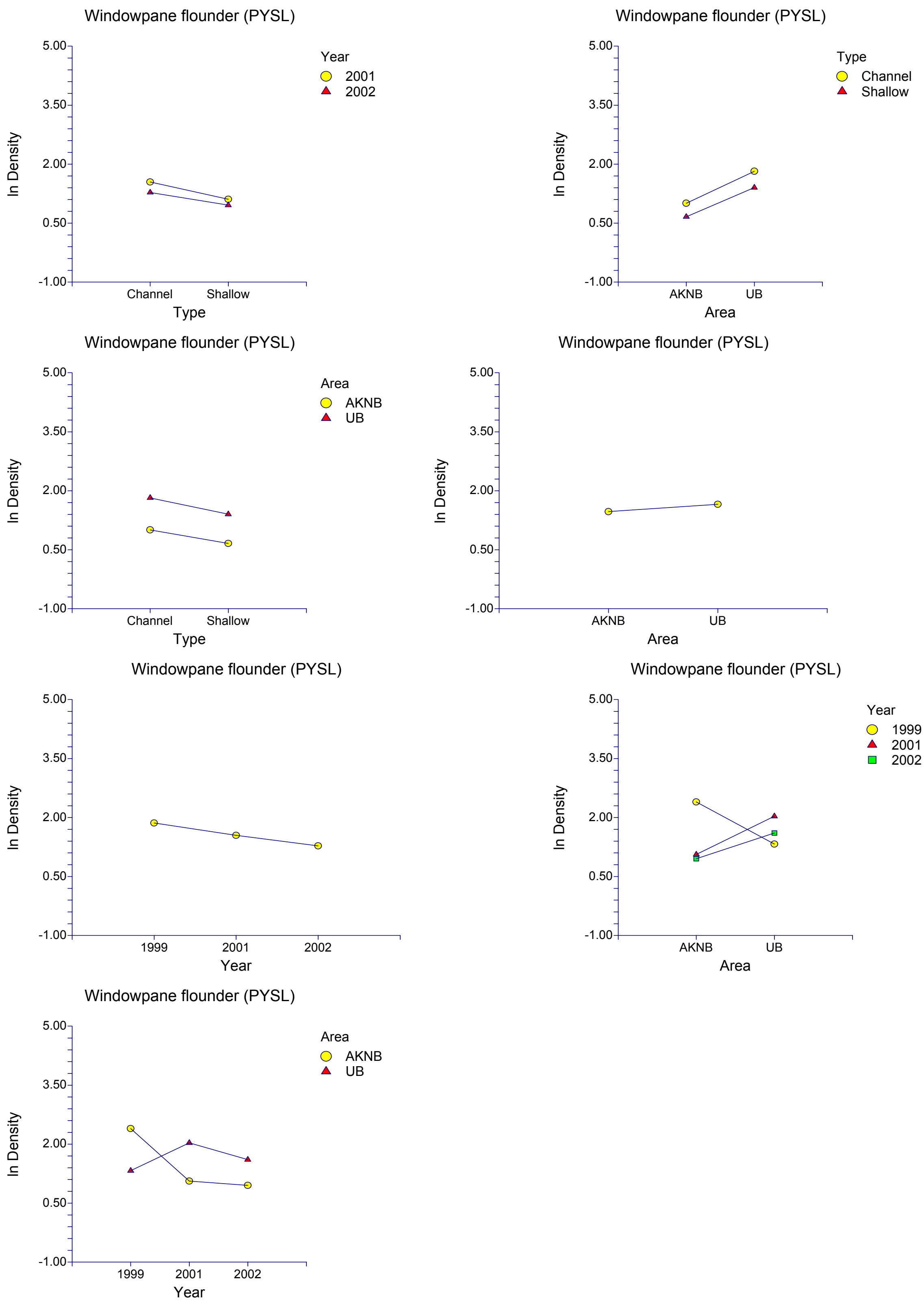


Figure 3.4-5 (Continued). Windowpane flounder post yolk-sac larvae analysis of variance interaction plots.

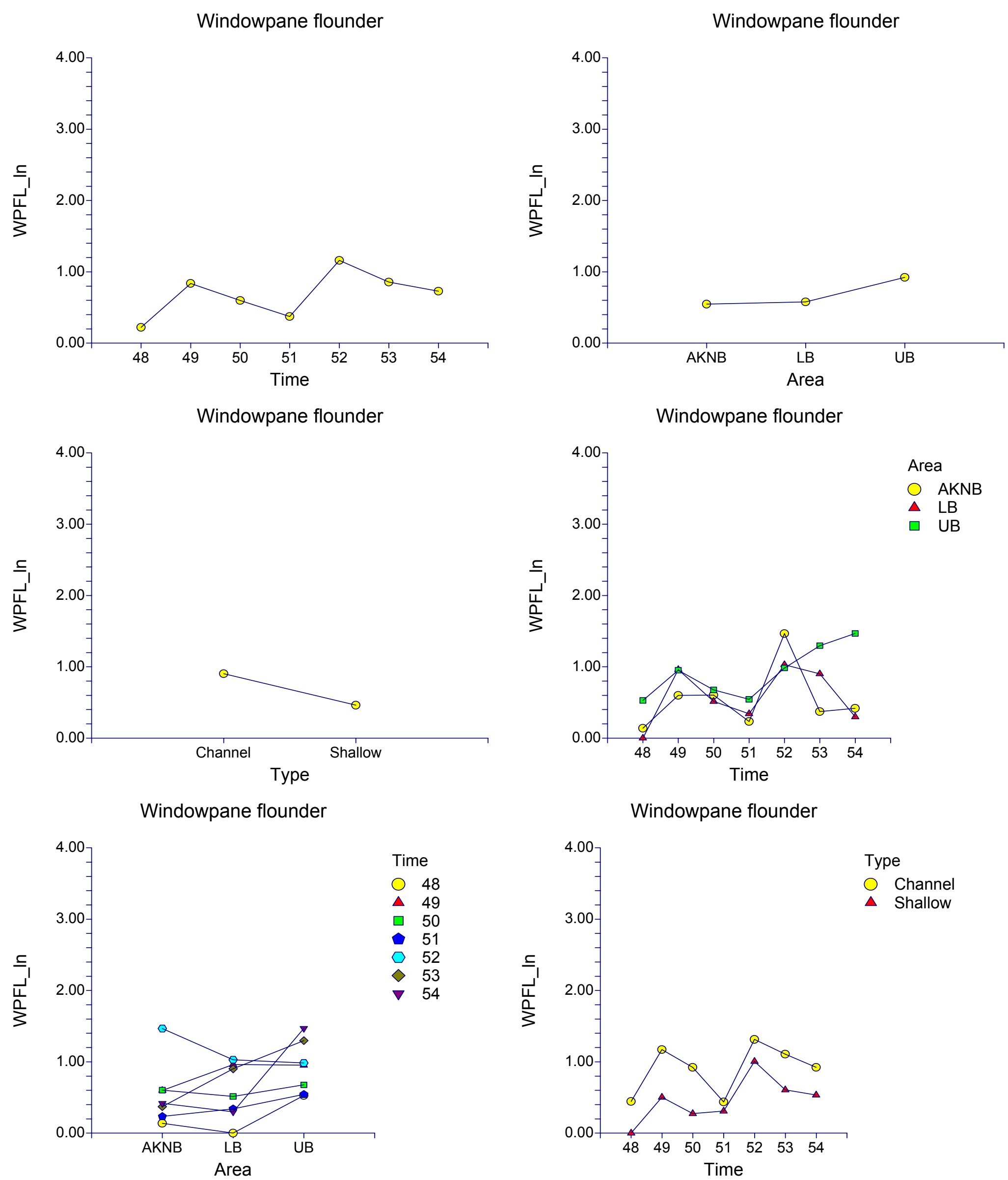


Figure 3.4-6. Windowpane flounder trawl CPUE analysis of variance interaction plots.

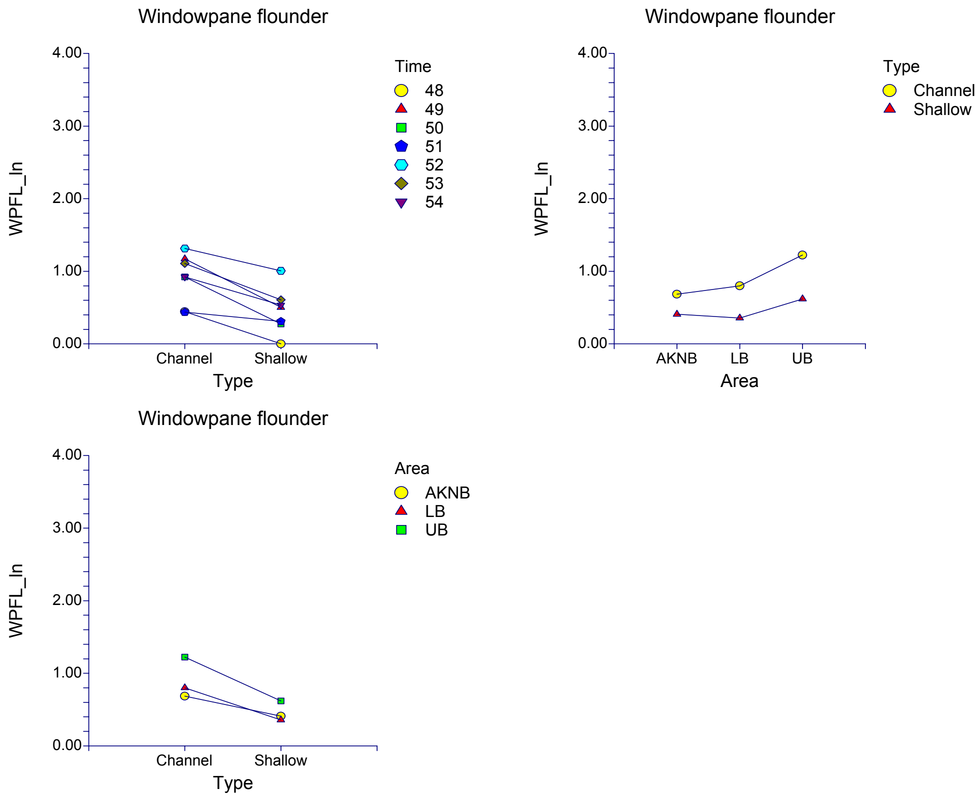


Figure 3.4-6 (Continued). Windowpane flounder trawl CPUE analysis of variance interaction plots.

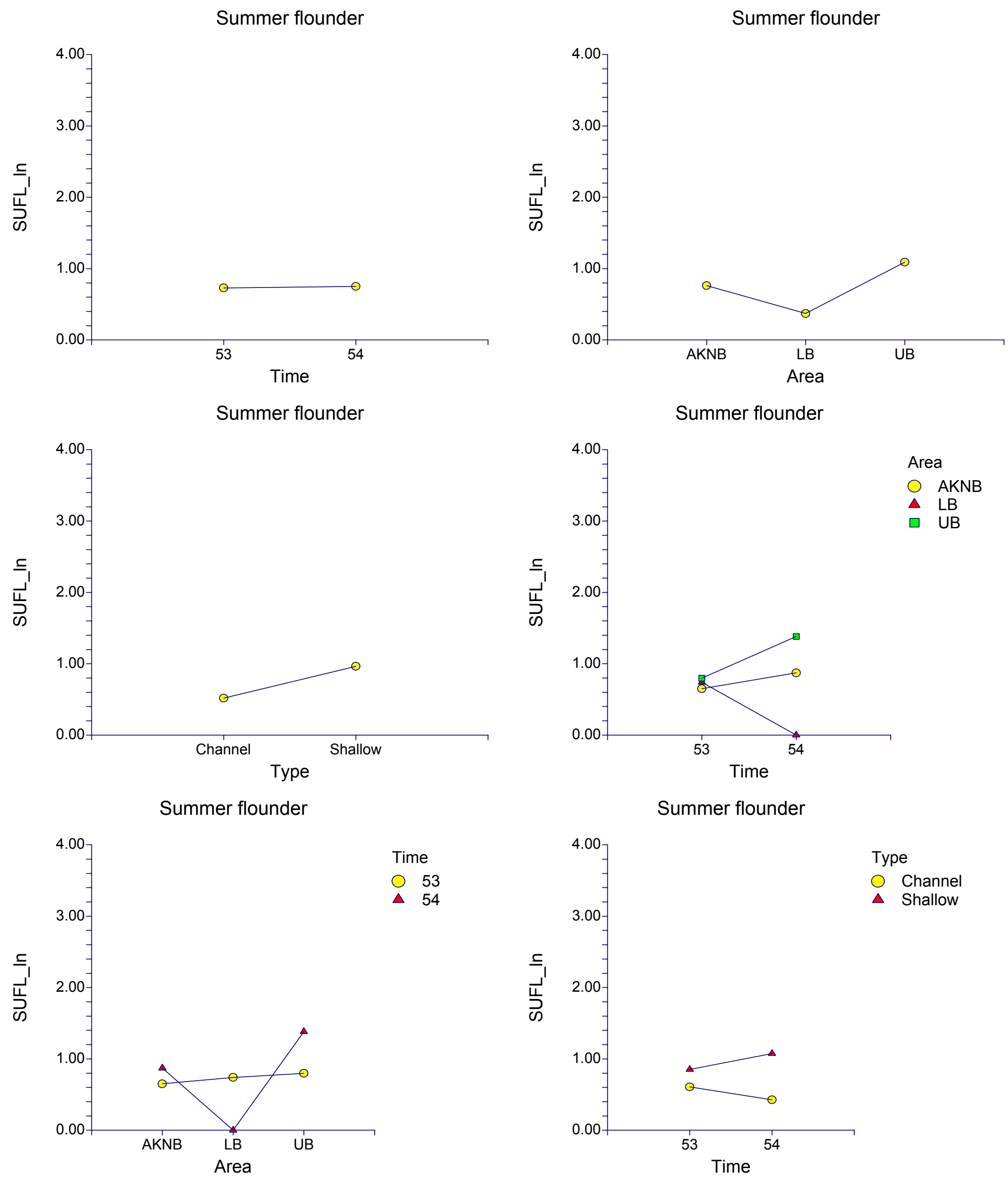


Figure 3.5-1. Summer flounder trawl CPUE analysis of variance interaction plots.

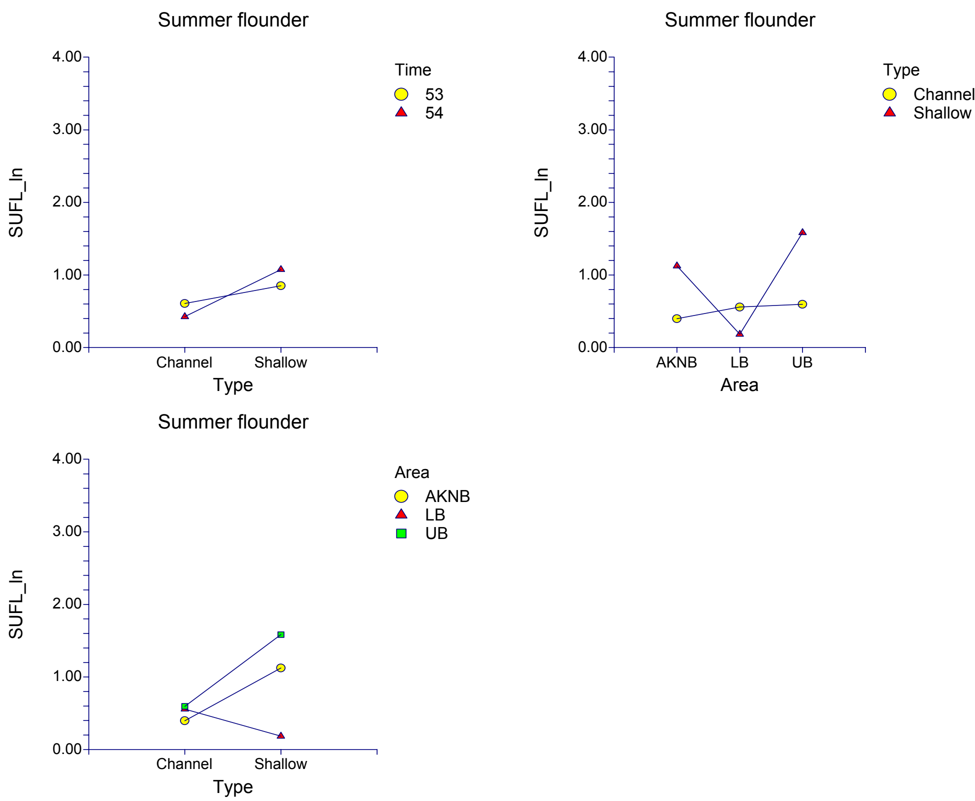


Figure 3.5-1 (Continued). Summer flounder trawl CPUE analysis of variance interaction plots.

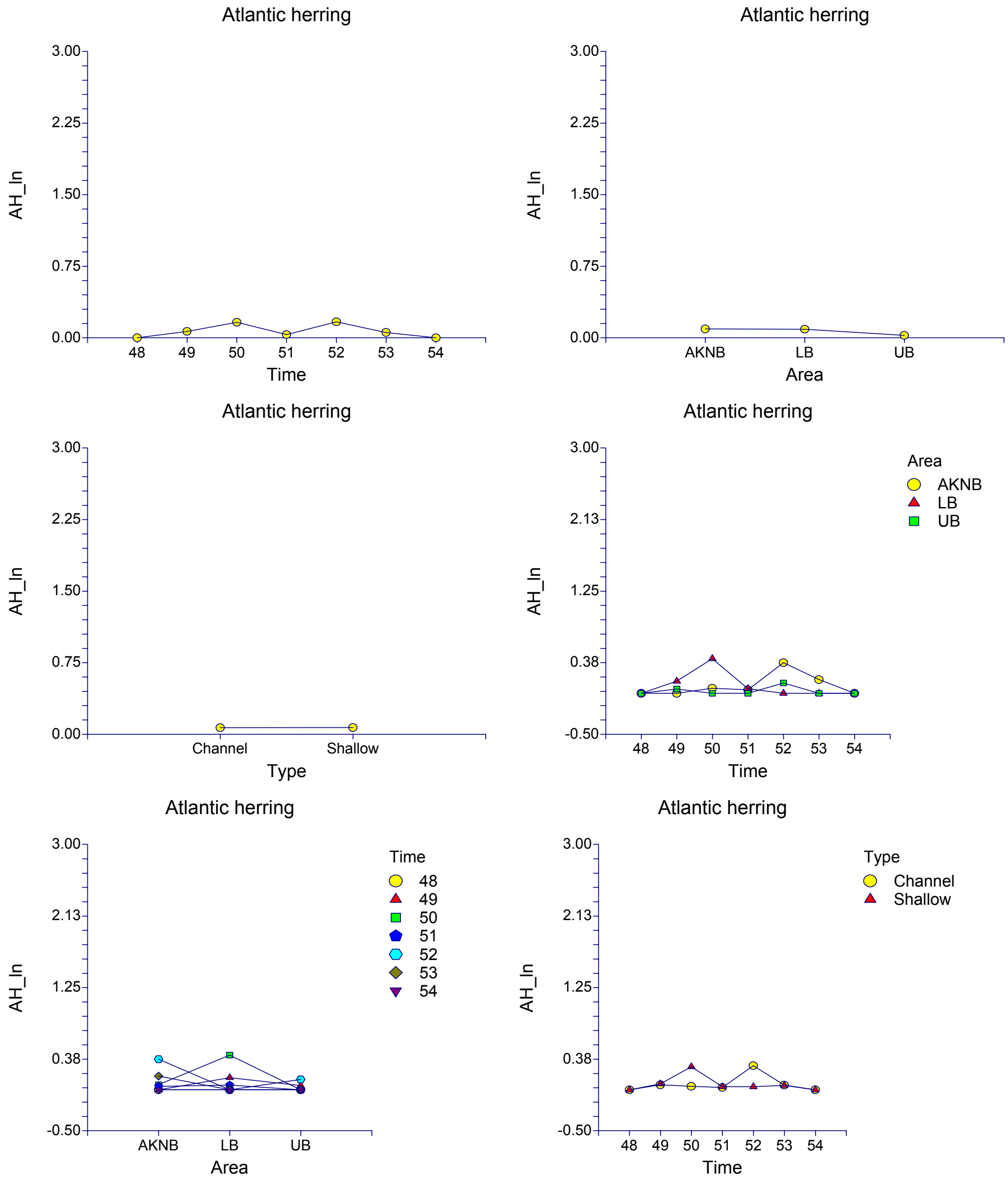


Figure 3.6-1. Atlantic herring trawl CPUE analysis of variance interaction plots.

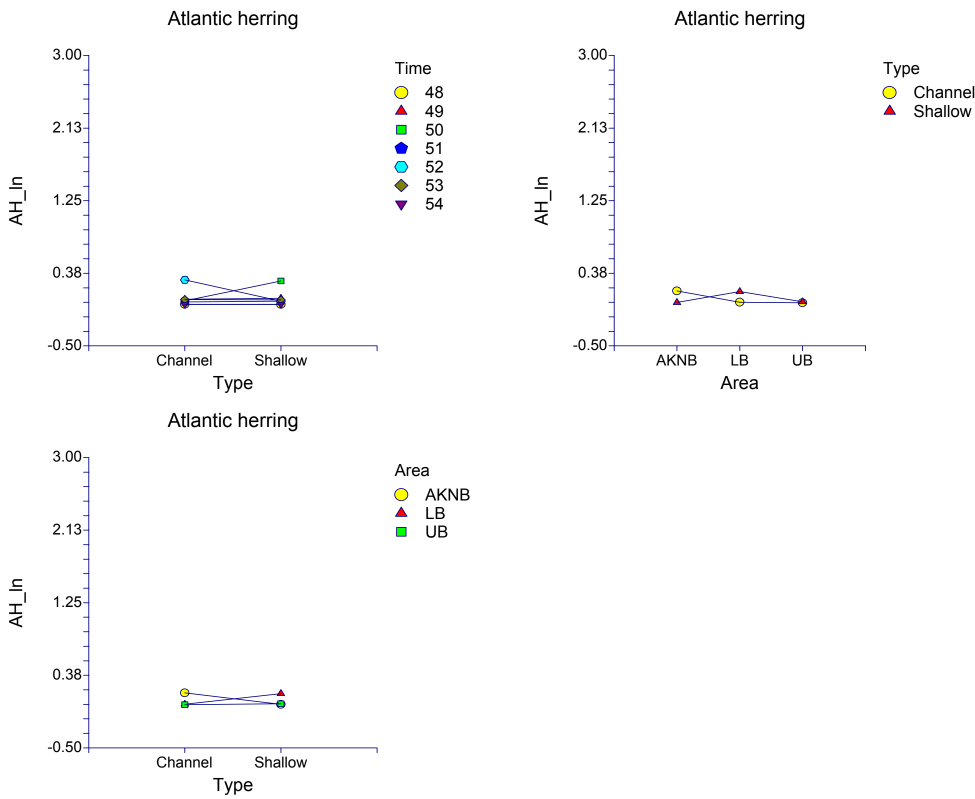


Figure 3.6-1 (Continued). Atlantic herring trawl CPUE analysis of variance interaction plots.

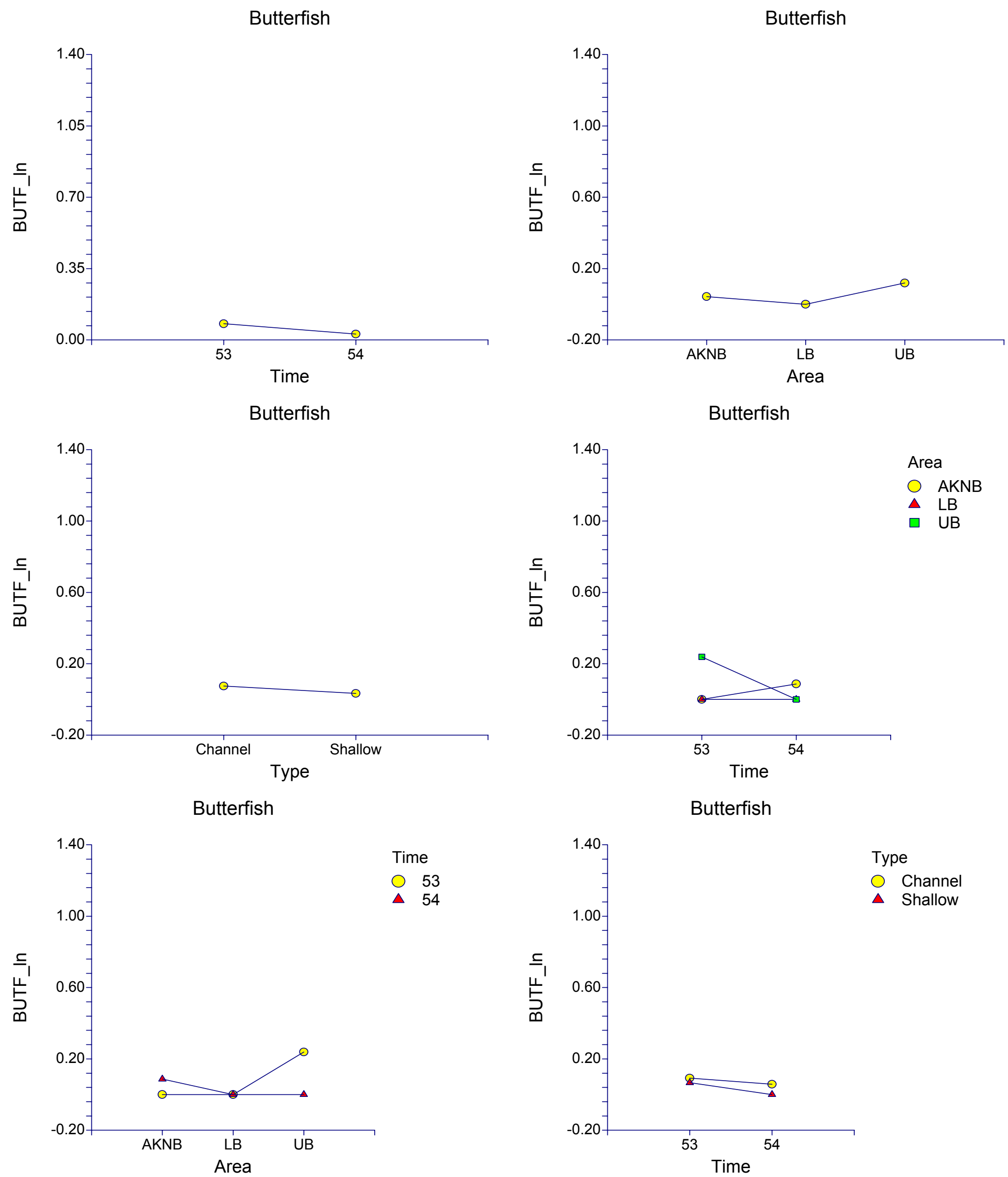


Figure 3.10-1. Butterfish trawl CPUE analysis of variance interaction plots.

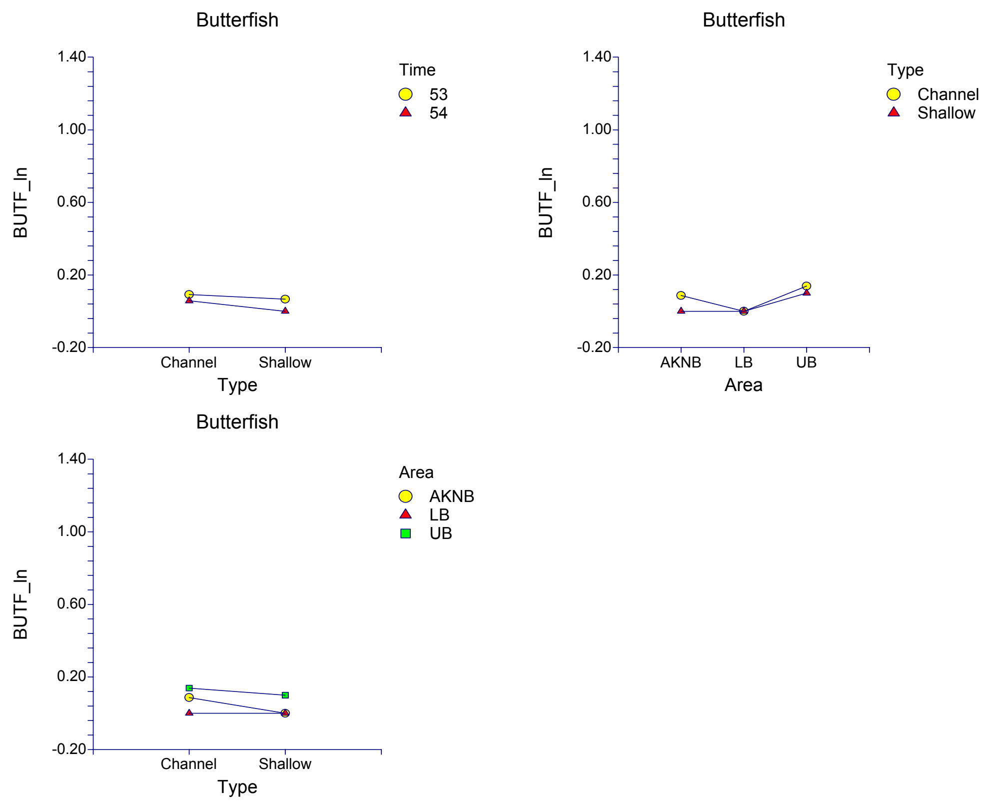


Figure 3.10-1 (Continued). Butterfish trawl CPUE analysis of variance interaction plots.

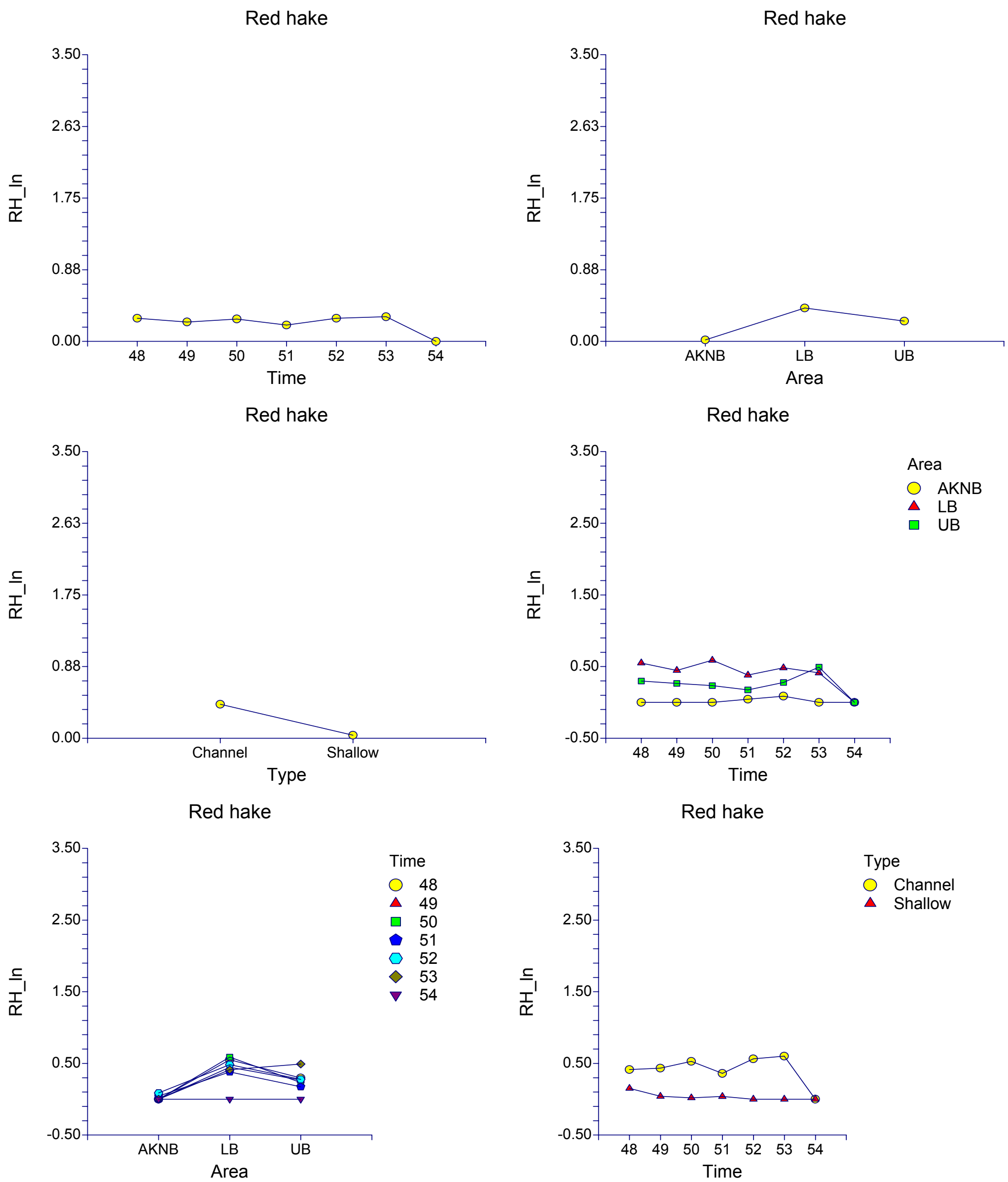


Figure 3.11-1. Red hake trawl CPUE analysis of variance interaction plots.

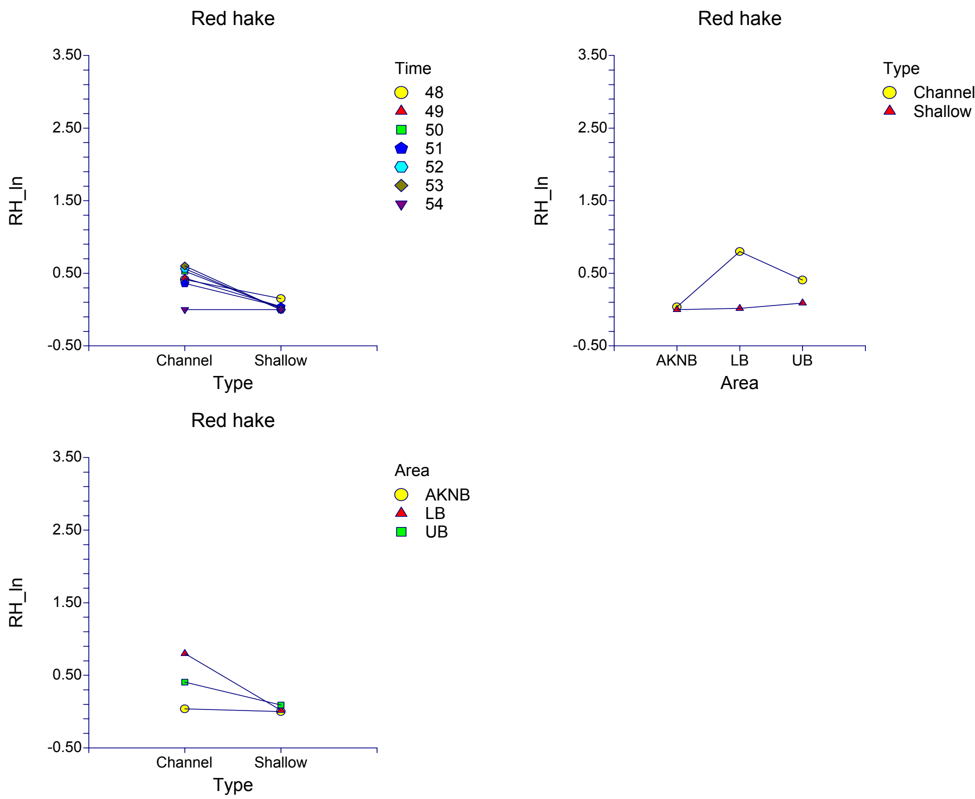


Figure 3.11-1 (Continued). Red hake trawl CPUE analysis of variance interaction plots.

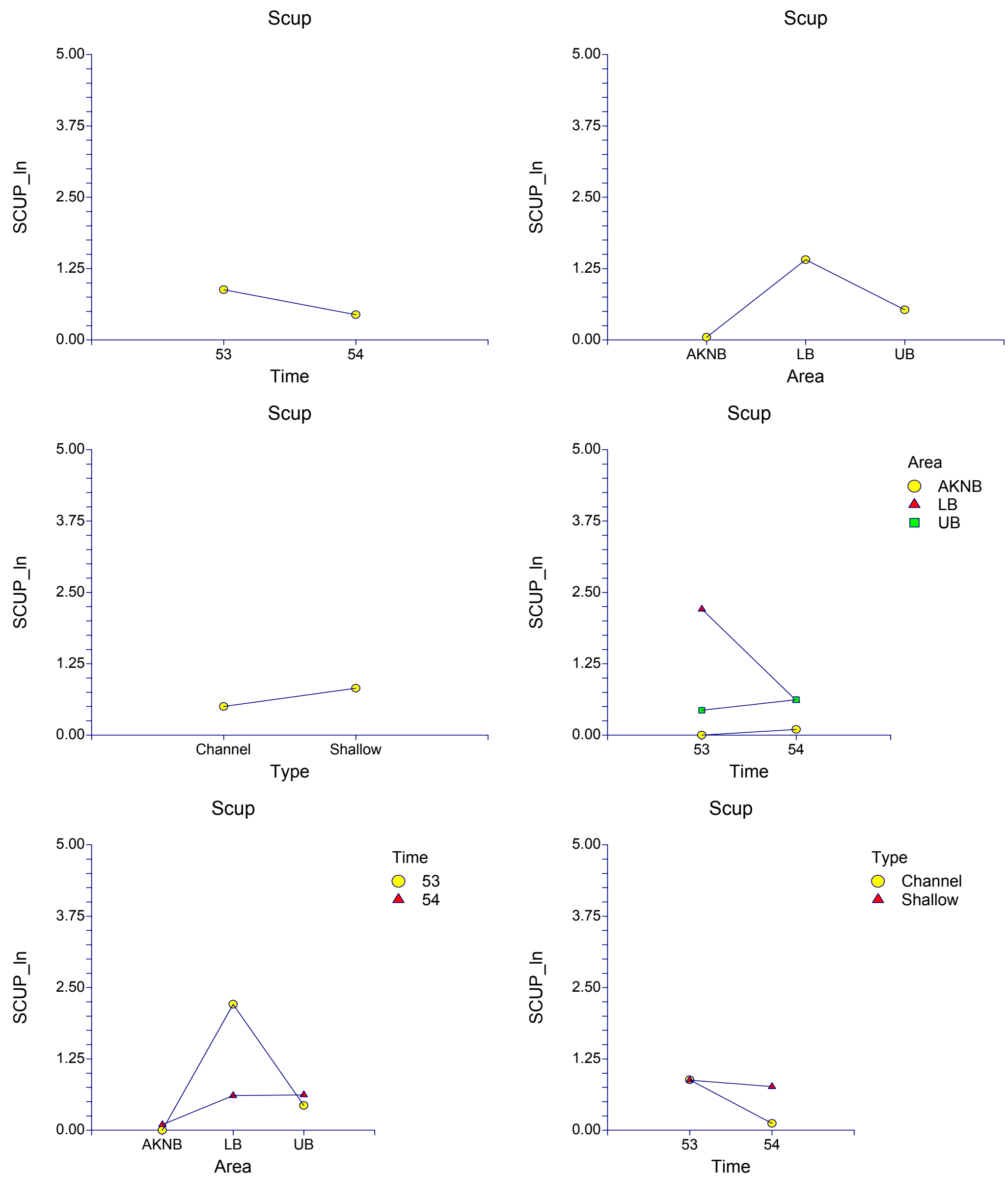


Figure 3-12-1. Scup trawl CPUE analysis of variance interaction plots.

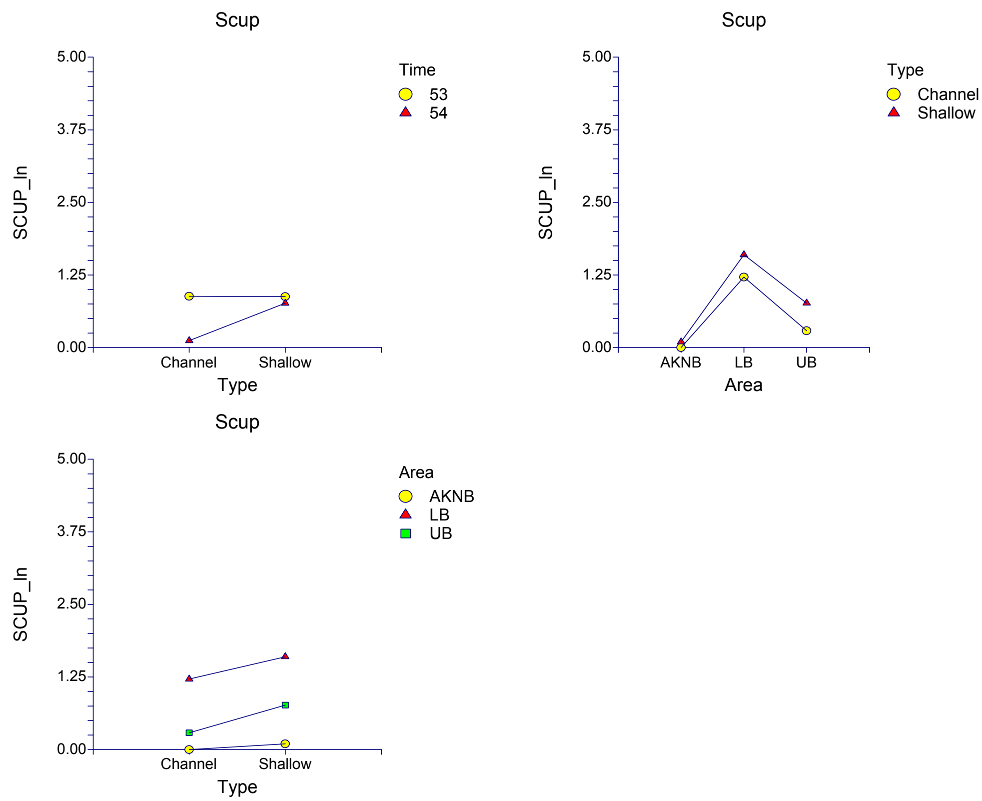


Figure 3.12-1 (Continued). Scup trawl CPUE analysis of variance interaction plots.

APPENDIX A – STATISTICAL METHODS

Descriptive Statistics are values used to summarize a series of observations. They are short-hand descriptors of a series of numbers. Often, a few values describing the essential characteristics of a larger set of numbers are sufficient to provide an understanding.

The *mean* ($\bar{x}$) of a series of observations (x_i) is a measure of the central tendency of the data and is calculated as:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$ **Eq. 1**

where

n = number of observations

A common measure of variability around the mean is the *variance* (s^2). It is the average of the squared deviations from the mean. The use of (*n*-1) rather than *n* corrects for a small bias when the number of observations is small.

$$s^2 = \frac{1}{(n-1)}\sum_{i=1}^{n}(x_i - \bar{x})^2$$ **Eq. 2**

The square root of the variance yields the *standard deviation* (*s* or SD), i.e.,

$$s = \sqrt{\frac{1}{(n-1)}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$ **Eq. 3**

It must be borne in mind that $\bar{x}$ is only an estimate of the true mean of a population (μ). How closely the estimate approximates the true mean is a function of the number of samples taken (*n*) and the degree of variability within the population (σ^2 which is estimated by s^2). It is, therefore, useful to have some measure of our reliability of our estimate of the mean. This can be accomplished using the *standard error of the mean* ($s_{\bar{x}}$ or SE) and the upper and lower *confidence limits*, UCL and LCL, respectively.

$$s_{\bar{x}} = \frac{s}{\sqrt{n}}$$ **Eq. 4**

and

$$s_{\bar{x}} = \frac{s}{\sqrt{n}}$$ **Eq. 5**

$$UCL = \bar{x} + t_{\alpha/2,n-1} s_{\bar{x}}$$ **Eq. 6**

$$LCL = \bar{x} - t_{\alpha/2,n-1} s_{\bar{x}}$$ **Eq. 7**

where,

t	=	critical value from Student's *t* distribution
α	=	value for the desired 1-α confidence interval

For most scientific work, the 95% confidence interval around the mean is estimated, i.e., we are 95% confident that μ lies within the range of *UCL* and *LCL*. For this computation, α is set to 0.05. To obtain the 99% confidence interval, α would be set to 0.01.

Percentiles of the empirical cumulative distribution function (*cdf*) can provide a more complete description of a distribution of data points than just a single measure of central tendency and variability. The cdf can be constructed by ranking all observations from lowest to highest. Various percentiles (*Zp*) may then be computed from:

$$Zp = (1-g)X_{k1} + gX_{k2}$$ **Eq. 8**

where,

k1	=	integer part of $p(n+1)$
k2	=	*k1* + 1
g	=	fractional part of $p(n + 1)$
X_k	=	k^{th} observation when data sorted lowest to highest
p	=	desired percentile as a decimal fraction
n	=	number of observations

The 50th percentile ($p = 0.5$) is a frequently used measure of central tendency called the *median*. It is the value at which 50% of the observations are greater and 50% of the observations are less.

LOWESS or locally weighted robust regression is a computational intensive method that provides a smoothed trend-line through a dataset without being overly sensitive to outliers. The procedure was originally proposed by Cleveland (1979) and further developed by Cleveland and Devlin (1988). For each data point, the method uses a low-degree polynomial fit by weighted least squares to estimate the local response from a subset of nearby data points. More weight is given to data points near the point whose response is being estimated and less weight to points further away. The process continues for all *n* data points. A number of the computational parameters are flexible, particularly the degree of polynomial and the distance weighting coefficient. This gives the user control over the degree of smoothing. The primary advantage of the method is that it does not require the specification of a functional model. Major disadvantages of the method are: (1) it generally requires a large number of data points, and (2) there is no easily conveyed mathematical formula representing the "best fit".

Multiple Linear Regression refers to a group of techniques used to study straight-line relationships between two or more variables. The general statistical model is:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_p x_{ip} + \varepsilon_i \qquad \textbf{Eq. 9}$$

where,

y	=	dependent (response) variable
x	=	independent (predictor) variable(s)
i	=	subscript indicating observation set number
β	=	unknown regression coefficients (to be solved for)
ε	=	the error of i^{th} row

While a number of different techniques are available for finding the solution for β and ε, it is usually accomplished by the method of least squares (i.e., minimizing the sum of the squared differences between the observed response and the predicted response. This model assumes than the relationship between the response variable and the predictor variable(s) is linear or can be transformed to a linear form.

The coefficient of determination, R^2, can be used to test the overall statistical significance of the model. Conceptually, R^2 represents the amount of total variance in the response variable explained by the predictor variables, i.e., 1 - (model error variance divided by total response variance).

When a number of potential predictor variables may be available for a given response variable, it is frequently undesirable and unnecessary to include all of them. In this situation, a systematic method for evaluating each predictor (or set of predictors) is required. In this report, a forward stepwise procedure was used for this purpose. This technique begins with no candidate variables (predictors) in the model. Next, the response variable with the highest R^2 is added to the model. The new model is then fit and the R^2 for the remaining predictors is recomputed. Predictors are added in this manner until no more statistically significant amount of explainable variability remains in the response variable.

Multiple linear regression, as described above, is a special case of a much broader class of models called General Linear Model or GLM. Another variant of the GLM class are Analysis of Variance (ANOVA) models.

ANOVA models are designed to examine the influence of a set of independent (predictor) variables on a response (dependent) variable. In contrast to regression models, which emphasize estimation of the predictor variable effect size on the response variable (through regression coefficients), ANOVA models emphasize mean differences in the response variable. ANOVA models take on a wide variety of forms. One commonly used type, the one-way ANOVA, looks at the influence of a single independent variable on the response parameter. A second type, the factorial ANOVA, examines the effect of one factor across several values of other factors. The factorial design is widely used because it not only allows one to study the individual effects of several factors in a single experiment, but also allows for the study of their interactions. (An interaction is present when the effect on a response variable is different at values of one factor when a second factor is varied).

An example of a factorial model with two independent variables and their interaction is:

$$Y_{ijk} = m + a_i + b_j + (ab)_{ij} + \varepsilon_{ijk} \qquad \textbf{Eq. 10}$$

where $i = 1,2,\ldots,I$; $j = 1,2,\ldots, J$; and $k = 1,2,\ldots,K$. The response variable, Y_{ijk}, is expressed as the sum of five components:

m	=	the mean.
a_i	=	the contribution of the i^{th} level of a factor A.
bj	=	the contribution of the j^{th} level of a factor B.
$(ab)ij$	=	the combined contribution of the ith level of A and the j^{th} level of B.
ε_{ijk}	=	the contribution of the k^{th} individual, or "error".

The statistical significance of effects is tested using an F-test. For the F-test to be valid, the following assumptions must be met:

(1) The response variable is continuous
(2) The ε_{ijk} follow the normal probability distribution with mean equal to zero.
(3) The variances of the ε_{ijk} are equal for all values of i, j, and k.
(4) The individual observations are independent.

Commonly, trawl and ichthyoplankton net samples of fish exhibit a high degree of positive skewness, i.e., while most catches are relatively low, a few extremely large catches may occur. This leads to violation of assumptions (2) and (3) above. Transformation of the catch values to their corresponding logarithms (first adding a constant 1 to avoid the log of zero catch) is generally effective in correcting this problem (Gunderson 1993). Therefore, the following transformation was used prior to ANOVA testing involving trawl or ichthyoplankton catches:

$$Y' = \log_e(CPUE + 1) \qquad \textbf{Eq. 10}$$

Within ANOVA, independent variables (or factors) fall within two types: *fixed factor* and *random factor*. A fixed factor includes all possible levels or the complete set of values to which inferences will be limited. A model with all fixed factors is termed a Model I ANOVA. A random factor is one in which the levels represent a random sample from the larger population of values. A model with all random factors is termed a Model II ANOVA. To illustrate the distinction, Channel versus Shallow or Arthur Kill/Newark Bay versus Upper Bay are considered fixed effects in the present study. The inferences drawn from these factors are restricted to just the habitats or areas specified and not intended to be representative of some broader realm of habitats or locations. Sample date, however, is considered a random effect as the day selected to be sampled was a random selection of all possible sampling times. Inferences are to be generalized over time and are not meant to be restricted solely to the sample date. ANOVA models may contain both fixed and random effects. These are known as Model III ANOVA.

While a wide variety of different ANOVA models are available, only basic two forms were used throughout this report. These two forms are described below.

Randomized Block ANOVA was the most commonly used form of ANOVA throughout this report. This Model III ANOVA was used especially when temporal trends were apparent in the data and comparison needed to be restricted to equivalent dates. For example, to test for differences in water temperature (T) between AREAS (ARTHUR KILL/NEWARK BAY versus UB), the following model was used:

$$T_{\mathrm{ijk}} = m + \mathrm{WEEK}_{\mathrm{i}} + \mathrm{AREA}_{\mathrm{j}} + \mathrm{WEEK}_{\mathrm{i}} \times \mathrm{AREA}_{\mathrm{j}} + \varepsilon_{ijk}$$

where WEEK is a random effect and AREA is a fixed effect.

As it is well known and expected that temperature varies over time, the main effect of WEEK (temperature) is of, therefore, only minor interest. Its function in the model is as a blocking factor, i.e., to restrict the comparison of the other factors to comparable time periods. Of interest in the analysis is the effect of AREA. When compared on a date-by-date basis, is the average temperature of one area significantly different than the other? To address this question, the WEEK × AREA interaction effect is examined first. A significant F-test (i.e., $p \leq 0.05$) indicates that there is a difference between areas, but the magnitude of this difference changes over time. A non-significant F-test ($p > 0.05$) indicates that there is no evidence to suggest that the relationship between areas changes over time and that it is then appropriate to examine the main AREA effect F-test for statistical significance.

Fixed Effects ANOVA was used less frequently throughout this report. This Model I ANOVA was used when time (e.g., WEEK) was not an important consideration, e.g., when analyses were restricted to a short time periods of relatively homogeneous abundance. Typical usage was of the form:

$$CPUE_{\mathrm{ijkl}} = m + \mathrm{YEAR_i} + \mathrm{AREA_j} + \mathrm{TYPE_k} + \mathrm{YEAR_i} \times \mathrm{AREA_j} + \mathrm{YEAR_i} \times \mathrm{TYPE_j} + \mathrm{YEAR_i} \times \mathrm{AREA_j} \times \mathrm{TYPE_j} + \varepsilon_{ijk}$$

where CPUE is restricted to a period of peak abundance and all factors, including TYPE (habitat), are fixed effects. Interpretation of the ANOVA results proceeds in a manner similar to that described above. For more details on the various ANOVA models, see texts such as Cochran and Cox (1957), Milliken and Johnson (1984), or Zar (1998).

Student-Newman-Keuls Test, a type of multiple comparison test, was used to isolate the source of statistical significance once a significant effect was identified using ANOVA. The critical value of the test (q) is calculated as:

$$q = \frac{\overline{X}_B - \overline{X}_A}{\sqrt{\frac{s^2}{n}}} \qquad \textbf{Eq. 11}$$

where $\overline{X}_B$ and $\overline{X}_A$ are means of the two groups being compared and s^2 is the error mean square from the ANOVA.

APPENDIX B - PHYSICAL-CHEMICAL MEASURES

Temperature, Surface and Mid-depth

Surface water temperatures ranged from 2.6ºC to 18.8ºC during the 2000 and 2001 study period (**Table B.1-1**). Mid-depth water temperature patterns were generally similar to those observed in the surface waters but with mid-depth temperatures averaging slightly cooler (**Table B.1-2**). The difference between surface and mid-depth temperatures was greatest in the spring and early summer. Seasonal patterns in water temperatures were typical of northern temperate waters. Winter temperatures at the surface averaged 5.6ºC, 3.3ºC, 4.2ºC and 5.5ºC for December, January, February and March, respectively. Spring and early summer average temperatures rose to 10.3 by April and continued to increase through May (15.9ºC) and June (18.2ºC).

Inspection of surface and mid-depth temperature by area suggests that the Arthur Kill/Newark Bay area is on average somewhat warmer than the Upper Bay. A randomized block design ANOVA and multiple comparison tests indicates differences among areas that are statistically highly significant. Other than WEEK ($p \leq 0.001$, used as the blocking factor), the only statistically significant effects of surface water temperatures were AREA ($p = 0.0012$) and the AREA × WEEK ($p \leq 0.001$) interaction (**Figure B.1-1**). Significant effects for mid-depth water temperatures were WEEK ($p \leq 0.001$, used as the blocking factor), TYPE ($p = 0.003$), AREA ($p = 0.002$) and the AREA × WEEK ($p \leq 0.001$) interaction (**Figure B.1-2**). The greatest difference in average temperature between areas occurred during the warmest weeks.

Overall, surface water temperatures at channel and shallow stations were generally similar over the entire sampling period. The significant TYPE effect in the ANOVA results indicated that mid-depth channel waters averaged slightly cooler (by 0.24ºC) than the shallow stations.

The difference in water temperatures between depths indicates if the water in an area is well mixed and if thermal stratification occurs during the period that the areas are sampled. Based on paired differences, surface and mid-depth temperatures are typically warmer than bottom temperatures. During the early summer, the difference between surface and bottom temperatures may be as much as 1.6ºC (**Figure B.1-3**). During cold periods, however, differences between surface and bottom temperatures tend to be small and at times surface temperatures may actually be somewhat cooler than bottom temperatures. Difference between the mid-depth and bottom temperatures tended to be less than 0.6ºC (**Figure B.1-4**).

Salinity, Surface and Mid-depth

Surface and mid-depth salinity was consistently measured from December 2000 through early June 2001. During that period, surface salinities typically averaged from about 14 to 23 ppt (**Table B.1-3**) and mid-depth salinities ranged from approximately 15 to 24 ppt (**Table B.1-4**). Only during the week of 9 April did salinities drop below this, reaching 6 to 9 ppt at the surface and 9.3 ppt at mid-depth, likely as the result of rains during the previous weeks.

Statistically significant differences in surface salinities were observed for all effects except the TYPE × WEEK and TYPE × WEEK × AREA interaction, while WEEK, AREA, WEEK × AREA and TYPE × AREA interactions were statistically significant effects of mid-depth salinities ($p < 0.01$). These ANOVA results indicated statistically significant greater surface and mid-depth salinities occurred in the Upper Bay than in the Arthur Kill/Newark Bay through time except during the low salinity period of weeks 15 and 17 (**Figure B.1-5 and B.1-6)**

Based on paired differences, surface salinity in the Arthur Kill/Newark Bay averaged approximately 0.3 to 2.4 ppt less than the corresponding bottom salinity while in the Upper Bay differences ranged from 0.6 to 6.7 ppt (**Figure B.1-7**). The greatest difference occurred during week 15 when overall salinities were reduced, likely the result of significant freshwater flows. During the same period, there was only a slight difference (0.8 ppt) between surface and bottom salinities in the Arthur Kill/Newark Bay. Similarly, average differences between mid-depth and bottom salinities range from 0.1 to 1.1 ppt lower than bottom salinities in the Arthur Kill/Newark Bay and from 0.4 to 5.9 ppt lower in the Upper Bay (**Figure B.1-8**). These results suggest that the Arthur Kill/Newark Bay is well mixed while the Upper Bay tends to be more stratified.

TABLE B.1-1 Average surface water temperature (ºC) and ±1 standard deviation by week and area.						
		AK/NB			**Upper Bay**	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**
50	10 DEC '00				6.0±0.3	6.0±0.3
51	17 DEC	5.4±0.3	5.3±0.2		5.7±0.3	5.7±0.4
3	15 JAN '01	3.1±0.1	3.3±0.3		3.2±0.5	3.3±0.6
4	22 JAN				3.2±0.4	3.4±0.4
5	29 JAN	3.6±0.3	3.4±0.1			
7	12 FEB	4.4±0.4	4.8±0.7		3.8±0.2	3.7±0.3
9	26 FEB	4.6±0.1	4.5±0.2		4.1±0.4	3.9±0.2
11	12 MAR	6.3±0.4	6.2±0.4		4.5±0.1	4.6±0.1
13	26 MAR	5.8±0.2	5.8±0.3	5.9±0.0	5.0±0.1	5.0±0.1
15	09 APR	9.7±0.5	9.8±0.3	9.3±0.0	8.1±0.7	8.2±0.5
17	23 APR	12.1±0.6	12.2±0.7	11.5±0.0	10.9±0.4	11.1±0.6
19	07 MAY	16.0±0.6	16.0±1.1	15.8±0.0	14.9±1.1	14.7±0.7
21	21 MAY	17.2±0.5	17.4±0.7	17.0±0.0	15.0±0.1	15.1±0.2
23	04 JUN	18.3±0.4	18.4±0.3	17.8±0.0	17.9±0.2	18.2±0.5

TABLE B.1-2 Average mid-depth water temperature (ºC) and ±1 standard deviation by week and area.						
		AK/NB			**Upper Bay**	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**
50	10 DEC ‘00				6.0±0.2	6.2±0.0
51	17 DEC	5.4±0.3	5.2±0.3		5.9±0.2	5.9±0.2
3	15 JAN ‘01	3.1±0.1	3.2±0.3		3.6±0.3	3.3±0.5
4	22 JAN				3.4±0.2	3.3±0.3
5	29 JAN	3.4 ±0.3	3.4±0.3			
7	12 FEB	3.8±0.2	4.6±0.8		3.6±0.1	3.7±0.2
9	26 FEB	4.1±0.2	4.5±0.4		3.9±0.1	3.7±0.2
11	12 MAR	4.9±0.2	5.3±0.2		4.3±0.1	4.3±0.0
13	26 MAR	5.6±0.2	6.0±0.1	5.8±0.0	4.9±0.1	5.0±0.1
15	09 APR	9.3±0.5	9.7±0.5	8.8±0.0	7.7±0.5	7.8±0.2
17	23 APR	11.7±0.4	12.2±0.8	11.7±0.0	9.7±0.1	10.4±0.4
19	07 MAY	14.8±0.5	14.7±0.5	15.1±0.0	13.2±0.3	13.7±0.8
21	21 MAY	16.7±0.3	17.6±1.6	16.4±0.0	15.0±0.2	14.9±0.1
23	04 JUN	17.5±0.2	18.0±0.6	17.6±0.0	16.7±0.6	17.1±0.3

TABLE B.1-4

Average surface salinity (ppt) and ±1 standard deviation
by week and area.

		AK/NB			Upper Bay	
Week	Start Date	**Channel**	**Shallow**	**Slope**	**Channel**	**Shallow**
50	10 DEC ‘00				23.7±1.6	23.7±1.7
51	17 DEC	18.0±2.5	16.4±3.2		22.8±2.5	22.9±1.4
3	15 JAN ‘01	20.7±1.3	20.1±1.4		20.7±2.1	21.1±2.3
4	22 JAN				22.0±1.4	22.6±1.5
5	29 JAN	19.4±1.2	19.3±1.3			
7	12 FEB	17.7±1.7	17.7±1.5		18.8±2.6	19.8±2.7
9	26 FEB	16.9±2.5	17.7±2.0		19.6±0.8	19.6±1.1
11	12 MAR	15.4±0.9	15.5±1.5		18.9±1.6	18.6±2.0
13	26 MAR	11.7±2.8	11.9±2.1	14.3±0.0	16.7±1.4	17.4±2.1
15	09 APR	9.1±0.6	9.1±0.8	9.8±0.0	6.3±2.0	7.7±1.2
17	23 APR	15.7±1.1	15.8±1.1	16.5±0.0	14.0±1.3	14.7±2.0
19	07 MAY	18.2±0.8	18.2±0.8	18.7±0.0	19.5±1.6	20.0±1.3
21	21 MAY	18.1±1.7	18.1±1.5	19.2±0.0	21.8±0.9	21.2±0.6
23	04 JUN	14.1±3.5	13.9±3.1	16.3±0.0	16.5±1.2	17.1±1.3

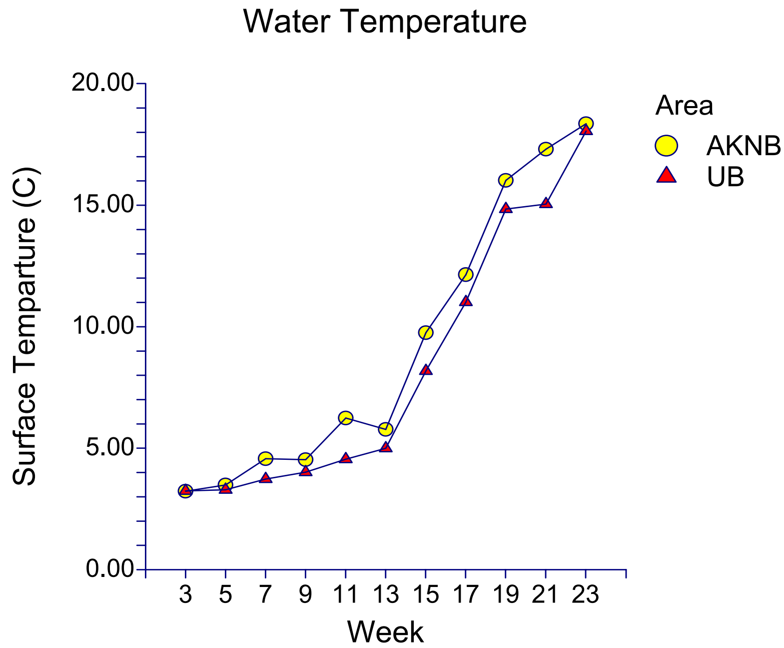


Figure B.1-1. Surface water WEEK × AREA interaction plot from randomized block design ANOVA.

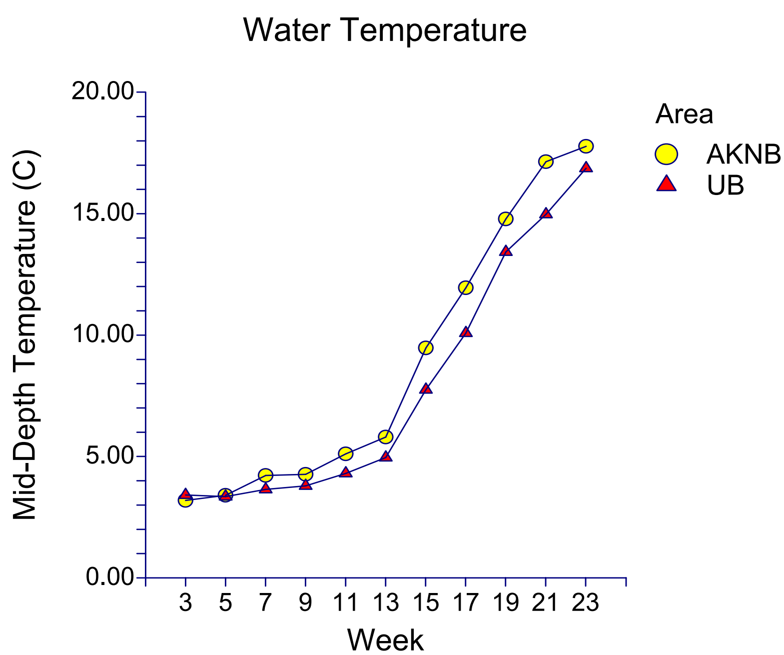


Figure B.1-2. Mid-depth water WEEK x AREA interaction plot from randomized block design

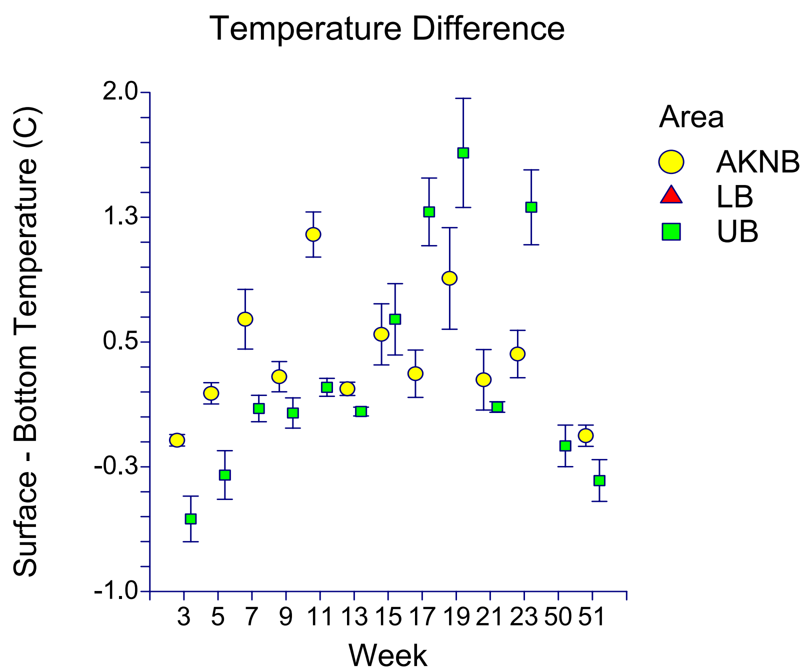


Figure B.1-3. Paired water temperature difference (Surface – Bottom) ± 1 standard error (SE) by WEEK and AREA.

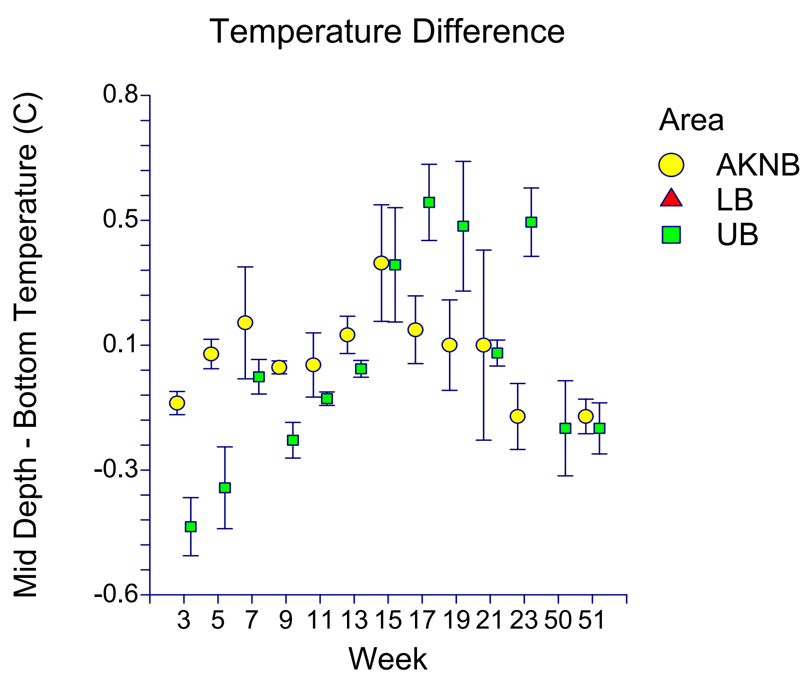


Figure B.1-4. Paired water temperature difference (Mid-depth – Bottom) ± 1 standard error (SE) by WEEK and AREA.

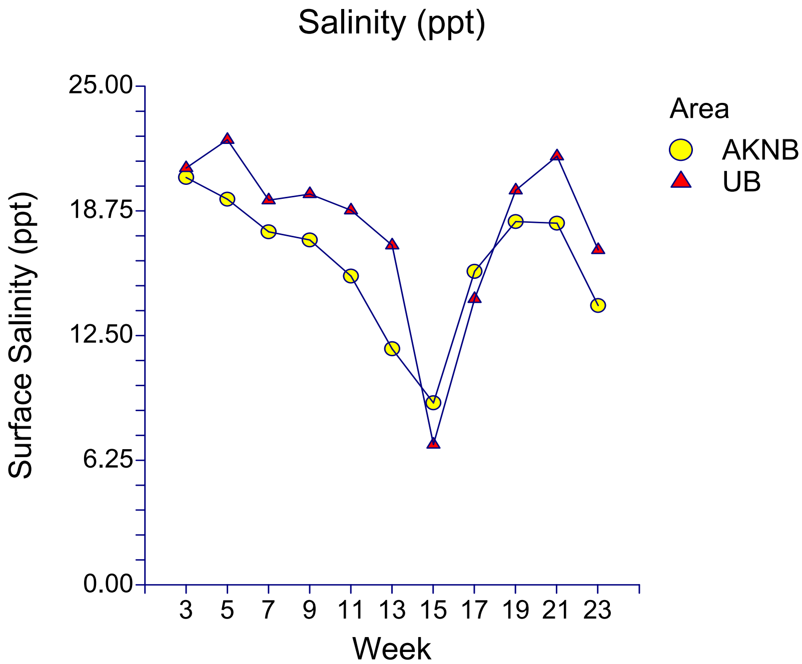


Figure B.1-5. Average surface salinity (ppt) by WEEK × AREA during 2001.

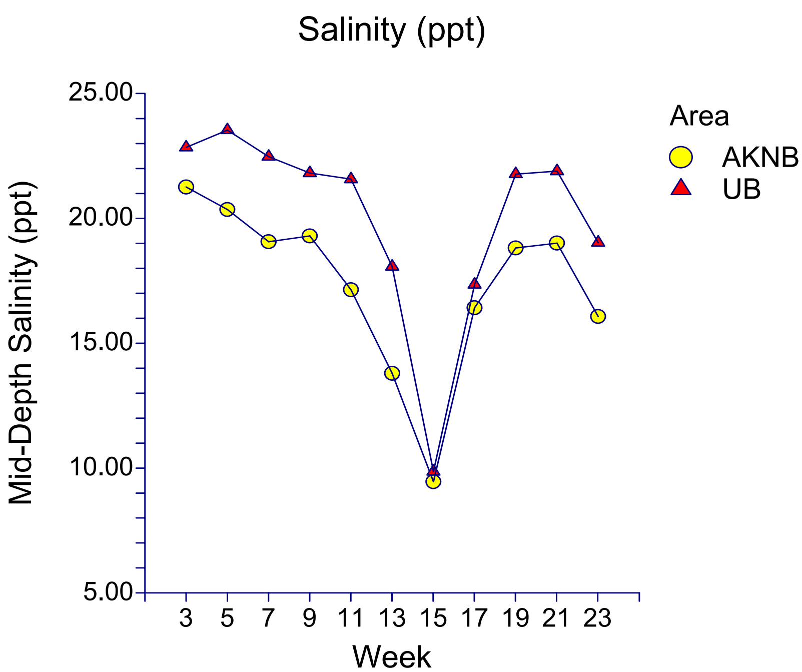


Figure B.1-6. Average mid-depth salinity (ppt) by WEEK × AREA during 2001.

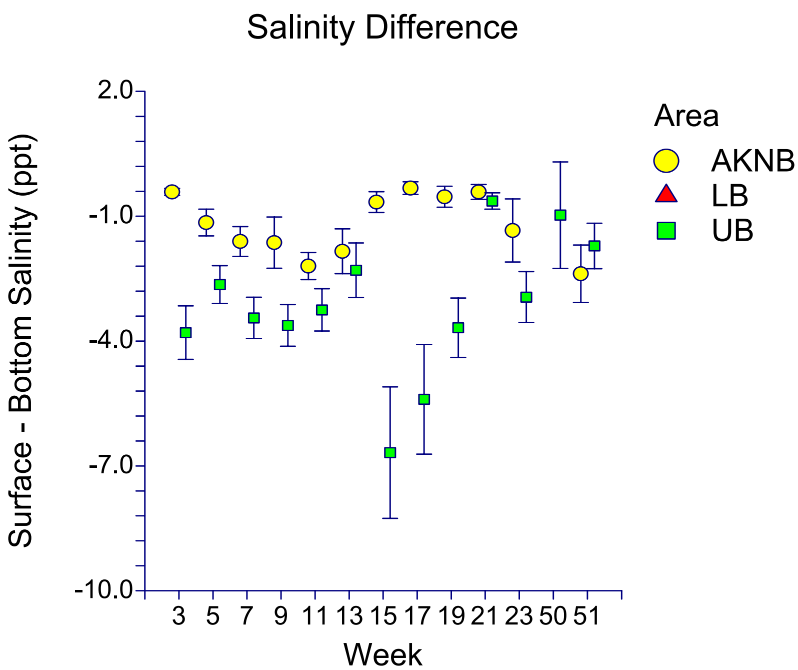


Figure B.1-7. Difference between average surface and bottom salinity (ppt).

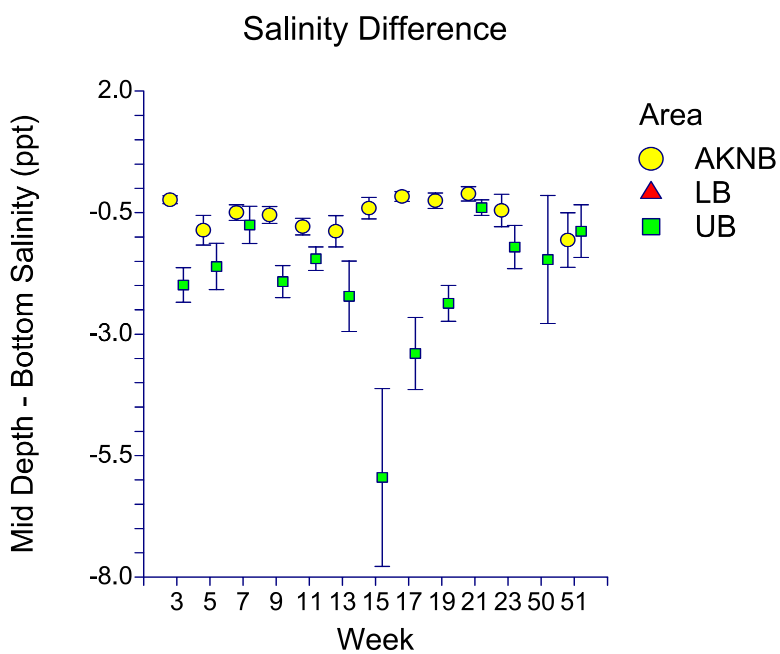


Figure B.1-8. Difference between average mid-depth and bottom salinity (ppt).

Surface Temperature, 2000

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Bronx (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3																														
22-Jan	4																														
29-Jan	5																														
5-Feb	6																														
12-Feb	7																														
19-Feb	8																														
26-Feb	9																														
5-Mar	10																														
12-Mar	11																														
19-Mar	12																														
26-Mar	13																														
2-Apr	14																														
9-Apr	15																														
16-Apr	16																														
23-Apr	17																														
30-Apr	18																														
7-May	19																														
14-May	20																														
21-May	21																														
28-May	22																														
4-Jun	23																														
11-Jun	24																														
18-Jun	25																														
25-Jun	26																														
2-Jul	27																														
9-Jul	28																														
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
27-Aug	35																														
3-Sep	36																														
10-Sep	37																														
17-Sep	38																														
24-Sep	39																														
1-Oct	40																														
8-Oct	41																														
15-Oct	42																														
22-Oct	43																														
29-Oct	44																														
5-Nov	45																														
12-Nov	46																														
19-Nov	47																														
26-Nov	48																														
3-Dec	49																														
10-Dec	50														5.8		6.2		5.8		6.2										
17-Dec	51	5.8	5.6	5.7	5.3			5.3	5.2	5.1	5.4	5.0	5.1	5.2		5.5				5.7		6.0	5.9	5.2	5.9						
24-Dec	52																														

Winter Flounder, YSL

Temperature (°C)	Salinity (ppt) 6 to 8	8 to 10	10 to 12	12 to 14	14 to 16	16 to 18	18 to 20	20 to 22	22 to 24	24 to 26	26 to 28	28 to 30	30 to 32	32 to 34	**TOTAL**	Cum %	
2 to 3								0.0	0.0						0.0	0.0%	0.0
3 to 4							0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0%	0.0
4 to 5					0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0%	0.0
5 to 6			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0%	0.0
6 to 7					0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	0.0
7 to 8	0.0	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0			0.0	0.0%	0.0
8 to 9		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0%	0.0
9 to 10		0.0	0.0			0.0	0.0	0.0	0.0	0.0			0.0		0.0	0.0%	0.0
10 to 11		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0%	0.0
11 to 12					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0%	0.0
12 to 13					0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0%	0.0
13 to 14					0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0%	0.0
14 to 15						0.0	0.0	0.0	0.0						0.0	0.0%	0.0
15 to 16					0.0	0.0	0.0	0.0							0.0	0.0%	0.0
16 to 17						0.0	0.0	0.0							0.0	0.0%	0.0
17 to 18				0.0	0.0	0.0	0.0								0.0	0.0%	0.0
18 to 19			0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0			0.0	0.0%	0.0
19 to 20						0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0%	0.0
20 to 21						0.0	0.0	0.0		0.0					0.0	0.0%	0.0
21 to 22					0.0			0.0							0.0	0.0%	0.0
22 to 23								0.0							0.0	0.0%	0.0
23 to 24								0.0							0.0	0.0%	0.0
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Cumulative %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

Winter Flounder, Eggs

Temperature (°C)	Salinity (ppt) 6 to 8	8 to 10	10 to 12	12 to 14	14 to 16	16 to 18	18 to 20	20 to 22	22 to 24	24 to 26	26 to 28	28 to 30	30 to 32	32 to 34	**TOTAL**	Cum %	
2 to 3								0.0	0.0						0.0	0.0%	0.0
3 to 4							0.0	0.0	0.0	1.4	0.0	0.0			1.4	0.8%	1.4
4 to 5					33.0	0.0	0.0	1.0	0.0	1.6	29.2				64.8	36.6%	66.2
5 to 6			0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.9	2.5			3.6	38.6%	69.8
6 to 7					0.0			20.8	3.0	0.2	0.5	0.0	32.7	6.3	63.5	73.7%	133.3
7 to 8	0.0	0.0	8.3			10.9	0.0	0.4		0.0	1.0	10.8			31.4	91.1%	164.7
8 to 9		0.0	0.0		0.0	7.2	0.0	0.0	0.0	1.5	0.0				8.7	95.9%	173.4
9 to 10		0.0	0.0			0.0	0.0	0.0	0.0	0.0			0.0		0.0	95.9%	173.4
10 to 11		0.0			0.0	0.0	0.0	0.0	3.3	0.0	3.6				6.9	99.7%	180.3
11 to 12					0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0			0.5	100.0%	180.8
12 to 13					0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	100.0%	180.8
13 to 14					0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	100.0%	180.8
14 to 15						0.0	0.0	0.0	0.0						0.0	100.0%	180.8
15 to 16					0.0	0.0	0.0	0.0							0.0	100.0%	180.8
16 to 17						0.0	0.0	0.0							0.0	100.0%	180.8
17 to 18				0.0	0.0	0.0	0.0								0.0	100.0%	180.8
18 to 19			0.0	0.0		0.0		0.0	0.0	0.0	0.0	0.0			0.0	100.0%	180.8
19 to 20						0.0	0.0	0.0	0.0	0.0	0.0				0.0	100.0%	180.8
20 to 21						0.0	0.0	0.0		0.0					0.0	100.0%	180.8
21 to 22					0.0			0.0							0.0	100.0%	180.8
22 to 23								0.0							0.0	100.0%	180.8
23 to 24								0.0							0.0	100.0%	180.8
TOTAL	0.0	0.0	8.3	0.0	33.0	18.1	0.0	22.2	6.5	4.7	35.7	13.3	32.7	6.3			
Cumulative %	0.0%	0.0%	4.6%	4.6%	22.8%	32.9%	32.9%	45.1%	48.7%	51.3%	71.1%	78.4%	96.5%	100.0%			
	0.0	0.0	8.3	8.3	41.3	59.4	59.4	81.6	88.1	92.8	128.5	141.8	174.5	180.8			

Winter Flounder, Eggs

	Dissolved Oxygen (mg/l)												
Turbidity (NTU)	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12	12 to 13	13 to 14	**TOTAL**	Cum %	
0 to 2						0.0						0.0	0.0%	0.0
2 to 4					0.0	0.0	0.0	0.0				0.0	0.0%	0.0
4 to 6				0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0%	0.0
6 to 8				0.0	0.0	0.0	0.0	0.4	4.7		0.0	5.1	3.9%	5.1
8 to 10		0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	3.9%	5.1
10 to 12		0.0	0.0	0.0	0.0		0.0	0.6		0.0		0.6	4.3%	5.7
12 to 14		0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0		4.2	7.5%	9.9
14 to 16			0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	7.5%	9.9
16 to 18				0.0	0.0		5.4	3.0	0.0	0.0		8.4	13.9%	18.3
18 to 20				0.0			0.0	0.0	14.5			14.5	24.9%	32.8
20 to 22			0.0		0.0			0.0				0.0	24.9%	32.8
22 to 24	0.0							0.0				0.0	24.9%	32.8
24 to 26				0.0				0.0				0.0	24.9%	32.8
26 to 28							0.0		0.0			0.0	24.9%	32.8
28 to 30					0.0			33.0				33.0	50.0%	65.8
30 to 32					0.0			0.0	0.0			0.0	50.0%	65.8
32 to 34				0.0								0.0	50.0%	65.8
36 to 38					0.0							0.0	50.0%	65.8
40 to 42							0.0					0.0	50.0%	65.8
46 to 48						0.0						0.0	50.0%	65.8
50 to 52					0.0							0.0	50.0%	65.8
62 to 64					0.0									
76 to 78								0.0						
82 to 84							0.0							
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	9.6	37.0	19.2	0.0	0.0	65.8	100.0%	131.6
Cumulative %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.6%	70.8%	100.0%	100.0%	100.0%			
	0.0	0.0	0.0	0.0	0.0	0.0	9.6	46.6	65.8	65.8	65.8			

Surface Temperature, 2002

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Bronx (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3																														
22-Jan	4																														
29-Jan	5																														
5-Feb	6																														
12-Feb	7																														
19-Feb	8																														
26-Feb	9																														
5-Mar	10																														
12-Mar	11																														
19-Mar	12																		7.2												
26-Mar	13																														
2-Apr	14																														
9-Apr	15																														
16-Apr	16																														
23-Apr	17																														
30-Apr	18																														
7-May	19																														
14-May	20																														
21-May	21																														
28-May	22																														
4-Jun	23																														
11-Jun	24																														
18-Jun	25																														
25-Jun	26																														
2-Jul	27																														
9-Jul	28																														
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
27-Aug	35																														
3-Sep	36																														
10-Sep	37																														
17-Sep	38																														
24-Sep	39																														
1-Oct	40																														
8-Oct	41																														
15-Oct	42																														
22-Oct	43																														
29-Oct	44																														
5-Nov	45																														
12-Nov	46																														
19-Nov	47																														
26-Nov	48																														
3-Dec	49																														
10-Dec	50																														
17-Dec	51																														
24-Dec	52																														

Surface Temperature, 2001

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Bronx (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3	3.1	3.0	3.0	3.7			3.3	3.1	3.2	3.6	3.5	3.0	3.1	2.6	3.0	2.8	2.7	3.1	4.0	3.0	3.5	4.1	3.8	3.1						
22-Jan	4														2.9	2.9	2.9	3.0	3.7	3.6	2.9	3.5	34.0	3.5	4.0						
29-Jan	5	3.6	4.0	3.4	3.6			3.3	3.5	3.6	3.2	3.3	3.3	3.4																	
5-Feb	6																														
12-Feb	7	4.1	4.1	4.2	5.3			5.0	4.5	4.2	5.3	5.3	4.6	3.8	3.9	3.6	3.2	3.3	3.8	3.9	3.6	3.9	3.9	4.0	3.9						
19-Feb	8																														
26-Feb	9	4.4	4.8	4.4	4.9			4.6	4.6	4.5	4.4	4.4	4.5	4.2	4.0	4.3	4.1	4.0	4.2	3.6	4.6	3.9	3.7	3.6	4.1						
5-Mar	10																														
12-Mar	11	5.6	6.3	6.2	5.5			6.3	6.5	6.7	6.8	6.5	6.2	6.0	4.6	4.4	4.8	4.6	4.6	4.5	4.4	4.6	4.5	4.5	4.6						
19-Mar	12																														
26-Mar	13	5.9	6.1	6.0	6.2	5.9	5.9	5.6	5.6	5.6	5.7	5.7	5.6	5.5	4.9	4.9	4.9	4.9	4.9	5.2	5.0	5.0	5.1	5.0	5.1						
2-Apr	14																														
9-Apr	15	9.0	9.4	9.3	9.7	9.3	9.3	10.2	10.2	9.8	10.0	10.1	9.8	9.8	9.3	8.4	8.2	7.8	8.7	7.6	7.5	7.8	8.9	8.2	7.6						
16-Apr	16																														
23-Apr	17	11.6	11.7	11.6	12.7	11.5	11.5	12.8	12.7	11.5	12.8	12.9	11.9	11.4	11.6	10.8	11.7	12.0	10.8	10.6	11.1	10.5	10.5	10.9	10.7						
30-Apr	18																														
7-May	19	15.7	15.2	15.7	18.0	15.8	15.8	16.1	16.3	16.8	16.0	16.1	15.3	15.0	16.0	15.8	16.0	14.6	14.1	14.2	15.2	13.5	14.5	14.3	14.9						
14-May	20																														
21-May	21	16.6	17.3	16.6	18.5	17.0	17.0	17.9	17.3	17.1	17.6	17.5	17.3	16.7	15.2	15.1	15.0	15.1	15.5	15.0	15.0	14.8	14.9	14.9	15.0						
28-May	22																														
4-Jun	23	17.8	18.0	17.8	18.6	17.8	17.8	18.8	18.5	18.3	18.6	18.5	18.7	18.3	18.0	18.1	17.5	18.4	18.4	17.8	17.7	17.8	18.7	18.5	17.8						
11-Jun	24																														
18-Jun	25																														
25-Jun	26																														
2-Jul	27																														
9-Jul	28																														
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
27-Aug	35																														
3-Sep	36																														
10-Sep	37																														
17-Sep	38																														
24-Sep	39																														
1-Oct	40																														
8-Oct	41																														
15-Oct	42																														
22-Oct	43																														
29-Oct	44																														
5-Nov	45																														
12-Nov	46																														
19-Nov	47																														
26-Nov	48																														
3-Dec	49																														
10-Dec	50																														
17-Dec	51																														
24-Dec	52																														

Windowpane Flounder, Eggs

Temperature (°C)	Salinity (ppt) 6 to 8	8 to 10	10 to 12	12 to 14	14 to 16	16 to 18	18 to 20	20 to 22	22 to 24	24 to 26	26 to 28	28 to 30	30 to 32	32 to 34	TOTAL	Cum %	
2 to 3								0.0	0.0						0.0	0.0%	0.0
3 to 4							0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0%	0.0
4 to 5					0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0%	0.0
5 to 6			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0%	0.0
6 to 7					0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	0.0
7 to 8	0.0	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0			0.0	0.0%	0.0
8 to 9		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0%	0.0
9 to 10		0.0	0.0			0.0	0.0	0.0	0.0	0.0			0.0		0.0	0.0%	0.0
10 to 11		0.0			0.0	0.0	0.0	0.0	0.0	0.0	5.2				5.2	0.0%	5.2
11 to 12					0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0			4.2	0.1%	9.4
12 to 13					0.0	0.0	0.0	0.0	34.0	181.2	0.0				215.2	1.8%	224.6
13 to 14					0.0	0.0	0.0	0.9	13.2	31.6	0.0				45.7	2.2%	270.3
14 to 15						0.0	10.5	122.3	838.6						971.4	10.1%	1241.7
15 to 16					0.0	0.0	0.0	327.5							327.5	12.7%	1569.2
16 to 17						286.6	1189.9	2212.3							3688.8	42.6%	5258.0
17 to 18				0.0	347.4	421.3	35.3								804.0	49.1%	6062.0
18 to 19			5.7	39.4		195.3		1145.4	1101.1	460.0	6.4	0.0			2953.3	73.1%	9015.3
19 to 20						369.2	30.2	2414.8	393.4	25.3	58.3				3291.2	99.8%	12306.5
20 to 21						0.0	0.0	0.0		30.1					30.1	100.0%	12336.6
21 to 22					0.0			0.0							0.0	100.0%	12336.6
22 to 23								0.0							0.0	100.0%	12336.6
23 to 24								0.0							0.0	100.0%	12336.6
TOTAL	0.0	0.0	5.7	39.4	347.4	1272.4	1265.9	6223.2	2380.3	732.4	69.9	0.0	0.0	0.0			
Cumulative %	0.0%	0.0%	0.0%	0.4%	3.2%	13.5%	23.8%	74.2%	93.5%	99.4%	100.0%	100.0%	100.0%	100.0%			
	0.0	0.0	5.7	45.1	392.5	1664.9	2930.8	9154.0	11534.3	12266.7	12336.6	12336.6	12336.6	12336.6			

APPENDIX C – ICHTHYOPLANKTON STUDIES

Winter flounder egg densities sampled from the New York/New Jersey Harbor during the 1998-1999 sampling program.

	Harbor Wide (HW)										Port Jersey (PJ)						South Brooklyn (SB)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**
Month																				
JAN																				
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAR	119.3	9.0	578.7	100.9	13.3	14.4	30.9	42.6	10.0	9.0	51.2	39.3	11.6	5.5	59.1	17.6	129.9	54.5	73.1	98.0
APR	149.5	11.4	18.8	16.3	0.0	5.6	0.0	4.0	0.0	4.7	0.0	92.5	1089.7	53.5	557.7	58.4	59.8	123.9	21.9	70.2
MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUL																				
AUG																				
SEP																				
OCT																				
NOV																				
DEC																				

Winter flounder egg densities sampled from the New York/New Jersey Harbor during the 2000-2001 sampling program.

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Brooklyn (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
22-Jan	4														0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
29-Jan	5	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
5-Feb	6																														
12-Feb	7	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
19-Feb	8																														
26-Feb	9	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7	9.3	8.3	0.0	0.0	0.0						
5-Mar	10																														
12-Mar	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
19-Mar	12																														
26-Mar	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	65.9	0.0	0.0	6.4	0.0	0.0	0.0	0.0						
2-Apr	14																														
9-Apr	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	10.5	0.0	0.0	0.0	21.5	14.5	10.9	0.0	0.0	0.0						
16-Apr	16																														
23-Apr	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
30-Apr	18																														
7-May	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
14-May	20																														
21-May	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
28-May	22																														
4-Jun	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
11-Jun	24																														
18-Jun	25																														
25-Jun	26																														
2-Jul	27																														
9-Jul	28																														
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
27-Aug	35																														
3-Sep	36																														
10-Sep	37																														
17-Sep	38																														
24-Sep	39																														
1-Oct	40																														
8-Oct	41																														
15-Oct	42																														
22-Oct	43																														
29-Oct	44																														
5-Nov	45																														
12-Nov	46																														
19-Nov	47																														
26-Nov	48																														
3-Dec	49																														
10-Dec	50																														
17-Dec	51																														
24-Dec	52																														

Winter flounder egg densities sampled from the New York/New Jersey Harbor during the 2001-2002 sampling program.

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Brooklyn (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3																														
22-Jan	4	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29-Jan	5																														
5-Feb	6	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-Feb	7																														
19-Feb	8	0.0	0.0	0.0	0.0				0.0	0.0		5.2	0.0	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.2	0.0	233.2
26-Feb	9																														
5-Mar	10	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	15.2	0.0	0.0	0.0	95.5	0.0	0.0		1.4	0.0	0.0	0.0	3.7	0.0	7.4	2.2	0.0	2.7
12-Mar	11																														
19-Mar	12	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	4.2	2.0	2.2	0.0	0.0	0.0	0.0	0.0	1.5	32.3	0.0	77.9	0.0	6.1
26-Mar	13																														
2-Apr	14	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
9-Apr	15																														
16-Apr	16	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0
23-Apr	17																														
30-Apr	18	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	6.6	10.6
7-May	19																														
14-May	20	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21-May	21																														
28-May	22																														
4-Jun	23	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-Jun	24																														
18-Jun	25	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25-Jun	26																														
2-Jul	27																														
9-Jul	28	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
27-Aug	35																														
3-Sep	36																														
10-Sep	37																														
17-Sep	38																														
24-Sep	39																														
1-Oct	40																														
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3-Dec	49																														
10-Dec	50																														
17-Dec	51																														
24-Dec	52																														

Winter flounder yolk sac larvae densities sampled from the New York/New Jersey Harbor during the 1998-1999 sampling program.

	Harbor Wide (HW)										Port Jersey (PJ)						South Brooklyn (SB)			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	1	2	3	4
Month																				
JAN																				
FEB	0.0	5.8	5.7	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	3.1
MAR	5.0	40.7	0.0	28.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	0.0	7.0
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.3	4.5	0.0	0.0	0.0	39.9	0.0	0.0	0.0
MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUL																				
AUG																				
SEP																				
OCT																				
NOV																				
DEC																				

Winter flounder yolk sac larvae densities sampled from the New York/New Jersey Harbor during the 2000-2001 sampling program.

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Brooklyn (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
22-Jan	4														0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
29-Jan	5	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
5-Feb	6																														
12-Feb	7	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
19-Feb	8																														
26-Feb	9	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	10.7	0.0	0.0	0.0	0.0	0.0						
5-Mar	10																														
12-Mar	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2						
19-Mar	12																														
26-Mar	13	5.3	9.5	22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	0.0	0.0	39.5	0.0	94.3	0.0	0.0	0.0	0.0	7.6						
2-Apr	14																														
9-Apr	15	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	0.0	59.8	0.0	14.9	0.0	0.0	0.0	0.0	15.6	0.0						
16-Apr	16																														
23-Apr	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0.0	6.0	0.0	188.5	57.9	0.0	0.0						
30-Apr	18																														
7-May	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
14-May	20																														
21-May	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
28-May	22																														
4-Jun	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
11-Jun	24																														
18-Jun	25																														
25-Jun	26																														
2-Jul	27																														
9-Jul	28																														
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
27-Aug	35																														
3-Sep	36																														
10-Sep	37																														
17-Sep	38																														
24-Sep	39																														
1-Oct	40																														
8-Oct	41																														
15-Oct	42																														
22-Oct	43																														
29-Oct	44																														
5-Nov	45																														
12-Nov	46																														
19-Nov	47																														
26-Nov	48																														
3-Dec	49																														
10-Dec	50																														
17-Dec	51																														
24-Dec	52																														

Winter flounder yolk sac larvae densities sampled from the New York/New Jersey Harbor during the 2001-2002 sampling program.

		Arthur Kill / Newark Bay													Upper Bay												Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Brooklyn (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3																														
22-Jan	4	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29-Jan	5																														
5-Feb	6	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.2	0.0	0.0	0.0	39.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-Feb	7																														
19-Feb	8	0.0	0.0	0.0	17.5				0.0	14.8		10.4	5.5	0.0	20.3	10.1	0.0	0.0	8.2	49.2	0.0	10.0	33.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85.3
26-Feb	9																														
5-Mar	10	66.8	19.8	0.0	0.0				2.9	5.0		0.0	15.1	13.3	8.8	29.9	0.0	1.9	0.0	5.7		20.1	0.0	0.0	0.0	3.5	7.1	65.6	6.3	8.7	14.4
12-Mar	11																														
19-Mar	12	0.0	0.0	0.0	0.0				4.8	0.0		0.0	4.8	4.3	2.0	0.0	10.1	10.8	2.0	58.4	12.3	0.0	47.3	0.0	11.7	4.5	5.2	1.9	2.2	1.7	4.1
26-Mar	13																														
2-Apr	14	4.4	0.0	52.9	9.1				8.4	8.7		5.3	25.4	0.0	18.7	14.3	9.8	2.4	0.0	65.4	5.1	31.0	0.0	4.9	2.6	10.1	22.9	121.3	37.2	35.3	165.6
9-Apr	15																														
16-Apr	16	0.0	12.5	0.0	14.0				4.1	0.0		0.0	12.6	0.0	6.6	2.0	8.2	0.0	0.0	21.6	18.3	19.7	5.8	3.5	0.0	5.8	7.7	47.8	0.0	2.1	46.4
23-Apr	17																														
30-Apr	18	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-May	19																														
14-May	20	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21-May	21																														
28-May	22																														
4-Jun	23	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-Jun	24																														
18-Jun	25	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25-Jun	26																														
2-Jul	27																														
9-Jul	28	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
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19-Nov	47																														
26-Nov	48																														
3-Dec	49																														
10-Dec	50																														
17-Dec	51																														
24-Dec	52																														

Winter flounder post-yolk sac larvae densities sampled from the New York/New Jersey Harbor during the 1998-1999 sampling program.

	Harbor Wide (HW)										Port Jersey (PJ)						South Brooklyn (SB)			
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**
JAN																				
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAR	5.0	4.5	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
APR	46.0	1240.0	9.4	130.5	72.1	66.9	55.7	36.2	32.0	33.0	776.7	108.8	9.1	129.9	0.0	129.7	0.0	49.6	153.5	28.1
MAY	0.0	0.0	0.0	0.0	12.6	0.0	0.0	11.7	0.0	31.2	0.0	0.0	0.0	8.4	0.0	6.2	0.0	20.7	0.0	0.0
JUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUL																				
AUG																				
SEP																				
OCT																				
NOV																				
DEC																				

Winter flounder post-yolk sac larvae densities sampled from the New York/New Jersey Harbor during the 2000-2001 sampling program.

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Brooklyn (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
22-Jan	4														0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
29-Jan	5	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
5-Feb	6																														
12-Feb	7	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
19-Feb	8																														
26-Feb	9	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.2	4.5	0.0	0.0	4.1	0.0	0.0	0.0						
5-Mar	10																														
12-Mar	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4	10.7	0.0	25.0						
19-Mar	12																														
26-Mar	13	5.3	19.0	27.9	17.6	0.0	8.7	7.1	0.0	0.0	0.0	0.0	0.0	0.0	15.1	0.0	6.1	19.8	5.1	120.7	0.0	0.0	10.3	15.2	3.8						
2-Apr	14																														
9-Apr	15	0.0	0.0	6.2	0.0	0.0	0.0	5.8	5.7	0.0	0.0	5.2	5.0	24.7	23.8	47.1	164.5	49.5	49.6	0.0	0.0	65.7	47.0	78.1	13.8						
16-Apr	16																														
23-Apr	17	115.0	84.4	134.1	174.6	93.0	26.6	75.5	138.8	75.0	37.4	42.6	120.3	105.9	779.1	313.1	22.1	35.4	39.4	53.7	90.1	1566.8	254.9	33.4	65.5						
30-Apr	18																														
7-May	19	198.0	17.2	64.0	36.3	548.8	117.6	27.1	29.3	77.6	20.7	15.3	61.1	47.1	205.9	284.8	24.0	21.0	5.4	90.4	23.5	223.5	0.0	46.7	34.8						
14-May	20																														
21-May	21	12.3	41.9	0.0	0.0	0.0	12.9	8.2	15.9	0.0	7.5	0.0	0.0	0.0	27.6	130.2	6.6	6.4	0.0	71.8	89.5	105.4	0.0	53.6	5.1						
28-May	22																														
4-Jun	23	0.0	227.7	0.0	5.2	13.5	21.5	134.5	57.1	8.8	11.5	0.0	0.0	0.0	0.0	18.8	15.3	0.0	0.0	34.2	0.0	7.3	0.0	0.0	0.0						
11-Jun	24																														
18-Jun	25																														
25-Jun	26																														
2-Jul	27																														
9-Jul	28																														
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
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26-Nov	48																														
3-Dec	49																														
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24-Dec	52																														

Winter flounder post-yolk sac larvae densities sampled from the New York/New Jersey Harbor during the 2001-2002 sampling program.

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Brooklyn (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
Week																															
1-Jan	1																														
8-Jan	2																														
15-Jan	3																														
22-Jan	4	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29-Jan	5																														
5-Feb	6	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-Feb	7																														
19-Feb	8	5.1	0.0	5.5	11.7				0.0	4.9		5.2	0.0	0.0	25.3	5.1	0.0	6.5	32.9	334.8	5.3	43.5	226.0	8.4	8.1	18.1	0.0	0.0	11.1	4.9	17.1
26-Feb	9																														
5-Mar	10	30.8	19.8	9.3	0.0				2.9	24.4		48.7	120.7	58.0	45.5	82.5	18.3	29.4	17.0	43.7		25.9	0.0	0.0	6.2	53.2	247.9	33.6	39.9	54.6	38.8
12-Mar	11																														
19-Mar	12	0.0	8.6	0.0	24.7				27.9	0.0		76.3	58.3	152.0	116.1	102.8	113.2	32.3	57.1	103.9	28.6	43.5	767.4	490.5	277.1	221.9	142.7	510.5	58.4	83.5	52.9
26-Mar	13																														
2-Apr	14	8.9	16.6	33.6	91.4				29.4	17.7		7.9	130.5	10.5	115.4	66.3	55.5	19.7	11.1	54.5	39.3	183.6	76.1	23.7	12.2	79.4	550.3	859.5	270.0	313.7	326.3
9-Apr	15																														
16-Apr	16	58.1	83.1	162.0	107.7				88.0	37.0		54.5	117.9	29.8	99.8	124.9	157.9	34.7	58.8	153.0	141.0	259.7	116.7	56.5	99.2	744.0	1085.9	2201.5	105.8	218.3	559.6
23-Apr	17																														
30-Apr	18	164.9	101.9	63.8	0.0				44.8	40.0		79.5	18.7	7.2	15.6	144.6	38.7	16.6	12.9	52.9	126.9	152.0	92.0	23.3	278.8	337.2	71.5	118.5	128.0	60.2	88.0
7-May	19																														
14-May	20	48.4	41.0	6.0	0.0				12.2	4.3		0.0	0.0	8.0	2.4	8.5	0.0	52.2	0.0	61.7	9.7	5.0	0.0	33.1	0.0	0.0	31.3	0.0	1.8	0.0	4.7
21-May	21																														
28-May	22																														
4-Jun	23	0.0	5.1	0.0	0.0				4.1	4.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-Jun	24																														
18-Jun	25	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25-Jun	26																														
2-Jul	27																														
9-Jul	28	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
27-Aug	35																														
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17-Dec	51																														
24-Dec	52																														

Windowpane flounder egg densities sampled from the New York/New Jersey Harbor during the 1998-1999 sampling program.

	Harbor Wide (HW)										**Port Jersey (PJ)**						**South Brooklyn (SB)**			
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**
JAN																				
FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAY	31.9	13.8	0.0	150.3	6.3	3.8	4.8	50.6	12.8	31.2	44.9	5.5	14.4	4.2	0.0	12.4	12.5	51.7	8.4	34.0
JUN	7.4	0.0	19.9	0.0	12.3	0.0	24.2	3.7	14.3	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUL																				
AUG																				
SEP																				
OCT																				
NOV																				
DEC																				

Windowpane flounder egg densities sampled from the New York/New Jersey Harbor during the 2000-2001 sampling program.

		Arthur Kill / Newark Bay													**Upper Bay**											**Lower Bay**					
		Arthur Kill (AK)						**Newark Bay (NB)**							**Port Jersey (PJ)**					**South Brooklyn (SB)**						**Lower Bay (LB)**					
		Channel		**Shallow**		**Slope**		**Channel**			**Shallow**				**Channel**		**Shallow**			**Channel**			**Shallow**			**Channel**			**Shallow**		
Week		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
1-Jan	1																														
8-Jan	2																														
15-Jan	3	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
22-Jan	4														0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
29-Jan	5	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
5-Feb	6																														
12-Feb	7	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
19-Feb	8																														
26-Feb	9	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
5-Mar	10																														
12-Mar	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
19-Mar	12																														
26-Mar	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
2-Apr	14																														
9-Apr	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
16-Apr	16																														
23-Apr	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
30-Apr	18																														
7-May	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135.5	94.9	18.0	63.0	16.2	519.9	141.1	109.5	101.9	0.0	34.8						
14-May	20																														
21-May	21	190.3	780.6	6.4	32.5	154.3	135.5	286.6	254.6	143.0	67.2	27.7	73.5	46.2	345.5	622.7	105.4	77.0	61.8	1327.6	770.8	864.4	196.7	607.5	131.6						
28-May	22																														
4-Jun	23	713.2	1426.3	52.6	0.0	798.2	559.0	347.4	475.9	242.3	5.7	0.0	39.4	17.2	2572.4	2977.2	3085.4	521.9	64.2	5479.0	920.7	826.8	1445.1	4004.9	90.7						
11-Jun	24																														
18-Jun	25																														
25-Jun	26																														
2-Jul	27																														
9-Jul	28																														
16-Jul	29																														
23-Jul	30																														
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Windowpane flounder egg densities sampled from the New York/New Jersey Harbor during the 2001-2002 sampling program.

		Arthur Kill / Newark Bay													Upper Bay											Lower Bay					
		Arthur Kill (AK)						Newark Bay (NB)							Port Jersey (PJ)					South Brooklyn (SB)						Lower Bay (LB)					
		Channel		Shallow		Slope		Channel			Shallow				Channel		Shallow			Channel			Shallow			Channel			Shallow		
		2	3	1	4	5	6	1	5	6	2	3	4	7	4	5	1	2	3	4	5	6	1	2	3	2	4	6	1	3	5
Week																															
1-Jan	1																														
8-Jan	2																														
15-Jan	3																														
22-Jan	4	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29-Jan	5																														
5-Feb	6	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-Feb	7																														
19-Feb	8	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26-Feb	9																														
5-Mar	10	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12-Mar	11																														
19-Mar	12	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26-Mar	13																														
2-Apr	14	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9-Apr	15																														
16-Apr	16	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-Apr	17																														
30-Apr	18	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.8	4.1	0.0	21.8	0.0	0.0
7-May	19																														
14-May	20	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21-May	21																														
28-May	22																														
4-Jun	23	1867.4	1538.4	1572.0	485.9				1984.0	2481.4		933.4	863.9	707.3	1181.7	1868.3	3132.6	264.1	124.3	509.4	1310.7	1193.1	800.6	2568.5	3059.2	2491.8	287.3	555.4	1108.3	8640.8	7213.7
11-Jun	24																														
18-Jun	25	0.0	65.6	0.0	0.0				22.6	25.0		0.0	0.0	0.0	1090.8	324.3	1798.6	24.6	0.0	712.5	4611.5	2181.0	975.4	1601.4	218.1	887.3	453.0	39.7	1145.4	74.2	434.0
25-Jun	26																														
2-Jul	27																														
9-Jul	28	0.0	0.0	0.0	0.0				0.0	0.0		0.0	0.0	0.0	12.9	0.0	0.0	0.0	27.1	0.0	42.0	0.0	101.3	191.3	63.2	0.0	0.0	0.0		0.0	0.0
16-Jul	29																														
23-Jul	30																														
30-Jul	31																														
6-Aug	32																														
13-Aug	33																														
20-Aug	34																														
27-Aug	35																														
3-Sep	36																														
10-Sep	37																														
17-Sep	38																														
24-Sep	39																														
1-Oct	40																														
8-Oct	41																														
15-Oct	42																														
22-Oct	43																														
29-Oct	44																														
5-Nov	45																														
12-Nov	46																														
19-Nov	47																														
26-Nov	48																														
3-Dec	49																														
10-Dec	50																														
17-Dec	51																														
24-Dec	52																														

Atlantic herring post-yolk sac larvae densities sampled from the New York/New Jersey Harbor during the 1998-1999 sampling program.

	Harbor Wide (HW)										**Port Jersey (PJ)**						**South Brooklyn (SB)**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**
Month																				
JAN																				
FEB	0.0	11.5	0.0	3.8	3.9	14.2	4.2	5.5			0.0	0.0	0.0	3.8	0.0	0.0	0.0	20.1	8.3	3.1
MAR	0.0	9.0	6.1	24.2	0.0	4.8	0.0	0.0	5.0	18.0	0.0	0.0	0.0	0.0	5.9	0.0	26.0	0.0	0.0	0.0
APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUL																				
AUG																				
SEP																				
OCT																				
NOV																				
DEC																				

Environmental Assessment
Appendix C4:
Gear Comparison Study

U.S. Army Corps of Engineers
New York District

January 2004

NEW YORK AND NEW JERSEY HARBOR NAVIGATION PROJECT

GEAR COMPARISON STUDY

FINAL
SEPTEMBER 2002

U.S. Army Corps of Engineers - New York District
Planning Division
Jacob K. Javits Federal Building
26 Federal Plaza
New York, New York 10278

TABLE OF CONTENTS

1.0 INTRODUCTION

Winter flounder (*Pseudopleuronectes americanus*) is an important recreational and commercial species along the Atlantic Coast of the United States where coastal estuaries play an essential role in the winter flounder life cycle. The New York-New Jersey (NY-NJ) Harbor estuary provides habitat for winter flounder and has been designated Essential Fish Habitat by the National Marine Fisheries Service (NMFS 1999) for all life stages of the species. Over the last several decades a decline in winter flounder abundance has been observed along the Atlantic Coast (NOAA 1993), prompting a "species of concern" designation for winter flounder by the Northeast Multispecies Fishery Management Plan. As a result, both state and Federal agencies have established monitoring programs to investigate population trends.

Understanding winter flounder population trends is necessary to assess the potential environmental impacts associated with improving navigation in the NY-NJ Harbor. Since 1998, the United States Army Corps of Engineers (USACE) New York District (District) has conducted studies as part of the New York-New Jersey Harbor Navigation Project to determine the spatial and temporal occurrence of early life stages of winter flounder in the Harbor (USACE 1999, 2002). The USACE sampling programs in 1998-1999 and 2000-2001 relied on epibenthic sleds fitted with 0.5-m mouth diameter plankton nets for collecting the demersal winter flounder eggs and larvae (USACE 1999, 2002). Epibenthic sled mounted plankton nets have been shown to be a better method for collecting early life stages of demersal species than standard towed plankton nets (Madenjian and Jude 1985).

Results of the New York-New Jersey Harbor Navigation Project (NY-NJHNP) indicate that eggs are collected in lower densities than larval life stages. In most aquatic populations eggs, when present, typically represent the dominant lifestage by numbers. Furthermore, winter flounder eggs adhere to the substrate (Able and Fahay 1998) and are unable to avoid the sampling gear, which should make them more susceptible to sampling. Because of these factors it has been suggested that winter flounder eggs may be underrepresented in samples collected with the standard epibenthic sled. Recent discussions have suggested that the sampling characteristics of this net might be enhanced by incorporating minor modifications. Winter flounder early life-stages are strongly demersal and it has been suggested that by sampling closer to the bottom or disturbing the bottom, catches may be "improved". Thus, modifications to the epibenthic sled were suggested that may potentially improve gear efficiency and increase the ability to collect winter flounder, in particular eggs.

Modifications suggested to possibly improve the collection efficiency of the epibenthic sled mounted plankton net include decreasing the net height above the substrate and mounting a device to disrupt sediments directly in the path of the net mouth (e.g. tickler chain). These modifications have been suggested because of the demersal orientation of winter flounder eggs and larvae. To test the suggested modifications a gear comparison study was conducted during winter-spring 2002 to evaluate three different modifications to the standard epibenthic sled; lowering the plankton net to 50.8 mm above the substrate, lowering from the existing 177.8 mm off the bottom the plankton net to 88.9 mm above the substrate, and adding a tickler chain to the sled 177.8 mm off the bottom. The objective of this study was, therefore, to determine whether or not these alternative net configurations could bring about improved sampling.

2.0 MATERIALS AND METHODS

A. Net Description

Since 1999 winter flounder early life-stages in NY/NJ Harbor have been sampled with an epibenthic sled. The standard configuration for this net consists of a 0.5-m mouth diameter plankton net mounted 177.8 mm from the bottom of the sled frame (Photo 1 and Photo 2). The sled frame is constructed of 19.05 mm diameter welded aluminum pipe mounted on aluminum skids. The 60 lb sled is built as a truss assembly to allow the net height to be adjusted.

B. Study Design

A paired sampling design was selected for the sled mounted plankton net gear comparison study. This design reduces the number of variables that can influence the results of gear comparison studies related primarily to lifestage specific abundance and distribution patterns (Anderson and Warren 1991, DeAlteris et al. 1989). Furthermore, the ability of the study to evaluate the sled modifications as they relate to collecting winter flounder eggs and larvae was optimized by selecting a relatively large sample size (modified sled and standard sled pairs were towed >40 times) (Anderson and Warren 1991, DeAlteris et al 1989) and targeting sites where early life-stages of winter flounder have been collected in the Harbor (USACE 1999, 2002).

To assess the outcome of the net comparison trials, some objective criteria as to what constitutes an "improved sample" is required. From a statistical perspective, preference is given to an estimator (or sample) that is unbiased (or least biased) and has the smallest sampled to sample variation (error variance). Thus if a net configuration collects eggs only, then the sample would be biased towards eggs and not constitute an improved sample. Alternatively, the same net configuration may be better at reducing the natural variability in density of winter flounder eggs collected and would thus provide the smallest error variance or an improved sample. Consequently, both bias and relative variance measures were examined in this study.

As aforementioned, the premise for adjusting the net height or adding a tickler chain is based on the fact that early life-stage winter flounder are demersal. Therefore sampling with the net 177.8 mm off the bottom may underestimate their true abundance, i.e., yield a biased estimate of the mean abundance. By lowering the net or adding a mechanism to disturb the bottom in front of the net mouth, mean catches may increase and become less biased. The null hypothesis of this study was that the mean density of winter flounder collected in the standard epibenthic sled net is less than or equal to the average density in the modified epibenthic sled (Please see Appendix A for a detailed description of hypothesis testing). A significantly higher mean catch in the modified gear configuration would result in the acceptance of the alternative hypothesis that the mean density of winter flounder collected in the modified net is greater than the mean density collected in the standard net.

Ichthyoplankton distribution patterns are inherently highly variable or patchy (Houde 1987). Consequently, error variances as discussed above can be large and many samples are generally needed to obtain reasonably precise estimates of mean abundance. Techniques such as increasing sample volume (to integrate patches) or restricting samples to homogeneous strata can help reduce this variability. Reduced error variance, in turn, results in increased precision for a given sampling program or a more cost effective program for the same precision. To test for differences in sample variability (as measured by the sample variance), Analysis of Covariance (ANCOVA) was conducted. Details of the ANCOVA are provided in Appendix B. A statistically significant lower degree of sample variance in an alternative gear configuration is taken as evidence of an improved sample.

C. Sample Station Selection

Twenty-two (22) sampling locations were selected to distribute the sampling effort among project areas with historically higher concentrations of winter flounder eggs and larvae, and between navigation channels and shoals. Twelve stations were located in shallow water areas near navigation channels, and 10 stations were located within navigation channels. Sixteen sampling locations corresponded to stations that were sampled during the baseline sampling program for the NY-NJ Harbor Navigation Project (USACE 1999, USACE 2002). Six additional stations (3 channel and 3 shoal) were selected in Lower New York Bay an area that was not previously included in the NY-NJ Harbor Navigation Project. All station locations and nominal depths are listed in Table 1.

D. Ichthyoplankton Collection

Each station was sampled bi-weekly over a 3-month period from March 2002 through early May 2002. This time period corresponded to the seasonal period when winter flounder eggs and larvae densities are typically greatest in the NY-NJ Harbor estuary.

Paired samples were collected with one (1) standard sled configuration and one (1) modified sled towed in tandem. The standard epibenthic sled used in each sampling program included 0.5-m plankton net with 0.5-mm mesh mounted 177.8 mm (i.e. measurement from the bottom of the net frame) above the substrate (Table 2; Photo 1). The three sled modifications evaluated were decreasing the net height above the substrate to 50.8 mm and 88.9 mm (i.e. net frame remained the same size), and the addition of a tickler chain at the front of the standard sled. The tickler chain was added to the front runners of the epibenthic sled approximately 254 mm in front of the net mouth (Photo 3). Five chains, 215.9 mm long each, were suspended between the sled runners, which would result in approximately 127 mm of each chain on the substrate during sampling.

All samples were collected during daylight hours using the District's research vessel "Hudson". Each epibenthic sled pair was towed against the prevailing current or tide when possible for approximately ten minutes. Tow direction, velocity and duration were adjusted to account for obstructions, limited transect distances and commercial traffic. An inclinometer was used to determine the warp angle from the boat to confirm that the sleds were on the bottom. Typically a 4:1 ratio of cable length to bottom depth was used. Cable length was the same for both samples in a pair. Each net was fitted with a General Oceanics flowmeter (Model 2030R) to calculate sample volume.

E. Sample Processing

Ichthyoplankton samples were washed from the plankton net into sample containers and preserved with 5% buffered formalin containing the vital stain rose bengal. Sample containers were then returned to the laboratory for analysis. Sample contents were placed in a Pyrex tray on top of a light box and fish eggs and larvae were removed from the detritus using featherweight forceps and eyedroppers. Organisms were counted, placed into labeled vials containing 5% formalin, and stored for identification and enumeration.

Winter flounder were identified, assigned a life stage (egg, yolk-sack larvae, post yolk-sac larvae, juvenile) based on morphometric characteristics, enumerated and densities were reported (No./1000 cubic meters [m^3]) based on sample volumes. Strict quality control (QC) procedures were followed during sample sorting, enumeration, and identification. QC for sample sorting consisted of a Continuous Sampling Plan (CSP) to assure an Average Outgoing Quality Limit (AOQL) of ≥ 90%. Additional descriptions of the QA/QC procedures are provided in the program standard operating procedures (SOP).

F. Data Analysis

The data were analyzed to determine if winter flounder densities (No./1000 m^3) by life stage and life stages combined were greater in samples collected with a modified sled compared to the standard epibenthic sled design. All analysis is were conducted on the following winter flounder life-stages: eggs, yolk-sac and post yolk-sac larvae, an unidentified (UID) larval life-stage, and all life-stages combined. All life stages were combined to determine the overall effectiveness of each gear for sampling winter flounder. A ratio between winter flounder densities collected by the modified gear and the standard gear was determined for each life stage. A ratio >1 indicated that the modified gear collected greater numbers than the standard gear. When no winter flounder were caught (i.e. standard = 0 and modification = 0) for each pair the data were removed from the analysis, since gear differences cannot be detected with paired zeros. All data were analyzed using Number Cruncher Statistical System (NCSS) (NCSS 2000). Preliminary analysis showed that the data did not meet the normality requirement for parametric statistics. Thus, the data were analyzed using Wilcoxon Signed-Rank Test, a non-parametric alternative to a paired T-test. The significance level (i.e. Type I error probability) was set at 0.05 for each analysis.

3.0 RESULTS

A total of 244 samples (122 standard gear – 122 modification) were collected from 3 March 2002 through 16 May 2002. Forty (40) samples were collected for the tickler chain modification, forty-two (42) for the 88.9-mm net height, and forty (40) paired samples were collected for the 50.8 mm net height. Irrespective of the sled used, zero fish or "no catch" was reported in 68-76% of the possible sample tows.

Four winter flounder life-stages (egg, yolk-sac, post yolk-sac, UID life-stage larvae) were present in sufficient paired tows to be used in the statistical analysis of each epibenthic sled modification tested. The post yolk-sac larval life-stage was the dominant life-stage over the evaluation period (Figure 1; Table 3). Eggs were collected in the lowest densities and more importantly during fewer sampling events than the other life stages. As a result, less than 25% of the samples that remained after removal of the paired zero samples, contained winter flounder eggs and could be used in the analyses (Table 4).

In general, mean life-stage densities were similar between paired sled types. The following section describes the differences observed between each standard sled and modified sled pair. Mean densities are presented by each life stage with 2 standard errors.

A. Standard Gear vs. Tickler Chain

Winter flounder densities were not significantly different across all life-stages collected between the standard sled and tickler chain modified sled pair (Figure 1; Table 3). Egg densities were greater with the standard gear (STD) than the tickler chain (TC). Greater densities were reported for eggs (STD=8/1000 m^3; TC=6/1000 m^3), post yolk-sac larvae (STD=185/1000 m^3, TC=158/1000 m^3), and all life-stages combined (STD=100/1000 m^3; TC=87/1000 m^3). Greater densities of the yolk-sac were reported for the tickler chain modified sled (STD=15/1000 m^3; TC=18/1000 m^3) and larvae stages (STD=8/1000 m^3; TC=11/1000 m^3). The ratio between densities collected by the modified gear and the standard gear was <1 for eggs, post yolk-sac larvae and all life stages combined but >1 for yolk-sac larvae and the unidentified larval stage (Table 5). The Wilcoxon Signed-Rank analysis did not show that significantly different densities (all P-values > 0.05) of winter flounder were collected by the tickler chain modification vs. standard gear (Table 4).

B. Standard Gear vs. 50.8 mm Net Height

Small differences in winter flounder abundance for all individual life-stages were noted between the standard sled and the sled with the net height adjusted to a height of 50.8-mm, with slightly higher densities calculated for the modified sled (Figure 1; Table 3). The greatest difference was in the UID larvae density (STD=9, 50.8 mm-net=45/1000 m^3). The Wilcoxon Signed-Rank Analysis did not identify statistically significant differences across individual life-stages (p=0.06) (Table 3); however when all life-stages were combined, the mean density (50.8 mm-Net=109.6/1000 m^3) with the 50.8 mm sled was significantly greater (p=0.04) than the standard sled mean density (STD=75.7/1000 m^3) (Table 3, Figure 1). The analysis for this sled modification comparison was supported by the greatest sample size (n=82) of the all gear comparison analyses conducted.

C. Standard Gear vs. 88.9 mm Net Height

Winter flounder densities calculated from the standard gear were slightly greater than the densities calculated for the modified sled with the net lowered to 88.9 mm (Figure 1). The ratio between densities collected by the modified gear and the standard gear was <1 for all life stages except the UID larval stage (Table 5). No statistical differences were detected at a=0.05 (Table 4).

D. ANCOVA Results

The ANCOVA analysis was conducted for the standard sled design and each sled modification. Results indicated no statistically significant difference (p=0.97) among the measured variance in the standard gear and the modified gear data.

4.0 DISCUSSION

This study does not indicate that incorporating a lower net height or tickler chain would, especially for eggs, result in repeatedly higher or lower numbers of winter flounder eggs and larvae collected. Differences were observed in winter flounder densities especially between the standard gear and the modified gear with the lowest net (50.8mm). This might be expected because of the demersal nature of winter flounder. Regardless, the differences between the modified gears were not apparent at the egg life-stage where the lower net and the tickler chain were expected to increase the numbers collected. Furthermore, only one comparison resulted in statistically greater densities in the modified gear (i.e. all life stages combined 50.8 mm vs. STD). The variability in winter flounder densities collected (0/1000 m^3 - 2,463/1000 m^3) made it difficult to detect differences between mean densities and resulted in weak statistical power for comparing the results.

Gear comparison studies often have inconsistent results (Anderson and Warren 1991, Coale et al. 1994, DeAlteris et al. 1989, Onorato et al. 1998, Gallagher and Conner 1983, Högman et al. 1973, Michaletz et al. 1995, Neumann et al. 1995, Parkinson et al. 1994) because too many variables are analyzed or the result of patchiness in the sample population (DeAlteris et al. 1989). The paired design of this study reduced the number of variables (e.g. variable boat speed, day to day variation, station to station variation) in the study. Alternatively, within gear variability was not compensated for by the study design because of the patchy distribution and low density of winter flounder in the Harbor. Variability is common in gear comparison studies because often natural populations exhibit patchy distribution (DeAlteris et al. 1989).

Winter flounder exhibit temporal and spatial patchy distribution patterns, especially at early life-stages in the NY-NJ Harbor (USACE 1999, USACE 2002). The low densities exacerbated by the patchiness in winter flounder eggs and larvae resulted in the removal of almost a quarter of the paired samples from the analysis because no flounder were collected in either sled pair. Sample sizes were further reduced when comparisons were made by life-stage. For example, eggs were only collected during 5 sampling events (i.e. 12% of samples collected for that comparison) by either the tickler chain or standard gear. This reduced sample size in relation to the variability in the data, masked the ability to detect a difference in means, and ultimately decreased the power of the test.

Because similar catch efficiencies were observed, an important question to consider is what level of difference between two gear types is meaningful enough to result in selecting a new gear? The level of effort practical for detecting this meaningful difference must also be considered. To demonstrate the level of effort required to detect a "meaningful" difference in gear modifications using the existing data, a post-hoc power analysis was conducted to determine the number of samples required to determine 5%-60% differences in collection efficiencies between gears (Vilderbuer and Kappenman 1998; See Appendix A). Results from this analysis demonstrate that to detect a 10% difference in winter flounder egg densities between the two gear types (i.e. modified gear - 110/1000 m^3; standard gear - 100/1000 m^3), approximately 1575 paired samples would need to be collected to have sufficient power = 0.80 (80%) to detect the difference. Moreover, eggs would need to be present in at least one sled sample from each pair. A sampling program to collect eggs on >1500 sampling events may be impractical.

In the absence of statistical support for an "improved sample" by the modified gear, two outcomes can result from this research: 1) select the appropriate modification and conduct additional testing or 2) continue using the standard gear as an unbiased method for collecting early life stages of winter flounder in the NY-NJ Harbor. The results suggest that higher catches were made by the epibenthic sled with the net closest to the bottom (50.8 mm). Therefore, if additional sampling is conducted, the study design should focus only on the difference between the 50.8 mm net height modification and the standard gear. The design of such a study would have to weigh the value of identifying an "improved sample" with the significant increase in effort to collect the necessary sample size.

The argument to select the second alternative and continue using the standard gear as an unbiased estimator of early life stage winter flounder densities in NY-NJ Harbor is supported by the three year database and the lack of definite results from the gear modifications. The existing three-year database provides a valuable baseline understanding of spatial and temporal occurrence of winter flounder early life-stages in the NY-NJ Harbor. These data will provide a basis for observing long-term trends in relative abundance of winter flounder if additional annual data are collected. Modifying the gear in a long-term sampling program without good evidence that the gear change will improve the ability to track trends in winter flounder abundance could compromise the usefulness of these data over time.

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TABLE 1. Gear comparison sampling station locations, GPS coordinates and nominal depth.

Area	Station Name		Station Location	Average Depth	GPS Coordinates (deg., min., sec.)			
					Start		End	
					North	**West**	**North**	**West**
South Brooklyn/ Upper Bay	SB – 1*	Shallow	Gowanus Bay Interpier South	27	40:39.45	74:00.86	40:39.56	74:01.05
	SB – 2 **	Shallow	Gowanus Bay Interpier	30	40:39.60	74:00.48	40:39.75	74:00.75
	SB – 3*	Shallow	Bay Ridge Flats	22	40:39.36	74:02.26	40:38.91	74:02.36
	SB – 4 **	Channel	Bay Ridge Channel	42	40:39.28	74:01.52	40:38.98	74:01.79
	SB – 5*	Channel	Anchorage Channel Middle	57	40:39.53	74:03.30	40:39.69	74:03.19
	SB – 6 **	Channel	Anchorage Channel South	49	40:38.76	74:03.11	40:38.48	74:02.98
Port Jersey	PJ – 1 **	Shallow	Jersey Flats	12	40:39.91	74:03.57	40:40.17	74:03.45
	PJ – 2*	Shallow	Caven Point	10	40:40.62	74:03.44	40:41.02	74:03.35
	PJ – 3 **	Shallow	Constable Hook	13	40:39.75	74:04.75	40:39.53	74:04.19
	PJ – 4 **	Channel	Port Jersey Channel	39	40:39.91	74:04.11	40:40.07	74:04.51
	PJ – 5*	Channel	Port Jersey Channel East	42	40:39.48	74:03.64	40:39.78	74:03.96
Newark Bay	NB – 3*	Shallow	Newark Bay Flats Middle	10	40:41.06	74:07.61	40:41.40	74:07.44
	NB – 4*	Shallow	Newark Bay Flats South	16	40:40.72	74:07.76	40:40.38	74:07.92
	NB – 5 **	Channel	Newark Bay Middle Reach	42	40:40.59	74:07.96	40:40.19	74:08.26
	NB – 6 **	Channel	Newark Bay South Reach	46	40:39.44	74:08.52	40:39.15	74:08.75
	NB – 7*	Shallow	Elizabeth Flats North	13	40:39.62	74:09.29	40:39.51	74:08.99
Lower Bay	LB – 1	Shallow	East Bank	13	40:33.45	74:00.24	40:33.94	74:00.52
	LB – 2	Channel	North End Ambrose Channel	50	40:33.23	74:01.54	40:33.40	74:01.55
	LB – 3	Shallow	Swash Channel Range	17	40:33.34	74:04.46	40 33.00	74 04.44
	LB – 4	Channel	Chapel Hill South Channel	30	40:31.06	74:02.41	40:30.64	74:02.39
	LB – 5 [A]	Shallow	Old Orchard Shoals	13	40:30.59	74:04.72	40:30.75	74:05.22
	LB – 6 [A]	Channel	Raritan Bay East Reach	41	40 29.41	74 06.39	40 29.53	74 06.90

* Stations sampled under the 2000-2001 Supplemental Study

** Stations sampled under the 1998-1999 and 2000-2001 sampling programs

TABLE 2. Epi-benthic Sled and Plankton Net Specifications
Standard Gear Type

Part	Specification
Mouth diameter	0.5 m
Overall length	3.0 m
Mesh size	0.5 mm
Cod end diameter	10.1 cm
Code end mesh	0.5 mm (PVC cod end bucket)
Epibenthic sled	Constructed of welded aluminum pipe

Note: Additional gear specifications provided in the standard operating procedures (SOP)

TABLE 3. Mean density (2X standard error) by life stage for tickler chain, 50.8 mm, and 88.9 mm gear comparisons.

Gear Type	Life Stage Mean Density (2X Standard Error)				
	Egg	Yolk-sac	Post yolk-sac	Larvae	All
Standard	7.66 (11.49)	15.49 (13.30)	185.45 (148.16)	7.77 (4.62)	99.97 (77.26)
Tickler	5.66 (4.88)	18.19 (9.02)	157.67 (108.82)	11.17 (8.52)	87.02 (57.24)
Standard	20.03 (33.91)	19.30 (20.02)	135.56 (53.29)	9.19 (6.84)	75.75 (30.18)
50.8 mm	21.56 (40.88)	37.54 (22.03)	180.91 (80.63)	45.57 (43.53)	109.62 (44.14)
Standard	16.87 (14.00)	9.96 (7.32)	90.45 (79.87)	6.04 (3.42)	46.46 (18.37)
88.9 mm	12.60 (16.82)	9.54 (5.39)	79.87 (34.54)	6.19 (5.45)	41.07 (17.52)

Note(s): Larvae include all unidentifiable yolk-sac and post yolk-sac larvae.
All includes yolk-sac, post yolk-sac, and unidentifiable larvae and eggs.

TABLE 4. Summary statistics from Wilcoxon signed-rank analysis between winter flounder densities collected by the standard epibenthic sled and three modifications (net height above the substrate at 50.8 mm and 88.9 mm, and the addition of a tickler chain) for each winter flounder by life-stage.

Modification	Life Stage	Samples Collected	Sample Size Used for Analysis	% of Total Samples Collected Used for Analysis	Probability Level	Power (1-β) (Alpha=0.5)
Tickler Chain	Egg	41	5	12%	0.50	0.05
	Yolk-Sac	41	22	53%	0.09	0.06
	Post Yolk-Sac	41	39	95%	0.94	0.18
	Larvae	41	11	26%	0.48	0.12
	All	--	77	--	0.27	0.16
50.8 mm	Egg	44	5	11%	0.68	0.061
	Yolk-Sac	44	22	51%	.082	0.32
	Post Yolk-Sac	44	41	93%	0.38	0.32
	Larvae	44	14	32%	0.06	0.33
	All	--	82	--	0.04	0.57
3..5”	Egg	42	10	24%	0.20	0.24
	Yolk-Sac	42	22	52%	0.96	0.05
	Post Yolk-Sac	42	36	86%	0.28	0.14
	Larvae	42	12	28%	0.81	0.05
	All	--	80	--	0.29	0.16

Table 5. Ratio between modified gear and the standard gear at collecting winter flounder by each life stage. For ratios the values > 1 indicates that a gear collected greater densities of winter flounder.

Gear	Egg	YSL	PYSL	LAR	ALL
Tickler Chain	0.74	1.17	0.85	1.44	0.87
88.9 mm	0.75	0.96	0.88	1.03	0.88
50.8 mm	1.08	1.95	1.34	4.96	1.45

Ratio = modified gear / standard gear densities

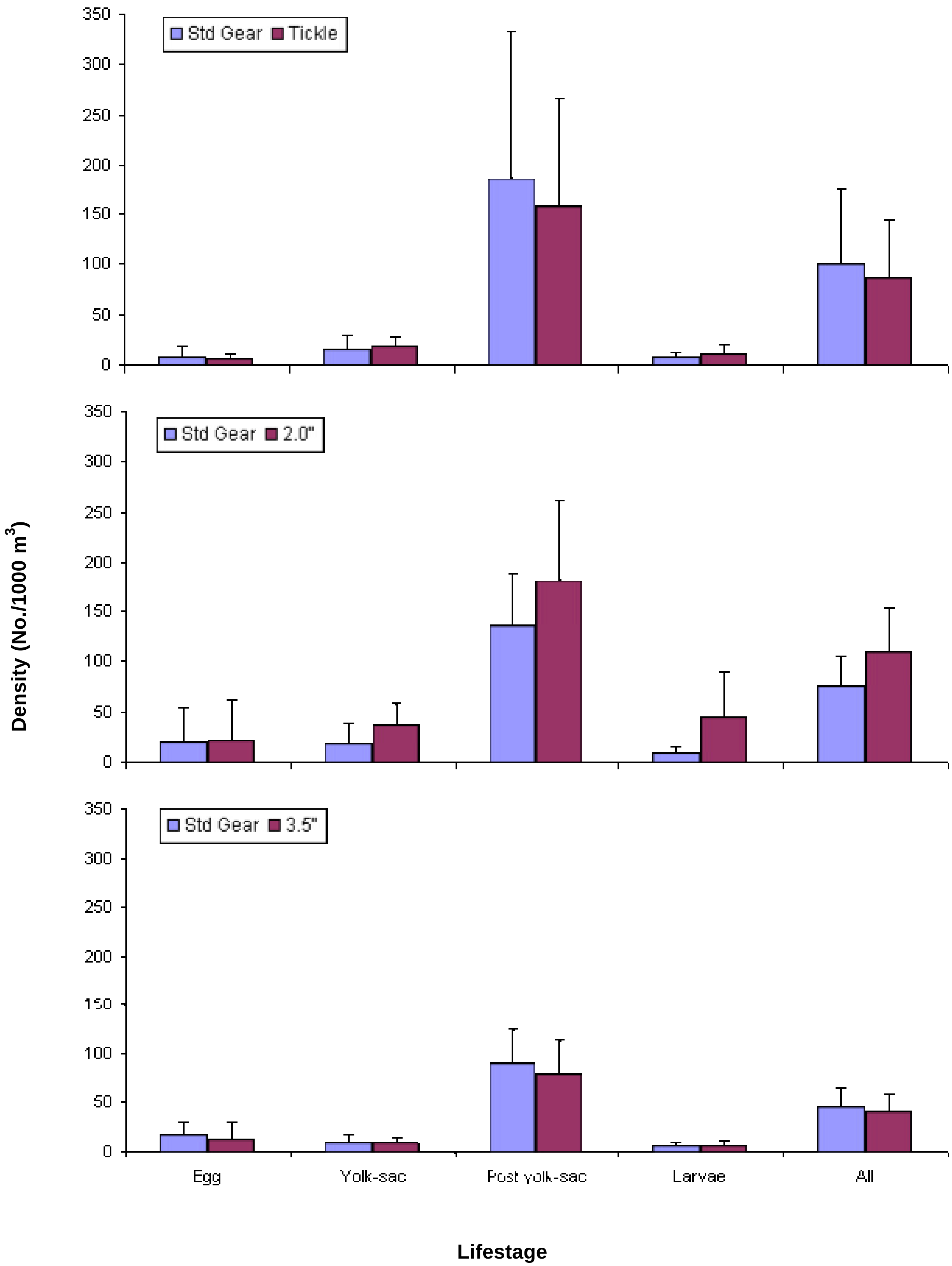


Figure 1. Mean density (+ 2 SE) comparison for standard gear versus tickle chain, 50.8 mm and 88.9 mm gear types at all sites combined

Photo 1. Epibenthic sled (side views).

Photo 2. Standard epibenthic sled with the net height 7-in above substrate and the modified sled with the net height 2-in above substrate**.**

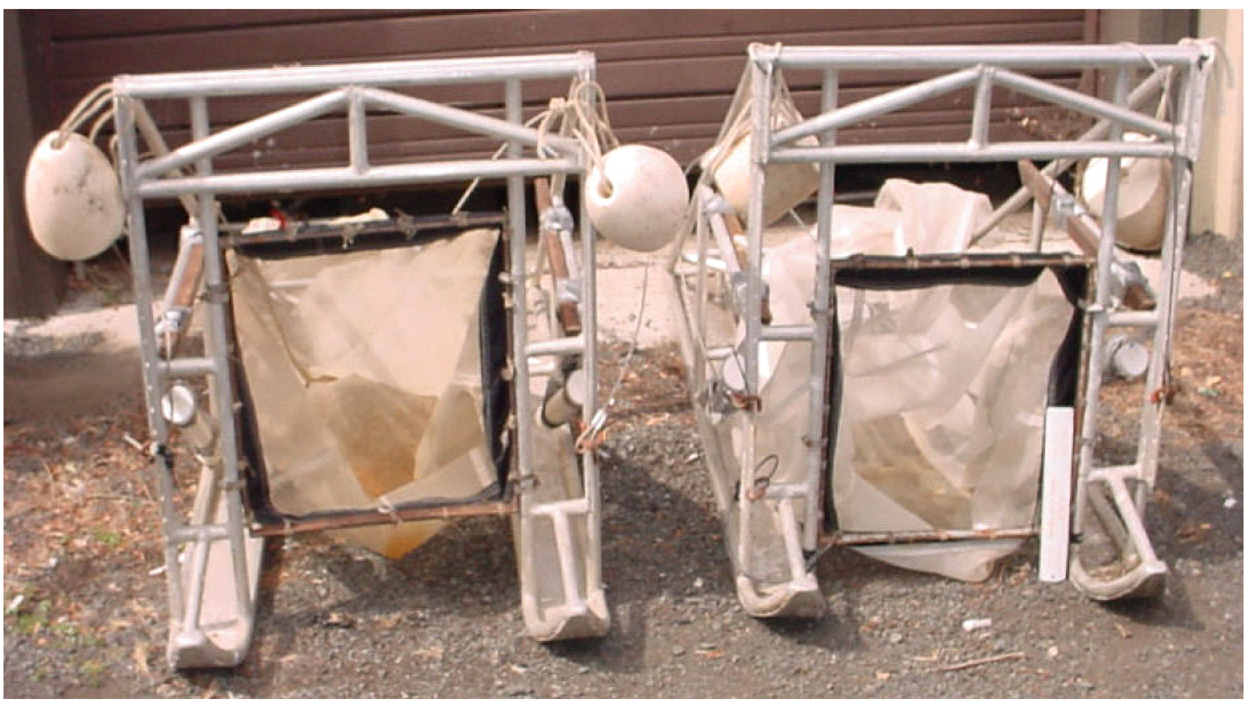


Photo 3. Standard epibenthic sled with the net height 7-in above substrate and the modified sled with the net height 7-in above substrate and the tickle chain.

APPENDIX A

Hypothesis Testing and Error Probabilities

Hypothesis formulation is a critical prerequisite to the application of nearly all statistical tests. To develop a statistically defensible conclusion, a null hypothesis (H_0) must be formulated prior to sampling. The null hypothesis is proposed in such a manner that the outcome can only be accepted or rejected. Although H_0 can be contradicted by a single fact, the hypothesis can be "proven" only by examination of all possible samples. Because this is generally impossible, the null hypothesis is, in practice, not proven, only disproven. A typical null hypothesis would be as follows:

$$H_0 : m_1 \leq m_2$$
$$H_A : m_1 > m_2$$

where μ_1 and μ_2 are the population means to be compared and H_A is called the *alternative hypothesis*. The alternative hypothesis is the hypothesis of interest. A set of experiments is conducted to provide evidence that the alternative hypothesis is true. This is done by showing that the null hypothesis is unlikely, thereby establishing that the only alternative hypothesis (the only remaining possibility) is likely. Expressed in terms of our study, the null and alternative hypotheses may be stated as:

> **H_0:** *The mean density of winter flounder collected in the standard is less than or equal to the mean density in the modified net.*

The alternative hypothesis, H_A, can be stated as:

> **H_A:** *The mean density of winter flounder collected in the modified net is greater than the mean density collected in the standard net.*

Stated in this manner, the mean winter flounder density collected by the standard net that is greater than the mean winter flounder density collected by the modified net would reject H_0.

Once samples have been drawn and analyzed, a decision must be made either to accept the null hypothesis or reject it. There are four possible outcomes to this decision process. One can either accept the null hypothesis when it is true or reject it when it is false; either would be a correct decision (Table 1). However, one can also reject H_0 when it is actually true or accept H_0 when it is actually false. Neither of these two decisions would be correct. The former situation is referred to as a Type I error, the latter as a Type II error. The Type I error, often called Producer's Risk or a false positive, is associated with a probability of α; the Type II error, referred to as Consumer's Risk or a false negative, is associated with a probability of b. Frequently, the Type II error rate is discussed in terms of the statistical power, $1-b$.

The consequences of an incorrect decision must be carefully considered. In the above situation, a Type I error would suggest changing the gear type when in fact the winter flounder densities collected are not different. Because long-term monitoring programs rely on samples collected in a consistent manner over time, a switch in sampling gear may unnecessarily compromise the utility of the database for examining long-term population trends. A Type II error, i.e., deciding that the gears are not different when one gear type actually collects higher winter flounder densities, also carries undesirable consequences. Underestimation of larval densities can lead to an underestimation of importance of a spawning location and failure to protect that site from dredging and/or development.

The degree of risk associated with each outcome can be calculated and controlled by the number of samples taken. For any given sampling design there is a trade-off when one risks committing a Type I or Type II error. Lowering the level of α to ensure protection against a Type I error increases the probability of committing a Type II error. Conversely, lower b to ensure protection against a Type II error increases the probability of committing a Type I error. The only way to decrease both error rates simultaneously is to increase the number of samples.

An α level of 0.05 is typically used in assessment studies of this type. This α level implies that by chance alone, on the mean, five times out of 100 it would be decided that the standard and modified gears are different when they are not. This may be more frequent than that desirable thus the α level can be adjusted for a lesser risk by setting it to some smaller value.

The level of *b* can usually be specified only in light of a known alternative. Since this alternative is not known before the study, there is no single Type II error probability for *b*. The value of β over a range of possible alternative values is known as an Operating Characteristic (OC) Curve
and is dependent on the particular statistical procedure being used. For testing the null hypothesis in this study, a non-parametric analog of the paired *t*-test, the Wilcoxon test, was used. The OC curve for the Wilcoxon test was computed using PASS (Hintze 2000). Al-Sunduqchi (1990) indicates that power calculations for the Wilcoxon test may be made from the standard *t*-test formulation by simply adjusting the sample size. The adjustment factor is dependent on the actual distribution of the data (Table 2): Power analysis was conducted to determine the number of samples required to detect a percent difference between the standard sampling gear and a modified gear at a range of power values (0.75-0.95) (Table 3). The power analysis is also presented graphically (Figure 1). The plot in Figure 1 is based on the assumption of a Uniform distribution. For example, assuming a Type I error risk of 5% and a 30% difference between gears, it would require 155 sample pairs to maintain a Type II error risk of 25% (1-β). If we wish to decrease the Type II risk to 5%, then the number of samples would need to be increased to 295 pairs. This example assumes a Uniform distribution, to adjust for other types of distributions, multiple by the corresponding value in Table 2. Thus if the underlying distribution was for example, Normal instead of Uniform, then the sample sizes would be 162 and 309, respectively.

Table 1. Detection of gear effectiveness

H_0: The mean density of winter flounder collected in the modified net is less than or equal to the mean density collected in the standard net.

Action	**TRUE**	**FALSE**
Fail to Reject H_0	**Correct** Correctly conclude that the modified gear catches no more than the standard gear. Probability = 1-α	**Incorrect** Incorrectly accept null hypothesis when in fact a modified gear catches are higher, i.e., conclude that there is no effect when indeed there is. Consequence – failure to change gear resulting in underestimation of winter flounder density. Possible failure to protect site. **Type II Error** ß typically set to 0.01 to 0.20, depending on severity of consequence.
Reject H_0	**Incorrect** Incorrectly reject null hypothesis when in fact there is no difference between gears, i.e., conclude that there is an effect when in reality no effect is present. Consequence - unnecessarily changing gear type and possible loss of data comparability. **Type I Error** α is typically set to 0.1 to 0.01.	**Correct** Correctly conclude that the modified gear captures more than the standard gear. Probability = 1-β (power)

Table 2. Adjustment Factors for Wilcoxon Test generated from PASS,

Distribution	Adjustment
Uniform	1.0
Double Exponential	2/3 = 0.666666…
Logistic	$9/\pi^2$ = 0.9118906…
Normal	$\pi/3$ = 1.04719755…

TABLE 3 Power analysis conducted at an a=0.05 to determine the number of samples required to detect a percent difference between the standard sampling gear and a modified gear at a range of power values (0.75-0.95).

	Power (1-β)				
	0.75	0.80	0.85	0.90	0.95
% Difference to Detect	Sample Size				
5	5575	6300	7200	8425	10400
10	1390	1575	1800	2110	2610
15	620	700	800	940	1190
20	350	395	455	530	655
25	224	254	290	340	418
30	155	180	205	240	295
35	115	132	150	174	215
40	90	102	115	134	165
45	71	80	91	106	131
50	58	66	74	85	105
55	48	54	62	72	88
60	41	46	52	61	75

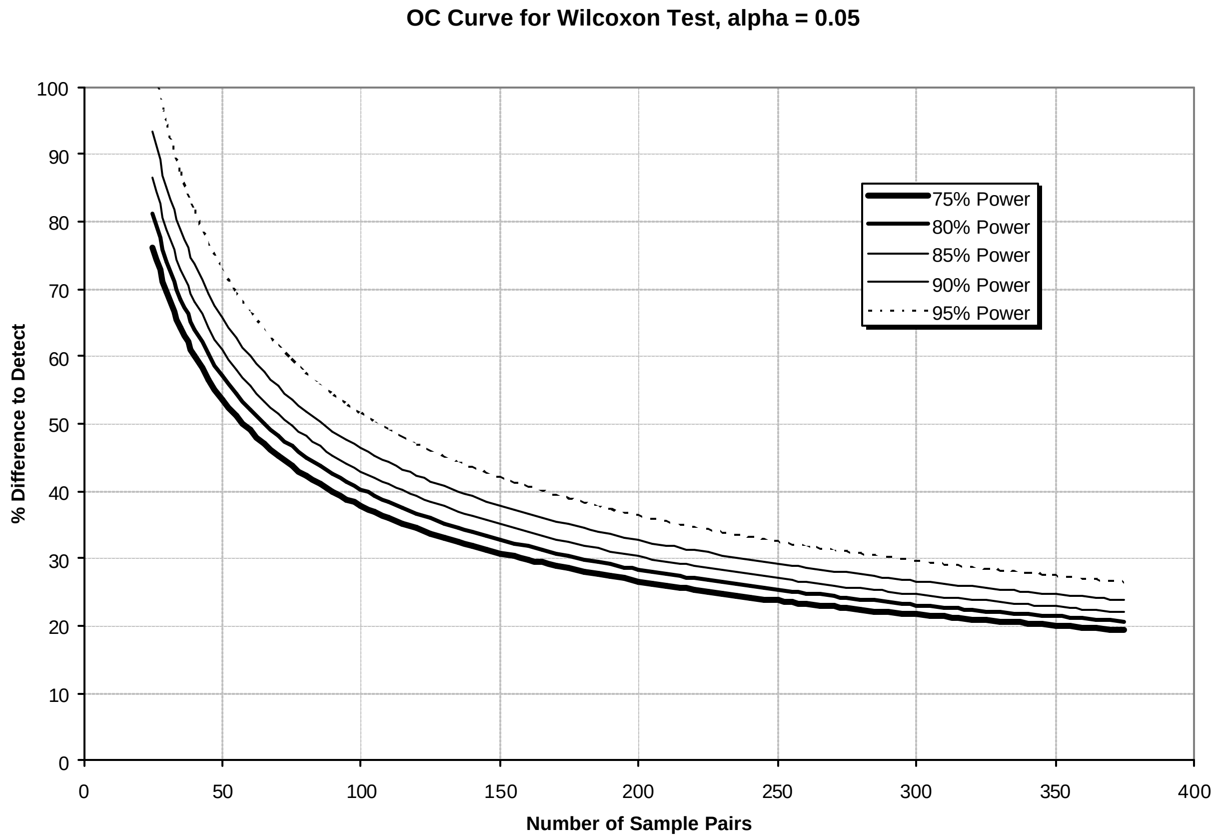


Figure 1. Operating Characteristic (OC) Curve for Wilcoxon Test at $\alpha = 0.05$, assuming a Uniform Distribution.

Literature Cited

Al-Sunduqchi, M. S. 1990. Determining the Appropriate Sample Size for Inferences Based on the Wilcoxon Statistics. Ph.D. Dissertation, Dept. of Statistics, Univ. Wyoming, Laramie, Wyoming.

Hintze, J.L. 2000. PASS 2000, Power Analysis and Sample Size for Windows. Published by NCSS, J.L. Hintze. Kaysville, Utah.

APPENDIX B

Analysis of Covariance

Standard and modified sampling gears may differ in two primary ways. Most directly, the two gears may differ in mean catch (density), i.e., one gear simply catches more per unit volume than does the other. A non-parametric paired *t*-test analog, the Wilcoxon test, was used for test for differences of this type. Details of this analysis are found in Section 2.E and in Appendix A. A less obvious difference between gears, however, may arise from inherent differences in variability. Fish larvae and other planktonic organisms generally occur in highly aggregated clusters. Consequently, ichthyoplankton samples frequently catch relatively little or relatively large numbers, depending on whether or not an aggregation is encountered. Such a distribution is referred to as "patchy" or over-dispersed. Some types of gears are better at "smoothing" out these patches than others, thereby reducing sample variance. For any given number of samples, the lower the variance the more precise the estimate of abundance. In the current study, it might be anticipated that modifications such as the addition of a ticker chain might produce more consistent (less patchy) catches by ensuring organisms are distributed into the water column.

In order to test for differences in sample variability among gears, the estimated mean ($\bar{x}$) and variance (s^2) for each sampling event was computed by gear type and life stage:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} X_i \qquad \textbf{Eq. 1}$$

$$s^2 = \frac{1}{n}\sum_{i=1}^{n}\left(X_i - \bar{x}\right) \qquad \textbf{Eq. 2}$$

where,

X_i	=	the density from one sample
N	=	number of samples collected

Analysis of Covariance (ANCOVA) was then used to test for differences among natural log transformed variances (Table 1). It is well known that the sample variance is related to the sample mean. Therefore, the effect of the sample mean was removed before testing for differences in variance. The ANCOVA model used in the analysis was:

$$s_{ijk}^2 = m + b\,(\bar{x}) + Stage_i + Gear_j + Stage_i \times Gear_j + e_{ijk} \qquad \textbf{Eq. 3}$$

where,

i	=	number of life stages
j	=	number of gear types
s_{ijk}^2	=	variance of the k[th] sample of the i[th] life stage and j[th] gear type
m	=	overall mean variance

$b(\overline{x})$	=	effect of mean (covariate) on variance
$Stage_i$	=	effect of ith life stage on variance
$Gear_j$	=	effect of jth gear type on variance
e_{ijk}	=	residual error

Both Stage and Gear were considered to be Fixed Effects, i.e., levels where specifically chosen, not random samples representative of some larger universe of choices. Both the mean and variance were logarithmically transformed to achieve a relationship conducive to analysis by linear models. The effectiveness of this transformation in achieving a linear relationship can be seen in Figure 1 and Figure 2.

The results indicate that once the effect of the mean is removed (highly significant), neither the interaction effect (STAGE × GEAR), nor the two main effects (STAGE and GEAR) are significantly different (Table 1). The overall similarity in means can be seen in Table 2 and Figures 3a-c and indicates that the degree of sample variability is not significantly different among life stages or sampling gears.

Table 1. Analysis of Variance Table

Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (Alpha=0.05)
X(lnMean)	1	196.6987	196.6987	594.33	0.000000*	1.000000
A: GEAR	3	8.057703E-02	2.685901E-02	0.08	0.969917	0.063402
B: STAGE	1	0.1748504	0.1748504	0.53	0.471256	0.109574
AB	3	1.918833	0.639611	1.93	0.138590	0.464124
S	43	14.23129	0.3309603			
Total (Adjusted)	51	374.3229				
Total	52					

* Term significant at alpha = 0.05

Table 2. Means and Standard Error Section

Term	Count	Mean	Standard Error
All	52	7.691822	
A: GEAR			
STD	28	7.679118	0.1087199
T20	8	7.73017	0.2033963
T35	9	7.60929	0.1917638
TC	7	7.748708	0.2174397
B: STAGE			
PYS	34	7.601927	9.866168E-02
YS	18	7.781716	0.1355975
AB: GEAR,STAGE			
STD,PYS	18	7.324609	0.1355975
STD,YS	10	8.033627	0.1819231
T20,PYS	6	7.517551	0.2348618
T20,YS	2	7.942789	0.4067925
T35,PYS	5	7.68919	0.2572782
T35,YS	4	7.52939	0.2876458
TC,PYS	5	7.876358	0.2572782
TC,YS	2	7.621058	0.4067925

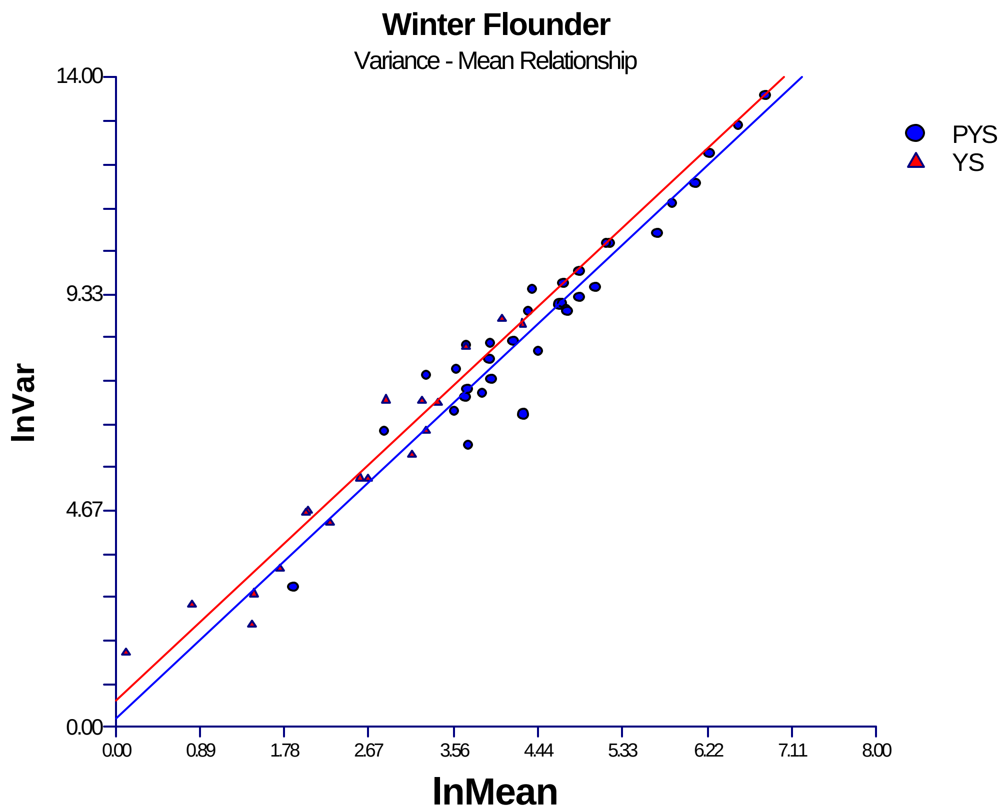


Figure 1. Plot of $\log_e$ Variance on $\log_e$ Mean for winter flounder samples by life stage. PY = post yolk-sac larvae; YS = yolk-sac larvae.

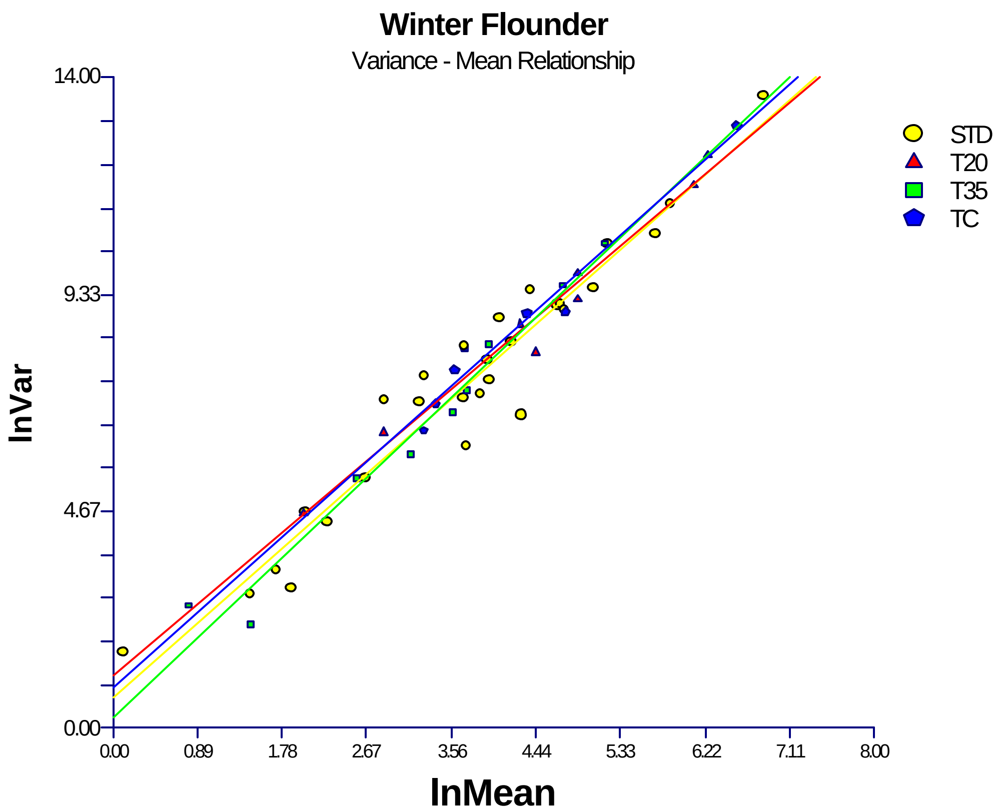
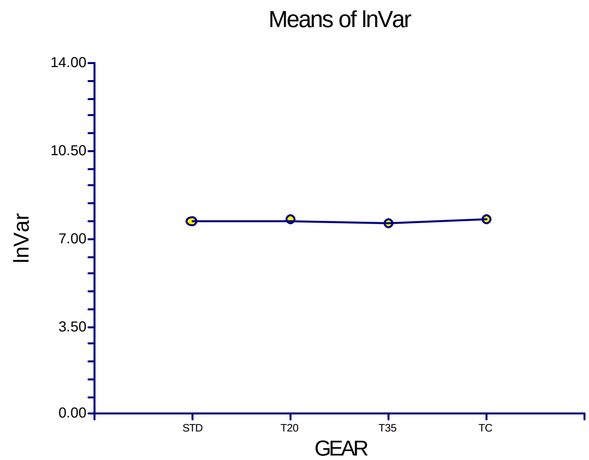
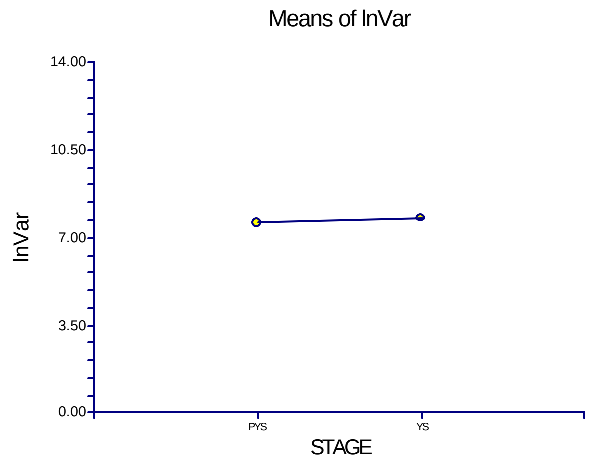


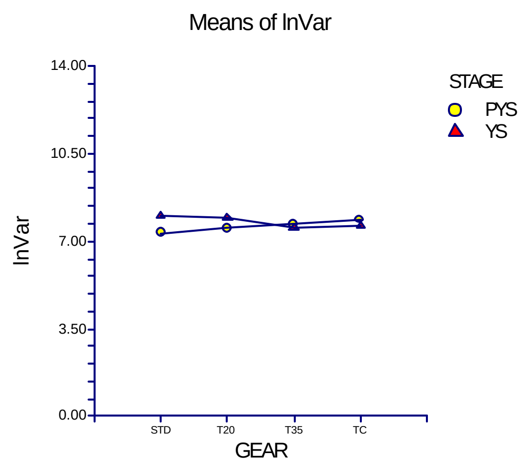
Figure 2. Plot of $\log_e$ Variance on $\log_e$ Mean for winter flounder samples by gear type. STD = standard trawl; T20 = 50.8 mm above substrate net; T35 = 88.9 mm above substrate net; TC = with tickler chain..





A

B



C

Figure 3. ANCOVA interaction plots. A. Plot of mean $\log_e$ Variance by gear type. B. Plot of mean $\log_e$ Variance by gear type. C. Plot of mean $\log_e$ Variance by interaction of gear type and life stage.