NEW YORK AND NEW JERSEY HARBOR DEEPENING PROJECT

AQUATIC BIOLOGICAL SURVEY REPORT
2008

Final Report

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1.0 INTRODUCTION

1.1 BACKGROUND

The 2008 Aquatic Biological Survey (ABS) was conducted as part of the New York and New Jersey Harbor Deepening Project (HDP). This project is a United States Army Corps of Engineers (USACE) and Port Authority of New York and New Jersey (PANYNJ) sponsored project to deepen navigation channels to 50 feet to accommodate larger commercial vessels. A primary goal of the ABS is to collect data on finfish, shellfish, macro-invertebrates, and water quality, with a focus on biological community structure, distribution and seasonal patterns of habitat use in New York/New Jersey Harbor (Harbor). The information collected is used in determining the potential project related biological impacts of deepening existing Harbor navigation channels, anchorages, and berthing areas.

The 2008 ABS supplements data provided in previous reports: 1998–1999 New York and New Jersey Harbor Navigation Study, 2000–2001 Supplemental Sampling Program, 2001-2002 Aquatic Biological Sampling Program ("2002 Survey"), the 2002–2003 Biological Sampling Program ("2003 Survey"), the 2004 Aquatic Biological Survey Report, the 2005 Aquatic Biological Survey Report, 2006 Aquatic Biological Survey Report, and the 2007 Aquatic Biological Survey Report. Collectively, these studies comprise the biological database for the HDP.

The finfish assemblage (species occurrence and relative abundance) within the Harbor is a dynamic community consisting of a variety of resident and migratory fish species typical of coastal estuaries and inshore waterways along the Middle Atlantic Bight. The Harbor estuary serves as a spawning ground, migratory pathway, nursery and foraging area for many species of finfish in non-channel (i.e. shoals and inter-pier areas typically less than 25 feet in depth) and channel habitats (typically 50 feet and deeper). Multi-year sampling programs are needed to establish the use of navigation channel and non-channel

habitats by finfish from year to year. Program sampling conducted from 2002-2008 is used to describe annual variability in seasonal movement patterns in usage and relative abundance and to expand the temporal coverage of the program database, particularly with respect to winter flounder. This sampling has provided a valuable long-term data set whereby fish responses to changing conditions and anthropogenic alterations in the Harbor may be assessed. The study objectives, survey areas, and sampling gear have been relatively consistent among sampling years to allow for inter-annual comparisons.

1.2 STUDY OBJECTIVES

During the 2008 Aquatic Biological Survey, data were collected on adult and early life stages of finfish in the Harbor with an emphasis on winter flounder. Sampling was conducted from February to July when winter flounder spawning and early life stages occur in the Harbor. The specific objectives were to determine the utilization and relative abundance of selected Harbor areas for adult and early life stage winter flounder and other EFH designated species.

To meet the program objectives, two sampling methodologies were employed. A bottom trawl was used to sample adult and juvenile finfish, and a plankton net mounted on an epibenthic sled was used to sample demersal eggs and larvae.

1.3 REPORT ORGANIZATION

For this report all finfish species are classified into one of three groups: Essential Fish Habitat (EFH) species, important non-EFH species (those identified by the resource agencies as forage, commercial and/or recreationally important species of special concern), and other species. For the 2008 report, six species were categorized as important non-EFH species: Alewife, Atlantic menhaden, Atlantic sturgeon (none collected in 2008), blue crab, shortnose sturgeon and striped bass. This organization has been used since the 2006 report to broaden the study's focus from primarily winter flounder to other important species in the Harbor's finfish community that have become

an increasing focus of interest for local and regional resource managers. Table 1-1 presents a summary of the EFH designated species by life stage occurring in the Harbor as determined by the National Marine Fisheries Service.

2.0 METHODS

2.1 SAMPLING LOCATIONS

Throughout the ABS program, a standard set of sampling locations has been used, but some adjustments have been made between years. Most of the sampling locations have been surveyed in each year with a few additions or deletions in some years. In 2008, 26 stations were sampled using both the bottom trawl and the epibenthic sled, including eight new locations in the Lower Bay (Table 2-1). Two additional Kill Van Kull stations were added beginning in March 2008 but were surveyed only using the epibenthic sled. Table 2-1 shows the locations of all of the historic stations sampled during the program since 2002 with the stations surveyed in 2008 highlighted in bold.

Of the 26 stations surveyed during 2008 using both the bottom trawl and the epibenthic sled, 16 were located in non-channel areas and 10 were located within navigation channels. Both of the Kill Van Kull stations (epibenthic sled only) were located in the navigational channel. Of note, the non-channel station LB-11 (Gravesend Bay Flats) was sampled from February through the first sampling event in April 2008 but was subsequently dropped for safety reasons because of underwater obstructions. Also, the channel station PJ-4 (Port Jersey Channel) was sampled from February through April but was subsequently dropped because of ongoing dredging operations in the immediate area.

As in previous years, to better document the spatial dynamics of the various finfish populations, the Harbor was divided into three geographic regions: Arthur Kill/Newark Bay, Upper New York Bay, and Lower New York Bay (Figure 2-1). Sampling stations were distributed as follows among the three regions:

- **Arthur Kill and Newark Bay**

  During the 2008 ABS program, four stations were sampled in this region including two each in the Arthur Kill and Newark Bay. Of the four stations surveyed, two were located in the Arthur Kill Channel (AK-2 and AK-3) and two were located in non-channel areas of Newark Bay (NB-4 and NB-7). Both of the

Newark Bay channel stations (NB-5 & NB-6) as well as the non-channel Newark Bay station (NB-3) were not sampled in 2008 because of ongoing dredging operations in the area. The non-channel AK-1 station has not been sampled since 2004 because the shallow water contour has been removed by dredging. Both the non-channel stations AK-4 and AK-7 have not been sampled since 2005 and 2006, respectively, because of underwater obstructions that have made those areas unsafe to trawl.

- **Upper New York Bay ("Upper Bay")**

  During the 2008 ABS program, ten stations were sampled in this region including four stations each in South Brooklyn (SB) and Port Jersey (PJ), and the two new Kill Van Kull (KVK) channel stations sampled with the epibenthic sled only. Of the four stations surveyed in South Brooklyn, three were located in navigation channels including the Bay Ridge Channel (SB-4) and Anchorage Channel (SB-5 & SB-6), and one was located in the Bay Ridge Flats (SB-3). Of the four stations surveyed in Port Jersey, one was located in the Port Jersey Channel (PJ-4) and three were located in non-channel areas including the Port Jersey Flats (PJ-1), the Caven Point Flats (PJ-2) and Constable Hook Flats (PJ-3). The two non-channel stations located within the inter-pier area of Gowanus Bay (SB-1 & SB-2) were not sampled in 2008 and have been dropped from the program. PJ-5 (Port Jersey Channel east) was not sampled in 2008 because of ongoing dredge operations in the area.

- **Lower New York Bay ("Lower Bay")**

  During the 2008 ABS program, 14 stations were sampled in the Lower Bay (LB) including eight new station locations added in 2008 to provide better spatial coverage of the non-channel areas of the Lower Bay (LB-7 through LB-13) and the Ambrose Channel North (LB-14). Of the six Lower Bay stations historically sampled in the Lower Bay, three are located in channels including Ambrose Channel (LB-2), Chapel Hill South Channel (LB-4) and Raritan Bay East Reach (LB-6), and three are located in non-channel areas including East Bank (LB-1),

Swash Channel Range (LB-3) and Old Orchard Shoals (LB-5). In 2008, the 10 non-channel stations in the Lower Bay were further classified into two groupings based on water depth: non-channel deep stations (≥ 25 feet: LB-7, LB-9, LB-10 & and LB-12) and non-channel shallow stations (< 25 feet: LB-1, LB-3, LB-5, LB-8, LB-11 & LB-13).

2.2 BOTTOM TRAWL

Bottom trawl sampling for adult and sub-adult finfish was scheduled to bracket the period when adult winter flounder are historically present in the Harbor to spawn. In 2008, bottom trawl surveys were conducted twice each month from 5 February through 30 May 2008 at the 26 bottom trawl stations described above. A total of 203 valid bottom trawls were conducted in 2008: 78 at navigation channel stations and 125 at non-channel stations (Table 2-1).

Bottom trawls were conducted using a 30-ft (9.1-m) otter trawl with the same specifications as used during previous years of the ABS sampling (Table 2-2). Bottom trawls were conducted during daylight[1] hours from one hour after sunrise to one hour before sunset against the prevailing current at a bottom speed of approximately 5.0 ft/sec (150 cm/sec). Boat speed was measured using a General Oceanics (GO) Model 2031 electronic flow meter coupled to a GO Model 2135 deck readout. GPS coordinates were recorded at the beginning and end of each tow. Target tow duration was ten minutes, although tow times were occasionally adjusted as needed to account for obstructions, limited transect distance, commercial traffic, and other safety considerations in the field. A minimum ratio of 5:1 tow cable length to maximum station water depth was maintained to ensure that the trawl was in contact with the bottom throughout each tow.

Upon retrieval of the net, all of the contents were placed in a collection tub filled with ambient water and the net was inspected. If it was determined that the net was damaged and that sample might have been lost or that the net did not fish properly, then the trawl

[1] Bottom trawls were conducted during the night for the 1998 through 2004 sampling programs. In 2005, sampling was changed to daylight hours due to safety considerations.

was deemed invalid and the tow repeated. For valid samples, all fish were identified and enumerated on the research vessel immediately following collection. The total length (TL) of each winter flounder caught was recorded to the nearest millimeter (mm). For all other species collected, up to 25 specimens of each species were measured for total length from each trawl sample. A random subsample of 25 specimens was selected for length determination when the number of fish collected exceeded 25.

When available, a total of up to five winter flounder (≥ 250 mm) per trawl were used for gender determination. If gender could not be determined in the field, specimens were preserved on ice and returned to the laboratory for later determination. Spawning condition (ripe, partially spent, and spent) was also recorded in the laboratory to provide additional information on spawning period. Since winter flounder typically exhibit adult gonad development at 250 mm TL and reach sexual maturity between 280 mm and 300 mm (Witherell 1993), a 250-mm TL requirement was established to limit the number of immature fish kept for analysis.

Except for winter flounder preserved for laboratory analysis, all fish collected were released into the water after on-board examination.

2.3 EPIBENTHIC SLED

Epibenthic sled sampling for ichthyoplankton was scheduled to bracket the period when winter flounder eggs and larvae are historically present in the Harbor. In 2008, ichthyoplankton surveys were conducted approximately every other week from 5 February through 9 July 2008 at the 28 stations described above. A total of 314 valid epibenthic sled tows were conducted in 2008: 129 at navigation channel stations and 185 at non-channel stations (Table 2-1).

Ichthyoplankton samples were collected using a 0.5-m² mouth plankton net with 0.5-mm mesh mounted on an aluminum epibenthic sled (Table 2-3). The plankton net was fitted with a GO Model 2030R flow meter to measure sample volume. All samples were collected during daylight hours from one hour after sunrise to one hour before sunset.

Tows were conducted against the prevailing current at a bottom speed of approximately 3.0 to 3.6 ft/sec (90 to 110 cm/sec). Boat speed was measured using a GO Model 2031 electronic flow meter coupled to a GO Model 2135 deck readout. GPS coordinates were recorded at the beginning and end of each tow to ensure proper station maintenance. Target tow duration was ten minutes, although tow times were occasionally adjusted as needed to account for obstructions, limited transect distance, commercial traffic, and other safety considerations in the field. A minimum ratio of 3:1 tow cable length to maximum station water depth was maintained to ensure that the sled was in contact with the bottom throughout each tow.

Upon retrieval of the epibenthic sled, the net was washed down from the outside concentrating the sample in the cod-end bucket. Each ichthyoplankton sample was then transferred to an appropriately sized container(s) and the remaining volume filled with 10% buffered Formalin containing the vital stain rose bengal. Samples were then returned to the laboratory for sorting and identification.

2.3.1 Laboratory Methodology for Ichthyoplankton Sort and Identification

All specimens were identified to the lowest taxonomic level practicable, assigned a life stage based on morphometric characteristics (i.e., egg, yolk-sac larvae, post yolk-sac larvae, or juvenile) and enumerated. For some larvae, it was not possible to discern between yolk-sac and post yolk-sac life stages because specimens were damaged. These were classified as unidentified larval stage. Quality control procedures consisted of a continuous sampling plan to assure an average outgoing quality limit (AOQL) of <0.10 (≥90% accuracy) during sample sorting, enumeration, life stage designation, and identification.

To further identify and describe the embryonic development of winter flounder eggs collected during the ichthyoplankton survey, the following sequential staging methodology was developed in consultation with USACE's Engineer Research and Development Center (ERDC) and based upon the winter flounder egg development

described by Martin and Drewry (1978). This methodology was employed by Schultz *et al*. (2007) and is consistent with other authors who have described similar staging systems for other species (Gorodilov 1996; Gadomski and Caddell 1996). In particular, Allen *et al.* (2005) describes a staging system for the developmental progression of lake trout, *Salvelinus namaycush*, which closely follows this study's five-stage methodology for winter flounder growth from fertilization to hatching as further described below. Staging of the eggs enables one to distinguish between eggs that were recently deposited from those that are more developed and may have moved from the site of their deposition (Schultz *et al.* 2007).

After sorting and species identification, all of the viable[2] winter flounder eggs were further identified into one of the following five stages using observed embryonic characteristics (see also Appendix D):

Stage 1 or Early Cleavage Stage: 1-64 cells, age equals 0-24 hours (<1 day).

Stage 2 or Blastula Stage: Final product of cleavage, formation of blastocoel, age equals 24-48 hours (1-2 days).

Stage 3 or Gastrula Stage: Between formation of blastocoel and formation of embryonic axis, age equals 48-72 hours (2-3 days).

Stage 4 or Early Embryo Stage: Formation of embryonic axis, age equals 3-15 days.

Stage 5 or Late Embryo Stage: After formation of embryonic near hatching, age equals >15 days.

In 2008, all non-viable winter flounder eggs were counted but only viable eggs were applied to the density calculations (see Section 2.5.2) to allow for direct comparisons between previous years of sampling in which non-viable eggs were not counted.

[2] Non-viable eggs include those that were unfertilized as well as those fertilized but obviously dead: an egg that has become opaque or murky in nature or has the presence of fungus and/or other types of deterioration.

In addition, all winter flounder yolk-sac and post yolk-sac larvae were further classified into the following developmental stages (see also Appendix D):

Stage 1: Yolk-sac present or eyes not pigmented.

Stage 2: Eyes pigmented, no loop or coil formed in the gut, no flexion of the notochord, and no yolk-sac present or minimal traces of yolk may remain.

Stage 3: Loop or coil formed in gut and/or flexion of the notochord has begun, but left eye has not migrated past the midline.

Stage 4: Left eye has migrated past the midline, but juvenile characteristics not present.

Up to 25 winter flounder of each larval stage were then randomly selected and measured from each sample. Larvae were measured in total length to the nearest 0.1 mm using microscopic imaging and measuring software further described below (see also Appendix D). Juveniles (Stage 5) that did not fit in the microscope view for image capturing measurement were measured to the nearest 1.0 mm using a calibrated measuring board. Larvae that exhibited prior damage/decomposition and/or sampling damage that could result in inaccurate lengths were not measured.

The measurement of winter flounder yolk-sac and post yolk-sac larvae was accomplished using a Motic DM143 Digital Microscope, a Canon Powershot S31S Digital Camera, and University of Texas Health Science Center at San Antonio (UTHSCSA) ImageTool software. The procedure involved first capturing a microscopic digital image of the larvae using Canon's CameraWindow software and saving it to a computer database. The images were then accessed and the larvae measured using the UTHSCSA image analysis software. Prior to each measurement session, a three-fold Daily Certification process was employed to verify the user's precision and accuracy with the image analysis tool by first testing the user's hand motion when measuring 1-mm marks, then calibrating the tool to the user's hand and eyes, and lastly verifying the calibration by testing the user when making 10-mm measurements.

2.4 WATER QUALITY MEASUREMENTS

Dissolved oxygen (DO), temperature, conductivity, and salinity were measured during each survey at each station location using a calibrated YSI Model 85 Handheld Oxygen, Conductivity, Salinity and Temperature System meter, or a comparable instrument, with a known degree of accuracy (Table 2-4). Measurements were recorded from the bottom strata of the water column at approximately one foot (0.3 m) above the substrate. Field instruments were calibrated each day both prior to and after sampling. At least once per sampling day, the veracity of the YSI Model 85 instrument was verified using an ASTM certified thermometer, a laboratory conductivity/salinity meter, and at least three water samples collected in the field and analyzed for DO using the Winkler titration method.

2.5 DATA ANALYSIS

All finfish were identified to the lowest practical taxonomic level in both trawl and ichthyoplankton sampling. Species were grouped into one of three categories: essential fish habitat (EFH) species, important non-EFH species, and other species.

2.5.1 Bottom Trawl

Catch per unit effort (CPUE), defined as the number of fish collected per 10 minutes of trawling, was determined for each bottom trawl sample and was standardized to 10 minutes using the following formula:

$$CPUE = \left(\frac{N}{T} \right) \times 10$$

Where:

N equals the number of fish collected during the trawl and

T equals the actual tow time expressed in minutes

2.5.2 Epibenthic Sled

Ichthyoplankton densities expressed as total number per 1,000 cubic meters (m^3) were computed for each epibenthic sled tow based on the volume of water sampled and using the following formula:

$$Density = \left(\frac{N}{[A \times D]} \right) \times 1{,}000$$

Where:

N equals the total number of organisms collected,

A equals the area of the net mouth (m^2) and

D equals the distance traveled (m) calculated as the total flow meter count multiplied by the flow meter constant (0.026873).

3.0 RESULTS

Adult finfish and ichthyoplankton results are described for two general habitat types (navigation channel and non-channel stations) in three Harbor regions (Arthur Kill/Newark Bay, Upper Bay, and Lower Bay). Species composition, relative abundance, density (per unit volume for ichthyoplankton samples), and catch per unit effort (CPUE) for bottom trawl samples are described in the sections below. Detailed station data for adult and juvenile finfish, ichthyoplankton, and water quality are provided in Appendices A through C, respectively.

3.1 ALL SPECIES

3.1.1 Bottom Trawl

A total of 24,615 finfish (42 species) and blue crab were collected during the 2008 bottom trawl survey (Tables 3-1 and 3-2). Bay anchovy (9,024 collected, 36.7% of the total catch) was the most commonly collected species in the Harbor during the 2008 sampling program, contributing over one third of the total bottom trawl catch, followed by white perch (3,202, 13.0%), Atlantic herring (2,667, 10.8%), alewife (2,210, 9.0%), spotted hake (2,002, 8.1%), striped bass (1,420, 5.8%), American sandlance (1,052, 4.3%), winter flounder (808, 3.3%), Atlantic silverside (714, 2.9%), blueback herring (391, 1.6%), and Atlantic menhaden (330, 1.3%). The remaining 32 species were each represented by less than 116 individuals, and of these, 21 were represented by 20 or fewer individuals (Table 3-2).

Approximately 68% (16,709 collected) of the total bottom trawl catch consisted of those fish grouped as other species; EFH and important non-EFH species represented 16% (3,861) and 16% (4,045) of the total bottom trawl catch, respectively. Two EFH species: Atlantic herring (2,667 collected, 10.8% of the total catch) and winter flounder (808, 3.3%), and three important non-EFH species: alewife (2,210, 9.0%), striped bass (1,420, 5.8%), and Atlantic menhaden (330, 1.3%) each contributed over one percent of the total catch in the Harbor (Table 3-2). The remaining EFH and important non-EFH species each represented less than 0.5% of the total catch.

When defined by station type, a total of 11,748 finfish from 41 species and 31 blue crabs were collected from the 78 bottom trawl samples collected at the 10 navigation channel stations, and a total of 12,783 finfish from 35 species and 53 blue crabs were collected from the 125 bottom trawl samples collected at the 16 non-channel stations sampled during 2008 (Table 3-2). White perch (3,199 collected, 27.2% of the total channel catch), alewife (2,092, 17.8%), spotted hake (1,908, 16.2%), bay anchovy (1,457, 12.4%), striped bass (1,201, 10.2%), and winter flounder (736, 6.2%) were the six most common species collected at channel stations. Bay anchovy (7,567 collected, 59.0% of the total

non-channel catch), Atlantic herring (2,634, 20.5%), American sandlance (883, 6.9%), Atlantic silverside (705, 5.5%), striped bass (219, 1.7%), and blueback herring (206, 1.6%) were the six most common species collected at non-channel stations. Finfish and blue crab abundances at channel stations totaled 4,796 in the Arthur Kill/Newark Bay and 4,831 in the Lower Bay as compared to 282 and 3,368 at the non-channel stations in those areas, respectively (Table 3-2). By contrast, 9,186 finfish and blue crabs were collected in non-channel areas of the Upper Bay as compared to 2,152 from channel areas of that region.

During the 2008 ABS, average weekly bottom trawl CPUE for all fish combined varied temporally and spatially with channel stations having generally higher CPUE rates from February to March in the Upper Bay and from February through April in the Lower Bay and Arthur Kill/Newark Bay (Figure 3-1). By comparison, CPUE rates at Upper Bay non-channel stations were considerably higher during April and May. In the Lower Bay and Arthur Kill/Newark Bay, channel CPUE rates were usually higher than non-channel CPUEs (Figure 3-1). These seasonal variations in CPUE were largely a reflection of the species collected with alewife (average monthly CPUE of 43.8 in February), white perch (97.2 in March) and spotted hake (45.2 in April) being the most commonly collected species in channel stations during the early months of the sampling season (Table 3-3). By contrast, later in the sampling season the highest monthly average bottom trawl CPUEs were found at non-channel stations and consisted of Atlantic herring (71.4 in April) and bay anchovy (208.4 in May).

When defined by management group, winter flounder, windowpane and scup were the most common EFH species collected from channel stations while Atlantic herring and winter flounder were the most common EFH species collected in non-channel areas (Table 3-3). Other EFH species were uncommon in bottom trawl collections; black sea bass, bluefish, butterfish, and clearnose skate had the lower monthly mean CPUE rates, while the mean CPUEs for little skate, red hake, and summer flounder were slightly higher. The highest monthly average bottom trawl CPUEs for important non-EFH species occurred at channel stations and included alewife in February (43.8), March (38.0) and

April (29.0) as well as striped bass in February (23.7), March (26.8) and April (13.1). Atlantic menhaden were common in channel collections during February (10.4) and striped bass were present in collections at non-channel stations during February (5.9). In May, monthly mean CPUE rates for alewife and blue crab were slightly higher at non-channel stations (Table 3-3). Of note, one shortnose sturgeon was collected at a non-channel station in the Upper Bay in May (Tables 3-2 and 3-3).

As a group, the 27 other species collected in the bottom trawls consisted of a diverse assemblage of finfish species with a range of abundances (rare to abundant) distributed spatially and temporally. The most common of these species were bay anchovy, white perch, spotted hake, American sandlance, Atlantic silverside and blueback herring (Table 3-3). Bay anchovy were collected primarily in May in non-channel stations (average monthly CPUE of 208.4) but were also found in channel areas (61.3). White perch and spotted hake were collected primarily in channels from February through April while American sandlance and Atlantic silverside were found primarily in non-channel stations during the early months of the sampling season. Blueback herring were collected at both channel and non-channel stations throughout the season from February through May (Table 3-3).

3.1.1.1 Arthur Kill/Newark Bay

A total of 5,048 fish consisting of 26 species and 30 blue crabs were collected in the 32 bottom trawl samples collected in the Arthur Kill/Newark Bay during 2008 (Table 3-2). White perch (3,033 collected, 59.7% of the total Arthur Kill/Newark Bay catch) was the dominant species collected; followed by striped bass (724, 14.3%), winter flounder (422; 8.3%), spotted hake (260, 5.1%), alewife; (190, 3.7%), bay anchovy (171, 3.4%), and Atlantic herring (99, 1.9%).

When defined by management group, EFH and important non-EFH species (n=1,503) comprised 29.6% of the total bottom trawl collections in the Arthur Kill/Newark Bay during the 2008 sampling program (Figure 3-2). Striped bass dominated the collections in

February and March followed by winter flounder. Alewife and striped bass dominated in April and Atlantic herring, winter flounder, and blue crab were the most common in May (Figure 3-2).

Twenty-four (24) fish species and blue crab were collected from the navigation channel stations and 12 fish species and blue crab were collected from the non-channel stations in the Arthur Kill/Newark Bay (Tables 3-4a and 3-4b). Of the most collected species in the Arthur Kill/Newark Bay, white perch, striped bass, winter flounder, alewife, and spotted hake were collected primarily from channel stations; Atlantic herring were primarily from non-channel stations and bay anchovy were collected from both areas. Trends in CPUE within the Arthur Kill/Newark Bay were influenced by large collections of white perch, striped bass, and winter flounder in channel stations primarily during the winter months (February and into March) and large collections of spotted hake, alewife, Atlantic herring, and bay anchovy primarily during spring (Tables 3-4a and 3-4b).

3.1.1.2 Upper Bay

A total of 11,287 fish consisting of 39 species and 51 blue crabs were collected in the 62 bottom trawl samples collected in the Upper Bay during 2008 (Table 3-2). Bay anchovy (5,737 collected, 50.6% of the total Upper Bay catch) was the dominant species collected; followed by Atlantic herring (2,415, 21.3%), spotted hake (930, 8.2%), striped bass (689, 6.1%), American sandlance (400, 3.5%), winter flounder (221, 1.9%), blueback herring (185, 1.6%), white perch (169, 1.4%), and alewife (154, 1.4%).

When defined by management group, EFH and important non-EFH species (n=3,726) comprised 32.9% of the total bottom trawl collections in the Upper Bay during the 2008 sampling program (Figure 3-2). Striped bass dominated the collections in February and March while Atlantic herring was the most common in April and May (Figure 3-2).

Thirty-seven (37) fish species and blue crab were sampled from navigation channel stations and 30 fish species and blue crab were collected from non-channel stations in the Upper Bay (Tables 3-4a and 3-4b). Of the dominant species collected in the Upper Bay,

white perch, winter flounder, and spotted hake were collected primarily from channel stations; Atlantic herring, American sandlance, blueback herring, and bay anchovy were primarily from non-channel stations; and alewife and striped bass were collected from both areas. Trends in CPUE within the Upper Bay were influenced by higher CPUEs of striped bass in channel stations primarily during the winter months of February (21.9) and March (31.6), large collections of spotted hake in channel stations from March to May (peak average monthly CPUE of 58.7 in April) and high CPUEs of Atlantic herring in non-channel stations during April (244.9) and May (76.6). Non-channel CPUEs for American sandlance were high in April (56.4) with the highest non-channel CPUEs recorded for bay anchovy (626.7) during May (Tables 3-4a and 3-4b).

3.1.1.3 Lower Bay

A total of 8,196 fish consisting of 33 species and 3 blue crabs were collected in the 109 bottom trawl samples collected in the Lower Bay during 2008 (Table 3-2). Bay anchovy (3,116 collected, 38.0% of the total Lower Bay catch) was the dominant species collected, followed by alewife (1,866, 22.8%), spotted hake (812, 9.9%), Atlantic silverside (680, 8.3%), American sandlance (652, 8.0%), Atlantic menhaden (276, 3.4%), blueback herring (185, 2.3%), winter flounder (165, 2.0%), and Atlantic herring (153, 1.9%).

When defined by management group, EFH and important non-EFH species (n=2,677) comprised 45.4% of the total bottom trawl collections in the Lower Bay during the 2008 sampling program (Figure 3-2). Alewife dominated the collections in February through April in the Lower Bay while winter flounder, scup and Atlantic herring were the most common in May (Figure 3-2).

Twenty-eight (28) species of fish were sampled from navigation channel stations and 29 species of fish and blue crab were collected from non-channel stations (Tables 3-4a and 3-4b). Of the dominant species collected in the Lower Bay, alewife, Atlantic menhaden, winter flounder, blueback herring, and spotted hake were collected primarily from

channel stations; Atlantic silverside, American sandlance were primarily from non-channel areas; and bay anchovy were collected from both stations. Trends in CPUE within the Lower Bay were influenced primarily by large collections of bay anchovy during May in both channel (110.8) and non-channel stations (70.6). Trends were also influenced by higher CPUEs of alewife in channel stations primarily from February to April (peak average monthly CPUE of 106.9 in February) and large catches of spotted hake in channel stations in March (67.5) and April (15.5). Relatively higher CPUEs of Atlantic menhaden were also collected at channel stations in February (25.5) and at non-channel stations during February for Atlantic silverside (33.0) and American sandlance (24.0) (Tables 3-4a and 3-4b).

3.1.2 Epibenthic Sled

Finfish eggs, larvae, and juveniles were collected from channel and non-channel stations in all three regions of the Harbor during ABS epibenthic sled sampling in 2008. A total of 273,043 early life stage eggs and larvae, and juveniles were collected in 2008 (Table 3-5). A majority of the ichthyoplankton collected were eggs (83.5%) and post yolk-sac larvae (15.3%), and most were collected in the Lower Bay (43.2%) and the Arthur Kill/Newark Bay (34.5%). A total of 160 valid ichthyoplankton samples were collected in the Lower Bay, 106 were collected in the Upper Bay and the Kill Van Kull, and 48 were collected in the Arthur Kill/Newark Bay (Table 2-1).

During the 2008 survey, a total of 33 taxa were identified in the ichthyoplankton samples including seven EFH designated species (Atlantic herring, Atlantic mackerel, black sea bass, butterfish, summer flounder, windowpane, and winter flounder) and one important non-EFH species (Atlantic menhaden). The Lower Bay samples included eight EFH and important non-EFH species, compared to the Upper Bay and the Arthur Kill/Newark Bay regions with 7 and 5 species, respectively (Table 3-5). Three life stages (eggs, yolk-sac larvae and post yolk-sac larvae) of windowpane, winter flounder, and Atlantic menhaden were represented in collections. Egg and post yolk-sac larvae stages of Atlantic mackerel and the post yolk-sac larvae stage of Atlantic herring, black sea bass, butterfish, and

summer flounder were collected. Juvenile life stage Atlantic herring and black sea bass were also collected.

Of these EFH and important non-EFH species, five (Atlantic herring, summer flounder, windowpane, winter flounder, and Atlantic menhaden) were collected from all three regions. Egg, yolk-sac larvae, and post yolk-sac larvae life stages of winter flounder and Atlantic menhaden were collected from all three regions. Windowpane egg and post yolk-sac larvae life stages were collected from all three regions and yolk-sac larvae were collected from the Lower Bay and Upper Bay. Atlantic herring and summer flounder post yolk-sac larvae life stages were collected from all three Harbor regions. Atlantic mackerel eggs were collected only in the Lower Bay and post yolk-sac larvae were only collected in the Upper Bay. Black sea bass and butterfish post yolk-sac larvae were only collected in the Lower Bay.

3.1.2.1 Eggs

A total of 228,083 eggs from 14 taxa of finfish were collected in the Harbor during ABS ichthyoplankton sampling in 2008 (Table 3-5). The majority of eggs collected were identified as bay anchovy (169,920 collected, 74.5% of the catch), followed by wrasses (Labridae family) (33,706, 14.8%), windowpane (10,239, 4.5%), searobin species (*Prionotus* sp.) (9,697, 4.3%), and Atlantic menhaden (2,842, 1.2%) with the remaining taxa each representing less than one percent of the total catch (Table 3-5).

Overall, average weekly egg densities were generally higher in the Arthur Kill/Newark Bay as compared to both the Upper Bay and Lower Bay (Figure 3-3). In the Arthur Kill/Newark Bay, peak egg densities were found at non-channel stations during the weeks of 22 June 2008 (59,789 eggs/1,000 m^3) and 6 July (114,194 eggs/1,000 m^3). In the Lower Bay, egg densities were generally higher in the channels (peak density of 32,536 eggs/1,000 m^3 during the week of 22 June) and were similar in scale to the collections in the Upper Bay which had a peak average weekly density of 26,887 eggs/1,000 m^3 at non-channel stations during the same week of 22 June (Figure 3-3). The

peak egg collections in June and July were generally the result of high collections of bay anchovy eggs in both channel and non-channel areas with maximum monthly average catches of 50,593 and 113,407 eggs/1,000 m³ occurring in non-channel stations during June and July, respectively (Table 3-6a). In addition, relatively large collections of wrasse eggs were made in all three Harbor regions and in both channel and non-channel areas with a maximum catch of 5,295 eggs/1,000 m³ occurring at non-channel stations in the Upper Bay during May (Table 3-6a).

When defined by management group, EFH and important non-EFH species (N=13,464) comprised 5.9% of the total egg collection during the 2008 ichthyoplankton sampling program (Figure 3-4 and Table 3-5). The collection of EFH and important non-EFH species eggs was dominated in February and March by winter flounder in all three regions. April, May and July collections were dominated by windowpane while June was dominated by Atlantic menhaden in the Arthur Kill/Newark Bay and a mix of windowpane and Atlantic menhaden in the Upper and Lower Bays (Figure 3-4).

Of the EFH and important non-EFH species, the mean monthly collection of winter flounder egg peaked at 203 eggs/1,000 m^3 at non-channel stations of the Upper Bay in February (Table 3-6a). Windowpane eggs were collected from April through July with peak mean monthly egg densities occurring in May in the Lower Bay at both non-channel (1,297 eggs/1,000 m^3) and channel stations (934 eggs/1,000 m^3). Monthly mean egg densities for windowpane were generally lower in the Upper Bay with the two highest densities of 405 and 431 eggs/1,000 m^3 occurring at channel stations during May and June, respectively, with only a few windowpane eggs collected in the Arthur Kill/Newark Bay during April and May (Table 3-6a). By comparison, Atlantic menhaden eggs were collected primarily in May and June with peak mean monthly densities of 339 and 612 eggs/1,000 m^3 occurring at channel stations during June in the Upper and Lower Bays, respectively (Table 3-6a).

3.1.2.2 Yolk-sac Larvae

A total of 1,120 yolk-sac larvae from 12 taxa of finfish were collected in the Harbor during ABS ichthyoplankton sampling in 2008 (Table 3-5). The majority of yolk-sac larvae collected were identified as winter flounder (866 collected, 77.3% of the catch), followed by grubby (102, 9.1%), Atlantic menhaden (48, 4.3%), bay anchovy (38, 3.4%), and American sandlance (28, 2.5%) with the remaining taxa each representing less than one percent of the total collection (Table 3-5).

Overall, average weekly densities of yolk-sac larvae were generally higher in the Lower Bay as compared to both the Upper Bay and Arthur Kill/Newark Bay (Figure 3-5). In the Lower Bay, peak yolk-sac densities were found during the week of 30 March 2008 at both channel (524 yolk-sac larvae/1,000 m^3) and non-channel stations (194 yolk-sac larvae/1,000 m^3). These peak weekly densities were largely the result of high collection of winter flounder yolk-sac larvae in both channel and non-channel areas (Table 3-6b). The Upper Bay and Arthur Kill/Newark Bay collections were similar in scale with peak average weekly densities of 84 and 65 yolk-sac larvae/1,000 m^3, respectively, occurring during the week of 22 June at navigation channel stations (Figure 3-5). These peak yolk-sac larvae collections in June were generally the result of high collections of Atlantic menhaden and bay anchovy in channel stations of both areas (Table 3-6b). Peak yolk-sac larvae density for the Arthur Kill/Newark Bay for non-channel stations occurred during the week of 16 March (17 yolk-sac larvae/1,000 m^3) and was primarily due to the collection of winter flounder. By comparison, peak yolk-sac larvae collections in non-channel stations of the Upper and Lower Bays were primarily the result of collections of winter flounder, grubby and American sandlance (Figure 3-5 and Table 3-6b).

When defined by management group, EFH and important non-EFH species (N=922) comprised 82.3% of the total yolk-sac larvae collection during the 2008 ichthyoplankton sampling program (Figure 3-6 and Table 3-5). The collection of EFH and important non-EFH species yolk-sac larvae were dominated during February through April by winter

flounder in all three regions while the May collections were dominated by windowpane and the June collections were dominated by Atlantic menhaden (Figure 3-6).

Of the EFH and important non-EFH species, peak mean monthly density of 269 yolk-sac larvae/1,000 m^3 for winter flounder at Lower Bay channel stations occurred during April (Table 3-6b). Windowpane yolk-sac larvae were collected only in the Upper and Lower Bays in April and May with a peak mean monthly density occurring in April in the Lower Bay at a little over one yolk-sac larvae/1,000 m^3 being collected in non-channel stations. By comparison, Atlantic menhaden yolk-sac larvae were collected only in June at channel stations in all three regions with a peak mean monthly density of 21 yolk-sac larvae/1,000 m^3 occurring in the Upper Bay (Table 3-6b).

3.1.2.3 Post Yolk-sac Larvae

A total of 41,673 post yolk-sac larvae from 29 taxa of finfish were collected in the Harbor during ABS ichthyoplankton sampling in 2008 (Table 3-5). The majority of post yolk-sac larvae collected were identified as bay anchovy (22,597 collected, 54.2% of the catch), followed by gobies (Gobidae family) (8,397, 20.1%), winter flounder (5,517, 13.2%), grubby (2,495, 6.0%), windowpane (774, 1.9%), and clupeiforms (Clupeiformes order) (420, 1.0%), with the remaining taxa each representing less than one percent of the total collection (Table 3-5).

Maximum average weekly densities of post yolk-sac larvae occurred during the last two sampling weeks of the program with peak occurrence at channel stations in the Lower Bay during the week of 6 July 2008 (10,790 post yolk-sac larvae/1,000 m^3) and in the Upper Bay at non-channel stations (6,702 post yolk-sac larvae/1,000 m^3) during the week of 22 June (Figure 3-7). In the Arthur Kill/Newark Bay, post yolk-sac larvae densities were generally higher in the channels with peak densities of 4,471 post yolk-sac larvae/1,000 m^3 during the week of 6 July and 1,354 post yolk-sac larvae/1,000 m^3 during the week of 22 June. The peak post yolk-sac larvae collections in June and July were generally the result of high catches of bay anchovy in both channel and non-channel areas

in the Lower and Upper Bays with maximum monthly average catches of 7,947 post yolk-sac larvae/1,000 m³ occurring in channel stations during July in the Lower Bay and 2,360 post yolk-sac larvae/1,000 m³ at non-channel stations in June in the Upper Bay (Table 3-6c). In the Arthur Kill/Newark Bay, the peak weekly density in July was largely due to gobies at channel stations with an average monthly collection of 3,897 post yolk-sac larvae/1,000 m³ (Table 3-6c).

When defined by management group, EFH and important non-EFH species (N=6,458) comprised 15.5% of the total post yolk-sac larvae collection during the 2008 ichthyoplankton sampling program (Figure 3-8 and Table 3-5). EFH and important non-EFH species collected at this life stage included Atlantic herring, Atlantic mackerel, black sea bass, butterfish, summer flounder, windowpane, winter flounder and Atlantic menhaden. The collection of EFH and important non-EFH species post yolk-sac larvae was dominated in March and April by winter flounder in all three regions (Figure 3-8). In May, winter flounder again dominated in the Upper and Lower Bays but was eclipsed by windowpane in the Arthur Kill/Newark Bay. Early collections in February were dominated by Atlantic herring in the Upper Bay and winter flounder in the Lower Bay, while later collections in June and July were dominated by windowpane primarily in the Lower Bay and Atlantic menhaden in the Upper Bay and Arthur Kill/Newark Bay (Figure 3-8).

Of the EFH and important non-EFH species, the mean monthly collection of winter flounder post yolk-sac larvae peaked during April in the Lower Bay at 502 post yolk-sac larvae/1,000 m^3 at non-channel stations and 314 post yolk-sac larvae/1,000 m³ at channel stations (Table 3-6c). Windowpane post yolk-sac larvae were collected from April through July with peak mean monthly post yolk-sac larvae densities occurring in May in the Lower Bay at both channel (127 post yolk-sac larvae/1,000 m^3) and non-channel stations (96 post yolk-sac larvae/1,000 m³). Monthly mean post yolk-sac larvae densities for windowpane were generally lower in the Upper Bay and Arthur Kill/Newark Bay as compared to the Lower Bay with the highest densities for those two regions occurring in the Upper Bay during May at channel (25 post yolk-sac larvae/1,000 m^3) and non-

channel stations (22 post yolk-sac larvae/1,000 m^3) (Table 3-6c). By comparison, Atlantic menhaden post yolk-sac larvae were collected during all months of the sampling program except for May but were collected at peak densities in the Upper Bay at both channel stations in July (13 post yolk-sac larvae/1,000 m^3) and non-channel stations in June (15 post yolk-sac larvae/1,000 m^3) (Table 3-6c).

3.1.2.4 Juveniles

A total of 37 juveniles from six taxa of finfish were collected in the Harbor during ABS ichthyoplankton sampling in 2008 (Table 3-5). The majority of juveniles collected were identified as northern pipefish (23 collected, 62.2% of the catch), followed by butterfish (9, 24.3%), and Atlantic Herring (2, 5.4%). The remaining taxa (bay anchovy, grubby, and weakfish) each represented 2.7 % of the total collection with only one individual of each caught (Table 3-5).

Peak weekly densities for juveniles occurred during the week of 22 June 2008 at channel stations of all three regions of the Harbor with 13 juveniles/1,000 m^3 occurring in the Arthur Kill/Newark Bay and 9 juveniles/1,000 m^3 in both the Upper and Lower Bays (Figure 3-9). The peak June collections of juveniles were almost entirely the result of northern pipefish catches in all three regions (Table 3-6d) while peak July collections were the result of channel catches of butterfish in the Lower Bay (8 juveniles/1,000 m^3) and non-channel collections of butterfish in the Upper Bay (4 juveniles/1,000 m^3) (Table 3-6d).

When defined by management group, EFH and important non-EFH species (n=12) comprised 32.4% of the total juvenile collection during the 2008 ichthyoplankton sampling program (Figure 3-10 and Table 3-5). Of the EFH and important non-EFH species, only Atlantic herring and butterfish juveniles were collected. All Atlantic herring were collected in the Upper Bay during April, while butterfish were only found in the Upper and Lower Bays in July (Figure 3-10).

3.2 WINTER FLOUNDER

3.2.1 Bottom Trawl

A total of 808 adult and juvenile winter flounder were collected during the bottom trawl sampling of the 2008 ABS (Table 3-2). A majority were collected in the Arthur Kill/Newark Bay (422 collected, 52.2%); followed by the Upper Bay (221, 27.4%) and the Lower Bay (165, 20.4%). Winter flounder were collected at both channel and non-channel stations. However, the vast majority (91.1%) were collected from channel stations (Table 3-2). They were collected during each month of the bottom trawl sampling program from February to May with the highest monthly average catches (all regions combined) occurring at channel stations from February through April (Table 3-3).

3.2.1.1 Winter Flounder Catch Per Unit Effort (CPUE)

Average weekly bottom trawl collections of winter flounder peaked during the first two months of the sampling season (Figure 3-11a) with the four highest collections occurring at channel stations in the Arthur Kill/Newark Bay during the weeks of 16 March 2008 (CPUE = 49.7), 10 February (42.5), 17 February (39.5) and 2 March (29.5). Relatively high collections of winter flounder (average weekly CPUE ≥15.0) also occurred at channel stations in the Arthur Kill/Newark Bay during the weeks of 13 April (CPUE = 22.4) and 27 April (16.0), at channel stations in the Upper Bay during the weeks of 10 February (15.0) and 24 February (27.0), and at channel stations in the Lower Bay during the week of 27 April 2008 (15.0). Of note, the maximum average weekly bottom trawl CPUE at non-channel stations was 3.0, occurring in the Upper Bay during the week 27 April 2008 (Figure 3-11a).

When compiled monthly by region (Tables 3-4a & 3-4b), mean CPUEs for winter flounder were highest at channel stations in the Arthur Kill/Newark Bay during February (monthly average CPUE = 41.0), March (39.6) and into April (19.2). The peak winter flounder abundance at channel stations in May occurred in the Lower Bay (6.8), but was followed closely by the Arthur Kill/Newark Bay (6.6) and Upper Bay (4.1) (Table 3-4a).

Monthly average CPUEs for winter flounder at non-channel stations were generally less than 1.0 with a maximum CPUE of 2.1 occurring in the Upper Bay during April (Table 3-4b). Of note, no winter flounder were collected at non-channel stations in the Arthur Kill/Newark Bay during February and March (Table 3-4b).

In 2008, eight new bottom trawl sampling locations were added in the Lower Bay to better define the spatial distribution of winter flounder across a range of water depths. Figure 3-11b presents average weekly bottom trawl CPUE of winter flounder in the Lower Bay by the three habitat depths: channel (≥ 50 feet), non-channel deep (25-50 feet), and non-channel shallow (< 25 feet). In the Lower Bay, adult and sub-adult winter flounder were collected primarily from the channels during the second half of the season from mid-March onward and showed a slight preference for deep non-channel stations over shallow non-channel stations in this region (Figure 3-11b).

3.2.1.2 Winter Flounder Size Distribution

During the 2008 bottom trawl survey a total of 780 winter flounder were measured and ranged between 60 and 445 mm TL (Figure 3-12). The majority of winter flounder collected were sub-adults (TL < 250 mm). Most of these measured between 100 and 150 mm TL and were likely juveniles. Nearly 14% of the winter flounder collected in non-channel areas measured greater than 250 mm TL (considered sexually mature) as compared to less than 8% in channel stations (Figure 3-12). Overall, the mean total length of winter flounder collected at channel and non-channels stations was 154 mm TL (standard deviation ± 54 mm) and 161 mm TL (±74 mm), respectively. The most commonly collected length class was 120-129 mm at channel stations and 140-149 mm TL at non-channel stations (Figure 3-12).

Spatial patterns in size distribution indicate that only a few winter flounder larger than 200 mm TL were collected in the Arthur Kill/Newark Bay (Figure 3-13) as compared to the Upper Bay (Figure 3-14) and the Lower Bay (Figure 3-15). These larger sub-adult and adult-sized winter flounder were especially common after spawning in the Upper Bay

during April and in the Lower Bay during April and May. For all regions, the most commonly measured winter flounder were in the 100 to 150 mm TL range and were likely juveniles. Bottom trawl sampling ended in May and there was no evidence that young of the year winter flounder had attained a length range of approximately 40 to 60 mm TL which based on the bottom trawl mesh size is the approximate length that juvenile winter flounder begin to be recruited into the trawl collections (Figures 3-13 to 3-15).

3.2.1.3 Winter Flounder Gender Ratio

During the 2008 bottom trawl survey, a total of 42 adult winter flounder ≥250 mm in total length had their gender determined in either the field or in the laboratory. A majority of these fish (74%) were collected in the Lower Bay and most (71%) were females (Figure 3-16). Table 3-7 presents additional spawning condition data for those 39 specimens which were analyzed in the lab, this additional information was not collected on the three analyzed in the field. Overall, females averaged 321 mm TL and weighed 411.1 g as compared to males which averaged 287 mm TL and weighed 274.0 g. When compared by region, females in the Upper Bay averaged 325 mm and 481.8 g as compared to females in the Lower Bay which averaged 319 mm and 387.6 g. Males in the Lower Bay averaged 289 mm and 279.5 g compared to a 271 mm male weighing 219.1 g from the Upper Bay (Table 3-7). The majority of winter flounder ≥250mm were collected in April and May after the spawning period was over and all but one (a partially spent male) from this period were found to be spent.

3.2.1.4 Winter Flounder Bottom Trawl Inter-Annual Occurrence

In 2008, winter flounder CPUEs were consistent with the most recent years of the sampling program, except for within the Arthur Kill/Newark Bay where the highest mean monthly catches of the entire program were observed in February (CPUE = 20.5) and March (CPUE = 19.8) (Figures 3-17a and 3-17b). From 2005 to 2007, the Upper Bay

generally had higher mean monthly catch rates than both the Arthur Kill/Newark Bay and the Lower Bay, which had comparable CPUEs (Figure 3-17b).

The 2002 to 2008 bottom trawl data indicates that both adult and juvenile winter flounder were generally present throughout the Harbor using habitat in each of the three regions during every year and most months of the survey (Figures 3-18a and 3-18b). Monthly trends for length frequency distribution by region are presented for both night (Figure 3-18a) and day sampling (Figure 3-18b). December bottom trawl sampling during 2002-2004 showed a somewhat higher frequency of larger sub-adult and adult fish greater than 200 mm TL (Figure 3-18a) while January through March samples from 2002 to 2008 were comprised predominantly of yearlings and juveniles that measured between 80 and 150 mm TL (Figures 3-18a and 3-18b). The widest range of winter flounder length classes appeared in April from 2002 through 2008 and in May during 2002-2004 bottom trawl sampling when more adult sized fish greater than 250 mm were collected in the Upper and Lower Bays (Figures 3 -18a and 3-18b).

During 2002-2004 sampling, the highest abundances of winter flounder occurred during June 2002 at Arthur Kill/Newark Bay (CPUE = 11.6) and during January 2004 at Upper Bay stations (CPUE = 11.3) (Figure 3-17a). The June 2002 peak corresponded to the high recruitment of age-0 winter flounder (<80 mm) in the trawl tows (Figure 3-18a). This late spring recruitment of age-0 winter flounder, primarily in the Arthur Kill/Newark Bay and in the Upper Bay, was also observed during the 2005 to 2008 sampling, although is somewhat less apparent in June and also involves some May recruitment in the Lower Bay (Figure 3-18b).

Regardless of whether the bottom trawl sampling was conducted during the night (2001-2004) or during the day (2005-2008), the winter flounder assemblage in each region was dominated by sexually immature individuals (TL <250 mm). From 2001 to 2004, only approximately 10% of the winter flounder collected at channel stations and 13% collected at non-channel stations measured greater than 250 mm TL (Figure 3-18c). By comparison, from 2005 through 2008, a slightly higher percentage of adult aged winter

flounder were collected at both channel (11%) and non-channel stations (17%) (Figure 3-18d). In addition, the mean total length of all winter flounder measured increased from 154 and 139 mm at channel and non-channel stations during night sampling, respectively, to 170 and 163 mm TL at channel and non-channel stations during day sampling, respectively (Figures 3-18c and 3-18d).

3.2.2 Epibenthic Sled

Winter flounder eggs, yolk-sac and post-yolk sac larvae were collected throughout the Harbor at both channel and non-channel stations during the 2008 ABS ichthyoplankton survey (Table 3-5). A total of 6,909 early life stage winter flounder were collected, consisting of 378 viable eggs, 866 yolk-sac larvae, 5,517 post yolk-sac larvae, and 148 unidentified larval stage (Table 3-5).

3.2.2.1 Winter Flounder Eggs

A total of 378 viable winter flounder eggs were collected during 2008 ichthyoplankton sampling in New York Harbor, the vast majority of which were collected in the Upper Bay (92.6%), followed by the Arthur Kill/Newark Bay (6.3%) and the Lower Bay (1.1%) (Table 3-5). Viable winter flounder eggs were collected overwhelmingly at non-channel areas of the Harbor and primarily during February sampling in the Upper Bay (monthly average density = 203 eggs/1,000 m^3) and Arthur Kill/Newark Bay (33 eggs/1,000 m^3). Much lower monthly average densities (<6 eggs/1,000 m^3) were collected at channel stations in the Upper Bay during February at non-channel stations in all three regions during March and at non-channel stations in the Lower Bay during March (Table 3-6a).

As described earlier in the methodology (Section 2.3.1), a new winter flounder egg staging protocol based upon the scientific literature was implemented in 2008. Figure 3-19 provides a breakdown of the egg collection by stages including the percentages of

non-viable collected[3]. A majority of the winter flounder eggs collected, 75.2%, were determined non-viable including a majority of the eggs collected during February in the Upper and Lower Bays (Figure 3-19). Approximately 75% of the eggs collected in the Arthur Kill/Newark Bay were classified as the earliest Stage 1 and 2 while of the few eggs collected in the Lower Bay 80% of them were from the later Stage 4 and 5. Of the viable eggs collected in the Upper Bay, a majority of them were classified as Stage 1 (Figure 3-19).

When separated by station type, approximately half of the winter flounder eggs collected at navigation channel stations were deemed non-viable while the rest were determined as Stage 1 (Figure 3-20a). More than 75% of the eggs at non-channel stations in the Upper Bay were determined non-viable with the remaining classified as Stage 1. The Arthur Kill/Newark Bay non-channel stations had a much lower percentage of non-viables and more Stage 3, 4 and 5 viable eggs (Figure 3-20b).

No winter flounder eggs were collected after the sampling week of 30 March 2008 (Figures 3-20a and 3-20b).

3.2.2.2 Winter Flounder Yolk-sac Larvae

A total of 866 winter flounder yolk-sac larvae were collected during 2008 ichthyoplankton sampling in New York Harbor. The vast majority of which were collected in the Lower Bay (92.4%) followed by the Upper Bay (5.8%), and the Arthur Kill/Newark Bay (1.8%) (Table 3-5). Winter flounder yolk-sac larvae were collected from February through April with peak occurrence during April in the Lower Bay at both channel (monthly average density = 269 yolk-sac larvae/1,000 m³) and non-channel stations (84 yolk-sac larvae/1,000 m³) (Table 3-6b). Outside of the Lower Bay, yolk-sac larvae densities were generally less than five organisms per 1,000 m³ at both types of stations, except for small peaks in the Arthur Kill/Newark Bay at channel stations in

[3] Note that non-viable eggs were counted but were NOT applied to the density calculations in 2008 so as to remain consistent with protocols from previous years of the program.

February (8.2 yolk-sac larvae/1,000 m³) and at non-channel stations in March (8.5 yolk-sac larvae/1,000 m³).

Figure 3-21 provides the percent composition of winter flounder larval life stages for each of the three sampling regions by month in 2008. Yolk-sac larvae (Stage 1) comprised 100 percent of the winter flounder larvae collections in the Arthur Kill/Newark Bay and the Upper Bay, as well as nearly 75% of the collections in the Lower Bay in February. By contrast, Stage 1 (yolk-sac larvae) typically accounted for less than 25% of the larvae collection in March and April (Figure 3-21). When separated by station type, the earliest collections of winter flounder yolk-sac larvae at channel stations occurred in mid February in the Arthur Kill/Newark Bay while the highest collections were made during the week of 30 March 2008 in the Lower Bay (Figure 3-22a). By contrast, yolk-sac larvae collections at non-channel stations were made sporadically from mid February to mid April in all three regions (Figure 3-22b). No winter flounder yolk-sac larvae were collected at either station type after the sampling week of 27 April 2008 (Figure 3-22a and 3-22b).

3.2.2.3 Winter Flounder Post Yolk-sac Larvae

A total of 5,517 winter flounder post yolk-sac larvae were collected during 2008 ichthyoplankton sampling in New York Harbor; the majority of which were collected in the Lower Bay (77.0%), followed by the Upper Bay (20.2%) and the Arthur Kill/Newark Bay (2.8%) (Table 3-5). Winter flounder post yolk-sac larvae were collected primarily from March through May with peak densities occurring in April and into May (Table 3-6c). The highest densities were recorded in April in the Lower Bay at both channel (314 post yolk-sac larvae/1,000 m³) and non-channel stations (502 post yolk-sac larvae/1,000 m³) but relatively high densities were also recorded at both station types in April in the Upper Bay (197 and 114 post yolk-sac larvae/1,000 m³, respectively) and at channel stations (86 post yolk-sac larvae/1,000 m³) in the Arthur Kill/Newark Bay in April. The high catches of winter flounder post yolk-sac larvae continued into May in the Lower Bay at both channel (180 post yolk-sac larvae/1,000 m³) and non-channel stations (173

post yolk-sac larvae/1,000 m³) and at channel stations in the Upper Bay (203 post yolk-sac larvae/1,000 m³). In March, the highest collections were made at non-channel stations of the Lower Bay (127 post yolk-sac larvae/1,000 m³) (Table 3-6c).

Figure 3-21 provides the percent composition of winter flounder larval life stages for each of the three sampling regions by month in 2008. Post yolk-sac larvae (Stages 2, 3, and 4) comprised 100% of the winter founder larvae collections in all regions during the month of May, as well as nearly 100% of the April collections in the Arthur Kill/Newark Bay and Upper Bay, and nearly 75% in the Lower Bay. Most of the post yolk-sac larvae collected were identified as either Stage 2 or Stage 3 with a slightly higher percentage of Stage 2 larvae occurring in March in all three regions as compared to April and May (Figure 3-21). When separated by station type, higher densities of Stage 2 post yolk-sac larvae occurred at non-channel stations (Figure 3-22b) as compared to channel stations (Figure 3-22a). No winter flounder post yolk-sac larvae were collected after the sampling week of 25 May 2008 (Figure 3-22a and 3-22b).

3.2.2.4 Winter Flounder Ichthyoplankton Inter-Annual Occurrence

Winter flounder eggs and larvae have been collected throughout New York/New Jersey Harbor over the course of the ABS program and provide an opportunity to observe trends in ichthyoplankton density and the distribution of habitat use. Winter flounder eggs have been collected in all sampled regions of the Harbor but primarily in the Upper and Lower Bays (Tables 3-23a). Peak winter flounder egg collections occur in February and March, although eggs have been collected in April (typically less than 10 eggs/1,000 m³ as a monthly average) during most of the sampling years from 2002 to 2008 (Table 3-23a). In 2008, winter flounder eggs were primarily collected in February in the Upper Bay with fewer eggs collected in March than in previous years. Average monthly winter flounder egg densities in 2008 were lower than previous years in the Lower Bay, but were higher during February than previous years in the Upper Bay and Arthur Kill/Newark Bay. By comparison, 2003, 2007 and 2008 have represented the peak years for egg collection since 2002 (Figure 3-23a).

The vast majority of winter flounder eggs collected in 2008 were collected in non-channel areas of the Harbor with only a few eggs collected in channel areas of the Upper Bay during February (Table 3-6a). This is comparable to the 2007 ABS collections, where the majority of the eggs were also collected in non-channel areas (USACE 2008). In 2008, additional sampling locations were added in the Lower Bay to further define the spatial distribution of winter flounder ichthyoplankton across a range of water depths. Only a few eggs (N=4) were collected in the Lower Bay during 2008 and all of them were collected in non-channel shallow stations of less than 25 feet (Figure 3-24a).

Winter flounder larvae (yolk-sac and post-yolk sac combined) have been collected in all sampled regions of the Harbor, but peak abundances typically occur in the Lower Bay (Figure 3-23b). Peak winter flounder larvae collections occur in April, although larvae are also collected in relatively high densities in March and May as well. Generally, very low collections of larvae have been made in each region during February and June, and only during 2005 in the Upper Bay and during 2007 in the Arthur Kill/Newark Bay were larvae collected in January and then at very low density (Figure 3-23b). In 2008, winter flounder larvae collections peaked in April in all three regions of the Harbor. Average monthly densities in 2008 were generally less than observed during 2003, 2004 and 2007 (Figure 3-23b).

In 2007, the highest average monthly yolk-sac larvae densities of 2,366 and 2,212 yolk-sac larvae/1,000 m^3 occurred at non-channel stations in the Lower Bay during March and April, respectively, and represented the highest yolk-sac larvae collections from 2002 to 2008 (USACE 2008). In 2008, fewer winter flounder yolk-sac larvae were collected and were predominately collected in the Lower Bay during April at both channel (269 yolk-sac larvae/1,000 m^3) and non-channel stations (84 post yolk-sac larvae/1,000 m^3) (Table 3-6b).

In 2007, peak mean monthly post yolk-sac larvae densities of 526 and 6,460 post yolk-sac larvae/1,000 m^3 occurred at channel and non-channel stations, respectively, in the

Lower Bay during April (USACE 2008). Mean monthly post yolk-sac larvae densities also peaked at non-channel stations in Upper Bay and Arthur Kill/Newark Bay (685 and 450 post yolk-sac larvae/1,000 m^3) during April 2007. The 2008 peak mean monthly post yolk-sac larvae densities of 502 and 314 post yolk-sac larvae/1,000 m^3 occurred during April in the Lower Bay at non-channel and channel stations, respectively (Table 3-6c). Upper Bay peak mean monthly post yolk-sac larvae densities of 197 and 203 post yolk-sac larvae/1,000 m^3 occurred at channel stations in April and May, respectively. Arthur Kill/Newark Bay peak mean monthly post yolk-sac larvae density of 86 post yolk-sac larvae /1,000 m^3 occurred at channel stations in April (Table 3-6c).

Figure 3-24b presents the average weekly density of winter flounder larvae (yolk-sac and post yolk-sac combined) in the Lower Bay by station type. Unlike eggs, which were collected entirely at non-channel shallow stations, winter flounder larvae were collected at channel and both non-channel station types in 2008; although the highest densities were focused in the non-channel shallows from the end of March to mid April. The highest channel collection was made earlier in the season during the week of 30 March 2008 and only one winter flounder larvae was collected in the Lower Bay after the week of 11 May (Figure 3-24b).

Figure 3-25a presents the length frequency distribution of all the winter flounder larvae measured in 2008. The Lower Bay had the most larvae measured followed by the Upper Bay and then the Arthur Kill/Newark Bay. In the Lower Bay, the most frequently collected larvae length was 4-5 mm TL (n=404) and 3-4 mm (n=350) and most of those (75% and 73%, respectively) were collected in non-channel areas (Figure 3-25a). By contrast, in the Upper Bay, the most frequently collected larvae lengths were slightly larger 5-6 mm TL (n=125) and 4-5 mm TL (n=105) and most of the larger larvae greater than 6 mm TL were collected in channel stations.

Figure 3-25b compiles the length frequency distribution data for winter flounder larvae from 2003 through 2008. In both the Arthur Kill/Newark Bay and the Upper Bay, the most frequently collected length class was 5-6 mm TL as opposed to the Lower Bay

where the most frequently measured length was slightly smaller at 4-5 mm TL. As in 2008, the all years data showed a peak of smaller larvae collected in the non-channel stations of the Lower Bay as opposed to the Arthur Kill/Newark Bay which appears more uniformly distributed between channel and non-channel areas (Figure 3-25b).

3.3 WATER QUALITY DATA

Overall, mean monthly bottom water temperature was slightly higher in the Arthur Kill/Newark Bay than in the other regions of the Harbor during the 2008 ABS sampling program (Figure 3-26). Mean temperatures in the Arthur Kill/Newark Bay were higher than the other two regions from May through July, but were approximately the same as the Upper Bay from February through April. The mean temperatures in the Lower Bay were slightly higher than the other regions in February, nearly equal to the other regions in March, and consistently lower than the other two regions from April through July. In February, mean bottom water temperatures throughout the Harbor ranged between 4 and 5°C and peaked to a high of approximately 23^{o}C in Arthur Kill/Newark Bay during July (Figure 3-26).

Mean monthly bottom water salinity recorded in parts per thousand (ppt) during the 2008 ABS program ranged from approximately 16 to 28 ppt (Figure 3-26). Salinities were consistently lowest in the Arthur Kill/Newark Bay and highest in the Lower Bay throughout the 2008 sampling season. In the Arthur Kill/Newark Bay and the Upper Bay, salinities generally increased each month as the season progressed with the lowest salinities in the Arthur Kill/Newark Bay recorded in February (16.2 ppt) to a high of 22.7 ppt in July (Figure 3-26).

Trends in bottom water dissolved oxygen levels were similar across the three Harbor regions, generally decreasing from February to July as water temperatures increased (Figure 3-26). Mean monthly dissolved oxygen in all three regions remained between 8.4 and 11.2 mg/L from February through April but decreased in June and July to between 4.9 and 7.5 mg/L (Figure 3-26). All water quality sampling data are presented in Appendix C.

3.3.1 Water Quality Data Inter-Annual Variation

Previous reports have documented the inter-annual variations in bottom water temperatures in the Harbor. Water temperatures during January and February were generally warmer in 2002, 2005, 2006 and 2007 in all regions as compared to other sampling years (USACE 2008). However, 2006 and 2007 tended to be among the coolest years in June and July for all three regions based on average monthly bottom water temperature. By comparison, 2002 had the warmest temperatures in both March and April for all three regions and 2006 had the warmest May (USACE 2008). Figure 3-27a presents the average monthly bottom water temperature by region from 2002-2008. The Arthur Kill/Newark Bay region shows the greatest monthly variations in bottom water temperature with an average monthly range from 3.4°C in February to 22.4°C in July. By comparison, the Lower Bay has the most steady bottom water temperatures with a range from 3.9°C in February to 19.0°C in July (Figure 3-27a). Of note, the average monthly bottom water temperatures in 2008 tended to be between 1 to 2°C higher than the all-year averages for all sampled months and in all regions with the greatest variations occurring in June and July (Figures 3-26 and 3-27a).

Figure 3-27b presents the average monthly bottom water salinities by region from 2002-2008. Average monthly salinities are lowest in the Arthur Kill/Newark Bay and highest in the Lower Bay with all three regions following a similar trend of decreased salinity during April through June and increased salinity during January and February (Figure 3-27b). In 2008, average monthly bottom water salinities in February and March were lower than the all-year averages for each of the three regions, although salinities for the remaining months of 2008 were generally higher than all-year averages (Figures 3-26 and 3-27b).

Figure 3-27c presents the average monthly bottom water dissolved oxygen by region from 2002-2008. Average monthly dissolved oxygen levels are generally the same across all three regions of the Harbor and correlate with bottom water temperatures. Dissolved

oxygen increased from December (January for the Lower Bay) into February and March with a peak of 10.9 mg/L in the Arthur Kill/Newark Bay, and then decreased progressively through July to a low of 5.4 mg/L in the Arthur Kill/Newark Bay (Figure 3-27c). For the most part, except for February and May in the Upper Bay and June in the Lower Bay, average monthly dissolved oxygen readings in 2008 where lower than the all-year averages (Figures 3-26 and 3-27c).

4.0 DISCUSSION

The data set of the Aquatic Biological Survey offers a unique and invaluable source of finfish abundance and distribution data in New York and New Jersey Harbor. While the systematic sampling program and the consistent sampling locations allow direct comparisons between years, the adaptive nature of the program has also allowed the program to evolve to meet the changing needs and requirements of local and regional resource managers. In 2008, for example, new sampling locations were added in the Lower Bay to better define the spatial distribution of winter flounder in particular across a range of water depths. Similarly, in 2008, a new winter flounder egg staging protocol was developed to better distinguish between eggs that were recently deposited from those that are more developed.

Water quality and habitat characteristics throughout the Harbor affect the spatial and temporal occurrence of finfish. The three Harbor regions defined in this study exhibit different water quality, currents, depth distributions and sediment conditions. Water temperatures are similar in the three regions during the winter months but the warmest water temperatures over the study period occur in the Arthur Kill/Newark Bay region during spring and into early summer (April to July). The Arthur Kill/Newark Bay region has the lowest salinities while the Lower Bay has the highest and least variable salinities. Arthur Kill/Newark Bay and Upper Bay salinities are influenced by freshwater runoff from the Raritan, Passaic, Hackensack and Hudson Rivers. Dissolved oxygen concentrations are similar throughout the regions over the sampling period. The bottom substrate in the Arthur Kill/Newark Bay region is dominated by fine grain sediments while the Lower Bay is comprised primarily of coarse grains and the Upper Bay consists of a mixture of fine and coarse sediments. A large percentage of the area of Arthur Kill/Newark Bay and Upper Bay regions are comprised of maintained deep channels and berthings areas. Lower Bay is dominated by shallow and deep shoals with a small percentage of maintained deep channel.

4.1 ALL SPECIES

The finfish composition of anadromous, semi-anadromous and shallow water residents collected during the 2008 Aquatic Biological Survey is typical of estuaries within the Middle Atlantic Bight (Able and Fahay 1998). The Harbor is dominated by migratory and seasonally transient fish species. Many species spawn in the Harbor seasonally, while others spawn offshore on the continental shelf or upstream in the Harbor tributaries. This seasonality and preference for different spawning habitat influence the occurrence and density of species collected during the sampling program. Species that spawn in the Harbor, such as bay anchovy, were present in high densities during their seasonal spawning period (April through July) while other species, such as American shad, were less abundant because they migrate through the Harbor to primary spawning habitats in the Hudson River.

Species abundance and richness has varied annually throughout the sampling program. For example, the highest total abundance of all species combined in bottom trawl catches prior to 2008 over the sampling program occurred in 2006 when 23,874 fish collected; whereas, only a total of 7,032 fish were collected during 2007. A total of 24,531 finfish from 42 species and 84 blue crabs were collected during 2008. This was the highest yearly catch total during the ABS program and may, in part, be a reflection of the additional sampling locations in the Lower Bay. The bottom trawl total in 2008 was the result of large catches of bay anchovy (36.7% of the total bottom trawl catch) in the Upper and Lower Bays during April and May. Temporal and spatial trends are generally evident across the Harbor regions. Specifically, there was a transition from higher CPUEs at channel stations during winter and early spring months to higher CPUEs at non-channel stations during late spring and early summer months (Figure 3-1).

In 2006, the Arthur Kill/Newark Bay had the lowest species richness and abundance, while the Lower Bay had the highest abundances and Upper Bay had the highest species richness (USACE 2007). In contrast to 2006, the Lower Bay had the lowest species richness and abundance, the Arthur Kill/Newark Bay had the highest abundances, and the Upper Bay had the highest species richness in 2007 (USACE 2008). In 2008, the Upper

Bay had the highest number of fish species and highest number of fish collected of the three Harbor sampling regions (Table 3-2). The yearly variation in number of species and relative abundance during the sampling program are likely within the natural variation of populations within a dynamic system.

Early life stage densities have also tended to vary spatially and temporally. A total of more than 270,000 eggs, larvae and juveniles from 33 identified taxa were collected during ichthyoplankton sampling in 2008. This compares to the more than 143,000 early life stage organisms from 34 taxa collected in 2007 (USACE 2008). In 2008, bay anchovy eggs comprised more than 62% of the total ichthyoplankton collection and were collected predominately in Arthur Kill/Newark Bay during June and July. Of note, the highest collections of eggs (all species combined) were made in the non-channel areas of the Arthur Kill/Newark Bay and the Upper Bay; and in the channel areas of the Lower Bay (Figure 3-3). In 2008, the Lower Bay had the highest ichthyoplankton taxa richness (31) as compared to 26 taxa collected in the Upper Bay and 22 taxa in the Arthur Kill/Newark Bay but again may be a reflection of the additional sampling effort in the Lower Bay during 2008 (Table 3-5).

4.1.1 Essential Fish Habitat Species

Over the years of the bottom trawl sampling program, the spatial and temporal preferences of some EFH species has become evident while the preferences of other species remain less apparent. Bottom trawl catches of several EFH species (red hake, windowpane, winter flounder, and little skate) have generally occurred in deeper water (channel) habitats and to a lesser extent, in shallow water (non-channel) habitats. Atlantic herring, bluefish, butterfish, scup, and summer flounder are generally collected in non-channel stations. For the most part, these trends continued in 2008, although only a few EFH species (notably winter flounder and Atlantic herring) were collected in substantial numbers this year.

Trends in the collection of winter flounder are discussed in more detail in Section 4.2 but generally in 2008 adult and sub-adult winter flounder were collected primarily in channel areas during February through April bottom trawl sampling. Unlike the most recent sampling years (2006 and 2007), when winter flounder adult and sub-adult collections were focused in the Upper Bay, the peak collections in 2008 were made in the Arthur Kill/Newark Bay (Table 3-2). In 2006, Atlantic herring were collected in the Arthur Kill/Newark Bay and Upper Bay at non-channel stations during warmer water temperatures (May). However, in 2007, Atlantic herring catches were high before water temperatures warmed (February and March) at channel stations in the Upper Bay during February and Lower Bay during March. Similar to the 2006 collections, Atlantic herring were collected in the Lower Bay and Upper Bay at non-channel stations during warmer water temperatures (April and May) in 2008.

For the less commonly collected EFH species, spatial and temporal trends in bottom trawl collections remain less evident. In 2008, red hake continued a trend of being collected primarily in deep water (channel) habitats but were collected primarily in the Lower and Upper Bays in March and April as compared to 2007 when they were collected primarily in the Upper Bay and Arthur Kill/Newark Bay in January (USACE 2008). In 2008, scup continued a trend of being collected primarily in the spring (May in 2008 and June in 2007) and primarily in the Upper Bay and to a lesser extent in the Lower Bay in 2008 but reversed a trend and were collected predominately in channel stations in 2008. Windowpane continued a trend of being collected primarily in channel stations in all three regions of the Harbor during most months of the sampling season.

Trends in the collection of winter flounder eggs and larvae are discussed in more detail in Section 4.2 but notably 2008 marked the second consecutive sampling year in which winter flounder eggs were collected almost exclusively in shallow (non-channel) habitats, perhaps defining an emerging trend that was less apparent during earlier years of the sampling program. In 2008, winter flounder eggs were primarily collected in the Upper Bay in February which is consistent with previous sampling years. In 2008, winter flounder larvae (both yolk-sac and post yolk-sac) were collected in both channel and non-

channel stations and primarily in the Lower and Upper Bays during April and May. During 2007, egg and larval densities were considerably higher than in previous years and they were also higher at non-channel stations than in channel stations. Winter flounder yolk-sac larval densities were high from March to April in non-channel stations of the Lower Bay while most post yolk-sac larvae were collected from March to May; with the peak concentration in April at Lower Bay non-channel stations in 2007.

Windowpane egg and larval densities were slightly higher at channel stations than at non-channel stations in 2008. During 2007, windowpane egg and larval densities were considerably higher than in previous years and this trend continued in 2008. In both sampling years, the collection of windowpane eggs was focused primarily in May and June in both the Upper and Lower Bays. In 2008, windowpane and winter flounder eggs and larvae were the only common EFH species in ichthyoplankton collections. However, Atlantic mackerel eggs and larvae, butterfish larvae, and summer flounder larvae have been collected in low densities primarily from the Lower Bay and Upper Bay during past years. In 2007 and 2008, a few Atlantic mackerel eggs were collected from channel and non-channel stations in the Lower Bay during May. In 2008, the highest collections of post yolk-sac summer flounder larvae were made in the Arthur Kill/Newark Bay during March.

4.1.2 Important Non-EFH Species

For the ABS program, alewife, Atlantic menhaden, blue crab, shortnose sturgeon and striped bass are grouped as important non-EFH species. With the exception of blue crab and shortnose sturgeon, these species have historically comprised an important part of the bottom trawl and/or ichthyoplankton collections. In 2008, Alewife were collected primarily from channel stations in the Lower Bay during the earliest months of the bottom trawl sampling season from February through April which is consistent with previous years of the program. Collections of Atlantic menhaden were also focused in the channel stations of the Lower Bay and primarily occurred in February.

The collection of blue crab in 2008 tended to be focused at both channel and non-channel stations in the Upper Bay and Arthur Kill/Newark Bay with the highest CPUEs occurring in May. In 2008, one shortnose sturgeon was collected in the bottom trawls and that occurred at a non-channel station in the Upper Bay in May. Shortnose sturgeon is a federally listed endangered species known to inhabit estuaries and large coastal rivers along the Atlantic Coast but is uncommon or no longer present in many of the river systems in its middle and southern range (Bain 1998). Since 2002, a total of five shortnose sturgeon and one Atlantic sturgeon have been collected in the ABS program. All of the sturgeon have been collected in non-channel areas of the Upper Bay in either May or June.

Striped bass was a dominant or very common species in collections during the first three program years when bottom trawl surveys were conducted at night; since changing to daytime trawling in 2005, however, striped bass catches have generally been lower. In 2008, striped bass were collected primarily at channel stations in the Arthur Kill/Newark Bay and Upper Bay from February through April which is consistent with the more recent years of the ABS program.

In 2008, Atlantic menhaden eggs and larvae were the only important non-EFH species early life stages identified in the ichthyoplankton collections and have remained a common component of ichthyoplankton samples since 2003. In 2008, Atlantic menhaden eggs were collected at both channel and non-channel stations in all three regions of the Harbor but collections were primarily focused in the Upper and Lower Bays in May and June (Table 3-6a). Yolk-sac larvae were collected exclusively at channel stations in June and were found primarily in the Upper Bay and Arthur Kill/Newark Bay while post yolk-sac Atlantic menhaden larvae were collected at both station types and in all three regions throughout the sampling program from February through July (Tables 3-6b and 3-6c).

4.2 WINTER FLOUNDER

As a valuable commercial and recreational species, winter flounder has remained a species of importance to local and regional resource managers. Winter flounder is

traditionally managed as three separate stocks: The Gulf of Maine, Southern New England/Mid-Atlantic, and Georges Bank, which was once considered a separate species (Able & Fahay 1998). Recent assessments of the Southern New England/Mid-Atlantic stock have noted declines in commercial landings and recreational catches since the mid 1980s (ASMFC 1998 and Vonderweidt *et al*. 2006). Other studies in the region, such as the Niantic River Estuary winter flounder surveys, have also shown steady declines in winter flounder abundances since the 1970s (MEL 2008). As an ongoing, systematic sampling program, the USACE-NYD Aquatic Biological Survey offers the most comprehensive data source on the population structure and yearly habitat use of the near shore population of winter flounder in the Harbor.

4.2.1 Winter Flounder Occurrence in NY/NJ Harbor

Yearly indices of winter flounder egg and larval densities as well as juvenile and adult bottom trawl abundances are available from 1999 through 2008. Overall, the total numbers of winter flounder collected by bottom trawl has increased in recent years from 263 in 2006 to 428 in 2007 and to 808 in 2008, which was the most since 2002 when 828 were collected during night time trawl sampling. The percentage of the total catch represented by non-sexually mature individuals (less than 250mm) also seems to have increased suggesting continued spawning success, survival of early life stages, and eventual recruitment of these juveniles to the bottom trawl sampling gear.

The densities of winter flounder eggs and larvae have also shown yearly variations with peaks in 2003, 2004 and 2007 (Tables 3-23a & 3-23b). In 2008, average monthly egg densities were the highest recorded in the Arthur Kill/Newark Bay and the second highest recorded in the Upper Bay where only the 2007 collections were slightly higher. By comparison, larval densities were generally lower in 2008 in all three regions. Although many factors, such as water temperature, salinity and sampling selectivity, may influence these annual variations, continued yearly data collection provides some insight into patterns of abundance and habitat use by all life stages of winter flounder.

Although the relative importance of the various Harbor regions has varied among years for each life stage, the spatial patterns observed in the early reports prior to 2003 suggested that winter flounder may utilize different areas of the Harbor for spawning and nursery habitat (USACE 1999, USACE 2002, USACE 2003a, and USACE 2003b). Distributional data from these studies prior to 2003 suggested that larval and juvenile winter flounder may move from spawning areas in the Lower Bay to nursery areas further into the Harbor estuary. This conclusion was based on increasing densities of older (post yolk-sac) larvae and young-of-the-year/juveniles in the Upper Bay compared to higher densities of younger (yolk sac) larvae and eggs in the Lower Bay.

More recent sampling years (2004 through 2008) have established that winter flounder spawning locations include both the Lower Bay and lower portions of the Upper Bay, but the dispersal movements of older larvae appear different than from previous survey conclusions. Winter flounder larvae are initially planktonic (NMFS 1999) and move primarily by drifting with currents, thus the increases of larvae in the Lower Bay ichthyoplankton catches during more recent years of the program may have been due, in part, to a redistribution of winter flounder spawned and hatched from shallower areas of the Upper and Lower Bays. In 2007, winter flounder egg and larval densities were the highest observed during the first eight years of the ABS program, which could account for the relatively large numbers of larvae collected from the deep waters of Lower Bay. In 2008, winter flounder egg densities were highest in the Upper Bay and larvae densities were highest in the Lower Bay, again suggesting larval movements towards the ocean. Because trawl surveys end before the young-of-the-year are fully recruited into the bottom trawl and because few young-of-the-year winter flounder are collected each year, it would be speculation to conclude that young-of-the-year (from the current spawning year) move back into nursery habitats in the estuary.

The occurrence of adult winter flounder during the peak spawning period (February through March) and the subsequent occurrence of eggs and yolk-sac larvae were used as indicators to identify potential spawning areas in the Harbor. Because winter flounder produce demersal eggs which adhere to the substrate (Crawford and Carey 1985),

collections with higher densities of winter flounder eggs were likely to be at or near the primary spawning areas. The predominance of winter flounder eggs in the Lower Bay and lower section of the Upper Bay during the peak spawning period coupled with the relatively high densities of yolk-sac larvae in these areas suggests these areas provide important winter flounder spawning habitat. Some winter flounder spawning occurs in the upper section of the Upper Bay and Arthur Kill/Newark Bay regions, but the intensity is notably less than in the Lower Bay. Of note, the years with the highest larvae concentrations (2003, 2004 and 2007), had water temperatures slightly below average during the onset of the spawning season in February and into March (Figure 3-23b & USACE 2008).

The vast majority (99%) of viable winter flounder eggs collected in 2008 were collected in non-channel areas of the Harbor with only a few eggs collected in channel areas of the Upper Bay during February (Table 3-6a). This continues a trend begun in 2005 and 2006 of predominately non-channel egg collections, and is comparable in proportion to the 2007 ABS collections, where the majority (97%) of the viable eggs were also collected in non-channel stations (USACE 2008). However, earlier sampling years, most notably 2002-2003 sampling program and 2004 did produce higher percentages of winter flounder eggs at channel locations, primarily in the Lower Bay and lower areas of the Upper Bay (USACE 2003b & USACE 2005). In 2008, additional sampling locations were added in the Lower Bay to further define the spatial distribution of winter flounder ichthyoplankton across a range of water depths. Only a few viable eggs were collected in the Lower Bay during 2008 (n=4) and all of them were collected in non-channel shallow stations of less than 25 feet (Figure 3-24a). The 2008 sampling year was notable for its relatively low collections of winter flounder eggs in the Lower Bay as compared to the Upper Bay where 93% of them were collected. This was also observed in 2005 and 2006 but contrasts to 2002-2003 and 2004 when most of the eggs were collected in the Lower Bay and 2007 when the eggs were collected relatively evenly among these two regions.

During the sampling season, more sexually mature winter flounder (those $\geq$ 250 mm) were collected from the Upper Bay during 2005 to 2007 and in the Lower Bay in 2008.

However, collections of adult (sexually mature) winter flounder have peaked before spawning in January 2007 or after spawning in April 2005, 2006 and 2007. No bottom trawl sampling was conducted in January 2008; but most sexually mature winter flounder were collected from the Lower Bay after spawning in April and May 2008. The laboratory analysis of those winter flounder ≥ 250mm collected in April and May showed that all but one of them were spent (Table 3-7), further suggesting that most of the sexually mature adults collected in 2008 were not collected during the ripe spawning period. The comparatively low abundance of ripe spawners during the peak of winter flounder spawning, typically late February through March in NY/NJ Harbor, suggests that most winter flounder spawning may be occurring in habitats beyond the areas currently sampled by the ABS program.

Schultz *et al*. 2007 found there to be substantial data on the broad-scale movements of winter flounder adults during the breeding season, but little specific information on where flounder deposit their eggs. This seems to describe the situation observed in NY/NJ Harbor. The most recent years of ABS sampling results suggest that spawning is taking place in relatively shallow water away from the channels. But to date sampling in shallow water has been limited by boat access and shallow water with low current velocities may represent a habitat type not previously sampled for this program that has been identified as a spawning type in other nearby estuaries.

4.1.2 Winter Flounder Habitat Suitability

Except for the Georges Bank population, which may spawn at depths up to 45 meters, adult winter flounder migrate inshore in the fall and early winter throughout most of its range, typically spawning in very shallow water less than five meters (NMFS 1999 and Brown *et al*. 2000). Coastal near shore winter flounder populations are believed to spawn in shallow waters where conditions favor limited movements of their demersal adhesive eggs due to tidal currents. Manderson *et al.* (2002), for example, determined that winter flounder settled on organically rich substrates, areas where local hydrographical conditions promote retention of passive particles while Schultz *et al.* 2007 found that

water depth (they sampled no deeper than 6 meters) and sediment type were not necessarily determining factors for winter flounder egg deposition. They found that early stage eggs were concentrated in low current areas. These areas in combination with the adhesive nature of the eggs would tend to maintain them where they were spawned. The yolk-sac larvae would then begin development in low current areas which would be beneficial for a life stage with limited mobility. If winter flounder seek out low current areas, these locations could be proportionally of greater importance for spawning and early development than other areas of the Harbor.

Broadly speaking, the Lower Bay contains a larger amount of potential winter flounder spawning and nursery habitat compared to the Upper Bay and Arthur Kill/Newark Bay due to the combination of large amounts of uninterrupted shallow water habitat and extensive areas of potentially suitable substrate. In habitat with a suitable substrate, a high percentage of the winter flounder eggs spawned are likely to remain on the bottom and few would break loose and drift with the current. In the Upper Bay, by contrast, the shallow water habitats are much less extensive and their habitat suitability for winter flounder spawning and early life stages is degraded. The degraded habitat quality is primarily due to fragmented shallow/shoal habitat and prevailing currents which can cause turbulence that can resuspend eggs in the water column making them more likely to be collected in the sampling gear. The fragmented shallow/shoal habitat of the Upper Bay would result in a higher percentage of eggs spawned close to navigation channels because the spawning adults cannot move as far from the channels as they can in the Lower Bay. The propeller wash from tugs, ships, and other commercial traffic in the channels as well as the hydrodynamics increases the turbulence and may resuspend winter flounder eggs and deposit them within the channel.

Moreover, the selected locations of Lower Bay shallow water stations may not include the primary spawning habitat used by winter flounder. The three shallow water stations (LB-1, LB-3 and LB-5) are close to channels and do not sample the near shore habitats of the extensive shallow water habitats on the east side of Staten Island or south of Coney Island. If the majority of winter flounder spawn in the shallower waters of these areas

(near shore), then the adults, eggs, and yolk-sac larvae may be under-represented in the ABS bottom trawl and ichthyoplankton collections. After hatching, the larvae would be more likely to drift with currents and spread over the shallows and potentially into sampling areas and increasing the chance of collection. This may in part explain why comparable amounts of eggs are collected in the Lower Bay and lower portions of the Upper Bay while larval densities are considerably higher in the Lower Bay as compared to the Upper Bay during ABS sampling.

The ABS program results have been used to document winter flounder spawning over broad regional areas of the Harbor and found substantial inter-annual variability in the relative abundance and distribution of adults during spawning and early life stages. However, it is not clear if spawning occurs over large areas that meet broad tolerances for physical habitat and water quality, or if recruitment relies on relatively small areas with a narrow range of conditions which maximize survival of early life stages. This would be an important consideration because if spawning is always a widespread activity, then restrictions on small scale projects such as bulkhead repair, pier construction, or localized dredging would provide little benefit in protecting spawners and early life stages. Whereas, if spawning is concentrated in relatively small areas with specific physical characteristics, then protection and restoration efforts could focus on those areas for maximum benefit.

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Table 1-1. Summary of federally managed species with EFH designations in NY/NJ Harbor.

SPECIES	EGGS	LARVAE	NEONATE/ EARLY JUVENILES	JUVENILES	ADULTS	SPAWNING ADULTS
Atlantic herring (*Clupea harengus*)		**M,S**		**M,S**	**M,S**	
Atlantic mackerel (*Scomber scombrus*)				**S**	**S**	
Black sea bass (*Centropristus striata*)				**M,S**	**M,S**	
Bluefish (*Pomatomus saltatrix*)				**M,S**	**M,S**	
Butterfish (*Peprilus triacanthus*)		**M**		**M,S**	**M,S**	
Red hake *(Urophycis chuss*)		**M,S**		**M,S**	**M,S**	
Scup (*Stenotomus chrysops*)	**S**	**S**		**S**	**S**	
Summer flounder (*Paralicthys dentatus*)		**F,M,S**		**M,S**	**M,S**	
Windowpane flounder (*Scopthalmus aquosus*)	**M,S**	**M,S**		**M,S**	**M,S**	**M,S**
Winter flounder (*Pseudopluronectes*	**M,S**	**M,S**		**M,S**	**M,S**	**M,S**
Clearnose skate (*Raja eglanteria*)				**X**	**X**	
Little skate (*Leucoraja erinacea*)				**X**	**X**	
Winter skate (*Leucoraja ocellata*)				**X**	**X**	
Cobia (*Rachycentron canadum*)	**X**	**X**		**X**	**X**	
King mackerel (*Scomberomorus cavalla*)	**X**	**X**		**X**	**X**	
Spanish mackerel (*Scomberomorus maculatus*)	**X**	**X**		**X**	**X**	
Dusky shark (*Carcharhinus obscurus*)			**X**	**X**		
Sand tiger shark (*Odontaspis taurus*)			**X**			
Sandbar shark (*Carcharinus plumbeus*)			**X**		**X**	

Source: National Marine Fisheries Service (2007): Guide to Essential Fish Habitat Designation in the Northeastern United States – the Hudson River/Raritan/Sandy Hook Bays, New York/ New Jersey Harbor Estuary.

Legend: S = Includes the seawater salinity zone (salinity ≥ 25.0‰)

M = Includes mixing water / brackish salinity zone (0.5‰ < salinity < 25.0‰)

F = Includes tidal freshwater salinity zone (0.0‰ < salinity < 0.5‰)

X = Designated EFH but no salinity zone specified

Table 2-1. Description of stations sampled during the 2008 Aquatic Biological Survey.

Area	Station Name	Type	Station Location	Depth (ft)	Valid Samples Collected	
					Trawl	Ichthyo.
South Brooklyn (4 Transects in 2008)	SB–1	Non-channel	Gowanus Bay Interpier South	27	NS	NS
	SB–2	Non-channel	Gowanus Bay Interpier	30	NS	NS
	SB–3	**Non-channel**	**Bay Ridge Flats**	**18**	**8**	**12**
	SB–4	**Channel**	**Bay Ridge Channel**	**40**	**8**	**12**
	SB–5	**Channel**	**Anchorage Channel Middle**	**47**	**8**	**11**
	SB–6	**Channel**	**Anchorage Channel South**	**48**	**8**	**12**
Port Jersey (4 Transects in 2008)	**PJ–1**	**Non-channel**	**Jersey Flats**	**19**	**8**	**12**
	PJ–2	**Non-channel**	**Caven Point**	**10**	**8**	**12**
	PJ–3	**Non-channel**	**Constable Hook**	**10**	**8**	**12**
	PJ–4	**Channel**	**Port Jersey Channel**	**51**	**6**	**7**
	PJ–5	Channel	Port Jersey Channel East	42	NS	NS
Newark Bay (2 Transects in 2008)	NB–3	Non-channel	Newark Bay Flats Middle	10	NS	NS
	NB–4	**Non-channel**	**Newark Bay Flats South**	**12**	**8**	**12**
	NB–5	Channel	Newark Bay Middle Reach	42	NS	NS
	NB–6	Channel	Newark Bay South Reach	46	NS	NS
	NB–7	**Non-channel**	**Elizabeth Flats North**	**11**	**8**	**12**
Lower Bay (14 Transects in 2008)	**LB–1**	**Non-channel**	**East Bank**	**17**	**8**	**12**
	LB–2	**Channel**	**North End Ambrose Channel**	**54**	**8**	**11**
	LB–3	**Non-channel**	**Swash Channel Range**	**20**	**8**	**13**
	LB–4	**Channel**	**Chapel Hill South Channel**	**37**	**8**	**12**
	LB–5	**Non-channel**	**Old Orchard Shoals**	**21**	**8**	**12**
	LB–6	**Channel**	**Raritan Bay East Reach**	**46**	**8**	**12**
	LB-7	**Non-channel**	**South of West Bank**	**31**	**8**	**12**
	LB-8	**Non-channel**	**West Bank Flat**	**20**	**8**	**12**
	LB-9	**Non-channel**	**West of Channel**	**30**	**8**	**12**
	LB-10	**Non-channel**	**Anchorage west of Gravesend Bay**	**30**	**8**	**12**
	LB-11	**Non-channel**	**Gravesend Bay Flats**	**22**	**5**	**5**
	LB-12	**Non-channel**	**West of Chapel Hill South Channel**	**25**	**8**	**11**
	LB-13	**Non-channel**	**East of Chapel Hill South Channel**	**19**	**8**	**12**
	LB-14	**Channel**	**Just north of Ambrose Channel**	**52**	**8**	**12**
Arthur Kill (2 Transects in 2008)	AK-1	Non-channel	Elizabeth Flats South	19	NS	NS
	AK-2	**Channel**	**North of Shooter's Island Reach**	**52**	**8**	**12**
	AK-3	**Channel**	**Elizabeth Reach**	**50**	**8**	**12**
	AK-4	Non-channel	Prall's Island	20	NS	NS
	AK-7	Non-channel	Island of Meadows	15	NS	NS
Kill Van Kull (2 Transects in 2008)	**KVK-1**	**Channel**	**Entrance to KVK Channel (Sand)**	**52**	**NS**	**8**
	KVK-2	**Channel**	**Entrance to KVK Channel (Silt)**	**55**	**NS**	**8**

Stations in BOLD represent those sampled during 2008
NS = Not Sampled

Table 2-2. Specifications of the bottom trawl used during the 1999-2008 Aquatic Biological Survey.

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 1.0-in (81.3 x 43.2 x 2.5 cm)
Tow line length	5 times maximum station water depth

Table 2-3. Specifications of the epibenthic sled and plankton net used during the 1999-2008 Aquatic Biological Survey.

Part	Specification
Mouth height x width	0.5 x 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)
Distance from sled base	Bottom of net is 17.8 cm above the bottom of the sled runners
Epibenthic sled	Constructed of aluminum pipe

Table 2-4. Water quality parameters measured during the 1999-2008 Aquatic Biological Survey.

Water Quality Parameter	Units and Accuracy	Sample Depths
Temperature	+/- 0.2 °C	Bottom
Dissolved oxygen	+/- 0.5 mg/L	Bottom
Conductivity	+/- 100 microseimens	Bottom
Salinity	+/- 0.1 ppt	Bottom

Table 3-1. Taxa identified in bottom trawl and epibenthic sled (ichthyoplankton) samples collected during the 2008 Aquatic Biological Survey with ranking based on total number collected.

Group	Common Name	Scientific Name	Trawl	Sled
Essential Fish Habitat Species	Atlantic herring	*Clupea harengus*	3	x
	Atlantic mackerel	*Scomber scombrus*		x
	Black sea bass	*Centropristis striata*	x	x
	Bluefish	*Pomatomus saltatrix*	x	
	Butterfish	*Peprilus triacanthus*	x	x
	Clearnose skate	*Raja eglanteria*	x	
	Little skate	*Raja erinacea*	x	
	Red hake	*Urophycis chuss*	x	
	Scup	*Stenotomus chrysops*	x	
	Summer flounder	*Paralichthys dentatus*	x	x
	Windowpane	*Scopthalmus aquosus*	x	3
	Winter flounder	*Pleuronectes americanus*	8	2
Important Non-EFH Species	Alewife	*Alosa pseudoharengus*	4	
	Atlantic menhaden	*Brevoortia tyrannus*	x	9
	Blue crab	*Callinectes sapidus*	x	
	Shortnose sturgeon	*Acipenser brevirostrum*	x	
	Striped bass	*Morone saxatilis*	6	
Other Species	American sandlance	*Ammodytes americanus*	7	x
	American shad	*Alosa sapidissima*	x	x
	Atlantic croaker	*Micropogonias undulates*	x	
	Atlantic silverside	*Menidia menidia*	9	x
	Atlantic tomcod	*Microgadus tomcod*	x	x
	Bay anchovy	*Anchoa mitchilli*	1	1
	Blueback herring	*Alosa aestivalis*	10	
	Clupeiforms	Clupeiformes		8
	Cods and Haddocks	Gadidae		x
	Cunner	*Tautogolabrus adspersus*	x	x
	Feather blenny	*Hypsoblennius hentzi*		x
	Four beard rockling	*Enchelyopus cimbrius*	x	x
	Fourspot flounder	*Hippoglossina oblonga*	x	
	Gizzard shad	*Dorosoma cepedianum*	x	
	Gobies	Gobiidae		4
	Goosefish	*Lophius americanus*		x
	Grubby	*Myoxocephalus aenaeus*	x	6
	Lined seahorse	*Hippocampus erectus*	x	x
	Longhorn sculpin	*Myoxocephalus octodecemspinosus*	x	
	Northern kingfish	*Menticirrhus saxatilis*	x	x
	Northern pipefish	*Syngnathus fuscus*	x	10
	Northern puffer	*Sphoeroides maculatus*		x
	Northern searobin	*Prionotus carolinus*	x	
	Oyster toadfish	*Opsanus tau*	x	
	Rock gunnel	*Pholis gunnellus*	x	x

Group	Common Name	Scientific Name	Trawl	Sled
	Sand flounders*	Paralichthyidae		x
	Searobin species	*Prionotus* sp.		7
	Sheepshead	*Archosargus probatocephalus*	x	
	Silver hake	*Merluccius bilinearis*	x	
	Smallmouth flounder	*Etropus microstomus*	x	
	Spot	*Leiostomus xanthurus*		x
	Spotted hake	*Urophycis regia*	5	
	Striped cuskeel	*Ophidion marginatum*		x
	Striped searobin	*Prionotus evolans*	x	
	Tautog	*Tautoga onitis*	x	x
	Weakfish	*Cynoscion regalis*	x	x
	White perch	*Morone americana*	2	
	Wrasses	Labridae		5
		Total Taxa	**43**	**33**

***** Sand flounders (family Paralichthyidae) were previously included in the family "Bothidae" by the American Fisheries Society and may have been presented as such in previous ABS reports. Current naming is based on Nelson *et. al*. 2004.

Note that 1 - 10 = Rank of the ten most abundant species based on total collected. X = Species was collected.

Table 3-2. Total number collected by species at channel and non-channel stations during bottom trawl sampling for the 2008 Aquatic Biological Survey.

Species	Station Type	Region			Total
		AKNB	LB	UB	
Essential Fish Habitat Species					
Atlantic herring	Channel	2	23	8	33
	Non-Channel	97	130	2,407	2,634
	Combined	*99*	*153*	*2,415*	*2,667*
Black sea bass	Channel		2		2
	Non-Channel		2		2
	Combined		*4*		*4*
Bluefish	Channel		1		1
	Non-Channel			3	3
	Combined		*1*	*3*	*4*
Butterfish	Channel	1	2		3
	Non-Channel		6		6
	Combined	*1*	*8*		*9*
Clearnose skate	Channel		2	3	5
	Non-Channel		4		4
	Combined		*6*	*3*	*9*
Little skate	Channel		23	16	39
	Non-Channel		14	1	15
	Combined		*37*	*17*	*54*
Red hake	Channel	1	16	15	32
	Non-Channel		2	1	3
	Combined	*1*	*18*	*16*	*35*
Scup	Channel		40	46	86
	Non-Channel		12	13	25
	Combined		*52*	*59*	*111*
Summer flounder	Channel	9	15	8	32
	Non-Channel	1	9	2	12
	Combined	*10*	*24*	*10*	*44*
Windowpane	Channel	18	32	37	87
	Non-Channel		25	4	29
	Combined	*18*	*57*	*41*	*116*
Winter flounder	Channel	420	127	189	736
	Non-Channel	2	38	32	72
	Combined	*422*	*165*	*221*	*808*
Sub-Total Essential Fish Habitat Species		***551***	***525***	***2,785***	***3,861***
Important Non-EFH Species					
Alewife	Channel	189	1,832	71	2,092
	Non-Channel	1	34	83	118
	Combined	*190*	*1,866*	*154*	*2,210*

Atlantic menhaden	Channel	7	231	20	258
	Non-Channel	*1*	*45*	*26*	72
	Combined	*8*	*276*	*46*	*330*
Blue crab	Channel	3		28	31
	Non-Channel	*27*	*3*	*23*	53
	Combined	*30*	*3*	*51*	*84*
Shortnose sturgeon	Channel				
	Non-Channel			1	1
	Combined			*1*	*1*
Striped bass	Channel	719		482	1,201
	Non-Channel	5	7	207	219
	Combined	*724*	*7*	*689*	*1,420*
Sub-Total Important Non-EFH Species		***952***	***2,152***	***941***	***4,045***
Other Species					
American sandlance	Channel		168	1	169
	Non-Channel		484	399	883
	Combined		*652*	*400*	*1,052*
American shad	Channel	12	13	27	52
	Non-Channel		2	11	13
	Combined	*12*	*15*	*38*	*65*
Atlantic croaker	Channel			4	4
	Non-Channel				
	Combined			*4*	*4*
Atlantic silverside	Channel		8	1	9
	Non-Channel	18	672	15	705
	Combined	*18*	*680*	*16*	*714*
Atlantic tomcod	Channel	3		17	20
	Non-Channel	12	2	21	35
	Combined	*15*	*2*	*38*	*55*
Bay anchovy	Channel	70	1,360	27	1,457
	Non-Channel	101	1,756	5,710	7,567
	Combined	*171*	*3,116*	*5,737*	*9,024*
Blueback herring	Channel	11	172	2	185
	Non-Channel	10	13	183	206
	Combined	*21*	*185*	*185*	*391*
Cunner	Channel	7	1	7	15
	Non-Channel		2	4	6
	Combined	*7*	*3*	*11*	*21*
Four beard rockling	Channel		1		1
	Non-Channel		1		1
	Combined		*2*		*2*
Fourspot flounder	Channel	1	3	4	8
	Non-Channel				
	Combined	*1*	*3*	*4*	*8*
Gizzard shad	Channel	4		6	10
	Non-Channel			1	1

	Combined	*4*		*7*	*11*
Grubby	Channel	18	4	6	28
	Shallow		1	9	10
	Combined	*18*	*5*	*15*	*38*
Lined seahorse	Channel			1	1
	Non-Channel				
	Combined			*1*	*1*
Longhorn sculpin	Channel		1	2	3
	Non-Channel			1	1
	Combined		*1*	*3*	*4*
Northern kingfish	Channel			1	1
	Non-Channel				
	Combined			*1*	*1*
Northern pipefish	Channel	4		3	7
	Non-Channel		3	3	6
	Combined	*4*	*3*	*6*	*13*
Northern searobin	Channel	1	1	2	4
	Non-Channel	1	4	1	6
	Combined	*2*	*5*	*3*	*10*
Oyster toadfish	Channel			2	2
	Non-Channel				
	Combined			*2*	*2*
Rock gunnel	Channel			1	1
	Shallow		2	1	3
	Combined		*2*	*2*	*4*
Sheepshead	Channel			1	1
	Non-Channel				
	Combined			*1*	*1*
Silver hake	Channel		11	5	16
	Non-Channel		3		3
	Combined		*14*	*5*	*19*
Smallmouth flounder	Channel	2	2	7	11
	Non-Channel	2	5	1	8
	Combined	*4*	*7*	*8*	*19*
Spotted hake	Channel	256	729	923	1,908
	Non-Channel	4	83	7	94
	Combined	*260*	*812*	*930*	*2,002*
Striped searobin	Channel		11	6	17
	Non-Channel			1	1
	Combined		*11*	*7*	*18*
Tautog	Channel	4		6	10
	Non-Channel		4	12	16
	Combined	*4*	*4*	*18*	*26*
Weakfish	Channel	1		1	2
	Non-Channel				
	Combined	*1*		*1*	*2*
White perch	Channel	3,033		166	3,199
	Non-Channel			3	3

Combined	*3,033*		*169*	*3,202*
Sub-Total Other	***3,575***	***5,522***	***7,612***	***16,709***
Total All - Channel	**4,796**	**4,831**	**2,152**	**11,779**
Total All - Non-Channel	**282**	**3,368**	**9,186**	**12,836**
Total All - Combined	***5,078***	***8,199***	***11,338***	***24,615***

Table 3-3. Monthly average bottom trawl CPUE by species for all navigation channel and non-channel stations during the 2008 Aquatic Biological Survey.

Species	Station Type	Feb	Mar	Apr	May	Total
Essential Fish Habitat Species						
Atlantic herring	Channel	0.15	0.40	0.07	0.91	1.53
	Non-Channel	0.03	0.63	71.36	21.66	93.67
Black sea bass	Channel				0.09	0.09
	Non-Channel			0.04	0.03	0.07
Bluefish	Channel				0.04	0.04
	Non-Channel				0.09	0.09
Butterfish	Channel			0.07	0.09	0.15
	Non-Channel				0.17	0.17
Clearnose skate	Channel			0.13	0.13	0.26
	Non-Channel				0.11	0.11
Little skate	Channel	0.45	0.95	0.40	0.22	2.02
	Non-Channel	0.03	0.09	0.27	0.11	0.51
Red hake	Channel	0.25	0.55	0.80	0.17	1.77
	Non-Channel				0.09	0.09
Scup	Channel				3.78	3.78
	Non-Channel				0.71	0.71
Summer flounder	Channel			0.07	1.37	1.44
	Non-Channel			0.08	0.29	0.36
Windowpane	Channel	0.70	2.20	0.60	0.95	4.45
	Non-Channel	0.03	0.28	0.04	0.51	0.87
Winter flounder	Channel	11.45	10.22	11.45	5.93	39.05
	Non-Channel	0.41	0.53	0.94	0.51	2.39
Important Non-EFH Species						
Alewife	Channel	43.80	37.96	29.01	0.97	111.74
	Non-Channel	0.22	1.09	0.35	1.91	3.57
Atlantic menhaden	Channel	10.40	1.50	0.94	0.26	13.10
	Non-Channel	1.93	0.16	0.28	0.03	2.39
Blue crab	Channel		0.05	0.67	0.87	1.59
	Non-Channel	0.10	0.09	0.19	1.29	1.67
Shortnose sturgeon	Channel					
	Non-Channel				0.03	0.03
Striped bass	Channel	23.70	26.84	13.13		63.67
	Non-Channel	5.94	0.34	0.47	0.17	6.92
Other Species						
American sandlance	Channel	0.30	8.15			8.45
	Non-Channel	15.13	0.09	15.23		30.45
American shad	Channel	0.05	1.30	1.60	0.04	3.00
	Non-Channel			0.35	0.11	0.46
Atlantic croaker	Channel	0.20				0.20
	Non-Channel					
Atlantic silverside	Channel	0.30	0.15			0.45
	Non-Channel	21.35	0.69			22.05

Species	Station Type	Feb	Mar	Apr	May	Total
Atlantic tomcod	Channel	0.15	0.35	0.07	0.39	0.96
	Non-Channel				1.02	1.02
Bay anchovy	Channel	0.45		2.88	61.33	64.66
	Non-Channel	0.03	0.03	10.50	208.36	218.92
Blueback herring	Channel	2.70	3.90	1.87	1.09	9.55
	Non-Channel	0.38	0.19	3.85	2.51	6.92
Cunner	Channel	0.15	0.25	0.40	0.04	0.85
	Non-Channel	0.03	0.06	0.12		0.21
Four beard rockling	Channel				0.04	0.04
	Non-Channel				0.03	0.03
Fourspot flounder	Channel	0.05	0.05		0.26	0.36
	Non-Channel					
Gizzard shad	Channel	0.40	0.10			0.50
	Non-Channel	0.03				0.03
Grubby	Channel	0.65	0.46	0.34	0.04	1.49
	Non-Channel	0.22		0.12		0.33
Lined seahorse	Channel				0.04	0.04
	Non-Channel					
Longhorn sculpin	Channel		0.10		0.04	0.14
	Non-Channel		0.03			0.03
Northern kingfish	Channel				0.04	0.04
	Non-Channel					
Northern pipefish	Channel		0.15	0.27		0.42
	Non-Channel		0.09	0.08	0.03	0.20
Northern searobin	Channel			0.13	0.09	0.22
	Non-Channel			0.04	0.14	0.18
Oyster toadfish	Channel				0.09	0.09
	Non-Channel					
Rock gunnel	Channel	0.05				0.05
	Non-Channel	0.03	0.06			0.09
Sheepshead	Channel				0.04	0.04
	Non-Channel					
Silver hake	Channel			0.20	0.58	0.78
	Non-Channel	0.03	0.03		0.03	0.09
Smallmouth flounder	Channel	0.45	0.10			0.55
	Non-Channel		0.06	0.04	0.15	0.25
Spotted hake	Channel	2.60	41.81	45.19	14.97	104.57
	Non-Channel	0.03	0.97	0.42	1.46	2.89
Striped searobin	Channel				0.74	0.74
	Non-Channel				0.03	0.03
Tautog	Channel	0.10		0.27	0.17	0.55
	Non-Channel	0.03		0.23	0.26	0.52
Weakfish	Channel			0.07	0.04	0.11
	Non-Channel					
White perch	Channel	61.25	97.21	3.91	0.13	162.50
	Non-Channel	0.03	0.03	0.04		0.10

Table 3-4a. Monthly average bottom trawl CPUE by species for all navigation channel stations in the Arthur Kill/Newark Bay (AKNB), Upper Bay (UB), and Lower Bay (LB) during the 2008 Aquatic Biological Survey.

Species	Region	Feb	Mar	Apr	May	Total
Essential Fish Habitat Species						
Atlantic herring	AKNB				0.50	0.50
	UB		1.00			1.00
	LB	0.38		0.25	1.58	2.21
Black sea bass	AKNB					
	UB					
	LB				0.17	0.17
Bluefish	AKNB					
	UB					
	LB				0.08	0.08
Butterfish	AKNB			0.25		0.25
	UB					
	LB				0.17	0.17
Clearnose skate	AKNB					
	UB			0.29	0.14	0.43
	LB				0.17	0.17
Little skate	AKNB					
	UB	0.50	0.63	0.86	0.14	2.13
	LB	0.63	1.75		0.33	2.71
Red hake	AKNB	0.25				0.25
	UB	0.38	0.63	1.00		2.00
	LB	0.13	0.75	1.25	0.33	2.46
Scup	AKNB					
	UB				6.71	6.71
	LB				3.33	3.33
Summer flounder	AKNB				2.33	2.33
	UB				1.18	1.18
	LB			0.25	1.17	1.42
Windowpane	AKNB	1.50	1.52	1.00	0.53	4.55
	UB	1.00	0.88	0.71	2.68	5.27
	LB		3.88		0.08	3.96
Winter flounder	AKNB	41.00	39.58	19.20	6.58	106.36
	UB	7.38	3.50	10.43	4.14	25.45
	LB	0.75	2.25	5.50	6.75	15.25
Important Non-EFH Species						
Alewife	AKNB	1.50	2.56	39.05	4.25	47.36
	UB	1.88	5.63	1.29	0.32	9.11
	LB	106.88	88.00	67.50	0.25	262.63
Atlantic menhaden	AKNB	0.25		0.79	0.75	1.79
	UB	0.38	0.63	1.43	0.29	2.71
	LB	25.50	3.13	0.25	0.08	28.96

Blue crab	AKNB				0.75	0.75
	UB		0.13	1.43	2.43	3.98
	LB					
Shortnose sturgeon	AKNB					
	UB					
	LB					
Striped bass	AKNB	74.75	70.95	35.72		181.42
	UB	21.88	31.63	7.71		61.21
	LB					
Other Species						
American sandlance	AKNB					
	UB	0.13				0.13
	LB	0.63	20.38			21.00
American shad	AKNB		0.25	2.76		3.01
	UB	0.13	2.13	1.29		3.54
	LB		1.00	1.00	0.08	2.08
Atlantic croaker	AKNB					
	UB	0.50				0.50
	LB					
Atlantic silverside	AKNB					
	UB		0.13			0.13
	LB	0.75	0.25			1.00
Atlantic tomcod	AKNB			0.26	0.50	0.76
	UB	0.38	0.88		1.00	2.25
	LB					
Bay anchovy	AKNB			1.05	17.50	18.55
	UB	0.50		1.86	1.64	4.00
	LB	0.63		6.50	110.75	117.88
Blueback herring	AKNB			2.75		2.75
	UB	0.25				0.25
	LB	6.50	9.75	4.25	2.08	22.58
Cunner	AKNB	0.25	0.51	1.01		1.77
	UB	0.25	0.25	0.29	0.14	0.93
	LB		0.13			0.13
Four beard rockling	AKNB					
	UB					
	LB				0.08	0.08
Fourspot flounder	AKNB		0.25			0.25
	UB				0.57	0.57
	LB	0.13			0.17	0.29
Gizzard shad	AKNB	0.75	0.26			1.01
	UB	0.63	0.13			0.75
	LB					
Grubby	AKNB	1.50	1.78	1.04	0.25	4.57
	UB	0.38	0.25	0.14		0.77
	LB	0.50				0.50

Lined seahorse	AKNB					
	UB				0.14	0.14
	LB					
Longhorn sculpin	AKNB					
	UB		0.13		0.14	0.27
	LB		0.13			0.13
Northern kingfish	AKNB					
	UB				0.14	0.14
	LB					
Northern pipefish	AKNB		0.26	0.75		1.01
	UB		0.25	0.14		0.39
	LB					
Northern searobin	AKNB			0.25		0.25
	UB			0.14	0.14	0.29
	LB				0.08	0.08
Oyster toadfish	AKNB					
	UB				0.29	0.29
	LB					
Rock gunnel	AKNB					
	UB	0.13				0.13
	LB					
Sheepshead	AKNB					
	UB				0.14	0.14
	LB					
Silver hake	AKNB					
	UB				0.75	0.75
	LB			0.75	0.67	1.42
Smallmouth flounder	AKNB	0.25	0.25			0.50
	UB	0.75	0.13			0.88
	LB	0.25				0.25
Spotted hake	AKNB		5.31	51.21	7.83	64.35
	UB	1.88	34.38	58.71	31.86	126.82
	LB	4.63	67.50	15.50	7.50	95.13
Striped searobin	AKNB					
	UB				0.86	0.86
	LB				0.92	0.92
Tautog	AKNB	0.25		0.78		1.03
	UB	0.13		0.14	0.57	0.84
	LB					
Weakfish	AKNB				0.25	0.25
	UB			0.14		0.14
	LB					
White perch	AKNB	286.25	470.04	9.17	0.75	766.21
	UB	10.00	8.00	3.14		21.14
	LB					

Table 3-4b. Monthly average bottom trawl CPUE by species for all non-channel stations combined in the Arthur Kill/Newark Bay (AKNB), Lower Bay (LB), and Upper Bay (UB) during the 2008 Aquatic Biological Survey.

Species	Region	Feb	Mar	Apr	May	Total
Essential Fish Habitat Species						
Atlantic herring	AKNB			18.06	6.25	24.31
	UB	0.13	0.38	244.86	76.56	321.91
	LB		0.85	4.60	2.00	7.45
Black sea bass	AKNB					
	UB					
	LB			0.07	0.05	0.11
Bluefish	AKNB					
	UB				0.33	0.33
	LB					
Butterfish	AKNB					
	UB					
	LB				0.27	0.27
Clearnose skate	AKNB					
	UB					
	LB				0.18	0.18
Little skate	AKNB					
	UB			0.14		0.14
	LB	0.05	0.15	0.40	0.18	0.78
Red hake	AKNB					
	UB				0.11	0.11
	LB				0.09	0.09
Scup	AKNB					
	UB				1.44	1.44
	LB				0.55	0.55
Summer flounder	AKNB				0.25	0.25
	UB			0.14	0.11	0.25
	LB			0.07	0.36	0.43
Windowpane	AKNB					
	UB	0.13			0.33	0.46
	LB		0.45	0.07	0.68	1.20
Winter flounder	AKNB			0.36	0.25	0.61
	UB	1.26	0.50	2.14	0.33	4.24
	LB	0.15	0.65	0.53	0.64	1.97
Important Non-EFH Species						
Alewife	AKNB		0.25			0.25
	UB	0.50	0.75	0.86	7.44	9.55
	LB	0.15	1.40	0.20		1.75
Atlantic menhaden	AKNB			0.31		0.31
	UB	3.46			0.11	3.57

	LB	1.70	0.25	0.40		2.35
Blue crab	AKNB	0.81		0.71	6.00	7.53
	UB		0.25	0.14	2.22	2.62
	LB		0.05	0.07	0.05	0.16
Shortnose sturgeon	AKNB					
	UB				0.11	0.11
	LB					
Striped bass	AKNB			0.31	1.00	1.31
	UB	23.75	1.25	0.71	0.22	25.94
	LB		0.05	0.40		0.45
Other Species						
American sandlance	AKNB					
	UB	0.51		56.43		56.94
	LB	24.00	0.15	0.07		24.22
American shad	AKNB					
	UB			1.00	0.44	1.44
	LB			0.13		0.13
Atlantic croaker	AKNB					
	UB					
	LB					
Atlantic silverside	AKNB	4.56				4.56
	UB	0.75	1.15			1.90
	LB	32.95	0.65			33.60
Atlantic tomcod	AKNB				3.19	3.19
	UB				2.33	2.33
	LB				0.09	0.09
Bay anchovy	AKNB	0.25			25.13	25.38
	UB			10.00	626.67	636.67
	LB		0.05	13.53	70.55	84.13
Blueback herring	AKNB				2.50	2.50
	UB	0.38	0.38	14.29	8.56	23.59
	LB	0.45	0.15		0.05	0.65
Cunner	AKNB					
	UB	0.13		0.43		0.55
	LB		0.10			0.10
Four beard rockling	AKNB					
	UB					
	LB				0.05	0.05
Fourspot flounder	AKNB					
	UB					
	LB					
Gizzard shad	AKNB					
	UB	0.13				0.13
	LB					
Grubby	AKNB					
	UB	0.75		0.43		1.18
	LB	0.05				0.05

Lined seahorse	AKNB					
	UB					
	LB					
Longhorn sculpin	AKNB					
	UB		0.13			0.13
	LB					
Northern kingfish	AKNB					
	UB					
	LB					
Northern pipefish	AKNB					
	UB			0.29	0.11	0.40
	LB		0.15			0.15
Northern searobin	AKNB				0.25	0.25
	UB				0.11	0.11
	LB			0.07	0.14	0.20
Oyster toadfish	AKNB					
	UB					
	LB					
Rock gunnel	AKNB					
	UB	0.13				0.13
	LB		0.10			0.10
Sheepshead	AKNB					
	UB					
	LB					
Silver hake	AKNB					
	UB					
	LB	0.05	0.05		0.05	0.15
Smallmouth flounder	AKNB				0.56	0.56
	UB				0.11	0.11
	LB		0.10	0.07	0.09	0.26
Spotted hake	AKNB				1.06	1.06
	UB		0.38	0.57		0.95
	LB	0.05	1.40	0.47	2.14	4.05
Striped searobin	AKNB					
	UB				0.11	0.11
	LB					
Tautog	AKNB					
	UB			0.71	0.78	1.49
	LB	0.05		0.07	0.09	0.21
Weakfish	AKNB					
	UB					
	LB					
White perch	AKNB					
	UB	0.13	0.13	0.14		0.39
	LB					

Table 3-5. Total number of eggs, yolk-sac, post yolk-sac, juveniles and unidentified larval stage collected by region at all stations during ichthyoplankton sampling for the 2008 Aquatic Biological Survey.

Common Name	Life Stage	Region			Grand Total
		AKNB	UB	LB	
Essential Fish Habitat Species					
Atlantic herring	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	1	9	1	11
	Juvenile	0	2	0	2
	Unidentified larval stage	0	0	0	0
	Total	1	11	1	13
Atlantic mackerel	Egg	0	0	5	5
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	16	0	16
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	16	5	21
Black sea bass	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	2	2
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	0	2	2
Butterfish	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	14	14
	Juvenile	0	3	7	9
	Unidentified larval stage	0	0	0	0
	Total	0	3	21	24
Summer flounder	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	7	7	4	18
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	7	7	4	18
Windowpane	Egg	30	2,301	7,908	10,239
	Yolk-sac	0	1	8	9
	Post yolk-sac	8	112	654	774
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	38	2,414	8,570	11,022
Winter flounder	Egg	24	350	4	378
	Yolk-sac	16	50	800	866
	Post yolk-sac	154	1,114	4,249	5,517
	Juvenile	0	0	0	0

	Unidentified larval stage	3	15	130	148
	Total	197	1,529	5,183	6,909
Sub-Total Essential Fish Habitat Species		*243*	*3,980*	*13,786*	*18,008*
Important Non-EFH Species					
Atlantic menhaden	Egg	34	992	1,816	2,842
	Yolk-sac	7	34	6	48
	Post yolk-sac	10	58	38	106
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	51	1,084	1,861	2,996
Sub-Total Important Non-EFH Species		*51*	*1,084*	*1,861*	*2,996*
Other Species					
American sandlance	Egg	0	0	0	0
	Yolk-sac	1	7	20	28
	Post yolk-sac	1	11	14	26
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	2	18	34	54
American shad	Egg	0	0	16	16
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	0	0
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	0	16	16
Atlantic silverside	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	1	1
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	0	1	1
Atlantic tomcod	Egg	0	0	0	0
	Yolk-sac	0	6	0	6
	Post yolk-sac	29	48	5	82
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	29	54	5	88
Bay anchovy	Egg	85,806	27,560	56,554	169,920
	Yolk-sac	10	28	0	38
	Post yolk-sac	465	6,307	15,826	22,597
	Juvenile	0	1	0	1
	Unidentified larval stage	0	0	0	0
	Total	86,281	33,896	72,380	192,557
Sand flounders	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	1	0	1
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	1	0	1

Clupeiforms	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	272	148	420
	Juvenile	0	0	0	0
	Unidentified larval stage	42	265	1,673	1,980
	Total	42	537	1,821	2,400
Cunner	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	1	8	140	149
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	1	8	140	149
Feather blenny	Egg	0	0	0	0
	Yolk-sac	0	0	1	1
	Post yolk-sac	1	55	7	63
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	1	55	8	64
Fourbeard rockling	Egg	3	162	278	443
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	12	27	39
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	3	174	305	482
Cods and Haddocks	Egg	16	189	280	485
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	0	0
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	16	189	280	485
Gobies	Egg	0	16	0	16
	Yolk-sac	5	5	0	9
	Post yolk-sac	1,925	2,927	3,545	8,397
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	1,930	2,948	3,545	8,423
Goosefish	Egg	0	42	32	74
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	0	0
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	42	32	74
Grubby	Egg	0	9	0	9
	Yolk-sac	25	35	42	102
	Post yolk-sac	441	635	1,419	2,495
	Juvenile	0	1	0	1
	Unidentified larval stage	0	0	0	0

	Total	466	680	1,461	2,607
Wrasses	Egg	4,968	14,159	14,579	33,706
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	0	0
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	4,968	14,159	14,579	33,706
Lined seahorse	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	4	4
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	0	4	4
Northern kingfish	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	19	19
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	0	19	19
Northern pipefish	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	89	150	119	359
	Juvenile	5	8	10	23
	Unidentified larval stage	0	0	0	0
	Total	94	158	130	382
Northern puffer	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	1	3	0	4
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	1	3	0	4
Searobin species	Egg	160	2,395	7,142	9,697
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	18	18
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	160	2,395	7,160	9,715
Rock gunnel	Egg	0	0	0	0
	Yolk-sac	0	0	1	1
	Post yolk-sac	7	29	63	99
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	7	29	64	100
Spot	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	1	1
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0

	Total	0	0	1	1
Striped cuskeel	Egg	0	0	0	0
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	1	1
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	0	1	1
Tautog	Egg	0	0	0	0
	Yolk-sac	1	10	0	11
	Post yolk-sac	11	60	81	152
	Juvenile	0	0	0	0
	Unidentified larval stage	1	0	0	1
	Total	13	70	81	164
Unidentified	Egg	0	8	5	13
	Yolk-sac	0	0	0	0
	Post yolk-sac	0	0	0	0
	Juvenile	0	0	0	0
	Unidentified larval stage	0	0	0	0
	Total	0	8	5	13
Weakfish	Egg	0	240	0	240
	Yolk-sac	0	1	0	1
	Post yolk-sac	12	75	199	286
	Juvenile	0	1	0	1
	Unidentified larval stage	0	0	0	0
	Total	12	317	199	528
Sub-Total Other Species		*94,027*	*55,741*	*102,272*	*252,040*
Egg Total		91,041	48,423	88,619	228,083
Yolk-sac Total		65	176	878	1,120
Post Yolk-sac Total		3,163	11,909	26,601	41,673
Juvenile Total		5	16	17	37
Unidentified Larval Stage Total		46	280	1,803	2,129
Grand Total		**94,321**	**60,805**	**117,918**	**273,043**

Table 3-6a. Monthly average egg density (number/1,000m^3) by species for channel stations and non-channel stations in Arthur Kill/Newark Bay (AKNB), Upper Bay (UB), and Lower Bay (LB) during ichthyoplankton sampling for the 2008 Aquatic Biological Survey.

Channel Stations								
Species	**Region**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Total**
Essential Fish Habitat Species								
Atlantic mackerel	AKNB							
	UB							
	LB				1.96			1.96
Windowpane	AKNB			6.91	29.90			36.81
	UB			265.28	404.77	431.28	248.57	1,349.89
	LB			36.05	934.28	32.77		1,003.10
Winter flounder	AKNB							
	UB	4.42						4.42
	LB							
Important Non-EFH Species								
Atlantic menhaden	AKNB					46.39		46.39
	UB				11.08	339.20		350.29
	LB				63.10	612.17		675.27
Other Species								
American shad	AKNB							
	UB							
	LB							
Bay anchovy	AKNB				16.70	14,341.20	18,327.36	32,685.26
	UB				6.43	5,296.02	2,108.30	7,410.75
	LB				414.29	15,269.58	16,041.00	31,724.87
Fourbeard rockling	AKNB		5.60					5.60
	UB		33.24	16.99	1.92		97.20	149.35
	LB		0.48	3.52	1.55	8.09	291.30	304.94
Cods and Haddocks	AKNB						47.05	47.05
	UB		8.97	11.43		36.85	152.49	209.74
	LB		1.39	10.55		16.18	23.00	51.11
Gobies	AKNB							
	UB							
	LB							
Goosefish	AKNB							
	UB					13.21	49.34	62.55
	LB						8.99	8.99
Grubby	AKNB							
	UB							
	LB							
Wrasses	AKNB				644.67	3,894.80	1,373.41	5,912.88
	UB			7.23	276.57	3,780.66	2,433.03	6,497.49
	LB				492.53	1,531.63	768.29	2,792.45
Searobin species	AKNB					205.63	90.64	296.27

	UB			64.75	888.45	1,645.51	2,598.71
	LB			257.71	1,397.39	445.00	2,100.10
	AKNB						
Unidentified	UB					486.00	486.00
	LB		0.49				0.49

Non-Channel Stations

Species	Region	Feb	Mar	Apr	May	Jun	Jul	Total
Essential Fish Habitat Species								
	AKNB							
Atlantic mackerel	UB							
	LB				0.22			0.22
	AKNB							
Windowpane	UB			53.00	72.03	17.97		143.00
	LB			184.40	1,297.35	78.32		1,560.07
	AKNB	32.55	1.73					34.28
Winter flounder	UB	202.95	5.88					208.83
	LB		0.82	0.25				1.08
Important Non-EFH Species								
	AKNB				2.13			2.13
Atlantic menhaden	UB				100.90	367.30		468.20
	LB			3.73	80.60	80.57		164.90
Other Species								
	AKNB							
American shad	UB							
	LB				3.84			3.84
	AKNB				2.13	50,593.07	113,407.04	164,002.25
Bay anchovy	UB				19.12	11,111.79	10,925.79	22,056.70
	LB				295.53	5,543.53	643.81	6,482.87
	AKNB							
Fourbeard rockling	UB		0.43	3.54	1.19			5.16
	LB		0.29	3.52	3.95	33.20		40.95
	AKNB							
Cods and Haddocks	UB		1.37				11.39	12.76
	LB			25.99			83.30	109.29
	AKNB							
Gobies	UB						22.79	22.79
	LB							
	AKNB							
Goosefish	UB							
	LB					7.64	8.33	15.97
	AKNB							
Grubby	UB	7.15						7.15

	LB						
Wrasses	AKNB			254.35	1,388.72	786.58	2,429.65
	UB			480.60	5,294.92	1,772.90	7,548.42
	LB			1,264.78	1,340.39	709.87	3,315.04
Searobin species	AKNB						
	UB			8.54		38.90	47.44
	LB			408.51	369.40	842.45	1,620.37
Unidentified	AKNB						
	UB						
	LB		2.47				2.47

Non-Channel Stations								
Species	**Region**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Total**
Essential Fish Habitat Species								
Windowpane	AKNB							
	UB				0.61			0.61
	LB			1.19	0.26			1.45
Winter flounder	AKNB		8.54	1.86				10.41
	UB	4.79	5.38	1.97				12.14
	LB	13.38	7.65	83.81				104.84
Important Non-EFH Species								
Atlantic menhaden	AKNB							
	UB							
	LB							
Other Species								
American sandlance	AKNB							
	UB							
	LB	4.15	0.18					4.33
Atlantic tomcod	AKNB							
	UB	3.47	0.46					3.93
	LB							
Bay anchovy	AKNB							
	UB					1.43		1.43
	LB							
Feather blenny	AKNB							
	UB							
	LB			0.60				0.60
Gobies	AKNB							
	UB						3.80	3.80
	LB							
Grubby	AKNB	1.42		1.84				3.25
	UB	1.50	4.47					5.96
	LB	0.93	2.39	4.36				7.69
Rock gunnel	AKNB							
	UB							
	LB	0.31						0.31
Tautog	AKNB							
	UB					1.52	4.73	6.24
	LB							
Weakfish	AKNB							
	UB					0.69		0.69
	LB							

Table 3-6c. Monthly average post-yolk sac larval density (number/1,000m^3) by species for channel stations and non-channel stations in Arthur Kill/Newark Bay (AKNB), Upper Bay (UB), and Lower Bay (LB) during ichthyoplankton sampling for the 2008 Aquatic Biological Survey.

Channel Stations								
Species	**Region**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Total**
Essential Fish Habitat Species								
Atlantic herring	AKNB	1.32						1.32
	UB	2.76	0.87					3.64
	LB							
Atlantic mackerel	AKNB							
	UB					7.20		7.20
	LB							
Black sea bass	AKNB							
	UB							
	LB							
Butterfish	AKNB							
	UB							
	LB					1.04		1.04
Summer flounder	AKNB		9.90	0.81				10.70
	UB	2.00	1.37					3.37
	LB			0.74				0.74
Windowpane	AKNB				3.77			3.77
	UB			0.72	24.97	8.33		34.03
	LB				126.76	9.67	7.67	144.10
Winter flounder	AKNB		6.49	85.54	1.35			93.38
	UB		33.30	196.51	203.42			433.23
	LB	2.96	65.93	314.06	180.06			563.02
Important Non-EFH Species								
Atlantic menhaden	AKNB	1.32	3.82			3.65		8.78
	UB		3.08			12.47	13.03	28.59
	LB	0.53				2.61		3.14
Other Species								
American sandlance	AKNB	1.32						1.32
	UB	3.71	0.37					4.08
	LB	0.54	1.92					2.47
Atlantic silverside	AKNB							
	UB							
	LB				0.49			0.49
Atlantic tomcod	AKNB		48.61	5.68				54.29
	UB		12.70	0.40				13.10
	LB							
Bay anchovy	AKNB					203.81	551.34	755.14
	UB					1,648.88	2,045.59	3,694.47
	LB					1,487.75	7,946.78	9,434.53

Sand flounders	AKNB							
	UB							
	LB							
Clupeiforms	AKNB							
	UB						39.10	39.10
	LB							
Cunner	AKNB					1.61		1.61
	UB					0.73		0.73
	LB					19.73	7.67	27.40
Feather blenny	AKNB							
	UB		0.34				35.85	36.19
	LB							
Fourbeard rockling	AKNB							
	UB				3.72			3.72
	LB				7.65	0.53		8.18
Gobies	AKNB					447.80	3,896.53	4,344.33
	UB					95.93	1,093.37	1,189.30
	LB					36.20	2,789.14	2,825.34
Grubby	AKNB	44.73	184.25	171.31				400.29
	UB	26.78	128.86	38.00	4.23			197.86
	LB	97.52	84.39	107.15	1.36			290.42
Lined seahorse	AKNB							
	UB							
	LB						4.49	4.49
Northern kingfish	AKNB							
	UB							
	LB					1.33		1.33
Northern pipefish	AKNB					36.43	22.66	59.09
	UB					32.72	21.49	54.21
	LB				0.78	20.20	19.91	40.88
Northern puffer	AKNB							
	UB					0.40	1.74	2.13
	LB							
Searobin species	AKNB							
	UB							
	LB							
Rock gunnel	AKNB	5.08	1.23					6.31
	UB	4.35	3.60	1.22				9.18
	LB	14.09	2.62					16.71
Spot	AKNB							
	UB							
	LB							
Striped cuskeel	AKNB							
	UB							
	LB							

	AKNB					4.29		4.29
Tautog	UB					18.47	4.05	22.52
	LB					15.93	6.42	22.35
	AKNB					1.61		1.61
Weakfish	UB					24.88	11.07	35.95
	LB					27.24	8.35	35.60

Non-Channel Stations

Species	Region	Feb	Mar	Apr	May	Jun	Jul	Total
Essential Fish Habitat Species								
	AKNB							
Atlantic herring	UB	0.79	0.76					1.56
	LB		0.27					0.27
	AKNB							
Atlantic mackerel	UB							
	LB							
	AKNB							
Black sea bass	UB							
	LB					0.63		0.63
	AKNB							
Butterfish	UB							
	LB					0.35	6.16	6.51
	AKNB	1.19						1.19
Summer flounder	UB	0.79						0.79
	LB	0.63		0.22				0.86
	AKNB				6.56			6.56
Windowpane	UB				21.61	1.42		23.03
	LB			3.03	96.22	9.93	1.03	110.22
	AKNB		13.29	39.70				52.99
Winter flounder	UB		25.68	114.02	4.12			143.83
	LB	4.04	127.45	501.69	173.35			806.53
Important Non-EFH Species								
	AKNB					4.16		4.16
Atlantic menhaden	UB			1.49		14.71		16.21
	LB	1.51	0.18	0.22		5.24	4.03	11.19
Other Species								
	AKNB							
American sandlance	UB	1.59						1.59
	LB	0.61	1.05	0.78				2.44
	AKNB							
Atlantic silverside	UB							
	LB							
	AKNB	1.19						1.19
Atlantic tomcod	UB		4.71					4.71
	LB	0.64	0.29	0.68				1.60
Bay anchovy	AKNB					87.08	225.57	312.65

	UB					2,360.12	710.84	3,070.96
	LB					2,203.70	500.79	2,704.48
Sand flounders	AKNB							
	UB						1.26	1.26
	LB							
Clupeiforms	AKNB							
	UB					610.21		610.21
	LB					43.92		43.92
Cunner	AKNB							
	UB					14.07		14.07
	LB					28.73	2.07	30.79
Feather blenny	AKNB					1.39		1.39
	UB					12.85	7.25	20.10
	LB			0.37		0.95	2.10	3.43
Fourbeard rockling	AKNB							
	UB				2.36			2.36
	LB			0.35	3.71			4.06
Gobies	AKNB					108.65	603.69	712.33
	UB					283.83	2,165.06	2,448.89
	LB					82.71	1,009.80	1,092.51
Grubby	AKNB	9.45	46.65	51.71				107.81
	UB	19.05	55.88	8.41	0.59			83.92
	LB	56.87	96.31	112.94	1.10			267.22
Lined seahorse	AKNB							
	UB							
	LB							
Northern kingfish	AKNB							
	UB							
	LB					4.58	1.03	5.61
Northern pipefish	AKNB					61.20	47.19	108.39
	UB					39.16	31.12	70.28
	LB				0.56	11.58	17.97	30.10
Northern puffer	AKNB					1.49		1.49
	UB							
	LB							
Searobin species	AKNB							
	UB							
	LB					5.01		5.01
Rock gunnel	AKNB	2.91						2.91
	UB	3.75	0.92	1.61				6.29
	LB	8.27	1.58	0.22				10.07
Spot	AKNB							
	UB							
	LB				0.25			0.25

Table 3-6b. Monthly average yolk-sac larval density (number/1,000m^3) by species for channel stations and non-channel stations in Arthur Kill/Newark Bay (AKNB), Upper Bay (UB), and Lower Bay (LB) during ichthyoplankton sampling for the 2008 Aquatic Biological Survey.

Channel Stations								
Species	**Region**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Total**
Essential Fish Habitat Species								
Windowpane	AKNB							
	UB							
	LB				0.74			0.74
Winter flounder	AKNB	8.16	1.23					9.39
	UB	2.90	5.11	4.02				12.03
	LB	2.95	6.85	268.66				278.46
Important Non-EFH Species								
Atlantic menhaden	AKNB					10.33		10.33
	UB					21.40		21.40
	LB					3.65		3.65
Other Species								
American sandlance	AKNB	1.10						1.10
	UB	3.31						3.31
	LB	2.22	0.72	0.72				3.67
Atlantic tomcod	AKNB							
	UB							
	LB							
Bay anchovy	AKNB					15.54		15.54
	UB					15.94		15.94
	LB							
Feather blenny	AKNB							
	UB							
	LB							
Gobies	AKNB					6.44		6.44
	UB					1.23		1.23
	LB							
Grubby	AKNB	2.68	3.76	15.51				21.94
	UB	1.14	3.93	4.52				9.58
	LB	2.85	1.29	6.20				10.35
Rock gunnel	AKNB							
	UB							
	LB							
Tautog	AKNB					1.61		1.61
	UB					3.19		3.19
	LB							
Weakfish	AKNB							
	UB							
	LB							

Striped cuskeel	AKNB			
	UB			
	LB	0.31		0.31
Tautog	AKNB	11.53		11.53
	UB	40.58	1.26	41.84
	LB	13.50	3.67	17.17
Weakfish	AKNB	15.80		15.80
	UB	14.07	10.12	24.19
	LB	40.55	2.83	43.38

Table 3-6d. Monthly average juvenile density (number/1,000m^3) by species for channel stations and non-channel stations in Arthur Kill/Newark Bay (AKNB), Upper Bay (UB), and Lower Bay (LB) during ichthyoplankton sampling for the 2008 Aquatic Biological Survey.

Channel Stations

Species	Region	Feb	Mar	Apr	May	Jun	Jul	Total
Essential Fish Habitat Species								
Atlantic herring	AKNB							
	UB							
	LB							
Butterfish	AKNB							
	UB							
	LB						7.67	7.67
Other Species								
Bay anchovy	AKNB							
	UB							
	LB							
Grubby	AKNB							
	UB		0.32					0.32
	LB							
Northern pipefish	AKNB					6.44		6.44
	UB					4.47		4.47
	LB					4.33		4.33
Weakfish	AKNB							
	UB							
	LB							

Non-Channel Stations

Species	Region	Feb	Mar	Apr	May	Jun	Jul	Total
Essential Fish Habitat Species								
Atlantic herring	AKNB							
	UB			1.79				1.79
	LB							
Butterfish	AKNB							
	UB						3.80	3.80
	LB						1.59	1.59
Other Species								
Bay anchovy	AKNB							
	UB	0.63						0.63
	LB							
Grubby	AKNB							
	UB							
	LB							

Northern pipefish	AKNB					
	UB					
	LB				0.60	0.60
Weakfish	AKNB					
	UB	0.63				0.63
	LB					

Table 3-7. Laboratory winter flounder gender determination analysis for the 2008 Aquatic Biological Survey.

2008 ABS Winter Flounder Gender Determination Analysis						
#	**Sample Date**	**Station**	**TL (mm)**	**Weight (g)**	**Sex**	**Comments**
1	2/20/2008	SB-6	271	219.1	M	Partially Spent
2	3/4/2008	SB-5	292	257.9	F	Spent
3	3/17/2008	SB-4	302	424.9	F	Ripe
4	3/18/2008	LB-5	441	772.3	F	Spent
5	3/18/2008	LB-6	277	302.4	F	Ripe
6	3/18/2008	LB-6	256	177.0	M	Spent
7	3/18/2008	LB-4	387	639.5	F	Spent
8	3/18/2008	LB-11	311	297.7	F	Spent
9	3/18/2008	LB-13	296	312.9	M	Ripe
10	3/18/2008	LB-13	293	249.2	M	Partially Spent
11	3/24/2008	LB-10	292	297.8	F	Spent
12	4/14/2008	LB-6	305	300.0	F	Spent
13	4/14/2008	LB-6	310	336.9	F	Spent
14	4/14/2008	LB-6	264	176.2	M	Spent
15	4/14/2008	LB-6	302	181.1	F	Spent
16	4/14/2008	LB-6	280	249.5	F	Spent
17	4/14/2008	LB-12	291	275.3	M	Spent
18	4/14/2008	LB-4	330	341.4	F	Spent
19	4/14/2008	LB-4	310	322.2	F	Spent
20	4/15/2008	LB-10	356	509.3	F	Spent
21	4/15/2008	LB-11	323	388.0	F	Spent
22	4/16/2008	SB-5	372	625.9	F	Spent
23	4/16/2008	SB-5	296	350.9	F	Spent
24	4/16/2008	SB-5	380	675.9	F	Spent
25	5/1/2008	LB-6	305	282.7	M	Partially Spent
26	5/1/2008	LB-6	348	492.2	F	Spent
27	5/1/2008	LB-4	445	1051.1	F	Spent
28	5/1/2008	LB-4	362	554.8	M	Spent
29	5/1/2008	LB-4	305	361.9	F	Spent
30	5/2/2008	LB-2	296	358.1	F	Spent
31	5/2/2008	LB-2	280	240.1	F	Spent
32	5/2/2008	LB-14	271	230.2	M	Spent
33	5/2/2008	LB-14	290	283.5	M	Spent
34	5/2/2008	LB-14	267	244.0	F	Spent
35	5/2/2008	LB-14	254	233.1	UND	Spent (visceral decomp)

36	5/2/2008	LB-14	260	253.5	M	Spent
37	5/14/2008	LB-4	264	198.2	F	Spent
38	5/15/2008	LB-14	277	255.2	F	Spent
39	5/16/2008	SB-5	261	267.7	F	Spent
40	5/28/2008	SB-6	372	769.7	F	Spent

UND = Undetermined sex due to visceral decomposition

Upper Bay Average	**M**	**271**	**219.1**
	F	**325**	**481.8**
Lower Bay Average	**M**	**289**	**279.5**
	F	**319**	**387.6**
Overall Average	**M**	**287**	**274.0**
	F	**321**	**411.1**

Area	Station Name	Type	Station Location	Depth (ft)	GPS Coordinates (deg., decimal min.) Flood Start North	Flood Start West	Ebb Start North	Ebb Start West
South Brooklyn (4 Transects in 2008)	SB–1*	Non-channel	Gowanus Bay Interpier South	27	40 39.45	74 00.86	40 39.56	74 01.05
	SB–2*	Non-channel	Gowanus Bay Interpier	30	40 39.60	74 00.48	40 39.75	74 00.75
	SB–3	Non-channel	Bay Ridge Flats	18	40 39.36	74 02.09	40 39.09	74 02.29
	SB–4	Channel	Bay Ridge Channel	40	40 39.38	74 01.51	40 39.12	74 01.95
	SB–5	Channel	Anchorage Channel Middle	47	40 40.92	74 02.53	40 40.49	74 02.79
	SB–6	Channel	Anchorage Channel South	48	40 38.01	74 02.92	40 37.70	74 02.83
Port Jersey (4 Transects in 2008)	**PJ–1**	Non-channel	Jersey Flats	19	40 40.16	74 03.38	40 39.85	74 03.63
	PJ–2	Non-channel	Caven Point	10	40 41.07	74 03.28	40 40.66	74 03.41
	PJ–3†	Non-channel	Constable Hook	10	40 39.74	74 04.74	40 39.47	74 04.31
	PJ–4	Channel	Port Jersey Channel	51	40 40.15	74 04.61	40 39.94	74 04.12
	PJ–5*	Channel	Port Jersey Channel East	42	40 39.48	74 03.64	40 39.78	74 03.96
Newark Bay (2 Transects in 2008)	NB–3*	Non-channel	Newark Bay Flats Middle	10	40 41.06	74:07.61	40 41.40	74 07.44
	NB–4	Non-channel	Newark Bay Flats South	12	40 40.66	74 07.63	40 40.29	74 07.87
	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†	Non-channel	Elizabeth Flats North	11	40 39.62	74 09.33	40 39.41	74 09.05
Lower Bay (14 Transects in 2008)	**LB–1**	Non-channel	East Bank	17	40 33.63	74 00.29	40 33.29	74 00.10
	LB–2	Channel	North End Ambrose Channel	54	40 33.42	74 01.58	40 33.07	74 01.46
	LB–3	Non-channel	Swash Channel Range	20	40 33.21	74 04.46	40 32.79	74 04.72
	LB–4	Channel	Chapel Hill South Channel	37	40 30.64	74 02.56	40 30.18	74 02.63
	LB–5	Non-channel	Old Orchard Shoals	21	40 30.92	74 05.44	40 30.72	74 04.94
	LB–6	Channel	Raritan Bay East Reach	46	40 29.39	74 06.52	40 29.53	74 07.09
	LB-7	Non-channel	South of West Bank	31	40 33.65	74 03.27	40 33.19	74 03.37
	LB-8	Non-channel	West Bank Flat	20	40 34.66	74 03.55	40 34.24	74 03.43
	LB-9	Non-channel	West of Channel	30	40 34.01	74 02.37	40 34.43	74 02.47
	LB-10	Non-channel	Anchorage west of Gravesend Bay	30	40 35.76	74 01.15	40 35.36	74 00.91
	LB-11	Non-channel	Gravesend Bay Flats	22	40 35.30	74 00.61	40 35.68	74 00.76
	LB-12	Non-channel	West of Chapel Hill South Channel	25	40 30.28	74 02.91	40 29.84	74 02.96
	LB-13	Non-channel	East of Chapel Hill South Channel	19	40 30.38	74 02.17	40 29.94	74 02.09
	LB-14	Channel	Just north of Ambrose Channel	52	40 34.43	74 01.75	40 34.13	74 01.74
Arthur Kill (2 Transects in 2008)	AK-1*	Non-channel	Elizabeth Flats South	19	40 38.84	74 10.58	40 38.85	74 10.13
	AK-2	Channel	North of Shooter's Island Reach	52	40 38.80	74 10.39	40 38.78	74 09.82
	AK-3	Channel	Elizabeth Reach	50	40 38.65	74 11.28	40 38.40	74 11.63
	AK-4*	Non-channel	Prall's Island	20	40 36.83	74 11.91	40 36.24	74 11.82
	AK-7*	Non-channel	Island of Meadows	15	40 34.59	74 12.49	40 34.70	74 12.47
Kill Van Kull (2 Transects in 2008)	**KVK-1**	Channel	Entrance to KVK Channel (Sand)	52	40 38.95	74 04.34	40 38.86	74 04.05
	KVK-2	Channel	Entrance to KVK Channel (Silt)	55	40 38.96	74 03.91	40 38.80	74 03.61

Stations in BOLD represent those sampled during 2008
*** Not sampled in 2008**
† Indicates station in which transect always begins at the Flood Start coordinates

Legend

2008 Transect

Previous Transects

Feet
0 2,500 5,000 10,000

Job No.	Date	Figure No.
147/74295	04/08/08	2-1

Station locations for the 2008 Aquatic Biological Survey.

FILE: \\PRL-SRV2\Projects\426906_NY-NJ ENVIRONMENTAL RESTORATION CONSULT\0054553_ERC-SZ 1033016AQUATICSUROFFICE\GIS\map_docs\mxd\ABS\2008 Sampling Stations\2008SamplingStations_11x17_04082008.mxd

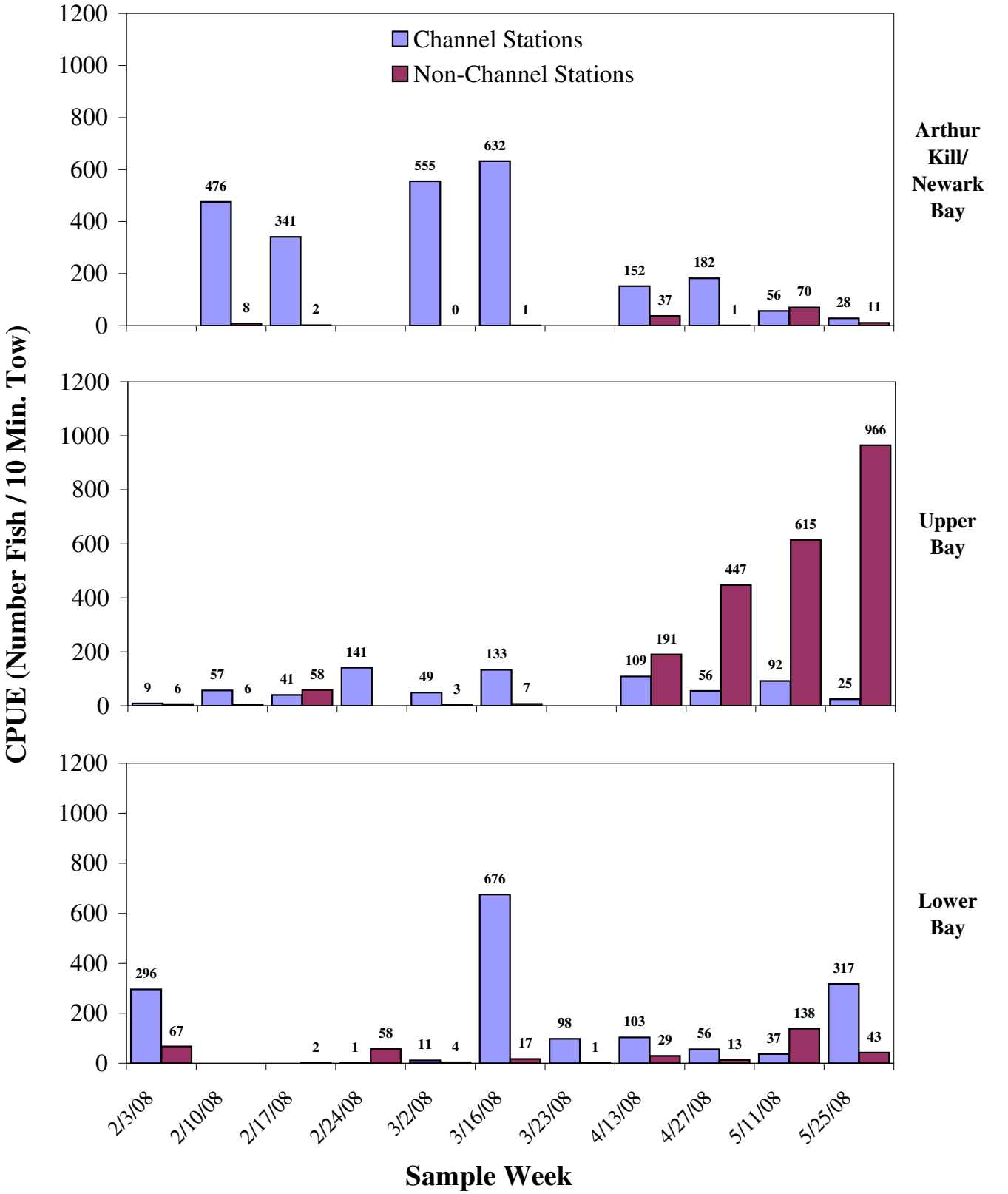

Figure 3-1 **Average weekly bottom trawl CPUE for all fish combined at navigation channel and non-channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations, 2008 Aquatic Biological Survey.**

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

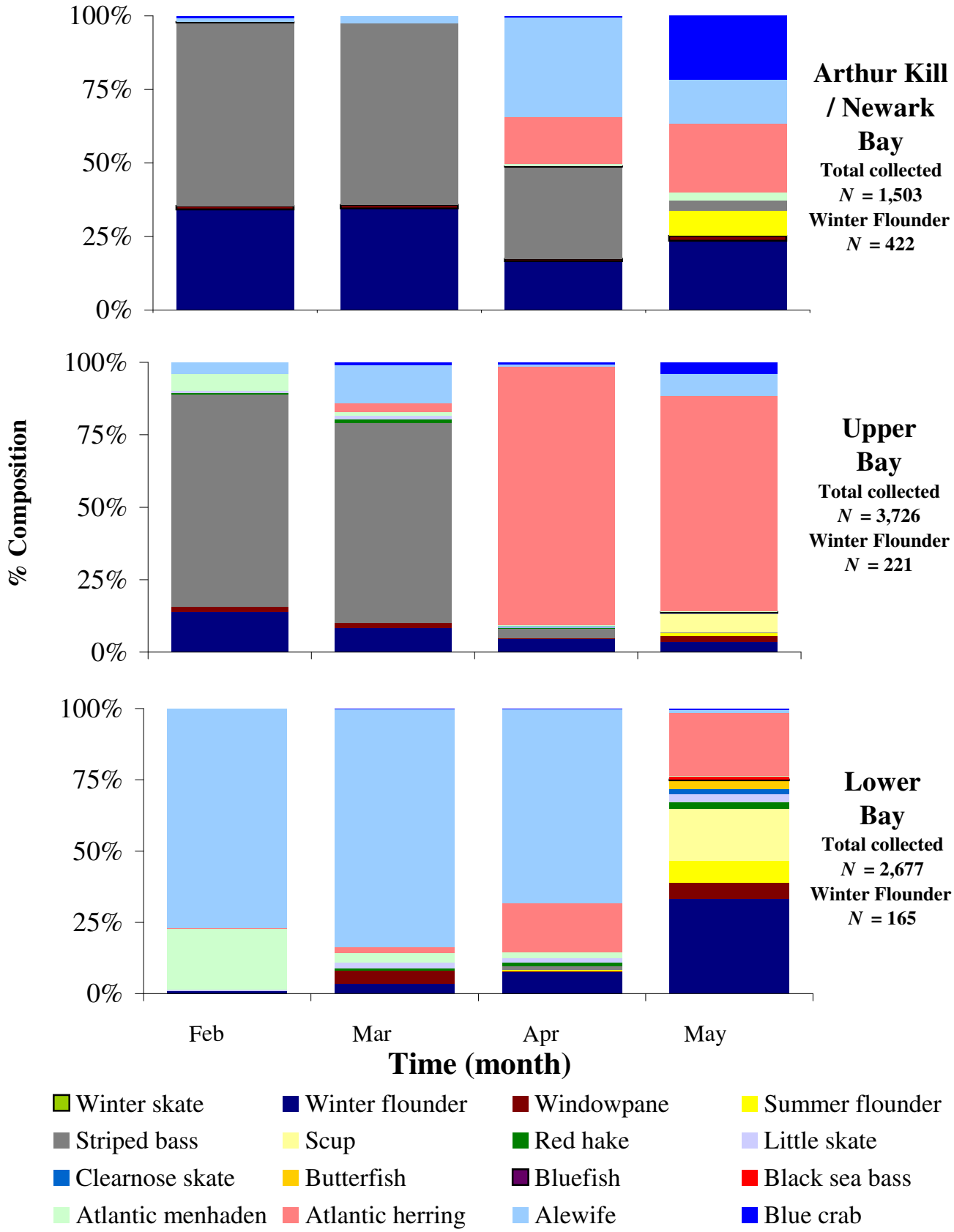

Figure 3-2 **EFH and Important Non-EFH Species composition of bottom trawl catches from Arthur Kill/Newark Bay, Upper Bay,and Lower Bay stations during the 2008 Aquatic Biological Survey.**

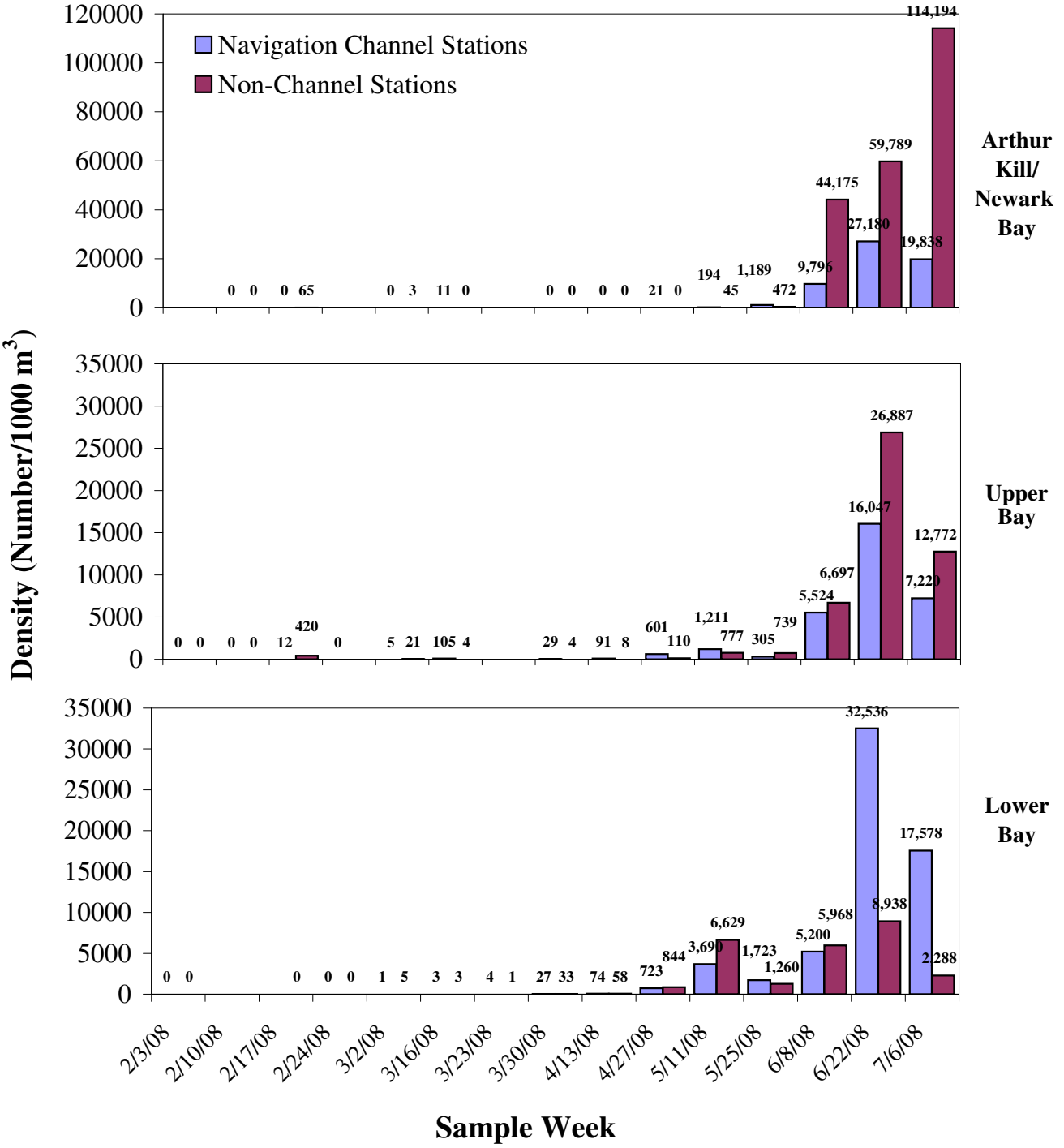

Figure 3-3 **Average weekly egg density of all species combined at navigation channel and non-channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay, 2008 Aquatic Biological Survey.**

Note: Scale change for Arthur Kill/Newark Bay.

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

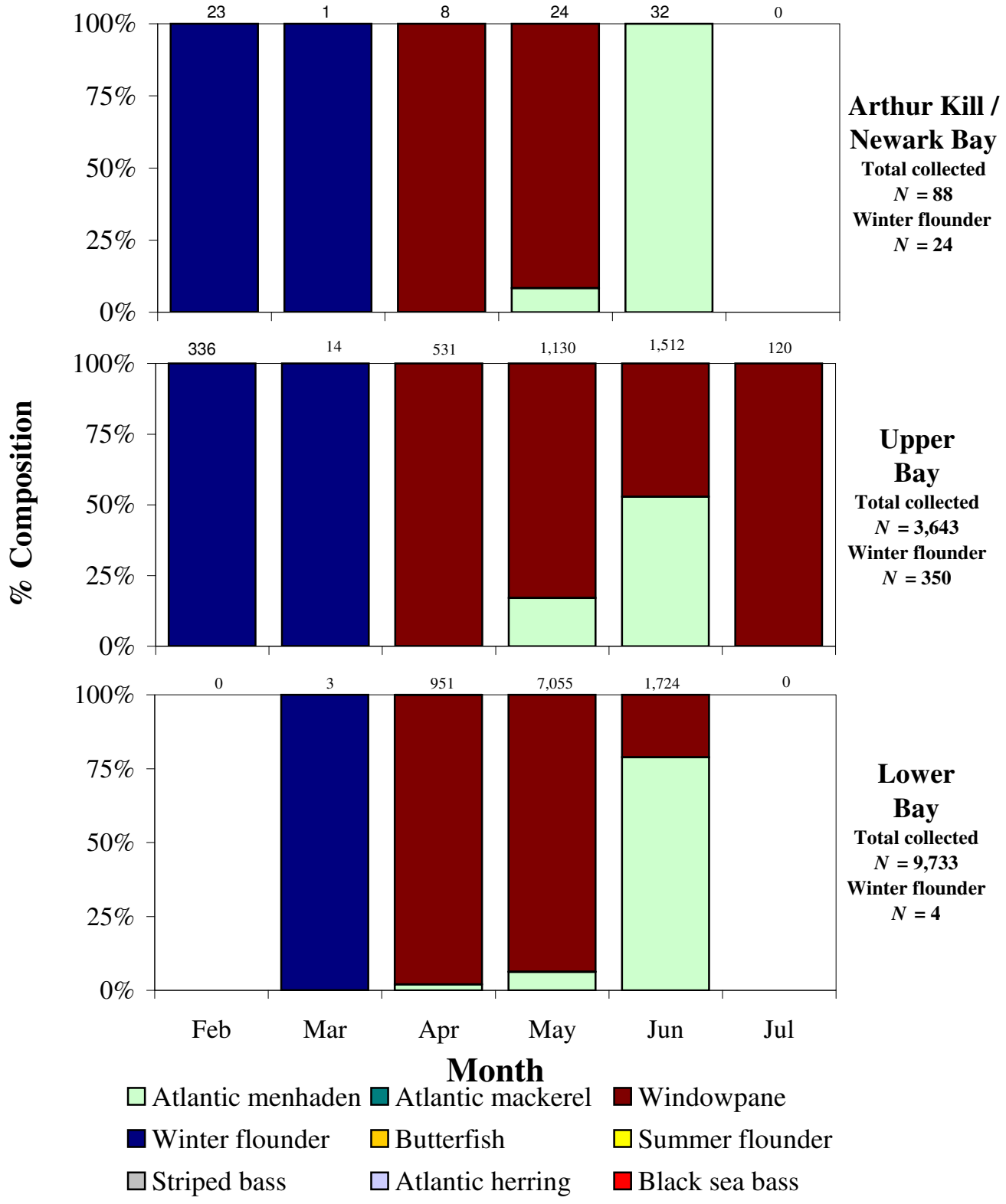

Figure 3-4 **EFH and important Non-EFH species compostion of eggs collected at all stations during the 2008 Aquatic Biological Survey.**

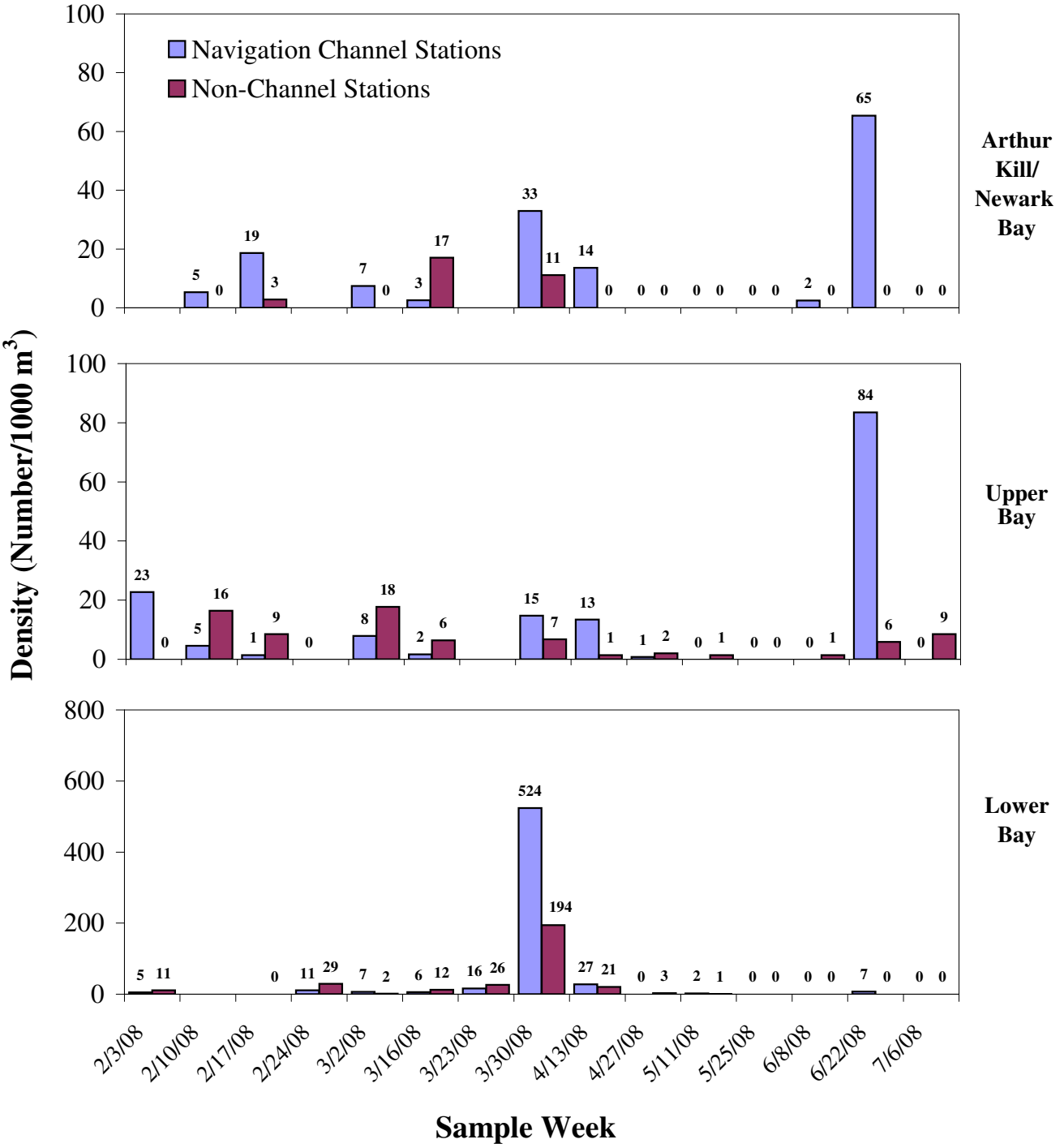

Figure 3-5 **Average weekly yolk-sac larvae density of all species combined at navigation channel and non-channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay, 2008 Aquatic Biological Survey.**

Note: Scale change for Lower Bay.

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

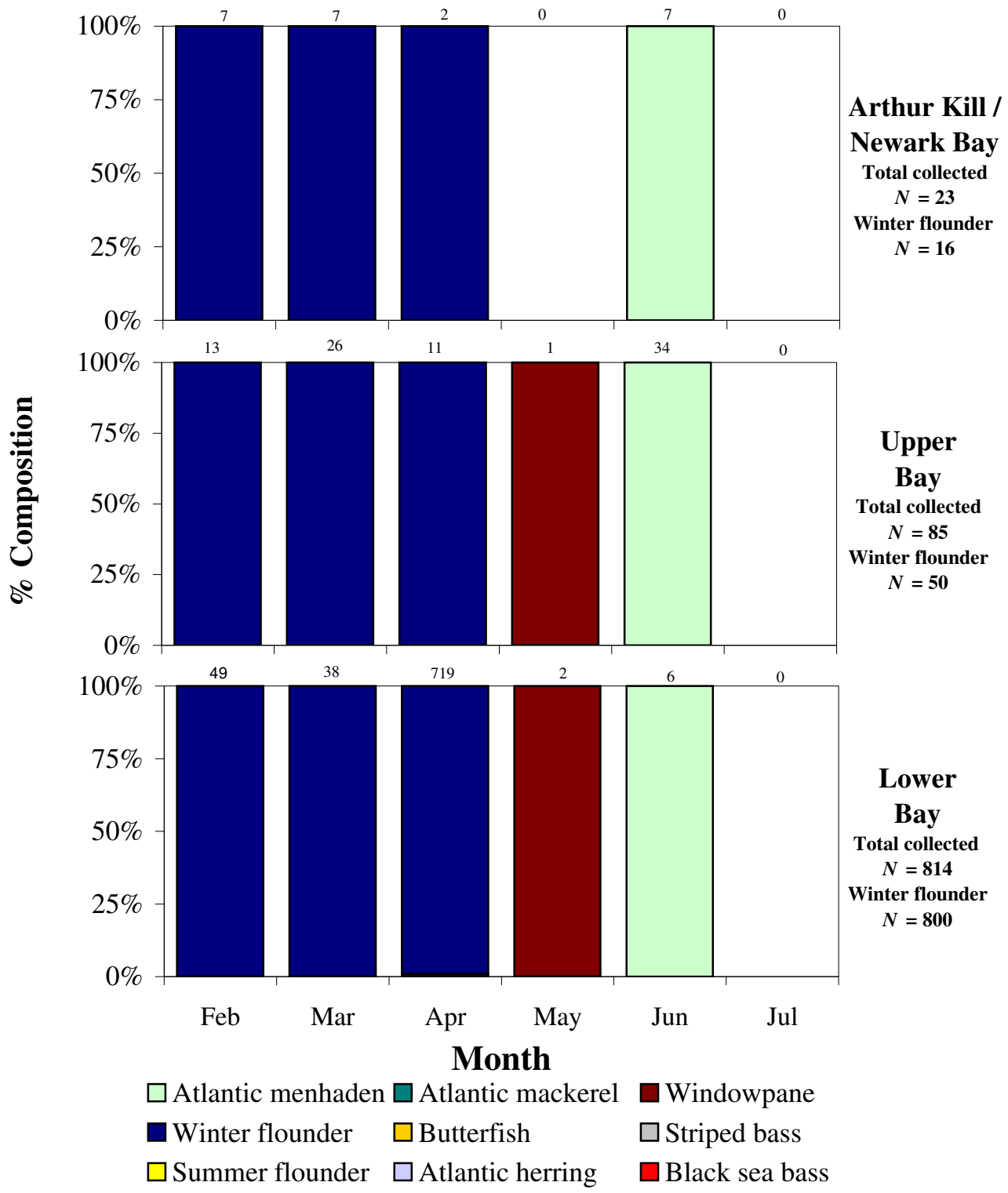

Figure 3-6 **EFH and important Non-EFH species compostion of yolk-sac larvae collected at all stations during the 2008 Aquatic Biological Survey.**

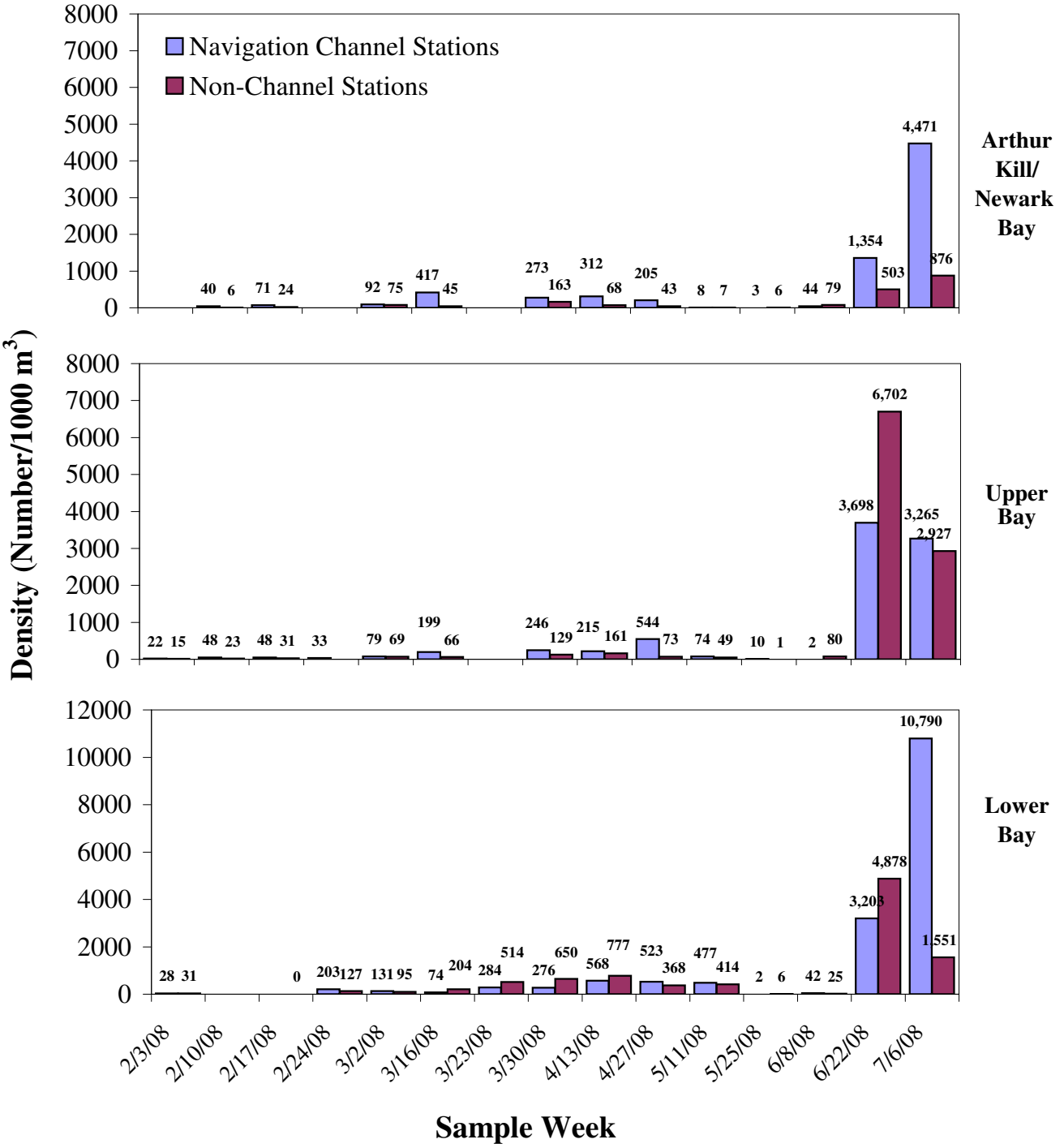

Figure 3-7 **Average weekly post-yolk sac larvae density of all species combined at navigation channel and non-channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay, 2008 Aquatic Biological Survey.**

Note: Scale change for Lower Bay.

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

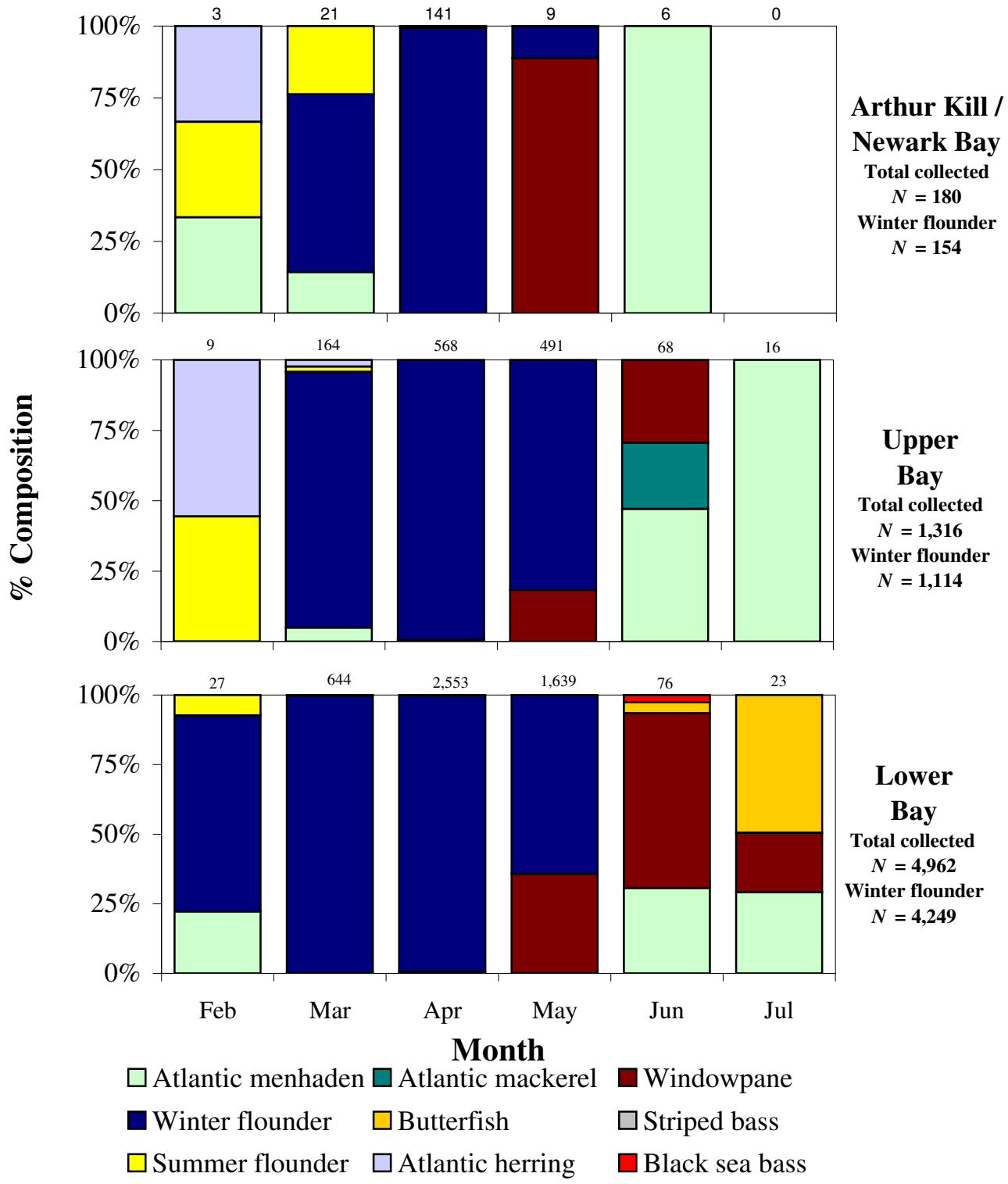

Figure 3-8 **EFH and important Non-EFH species compostion of post yolk-sac larvae collected at all stations during the 2008 Aquatic Biological Survey.**

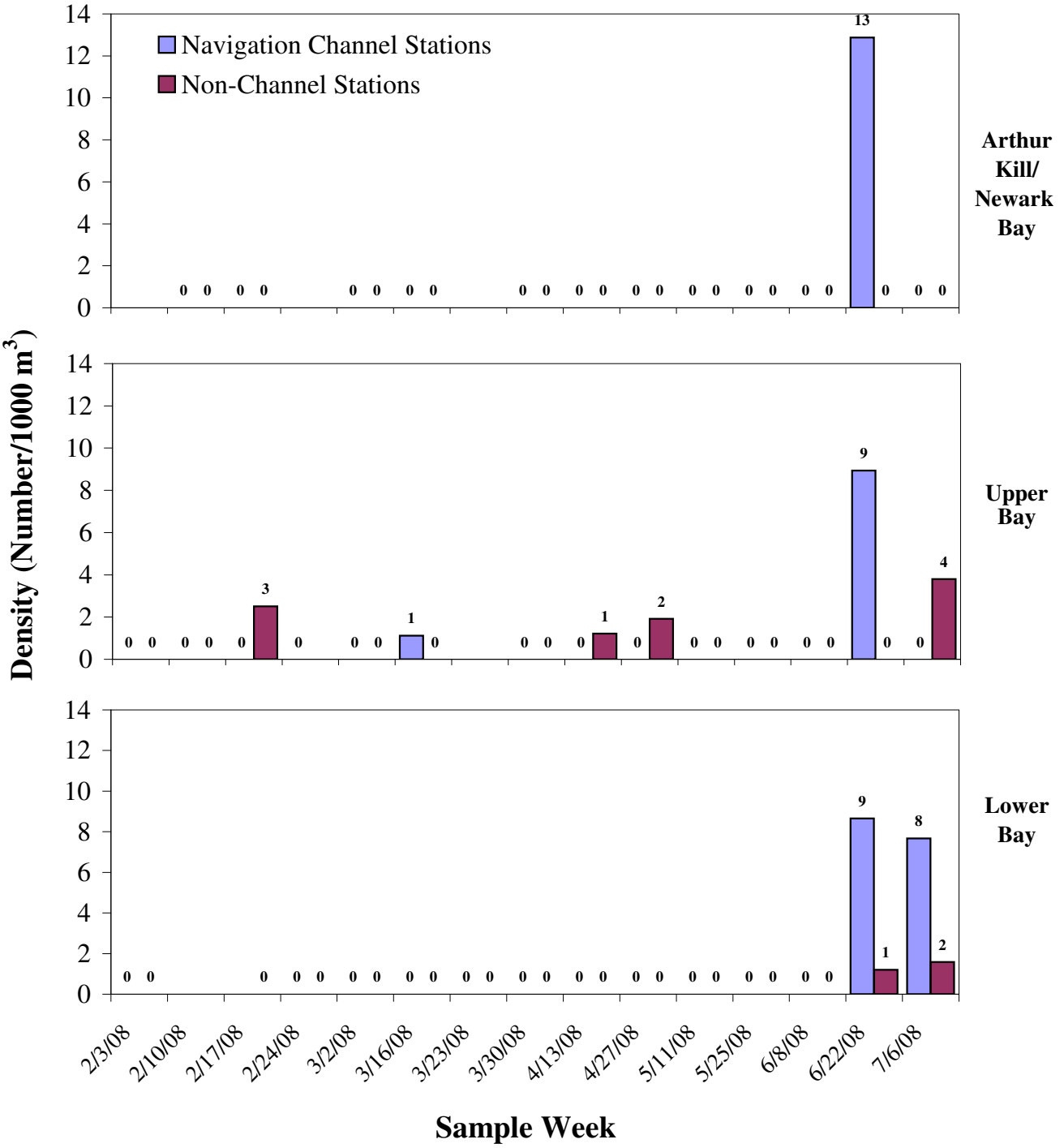

Figure 3-9 **Average weekly juvenile density of all species combined at navigation channel and non-channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay, 2008 Aquatic Biological Survey.**

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

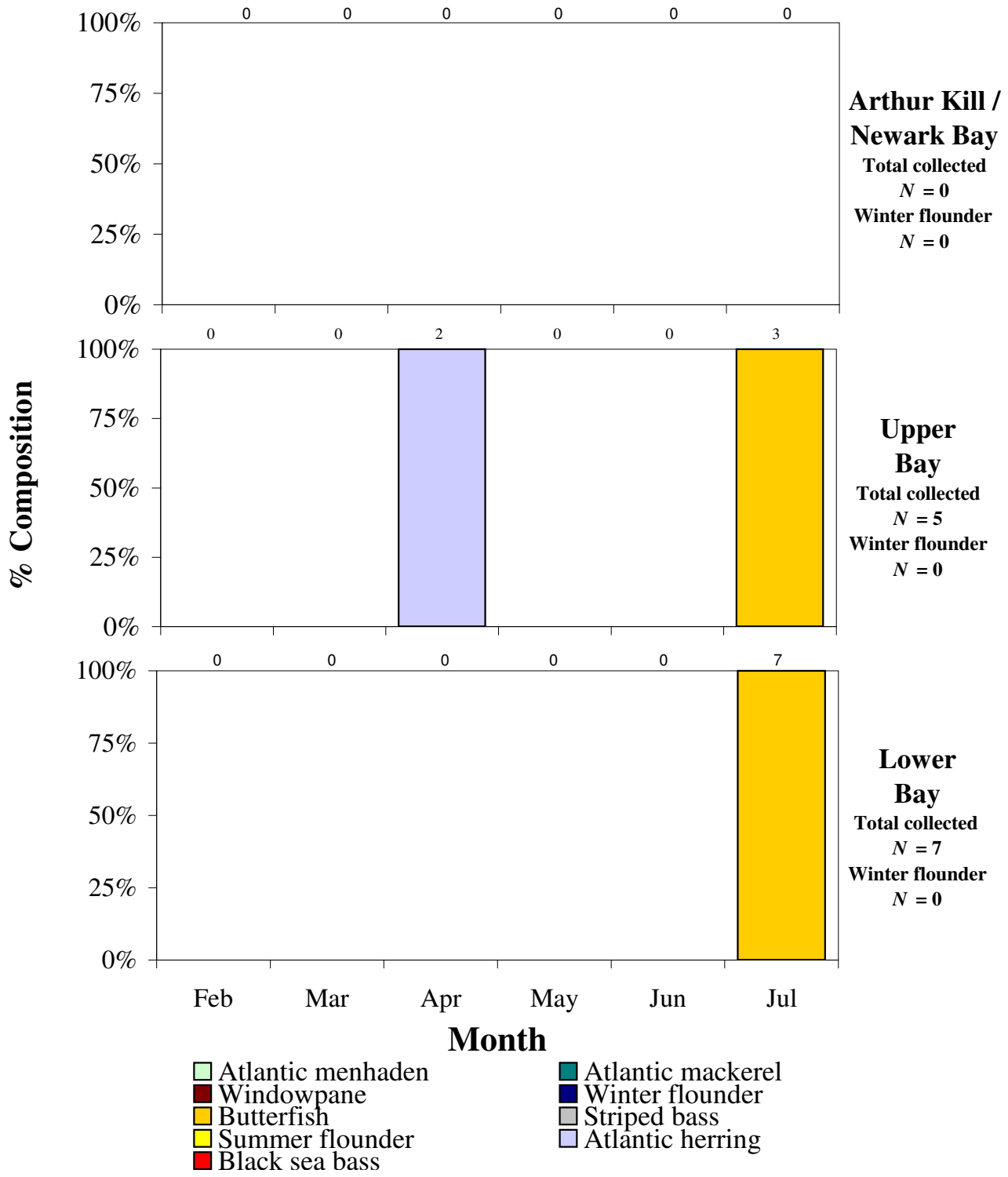

Figure 3-10 **EFH and important Non-EFH species compostion of juveniles collected at all stations during the 2008 Aquatic Biological Survey.**

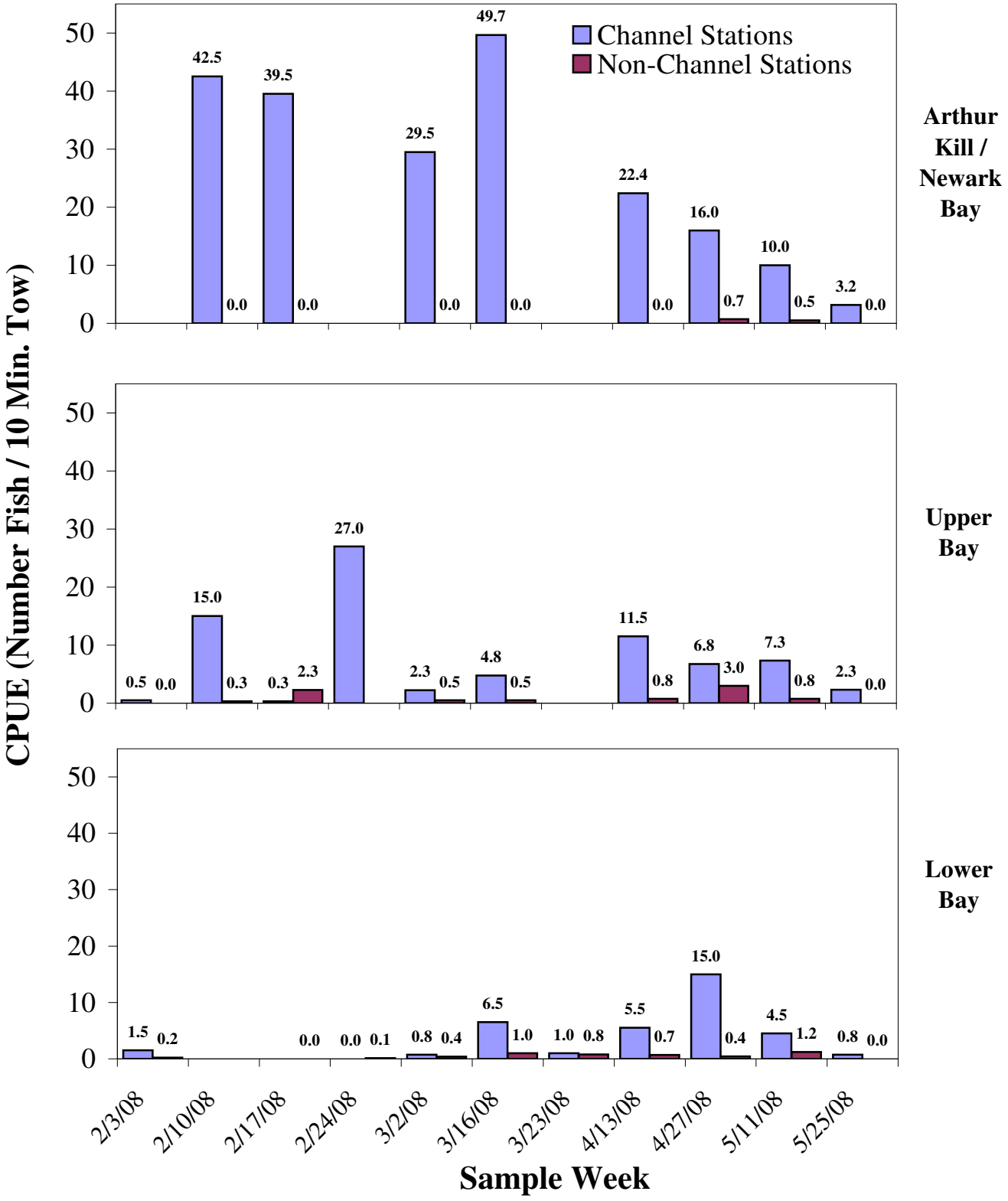

Figure 3-11a **Average weekly winter flounder bottom trawl CPUE at navigation channel and non-channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay during the 2008 Aquatic Biological Survey.**

Note: Dates listed indicate the first day of each sampling week.

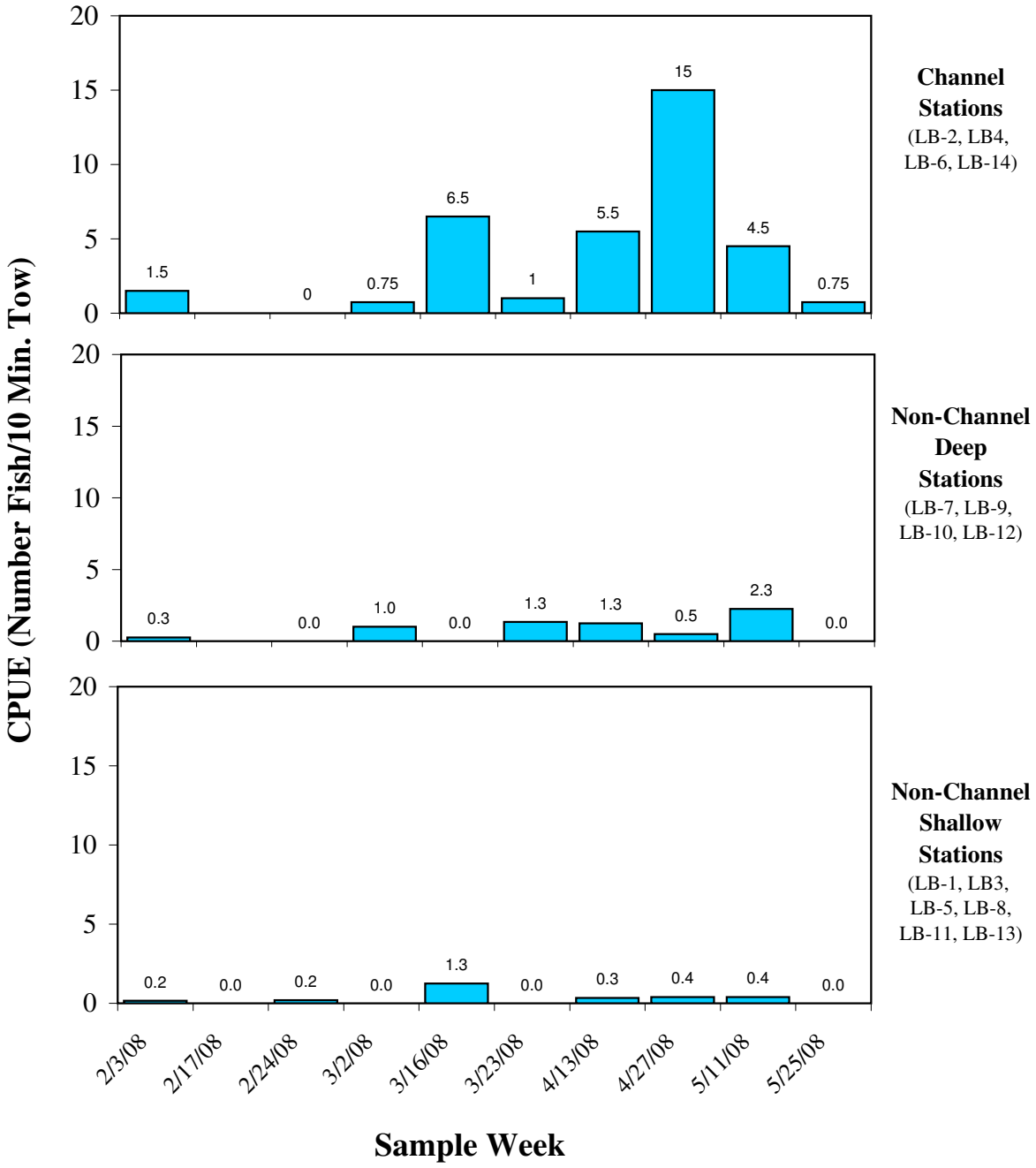

Figure 3-11b **Average weekly bottom trawl CPUE of winter flounder in the Lower Bay by station depth during the 2008 Aquatic Biological Survey.**

Note: Dates listed indicate the first day of each sampling week.

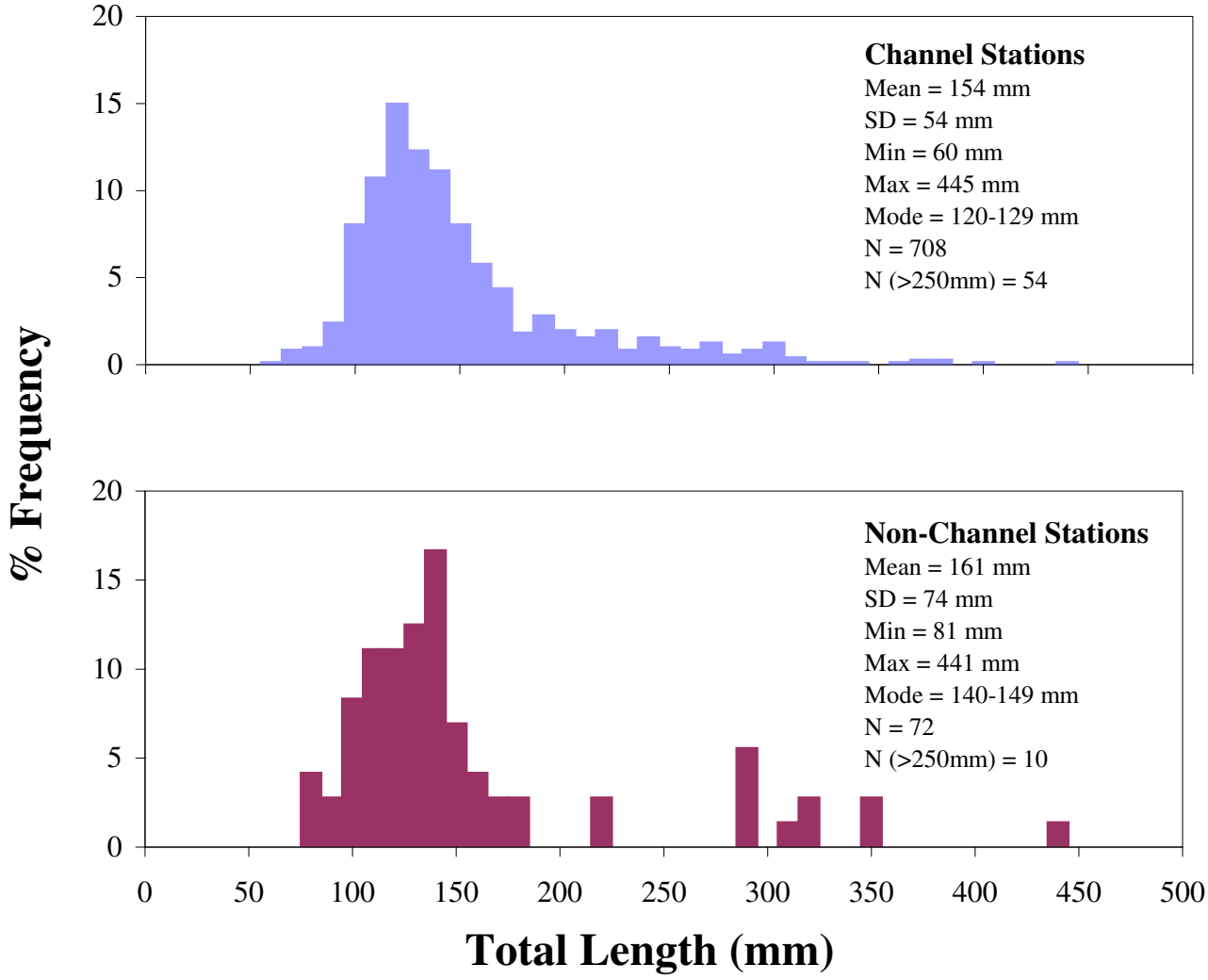

Figure 3-12 **Length frequency distribution (10 mm intervals) of all winter flounder measured during bottom trawl sampling for the 2008 Aquatic Biological Survey.**

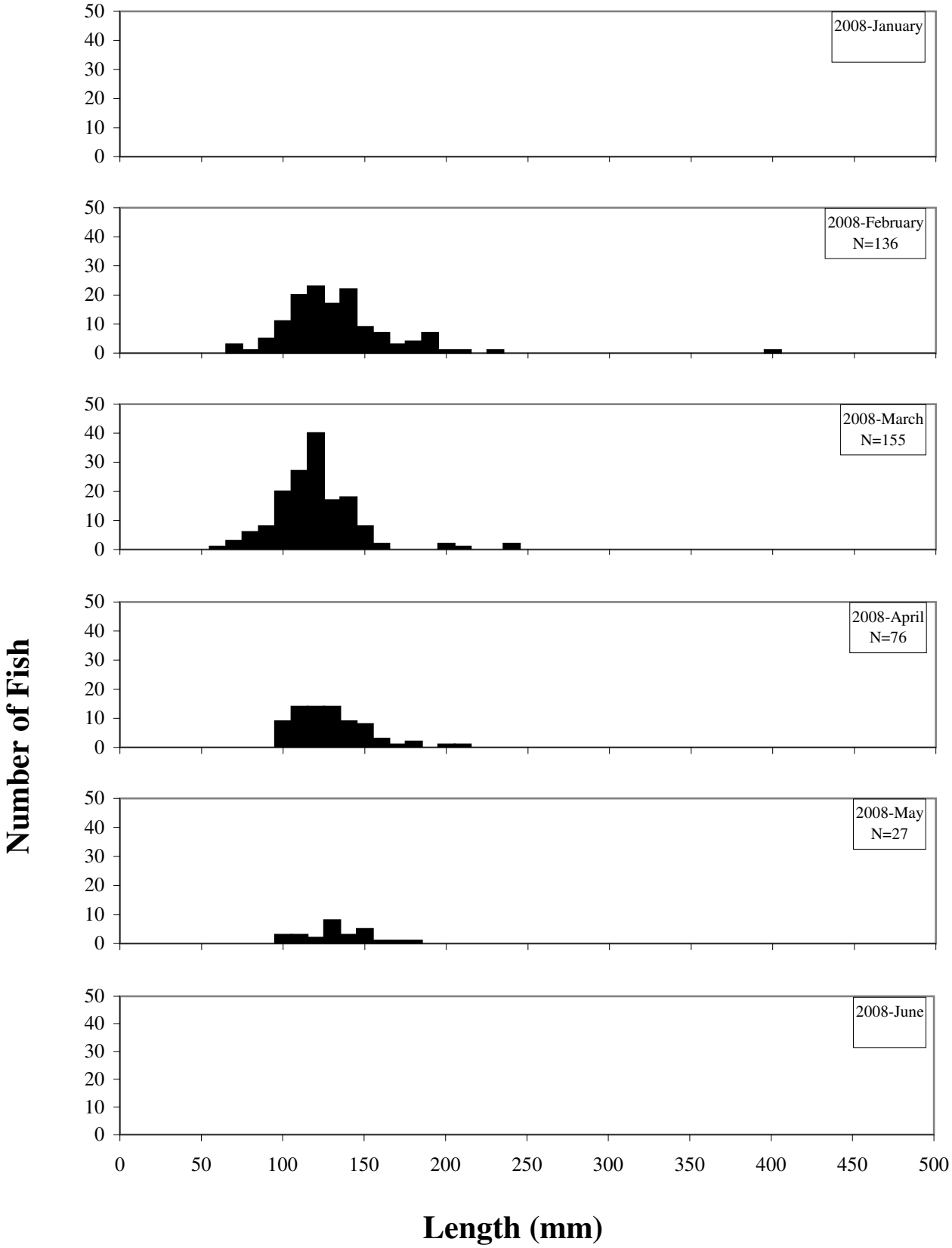

Figure 3-13 **Length frequency distribution of winter flounder collected during bottom trawl sampling at Arthur Kill/Newark Bay stations, 2008 Aquatic Biological Survey.**

Note: No Sampling was conducted during January and June.

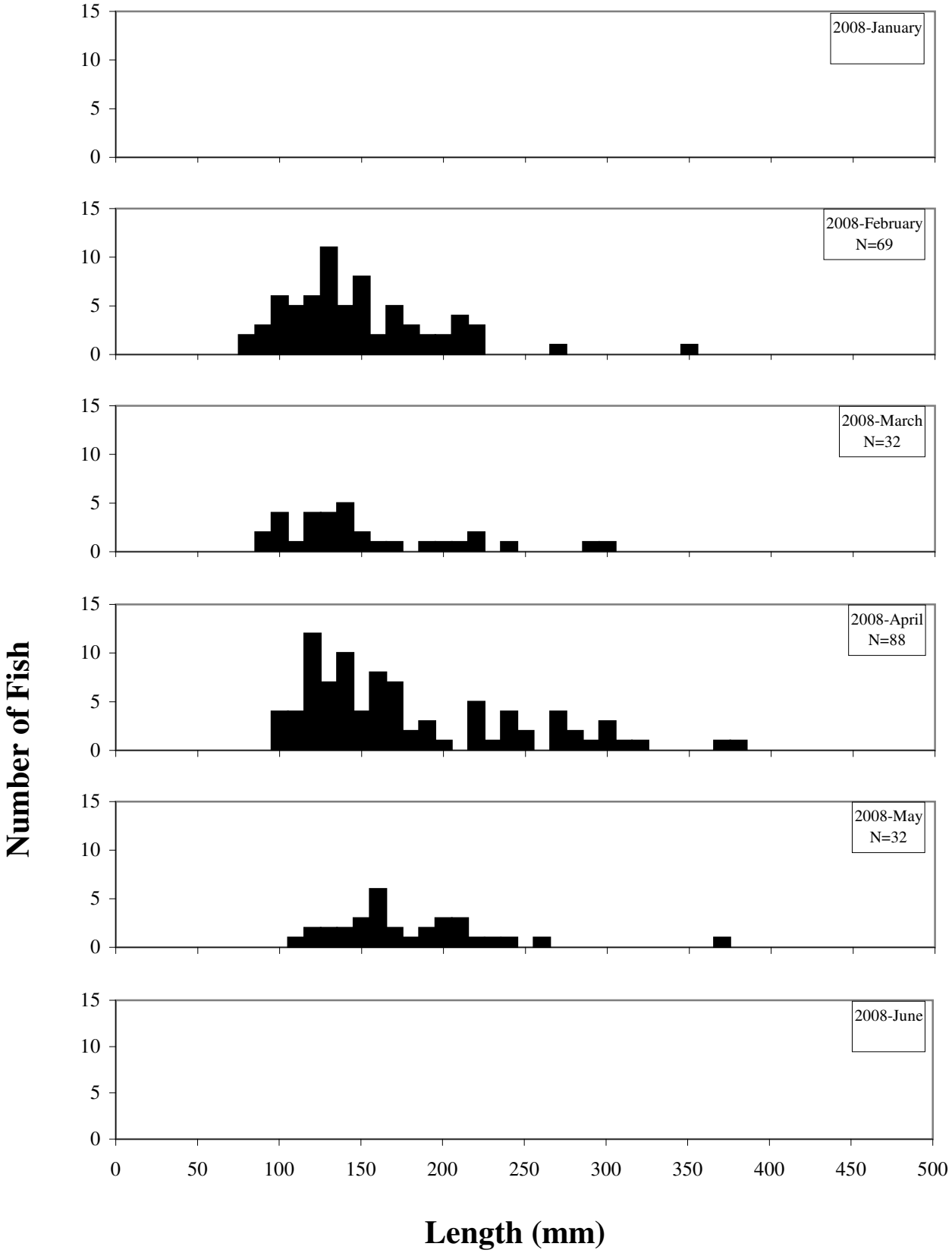

Figure 3-14 **Length frequency distribution of winter flounder collected during bottom trawl sampling at Upper Bay stations, 2008 Aquatic Biological Survey.**

Note: No Sampling was conducted during January and June.

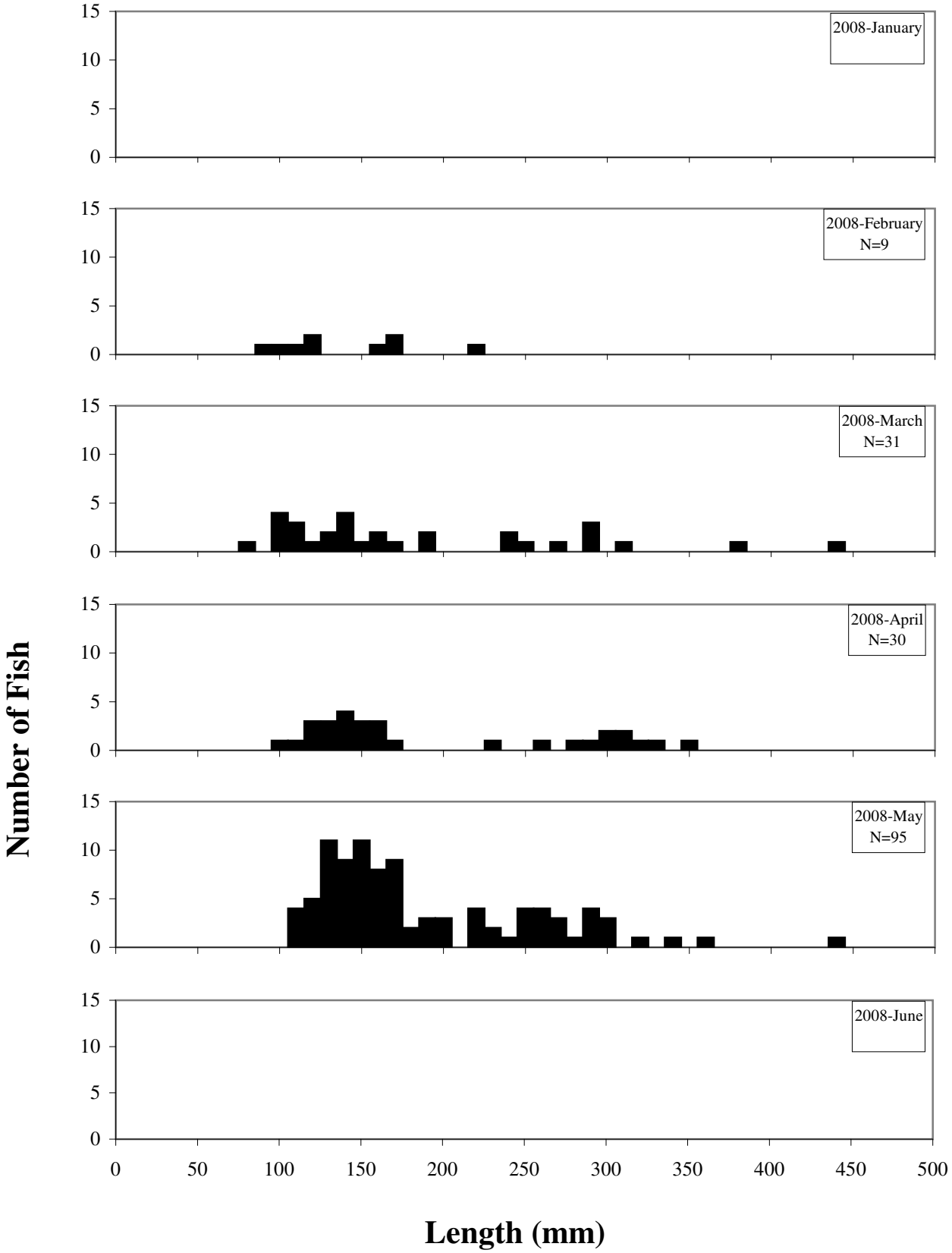

Figure 3-15 Length frequency distribution of winter flounder collected during bottom trawl sampling at Lower Bay stations, 2008 Aquatic Biological Survey.

Note: No Sampling was conducted during January and June.

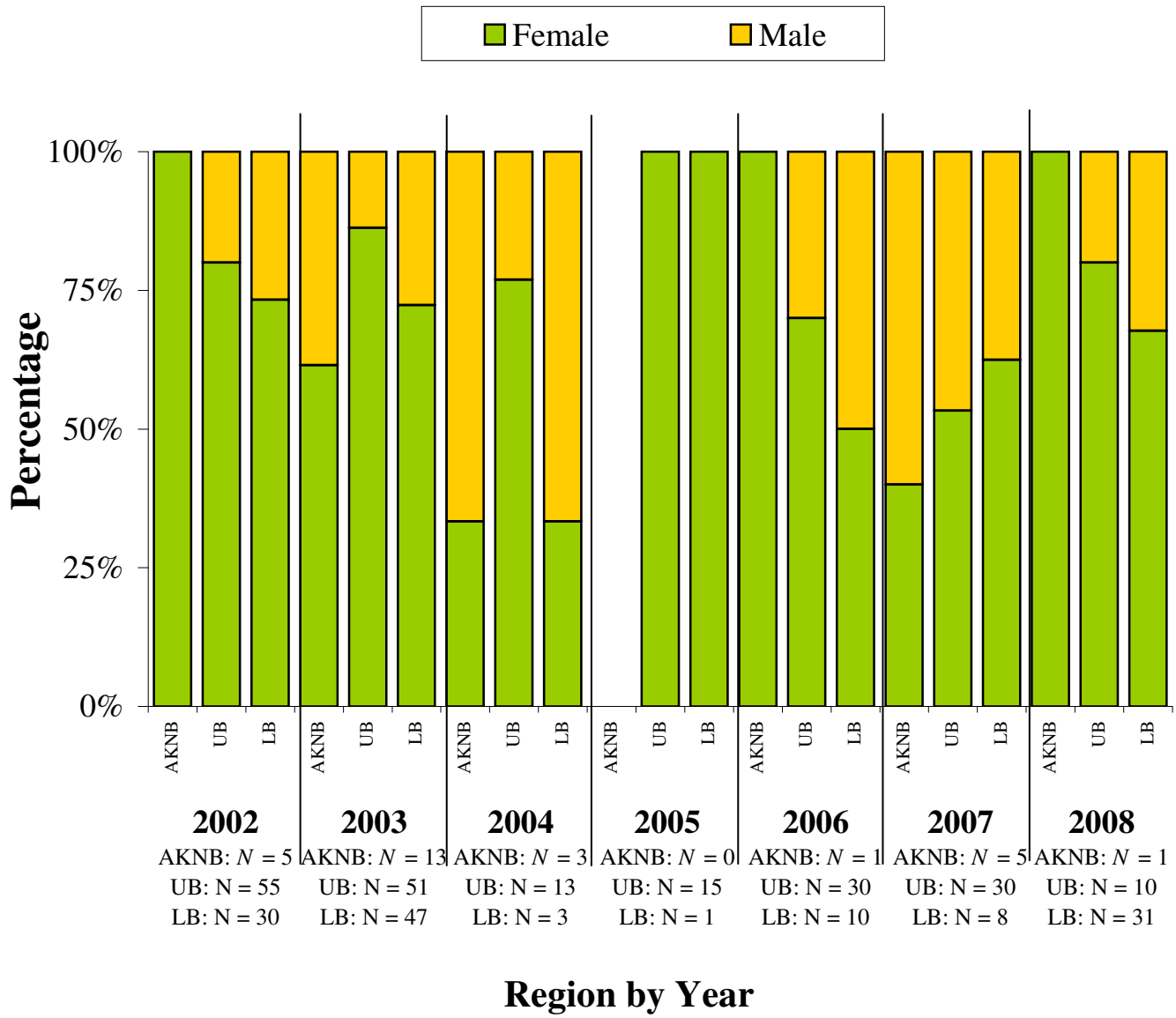

Figure 3-16 **Gender ratio of winter flounder adults (total length ≥ 250 mm) collected at all regions during the 2002 through 2008 Aquatic Biological Surveys.**

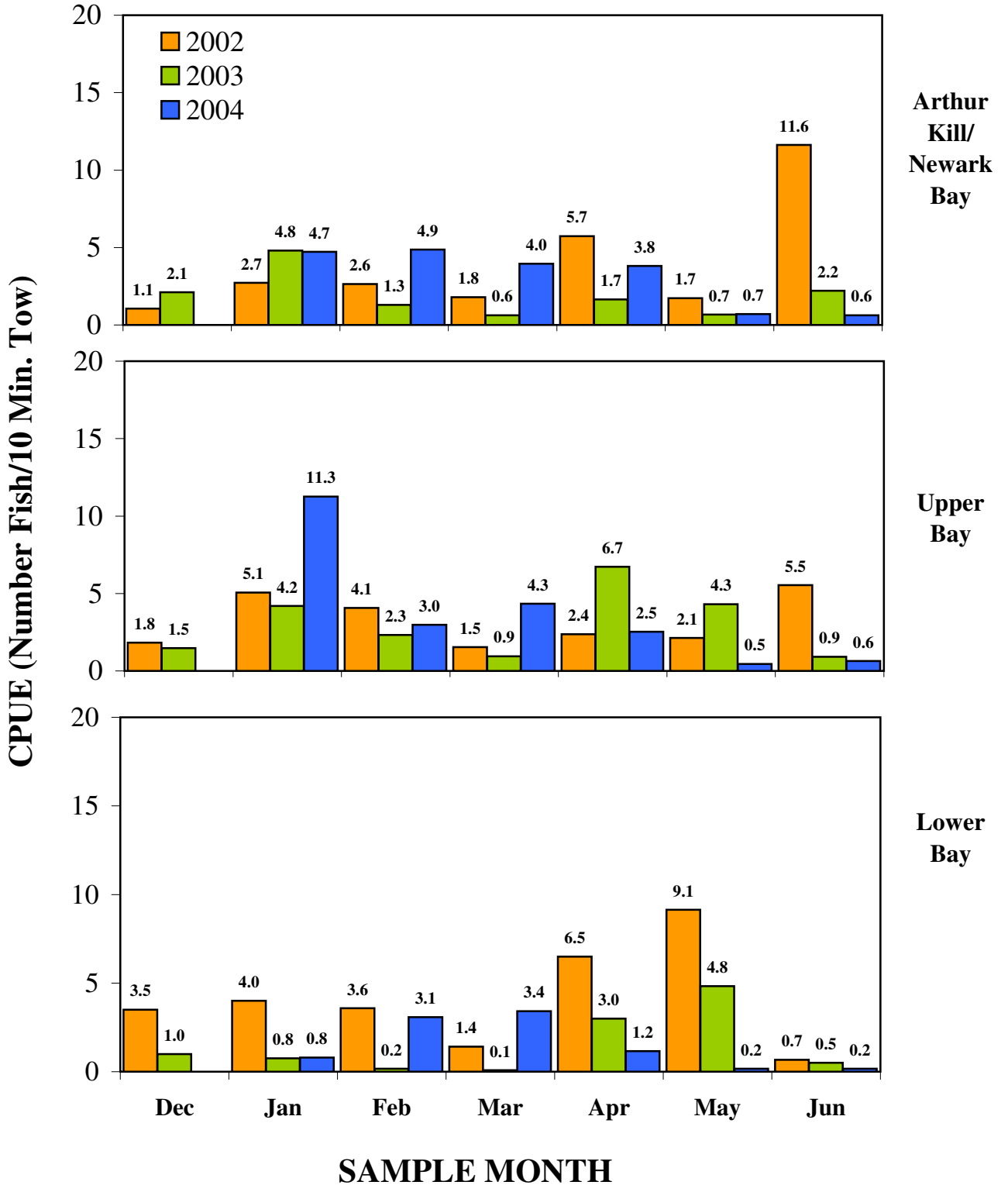

Figure 3-17a **Average monthly bottom trawl CPUE of winter flounder during the 2002, 2003 and 2004 night surveys in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations**

Note: December was not sampled during 2004.

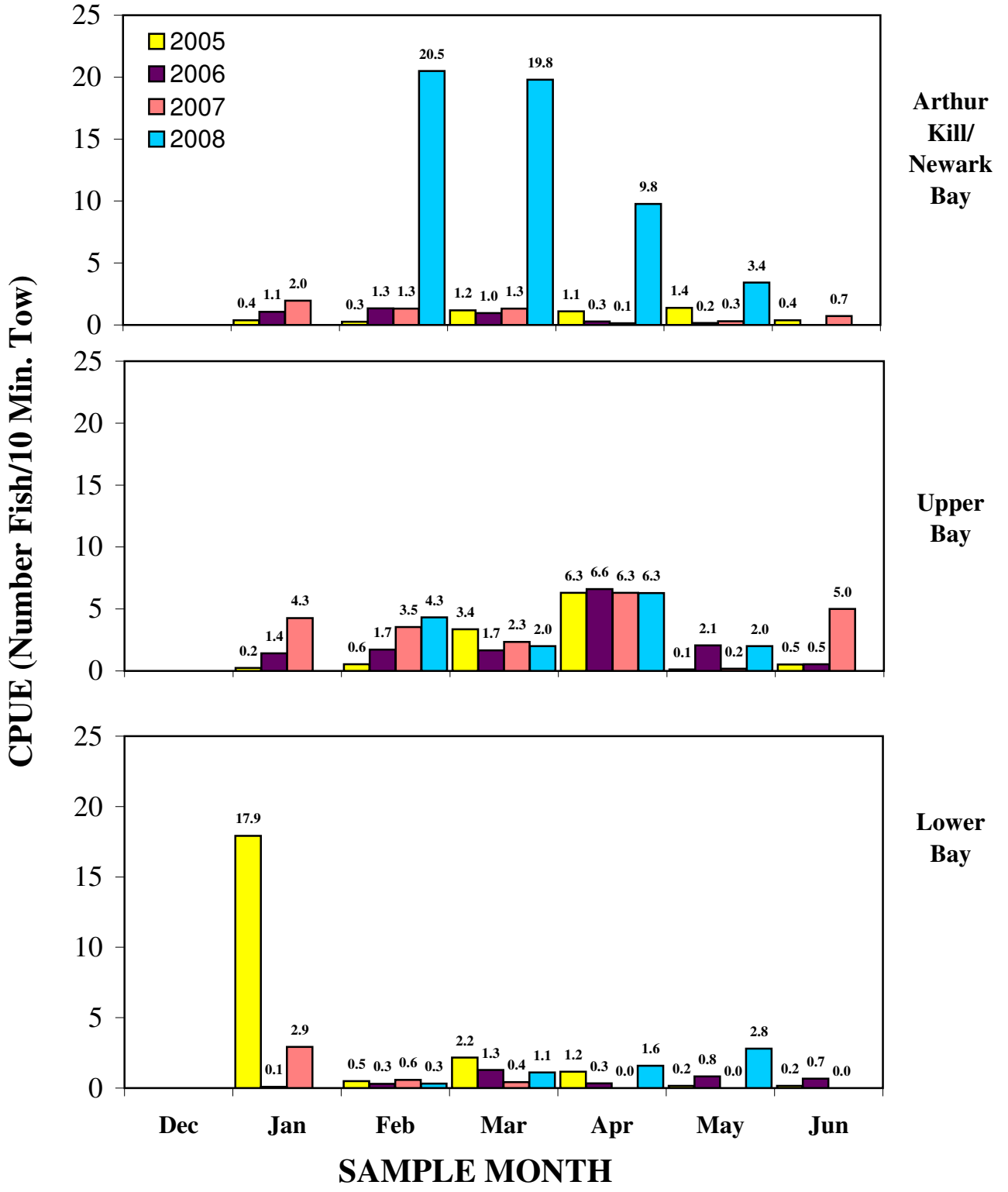

Figure 3-17b **Average monthly bottom trawl CPUE of winter flounder during the 2005, 2006, 2007, and 2008 daytime surveys in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations**

Note: December was not sampled during these years.
Note: January and June were not sampled in 2008

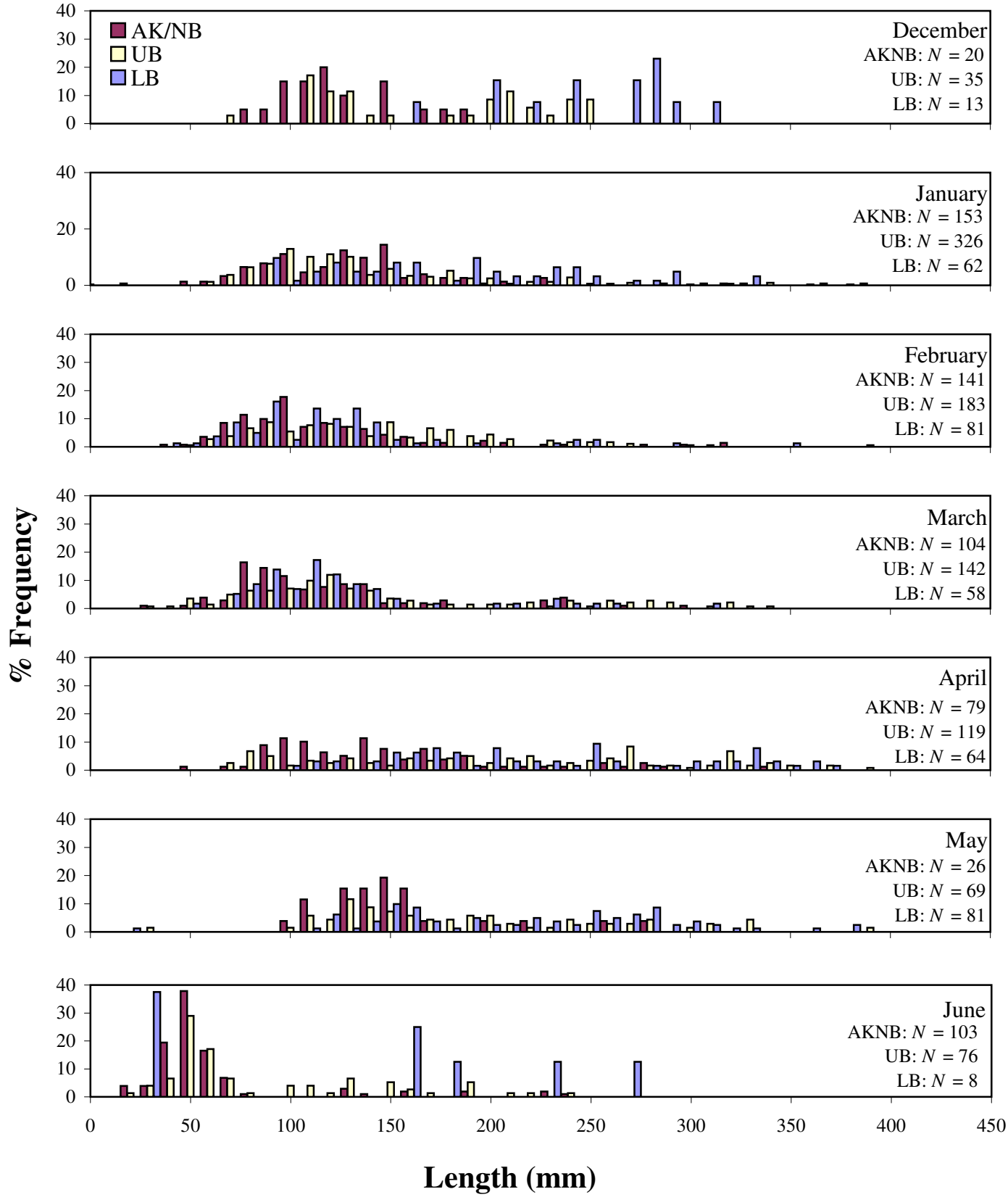

Figure 3-18a **Length frequency distribution of winter flounder collected during bottom trawl sampling at Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations during the 2002, 2003, and 2004 Aquatic Biological Surveys.**

Note: Sampling was conducted at night with no sampling in December 2003.

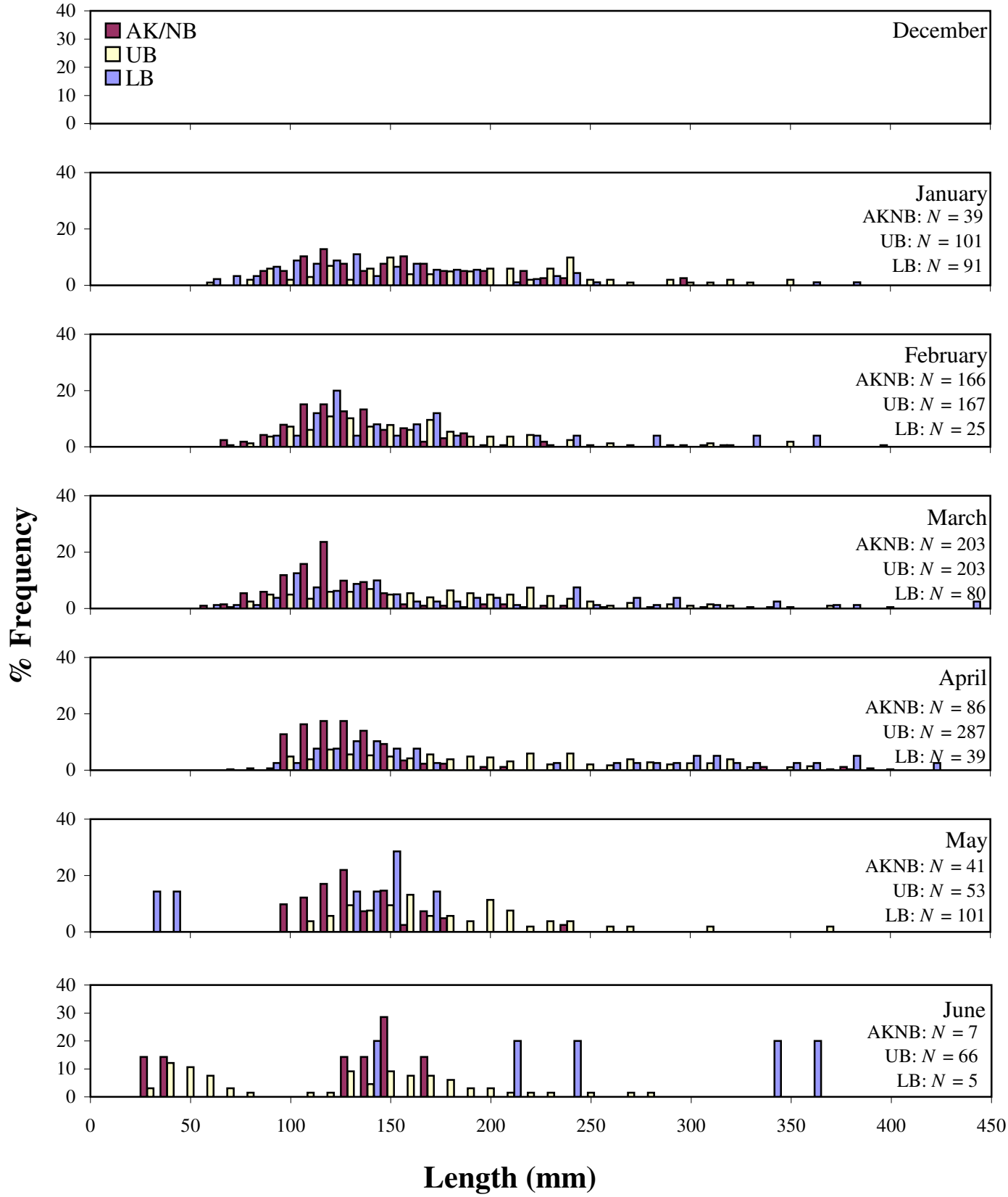

Figure 3-18b **Length frequency distribution of winter flounder collected during bottom trawl sampling at Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations during the 2005, 2006, 2007, and 2008 Aquatic Biological Surveys.**

Note: Sampling was conducted during the day with no sampling in December and no sampling in January or June 2008.

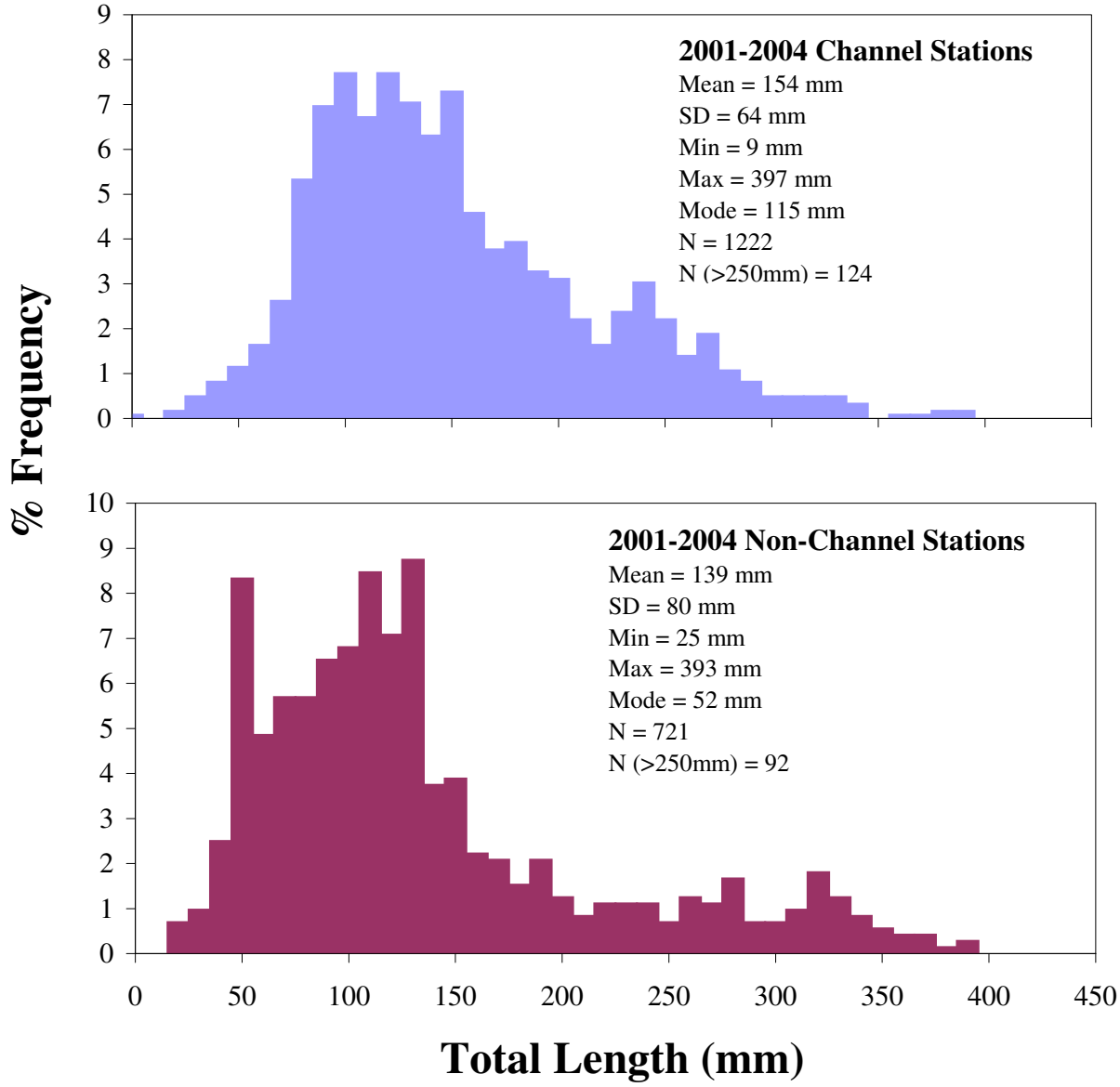

Figure 3-18c **Length frequency distribution (10 mm intervals) of all winter flounder measured during bottom trawl sampling during the 2001-2004 Aquatic Biological Surveys.**

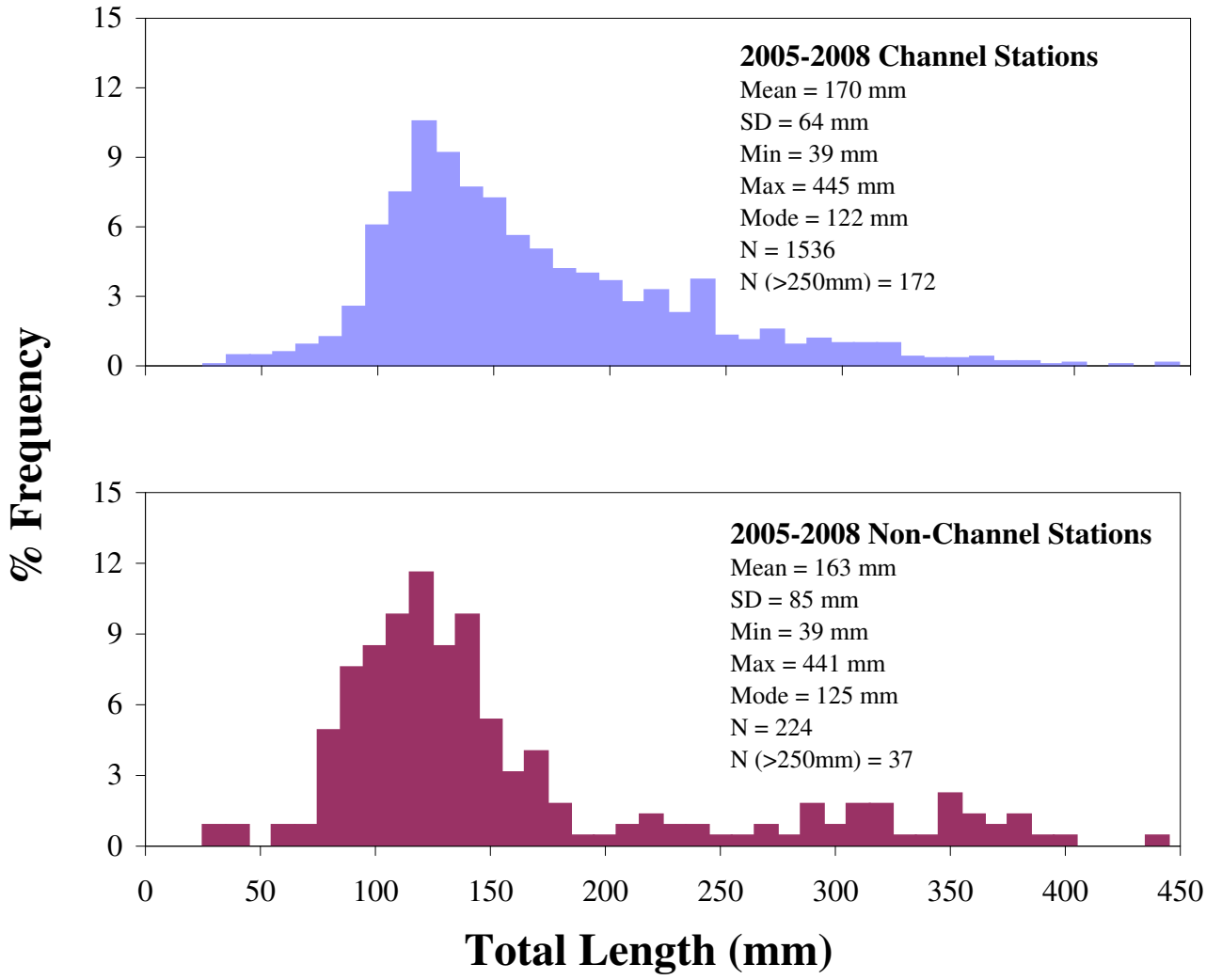

Figure 3-18d **Length frequency distribution (10 mm intervals) of all winter flounder measured during bottom trawl sampling during the 2005-2008 Aquatic Biological Surveys.**

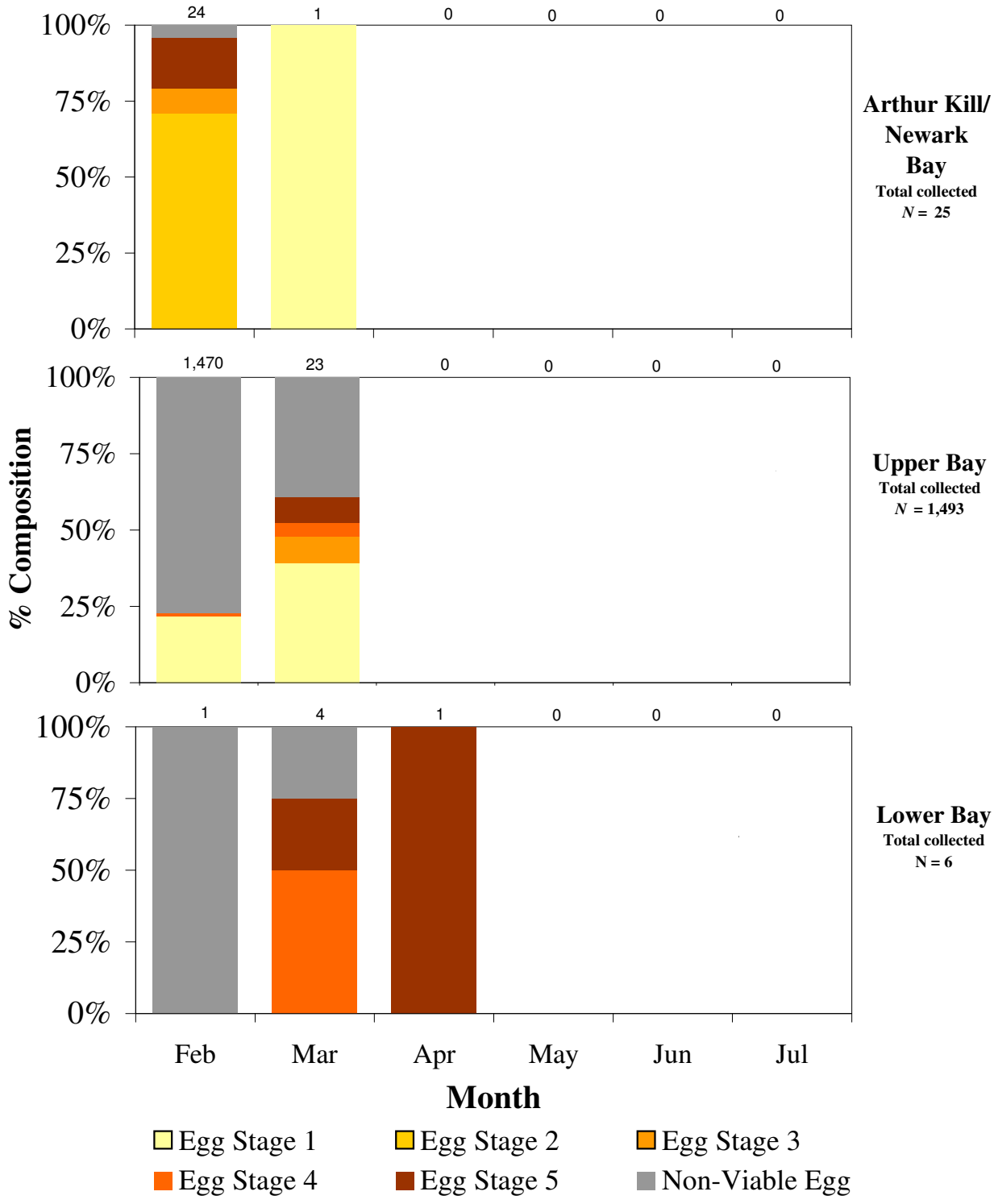

Figure 3-19 **Percent composition of winter flounder egg lifestages in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations during the 2008 Aquatic Biological Survey.**

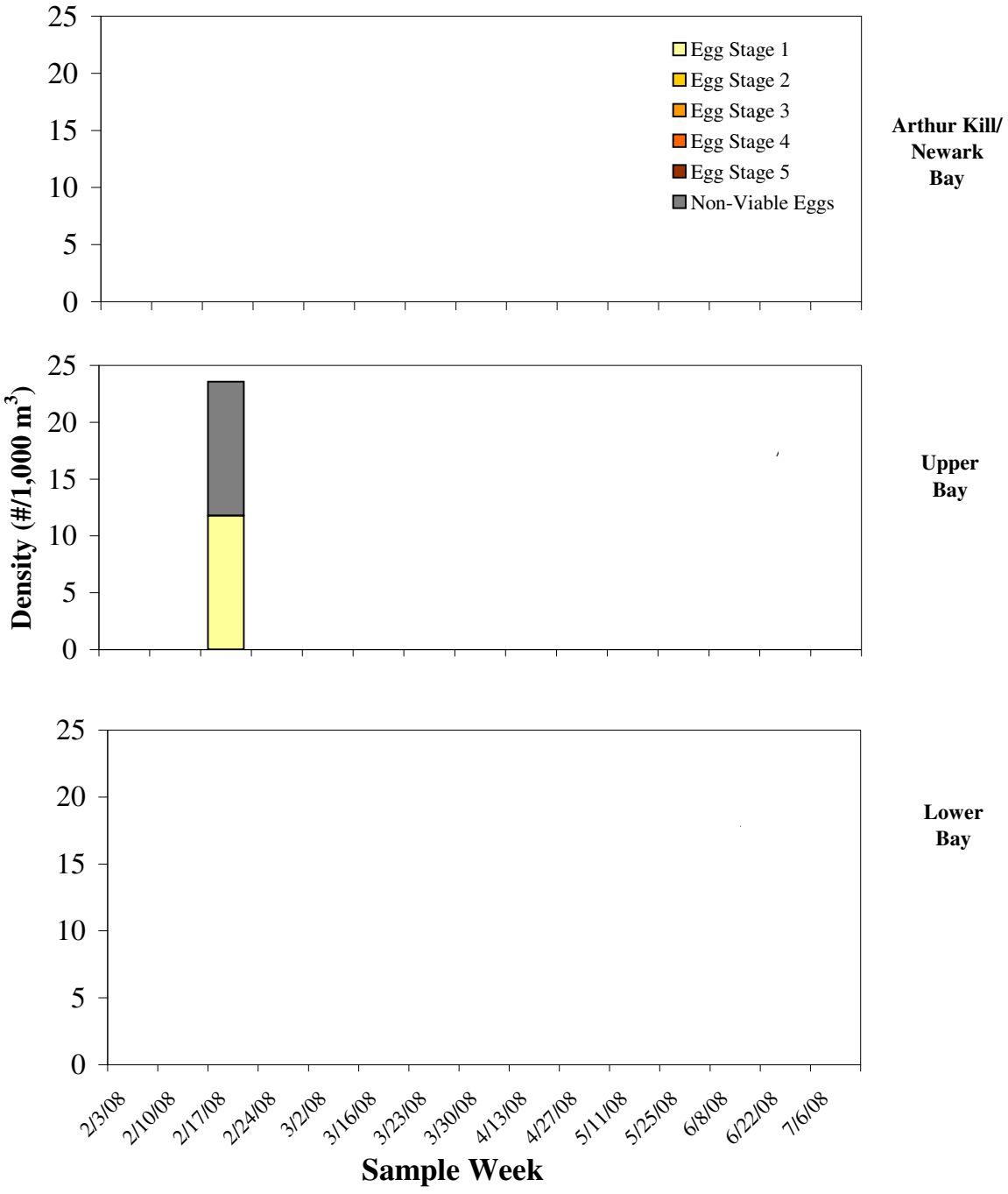

Figure 3-20a **Average weekly winter flounder egg density at navigation channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay, during the 2008 Aquatic Biological Survey**

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

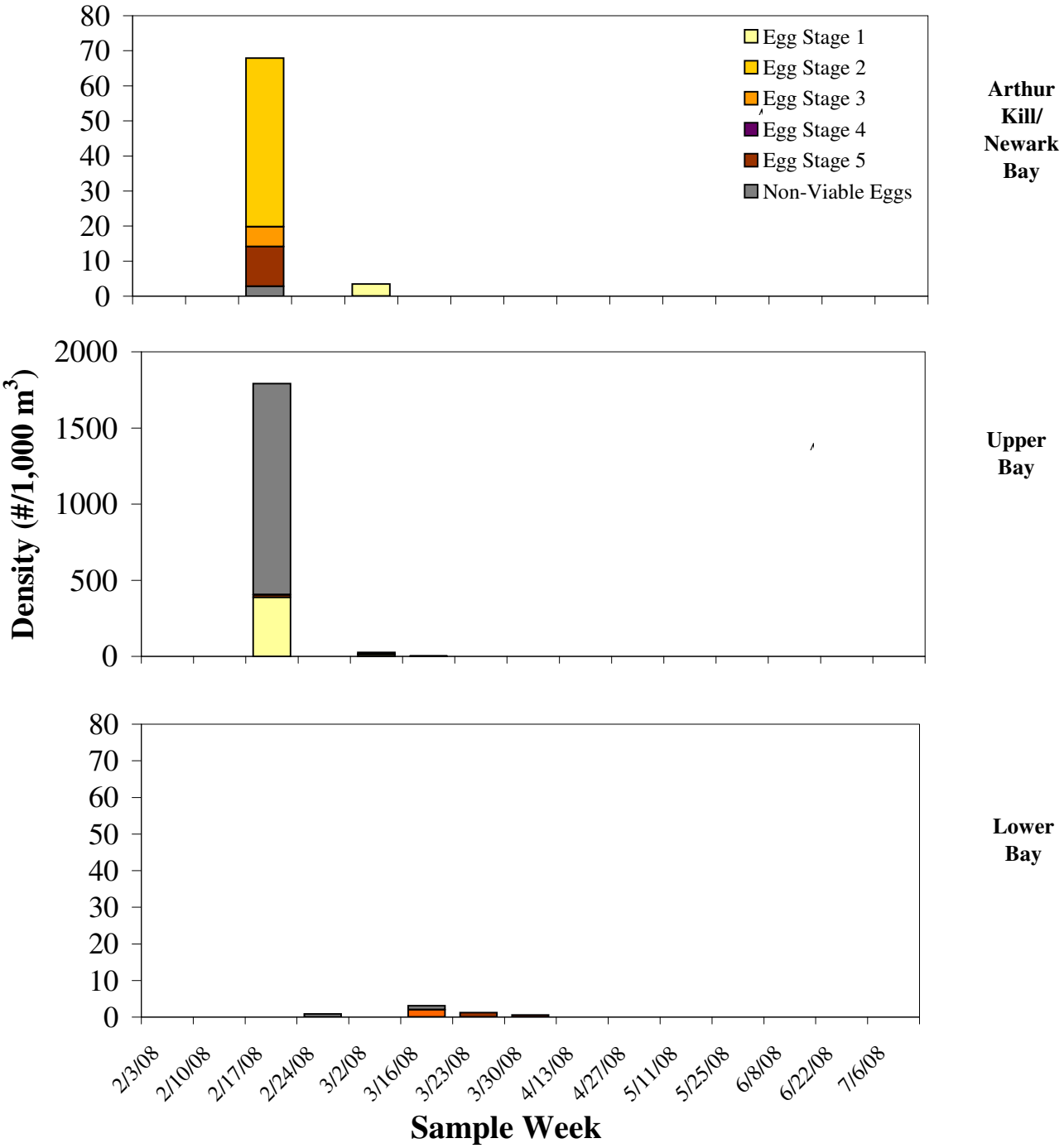

Figure 3-20b **Average weekly winter flounder egg density at non-channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay, during the 2008 Aquatic Biological Survey**

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

Note: Scale change in the Upper Bay.

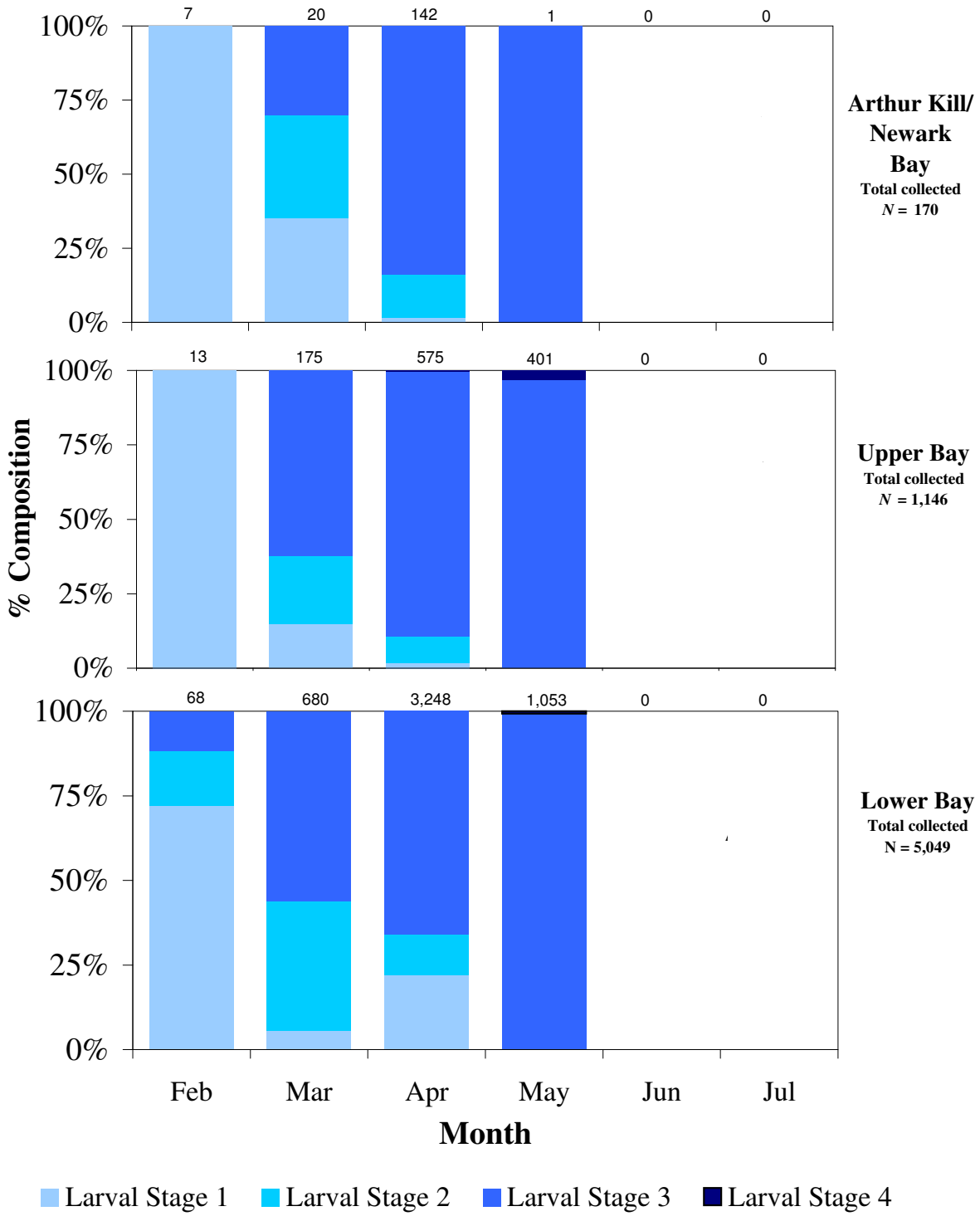

Figure 3-21 **Percent composition of winter flounder larval lifestages in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations during the 2008 Aquatic Biological Survey.**

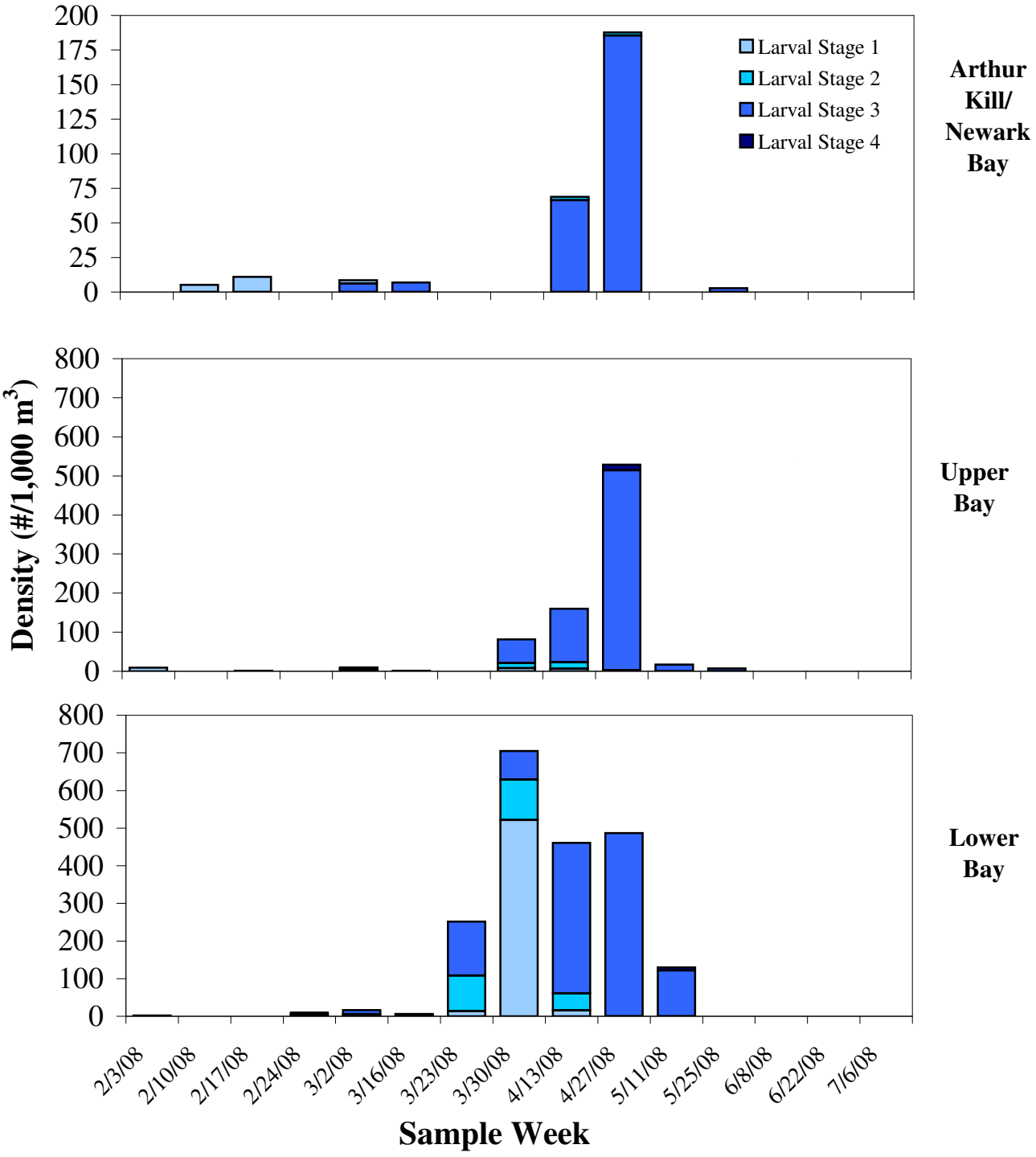

Figure 3-22a **Average weekly winter flounder larval density at navigation channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay, during the 2008 Aquatic Biological Survey**

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

Note: Scale change in the Arthur Kill/Newark Bay.

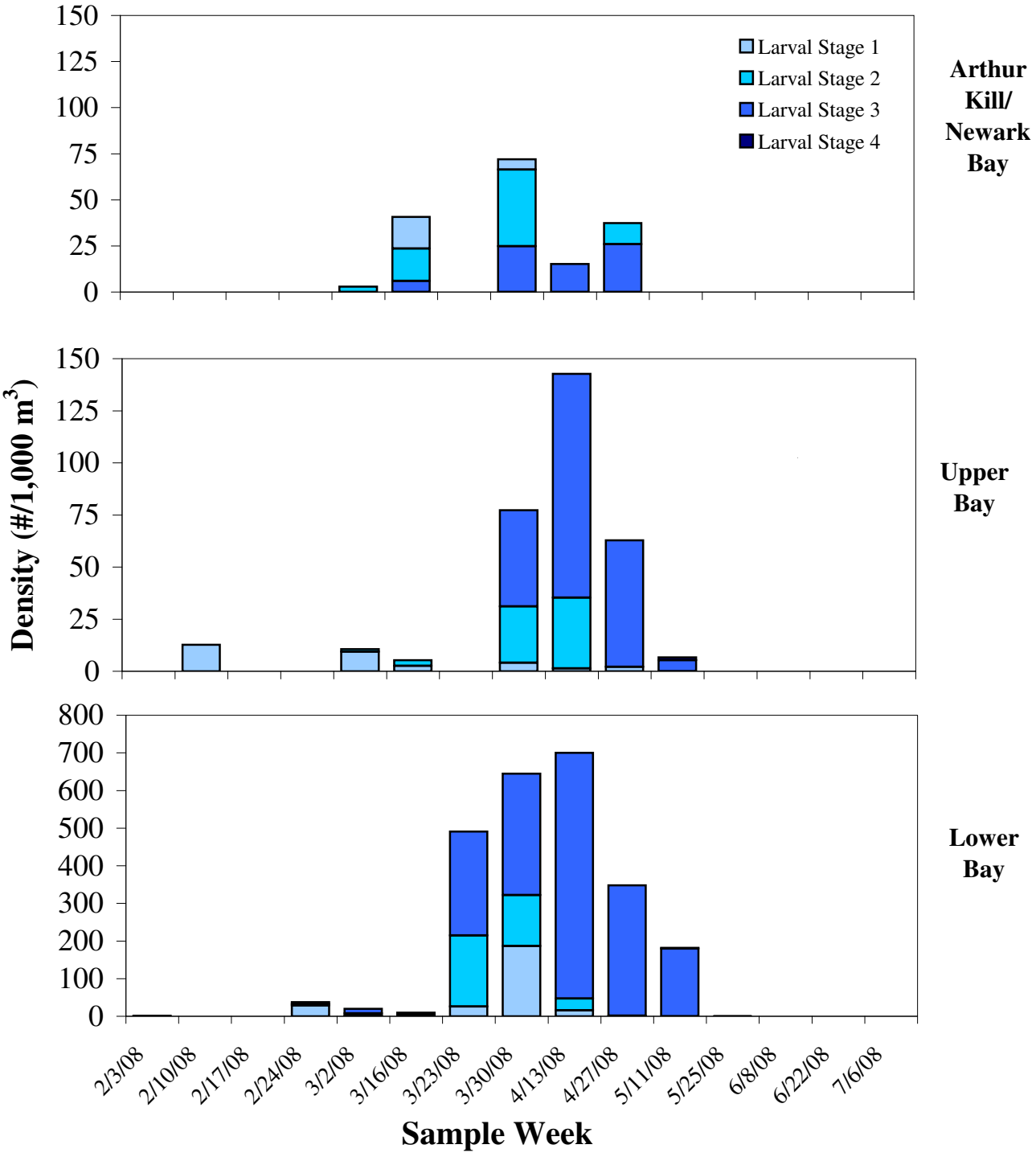

Figure 3-22b **Average weekly winter flounder larval density at non-channel stations in the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay, during the 2008 Aquatic Biological Survey**

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

Note: Scale change in the Lower Bay.

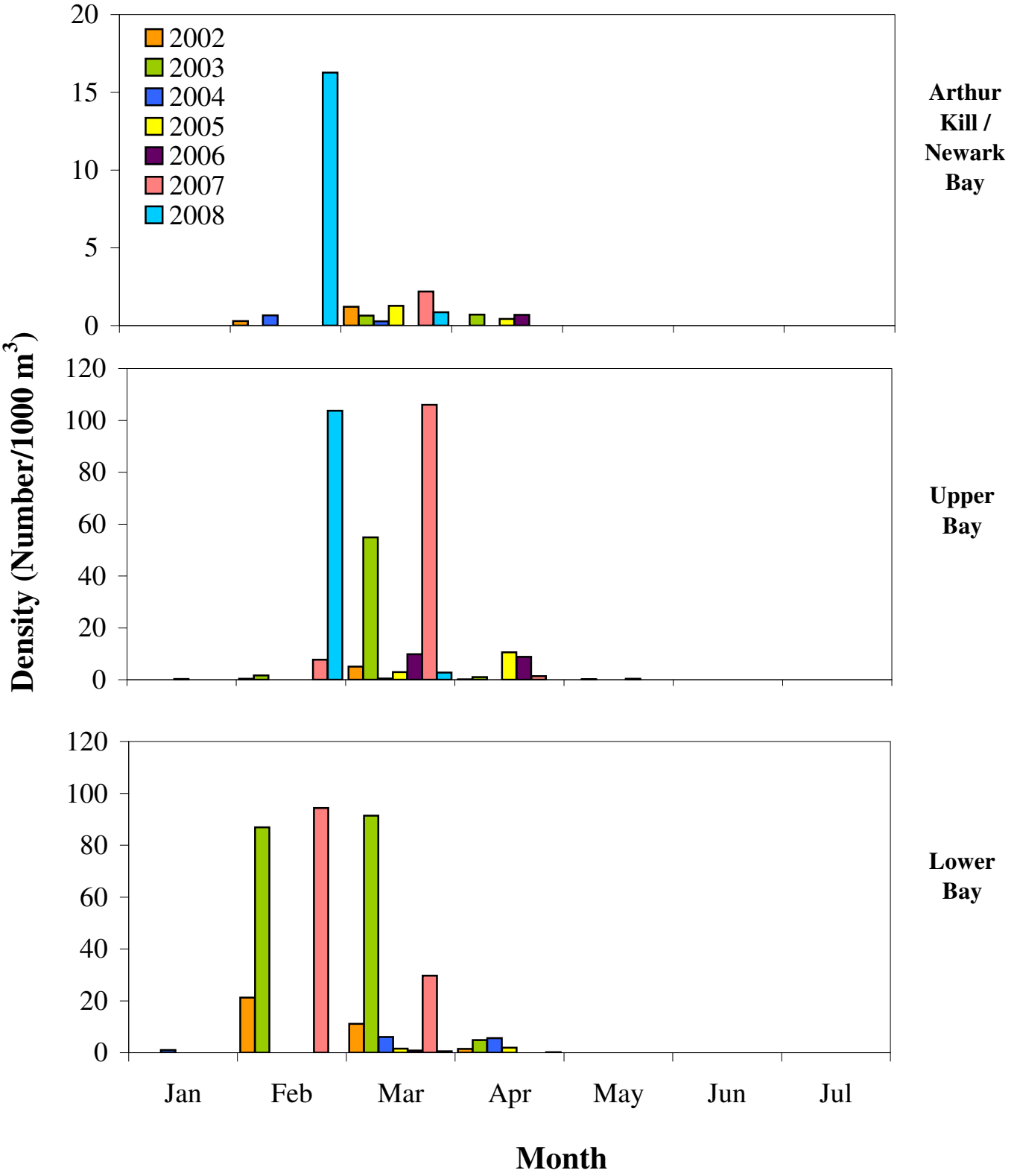

Figure 3-23a **Average monthly winter flounder egg density by region during the 2002 through 2008 Aquatic Biological Survey.**

Note(s): Scale change for Arthur Kill/Newark Bay.

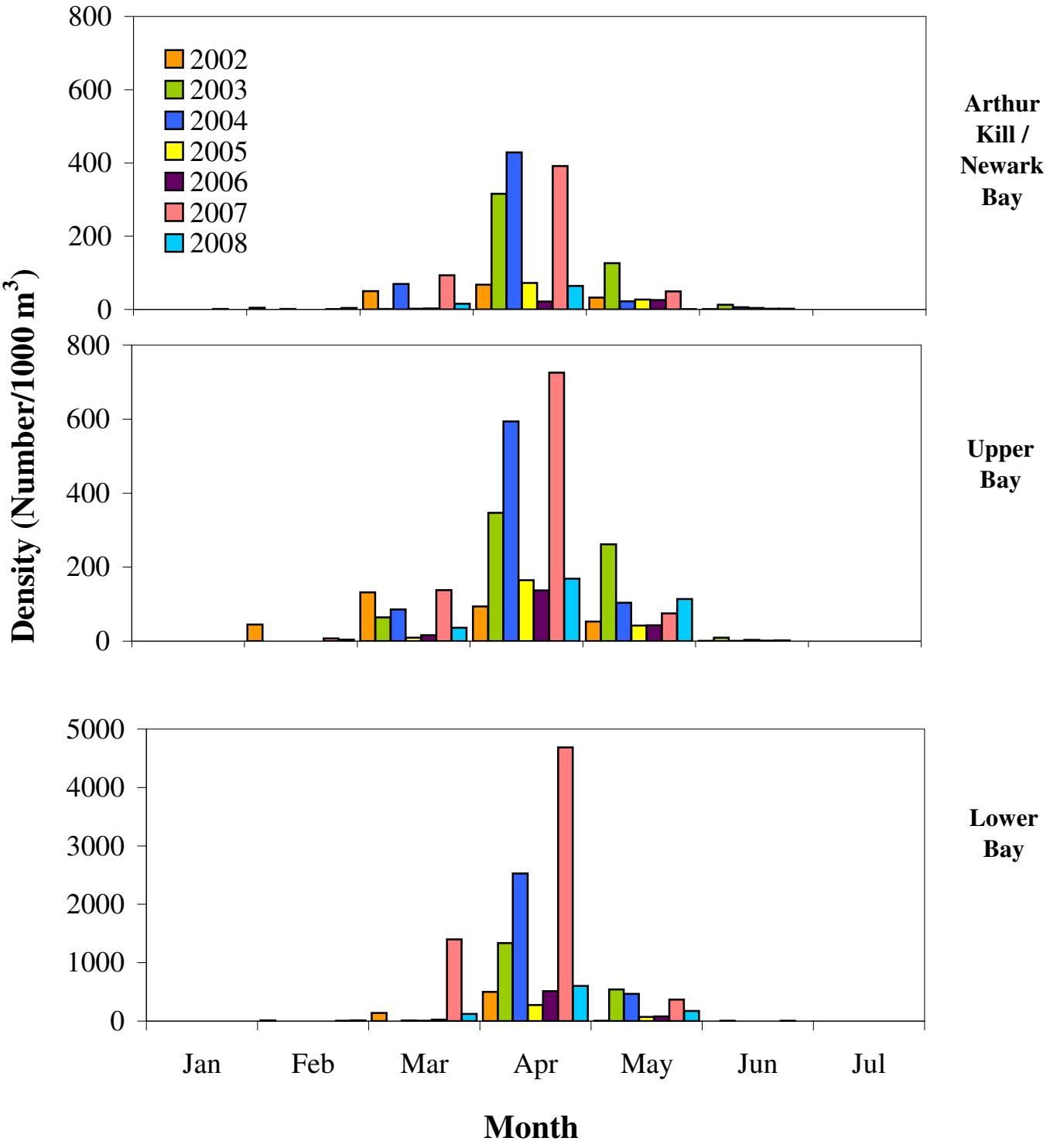

Figure 3-23b **Average monthly winter flounder larval density by region during the 2002 through 2008 Aquatic Biological Survey.**

Note(s): Scale change for Lower Bay.

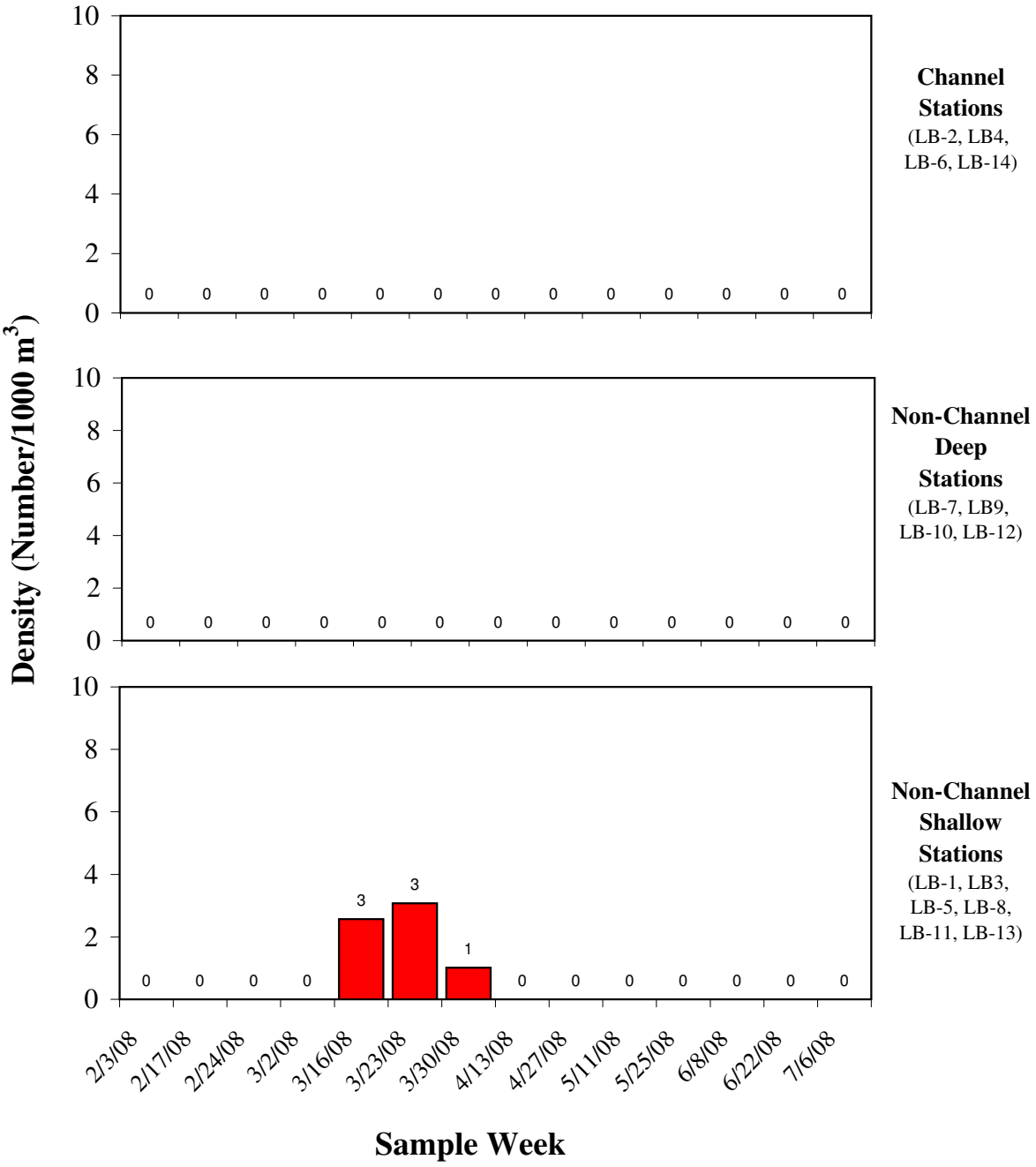

Figure 3-24a **Average weekly winter flounder egg density in the Lower Bay by station depth during the 2008 Aquatic Biological Survey.**

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

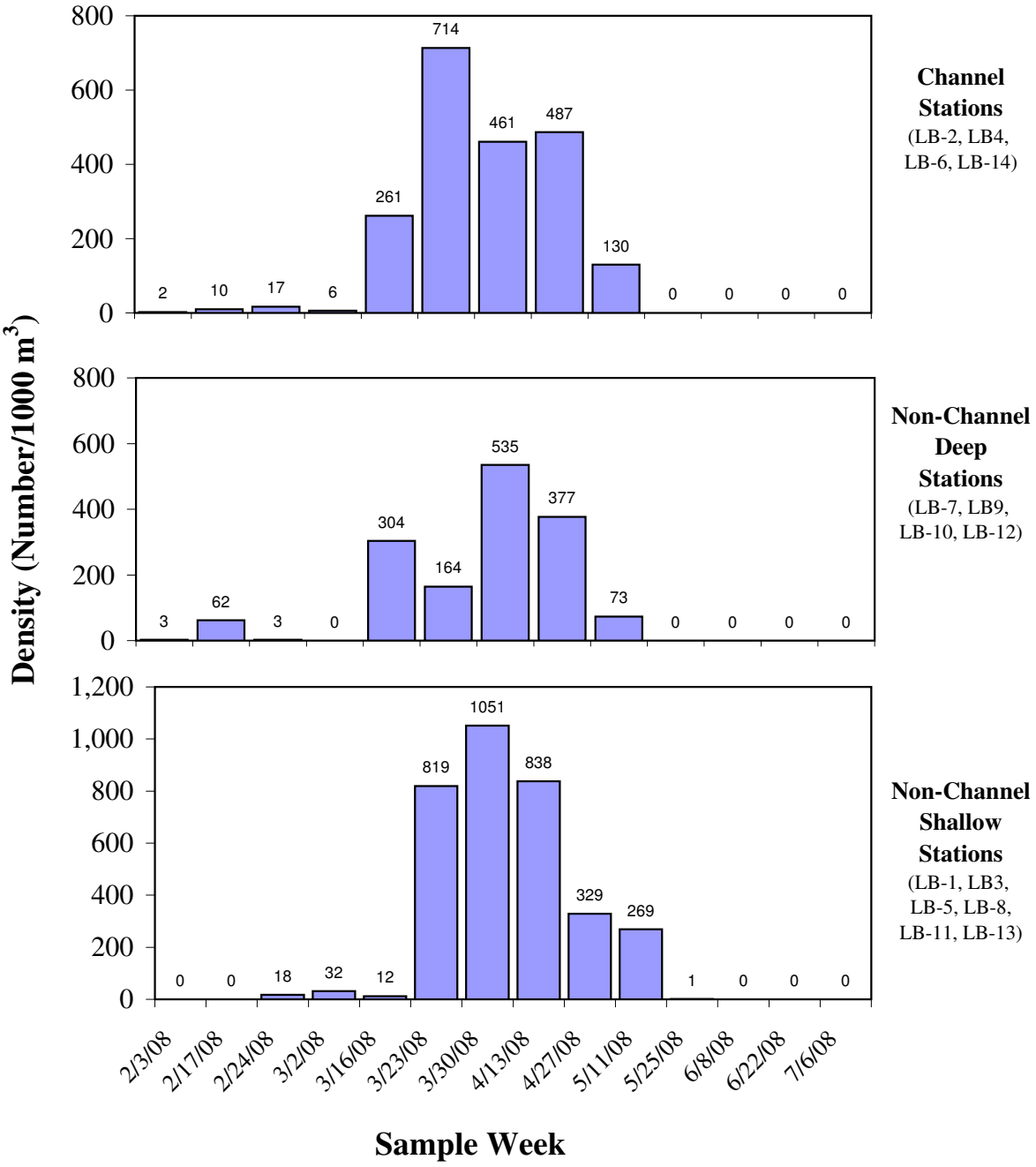

Figure 3-24b **Average weekly winter flounder larvae density in the Lower Bay by station depth during the 2008 Aquatic Biological Survey.**

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

Note: Scale change in non-channel shallow stations

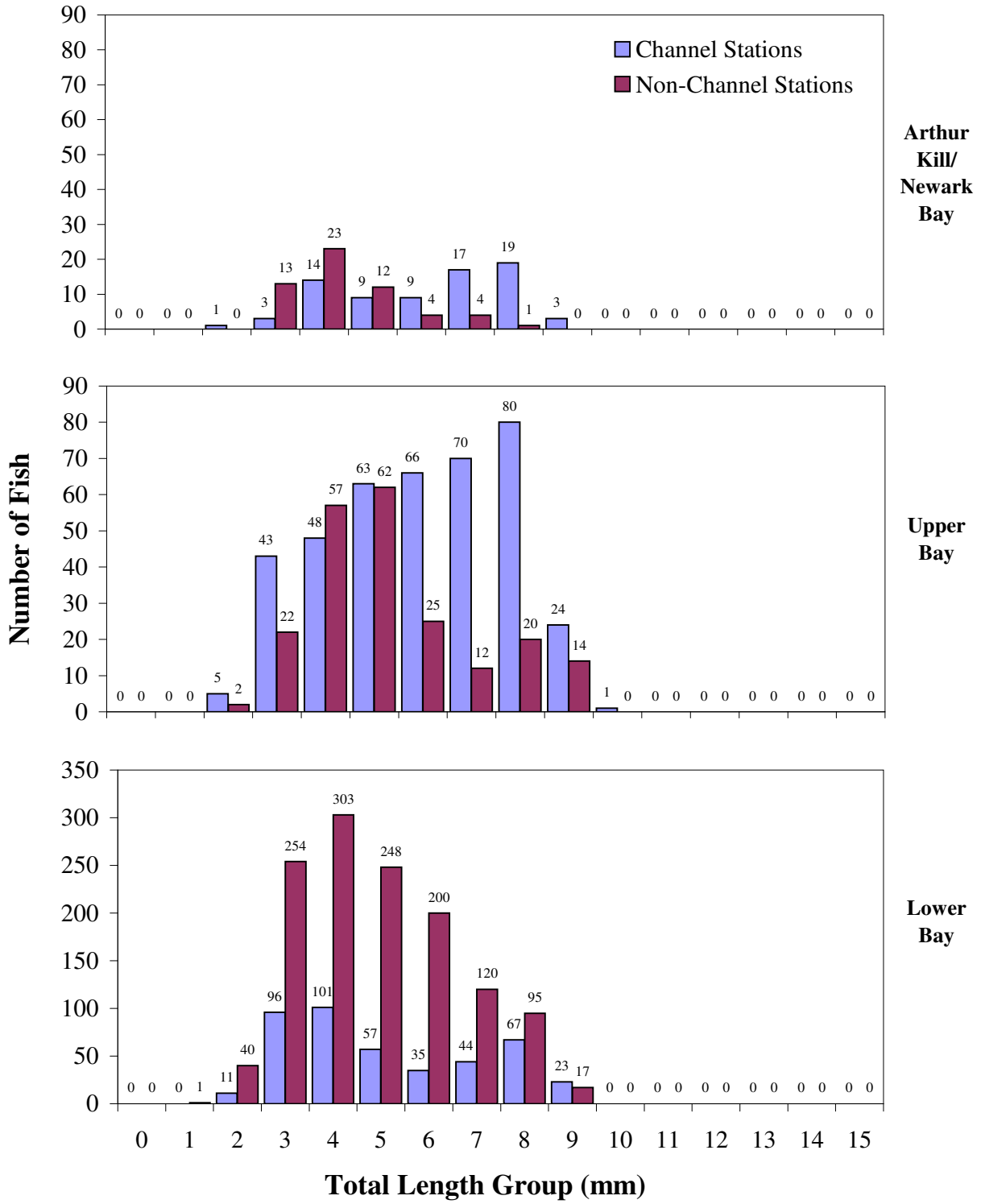

Figure 3-25a **Length frequency distribution of winter flounder larvae collected during ichthyoplankton sampling at the Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations, 2008 Aquatic Biological Survey.**

Note: Scale change in Lower Bay

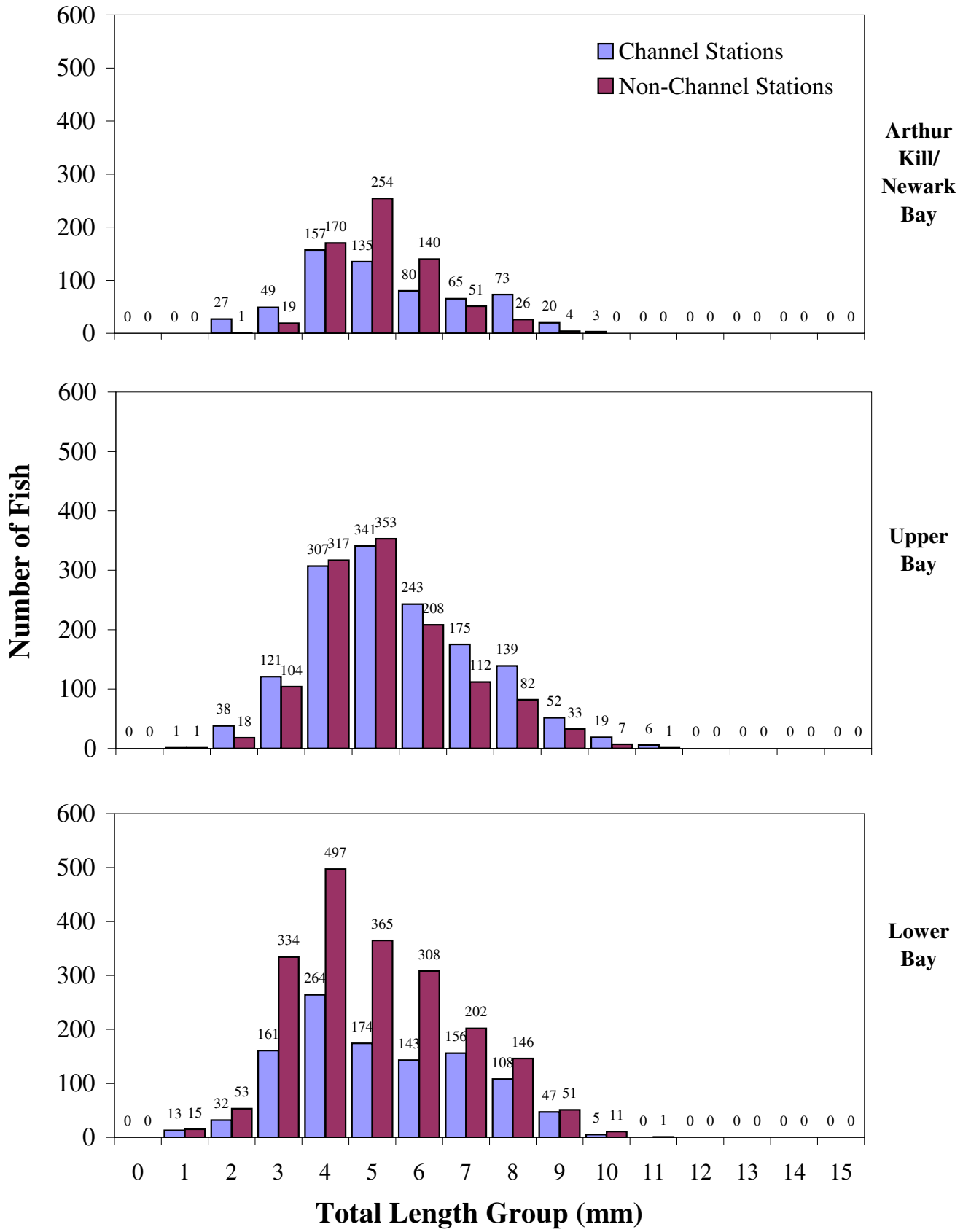

Figure 3-25b **Length frequency distribution of winter flounder larvae collected during ichthyoplankton sampling at Arthur Kill/Newark Bay, Upper Bay, and Lower Bay stations during the 2003-2008 Aquatic Biological Surveys.**

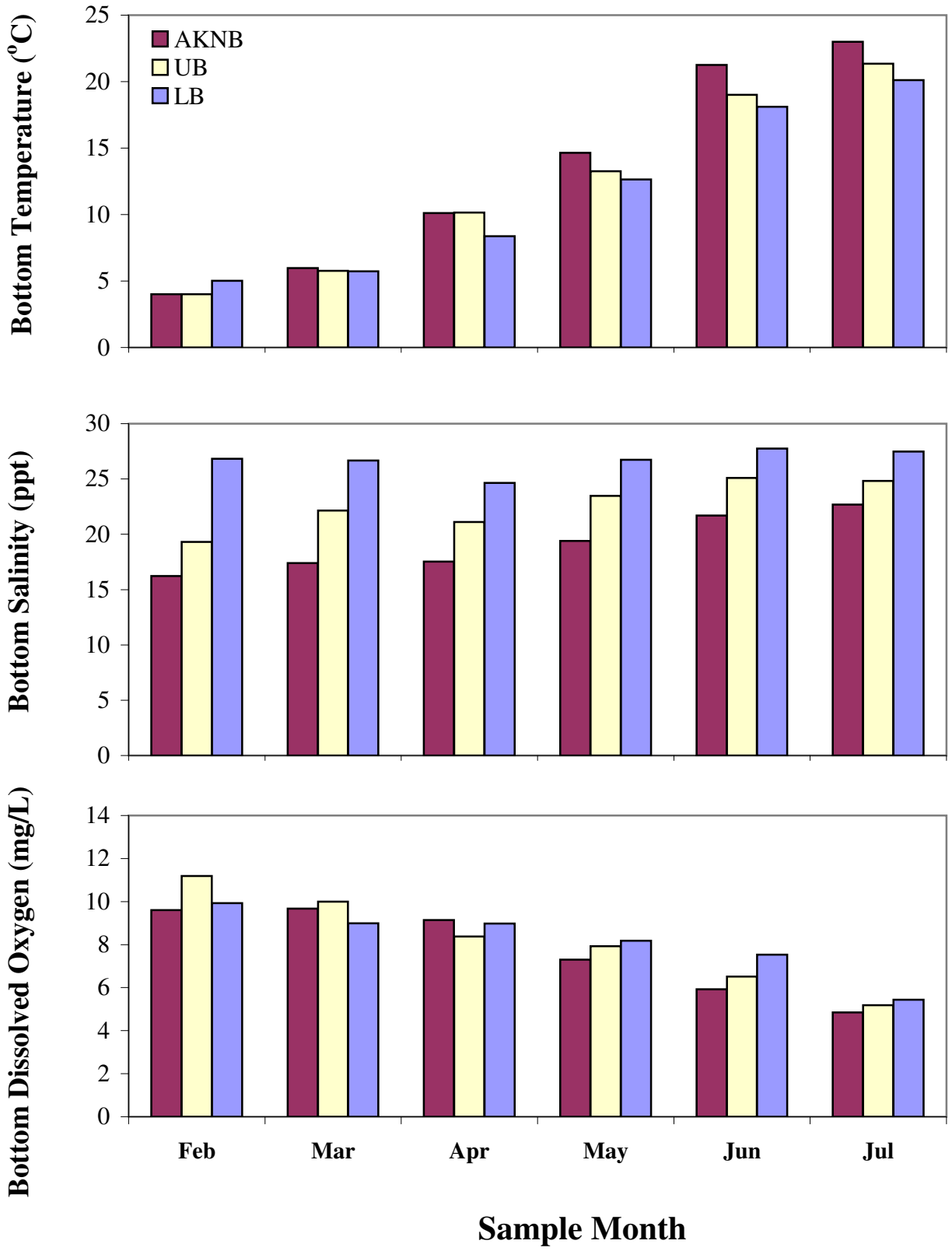

Figure 3-26 Average monthly water quality data by region during the 2008 Aquatic Biological Survey.

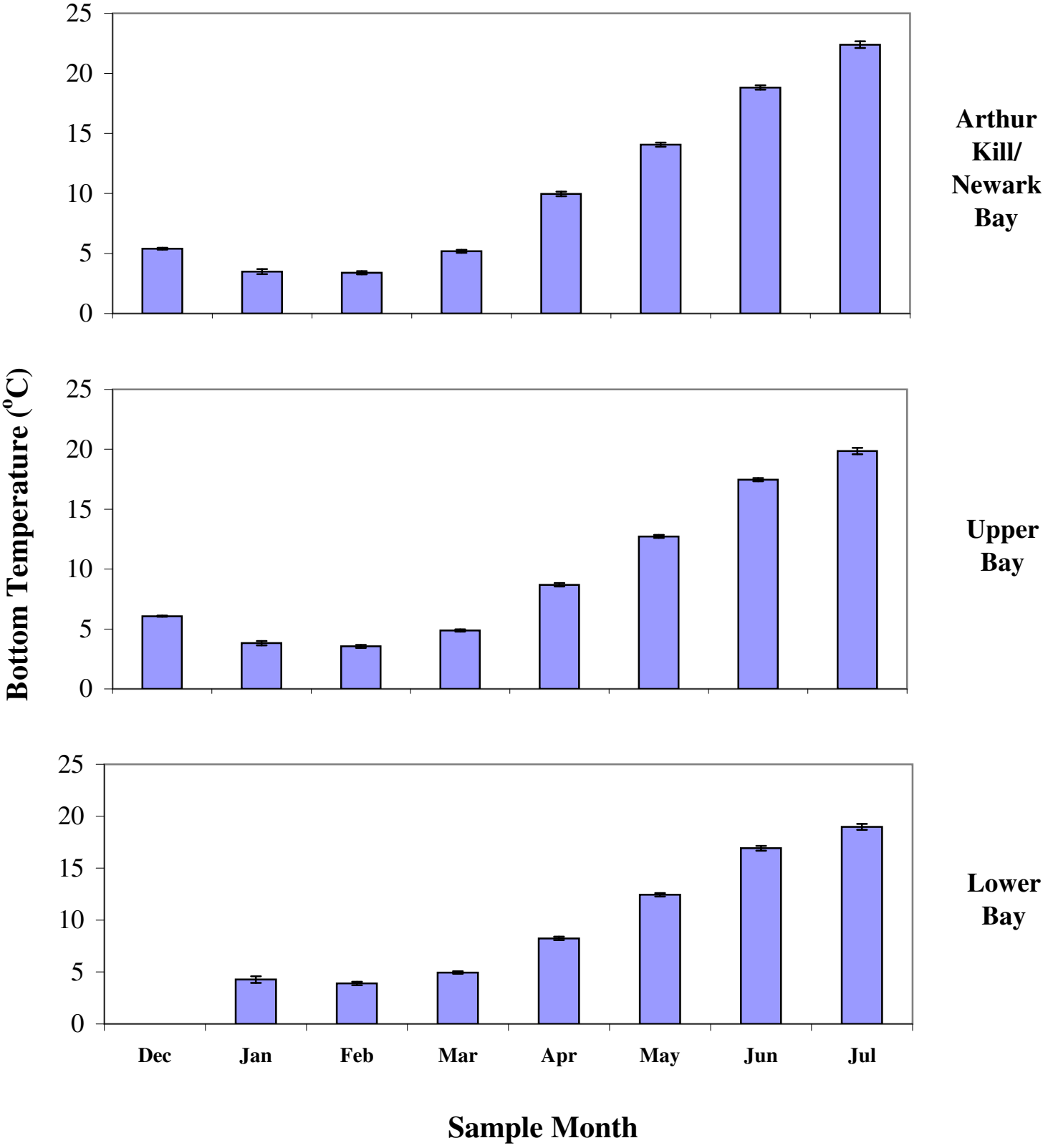

Figure 3-27a **Average monthly bottom water temperature (± 1 standard error) by region during the 2002-2008 Aquatic Biological Surveys.**

Note: December sampling did not occur during the 2004-2008 Programs.

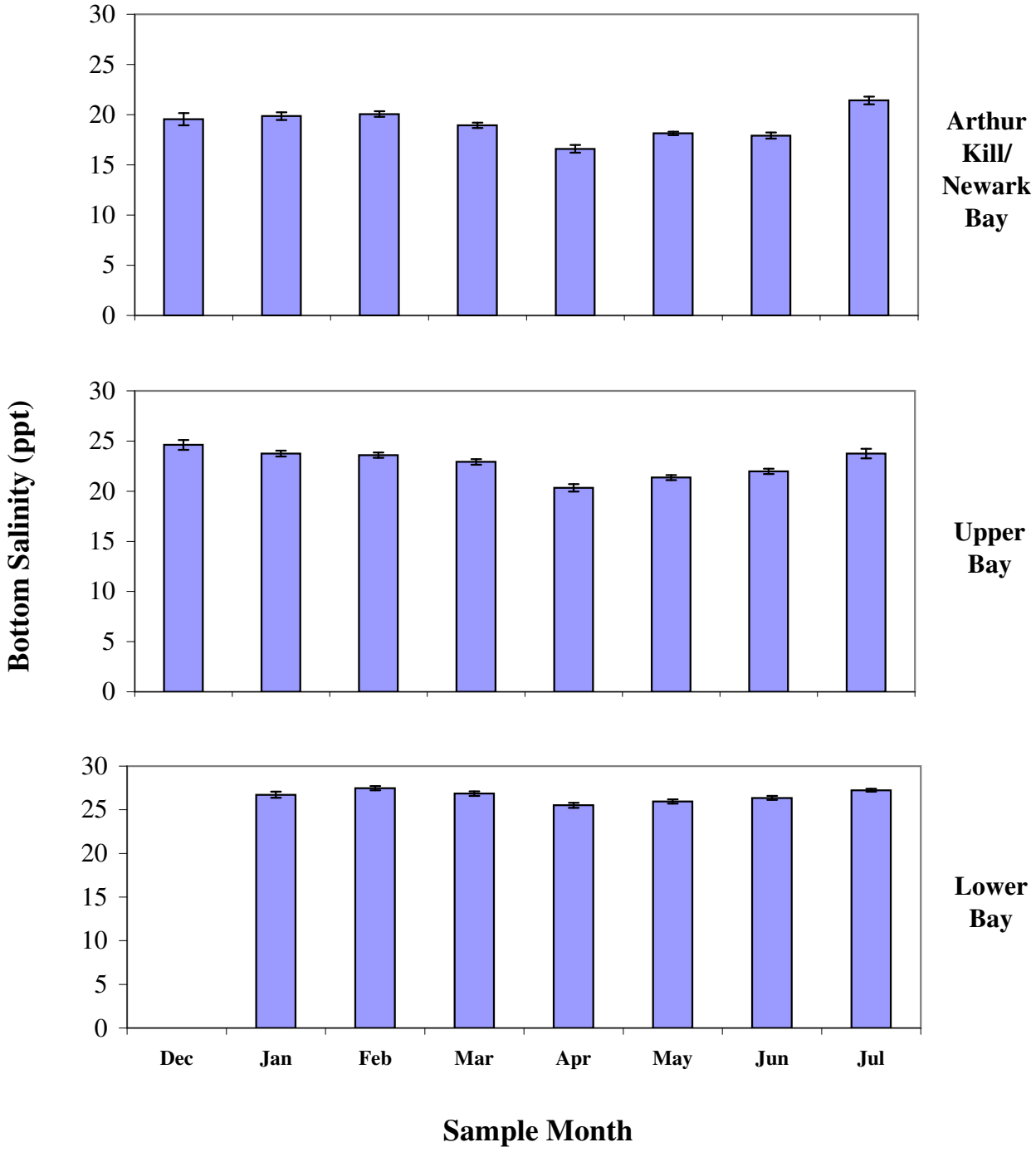

Figure 3-27b **Average monthly bottom water salinity (± 1 standard error) by region during the 2002-2008 Aquatic Biological Surveys.**

Note: December sampling did not occur during the 2004-2008 Programs.

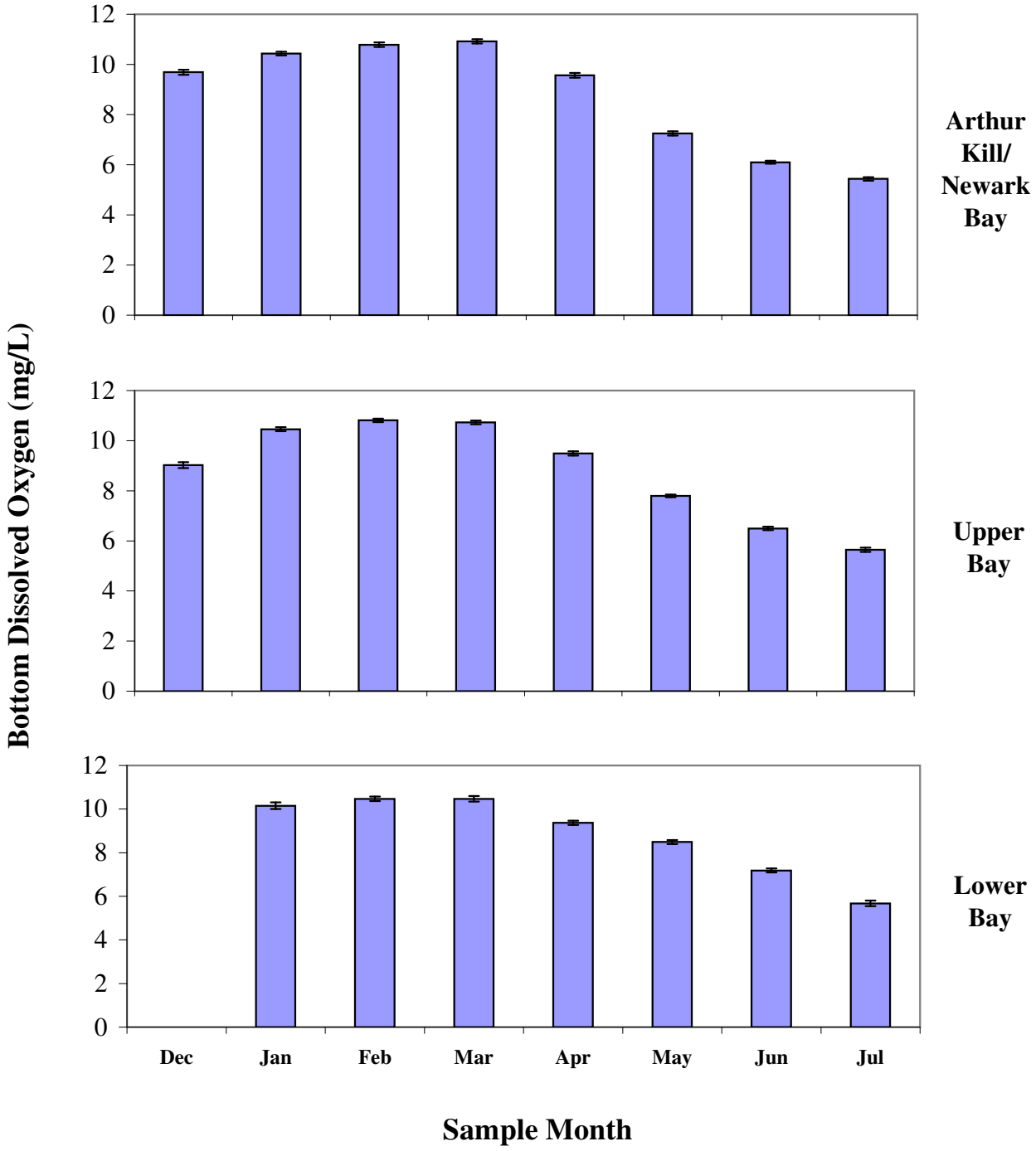

Figure 3-27c **Average monthly bottom water dissolved oxygen (± 1 standard error) by region during the 2002-2008 Aquatic Biological Surveys.**

Note: December sampling did not occur during the 2004-2008 Programs.

Appendix A

Bottom Trawl CPUE (number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
5-Feb-08	LB-3	Alewife	1.00
5-Feb-08	LB-3	American sandlance	4.00
5-Feb-08	LB-5	American sandlance	1.00
5-Feb-08	LB-6	Alewife	384.00
5-Feb-08	LB-6	Atlantic herring	2.00
5-Feb-08	LB-6	Atlantic menhaden	18.00
5-Feb-08	LB-6	Atlantic silverside	2.00
5-Feb-08	LB-6	Blueback herring	24.00
5-Feb-08	LB-6	Grubby	1.00
5-Feb-08	LB-6	Little skate	1.00
5-Feb-08	LB-6	Spotted hake	1.00
5-Feb-08	LB-6	Winter flounder	3.00
5-Feb-08	LB-12	Alewife	1.00
5-Feb-08	LB-12	Atlantic silverside	7.00
5-Feb-08	LB-4	Alewife	471.00
5-Feb-08	LB-4	American sandlance	5.00
5-Feb-08	LB-4	Atlantic herring	1.00
5-Feb-08	LB-4	Atlantic menhaden	186.00
5-Feb-08	LB-4	Bay anchovy	4.00
5-Feb-08	LB-4	Blueback herring	28.00
5-Feb-08	LB-4	Spotted hake	1.00
5-Feb-08	LB-9	Atlantic silverside	9.00
6-Feb-08	LB-10	Alewife	1.00
6-Feb-08	LB-10	Atlantic menhaden	3.00
6-Feb-08	LB-10	Atlantic silverside	481.00
6-Feb-08	LB-10	Winter flounder	1.00
6-Feb-08	LB-11	American sandlance	3.00
6-Feb-08	LB-11	Atlantic silverside	126.00
6-Feb-08	LB-11	Winter flounder	1.00
6-Feb-08	SB-4	American sandlance	1.00
6-Feb-08	SB-4	Striped bass	16.00
6-Feb-08	SB-4	Winter flounder	1.00
6-Feb-08	SB-3	Atlantic herring	1.00
6-Feb-08	SB-3	Atlantic menhaden	1.00
6-Feb-08	SB-3	Atlantic silverside	2.00
6-Feb-08	SB-3	Blueback herring	1.00
6-Feb-08	SB-3	Striped bass	1.00
7-Feb-08	LB-8	Atlantic menhaden	9.00
7-Feb-08	LB-8	Atlantic silverside	1.00
7-Feb-08	LB-8	Blueback herring	9.00
7-Feb-08	LB-7	Atlantic silverside	9.00
7-Feb-08	LB-7	Silver hake	1.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
7-Feb-08	LB-2	Fourspot flounder	1.00
7-Feb-08	LB-2	Little skate	3.00
7-Feb-08	LB-2	Smallmouth flounder	1.00
7-Feb-08	LB-2	Spotted hake	25.00
7-Feb-08	LB-2	Winter flounder	3.00
7-Feb-08	LB-14	Atlantic silverside	4.00
7-Feb-08	LB-14	Grubby	3.00
7-Feb-08	LB-14	Little skate	1.00
7-Feb-08	LB-14	Red hake	1.00
7-Feb-08	LB-14	Smallmouth flounder	1.00
7-Feb-08	LB-14	Spotted hake	8.00
12-Feb-08	SB-5	Alewife	5.00
12-Feb-08	SB-5	American shad	1.00
12-Feb-08	SB-5	Atlantic croaker	3.00
12-Feb-08	SB-5	Atlantic tomcod	2.00
12-Feb-08	SB-5	Bay anchovy	3.00
12-Feb-08	SB-5	Blueback herring	1.00
12-Feb-08	SB-5	Striped bass	23.00
12-Feb-08	SB-5	White perch	26.00
12-Feb-08	SB-5	Windowpane	1.00
12-Feb-08	SB-5	Winter flounder	28.00
12-Feb-08	PJ-1	Alewife	3.00
12-Feb-08	PJ-1	Atlantic silverside	1.00
12-Feb-08	PJ-1	Blueback herring	1.00
12-Feb-08	PJ-1	Cunner	1.00
12-Feb-08	PJ-1	Grubby	2.00
12-Feb-08	PJ-1	Rock gunnel	1.00
12-Feb-08	PJ-1	Winter flounder	1.00
12-Feb-08	PJ-4	Alewife	1.00
12-Feb-08	PJ-4	Atlantic tomcod	1.00
12-Feb-08	PJ-4	Bay anchovy	1.00
12-Feb-08	PJ-4	Blueback herring	1.00
12-Feb-08	PJ-4	Gizzard shad	1.00
12-Feb-08	PJ-4	Grubby	1.00
12-Feb-08	PJ-4	Red hake	2.00
12-Feb-08	PJ-4	Spotted hake	2.00
12-Feb-08	PJ-4	Striped bass	8.00
12-Feb-08	PJ-4	White perch	1.00
12-Feb-08	PJ-4	Winter flounder	2.00
12-Feb-08	PJ-3	American sandlance	2.00
12-Feb-08	PJ-3	Atlantic silverside	1.00
12-Feb-08	PJ-2	American sandlance	1.00
12-Feb-08	PJ-2	Atlantic silverside	2.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
12-Feb-08	PJ-2	Striped bass	1.00
13-Feb-08	AK-3	Gizzard shad	2.00
13-Feb-08	AK-3	Grubby	4.00
13-Feb-08	AK-3	Red hake	1.00
13-Feb-08	AK-3	Striped bass	195.00
13-Feb-08	AK-3	White perch	435.00
13-Feb-08	AK-3	Windowpane	5.00
13-Feb-08	AK-3	Winter flounder	73.00
13-Feb-08	AK-2	Alewife	1.00
13-Feb-08	AK-2	Gizzard shad	1.00
13-Feb-08	AK-2	Striped bass	40.00
13-Feb-08	AK-2	White perch	183.00
13-Feb-08	AK-2	Winter flounder	12.00
13-Feb-08	NB-7	Blue crab	1.00
13-Feb-08	NB-4	Atlantic silverside	16.00
6-Mar-08	LB-2	Spotted hake	9.00
6-Mar-08	LB-2	Windowpane	1.00
6-Mar-08	LB-9	Cunner	1.00
6-Mar-08	LB-11	Atlantic herring	1.00
6-Mar-08	LB-11	Atlantic silverside	3.00
14-Apr-08	LB-13	Summer flounder	1.00
15-Apr-08	LB-9	Alewife	1.00
15-Apr-08	LB-9	American shad	1.00
15-Apr-08	LB-9	Atlantic herring	1.00
15-Apr-08	LB-9	Bay anchovy	79.00
15-Apr-08	LB-9	Black sea bass	1.00
15-Apr-08	LB-9	Little skate	2.00
15-Apr-08	LB-9	Smallmouth flounder	1.00
15-Apr-08	LB-9	Striped bass	1.00
15-Apr-08	LB-9	Blue crab	1.00
15-Apr-08	LB-10	Alewife	1.00
15-Apr-08	LB-10	American shad	1.00
15-Apr-08	LB-10	Atlantic herring	1.00
15-Apr-08	LB-10	Bay anchovy	110.00
15-Apr-08	LB-10	Little skate	1.00
15-Apr-08	LB-10	Spotted hake	1.00
15-Apr-08	LB-10	Striped bass	3.00
15-Apr-08	LB-10	Winter flounder	4.00
13-Feb-08	NB-4	Blue crab	1.00
19-Feb-08	NB-4	Atlantic silverside	1.00
19-Feb-08	NB-4	Bay anchovy	1.00
19-Feb-08	NB-7	Atlantic silverside	1.25
19-Feb-08	NB-7	Blue crab	1.25

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
19-Feb-08	AK-3	Alewife	3.00
19-Feb-08	AK-3	Cunner	1.00
19-Feb-08	AK-3	Grubby	1.00
19-Feb-08	AK-3	Smallmouth flounder	1.00
19-Feb-08	AK-3	Striped bass	60.00
19-Feb-08	AK-3	Tautog	1.00
19-Feb-08	AK-3	White perch	501.00
19-Feb-08	AK-3	Windowpane	1.00
19-Feb-08	AK-3	Winter flounder	78.00
19-Feb-08	AK-2	Alewife	2.00
19-Feb-08	AK-2	Atlantic menhaden	1.00
19-Feb-08	AK-2	Grubby	1.00
19-Feb-08	AK-2	Striped bass	4.00
19-Feb-08	AK-2	White perch	26.00
19-Feb-08	AK-2	Winter flounder	1.00
19-Feb-08	PJ-4	Atlantic croaker	1.00
19-Feb-08	PJ-4	Gizzard shad	4.00
19-Feb-08	PJ-4	Grubby	2.00
19-Feb-08	PJ-4	Spotted hake	2.00
19-Feb-08	PJ-4	Striped bass	60.00
19-Feb-08	PJ-4	White perch	15.00
19-Feb-08	PJ-1	Gizzard shad	1.00
19-Feb-08	PJ-1	Grubby	4.00
19-Feb-08	PJ-1	Striped bass	188.00
19-Feb-08	PJ-1	White perch	1.00
19-Feb-08	PJ-1	Windowpane	1.00
19-Feb-08	PJ-1	Winter flounder	8.00
20-Feb-08	LB-8	American sandlance	2.00
20-Feb-08	PJ-3	American sandlance	1.11
20-Feb-08	PJ-3	Atlantic menhaden	26.67
20-Feb-08	PJ-3	Winter flounder	1.11
20-Feb-08	SB-3	Alewife	1.00
20-Feb-08	SB-3	Blueback herring	1.00
20-Feb-08	SB-4	Alewife	5.00
20-Feb-08	SB-4	Atlantic menhaden	1.00
20-Feb-08	SB-6	Alewife	2.00
20-Feb-08	SB-6	Cunner	1.00
20-Feb-08	SB-6	Little skate	4.00
20-Feb-08	SB-6	Red hake	1.00
20-Feb-08	SB-6	Smallmouth flounder	6.00
20-Feb-08	SB-6	Spotted hake	7.00
20-Feb-08	SB-6	Striped bass	2.00
20-Feb-08	SB-6	Tautog	1.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
20-Feb-08	SB-6	Windowpane	7.00
20-Feb-08	SB-6	Winter flounder	1.00
25-Feb-08	LB-7	American sandlance	3.00
25-Feb-08	LB-7	Atlantic menhaden	22.00
25-Feb-08	LB-12	Spotted hake	1.00
25-Feb-08	LB-4	Bay anchovy	1.00
25-Feb-08	LB-13	American sandlance	466.00
25-Feb-08	LB-9	American sandlance	1.00
25-Feb-08	LB-9	Tautog	1.00
26-Feb-08	LB-10	Little skate	1.00
26-Feb-08	LB-11	Atlantic silverside	26.00
26-Feb-08	LB-11	Grubby	1.00
26-Feb-08	LB-11	Winter flounder	1.00
26-Feb-08	LB-2	Spotted hake	2.00
26-Feb-08	SB-5	Alewife	2.00
26-Feb-08	SB-5	Atlantic menhaden	2.00
26-Feb-08	SB-5	Cunner	1.00
26-Feb-08	SB-5	Rock gunnel	1.00
26-Feb-08	SB-5	Spotted hake	4.00
26-Feb-08	SB-5	Striped bass	66.00
26-Feb-08	SB-5	White perch	38.00
26-Feb-08	SB-5	Winter flounder	27.00
3-Mar-08	LB-8	Windowpane	1.00
3-Mar-08	LB-7	Bay anchovy	1.00
3-Mar-08	LB-3	Atlantic silverside	2.00
3-Mar-08	LB-4	Spotted hake	2.00
3-Mar-08	LB-4	Windowpane	1.00
3-Mar-08	LB-4	Winter flounder	2.00
3-Mar-08	LB-13	Rock gunnel	1.00
3-Mar-08	LB-6	Alewife	1.00
3-Mar-08	LB-6	Atlantic menhaden	1.00
3-Mar-08	LB-6	Atlantic silverside	2.00
3-Mar-08	LB-6	Red hake	1.00
3-Mar-08	LB-6	Winter flounder	1.00
3-Mar-08	LB-5	Spotted hake	1.00
4-Mar-08	PJ-2	Atlantic herring	2.00
4-Mar-08	PJ-2	Winter flounder	1.00
4-Mar-08	SB-5	American shad	2.00
4-Mar-08	SB-5	Atlantic silverside	1.00
4-Mar-08	SB-5	Cunner	1.00
4-Mar-08	SB-5	Spotted hake	3.00
4-Mar-08	SB-5	Striped bass	5.00
4-Mar-08	SB-5	Winter flounder	8.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
4-Mar-08	SB-5	Blue crab	1.00
4-Mar-08	PJ-1	Atlantic silverside	4.00
4-Mar-08	PJ-1	Blue crab	1.00
4-Mar-08	SB-6	American shad	3.00
4-Mar-08	SB-6	Atlantic herring	5.00
4-Mar-08	SB-6	Little skate	1.00
4-Mar-08	SB-6	Spotted hake	1.00
4-Mar-08	SB-4	Alewife	2.00
4-Mar-08	SB-4	American shad	2.00
4-Mar-08	SB-4	Atlantic herring	3.00
4-Mar-08	SB-4	Atlantic menhaden	1.00
4-Mar-08	SB-4	Gizzard shad	1.00
4-Mar-08	SB-4	Spotted hake	5.00
4-Mar-08	SB-4	Striped bass	8.00
4-Mar-08	SB-4	Windowpane	1.00
4-Mar-08	PJ-4	Alewife	26.00
4-Mar-08	PJ-4	American shad	6.00
4-Mar-08	PJ-4	Atlantic menhaden	2.00
4-Mar-08	PJ-4	Grubby	1.00
4-Mar-08	PJ-4	Red hake	2.00
4-Mar-08	PJ-4	Spotted hake	2.00
4-Mar-08	PJ-4	Striped bass	99.00
4-Mar-08	PJ-4	White perch	5.00
4-Mar-08	PJ-4	Winter flounder	1.00
6-Mar-08	LB-14	Atlantic menhaden	3.00
6-Mar-08	LB-14	Blueback herring	6.00
6-Mar-08	LB-14	Spotted hake	14.00
6-Mar-08	LB-2	Alewife	1.00
6-Mar-08	LB-11	Spotted hake	1.00
6-Mar-08	LB-11	Blue crab	1.00
6-Mar-08	LB-10	Atlantic herring	13.00
6-Mar-08	LB-10	Atlantic menhaden	1.00
6-Mar-08	LB-10	Atlantic silverside	7.00
6-Mar-08	LB-10	Silver hake	1.00
6-Mar-08	LB-10	Smallmouth flounder	2.00
6-Mar-08	LB-10	Spotted hake	1.00
6-Mar-08	LB-10	Windowpane	1.00
6-Mar-08	LB-10	Winter flounder	4.00
7-Mar-08	PJ-3	Atlantic herring	1.00
7-Mar-08	PJ-3	Atlantic silverside	1.00
7-Mar-08	PJ-3	Spotted hake	2.00
7-Mar-08	PJ-3	Winter flounder	1.00
7-Mar-08	PJ-3	Blue crab	1.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
7-Mar-08	AK-3	Cunner	1.00
7-Mar-08	AK-3	Fourspot flounder	1.00
7-Mar-08	AK-3	Grubby	4.00
7-Mar-08	AK-3	Smallmouth flounder	1.00
7-Mar-08	AK-3	Spotted hake	9.00
7-Mar-08	AK-3	Striped bass	78.00
7-Mar-08	AK-3	White perch	807.00
7-Mar-08	AK-3	Windowpane	2.00
7-Mar-08	AK-3	Winter flounder	50.00
7-Mar-08	AK-2	Alewife	2.00
7-Mar-08	AK-2	American shad	1.00
7-Mar-08	AK-2	Spotted hake	1.00
7-Mar-08	AK-2	Striped bass	21.00
7-Mar-08	AK-2	White perch	122.00
7-Mar-08	AK-2	Windowpane	1.00
7-Mar-08	AK-2	Winter flounder	9.00
17-Mar-08	SB-5	Alewife	5.00
17-Mar-08	SB-5	Atlantic menhaden	1.00
17-Mar-08	SB-5	Atlantic tomcod	1.00
17-Mar-08	SB-5	Spotted hake	12.00
17-Mar-08	SB-5	White perch	2.00
17-Mar-08	SB-5	Winter flounder	5.00
17-Mar-08	PJ-2	Alewife	5.00
17-Mar-08	PJ-2	Atlantic silverside	1.00
17-Mar-08	PJ-2	Blueback herring	2.00
17-Mar-08	PJ-2	Striped bass	1.00
17-Mar-08	PJ-1	Alewife	1.00
17-Mar-08	PJ-1	Atlantic silverside	1.00
17-Mar-08	PJ-1	Blueback herring	1.00
17-Mar-08	PJ-1	Longhorn sculpin	1.00
17-Mar-08	PJ-1	Spotted hake	1.00
17-Mar-08	PJ-1	Striped bass	9.00
17-Mar-08	PJ-1	White perch	1.00
17-Mar-08	PJ-1	Winter flounder	2.00
17-Mar-08	PJ-4	Alewife	4.00
17-Mar-08	PJ-4	American shad	3.00
17-Mar-08	PJ-4	Atlantic menhaden	1.00
17-Mar-08	PJ-4	Atlantic tomcod	5.00
17-Mar-08	PJ-4	Cunner	1.00
17-Mar-08	PJ-4	Grubby	1.00
17-Mar-08	PJ-4	Northern pipefish	2.00
17-Mar-08	PJ-4	Red hake	1.00
17-Mar-08	PJ-4	Spotted hake	52.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
17-Mar-08	PJ-4	Striped bass	81.00
17-Mar-08	PJ-4	White perch	57.00
17-Mar-08	PJ-4	Windowpane	1.00
17-Mar-08	PJ-4	Winter flounder	10.00
17-Mar-08	SB-4	Spotted hake	14.00
17-Mar-08	SB-4	Striped bass	59.00
17-Mar-08	SB-4	Winter flounder	4.00
17-Mar-08	SB-6	Alewife	8.00
17-Mar-08	SB-6	American shad	1.00
17-Mar-08	SB-6	Atlantic tomcod	1.00
17-Mar-08	SB-6	Little skate	4.00
17-Mar-08	SB-6	Longhorn sculpin	1.00
17-Mar-08	SB-6	Red hake	2.00
17-Mar-08	SB-6	Smallmouth flounder	1.00
17-Mar-08	SB-6	Spotted hake	186.00
17-Mar-08	SB-6	Striped bass	1.00
17-Mar-08	SB-6	Windowpane	5.00
18-Mar-08	LB-3	Little skate	1.00
18-Mar-08	LB-3	Spotted hake	1.00
18-Mar-08	LB-5	American sandlance	2.00
18-Mar-08	LB-5	Atlantic herring	2.00
18-Mar-08	LB-5	Atlantic menhaden	2.00
18-Mar-08	LB-5	Blueback herring	2.00
18-Mar-08	LB-5	Windowpane	1.00
18-Mar-08	LB-5	Winter flounder	1.00
18-Mar-08	LB-6	Atlantic menhaden	1.00
18-Mar-08	LB-6	Little skate	13.00
18-Mar-08	LB-6	Longhorn sculpin	1.00
18-Mar-08	LB-6	Red hake	2.00
18-Mar-08	LB-6	Spotted hake	486.00
18-Mar-08	LB-6	Windowpane	19.00
18-Mar-08	LB-6	Winter flounder	11.00
18-Mar-08	LB-12	Alewife	28.00
18-Mar-08	LB-12	American sandlance	1.00
18-Mar-08	LB-12	Atlantic menhaden	2.00
18-Mar-08	LB-12	Cunner	1.00
18-Mar-08	LB-12	Northern pipefish	3.00
18-Mar-08	LB-12	Spotted hake	22.00
18-Mar-08	LB-12	Windowpane	6.00
18-Mar-08	LB-4	Alewife	701.00
18-Mar-08	LB-4	American shad	1.00
18-Mar-08	LB-4	Atlantic menhaden	20.00
18-Mar-08	LB-4	Blueback herring	64.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
18-Mar-08	LB-4	Cunner	1.00
18-Mar-08	LB-4	Red hake	1.00
18-Mar-08	LB-4	Spotted hake	18.00
18-Mar-08	LB-4	Windowpane	10.00
18-Mar-08	LB-4	Winter flounder	2.00
18-Mar-08	LB-13	Winter flounder	2.00
18-Mar-08	LB-11	Atlantic herring	1.00
18-Mar-08	LB-11	Atlantic silverside	1.00
18-Mar-08	LB-11	Little skate	2.00
18-Mar-08	LB-11	Spotted hake	1.00
18-Mar-08	LB-11	Striped bass	1.00
18-Mar-08	LB-11	Winter flounder	2.00
19-Mar-08	PJ-3	Atlantic silverside	2.22
19-Mar-08	NB-4	Alewife	1.00
19-Mar-08	AK-2	Alewife	1.00
19-Mar-08	AK-2	Spotted hake	4.00
19-Mar-08	AK-2	Striped bass	11.00
19-Mar-08	AK-2	White perch	16.00
19-Mar-08	AK-2	Windowpane	1.00
19-Mar-08	AK-3	Alewife	7.24
19-Mar-08	AK-3	Cunner	1.03
19-Mar-08	AK-3	Gizzard shad	1.03
19-Mar-08	AK-3	Grubby	3.10
19-Mar-08	AK-3	Northern pipefish	1.03
19-Mar-08	AK-3	Spotted hake	7.24
19-Mar-08	AK-3	Striped bass	173.79
19-Mar-08	AK-3	White perch	935.17
19-Mar-08	AK-3	Windowpane	2.07
19-Mar-08	AK-3	Winter flounder	99.31
24-Mar-08	LB-2	American sandlance	163.00
24-Mar-08	LB-2	Red hake	2.00
24-Mar-08	LB-14	Alewife	1.00
24-Mar-08	LB-14	American shad	7.00
24-Mar-08	LB-14	Blueback herring	8.00
24-Mar-08	LB-14	Little skate	1.00
24-Mar-08	LB-14	Spotted hake	11.00
24-Mar-08	LB-14	Winter flounder	2.00
24-Mar-08	LB-9	Rock gunnel	1.00
24-Mar-08	LB-9	Spotted hake	1.00
24-Mar-08	LB-9	Winter flounder	1.00
24-Mar-08	LB-10	Blueback herring	1.00
24-Mar-08	LB-10	Winter flounder	3.00
14-Apr-08	LB-8	Tautog	1.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
14-Apr-08	LB-7	Atlantic herring	67.00
14-Apr-08	LB-7	Spotted hake	3.00
14-Apr-08	LB-5	Spotted hake	1.00
14-Apr-08	LB-6	Alewife	270.00
14-Apr-08	LB-6	American shad	1.00
14-Apr-08	LB-6	Atlantic herring	1.00
14-Apr-08	LB-6	Atlantic menhaden	1.00
14-Apr-08	LB-6	Bay anchovy	25.00
14-Apr-08	LB-6	Blueback herring	16.00
14-Apr-08	LB-6	Spotted hake	48.00
14-Apr-08	LB-6	Winter flounder	5.00
14-Apr-08	LB-12	Little skate	1.00
14-Apr-08	LB-12	Spotted hake	1.00
14-Apr-08	LB-12	Winter flounder	1.00
14-Apr-08	LB-4	Bay anchovy	1.00
14-Apr-08	LB-4	Blueback herring	1.00
14-Apr-08	LB-4	Red hake	5.00
14-Apr-08	LB-4	Spotted hake	6.00
14-Apr-08	LB-4	Summer flounder	1.00
14-Apr-08	LB-4	Winter flounder	3.00
15-Apr-08	LB-11	Striped bass	2.00
15-Apr-08	LB-11	Winter flounder	2.00
15-Apr-08	LB-1	American sandlance	1.00
15-Apr-08	LB-1	Little skate	1.00
15-Apr-08	LB-1	Northern searobin	1.00
15-Apr-08	LB-1	Windowpane	1.00
15-Apr-08	LB-2	Silver hake	2.00
15-Apr-08	LB-2	Spotted hake	6.00
15-Apr-08	LB-2	Winter flounder	12.00
15-Apr-08	LB-14	American shad	3.00
15-Apr-08	LB-14	Silver hake	1.00
15-Apr-08	LB-14	Spotted hake	2.00
15-Apr-08	LB-14	Winter flounder	2.00
15-Apr-08	PJ-2	Alewife	2.00
15-Apr-08	PJ-2	American sandlance	395.00
15-Apr-08	PJ-2	American shad	2.00
15-Apr-08	PJ-2	Bay anchovy	6.00
15-Apr-08	PJ-2	Blueback herring	1.00
15-Apr-08	PJ-2	Striped bass	2.00
15-Apr-08	PJ-2	Summer flounder	1.00
15-Apr-08	PJ-2	White perch	1.00
16-Apr-08	PJ-3	Alewife	1.00
16-Apr-08	PJ-3	American shad	5.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
16-Apr-08	PJ-3	Atlantic herring	235.00
16-Apr-08	PJ-3	Blueback herring	2.00
16-Apr-08	PJ-3	Spotted hake	1.00
16-Apr-08	SB-6	American shad	4.00
16-Apr-08	SB-6	Red hake	1.00
16-Apr-08	SB-6	Striped bass	1.00
16-Apr-08	SB-3	Winter flounder	1.00
16-Apr-08	SB-4	Spotted hake	45.00
16-Apr-08	SB-4	Striped bass	14.00
16-Apr-08	SB-4	Windowpane	1.00
16-Apr-08	SB-4	Winter flounder	3.00
16-Apr-08	SB-5	Little skate	6.00
16-Apr-08	SB-5	Northern pipefish	1.00
16-Apr-08	SB-5	Northern searobin	1.00
16-Apr-08	SB-5	Spotted hake	84.00
16-Apr-08	SB-5	White perch	2.00
16-Apr-08	SB-5	Windowpane	1.00
16-Apr-08	SB-5	Winter flounder	31.00
16-Apr-08	SB-5	Clearnose skate	2.00
16-Apr-08	SB-5	Blue crab	8.00
17-Apr-08	NB-4	Atlantic herring	71.00
17-Apr-08	NB-7	Atlantic herring	1.25
17-Apr-08	NB-7	Atlantic menhaden	1.25
17-Apr-08	NB-7	Striped bass	1.25
17-Apr-08	AK-3	Alewife	4.21
17-Apr-08	AK-3	American shad	1.05
17-Apr-08	AK-3	Atlantic menhaden	3.16
17-Apr-08	AK-3	Atlantic tomcod	1.05
17-Apr-08	AK-3	Bay anchovy	4.21
17-Apr-08	AK-3	Cunner	1.05
17-Apr-08	AK-3	Grubby	3.16
17-Apr-08	AK-3	Spotted hake	16.84
17-Apr-08	AK-3	Striped bass	17.89
17-Apr-08	AK-3	Tautog	2.11
17-Apr-08	AK-3	White perch	13.68
17-Apr-08	AK-3	Winter flounder	35.79
17-Apr-08	AK-2	Alewife	3.00
17-Apr-08	AK-2	Cunner	2.00
17-Apr-08	AK-2	Spotted hake	44.00
17-Apr-08	AK-2	Striped bass	121.00
17-Apr-08	AK-2	Tautog	1.00
17-Apr-08	AK-2	White perch	20.00
17-Apr-08	AK-2	Winter flounder	9.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
17-Apr-08	PJ-4	Alewife	2.00
17-Apr-08	PJ-4	American shad	4.00
17-Apr-08	PJ-4	Atlantic menhaden	10.00
17-Apr-08	PJ-4	Cunner	2.00
17-Apr-08	PJ-4	Spotted hake	149.00
17-Apr-08	PJ-4	Striped bass	39.00
17-Apr-08	PJ-4	Tautog	1.00
17-Apr-08	PJ-4	White perch	18.00
17-Apr-08	PJ-4	Windowpane	1.00
17-Apr-08	PJ-4	Winter flounder	12.00
17-Apr-08	PJ-1	Alewife	1.00
17-Apr-08	PJ-1	Bay anchovy	4.00
17-Apr-08	PJ-1	Blueback herring	97.00
17-Apr-08	PJ-1	Cunner	1.00
17-Apr-08	PJ-1	Grubby	1.00
17-Apr-08	PJ-1	Northern pipefish	1.00
17-Apr-08	PJ-1	Winter flounder	2.00
28-Apr-08	NB-7	Winter flounder	1.43
28-Apr-08	NB-7	Blue crab	2.86
28-Apr-08	AK-3	Grubby	1.00
28-Apr-08	AK-3	Spotted hake	58.00
28-Apr-08	AK-3	Striped bass	2.00
28-Apr-08	AK-3	Windowpane	2.00
28-Apr-08	AK-3	Winter flounder	25.00
28-Apr-08	AK-2	Alewife	149.00
28-Apr-08	AK-2	American shad	10.00
28-Apr-08	AK-2	Blueback herring	11.00
28-Apr-08	AK-2	Butterfish	1.00
28-Apr-08	AK-2	Cunner	1.00
28-Apr-08	AK-2	Northern pipefish	3.00
28-Apr-08	AK-2	Northern searobin	1.00
28-Apr-08	AK-2	Spotted hake	86.00
28-Apr-08	AK-2	Striped bass	2.00
28-Apr-08	AK-2	White perch	3.00
28-Apr-08	AK-2	Windowpane	2.00
28-Apr-08	AK-2	Winter flounder	7.00
29-Apr-08	PJ-2	Alewife	2.00
29-Apr-08	PJ-2	Atlantic herring	846.00
29-Apr-08	PJ-2	Bay anchovy	20.00
29-Apr-08	PJ-2	Northern pipefish	1.00
29-Apr-08	PJ-2	Spotted hake	1.00
29-Apr-08	PJ-2	Striped bass	3.00
29-Apr-08	PJ-2	Winter flounder	3.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
29-Apr-08	PJ-2	Blue crab	1.00
29-Apr-08	PJ-1	Atlantic herring	633.00
29-Apr-08	PJ-1	Bay anchovy	40.00
29-Apr-08	PJ-1	Grubby	1.00
29-Apr-08	PJ-1	Spotted hake	2.00
29-Apr-08	PJ-1	Winter flounder	6.00
29-Apr-08	PJ-4	Alewife	1.00
29-Apr-08	PJ-4	American shad	1.00
29-Apr-08	PJ-4	Grubby	1.00
29-Apr-08	PJ-4	Spotted hake	35.00
29-Apr-08	PJ-4	White perch	2.00
29-Apr-08	PJ-4	Windowpane	1.00
29-Apr-08	PJ-4	Winter flounder	6.00
29-Apr-08	PJ-4	Blue crab	1.00
29-Apr-08	SB-3	Cunner	2.00
29-Apr-08	SB-3	Grubby	1.00
29-Apr-08	SB-3	Little skate	1.00
29-Apr-08	SB-3	Tautog	5.00
29-Apr-08	SB-3	Winter flounder	3.00
29-Apr-08	SB-4	Alewife	5.00
29-Apr-08	SB-4	Bay anchovy	12.00
29-Apr-08	SB-4	Red hake	6.00
29-Apr-08	SB-4	Spotted hake	52.00
29-Apr-08	SB-4	Weakfish	1.00
29-Apr-08	SB-4	Windowpane	1.00
29-Apr-08	SB-4	Winter flounder	16.00
29-Apr-08	SB-5	Alewife	1.00
29-Apr-08	SB-5	Bay anchovy	1.00
29-Apr-08	SB-5	Spotted hake	46.00
29-Apr-08	SB-5	Winter flounder	5.00
29-Apr-08	SB-5	Blue crab	1.00
30-Apr-08	LB-7	Alewife	1.00
30-Apr-08	LB-7	Atlantic menhaden	6.00
30-Apr-08	LB-7	Bay anchovy	14.00
30-Apr-08	LB-3	Spotted hake	1.00
30-Apr-08	LB-3	Winter flounder	1.00
30-Apr-08	LB-9	Little skate	1.00
1-May-08	LB-6	Alewife	2.00
1-May-08	LB-6	Atlantic herring	19.00
1-May-08	LB-6	Bay anchovy	47.00
1-May-08	LB-6	Spotted hake	4.00
1-May-08	LB-6	Summer flounder	1.00
1-May-08	LB-6	Winter flounder	2.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
1-May-08	LB-12	Bay anchovy	12.00
1-May-08	LB-12	Blueback herring	1.00
1-May-08	LB-12	Butterfish	1.00
1-May-08	LB-4	American shad	1.00
1-May-08	LB-4	Bay anchovy	7.00
1-May-08	LB-4	Blueback herring	25.00
1-May-08	LB-4	Bluefish	1.00
1-May-08	LB-4	Butterfish	1.00
1-May-08	LB-4	Little skate	2.00
1-May-08	LB-4	Red hake	3.00
1-May-08	LB-4	Spotted hake	4.00
1-May-08	LB-4	Summer flounder	3.00
1-May-08	LB-4	Winter flounder	4.00
1-May-08	LB-13	Bay anchovy	1.00
1-May-08	LB-13	Winter flounder	1.00
1-May-08	LB-10	Bay anchovy	62.00
1-May-08	LB-10	Black sea bass	1.00
1-May-08	LB-10	Smallmouth flounder	1.00
1-May-08	LB-10	Spotted hake	6.00
1-May-08	LB-10	Summer flounder	3.00
1-May-08	LB-10	Windowpane	2.00
1-May-08	LB-10	Winter flounder	2.00
1-May-08	SB-6	Alewife	1.00
1-May-08	SB-6	Atlantic menhaden	2.00
1-May-08	SB-6	Bay anchovy	1.00
1-May-08	SB-6	Lined seahorse	1.00
1-May-08	SB-6	Little skate	1.00
1-May-08	SB-6	Northern searobin	1.00
1-May-08	SB-6	Scup	1.00
1-May-08	SB-6	Silver hake	4.00
1-May-08	SB-6	Spotted hake	12.00
1-May-08	SB-6	Summer flounder	1.00
1-May-08	SB-6	Windowpane	4.00
2-May-08	PJ-3	Atlantic herring	195.00
2-May-08	PJ-3	Bay anchovy	20.00
2-May-08	PJ-3	Striped bass	1.00
2-May-08	PJ-3	Windowpane	1.00
2-May-08	LB-1	Clearnose skate	1.00
2-May-08	LB-2	Bay anchovy	28.00
2-May-08	LB-2	Little skate	1.00
2-May-08	LB-2	Spotted hake	4.00
2-May-08	LB-2	Winter flounder	8.00
2-May-08	LB-14	Black sea bass	1.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
2-May-08	LB-14	Silver hake	4.00
2-May-08	LB-14	Spotted hake	5.00
2-May-08	LB-14	Summer flounder	2.00
2-May-08	LB-14	Winter flounder	46.00
13-May-08	PJ-2	Alewife	59.00
13-May-08	PJ-2	Atlantic herring	436.00
13-May-08	PJ-2	Atlantic menhaden	1.00
13-May-08	PJ-2	Atlantic tomcod	7.00
13-May-08	PJ-2	Bay anchovy	1408.00
13-May-08	PJ-2	Blueback herring	36.00
13-May-08	PJ-2	Blue crab	1.00
13-May-08	PJ-3	Alewife	1.00
13-May-08	PJ-3	Atlantic herring	26.00
13-May-08	PJ-3	Bay anchovy	83.00
13-May-08	PJ-3	Blueback herring	41.00
13-May-08	PJ-3	Striped bass	1.00
13-May-08	PJ-3	Tautog	1.00
13-May-08	PJ-3	Blue crab	1.00
13-May-08	AK-3	Atlantic herring	1.00
13-May-08	AK-3	Atlantic tomcod	1.00
13-May-08	AK-3	Bay anchovy	2.00
13-May-08	AK-3	Grubby	1.00
13-May-08	AK-3	Spotted hake	16.00
13-May-08	AK-3	Summer flounder	2.00
13-May-08	AK-3	Winter flounder	10.00
13-May-08	AK-3	Blue crab	3.00
13-May-08	AK-2	Alewife	17.00
13-May-08	AK-2	Atlantic herring	1.00
13-May-08	AK-2	Atlantic menhaden	3.00
13-May-08	AK-2	Atlantic tomcod	1.00
13-May-08	AK-2	Bay anchovy	28.00
13-May-08	AK-2	Spotted hake	11.00
13-May-08	AK-2	Summer flounder	3.00
13-May-08	AK-2	Weakfish	1.00
13-May-08	AK-2	White perch	3.00
13-May-08	AK-2	Windowpane	1.00
13-May-08	AK-2	Winter flounder	10.00
13-May-08	NB-4	Atlantic herring	25.00
13-May-08	NB-4	Atlantic tomcod	3.00
13-May-08	NB-4	Bay anchovy	87.00
13-May-08	NB-4	Blueback herring	10.00
13-May-08	NB-4	Striped bass	1.00
13-May-08	NB-4	Blue crab	1.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
13-May-08	NB-7	Atlantic tomcod	4.00
13-May-08	NB-7	Northern searobin	1.00
13-May-08	NB-7	Smallmouth flounder	1.00
13-May-08	NB-7	Spotted hake	3.00
13-May-08	NB-7	Striped bass	3.00
13-May-08	NB-7	Summer flounder	1.00
13-May-08	NB-7	Winter flounder	1.00
13-May-08	NB-7	Blue crab	13.00
14-May-08	LB-8	Bay anchovy	4.00
14-May-08	LB-8	Winter flounder	1.00
14-May-08	LB-5	Bay anchovy	17.00
14-May-08	LB-5	Northern searobin	2.00
14-May-08	LB-5	Red hake	1.00
14-May-08	LB-5	Scup	2.00
14-May-08	LB-5	Spotted hake	10.00
14-May-08	LB-5	Windowpane	6.00
14-May-08	LB-6	Silver hake	2.00
14-May-08	LB-6	Spotted hake	33.00
14-May-08	LB-6	Striped searobin	5.00
14-May-08	LB-6	Summer flounder	5.00
14-May-08	LB-6	Windowpane	1.00
14-May-08	LB-6	Clearnose skate	2.00
14-May-08	LB-12	Bay anchovy	4.00
14-May-08	LB-12	Silver hake	1.00
14-May-08	LB-12	Spotted hake	6.00
14-May-08	LB-12	Summer flounder	1.00
14-May-08	LB-12	Clearnose skate	1.00
14-May-08	LB-4	Alewife	1.00
14-May-08	LB-4	Atlantic menhaden	1.00
14-May-08	LB-4	Bay anchovy	3.00
14-May-08	LB-4	Red hake	1.00
14-May-08	LB-4	Spotted hake	28.00
14-May-08	LB-4	Striped searobin	3.00
14-May-08	LB-4	Summer flounder	2.00
14-May-08	LB-4	Winter flounder	1.00
14-May-08	LB-3	Atlantic herring	16.00
14-May-08	LB-3	Bay anchovy	201.00
14-May-08	LB-3	Scup	1.00
14-May-08	LB-3	Spotted hake	15.00
14-May-08	LB-3	Summer flounder	2.00
14-May-08	LB-3	Windowpane	3.00
14-May-08	LB-3	Winter flounder	1.00
14-May-08	LB-3	Clearnose skate	1.00

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
14-May-08	LB-7	Atlantic herring	19.00
14-May-08	LB-7	Bay anchovy	85.00
14-May-08	LB-7	Butterfish	2.00
14-May-08	LB-7	Scup	2.00
14-May-08	LB-7	Spotted hake	1.00
14-May-08	LB-7	Winter flounder	1.00
14-May-08	LB-7	Clearnose skate	1.00
15-May-08	LB-13	Bay anchovy	1.00
15-May-08	LB-2	Bay anchovy	2.00
15-May-08	LB-2	Black sea bass	1.00
15-May-08	LB-2	Butterfish	1.00
15-May-08	LB-2	Fourspot flounder	1.00
15-May-08	LB-2	Scup	13.00
15-May-08	LB-2	Silver hake	1.00
15-May-08	LB-2	Spotted hake	1.00
15-May-08	LB-2	Striped searobin	3.00
15-May-08	LB-2	Winter flounder	7.00
15-May-08	LB-14	Bay anchovy	12.00
15-May-08	LB-14	Northern searobin	1.00
15-May-08	LB-14	Spotted hake	7.00
15-May-08	LB-14	Summer flounder	1.00
15-May-08	LB-14	Winter flounder	10.00
15-May-08	LB-9	Atlantic herring	4.00
15-May-08	LB-9	Bay anchovy	166.00
15-May-08	LB-9	Little skate	3.00
15-May-08	LB-9	Red hake	1.00
15-May-08	LB-9	Summer flounder	1.00
15-May-08	LB-9	Tautog	2.00
15-May-08	LB-9	Winter flounder	4.00
15-May-08	LB-10	Atlantic herring	1.00
15-May-08	LB-10	Bay anchovy	643.00
15-May-08	LB-10	Butterfish	1.00
15-May-08	LB-10	Scup	4.00
15-May-08	LB-10	Spotted hake	2.00
15-May-08	LB-10	Winter flounder	4.00
15-May-08	LB-10	Blue crab	1.00
16-May-08	SB-6	Alewife	1.25
16-May-08	SB-6	Bay anchovy	7.50
16-May-08	SB-6	Scup	5.00
16-May-08	SB-6	Silver hake	1.25
16-May-08	SB-6	Spotted hake	5.00
16-May-08	SB-6	Summer flounder	1.25
16-May-08	SB-6	Windowpane	8.75

Appendix A. Bottom trawl CPUE (Number per 10 minute trawl) by date and station sampled during the 2008 Aquatic Biological Survey.

Date	Station	Common Name	CPUE
16-May-08	SB-4	Atlantic tomcod	6.00
16-May-08	SB-4	Fourspot flounder	1.00
16-May-08	SB-4	Spotted hake	1.00
16-May-08	SB-4	Windowpane	3.00
16-May-08	SB-4	Winter flounder	1.00
16-May-08	SB-4	Blue crab	1.00

Appendix B

Ichthyoplankton (epibenthic sled) life stage densities by date and station collected during the 2008 Aquatic Biological Survey.

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
05-Feb-08	LB-3	Atlantic menhaden	PYS	5.67
05-Feb-08	LB-3	Grubby	PYS	45.36
05-Feb-08	LB-3	Rock gunnel	PYS	5.67
05-Feb-08	LB-5	American sandlance	YS	8.67
05-Feb-08	LB-5	Grubby	PYS	43.33
05-Feb-08	LB-12	Atlantic menhaden	PYS	13.13
05-Feb-08	LB-12	Grubby	PYS	19.69
05-Feb-08	LB-12	Rock gunnel	PYS	19.69
05-Feb-08	LB-4	American sandlance	YS	4.21
05-Feb-08	LB-4	Atlantic menhaden	PYS	4.21
05-Feb-08	LB-4	Grubby	PYS	33.69
05-Feb-08	LB-4	Rock gunnel	PYS	71.58
05-Feb-08	LB-13	Grubby	PYS	18.48
05-Feb-08	LB-13	Rock gunnel	PYS	12.32
05-Feb-08	LB-13	Rock gunnel	YS	6.16
05-Feb-08	LB-9	Grubby	PYS	5.51
05-Feb-08	LB-9	Grubby	YS	5.51
05-Feb-08	LB-9	Winter flounder	ST1	5.51
06-Feb-08	LB-10	American sandlance	PYS	5.43
06-Feb-08	LB-10	American sandlance	YS	43.43
06-Feb-08	LB-10	Grubby	PYS	27.14
06-Feb-08	LB-10	Rock gunnel	PYS	10.86
06-Feb-08	LB-11	Grubby	PYS	31.30
06-Feb-08	LB-11	Grubby	YS	6.26
06-Feb-08	LB-11	Rock gunnel	PYS	18.78
06-Feb-08	LB-1	American sandlance	PYS	6.83
06-Feb-08	LB-1	Rock gunnel	PYS	6.83
06-Feb-08	SB-6	American sandlance	PYS	3.18
06-Feb-08	SB-4	American sandlance	PYS	26.50
06-Feb-08	SB-4	American sandlance	YS	26.50
06-Feb-08	SB-4	Grubby	PYS	15.14
06-Feb-08	SB-4	Winter flounder	ST1	18.93
06-Feb-08	SB-3	Grubby	PYS	11.14
06-Feb-08	SB-3	Rock gunnel	PYS	3.71
07-Feb-08	LB-8	American sandlance	YS	12.18
07-Feb-08	LB-8	Grubby	PYS	6.09
07-Feb-08	LB-8	Rock gunnel	PYS	6.09
07-Feb-08	LB-7	American sandlance	YS	18.72
07-Feb-08	LB-7	Winter flounder	ST1	6.24

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
07-Feb-08	LB-2	American sandlance	YS	7.85
07-Feb-08	LB-2	Winter flounder	ST1	7.85
07-Feb-08	LB-14	American sandlance	PYS	4.34
12-Feb-08	SB-5	Grubby	PYS	10.65
12-Feb-08	SB-5	Rock gunnel	PYS	3.55
12-Feb-08	PJ-1	Grubby	PYS	10.99
12-Feb-08	PJ-1	Grubby	YS	5.50
12-Feb-08	PJ-4	Grubby	PYS	59.25
12-Feb-08	PJ-4	Grubby	YS	9.12
12-Feb-08	PJ-4	Rock gunnel	PYS	22.79
12-Feb-08	PJ-3	American sandlance	PYS	7.23
12-Feb-08	PJ-3	Grubby	PYS	14.46
12-Feb-08	PJ-3	Rock gunnel	PYS	14.46
12-Feb-08	PJ-2	American sandlance	PYS	5.47
12-Feb-08	PJ-2	Grubby	PYS	10.95
12-Feb-08	PJ-2	Grubby	YS	5.47
12-Feb-08	PJ-2	Rock gunnel	PYS	5.47
12-Feb-08	PJ-2	Winter flounder	ST1	38.32
13-Feb-08	AK-3	American sandlance	PYS	5.28
13-Feb-08	AK-3	Atlantic herring	PYS	5.28
13-Feb-08	AK-3	Atlantic menhaden	PYS	5.28
13-Feb-08	AK-3	Grubby	PYS	26.38
13-Feb-08	AK-3	Rock gunnel	PYS	10.55
13-Feb-08	AK-3	Winter flounder	ST1	10.55
13-Feb-08	AK-2	American eel	PYS	6.72
13-Feb-08	AK-2	Grubby	PYS	20.15
13-Feb-08	NB-7	Rock gunnel	PYS	11.63
19-Feb-08	NB-4	Atlantic tomcod	PYS	4.75
19-Feb-08	NB-4	Grubby	PYS	9.49
19-Feb-08	NB-4	Summer flounder	PYS	4.75
19-Feb-08	NB-7	Grubby	PYS	28.30
19-Feb-08	NB-7	Grubby	YS	5.66
19-Feb-08	NB-7	Winter flounder	ES2	96.23
19-Feb-08	NB-7	Winter flounder	ES3	11.32
19-Feb-08	NB-7	Winter flounder	ES5	22.64
19-Feb-08	NB-7	Winter flounder	WFNVE	5.66
19-Feb-08	AK-3	Grubby	PYS	74.93
19-Feb-08	AK-3	Grubby	YS	10.70
19-Feb-08	AK-3	Rock gunnel	PYS	5.35

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
19-Feb-08	AK-2	American sandlance	YS	4.42
19-Feb-08	AK-2	Grubby	PYS	57.45
19-Feb-08	AK-2	Rock gunnel	PYS	4.42
19-Feb-08	AK-2	Winter flounder	ST1	22.10
19-Feb-08	PJ-4	Grubby	PYS	99.19
19-Feb-08	PJ-4	Summer flounder	PYS	4.96
19-Feb-08	PJ-1	Atlantic herring	PYS	6.35
19-Feb-08	PJ-1	Atlantic tomcod	YS	12.71
19-Feb-08	PJ-1	Grubby	PYS	12.71
19-Feb-08	PJ-1	Rock gunnel	PYS	6.35
20-Feb-08	PJ-3	Grubby	PYS	4.88
20-Feb-08	PJ-3	Winter flounder	ES1	1489.02
20-Feb-08	PJ-3	Winter flounder	ES4	29.29
20-Feb-08	PJ-3	Winter flounder	WFNVE	4569.59
20-Feb-08	PJ-2	Atlantic tomcod	YS	15.04
20-Feb-08	PJ-2	Bay anchovy	JUV	5.01
20-Feb-08	PJ-2	Grubby	PYS	30.09
20-Feb-08	PJ-2	Weakfish	JUV	5.01
20-Feb-08	PJ-2	Winter flounder	ES1	60.17
20-Feb-08	PJ-2	Winter flounder	ES4	35.10
20-Feb-08	PJ-2	Winter flounder	ES5	10.03
20-Feb-08	PJ-2	Winter flounder	WFNVE	972.79
20-Feb-08	SB-3	Grubby	Egg	57.20
20-Feb-08	SB-3	Grubby	PYS	57.20
20-Feb-08	SB-3	Grubby	YS	6.36
20-Feb-08	SB-3	Summer flounder	PYS	6.36
20-Feb-08	SB-4	Grubby	PYS	21.14
20-Feb-08	SB-4	Rock gunnel	PYS	8.46
20-Feb-08	SB-4	Winter flounder	ST1	4.23
20-Feb-08	SB-6	Grubby	PYS	8.84
20-Feb-08	SB-6	Winter flounder	ES1	35.36
20-Feb-08	SB-6	Winter flounder	WFNVE	35.36
25-Feb-08	LB-7	Grubby	PYS	268.08
25-Feb-08	LB-7	Grubby	YS	6.87
25-Feb-08	LB-7	Rock gunnel	PYS	20.62
25-Feb-08	LB-7	Winter flounder	ST1	75.61
25-Feb-08	LB-3	Grubby	PYS	64.89
25-Feb-08	LB-3	Summer flounder	PYS	6.49
25-Feb-08	LB-5	Atlantic tomcod	PYS	6.02

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
25-Feb-08	LB-5	Grubby	PYS	54.14
25-Feb-08	LB-5	Rock gunnel	PYS	24.06
25-Feb-08	LB-6	Grubby	PYS	177.50
25-Feb-08	LB-6	Rock gunnel	PYS	8.66
25-Feb-08	LB-6	Winter flounder	ST1	4.33
25-Feb-08	LB-12	Atlantic menhaden	PYS	5.10
25-Feb-08	LB-12	Grubby	PYS	61.21
25-Feb-08	LB-12	Rock gunnel	PYS	20.40
25-Feb-08	LB-12	Winter flounder	ST1	76.51
25-Feb-08	LB-12	Winter flounder	ST2	10.20
25-Feb-08	LB-12	Winter flounder	ST3	5.10
25-Feb-08	LB-4	American sandlance	YS	5.70
25-Feb-08	LB-4	Grubby	PYS	444.94
25-Feb-08	LB-4	Grubby	YS	22.82
25-Feb-08	LB-4	Rock gunnel	PYS	28.52
25-Feb-08	LB-4	Winter flounder	ST1	11.41
25-Feb-08	LB-4	Winter flounder	ST2	5.70
25-Feb-08	LB-13	Grubby	PYS	233.57
25-Feb-08	LB-13	Rock gunnel	PYS	7.53
25-Feb-08	LB-13	Winter flounder	WFNVE	7.53
25-Feb-08	LB-9	Atlantic tomcod	PYS	6.71
25-Feb-08	LB-9	Grubby	PYS	67.07
25-Feb-08	LB-9	Winter flounder	ST3	6.71
26-Feb-08	LB-10	Grubby	PYS	85.10
26-Feb-08	LB-10	Winter flounder	ST1	34.04
26-Feb-08	LB-10	Winter flounder	ST2	22.69
26-Feb-08	LB-10	Winter flounder	ST3	17.02
26-Feb-08	LB-11	Atlantic menhaden	PYS	6.34
26-Feb-08	LB-11	Grubby	PYS	57.06
26-Feb-08	LB-11	Rock gunnel	PYS	6.34
26-Feb-08	LB-11	Winter flounder	ST1	69.74
26-Feb-08	LB-11	Winter flounder	ST2	6.34
26-Feb-08	LB-11	Winter flounder	ST3	12.68
26-Feb-08	LB-1	Grubby	PYS	49.46
26-Feb-08	LB-1	Rock gunnel	PYS	6.18
26-Feb-08	LB-1	Summer flounder	PYS	6.18
26-Feb-08	LB-2	Grubby	PYS	96.16
26-Feb-08	LB-2	Winter flounder	ST2	6.01
26-Feb-08	LB-14	Grubby	PYS	27.90

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
26-Feb-08	LB-14	Rock gunnel	PYS	3.99
26-Feb-08	LB-14	Winter flounder	ST2	7.97
26-Feb-08	LB-14	Winter flounder	ST3	3.99
26-Feb-08	SB-5	Atlantic herring	PYS	22.12
26-Feb-08	SB-5	Summer flounder	PYS	11.06
03-Mar-08	LB-8	Atlantic herring	PYS	5.49
03-Mar-08	LB-8	Grubby	PYS	49.41
03-Mar-08	LB-7	Grubby	PYS	74.22
03-Mar-08	LB-7	Rock gunnel	PYS	5.71
03-Mar-08	LB-7	Winter flounder	ST3	5.71
03-Mar-08	LB-3	Grubby	PYS	42.64
03-Mar-08	LB-3	Grubby	YS	4.74
03-Mar-08	LB-3	Winter flounder	ST2	66.33
03-Mar-08	LB-3	Winter flounder	ST3	71.07
03-Mar-08	LB-12	Grubby	PYS	110.39
03-Mar-08	LB-12	Rock gunnel	PYS	11.04
03-Mar-08	LB-4	Grubby	PYS	120.52
03-Mar-08	LB-4	Rock gunnel	PYS	5.02
03-Mar-08	LB-13	Grubby	PYS	10.71
03-Mar-08	LB-6	Grubby	PYS	228.37
03-Mar-08	LB-6	Grubby	YS	5.44
03-Mar-08	LB-6	Rock gunnel	PYS	5.44
03-Mar-08	LB-6	Winter flounder	ST1	21.75
03-Mar-08	LB-5	Grubby	PYS	33.21
04-Mar-08	PJ-2	Grubby	PYS	33.84
04-Mar-08	PJ-2	Rock gunnel	PYS	5.64
04-Mar-08	SB-5	Grubby	PYS	47.30
04-Mar-08	SB-5	Rock gunnel	PYS	9.46
04-Mar-08	SB-5	Unidentified	Egg	14.19
04-Mar-08	SB-5	Winter flounder	ST1	14.19
04-Mar-08	SB-5	Winter flounder	ST3	4.73
04-Mar-08	PJ-1	Grubby	PYS	40.61
04-Mar-08	PJ-1	Winter flounder	ES1	45.69
04-Mar-08	PJ-1	Winter flounder	ES3	5.08
04-Mar-08	PJ-1	Winter flounder	ES4	5.08
04-Mar-08	PJ-1	Winter flounder	ST1	15.23
04-Mar-08	PJ-1	Winter flounder	ST2	5.08
04-Mar-08	PJ-1	Winter flounder	WFNVE	40.61
04-Mar-08	SB-6	Grubby	PYS	3.38

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
04-Mar-08	SB-6	Winter flounder	ST3	3.38
04-Mar-08	SB-4	Atlantic menhaden	PYS	4.07
04-Mar-08	SB-4	Atlantic tomcod	PYS	4.07
04-Mar-08	SB-4	Grubby	PYS	122.12
04-Mar-08	SB-4	Grubby	YS	4.07
04-Mar-08	SB-4	Unidentified	Egg	4.07
04-Mar-08	SB-4	Winter flounder	ST3	4.07
04-Mar-08	SB-3	Atlantic tomcod	PYS	5.58
04-Mar-08	SB-3	Grubby	PYS	150.73
04-Mar-08	SB-3	Grubby	YS	22.33
04-Mar-08	SB-3	Unidentified	Egg	22.33
04-Mar-08	SB-3	Winter flounder	ST1	22.33
04-Mar-08	PJ-4	Atlantic menhaden	PYS	8.91
04-Mar-08	PJ-4	Atlantic tomcod	PYS	4.46
04-Mar-08	PJ-4	Grubby	PYS	84.69
04-Mar-08	PJ-4	Grubby	YS	8.91
04-Mar-08	PJ-4	Rock gunnel	PYS	4.46
04-Mar-08	PJ-4	Winter flounder	ST1	4.46
04-Mar-08	PJ-4	Winter flounder	ST2	4.46
04-Mar-08	PJ-4	Winter flounder	ST3	4.46
06-Mar-08	LB-14	American sandlance	PYS	3.96
06-Mar-08	LB-14	Grubby	PYS	7.91
06-Mar-08	LB-14	Rock gunnel	PYS	3.96
06-Mar-08	LB-14	Unidentified	Egg	3.96
06-Mar-08	LB-14	Winter flounder	ST3	31.65
06-Mar-08	LB-2	Grubby	PYS	97.69
06-Mar-08	LB-2	Rock gunnel	PYS	6.51
06-Mar-08	LB-2	Winter flounder	ST3	13.03
06-Mar-08	LB-1	American sandlance	PYS	11.48
06-Mar-08	LB-1	Grubby	PYS	132.03
06-Mar-08	LB-1	Rock gunnel	PYS	5.74
06-Mar-08	LB-1	Winter flounder	ST3	40.18
06-Mar-08	LB-9	Grubby	PYS	78.21
06-Mar-08	LB-9	Winter flounder	ST1	5.59
06-Mar-08	LB-11	American sandlance	PYS	5.90
06-Mar-08	LB-11	Grubby	PYS	100.27
06-Mar-08	LB-11	Winter flounder	ST1	5.90
06-Mar-08	LB-11	Winter flounder	ST3	5.90
06-Mar-08	LB-10	Grubby	PYS	86.60

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Date	Station	Common Name	LifeStage	Density
06-Mar-08	LB-10	Unidentified	Egg	49.48
07-Mar-08	PJ-3	Atlantic tomcod	YS	5.57
07-Mar-08	PJ-3	Grubby	PYS	33.40
07-Mar-08	PJ-3	Grubby	YS	5.57
07-Mar-08	PJ-3	Winter flounder	ES3	5.57
07-Mar-08	NB-7	Grubby	PYS	90.09
07-Mar-08	NB-7	Winter flounder	ES1	6.93
07-Mar-08	NB-4	Grubby	PYS	53.34
07-Mar-08	NB-4	Winter flounder	ST2	5.93
07-Mar-08	AK-3	Grubby	PYS	97.37
07-Mar-08	AK-3	Winter flounder	ST3	12.17
07-Mar-08	AK-2	Atlantic menhaden	PYS	4.92
07-Mar-08	AK-2	Grubby	PYS	64.02
07-Mar-08	AK-2	Grubby	YS	9.85
07-Mar-08	AK-2	Rock gunnel	PYS	4.92
07-Mar-08	AK-2	Winter flounder	ST1	4.92
17-Mar-08	SB-5	Atlantic herring	PYS	12.20
17-Mar-08	SB-5	Atlantic menhaden	PYS	6.10
17-Mar-08	SB-5	Fourbeard rockling	Egg	6.10
17-Mar-08	SB-5	Grubby	PYS	6.10
17-Mar-08	SB-5	Summer flounder	PYS	6.10
17-Mar-08	PJ-2	Atlantic herring	PYS	9.18
17-Mar-08	PJ-2	Atlantic tomcod	PYS	4.59
17-Mar-08	PJ-2	Grubby	PYS	22.95
17-Mar-08	PJ-2	Winter flounder	ES5	9.18
17-Mar-08	PJ-2	Winter flounder	WFNVE	4.59
17-Mar-08	PJ-1	Atlantic tomcod	PYS	5.00
17-Mar-08	PJ-1	Grubby	PYS	50.02
17-Mar-08	PJ-1	Grubby	YS	15.01
17-Mar-08	PJ-4	Atlantic menhaden	PYS	4.46
17-Mar-08	PJ-4	Atlantic tomcod	PYS	106.95
17-Mar-08	PJ-4	Grubby	JUV	4.46
17-Mar-08	PJ-4	Grubby	PYS	84.67
17-Mar-08	SB-3	Atlantic tomcod	PYS	41.29
17-Mar-08	SB-3	Fourbeard rockling	Egg	5.16
17-Mar-08	SB-3	Grubby	PYS	92.91
17-Mar-08	SB-4	Atlantic menhaden	PYS	19.62
17-Mar-08	SB-4	Atlantic tomcod	PYS	52.32
17-Mar-08	SB-4	Fourbeard rockling	Egg	412.01

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Date	Station	Common Name	LifeStage	Density
17-Mar-08	SB-4	Grubby	PYS	438.17
17-Mar-08	SB-4	Summer flounder	PYS	13.08
17-Mar-08	SB-4	Winter flounder	ST1	6.54
17-Mar-08	SB-6	Grubby	PYS	45.90
18-Mar-08	LB-3	Grubby	PYS	42.81
18-Mar-08	LB-5	Grubby	PYS	557.80
18-Mar-08	LB-5	Grubby	YS	19.23
18-Mar-08	LB-5	Winter flounder	ST1	12.82
18-Mar-08	LB-5	Winter flounder	ST3	6.41
18-Mar-08	LB-6	Cods and Haddocks	Egg	6.23
18-Mar-08	LB-6	Grubby	PYS	37.40
18-Mar-08	LB-6	Winter flounder	ST2	6.23
18-Mar-08	LB-12	Atlantic tomcod	PYS	5.78
18-Mar-08	LB-12	Fourbeard rockling	Egg	5.78
18-Mar-08	LB-12	Grubby	PYS	237.11
18-Mar-08	LB-12	Grubby	YS	5.78
18-Mar-08	LB-4	American sandlance	YS	5.78
18-Mar-08	LB-4	Grubby	PYS	104.07
18-Mar-08	LB-4	Winter flounder	ST1	5.78
18-Mar-08	LB-13	Grubby	PYS	41.15
18-Mar-08	LB-13	Winter flounder	ES4	10.29
18-Mar-08	LB-13	Winter flounder	WFNVE	5.14
18-Mar-08	LB-11	Grubby	PYS	95.04
18-Mar-08	LB-11	Grubby	YS	22.63
18-Mar-08	LB-11	Rock gunnel	PYS	9.05
18-Mar-08	LB-11	Winter flounder	ST2	4.53
18-Mar-08	LB-11	Winter flounder	ST3	22.63
19-Mar-08	PJ-3	Grubby	PYS	26.47
19-Mar-08	PJ-3	Winter flounder	ST1	10.59
19-Mar-08	PJ-3	Winter flounder	ST2	10.59
19-Mar-08	NB-4	Grubby	PYS	5.69
19-Mar-08	NB-4	Winter flounder	ST1	34.17
19-Mar-08	NB-4	Winter flounder	ST2	22.78
19-Mar-08	NB-4	Winter flounder	ST3	5.69
19-Mar-08	NB-4	Winter flounder	UID	5.69
19-Mar-08	NB-7	Grubby	PYS	37.48
19-Mar-08	NB-7	Winter flounder	ST2	12.49
19-Mar-08	NB-7	Winter flounder	ST3	6.25
19-Mar-08	AK-2	Atlantic menhaden	PYS	10.35

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Date	Station	Common Name	LifeStage	Density
19-Mar-08	AK-2	Atlantic tomcod	PYS	5.18
19-Mar-08	AK-2	Fourbeard rockling	Egg	5.18
19-Mar-08	AK-2	Grubby	PYS	351.93
19-Mar-08	AK-2	Grubby	YS	5.18
19-Mar-08	AK-2	Summer flounder	PYS	5.18
19-Mar-08	AK-2	Winter flounder	ST3	5.18
19-Mar-08	AK-3	Atlantic tomcod	PYS	189.28
19-Mar-08	AK-3	Fourbeard rockling	Egg	17.21
19-Mar-08	AK-3	Grubby	PYS	223.69
19-Mar-08	AK-3	Summer flounder	PYS	34.41
19-Mar-08	AK-3	Winter flounder	ST3	8.60
24-Mar-08	LB-8	Grubby	PYS	49.17
24-Mar-08	LB-8	Winter flounder	ES5	6.15
24-Mar-08	LB-8	Winter flounder	ST1	104.48
24-Mar-08	LB-8	Winter flounder	ST2	516.24
24-Mar-08	LB-8	Winter flounder	ST3	952.58
24-Mar-08	LB-8	Winter flounder	UID	18.44
24-Mar-08	LB-7	Grubby	PYS	38.83
24-Mar-08	LB-7	Winter flounder	ST1	9.71
24-Mar-08	LB-7	Winter flounder	ST2	24.27
24-Mar-08	LB-7	Winter flounder	ST3	24.27
24-Mar-08	LB-1	Grubby	PYS	52.50
24-Mar-08	LB-1	Winter flounder	ST2	11.67
24-Mar-08	LB-1	Winter flounder	ST3	35.00
24-Mar-08	LB-2	American sandlance	PYS	11.43
24-Mar-08	LB-2	Fourbeard rockling	Egg	3.81
24-Mar-08	LB-2	Grubby	PYS	15.24
24-Mar-08	LB-2	Winter flounder	ST1	7.62
24-Mar-08	LB-2	Winter flounder	ST2	129.50
24-Mar-08	LB-2	Winter flounder	ST3	243.77
24-Mar-08	LB-2	Winter flounder	UID	19.04
24-Mar-08	LB-14	Cods and Haddocks	Egg	4.92
24-Mar-08	LB-14	Grubby	PYS	63.93
24-Mar-08	LB-14	Grubby	YS	4.92
24-Mar-08	LB-14	Winter flounder	ST1	19.67
24-Mar-08	LB-14	Winter flounder	ST2	59.01
24-Mar-08	LB-14	Winter flounder	ST3	44.26
24-Mar-08	LB-9	American sandlance	PYS	3.58
24-Mar-08	LB-9	American sandlance	YS	3.58

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Date	Station	Common Name	LifeStage	Density
24-Mar-08	LB-9	Grubby	PYS	53.75
24-Mar-08	LB-9	Winter flounder	ST1	10.75
24-Mar-08	LB-9	Winter flounder	ST2	193.51
24-Mar-08	LB-9	Winter flounder	ST3	143.34
24-Mar-08	LB-9	Winter flounder	UID	35.84
24-Mar-08	LB-10	Atlantic menhaden	PYS	3.67
24-Mar-08	LB-10	Grubby	PYS	40.34
24-Mar-08	LB-10	Winter flounder	ST1	3.67
24-Mar-08	LB-10	Winter flounder	ST2	198.05
24-Mar-08	LB-10	Winter flounder	ST3	227.39
24-Mar-08	LB-10	Winter flounder	UID	40.34
31-Mar-08	PJ-1	Grubby	PYS	57.84
31-Mar-08	PJ-1	Winter flounder	ST2	6.43
31-Mar-08	SB-6	Atlantic tomcod	PYS	5.34
31-Mar-08	SB-6	Fourbeard rockling	Egg	5.34
31-Mar-08	SB-6	Grubby	PYS	144.15
31-Mar-08	SB-6	Grubby	YS	10.68
31-Mar-08	SB-6	Winter flounder	ST1	10.68
31-Mar-08	SB-6	Winter flounder	ST2	53.39
31-Mar-08	SB-6	Winter flounder	ST3	208.22
31-Mar-08	SB-6	Winter flounder	UID	10.68
31-Mar-08	SB-3	Cods and Haddocks	Egg	11.50
31-Mar-08	SB-3	Grubby	PYS	51.73
31-Mar-08	SB-3	Grubby	YS	5.75
31-Mar-08	SB-3	Winter flounder	ST3	34.49
31-Mar-08	SB-4	Feather blenny	PYS	4.83
31-Mar-08	SB-4	Fourbeard rockling	Egg	4.83
31-Mar-08	SB-4	Cods and Haddocks	Egg	33.78
31-Mar-08	SB-4	Grubby	PYS	236.44
31-Mar-08	SB-4	Grubby	YS	4.83
31-Mar-08	SB-4	Winter flounder	ST1	4.83
31-Mar-08	SB-4	Winter flounder	ST3	24.13
31-Mar-08	SB-5	Fourbeard rockling	Egg	23.08
31-Mar-08	SB-5	Cods and Haddocks	Egg	34.63
31-Mar-08	SB-5	Grubby	PYS	86.56
31-Mar-08	SB-5	Grubby	YS	11.54
31-Mar-08	SB-5	Rock gunnel	PYS	5.77
31-Mar-08	PJ-4	Atlantic tomcod	PYS	4.67
31-Mar-08	PJ-4	Fourbeard rockling	Egg	14.01

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
31-Mar-08	PJ-4	Cods and Haddocks	Egg	46.70
31-Mar-08	PJ-4	Grubby	PYS	116.74
31-Mar-08	PJ-4	Grubby	YS	4.67
31-Mar-08	PJ-4	Rock gunnel	PYS	4.67
31-Mar-08	PJ-4	Winter flounder	ST2	4.67
31-Mar-08	PJ-4	Winter flounder	ST3	9.34
31-Mar-08	KVK-1	American sandlance	PYS	5.14
31-Mar-08	KVK-1	Cods and Haddocks	Egg	5.14
31-Mar-08	KVK-1	Grubby	PYS	169.74
31-Mar-08	KVK-1	Grubby	YS	10.29
31-Mar-08	KVK-1	Rock gunnel	PYS	15.43
31-Mar-08	KVK-1	Winter flounder	ST1	30.86
31-Mar-08	KVK-1	Winter flounder	ST2	10.29
31-Mar-08	KVK-1	Winter flounder	ST3	92.58
31-Mar-08	KVK-2	Cods and Haddocks	Egg	5.32
31-Mar-08	KVK-2	Grubby	PYS	218.01
31-Mar-08	KVK-2	Rock gunnel	PYS	10.63
31-Mar-08	KVK-2	Winter flounder	ST2	10.63
31-Mar-08	KVK-2	Winter flounder	ST3	31.90
31-Mar-08	KVK-2	Winter flounder	UID	5.32
31-Mar-08	PJ-3	Cods and Haddocks	Egg	4.95
31-Mar-08	PJ-3	Grubby	PYS	44.53
31-Mar-08	PJ-3	Grubby	YS	4.95
31-Mar-08	PJ-3	Winter flounder	ST2	74.22
31-Mar-08	PJ-3	Winter flounder	ST3	79.17
31-Mar-08	PJ-3	Winter flounder	UID	4.95
31-Mar-08	PJ-2	Grubby	PYS	65.48
31-Mar-08	PJ-2	Rock gunnel	PYS	5.46
31-Mar-08	PJ-2	Winter flounder	ST1	16.37
31-Mar-08	PJ-2	Winter flounder	ST2	27.28
31-Mar-08	PJ-2	Winter flounder	ST3	70.94
03-Apr-08	LB-8	American sandlance	PYS	6.10
03-Apr-08	LB-8	Fourbeard rockling	Egg	6.10
03-Apr-08	LB-8	Cods and Haddocks	Egg	6.10
03-Apr-08	LB-8	Grubby	PYS	48.77
03-Apr-08	LB-8	Winter flounder	ES5	6.10
03-Apr-08	LB-8	Winter flounder	ST1	73.16
03-Apr-08	LB-8	Winter flounder	ST2	475.52
03-Apr-08	LB-8	Winter flounder	ST3	518.20

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
03-Apr-08	LB-8	Winter flounder	UID	12.19
03-Apr-08	LB-7	Cods and Haddocks	Egg	6.86
03-Apr-08	LB-7	Grubby	PYS	20.57
03-Apr-08	LB-7	Winter flounder	ST3	27.43
03-Apr-08	LB-3	Fourbeard rockling	Egg	5.04
03-Apr-08	LB-3	Cods and Haddocks	Egg	5.04
03-Apr-08	LB-3	Grubby	PYS	60.52
03-Apr-08	LB-3	Grubby	YS	5.04
03-Apr-08	LB-3	Winter flounder	ST1	272.36
03-Apr-08	LB-3	Winter flounder	ST2	237.05
03-Apr-08	LB-3	Winter flounder	ST3	736.38
03-Apr-08	LB-3	Winter flounder	UID	20.17
03-Apr-08	LB-5	Fourbeard rockling	Egg	5.76
03-Apr-08	LB-5	Grubby	PYS	40.31
03-Apr-08	LB-5	Winter flounder	ST1	460.73
03-Apr-08	LB-5	Winter flounder	ST2	132.46
03-Apr-08	LB-5	Winter flounder	ST3	460.73
03-Apr-08	LB-5	Winter flounder	UID	483.77
03-Apr-08	LB-6	Fourbeard rockling	Egg	23.27
03-Apr-08	LB-6	Cods and Haddocks	Egg	11.64
03-Apr-08	LB-6	Grubby	PYS	52.37
03-Apr-08	LB-6	Winter flounder	ST1	2077.17
03-Apr-08	LB-6	Winter flounder	ST2	418.93
03-Apr-08	LB-6	Winter flounder	ST3	232.74
03-Apr-08	LB-6	Winter flounder	UID	34.91
03-Apr-08	LB-12	Atlantic menhaden	PYS	5.29
03-Apr-08	LB-12	Cods and Haddocks	Egg	74.05
03-Apr-08	LB-12	Grubby	PYS	460.15
03-Apr-08	LB-12	Winter flounder	ST1	84.63
03-Apr-08	LB-12	Winter flounder	ST2	26.45
03-Apr-08	LB-12	Winter flounder	ST3	433.71
03-Apr-08	LB-4	Fourbeard rockling	Egg	4.93
03-Apr-08	LB-4	Cods and Haddocks	Egg	44.33
03-Apr-08	LB-4	Grubby	PYS	128.08
03-Apr-08	LB-4	Winter flounder	ST1	9.85
03-Apr-08	LB-4	Winter flounder	ST2	9.85
03-Apr-08	LB-4	Winter flounder	ST3	34.48
03-Apr-08	LB-13	American sandlance	PYS	12.63
03-Apr-08	LB-13	Cods and Haddocks	Egg	6.31

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
03-Apr-08	LB-13	Grubby	PYS	252.58
03-Apr-08	LB-13	Winter flounder	ST1	972.42
03-Apr-08	LB-13	Winter flounder	ST2	467.27
03-Apr-08	LB-13	Winter flounder	ST3	694.59
03-Apr-08	LB-2	Cods and Haddocks	Egg	8.00
03-Apr-08	LB-2	Grubby	PYS	120.04
03-Apr-08	LB-2	Grubby	YS	8.00
03-Apr-08	LB-2	Winter flounder	ST3	8.00
03-Apr-08	LB-1	Atlantic tomcod	PYS	8.69
03-Apr-08	LB-1	Fourbeard rockling	Egg	17.38
03-Apr-08	LB-1	Cods and Haddocks	Egg	52.14
03-Apr-08	LB-1	Grubby	PYS	26.07
03-Apr-08	LB-1	Winter flounder	ST3	104.28
03-Apr-08	LB-14	Cods and Haddocks	Egg	14.32
03-Apr-08	LB-14	Grubby	PYS	71.62
03-Apr-08	LB-14	Winter flounder	ST3	28.65
03-Apr-08	LB-9	Atlantic tomcod	PYS	7.54
03-Apr-08	LB-9	Fourbeard rockling	Egg	7.54
03-Apr-08	LB-9	Cods and Haddocks	Egg	22.63
03-Apr-08	LB-9	Grubby	PYS	165.98
03-Apr-08	LB-9	Grubby	YS	30.18
03-Apr-08	LB-9	Winter flounder	ST2	7.54
03-Apr-08	LB-9	Winter flounder	ST3	22.63
03-Apr-08	LB-10	Fourbeard rockling	Egg	10.76
03-Apr-08	LB-10	Cods and Haddocks	Egg	16.14
03-Apr-08	LB-10	Grubby	PYS	484.08
03-Apr-08	LB-10	Grubby	YS	21.51
03-Apr-08	LB-10	Rock gunnel	PYS	5.38
03-Apr-08	LB-10	Summer flounder	PYS	5.38
03-Apr-08	LB-10	Windowpane	Egg	80.68
03-Apr-08	LB-10	Winter flounder	ST1	5.38
03-Apr-08	LB-10	Winter flounder	ST3	48.41
03-Apr-08	LB-11	Grubby	PYS	309.94
03-Apr-08	LB-11	Grubby	YS	15.76
03-Apr-08	LB-11	Windowpane	Egg	5.25
03-Apr-08	LB-11	Winter flounder	ST2	5.25
03-Apr-08	LB-11	Winter flounder	ST3	178.61
04-Apr-08	NB-4	Grubby	PYS	44.72
04-Apr-08	NB-4	Winter flounder	ST1	11.18

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
04-Apr-08	NB-4	Winter flounder	ST2	27.95
04-Apr-08	NB-4	Winter flounder	ST3	11.18
04-Apr-08	NB-7	Grubby	PYS	148.98
04-Apr-08	NB-7	Grubby	YS	11.04
04-Apr-08	NB-7	Winter flounder	ST2	55.18
04-Apr-08	NB-7	Winter flounder	ST3	38.63
04-Apr-08	NB-7	Winter flounder	UID	5.52
04-Apr-08	AK-3	Atlantic tomcod	PYS	12.70
04-Apr-08	AK-3	Grubby	PYS	63.48
04-Apr-08	AK-3	Grubby	YS	12.70
04-Apr-08	AK-2	Atlantic tomcod	PYS	9.67
04-Apr-08	AK-2	Grubby	PYS	454.66
04-Apr-08	AK-2	Grubby	YS	53.20
04-Apr-08	AK-2	Summer flounder	PYS	4.84
04-Apr-08	AK-2	Winter flounder	UID	4.84
14-Apr-08	LB-8	Grubby	PYS	59.78
14-Apr-08	LB-8	Windowpane	Egg	17.93
14-Apr-08	LB-8	Winter flounder	ST3	358.67
14-Apr-08	LB-7	Grubby	PYS	70.22
14-Apr-08	LB-7	Windowpane	Egg	46.81
14-Apr-08	LB-7	Winter flounder	ST1	23.41
14-Apr-08	LB-7	Winter flounder	ST2	35.11
14-Apr-08	LB-7	Winter flounder	ST3	579.27
14-Apr-08	LB-7	Winter flounder	UID	5.85
14-Apr-08	LB-3	Grubby	PYS	25.28
14-Apr-08	LB-3	Windowpane	Egg	44.25
14-Apr-08	LB-3	Winter flounder	ST2	6.32
14-Apr-08	LB-3	Winter flounder	ST3	2174.46
14-Apr-08	LB-3	Winter flounder	UID	18.96
14-Apr-08	LB-5	Fourbeard rockling	Egg	6.04
14-Apr-08	LB-5	Grubby	PYS	42.27
14-Apr-08	LB-5	Windowpane	Egg	18.12
14-Apr-08	LB-5	Winter flounder	ST1	48.31
14-Apr-08	LB-5	Winter flounder	ST2	6.04
14-Apr-08	LB-5	Winter flounder	ST3	205.31
14-Apr-08	LB-5	Winter flounder	UID	6.04
14-Apr-08	LB-6	American sandlance	YS	5.79
14-Apr-08	LB-6	Grubby	PYS	52.12
14-Apr-08	LB-6	Windowpane	Egg	57.91

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Date	Station	Common Name	LifeStage	Density
14-Apr-08	LB-6	Winter flounder	ST1	17.37
14-Apr-08	LB-6	Winter flounder	ST2	5.79
14-Apr-08	LB-6	Winter flounder	ST3	75.29
14-Apr-08	LB-12	Grubby	PYS	78.28
14-Apr-08	LB-12	Windowpane	Egg	6.52
14-Apr-08	LB-12	Winter flounder	ST1	13.05
14-Apr-08	LB-12	Winter flounder	ST2	13.05
14-Apr-08	LB-12	Winter flounder	ST3	150.04
14-Apr-08	LB-4	Grubby	PYS	82.21
14-Apr-08	LB-4	Windowpane	Egg	21.63
14-Apr-08	LB-4	Winter flounder	ST1	38.94
14-Apr-08	LB-4	Winter flounder	ST2	168.75
14-Apr-08	LB-4	Winter flounder	ST3	800.49
14-Apr-08	LB-13	Grubby	PYS	427.83
14-Apr-08	LB-13	Windowpane	Egg	36.41
14-Apr-08	LB-13	Winter flounder	ST2	9.10
14-Apr-08	LB-13	Winter flounder	ST3	464.24
15-Apr-08	LB-9	Feather blenny	YS	14.32
15-Apr-08	LB-9	Cods and Haddocks	Egg	14.32
15-Apr-08	LB-9	Grubby	PYS	71.61
15-Apr-08	LB-9	Grubby	YS	28.64
15-Apr-08	LB-9	Windowpane	Egg	100.25
15-Apr-08	LB-9	Winter flounder	ST2	14.32
15-Apr-08	LB-9	Winter flounder	ST3	386.67
15-Apr-08	LB-10	Cods and Haddocks	Egg	5.14
15-Apr-08	LB-10	Grubby	PYS	46.26
15-Apr-08	LB-10	Windowpane	Egg	128.50
15-Apr-08	LB-10	Winter flounder	ST1	35.98
15-Apr-08	LB-10	Winter flounder	ST2	92.52
15-Apr-08	LB-10	Winter flounder	ST3	791.58
15-Apr-08	LB-1	Grubby	PYS	14.75
15-Apr-08	LB-1	Windowpane	Egg	95.89
15-Apr-08	LB-1	Winter flounder	ST1	22.13
15-Apr-08	LB-1	Winter flounder	ST2	103.27
15-Apr-08	LB-1	Winter flounder	ST3	767.14
15-Apr-08	LB-2	Cods and Haddocks	Egg	6.08
15-Apr-08	LB-2	Grubby	PYS	54.73
15-Apr-08	LB-2	Grubby	YS	6.08
15-Apr-08	LB-2	Windowpane	Egg	60.81

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Date	Station	Common Name	LifeStage	Density
15-Apr-08	LB-2	Winter flounder	ST2	6.08
15-Apr-08	LB-2	Winter flounder	ST3	267.57
15-Apr-08	LB-14	Grubby	PYS	296.04
15-Apr-08	LB-14	Grubby	YS	35.53
15-Apr-08	LB-14	Summer flounder	PYS	5.92
15-Apr-08	LB-14	Windowpane	Egg	148.02
15-Apr-08	LB-14	Winter flounder	ST1	5.92
15-Apr-08	LB-14	Winter flounder	ST3	455.91
15-Apr-08	PJ-2	Grubby	PYS	5.70
15-Apr-08	PJ-2	Rock gunnel	PYS	5.70
15-Apr-08	PJ-2	Winter flounder	ST2	34.23
15-Apr-08	PJ-2	Winter flounder	ST3	91.28
15-Apr-08	PJ-2	Winter flounder	UID	11.41
16-Apr-08	PJ-3	Atlantic herring	JUV	4.87
16-Apr-08	PJ-3	Atlantic menhaden	PYS	4.87
16-Apr-08	PJ-3	Grubby	PYS	19.48
16-Apr-08	PJ-3	Windowpane	Egg	4.87
16-Apr-08	PJ-3	Winter flounder	ST3	38.95
16-Apr-08	SB-6	Grubby	PYS	15.62
16-Apr-08	SB-6	Windowpane	Egg	7.81
16-Apr-08	SB-6	Winter flounder	ST2	31.23
16-Apr-08	SB-6	Winter flounder	ST3	347.45
16-Apr-08	SB-6	Winter flounder	UID	23.42
16-Apr-08	SB-3	Fourbeard rockling	Egg	17.12
16-Apr-08	SB-3	Grubby	PYS	5.71
16-Apr-08	SB-3	Windowpane	Egg	11.41
16-Apr-08	SB-3	Winter flounder	ST2	34.23
16-Apr-08	SB-3	Winter flounder	ST3	159.75
16-Apr-08	SB-4	Atlantic tomcod	PYS	4.02
16-Apr-08	SB-4	Fourbeard rockling	Egg	12.06
16-Apr-08	SB-4	Grubby	PYS	16.09
16-Apr-08	SB-4	Grubby	YS	4.02
16-Apr-08	SB-4	Windowpane	Egg	4.02
16-Apr-08	SB-4	Winter flounder	ST1	16.09
16-Apr-08	SB-4	Winter flounder	ST2	28.15
16-Apr-08	SB-4	Winter flounder	ST3	160.85
16-Apr-08	KVK-1	Grubby	PYS	120.55
16-Apr-08	KVK-1	Grubby	YS	17.22
16-Apr-08	KVK-1	Windowpane	Egg	40.18

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Date	Station	Common Name	LifeStage	Density
16-Apr-08	KVK-1	Winter flounder	ST2	5.74
16-Apr-08	KVK-1	Winter flounder	ST3	126.29
16-Apr-08	KVK-2	Fourbeard rockling	Egg	48.24
16-Apr-08	KVK-2	Grubby	PYS	130.25
16-Apr-08	KVK-2	Grubby	YS	19.30
16-Apr-08	KVK-2	Windowpane	Egg	110.95
16-Apr-08	KVK-2	Winter flounder	ST1	24.12
16-Apr-08	KVK-2	Winter flounder	ST2	33.77
16-Apr-08	KVK-2	Winter flounder	ST3	125.43
16-Apr-08	SB-5	Fourbeard rockling	Egg	97.96
16-Apr-08	SB-5	Grubby	PYS	12.25
16-Apr-08	SB-5	Rock gunnel	PYS	12.25
16-Apr-08	SB-5	Windowpane	Egg	214.30
17-Apr-08	NB-4	Grubby	PYS	25.45
17-Apr-08	NB-7	Grubby	PYS	79.34
17-Apr-08	NB-7	Winter flounder	ST3	30.51
17-Apr-08	AK-3	Atlantic tomcod	PYS	11.69
17-Apr-08	AK-3	Grubby	PYS	344.93
17-Apr-08	AK-3	Grubby	YS	17.54
17-Apr-08	AK-3	Winter flounder	ST3	99.39
17-Apr-08	AK-2	Grubby	PYS	129.60
17-Apr-08	AK-2	Grubby	YS	9.60
17-Apr-08	AK-2	Winter flounder	ST2	4.80
17-Apr-08	AK-2	Winter flounder	ST3	33.60
17-Apr-08	PJ-4	Grubby	PYS	59.74
17-Apr-08	PJ-4	Windowpane	Egg	12.80
17-Apr-08	PJ-4	Winter flounder	ST3	59.74
17-Apr-08	PJ-1	Atlantic menhaden	PYS	5.59
17-Apr-08	PJ-1	Grubby	PYS	27.96
17-Apr-08	PJ-1	Rock gunnel	PYS	5.59
17-Apr-08	PJ-1	Winter flounder	ST1	5.59
17-Apr-08	PJ-1	Winter flounder	ST2	67.11
17-Apr-08	PJ-1	Winter flounder	ST3	139.82
17-Apr-08	PJ-1	Winter flounder	UID	16.78
28-Apr-08	NB-4	Winter flounder	ST2	5.27
28-Apr-08	NB-4	Winter flounder	ST3	10.54
28-Apr-08	NB-7	Grubby	PYS	11.79
28-Apr-08	NB-7	Winter flounder	ST2	17.68
28-Apr-08	NB-7	Winter flounder	ST3	41.26

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Date	Station	Common Name	LifeStage	Density
28-Apr-08	AK-3	Grubby	PYS	26.48
28-Apr-08	AK-3	Windowpane	Egg	37.08
28-Apr-08	AK-3	Winter flounder	ST3	323.09
28-Apr-08	AK-2	Grubby	PYS	8.73
28-Apr-08	AK-2	Windowpane	Egg	4.36
28-Apr-08	AK-2	Winter flounder	ST2	4.36
28-Apr-08	AK-2	Winter flounder	ST3	48.01
29-Apr-08	PJ-2	Atlantic herring	JUV	7.67
29-Apr-08	PJ-2	Fourbeard rockling	Egg	7.67
29-Apr-08	PJ-2	Windowpane	Egg	207.14
29-Apr-08	PJ-2	Winter flounder	ST3	191.79
29-Apr-08	KVK-1	Fourbeard rockling	Egg	8.03
29-Apr-08	KVK-1	Grubby	PYS	8.03
29-Apr-08	KVK-1	Wrasses	Egg	72.31
29-Apr-08	KVK-1	Windowpane	Egg	875.74
29-Apr-08	KVK-1	Winter flounder	ST2	8.03
29-Apr-08	KVK-1	Winter flounder	ST3	216.93
29-Apr-08	KVK-1	Winter flounder	ST4	16.07
29-Apr-08	SB-3	Windowpane	Egg	147.61
29-Apr-08	SB-3	Winter flounder	ST1	8.20
29-Apr-08	SB-3	Winter flounder	ST3	41.00
29-Apr-08	SB-4	Cods and Haddocks	Egg	110.73
29-Apr-08	SB-4	Grubby	PYS	13.84
29-Apr-08	SB-4	Grubby	YS	4.61
29-Apr-08	SB-4	Windowpane	Egg	1347.16
29-Apr-08	SB-4	Winter flounder	ST3	562.86
29-Apr-08	SB-5	Fourbeard rockling	Egg	3.62
29-Apr-08	SB-5	Cods and Haddocks	Egg	3.62
29-Apr-08	SB-5	Grubby	PYS	3.62
29-Apr-08	SB-5	Windowpane	Egg	39.82
29-Apr-08	SB-5	Windowpane	PYS	7.24
29-Apr-08	SB-5	Winter flounder	ST2	7.24
29-Apr-08	SB-5	Winter flounder	ST3	235.29
30-Apr-08	LB-8	Atlantic menhaden	Egg	15.87
30-Apr-08	LB-8	Feather blenny	PYS	5.29
30-Apr-08	LB-8	Cods and Haddocks	Egg	42.33
30-Apr-08	LB-8	Grubby	PYS	5.29
30-Apr-08	LB-8	Windowpane	Egg	264.55
30-Apr-08	LB-8	Windowpane	PYS	15.87

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
30-Apr-08	LB-8	Windowpane	YS	5.29
30-Apr-08	LB-8	Winter flounder	ST2	5.29
30-Apr-08	LB-8	Winter flounder	ST3	291.00
30-Apr-08	LB-7	Atlantic menhaden	Egg	9.11
30-Apr-08	LB-7	Cods and Haddocks	Egg	86.59
30-Apr-08	LB-7	Windowpane	Egg	1057.28
30-Apr-08	LB-7	Windowpane	PYS	13.67
30-Apr-08	LB-7	Windowpane	YS	13.67
30-Apr-08	LB-7	Winter flounder	ST3	218.75
30-Apr-08	LB-3	Fourbeard rockling	Egg	21.05
30-Apr-08	LB-3	Cods and Haddocks	Egg	252.62
30-Apr-08	LB-3	Windowpane	Egg	1978.89
30-Apr-08	LB-3	Windowpane	PYS	15.79
30-Apr-08	LB-3	Winter flounder	ST3	452.62
30-Apr-08	LB-5	Atlantic menhaden	Egg	57.24
30-Apr-08	LB-5	Fourbeard rockling	Egg	4.77
30-Apr-08	LB-5	Fourbeard rockling	PYS	4.77
30-Apr-08	LB-5	Cods and Haddocks	Egg	33.39
30-Apr-08	LB-5	Windowpane	Egg	276.65
30-Apr-08	LB-5	Windowpane	PYS	23.85
30-Apr-08	LB-5	Windowpane	YS	9.54
30-Apr-08	LB-5	Winter flounder	ST3	281.42
30-Apr-08	LB-9	Atlantic menhaden	Egg	7.23
30-Apr-08	LB-9	Feather blenny	PYS	3.62
30-Apr-08	LB-9	Fourbeard rockling	PYS	3.62
30-Apr-08	LB-9	Grubby	YS	3.62
30-Apr-08	LB-9	Windowpane	Egg	267.60
30-Apr-08	LB-9	Windowpane	PYS	3.62
30-Apr-08	LB-9	Winter flounder	ST3	57.86
01-May-08	LB-6	Atlantic mackerel	Egg	21.57
01-May-08	LB-6	Fourbeard rockling	PYS	5.39
01-May-08	LB-6	Grubby	PYS	5.39
01-May-08	LB-6	Windowpane	Egg	1596.12
01-May-08	LB-6	Windowpane	PYS	16.18
01-May-08	LB-6	Winter flounder	ST3	754.92
01-May-08	LB-12	Fourbeard rockling	PYS	14.47
01-May-08	LB-12	Grubby	PYS	19.30
01-May-08	LB-12	Wrasses	Egg	28.94
01-May-08	LB-12	Searobin species	Egg	19.30

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
01-May-08	LB-12	Windowpane	Egg	718.77
01-May-08	LB-12	Windowpane	PYS	24.12
01-May-08	LB-12	Winter flounder	ST2	9.65
01-May-08	LB-12	Winter flounder	ST3	1220.47
01-May-08	LB-4	Atlantic menhaden	Egg	4.76
01-May-08	LB-4	Grubby	PYS	9.52
01-May-08	LB-4	Wrasses	Egg	33.31
01-May-08	LB-4	Searobin species	Egg	4.76
01-May-08	LB-4	Windowpane	Egg	509.22
01-May-08	LB-4	Winter flounder	ST3	513.98
01-May-08	LB-13	Atlantic mackerel	Egg	4.82
01-May-08	LB-13	Atlantic menhaden	Egg	9.64
01-May-08	LB-13	Fourbeard rockling	PYS	4.82
01-May-08	LB-13	Grubby	PYS	4.82
01-May-08	LB-13	Wrasses	Egg	24.09
01-May-08	LB-13	Searobin species	Egg	4.82
01-May-08	LB-13	Windowpane	Egg	375.80
01-May-08	LB-13	Windowpane	PYS	9.64
01-May-08	LB-13	Winter flounder	ST3	197.53
01-May-08	LB-10	Wrasses	Egg	178.52
01-May-08	LB-10	Windowpane	Egg	2119.92
01-May-08	SB-6	Fourbeard rockling	PYS	10.94
01-May-08	SB-6	Grubby	PYS	32.83
01-May-08	SB-6	Wrasses	Egg	21.89
01-May-08	SB-6	Windowpane	Egg	591.00
01-May-08	SB-6	Windowpane	PYS	5.47
01-May-08	SB-6	Winter flounder	ST3	1679.96
01-May-08	SB-6	Winter flounder	ST4	49.25
02-May-08	PJ-3	Fourbeard rockling	PYS	5.27
02-May-08	PJ-3	Grubby	PYS	5.27
02-May-08	PJ-3	Wrasses	Egg	5.27
02-May-08	PJ-3	Windowpane	Egg	73.82
02-May-08	PJ-3	Windowpane	PYS	36.91
02-May-08	PJ-3	Winter flounder	ST3	10.55
02-May-08	LB-1	Atlantic menhaden	Egg	12.19
02-May-08	LB-1	Fourbeard rockling	PYS	6.09
02-May-08	LB-1	Wrasses	Egg	60.93
02-May-08	LB-1	Windowpane	Egg	316.82
02-May-08	LB-1	Windowpane	PYS	6.09

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Date	Station	Common Name	LifeStage	Density
02-May-08	LB-1	Winter flounder	ST3	268.08
02-May-08	LB-3	Atlantic menhaden	Egg	6.42
02-May-08	LB-3	Fourbeard rockling	PYS	6.42
02-May-08	LB-3	Wrasses	Egg	44.97
02-May-08	LB-3	Windowpane	Egg	134.91
02-May-08	LB-3	Windowpane	PYS	12.85
02-May-08	LB-3	Winter flounder	ST3	475.41
02-May-08	LB-14	Fourbeard rockling	PYS	14.72
02-May-08	LB-14	Windowpane	PYS	58.88
02-May-08	LB-14	Winter flounder	ST3	191.37
02-May-08	KVK-2	Grubby	PYS	13.64
02-May-08	KVK-2	Wrasses	Egg	27.28
02-May-08	KVK-2	Windowpane	Egg	504.77
02-May-08	KVK-2	Winter flounder	ST3	375.16
02-May-08	KVK-2	Winter flounder	ST4	20.46
13-May-08	PJ-2	Atlantic menhaden	Egg	21.45
13-May-08	PJ-2	Fourbeard rockling	Egg	10.73
13-May-08	PJ-2	Wrasses	Egg	439.75
13-May-08	PJ-2	Windowpane	Egg	32.18
13-May-08	PJ-2	Windowpane	PYS	10.73
13-May-08	PJ-2	Winter flounder	ST3	16.09
13-May-08	PJ-2	Winter flounder	ST4	5.36
13-May-08	PJ-3	Wrasses	Egg	415.91
13-May-08	PJ-3	Windowpane	Egg	11.55
13-May-08	AK-3	Bay anchovy	Egg	48.82
13-May-08	AK-3	Wrasses	Egg	225.77
13-May-08	AK-3	Windowpane	Egg	18.31
13-May-08	AK-3	Windowpane	PYS	6.10
13-May-08	AK-2	Bay anchovy	Egg	17.97
13-May-08	AK-2	Wrasses	Egg	71.87
13-May-08	AK-2	Windowpane	Egg	4.49
13-May-08	AK-2	Windowpane	PYS	8.98
13-May-08	NB-4	Atlantic menhaden	Egg	8.53
13-May-08	NB-4	Bay anchovy	Egg	8.53
13-May-08	NB-4	Wrasses	Egg	46.91
13-May-08	NB-4	Windowpane	PYS	8.53
13-May-08	NB-7	Wrasses	Egg	25.69
13-May-08	NB-7	Windowpane	PYS	6.42
14-May-08	LB-8	Atlantic menhaden	Egg	5.31

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Date	Station	Common Name	LifeStage	Density
14-May-08	LB-8	Bay anchovy	Egg	58.41
14-May-08	LB-8	Fourbeard rockling	PYS	5.31
14-May-08	LB-8	Wrasses	Egg	446.04
14-May-08	LB-8	Searobin species	Egg	10.62
14-May-08	LB-8	Windowpane	Egg	169.92
14-May-08	LB-8	Windowpane	PYS	21.24
14-May-08	LB-8	Winter flounder	ST3	10.62
14-May-08	LB-5	Atlantic menhaden	Egg	43.36
14-May-08	LB-5	Bay anchovy	Egg	346.85
14-May-08	LB-5	Wrasses	Egg	3771.99
14-May-08	LB-5	Searobin species	Egg	130.07
14-May-08	LB-5	Windowpane	Egg	997.19
14-May-08	LB-5	Windowpane	PYS	178.84
14-May-08	LB-5	Winter flounder	ST3	319.75
14-May-08	LB-5	Winter flounder	ST4	10.84
14-May-08	LB-6	Wrasses	Egg	1145.90
14-May-08	LB-6	Searobin species	Egg	520.86
14-May-08	LB-6	Windowpane	Egg	2916.84
14-May-08	LB-6	Windowpane	PYS	553.42
14-May-08	LB-6	Winter flounder	ST3	78.13
14-May-08	LB-6	Winter flounder	ST4	32.55
14-May-08	LB-12	Bay anchovy	Egg	679.97
14-May-08	LB-12	Fourbeard rockling	PYS	5.31
14-May-08	LB-12	Wrasses	Egg	6459.73
14-May-08	LB-12	Searobin species	Egg	4759.80
14-May-08	LB-12	Windowpane	Egg	9519.60
14-May-08	LB-12	Windowpane	PYS	828.72
14-May-08	LB-12	Winter flounder	ST3	111.56
14-May-08	LB-12	Winter flounder	ST4	5.31
14-May-08	LB-4	Atlantic silverside	PYS	5.38
14-May-08	LB-4	Bay anchovy	Egg	86.15
14-May-08	LB-4	Fourbeard rockling	PYS	10.77
14-May-08	LB-4	Wrasses	Egg	1636.78
14-May-08	LB-4	Searobin species	Egg	1292.19
14-May-08	LB-4	Windowpane	Egg	2584.39
14-May-08	LB-4	Windowpane	PYS	382.27
14-May-08	LB-4	Winter flounder	ST3	279.98
14-May-08	LB-3	Bay anchovy	Egg	446.25
14-May-08	LB-3	Fourbeard rockling	PYS	11.16

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Date	Station	Common Name	LifeStage	Density
14-May-08	LB-3	Wrasses	Egg	7586.24
14-May-08	LB-3	Windowpane	Egg	3034.50
14-May-08	LB-3	Windowpane	PYS	334.69
14-May-08	LB-3	Winter flounder	ST3	953.86
14-May-08	LB-7	Fourbeard rockling	PYS	5.72
14-May-08	LB-7	Wrasses	Egg	685.93
14-May-08	LB-7	Searobin species	Egg	114.32
14-May-08	LB-7	Windowpane	Egg	1028.90
14-May-08	LB-7	Windowpane	PYS	68.59
14-May-08	LB-7	Winter flounder	ST3	137.19
15-May-08	LB-13	Bay anchovy	Egg	93.46
15-May-08	LB-13	Wrasses	Egg	373.84
15-May-08	LB-13	Searobin species	Egg	654.21
15-May-08	LB-13	Windowpane	Egg	1028.05
15-May-08	LB-13	Windowpane	PYS	443.93
15-May-08	LB-13	Winter flounder	ST3	40.89
15-May-08	LB-1	Wrasses	Egg	755.77
15-May-08	LB-1	Searobin species	Egg	179.00
15-May-08	LB-1	Windowpane	Egg	1372.31
15-May-08	LB-1	Windowpane	PYS	39.78
15-May-08	LB-1	Winter flounder	ST3	9.94
15-May-08	LB-2	Fourbeard rockling	PYS	24.53
15-May-08	LB-2	Wrasses	Egg	507.00
15-May-08	LB-2	Searobin species	Egg	408.87
15-May-08	LB-2	Windowpane	Egg	981.29
15-May-08	LB-2	Windowpane	PYS	163.55
15-May-08	LB-2	Windowpane	YS	8.18
15-May-08	LB-2	Winter flounder	ST3	24.53
15-May-08	LB-14	Fourbeard rockling	PYS	28.70
15-May-08	LB-14	Wrasses	Egg	688.86
15-May-08	LB-14	Searobin species	Egg	574.05
15-May-08	LB-14	Windowpane	Egg	1416.00
15-May-08	LB-14	Windowpane	PYS	220.05
15-May-08	LB-14	Winter flounder	ST3	105.24
15-May-08	LB-9	Fourbeard rockling	PYS	16.60
15-May-08	LB-9	Wrasses	Egg	2523.39
15-May-08	LB-9	Searobin species	Egg	863.27
15-May-08	LB-9	Windowpane	Egg	1992.15
15-May-08	LB-9	Windowpane	PYS	16.60

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Date	Station	Common Name	LifeStage	Density
15-May-08	LB-9	Winter flounder	ST3	8.30
15-May-08	LB-10	Atlantic menhaden	Egg	91.67
15-May-08	LB-10	Fourbeard rockling	PYS	5.73
15-May-08	LB-10	Wrasses	Egg	2016.71
15-May-08	LB-10	Searobin species	Egg	2016.71
15-May-08	LB-10	Windowpane	Egg	5408.45
15-May-08	LB-10	Windowpane	PYS	103.13
15-May-08	LB-10	Windowpane	YS	5.73
15-May-08	LB-10	Winter flounder	ST3	28.65
15-May-08	KVK-2	Wrasses	Egg	558.90
15-May-08	KVK-2	Searobin species	Egg	156.49
15-May-08	KVK-2	Windowpane	Egg	625.97
15-May-08	KVK-2	Windowpane	PYS	27.94
15-May-08	KVK-2	Winter flounder	ST3	11.18
16-May-08	SB-6	Fourbeard rockling	PYS	19.05
16-May-08	SB-6	Wrasses	Egg	704.86
16-May-08	SB-6	Searobin species	Egg	247.65
16-May-08	SB-6	Windowpane	Egg	971.56
16-May-08	SB-6	Windowpane	PYS	119.06
16-May-08	SB-6	Winter flounder	ST3	23.81
16-May-08	SB-4	Bay anchovy	Egg	45.27
16-May-08	SB-4	Fourbeard rockling	PYS	5.66
16-May-08	SB-4	Wrasses	Egg	565.93
16-May-08	SB-4	Searobin species	Egg	135.82
16-May-08	SB-4	Windowpane	Egg	905.49
16-May-08	SB-4	Windowpane	PYS	73.57
16-May-08	SB-4	Winter flounder	ST3	22.64
16-May-08	SB-3	Bay anchovy	Egg	87.17
16-May-08	SB-3	Fourbeard rockling	PYS	10.90
16-May-08	SB-3	Wrasses	Egg	784.57
16-May-08	SB-3	Windowpane	Egg	261.52
16-May-08	SB-3	Windowpane	PYS	65.38
16-May-08	SB-3	Windowpane	YS	5.45
16-May-08	KVK-1	Atlantic menhaden	Egg	21.21
16-May-08	KVK-1	Fourbeard rockling	PYS	5.30
16-May-08	KVK-1	Wrasses	Egg	254.56
16-May-08	KVK-1	Searobin species	Egg	148.50
16-May-08	KVK-1	Windowpane	Egg	657.62
16-May-08	KVK-1	Windowpane	PYS	37.12

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Date	Station	Common Name	LifeStage	Density
16-May-08	KVK-1	Winter flounder	ST3	26.52
16-May-08	PJ-1	Fourbeard rockling	PYS	5.11
16-May-08	PJ-1	Wrasses	Egg	1043.02
16-May-08	PJ-1	Windowpane	PYS	76.69
16-May-08	PJ-1	Winter flounder	ST3	5.11
16-May-08	SB-5	Wrasses	Egg	34.41
16-May-08	SB-5	Windowpane	Egg	22.94
27-May-08	SB-3	Wrasses	Egg	240.32
27-May-08	SB-3	Searobin species	Egg	76.90
27-May-08	SB-3	Windowpane	Egg	269.16
27-May-08	SB-3	Windowpane	PYS	4.81
27-May-08	SB-4	Wrasses	Egg	102.92
27-May-08	SB-4	Windowpane	Egg	51.46
27-May-08	SB-4	Windowpane	PYS	6.43
27-May-08	AK-3	Wrasses	Egg	1892.35
27-May-08	AK-3	Windowpane	Egg	86.02
27-May-08	AK-2	Wrasses	Egg	388.68
27-May-08	AK-2	Windowpane	Egg	10.80
27-May-08	AK-2	Winter flounder	ST3	5.40
27-May-08	NB-4	Wrasses	Egg	383.63
27-May-08	NB-4	Windowpane	PYS	11.28
27-May-08	NB-7	Wrasses	Egg	561.18
28-May-08	PJ-1	Atlantic menhaden	Egg	143.50
28-May-08	PJ-1	Bay anchovy	Egg	20.50
28-May-08	PJ-1	Wrasses	Egg	287.01
28-May-08	KVK-2	Atlantic menhaden	Egg	6.78
28-May-08	KVK-2	Bay anchovy	Egg	20.33
28-May-08	KVK-2	Fourbeard rockling	Egg	6.78
28-May-08	KVK-2	Wrasses	Egg	365.87
28-May-08	KVK-2	Searobin species	Egg	13.55
28-May-08	KVK-2	Windowpane	Egg	54.20
28-May-08	KVK-1	Atlantic menhaden	Egg	51.00
28-May-08	KVK-1	Bay anchovy	Egg	5.10
28-May-08	KVK-1	Wrasses	Egg	76.49
28-May-08	KVK-1	Searobin species	Egg	10.20
28-May-08	KVK-1	Windowpane	Egg	10.20
28-May-08	KVK-1	Windowpane	PYS	5.10
28-May-08	SB-6	Atlantic menhaden	Egg	42.93
28-May-08	SB-6	Fourbeard rockling	Egg	14.31

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Date	Station	Common Name	LifeStage	Density
28-May-08	SB-6	Wrasses	Egg	329.16
28-May-08	SB-6	Windowpane	Egg	57.25
28-May-08	SB-6	Winter flounder	ST3	28.62
28-May-08	LB-8	Atlantic menhaden	Egg	18.03
28-May-08	LB-8	Bay anchovy	Egg	72.11
28-May-08	LB-8	Wrasses	Egg	378.59
28-May-08	LB-8	Windowpane	Egg	72.11
28-May-08	LB-7	Atlantic menhaden	Egg	19.44
28-May-08	LB-7	Bay anchovy	Egg	29.16
28-May-08	LB-7	Wrasses	Egg	242.97
28-May-08	LB-7	Windowpane	Egg	9.72
28-May-08	LB-9	Atlantic menhaden	Egg	113.77
28-May-08	LB-9	Bay anchovy	Egg	151.70
28-May-08	LB-9	Wrasses	Egg	493.02
28-May-08	LB-9	Searobin species	Egg	18.96
28-May-08	LB-9	Windowpane	Egg	56.89
28-May-08	LB-9	Windowpane	PYS	4.74
29-May-08	LB-13	Atlantic menhaden	Egg	448.08
29-May-08	LB-13	Bay anchovy	Egg	784.15
29-May-08	LB-13	Wrasses	Egg	280.05
29-May-08	LB-13	Searobin species	Egg	56.01
29-May-08	LB-4	Bay anchovy	Egg	1293.40
29-May-08	LB-4	Wrasses	Egg	223.00
29-May-08	LB-4	Windowpane	Egg	44.60
29-May-08	LB-5	Atlantic menhaden	Egg	434.07
29-May-08	LB-5	Bay anchovy	Egg	3646.16
29-May-08	LB-5	Fourbeard rockling	Egg	86.81
29-May-08	LB-5	Wrasses	Egg	173.63
29-May-08	LB-5	Spot	PYS	5.43
29-May-08	LB-5	Windowpane	PYS	5.43
29-May-08	LB-6	Atlantic menhaden	Egg	448.39
29-May-08	LB-6	Bay anchovy	Egg	3138.74
29-May-08	LB-6	Wrasses	Egg	448.39
29-May-08	LB-3	American shad	Egg	84.43
29-May-08	LB-3	Bay anchovy	Egg	168.87
29-May-08	LB-3	Wrasses	Egg	548.82
29-May-08	LB-3	Searobin species	Egg	21.11
29-May-08	LB-3	Windowpane	Egg	63.33
29-May-08	PJ-3	Atlantic menhaden	Egg	494.08

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
29-May-08	PJ-3	Bay anchovy	Egg	64.44
29-May-08	PJ-3	Wrasses	Egg	279.26
30-May-08	PJ-2	Atlantic menhaden	Egg	249.08
30-May-08	PJ-2	Wrasses	Egg	830.25
30-May-08	LB-14	Atlantic menhaden	Egg	87.43
30-May-08	LB-14	Bay anchovy	Egg	21.86
30-May-08	LB-14	Wrasses	Egg	393.42
30-May-08	LB-14	Windowpane	Egg	109.28
30-May-08	LB-2	Atlantic menhaden	Egg	153.50
30-May-08	LB-2	Bay anchovy	Egg	17.06
30-May-08	LB-2	Fourbeard rockling	Egg	17.06
30-May-08	LB-2	Wrasses	Egg	341.11
30-May-08	LB-2	Northern pipefish	PYS	8.53
30-May-08	LB-2	Searobin species	Egg	34.11
30-May-08	LB-2	Windowpane	Egg	119.39
30-May-08	LB-1	Atlantic menhaden	Egg	473.34
30-May-08	LB-1	Wrasses	Egg	90.16
30-May-08	LB-1	Searobin species	Egg	90.16
30-May-08	LB-1	Winter flounder	ST3	5.63
30-May-08	LB-10	Atlantic menhaden	Egg	97.92
30-May-08	LB-10	Bay anchovy	Egg	24.48
30-May-08	LB-10	Wrasses	Egg	660.93
30-May-08	LB-10	Northern pipefish	PYS	12.24
30-May-08	LB-10	Searobin species	Egg	48.96
30-May-08	LB-10	Windowpane	Egg	122.39
30-May-08	LB-10	Windowpane	PYS	18.36
09-Jun-08	LB-13	Atlantic menhaden	Egg	460.54
09-Jun-08	LB-13	Bay anchovy	Egg	3147.03
09-Jun-08	LB-13	Wrasses	Egg	1918.92
09-Jun-08	LB-13	Northern pipefish	PYS	14.39
09-Jun-08	LB-13	Searobin species	Egg	76.76
09-Jun-08	LB-13	Windowpane	Egg	153.51
09-Jun-08	LB-13	Windowpane	PYS	9.59
09-Jun-08	LB-12	Atlantic menhaden	Egg	560.63
09-Jun-08	LB-12	Bay anchovy	Egg	8970.08
09-Jun-08	LB-12	Wrasses	Egg	1681.89
09-Jun-08	LB-12	Northern pipefish	PYS	4.38
09-Jun-08	LB-12	Searobin species	Egg	560.63
09-Jun-08	LB-12	Windowpane	Egg	1121.26

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
09-Jun-08	LB-4	Atlantic menhaden	Egg	136.62
09-Jun-08	LB-4	Atlantic menhaden	PYS	4.27
09-Jun-08	LB-4	Bay anchovy	Egg	1297.93
09-Jun-08	LB-4	Fourbeard rockling	PYS	4.27
09-Jun-08	LB-4	Wrasses	Egg	614.81
09-Jun-08	LB-4	Northern pipefish	PYS	38.43
09-Jun-08	LB-4	Searobin species	Egg	68.31
09-Jun-08	LB-4	Windowpane	Egg	204.94
09-Jun-08	LB-4	Windowpane	PYS	8.54
09-Jun-08	LB-6	Bay anchovy	Egg	6062.41
09-Jun-08	LB-6	Northern pipefish	PYS	11.84
09-Jun-08	LB-6	Searobin species	Egg	2526.01
09-Jun-08	LB-6	Windowpane	PYS	7.89
09-Jun-08	LB-5	Bay anchovy	Egg	11664.31
09-Jun-08	LB-5	Fourbeard rockling	Egg	416.58
09-Jun-08	LB-3	Bay anchovy	Egg	6958.02
09-Jun-08	LB-8	Bay anchovy	Egg	4887.63
09-Jun-08	LB-8	Fourbeard rockling	Egg	181.02
09-Jun-08	LB-8	Wrasses	Egg	905.12
09-Jun-08	LB-8	Northern pipefish	PYS	11.31
09-Jun-08	LB-8	Windowpane	PYS	11.31
09-Jun-08	LB-7	Bay anchovy	Egg	675.81
09-Jun-08	LB-7	Wrasses	Egg	511.42
09-Jun-08	LB-7	Northern pipefish	PYS	54.80
09-Jun-08	LB-7	Windowpane	PYS	36.53
09-Jun-08	LB-2	Atlantic menhaden	Egg	85.84
09-Jun-08	LB-2	Bay anchovy	Egg	743.98
09-Jun-08	LB-2	Wrasses	Egg	1173.20
09-Jun-08	LB-2	Northern pipefish	PYS	7.15
09-Jun-08	LB-2	Windowpane	Egg	57.23
09-Jun-08	LB-2	Windowpane	PYS	28.61
09-Jun-08	LB-1	Atlantic menhaden	Egg	53.31
09-Jun-08	LB-1	Bay anchovy	Egg	1226.23
09-Jun-08	LB-1	Wrasses	Egg	1119.60
09-Jun-08	LB-1	Searobin species	Egg	373.20
09-Jun-08	LB-1	Windowpane	Egg	106.63
09-Jun-08	LB-1	Windowpane	PYS	6.66
09-Jun-08	LB-9	Atlantic menhaden	Egg	28.40
09-Jun-08	LB-9	Bay anchovy	Egg	1050.98

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Date	Station	Common Name	LifeStage	Density
09-Jun-08	LB-9	Wrasses	Egg	596.50
09-Jun-08	LB-9	Northern pipefish	PYS	21.30
09-Jun-08	LB-9	Searobin species	Egg	28.40
09-Jun-08	LB-9	Windowpane	Egg	28.40
09-Jun-08	LB-9	Windowpane	PYS	7.10
10-Jun-08	SB-3	Atlantic menhaden	Egg	287.47
10-Jun-08	SB-3	Bay anchovy	Egg	2299.74
10-Jun-08	SB-3	Wrasses	Egg	646.80
10-Jun-08	SB-3	Northern pipefish	PYS	4.49
10-Jun-08	SB-3	Windowpane	Egg	143.73
10-Jun-08	SB-4	Atlantic menhaden	Egg	1395.49
10-Jun-08	SB-4	Bay anchovy	Egg	5116.81
10-Jun-08	SB-4	Cods and Haddocks	Egg	93.03
10-Jun-08	SB-4	Wrasses	Egg	2139.76
10-Jun-08	SB-4	Northern pipefish	PYS	5.81
10-Jun-08	SB-4	Searobin species	Egg	372.13
10-Jun-08	SB-4	Windowpane	Egg	1116.39
10-Jun-08	SB-6	Atlantic menhaden	Egg	297.11
10-Jun-08	SB-6	Atlantic menhaden	PYS	6.19
10-Jun-08	SB-6	Bay anchovy	Egg	3169.16
10-Jun-08	SB-6	Cods and Haddocks	Egg	99.04
10-Jun-08	SB-6	Wrasses	Egg	742.77
10-Jun-08	SB-6	Windowpane	Egg	396.14
11-Jun-08	PJ-2	Atlantic menhaden	PYS	5.65
11-Jun-08	PJ-2	Bay anchovy	Egg	5781.79
11-Jun-08	PJ-2	Bay anchovy	PYS	175.03
11-Jun-08	PJ-2	Wrasses	Egg	2168.17
11-Jun-08	PJ-2	Northern pipefish	PYS	11.29
11-Jun-08	PJ-2	Windowpane	PYS	5.65
11-Jun-08	SB-5	Atlantic menhaden	Egg	71.39
11-Jun-08	SB-5	Bay anchovy	Egg	2427.18
11-Jun-08	SB-5	Wrasses	Egg	1106.51
11-Jun-08	SB-5	Searobin species	Egg	249.86
11-Jun-08	SB-5	Windowpane	Egg	285.55
11-Jun-08	PJ-3	Atlantic menhaden	PYS	11.02
11-Jun-08	PJ-3	Bay anchovy	Egg	8288.20
11-Jun-08	PJ-3	Bay anchovy	PYS	16.53
11-Jun-08	PJ-3	Wrasses	Egg	705.38
11-Jun-08	PJ-3	Northern pipefish	PYS	22.04

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Date	Station	Common Name	LifeStage	Density
11-Jun-08	PJ-3	Weakfish	YS	5.51
11-Jun-08	PJ-1	Atlantic menhaden	PYS	6.32
11-Jun-08	PJ-1	Bay anchovy	Egg	3536.97
11-Jun-08	PJ-1	Bay anchovy	PYS	25.26
11-Jun-08	PJ-1	Wrasses	Egg	2930.63
11-Jun-08	PJ-1	Northern pipefish	PYS	37.90
11-Jun-08	LB-10	Bay anchovy	Egg	2832.71
11-Jun-08	LB-10	Bay anchovy	PYS	15.62
11-Jun-08	LB-10	Wrasses	Egg	1374.70
11-Jun-08	LB-10	Northern pipefish	PYS	20.83
11-Jun-08	LB-10	Searobin species	Egg	41.66
11-Jun-08	LB-10	Windowpane	PYS	15.62
11-Jun-08	LB-14	Bay anchovy	Egg	4011.59
11-Jun-08	LB-14	Fourbeard rockling	Egg	64.70
11-Jun-08	LB-14	Cods and Haddocks	Egg	129.41
11-Jun-08	LB-14	Wrasses	Egg	2458.72
11-Jun-08	LB-14	Northern pipefish	PYS	24.26
11-Jun-08	LB-14	Searobin species	Egg	1164.65
11-Jun-08	LB-14	Windowpane	PYS	32.35
11-Jun-08	KVK-2	Atlantic menhaden	Egg	22.17
11-Jun-08	KVK-2	Bay anchovy	Egg	2024.63
11-Jun-08	KVK-2	Cods and Haddocks	Egg	59.11
11-Jun-08	KVK-2	Goosefish	Egg	14.78
11-Jun-08	KVK-2	Wrasses	Egg	354.68
11-Jun-08	KVK-2	Searobin species	Egg	362.07
11-Jun-08	KVK-2	Windowpane	Egg	391.63
11-Jun-08	KVK-1	Atlantic menhaden	Egg	271.67
11-Jun-08	KVK-1	Bay anchovy	Egg	3740.75
11-Jun-08	KVK-1	Wrasses	Egg	940.41
11-Jun-08	KVK-1	Searobin species	Egg	5.22
11-Jun-08	KVK-1	Windowpane	Egg	355.27
11-Jun-08	AK-2	Atlantic menhaden	Egg	185.55
11-Jun-08	AK-2	Bay anchovy	Egg	4545.86
11-Jun-08	AK-2	Wrasses	Egg	1484.36
11-Jun-08	AK-2	Northern pipefish	PYS	5.80
11-Jun-08	AK-3	Atlantic menhaden	PYS	14.58
11-Jun-08	AK-3	Atlantic menhaden	YS	4.86
11-Jun-08	AK-3	Bay anchovy	Egg	11042.51
11-Jun-08	AK-3	Bay anchovy	PYS	58.32

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Date	Station	Common Name	LifeStage	Density
11-Jun-08	AK-3	Clupeiforms	UID	24.30
11-Jun-08	AK-3	Gobies	PYS	4.86
11-Jun-08	AK-3	Wrasses	Egg	2332.92
11-Jun-08	AK-3	Northern pipefish	PYS	4.86
11-Jun-08	AK-3	Tautog	UID	4.86
11-Jun-08	NB-4	Atlantic menhaden	PYS	5.50
11-Jun-08	NB-4	Bay anchovy	Egg	65860.51
11-Jun-08	NB-4	Bay anchovy	PYS	16.51
11-Jun-08	NB-4	Clupeiforms	UID	38.52
11-Jun-08	NB-4	Wrasses	Egg	352.20
11-Jun-08	NB-4	Northern pipefish	PYS	77.04
11-Jun-08	NB-7	Bay anchovy	Egg	21077.97
11-Jun-08	NB-7	Wrasses	Egg	1059.19
11-Jun-08	NB-7	Northern pipefish	PYS	59.58
23-Jun-08	SB-6	Atlantic menhaden	PYS	22.00
23-Jun-08	SB-6	Atlantic menhaden	YS	44.00
23-Jun-08	SB-6	Bay anchovy	Egg	6217.99
23-Jun-08	SB-6	Bay anchovy	PYS	828.58
23-Jun-08	SB-6	Clupeiforms	UID	80.66
23-Jun-08	SB-6	Cunner	PYS	7.33
23-Jun-08	SB-6	Cods and Haddocks	Egg	117.32
23-Jun-08	SB-6	Gobies	PYS	73.33
23-Jun-08	SB-6	Goosefish	Egg	117.32
23-Jun-08	SB-6	Wrasses	Egg	8681.72
23-Jun-08	SB-6	Searobin species	Egg	1877.13
23-Jun-08	SB-6	Tautog	YS	7.33
23-Jun-08	SB-6	Weakfish	PYS	7.33
23-Jun-08	SB-6	Windowpane	Egg	1407.85
23-Jun-08	SB-6	Windowpane	PYS	7.33
23-Jun-08	SB-4	Atlantic menhaden	Egg	1177.06
23-Jun-08	SB-4	Atlantic menhaden	PYS	24.52
23-Jun-08	SB-4	Atlantic menhaden	YS	159.39
23-Jun-08	SB-4	Bay anchovy	Egg	18048.26
23-Jun-08	SB-4	Bay anchovy	PYS	1569.41
23-Jun-08	SB-4	Bay anchovy	YS	159.39
23-Jun-08	SB-4	Clupeiforms	UID	36.78
23-Jun-08	SB-4	Gobies	PYS	318.79
23-Jun-08	SB-4	Gobies	YS	12.26
23-Jun-08	SB-4	Wrasses	Egg	16086.49

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Date	Station	Common Name	LifeStage	Density
23-Jun-08	SB-4	Northern pipefish	JUV	36.78
23-Jun-08	SB-4	Northern pipefish	PYS	12.26
23-Jun-08	SB-4	Searobin species	Egg	4708.24
23-Jun-08	SB-4	Tautog	PYS	36.78
23-Jun-08	SB-4	Tautog	YS	24.52
23-Jun-08	SB-4	Weakfish	PYS	12.26
23-Jun-08	SB-3	Atlantic menhaden	Egg	2273.26
23-Jun-08	SB-3	Atlantic menhaden	PYS	94.72
23-Jun-08	SB-3	Bay anchovy	Egg	44707.45
23-Jun-08	SB-3	Bay anchovy	PYS	15439.22
23-Jun-08	SB-3	Clupeiforms	PYS	4735.96
23-Jun-08	SB-3	Cunner	PYS	94.72
23-Jun-08	SB-3	Feather blenny	PYS	94.72
23-Jun-08	SB-3	Gobies	PYS	1704.95
23-Jun-08	SB-3	Wrasses	Egg	28036.87
23-Jun-08	SB-3	Northern pipefish	PYS	94.72
23-Jun-08	SB-3	Tautog	PYS	284.16
23-Jun-08	SB-3	Weakfish	PYS	94.72
23-Jun-08	SB-5	Bay anchovy	Egg	3540.68
23-Jun-08	SB-5	Bay anchovy	PYS	169.92
23-Jun-08	SB-5	Clupeiforms	UID	55.32
23-Jun-08	SB-5	Gobies	PYS	63.23
23-Jun-08	SB-5	Wrasses	Egg	1770.34
23-Jun-08	SB-5	Northern pipefish	JUV	7.90
23-Jun-08	SB-5	Northern pipefish	PYS	15.81
23-Jun-08	SB-5	Northern puffer	PYS	3.95
23-Jun-08	SB-5	Tautog	PYS	3.95
23-Jun-08	SB-5	Weakfish	PYS	7.90
23-Jun-08	SB-5	Windowpane	PYS	3.95
23-Jun-08	PJ-1	Bay anchovy	Egg	6747.40
23-Jun-08	PJ-1	Bay anchovy	PYS	494.70
23-Jun-08	PJ-1	Clupeiforms	UID	324.39
23-Jun-08	PJ-1	Feather blenny	PYS	8.11
23-Jun-08	PJ-1	Gobies	PYS	113.54
23-Jun-08	PJ-1	Wrasses	Egg	2335.64
23-Jun-08	PJ-1	Northern pipefish	PYS	89.21
23-Jun-08	PJ-1	Tautog	PYS	16.22
23-Jun-08	KVK-2	Atlantic mackerel	PYS	71.99
23-Jun-08	KVK-2	Atlantic menhaden	Egg	71.99

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Date	Station	Common Name	LifeStage	Density
23-Jun-08	KVK-2	Atlantic menhaden	PYS	71.99
23-Jun-08	KVK-2	Bay anchovy	Egg	5183.45
23-Jun-08	KVK-2	Bay anchovy	PYS	13750.55
23-Jun-08	KVK-2	Clupeiforms	UID	647.93
23-Jun-08	KVK-2	Gobies	PYS	503.95
23-Jun-08	KVK-2	Wrasses	Egg	3599.62
23-Jun-08	KVK-2	Northern pipefish	PYS	287.97
23-Jun-08	KVK-2	Searobin species	Egg	287.97
23-Jun-08	KVK-2	Tautog	PYS	143.98
23-Jun-08	KVK-2	Weakfish	PYS	215.98
23-Jun-08	KVK-2	Windowpane	Egg	359.96
23-Jun-08	KVK-2	Windowpane	PYS	71.99
23-Jun-08	KVK-1	Atlantic menhaden	Egg	85.15
23-Jun-08	KVK-1	Atlantic menhaden	YS	10.64
23-Jun-08	KVK-1	Bay anchovy	Egg	3491.32
23-Jun-08	KVK-1	Bay anchovy	PYS	170.31
23-Jun-08	KVK-1	Clupeiforms	UID	101.12
23-Jun-08	KVK-1	Wrasses	Egg	2384.31
23-Jun-08	KVK-1	Northern pipefish	PYS	5.32
23-Jun-08	KVK-1	Searobin species	Egg	1021.85
23-Jun-08	KVK-1	Weakfish	PYS	5.32
23-Jun-08	PJ-3	Atlantic menhaden	Egg	194.29
23-Jun-08	PJ-3	Bay anchovy	Egg	8548.56
23-Jun-08	PJ-3	Bay anchovy	PYS	2392.14
23-Jun-08	PJ-3	Clupeiforms	PYS	145.71
23-Jun-08	PJ-3	Cunner	PYS	12.14
23-Jun-08	PJ-3	Gobies	PYS	194.29
23-Jun-08	PJ-3	Wrasses	Egg	3885.71
23-Jun-08	PJ-3	Northern pipefish	PYS	36.43
23-Jun-08	PJ-3	Tautog	PYS	24.29
23-Jun-08	PJ-3	Tautog	YS	12.14
23-Jun-08	PJ-3	Weakfish	PYS	12.14
23-Jun-08	PJ-2	Atlantic menhaden	Egg	183.35
23-Jun-08	PJ-2	Bay anchovy	Egg	8984.22
23-Jun-08	PJ-2	Bay anchovy	PYS	338.05
23-Jun-08	PJ-2	Bay anchovy	YS	11.46
23-Jun-08	PJ-2	Clupeiforms	UID	85.95
23-Jun-08	PJ-2	Cunner	PYS	5.73
23-Jun-08	PJ-2	Gobies	PYS	257.84

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Date	Station	Common Name	LifeStage	Density
23-Jun-08	PJ-2	Wrasses	Egg	1650.16
23-Jun-08	PJ-2	Northern pipefish	PYS	17.19
23-Jun-08	PJ-2	Weakfish	PYS	5.73
23-Jun-08	PJ-2	Windowpane	PYS	5.73
24-Jun-08	LB-10	Atlantic menhaden	Egg	137.51
24-Jun-08	LB-10	Atlantic menhaden	PYS	17.19
24-Jun-08	LB-10	Bay anchovy	Egg	4125.17
24-Jun-08	LB-10	Bay anchovy	PYS	5706.48
24-Jun-08	LB-10	Clupeiforms	UID	240.63
24-Jun-08	LB-10	Cunner	PYS	85.94
24-Jun-08	LB-10	Feather blenny	PYS	17.19
24-Jun-08	LB-10	Gobies	PYS	309.39
24-Jun-08	LB-10	Goosefish	Egg	137.51
24-Jun-08	LB-10	Wrasses	Egg	2406.35
24-Jun-08	LB-10	Searobin species	Egg	1168.80
24-Jun-08	LB-10	Tautog	PYS	34.38
24-Jun-08	LB-1	Bay anchovy	Egg	1482.50
24-Jun-08	LB-1	Bay anchovy	PYS	782.43
24-Jun-08	LB-1	Clupeiforms	UID	159.57
24-Jun-08	LB-1	Cunner	PYS	10.30
24-Jun-08	LB-1	Gobies	PYS	41.18
24-Jun-08	LB-1	Wrasses	Egg	658.89
24-Jun-08	LB-1	Northern pipefish	JUV	5.15
24-Jun-08	LB-1	Northern pipefish	PYS	25.74
24-Jun-08	LB-1	Searobin species	Egg	700.07
24-Jun-08	LB-1	Windowpane	PYS	5.15
24-Jun-08	LB-2	Atlantic menhaden	PYS	16.61
24-Jun-08	LB-2	Bay anchovy	Egg	4917.39
24-Jun-08	LB-2	Bay anchovy	PYS	1221.04
24-Jun-08	LB-2	Butterfish	PYS	8.31
24-Jun-08	LB-2	Clupeiforms	UID	323.95
24-Jun-08	LB-2	Cunner	PYS	33.23
24-Jun-08	LB-2	Gobies	PYS	8.31
24-Jun-08	LB-2	Wrasses	Egg	3854.17
24-Jun-08	LB-2	Northern pipefish	JUV	8.31
24-Jun-08	LB-2	Northern pipefish	PYS	16.61
24-Jun-08	LB-2	Searobin species	Egg	1063.22
24-Jun-08	LB-9	Atlantic menhaden	PYS	28.80
24-Jun-08	LB-9	Bay anchovy	Egg	6481.07

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
24-Jun-08	LB-9	Bay anchovy	PYS	5127.25
24-Jun-08	LB-9	Clupeiforms	UID	921.75
24-Jun-08	LB-9	Cunner	PYS	115.22
24-Jun-08	LB-9	Wrasses	Egg	4032.67
24-Jun-08	LB-9	Northern pipefish	PYS	28.80
24-Jun-08	LB-9	Searobin species	Egg	288.05
24-Jun-08	LB-9	Tautog	PYS	28.80
24-Jun-08	LB-9	Weakfish	PYS	28.80
24-Jun-08	LB-14	Bay anchovy	Egg	4476.71
24-Jun-08	LB-14	Bay anchovy	PYS	3739.37
24-Jun-08	LB-14	Clupeiforms	UID	1448.35
24-Jun-08	LB-14	Cunner	PYS	26.33
24-Jun-08	LB-14	Gobies	PYS	52.67
24-Jun-08	LB-14	Wrasses	Egg	3555.03
24-Jun-08	LB-14	Northern pipefish	JUV	26.33
24-Jun-08	LB-14	Northern pipefish	PYS	52.67
24-Jun-08	LB-14	Searobin species	Egg	658.34
24-Jun-08	LB-14	Tautog	PYS	26.33
24-Jun-08	AK-2	Atlantic menhaden	YS	19.28
24-Jun-08	AK-2	Bay anchovy	Egg	22207.81
24-Jun-08	AK-2	Bay anchovy	PYS	302.02
24-Jun-08	AK-2	Bay anchovy	YS	44.98
24-Jun-08	AK-2	Clupeiforms	UID	44.98
24-Jun-08	AK-2	Cunner	PYS	6.43
24-Jun-08	AK-2	Gobies	PYS	584.75
24-Jun-08	AK-2	Wrasses	Egg	7813.86
24-Jun-08	AK-2	Northern pipefish	PYS	57.83
24-Jun-08	AK-2	Searobin species	Egg	822.51
24-Jun-08	AK-2	Tautog	YS	6.43
24-Jun-08	AK-2	Weakfish	PYS	6.43
24-Jun-08	AK-3	Atlantic menhaden	YS	17.17
24-Jun-08	AK-3	Bay anchovy	Egg	19568.63
24-Jun-08	AK-3	Bay anchovy	PYS	454.88
24-Jun-08	AK-3	Bay anchovy	YS	17.17
24-Jun-08	AK-3	Clupeiforms	UID	60.08
24-Jun-08	AK-3	Gobies	PYS	1201.58
24-Jun-08	AK-3	Gobies	YS	25.75
24-Jun-08	AK-3	Wrasses	Egg	3948.06
24-Jun-08	AK-3	Northern pipefish	JUV	25.75

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
24-Jun-08	AK-3	Northern pipefish	PYS	77.24
24-Jun-08	AK-3	Tautog	PYS	17.17
24-Jun-08	NB-4	Atlantic menhaden	PYS	11.14
24-Jun-08	NB-4	Bay anchovy	Egg	67219.06
24-Jun-08	NB-4	Bay anchovy	PYS	284.17
24-Jun-08	NB-4	Clupeiforms	UID	27.86
24-Jun-08	NB-4	Feather blenny	PYS	5.57
24-Jun-08	NB-4	Gobies	PYS	261.88
24-Jun-08	NB-4	Wrasses	Egg	713.20
24-Jun-08	NB-4	Northern pipefish	PYS	72.43
24-Jun-08	NB-4	Tautog	PYS	22.29
24-Jun-08	NB-4	Weakfish	PYS	33.43
24-Jun-08	NB-7	Bay anchovy	Egg	48214.76
24-Jun-08	NB-7	Bay anchovy	PYS	47.64
24-Jun-08	NB-7	Clupeiforms	UID	41.69
24-Jun-08	NB-7	Gobies	PYS	172.71
24-Jun-08	NB-7	Wrasses	Egg	3430.30
24-Jun-08	NB-7	Northern pipefish	PYS	35.73
24-Jun-08	NB-7	Northern puffer	PYS	5.96
24-Jun-08	NB-7	Tautog	PYS	23.82
24-Jun-08	NB-7	Weakfish	PYS	29.78
25-Jun-08	LB-13	Atlantic menhaden	PYS	37.16
25-Jun-08	LB-13	Bay anchovy	Egg	14268.16
25-Jun-08	LB-13	Bay anchovy	PYS	7914.37
25-Jun-08	LB-13	Clupeiforms	UID	1374.80
25-Jun-08	LB-13	Cunner	PYS	74.31
25-Jun-08	LB-13	Gobies	PYS	37.16
25-Jun-08	LB-13	Wrasses	Egg	2526.65
25-Jun-08	LB-13	Searobin species	Egg	891.76
25-Jun-08	LB-13	Searobin species	PYS	37.16
25-Jun-08	LB-13	Weakfish	PYS	148.63
25-Jun-08	LB-13	Windowpane	PYS	74.31
25-Jun-08	LB-4	Bay anchovy	Egg	2473.88
25-Jun-08	LB-4	Bay anchovy	PYS	2559.18
25-Jun-08	LB-4	Clupeiforms	UID	287.91
25-Jun-08	LB-4	Cunner	PYS	10.66
25-Jun-08	LB-4	Gobies	PYS	53.32
25-Jun-08	LB-4	Wrasses	Egg	597.14
25-Jun-08	LB-4	Northern kingfish	PYS	10.66

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
25-Jun-08	LB-4	Northern pipefish	PYS	10.66
25-Jun-08	LB-4	Searobin species	Egg	1023.67
25-Jun-08	LB-4	Tautog	PYS	42.65
25-Jun-08	LB-4	Weakfish	PYS	42.65
25-Jun-08	LB-12	Bay anchovy	Egg	6591.39
25-Jun-08	LB-12	Bay anchovy	PYS	8692.39
25-Jun-08	LB-12	Clupeiforms	UID	782.73
25-Jun-08	LB-12	Cunner	PYS	123.59
25-Jun-08	LB-12	Gobies	PYS	41.20
25-Jun-08	LB-12	Wrasses	Egg	1400.67
25-Jun-08	LB-12	Northern kingfish	PYS	82.39
25-Jun-08	LB-12	Searobin species	Egg	576.75
25-Jun-08	LB-12	Searobin species	PYS	41.20
25-Jun-08	LB-12	Tautog	PYS	123.59
25-Jun-08	LB-12	Weakfish	PYS	123.59
25-Jun-08	LB-6	Atlantic menhaden	Egg	4674.89
25-Jun-08	LB-6	Atlantic menhaden	YS	29.22
25-Jun-08	LB-6	Bay anchovy	Egg	98172.74
25-Jun-08	LB-6	Bay anchovy	PYS	4382.43
25-Jun-08	LB-6	Clupeiforms	UID	964.13
25-Jun-08	LB-6	Cunner	PYS	87.65
25-Jun-08	LB-6	Gobies	PYS	175.30
25-Jun-08	LB-6	Searobin species	Egg	4674.89
25-Jun-08	LB-6	Tautog	PYS	58.43
25-Jun-08	LB-6	Weakfish	PYS	175.30
25-Jun-08	LB-5	Bay anchovy	Egg	8524.13
25-Jun-08	LB-5	Bay anchovy	PYS	714.52
25-Jun-08	LB-5	Butterfish	PYS	6.27
25-Jun-08	LB-5	Clupeiforms	UID	213.10
25-Jun-08	LB-5	Cunner	PYS	6.27
25-Jun-08	LB-5	Gobies	PYS	169.23
25-Jun-08	LB-5	Wrasses	Egg	701.99
25-Jun-08	LB-5	Searobin species	Egg	701.99
25-Jun-08	LB-5	Searobin species	PYS	6.27
25-Jun-08	LB-5	Tautog	PYS	12.54
25-Jun-08	LB-5	Weakfish	PYS	62.68
25-Jun-08	LB-5	Windowpane	PYS	12.54
25-Jun-08	LB-3	Atlantic menhaden	PYS	11.25
25-Jun-08	LB-3	Bay anchovy	Egg	6482.58

Appendix B. Ichthyoplankton (epibenthic sled) life stage densities (Number per 1,000 m^3) by date and station collected during the 2008 Aquatic Biological Survey. ES1 to ES5 are winter flounder egg stages 1-5, WFNVE are winter flounder non-viable eggs, ST1 to ST4 are winter flounder larval life stages 1-4, YS is yolk-sac larvae, PYS is post yolk-sac larvae, JUV is juveniles, and UID is unidentified larval lifestage.

Date	Station	Common Name	LifeStage	Density
25-Jun-08	LB-3	Bay anchovy	PYS	540.20
25-Jun-08	LB-3	Black sea bass	PYS	11.25
25-Jun-08	LB-3	Clupeiforms	PYS	90.03
25-Jun-08	LB-3	Gobies	PYS	416.41
25-Jun-08	LB-3	Wrasses	Egg	720.29
25-Jun-08	LB-3	Northern pipefish	JUV	5.63
25-Jun-08	LB-3	Northern pipefish	PYS	5.63

Appendix C

Water quality data by date and station collected during the 2008 Aquatic Biological Survey

Date	Station	Temp. (°C)	DO (mg/L)	Cond. (uS/cm)	Salinity (ppt)	Depth (ft)
05-Feb-08	LB-12	4.7	11.5	39340	24.6	24
05-Feb-08	LB-13	4.7	10.1	40630	25.4	19
05-Feb-08	LB-3	5	10.4	36320	22.8	20
05-Feb-08	LB-4	5.3	9.8	46336	29.6	37
05-Feb-08	LB-5	4.6	10.4	35600	22	21
05-Feb-08	LB-6	4.7	10.1	25200	25.9	45
05-Feb-08	LB-9	5	9.7	42810	26.8	30
06-Feb-08	LB-1	5.6	10.4	44570	28.4	17
06-Feb-08	LB-10	6.1	10.4	43490	27.5	30
06-Feb-08	LB-11	5.5	10.2	42750	27	20
06-Feb-08	SB-3	5.4	10.4	35880	22.2	18
06-Feb-08	SB-4	5	10.2	36460	23.2	40
06-Feb-08	SB-6	5.5	10.4	40540	25.5	48
07-Feb-08	LB-14	5.7	10.2	45160	28.6	50
07-Feb-08	LB-2	5.9	10.2	46760	29.9	53
07-Feb-08	LB-7	5.9	10.21	45320	28.8	29
07-Feb-08	LB-8	5.5	9.94	42480	26.8	15
12-Feb-08	PJ-1	3.1	11.7	24880	14.8	19
12-Feb-08	PJ-2	2.9	11.8	22640	14.2	10
12-Feb-08	PJ-3	2	12.1	23130	13.7	9
12-Feb-08	PJ-4	4.5	10.22	41310	26.4	51
12-Feb-08	SB-5	4.4	10.68	36130	22.3	48
13-Feb-08	AK-2	4.2	7.8	33900	20.8	52
13-Feb-08	AK-3	4.2	7.95	29500	18.06	52
13-Feb-08	NB-4	3.5	8	24800	14.8	12
13-Feb-08	NB-7	3.7	8	26900	16	12
19-Feb-08	AK-2	4.2	10.9	26810	18	47
19-Feb-08	AK-3	4.2	10.9	28480	17.4	41
19-Feb-08	NB-4	3.9	12	16960	9.8	9
19-Feb-08	NB-7	4.1	11.3	25000	15	8
19-Feb-08	PJ-1	3.7	11.6	23850	14.2	7
19-Feb-08	PJ-4	4.7	10.2	39140	24	45
20-Feb-08	LB-8	4.3	11.4	35770	22.8	15
20-Feb-08	PJ-2	2.6	13	17400	10	10
20-Feb-08	PJ-3	3.5	12.5	28830	15.1	8
20-Feb-08	SB-3	3.6	12.2	25250	15.1	15
20-Feb-08	SB-4	4	11.4	30350	18.5	37
20-Feb-08	SB-6	4.3	11.5	34340	20.6	46
25-Feb-08	LB-12	4.8	9.3	43460	26.9	26
25-Feb-08	LB-13	4.7	9.4	43010	27.1	20
25-Feb-08	LB-3	4.4	9.6	40400	24.8	20
25-Feb-08	LB-4	5	9.1	46610	29.5	38
25-Feb-08	LB-5	4.3	9.7	39800	24.4	22
25-Feb-08	LB-6	4.3	9.6	39440	24.5	42
25-Feb-08	LB-7	5.3	9.5	42380	26.5	30

Date	Station	Temp. (°C)	DO (mg/L)	Cond. (uS/cm)	Salinity (ppt)	Depth (ft)
25-Feb-08	LB-9	4.3	9.7	39430	24.4	27
26-Feb-08	LB-1	4.7	9.6	46780	29.8	19
26-Feb-08	LB-10	4.6	9.9	42900	27	29
26-Feb-08	LB-11	4.4	9.7	39910	25	21
26-Feb-08	LB-14	5.6	9	49700	31.9	57
26-Feb-08	LB-2	5.7	8.9	50000	32.2	55
26-Feb-08	SB-5	4.9	9.1	45470	29	44
03-Mar-08	LB-12	5.6	9	47240	29.7	25
03-Mar-08	LB-13	5.3	10	43000	27	20
03-Mar-08	LB-3	4.7	10	40610	25.3	15
03-Mar-08	LB-4	5.7	9.2	47970	30.1	36
03-Mar-08	LB-5	5.4	9.7	41640	26.4	20
03-Mar-08	LB-6	5.9	8.5	48170	30.9	40
03-Mar-08	LB-7	5.7	9.1	45880	29.6	29
03-Mar-08	LB-8	4.6	10.5	37890	23.7	11
04-Mar-08	PJ-1	5.3	10.6	34580	21.5	13
04-Mar-08	PJ-2	4.7	11.6	28460	17.8	12
04-Mar-08	PJ-4	5.9	9	45820	29.4	47
04-Mar-08	SB-3	5.4	10	38080	23.9	17
04-Mar-08	SB-4	5.6	9.9	41360	25.9	38
04-Mar-08	SB-5	5.9	9.6	45980	29.3	50
04-Mar-08	SB-6	5.9	9.4	45190	28.8	47
06-Mar-08	LB-1	5.8	8.3	42990	27.2	16
06-Mar-08	LB-10	5.5	8.6	39260	24.6	26
06-Mar-08	LB-11	5.5	8.6	39230	24.5	16
06-Mar-08	LB-14	6.1	8.3	47110	30.1	50
06-Mar-08	LB-2	5.9	8.3	45820	29.3	53
06-Mar-08	LB-9	5.5	8.7	40160	25.2	25
07-Mar-08	AK-2	5.9	9.5	27890	17	43
07-Mar-08	AK-3	6.1	9.3	28190	17.2	40
07-Mar-08	NB-4	6	9.5	25470	15.5	10
07-Mar-08	NB-7	5.7	9.7	26940	16.3	11
07-Mar-08	PJ-3	5	11.4	28760	15.2	14
17-Mar-08	PJ-1	4.8	14.5	23650	14.3	12
17-Mar-08	PJ-2	4.3	12.4	19460	11.4	10
17-Mar-08	PJ-4	6.1	8.8	40600	25.5	48
17-Mar-08	SB-3	5.8	9.9	30020	18.4	17
17-Mar-08	SB-4	5.9	9.5	36350	24.5	38
17-Mar-08	SB-5	5.7	10.7	35360	19.6	51
17-Mar-08	SB-6	5.8	10.3	31290	17.5	48
18-Mar-08	LB-11	5.7	9	36160	22.5	18
18-Mar-08	LB-12	6	8.6	44600	28.3	26
18-Mar-08	LB-13	5.9	8.7	41250	26.2	18
18-Mar-08	LB-3	5.6	9.6	32460	20.6	19
18-Mar-08	LB-4	6	8.4	46780	29.9	37

Date	Station	Temp. (°C)	DO (mg/L)	Cond. (uS/cm)	Salinity (ppt)	Depth (ft)
18-Mar-08	LB-5	5.3	9.3	29960	18.3	21
18-Mar-08	LB-6	6.1	8.3	45300	28.8	45
19-Mar-08	AK-2	5.9	9.6	34400	21.4	46
19-Mar-08	AK-3	6	9.7	31670	19.6	46
19-Mar-08	NB-4	6.1	10.1	26370	15.9	12
19-Mar-08	NB-7	6.1	10	26330	16.2	10
19-Mar-08	PJ-3	5.6	11	27540	16.6	14
24-Mar-08	LB-1	6.1	9.1	46530	29.7	20
24-Mar-08	LB-10	6.1	8.9	39940	25.1	31
24-Mar-08	LB-14	6.4	8.7	46820	29.9	51
24-Mar-08	LB-2	6.1	8.9	48530	30.9	50
24-Mar-08	LB-7	5.8	9	42650	27	30
24-Mar-08	LB-8	6.1	9.3	32750	23.3	18
24-Mar-08	LB-9	5.9	9	36680	22.9	28
31-Mar-08	KVK-1	6.4	8.5	45620	29.1	52
31-Mar-08	KVK-2	6.4	8.5	46390	29.7	49
31-Mar-08	PJ-1	6.1	10.7	23600	13.9	12
31-Mar-08	PJ-2	6.1	10	16690	10.2	10
31-Mar-08	PJ-3	6	9.7	22690	13.6	9
31-Mar-08	PJ-4	6.3	8.3	45740	29.4	47
31-Mar-08	SB-3	6.1	9.2	35630	20.9	18
31-Mar-08	SB-4	6.2	8.7	46680	29.8	38
31-Mar-08	SB-5	6.3	8.6	46440	29.7	45
31-Mar-08	SB-6	6.3	9.1	46250	29.6	49
03-Apr-08	LB-1	6.9	10.2	36580	24.5	15
03-Apr-08	LB-10	6.6	9.8	41130	25.7	29
03-Apr-08	LB-11	6.8	10.3	36810	23	15
03-Apr-08	LB-12	6.9	9.6	43010	27.3	23
03-Apr-08	LB-13	7	9.8	39300	24.9	17
03-Apr-08	LB-14	6.7	9.8	44500	28.4	49
03-Apr-08	LB-2	6.7	9.6	46710	29.9	49
03-Apr-08	LB-3	6.7	9.5	40520	25.5	16
03-Apr-08	LB-4	6.8	9.4	44760	28.4	35
03-Apr-08	LB-5	7.3	10.6	33060	20.6	20
03-Apr-08	LB-6	6.9	9.8	41790	26.5	44
03-Apr-08	LB-7	6.6	9.9	44170	28.1	30
03-Apr-08	LB-8	7.3	10.2	33870	21.2	14
03-Apr-08	LB-9	6.7	10.3	35590	22.4	23
04-Apr-08	AK-2	7.5	10.4	30520	17.9	48
04-Apr-08	AK-3	8.1	10.5	28380	17.4	48
04-Apr-08	NB-4	7.8	10.3	27160	16.6	11
04-Apr-08	NB-7	7.4	10.4	28050	16.9	8
14-Apr-08	LB-12	9	7.8	32460	20.2	27
14-Apr-08	LB-13	8.7	7.5	38650	24.3	22
14-Apr-08	LB-3	9	7.7	36860	20.6	15

Date	Station	Temp. (°C)	DO (mg/L)	Cond. (uS/cm)	Salinity (ppt)	Depth (ft)
14-Apr-08	LB-4	9	7.8	32460	20.2	39
14-Apr-08	LB-5	8.9	7.5	33020	20.6	19
14-Apr-08	LB-6	8	7.4	45570	29.1	44
14-Apr-08	LB-7	8.4	7.7	42400	27.1	28
14-Apr-08	LB-8	8.7	7.8	35740	22.6	11
15-Apr-08	LB-1	8.6	8.9	42160	26.9	16
15-Apr-08	LB-10	8.2	9.1	44040	26.7	29
15-Apr-08	LB-14	8.5	9.3	38500	23	50
15-Apr-08	LB-2	8.3	9.1	42420	28	51
15-Apr-08	LB-9	8.5	9.7	38640	23.4	25
15-Apr-08	PJ-2	9.7	10	17060	10	11
16-Apr-08	KVK-1	8.8	8.1	41040	26.3	50
16-Apr-08	KVK-2	8.6	8.2	40770	25.3	50
16-Apr-08	PJ-3	8.8	10.1	30140	18.7	9
16-Apr-08	SB-3	9	9.2	27800	17.5	18
16-Apr-08	SB-4	8.8	8.4	26890	24.8	38
16-Apr-08	SB-5	8.7	8.3	34320	22.9	46
16-Apr-08	SB-6	8.2	8.2	43810	28	48
17-Apr-08	AK-2	9.7	8.9	30180	18.7	46
17-Apr-08	AK-3	9.8	8.6	29050	17.7	43
17-Apr-08	NB-4	10.4	9.4	25280	15.4	10
17-Apr-08	NB-7	10	9.4	27010	16.4	8
17-Apr-08	PJ-1	9.5	9	24600	14.9	12
17-Apr-08	PJ-4	8.8	8.2	40300	25.6	46
28-Apr-08	AK-2	12.4	7.9	32550	20.7	49
28-Apr-08	AK-3	12	7.3	34820	22	49
28-Apr-08	NB-4	13.4	8.1	23620	14.6	8
28-Apr-08	NB-7	12.9	8.5	26340	16.1	8
29-Apr-08	KVK-1	11.7	7.6	42510	27.2	52
29-Apr-08	PJ-1	12.2	8.1	27590	17.1	12
29-Apr-08	PJ-2	12.7	9	18670	11.1	11
29-Apr-08	PJ-4	11.5	7.4	40670	25.8	45
29-Apr-08	SB-3	12.2	7.8	27490	17	20
29-Apr-08	SB-4	11.6	7.3	41360	26.3	41
29-Apr-08	SB-5	11.9	7.5	31320	20.3	49
30-Apr-08	LB-3	12.2	7.5	34440	21.5	16
30-Apr-08	LB-5	12.3	8.4	37950	23.5	19
30-Apr-08	LB-7	11.7	8.4	43770	28.1	29
30-Apr-08	LB-8	12	8.6	30640	19.1	11
30-Apr-08	LB-9	11.7	8.2	42680	27.2	28
01-May-08	LB-10	12	8.4	34820	23.5	31
01-May-08	LB-12	11.2	7.9	45300	29.2	24
01-May-08	LB-13	12.1	9	31480	19.6	18
01-May-08	LB-4	10.9	7.8	46740	30.3	35
01-May-08	LB-6	11.3	8.2	45810	29.6	44

Date	Station	Temp. (°C)	DO (mg/L)	Cond. (uS/cm)	Salinity (ppt)	Depth (ft)
01-May-08	SB-6	11.4	8.1	43780	28.1	48
02-May-08	KVK-2	12.2	7.5	34880	22.1	60
02-May-08	LB-1	11.7	7.9	40930		17
02-May-08	LB-14	11.2	7.9	42470	29.3	50
02-May-08	LB-3	11.5	8	42400	28.1	50
02-May-08	PJ-3	12.5	8.3	28880	17.4	10
13-May-08	AK-2	14.2	7.1	31190	19.4	49
13-May-08	AK-3	14.3	6.9	29490	18.2	41
13-May-08	NB-4	14.4	7.4	25870	15.8	11
13-May-08	NB-7	14.7	7.5	26300	16.1	12
13-May-08	PJ-2	13	8.1	27220	16.7	11
13-May-08	PJ-3	12.9	7.8	30260	18.8	8
14-May-08	LB-12	13.2	7.4	40290	25.8	24
14-May-08	LB-3	13.6	7.1	33950	22.1	19
14-May-08	LB-4	13.1	7.3	39900	24.9	38
14-May-08	LB-5	13.3	6.7	36500	22.6	19
14-May-08	LB-6	12.4	7	43500	28.2	43
14-May-08	LB-7	12.8	7.3	41870	27	29
14-May-08	LB-8	13.4	7.6	35360	22.3	11
15-May-08	KVK-2	13.2	8	40650	25.9	50
15-May-08	LB-1	13	7.6	41750	26.6	17
15-May-08	LB-10	13	7.7	40100	25.8	30
15-May-08	LB-13	13.2	8	41130	26.2	20
15-May-08	LB-14	12.6	8.1	43180	27.6	51
15-May-08	LB-2	12.1	8.2	46570	30.1	51
15-May-08	LB-9	13.5	7.7	36690	22.9	26
16-May-08	KVK-1	13.4	7.6	35800	22.7	50
16-May-08	PJ-1	13.9	7.5	31236	19.5	12
16-May-08	SB-3	13.6	7.6	36156	22.8	18
16-May-08	SB-4	13	7.6	41000	26.3	40
16-May-08	SB-5	13.1	7.5	41230	24.1	50
16-May-08	SB-6	12.8	7.7	43230	27.8	53
27-May-08	AK-2	13.6	7.2	37760	24.1	46
27-May-08	AK-3	13.5	7.3	37560	23.9	49
27-May-08	NB-4	15.7	7.3	30800	19.2	11
27-May-08	NB-7	16.8	7.7	29600	18.5	11
27-May-08	SB-3	13.6	7.8	38120	24.4	17
27-May-08	SB-4	12.8	8.1	40810	26.3	40
28-May-08	KVK-1	13	8.2	41440	26.5	51
28-May-08	KVK-2	12.5	8.4	44090	28.3	57
28-May-08	LB-7	13.3	8.5	42410	27.3	30
28-May-08	LB-8	13.9	8.9	39700	25.5	14
28-May-08	LB-9	13.2	8.9	42890	27.1	30
28-May-08	PJ-1	14.4	7.7	33010	20.8	12
28-May-08	SB-6	13.9	8.7	36460	29.1	48

Date	Station	Temp. (°C)	DO (mg/L)	Cond. (uS/cm)	Salinity (ppt)	Depth (ft)
29-May-08	LB-13	12.9	9.5	43880	28.3	17
29-May-08	LB-3	13.8	9.8	41330	26.1	18
29-May-08	LB-4	12.1	9.3	46330	29.9	35
29-May-08	LB-5	14	9.3	41270	26.6	18
29-May-08	LB-6	12.6	9.4	45290	29.3	45
29-May-08	PJ-3	14.8	8.3	35250	21.7	11
30-May-08	LB-1	13.8	8.2	41310	26.4	15
30-May-08	LB-10	14.2	8.4	40990	26.2	28
30-May-08	LB-14	11.5	8.5	47390	30.2	48
30-May-08	LB-2	10.8	8.5	48010	31.3	49
30-May-08	PJ-2	15.1	8	32320	20.2	9
09-Jun-08	LB-1	17.5	7.6	40220	30.6	21
09-Jun-08	LB-12	16.8	7.3	43200	28	27
09-Jun-08	LB-13	17	7.1	43070	27.9	19
09-Jun-08	LB-2	14.7	7.7	47270	30.8	52
09-Jun-08	LB-3	17.2	7.7	42900	27.9	19
09-Jun-08	LB-4	16.8	7.3	43260	27.9	38
09-Jun-08	LB-5	17.1	7.6	43170	27.9	21
09-Jun-08	LB-6	16	7.7	44420	28.8	43
09-Jun-08	LB-7	16.2	7.5	45220	29.4	30
09-Jun-08	LB-8	17.2	7.5	43530	28.2	20
09-Jun-08	LB-9	16.5	7.9	45200	29.5	33
10-Jun-08	SB-3	18.5	6.2	39300	25	17
10-Jun-08	SB-4	17.8	6.4	39450	25.4	37
10-Jun-08	SB-6	17	6.9	43270	28	45
11-Jun-08	AK-2	19.9	5.8	36580	23.2	45
11-Jun-08	AK-3	20.6	5.5	35460	22.4	49
11-Jun-08	KVK-1	17.4	6.8	42990	27.9	50
11-Jun-08	KVK-2	17.4	6.8	42990	27.9	57
11-Jun-08	LB-10	17.5	6.4	43700	28.2	27
11-Jun-08	LB-14	16.8	7.2	44310	28.6	49
11-Jun-08	NB-4	21	5.5	33580	21.1	10
11-Jun-08	NB-7	20.4	6.2	36140	23	8
11-Jun-08	PJ-1	19.3	6.2	35250	22.4	11
11-Jun-08	PJ-2	19.5	6.4	34830	22	11
11-Jun-08	PJ-3	19.3	6.4	37160	23.7	6
11-Jun-08	SB-5	16.8	6.8	44410	28.8	47
23-Jun-08	KVK-1	19.1	7.3	41880	26.8	51
23-Jun-08	KVK-2	19.1	7.3	41880	26.8	49
23-Jun-08	PJ-1	20.8	5.6	34040	21.4	18
23-Jun-08	PJ-2	20.9	5.6	32890	20.6	7
23-Jun-08	PJ-3	20.4	5.9	36830	23.4	11
23-Jun-08	SB-3	19.8	6.5	39730	25.4	17
23-Jun-08	SB-4	19.7	6.7	40330	25.7	40
23-Jun-08	SB-5	20	6.2	38710	24.7	42

Date	Station	Temp. (°C)	DO (mg/L)	Cond. (uS/cm)	Salinity (ppt)	Depth (ft)
23-Jun-08	SB-6	19.5	7.2	40050	25.6	47
24-Jun-08	AK-2	21.5	6	34620	21.8	46
24-Jun-08	AK-3	21.8	6	34090	21.4	48
24-Jun-08	LB-1	19.4	7.7	41850	26.8	16
24-Jun-08	LB-10	19.4	7.7	41850	26.9	30
24-Jun-08	LB-14	18.5	7.9	36780	27.8	50
24-Jun-08	LB-2	18.6	8.2	43270	27.9	51
24-Jun-08	LB-9	18.9	7.8	42250	27.1	28
24-Jun-08	NB-4	22.8	6	31310	19.6	11
24-Jun-08	NB-7	22	6.4	33350	21	11
25-Jun-08	LB-12	19.8	6.9	40800	26.2	28
25-Jun-08	LB-13	19.6	7.4	40640	26	19
25-Jun-08	LB-3	20.3	7.5	40910	26.1	19
25-Jun-08	LB-4	19	6.5	43370	27.9	36
25-Jun-08	LB-5	20.8	8	40260	25.2	20
25-Jun-08	LB-6	19.9	6.9	42040	27.1	44
25-Jun-08	LB-7	18.9	7.2	41700	27.1	30
25-Jun-08	LB-8	20.4	9.5	40160	25.7	12
07-Jul-08	KVK-1	20	5.3	42070	27.1	54
07-Jul-08	LB-12	20.1	5.3	42040	26.9	30
07-Jul-08	LB-13	20	5.2	42270	27.5	24
07-Jul-08	LB-3	19.6	5.3	41910	27.1	20
07-Jul-08	LB-4	20.2	5.1	42170	27.3	40
07-Jul-08	LB-5	19.9	5.2	41280	26.7	21
07-Jul-08	LB-6	19.9	5.1	41750	26.9	46
07-Jul-08	LB-7	19.2	5.6	43770	28.1	28
07-Jul-08	LB-8	19.6	5.5	42630	27.5	15
08-Jul-08	LB-1	20.7	5.6	43820	28.3	18
08-Jul-08	LB-10	20.7	5.3	41300	26.5	29
08-Jul-08	LB-14	20.5	6	44260	28.5	51
08-Jul-08	LB-2	20.4	6	44100	28.4	49
08-Jul-08	LB-9	20.6	5.5	42770	27.6	28
08-Jul-08	PJ-2	21.2	5	38510	24.6	12
08-Jul-08	PJ-3	22.9	5.7	36020	23	11
08-Jul-08	SB-3	21	4.9	39200	25	19
08-Jul-08	SB-4	20.9	4.9	40100	25.6	41
08-Jul-08	SB-6	20.8	5.5	42590	27.3	51
09-Jul-08	AK-2	22.6	4.8	36450	23.1	47
09-Jul-08	AK-3	22.9	4.8	36020	22.8	40
09-Jul-08	KVK-2	21.4	5.1	39360	25.2	52
09-Jul-08	NB-4	23.6	4.8	34610	21.8	10
09-Jul-08	NB-7	22.9	5	36380	23	12
09-Jul-08	PJ-1	22.3	5.2	35150	22.1	11
09-Jul-08	SB-5	21.6	5	37220	23.6	43

Appendix D

Laboratory microscope setup and winter flounder egg and larval staging photographs and illustrations

Figure 1. Laboratory analysis set up showing the Motic DM143 Digital Microscope with Canon Powershot S31S Digital Camera.

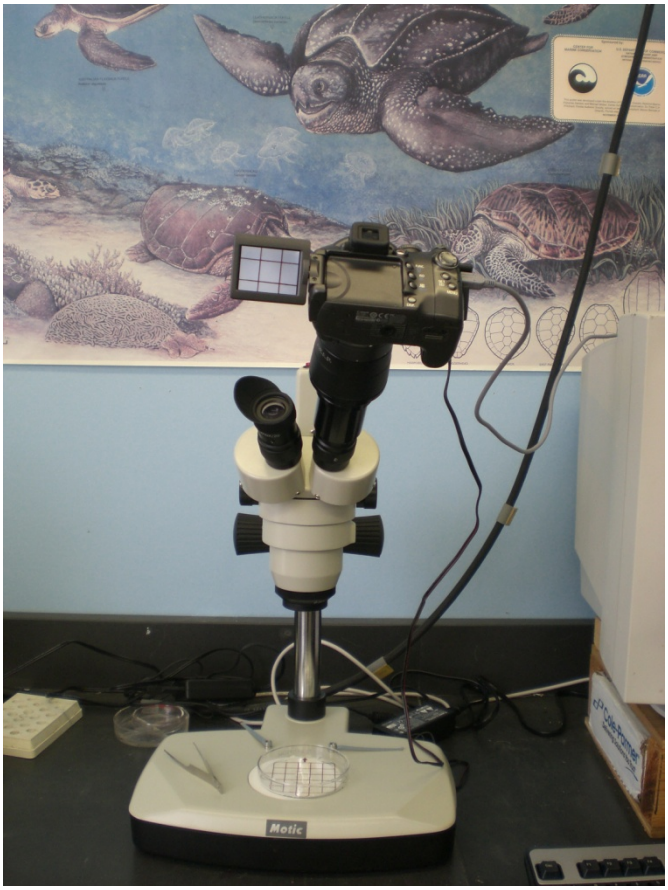


Figure 2. Winter Flounder - Egg Stage 1 or Early Cleavage Stage.

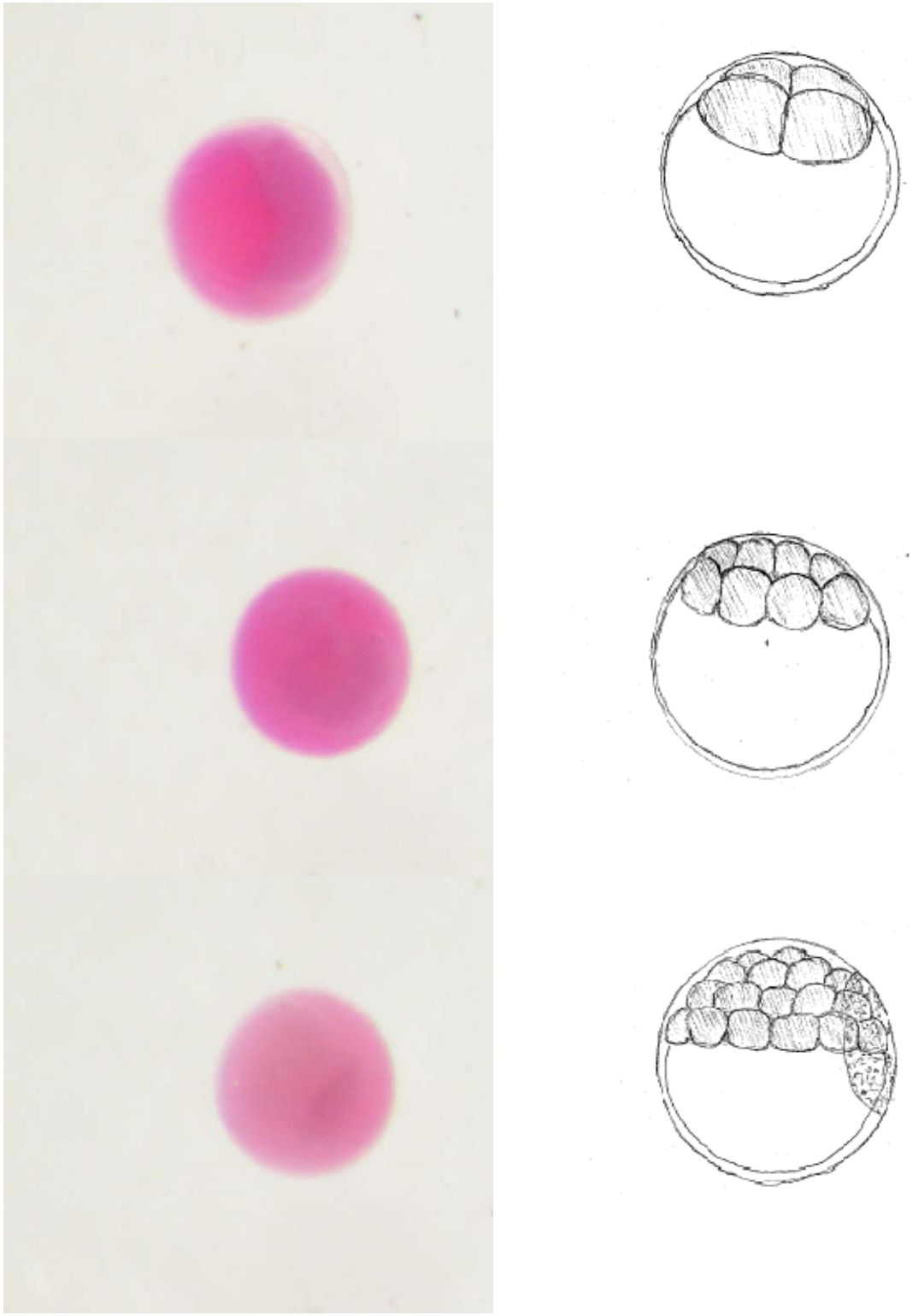
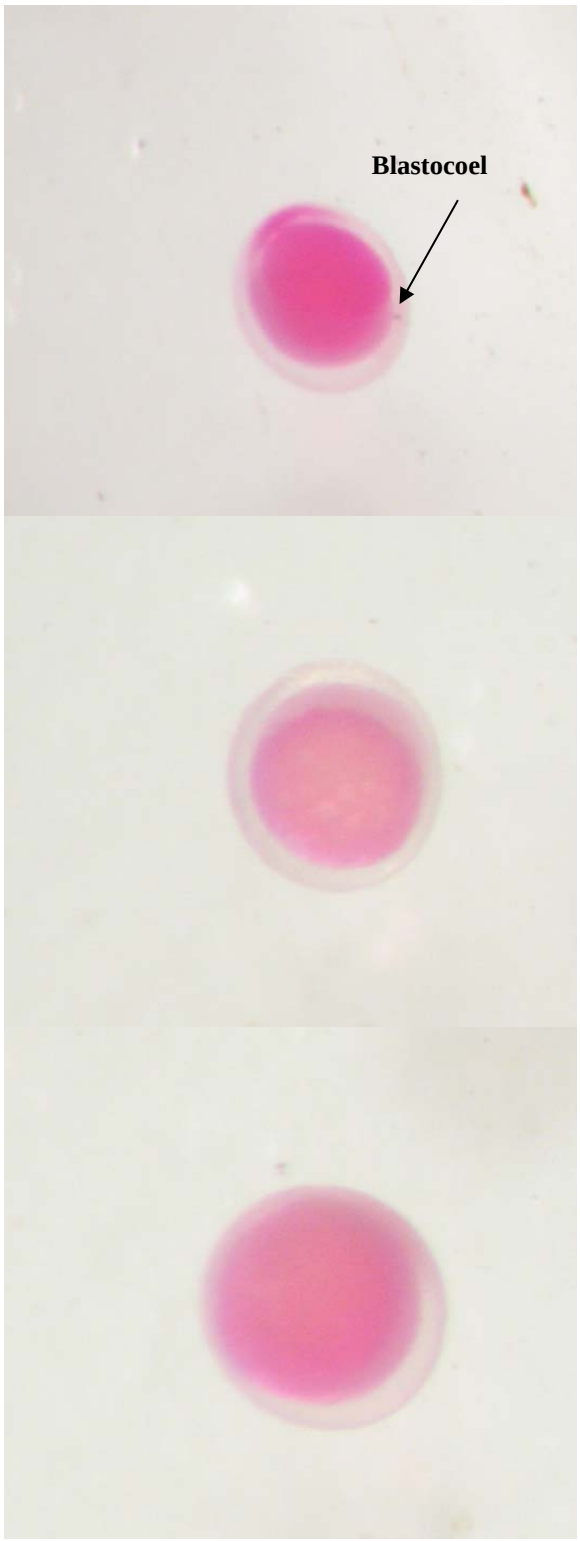


Figure 3. Winter Flounder - Egg Stage 2 or Blastula Stage.



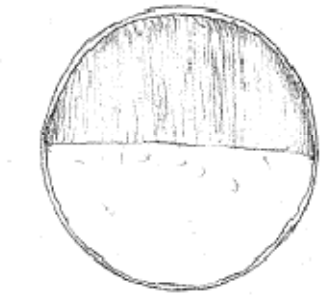


Figure 4. Winter Flounder – Egg Stage 3 or Gastrula Stage.

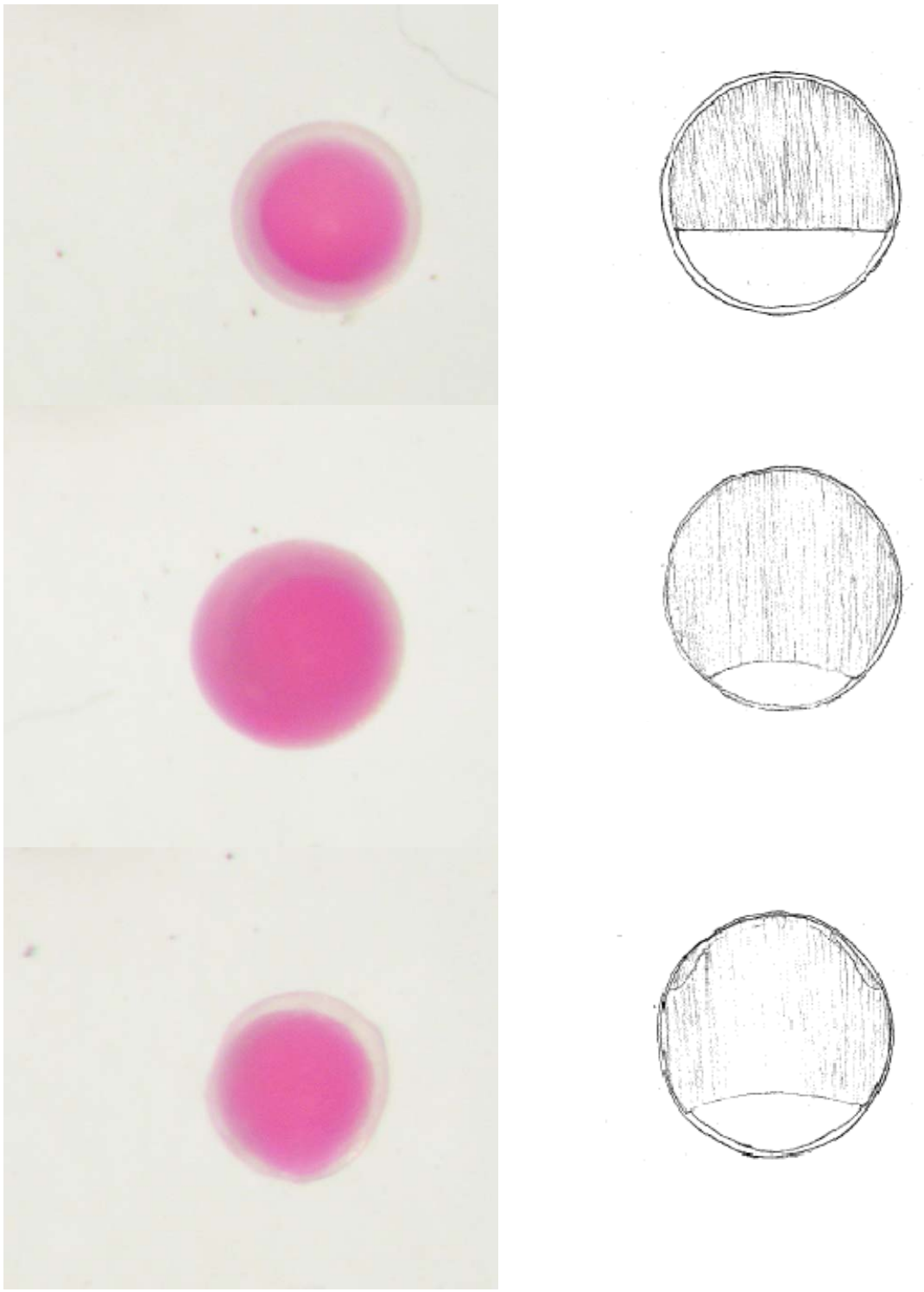


Figure 5. Winter Flounder - Egg Stage 4 or Early Embryo Stage.

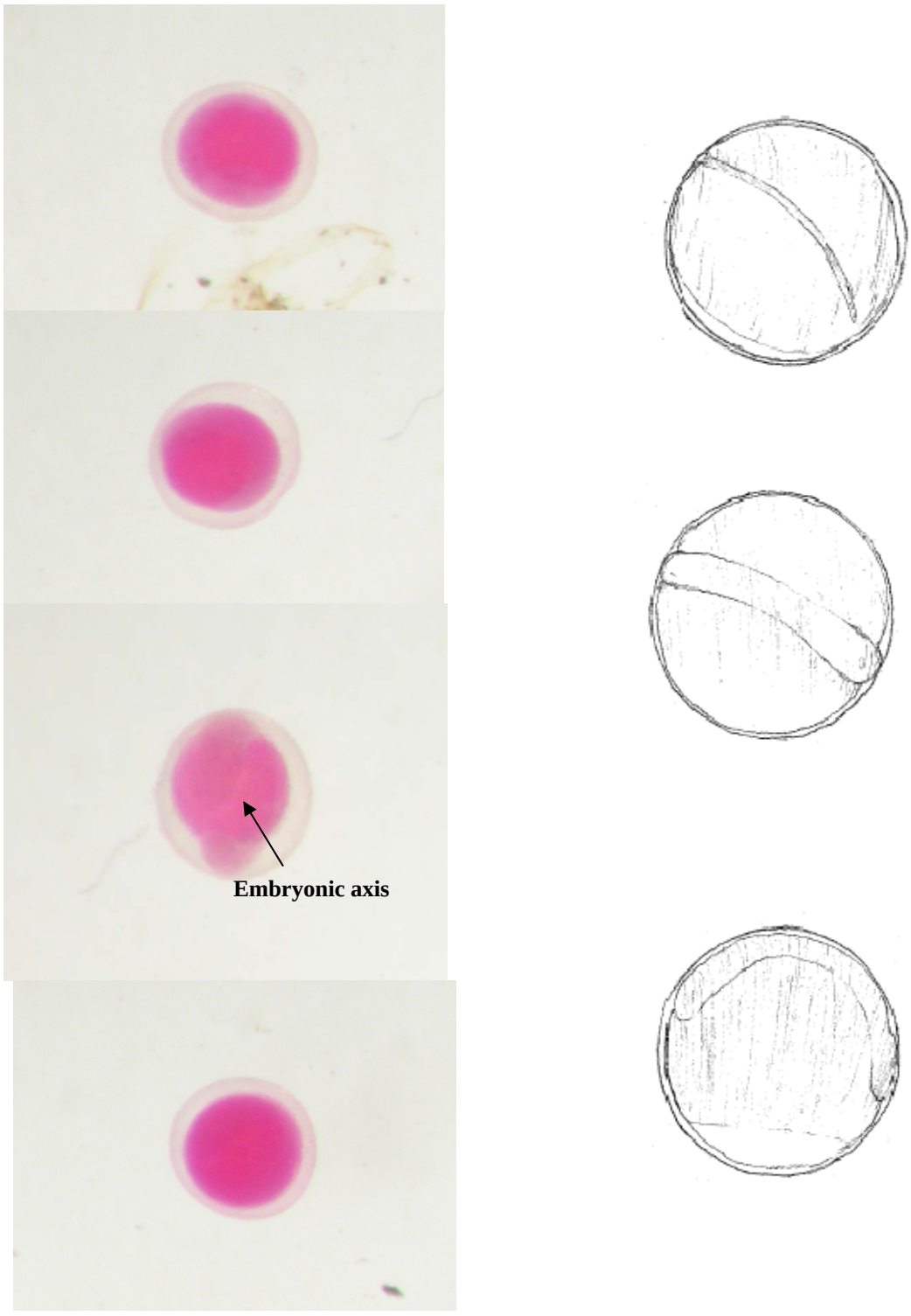
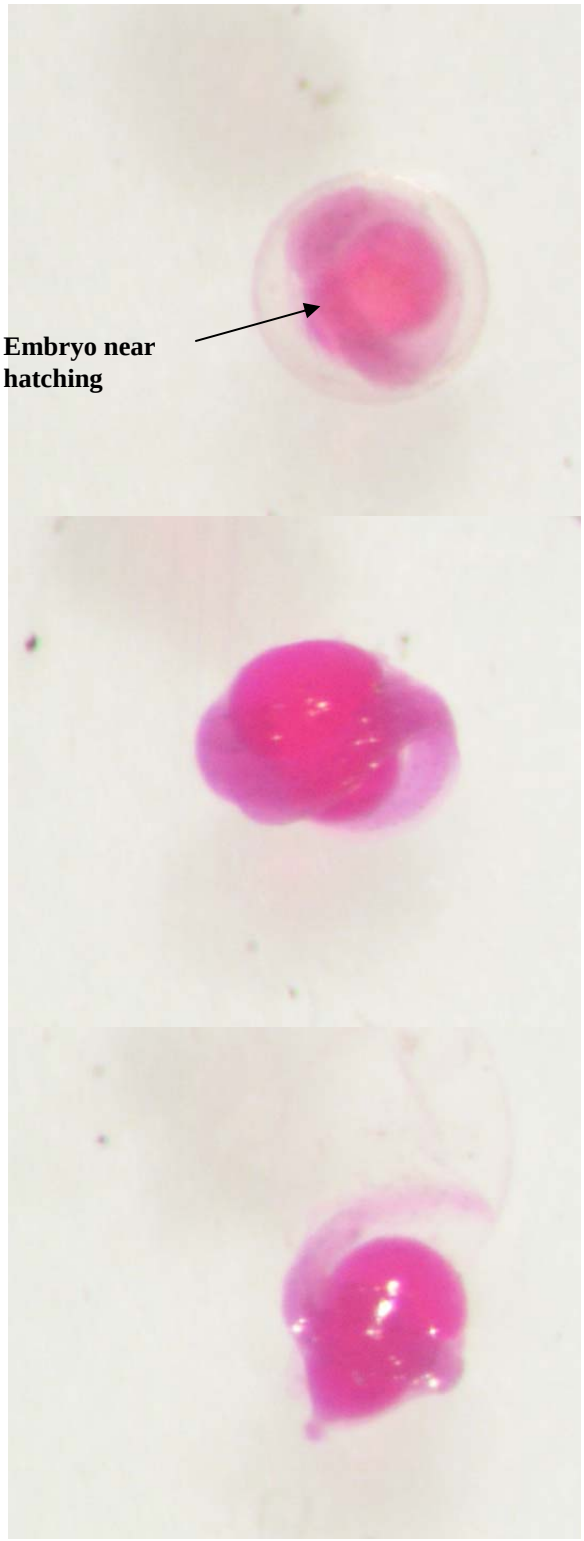


Figure 6. Winter Flounder - Egg Stage 5 or Late Embryo Stage.



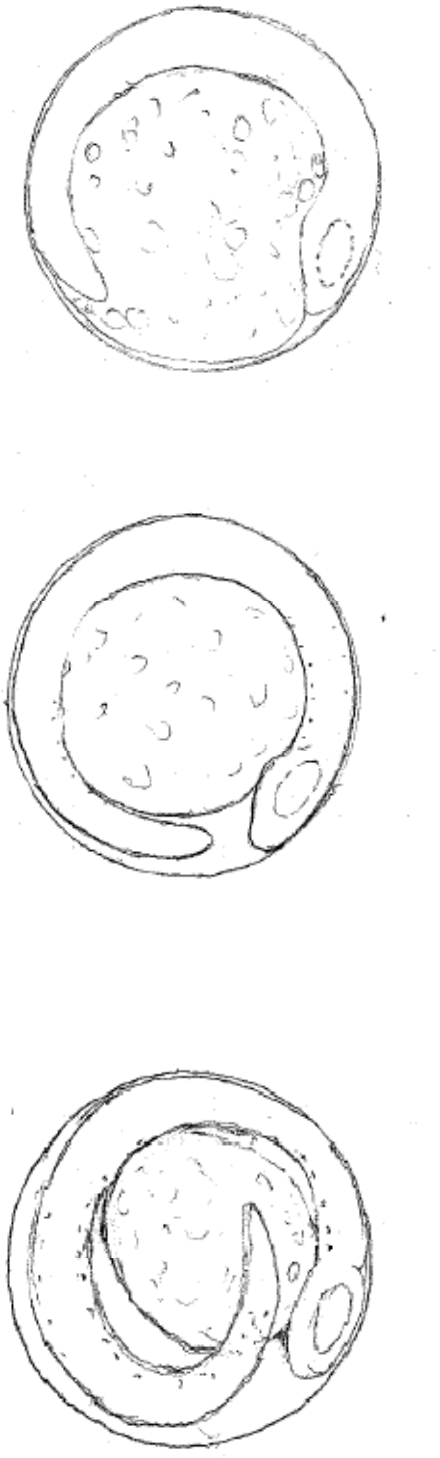


Figure 7. Winter Flounder - Larval Stage 1.

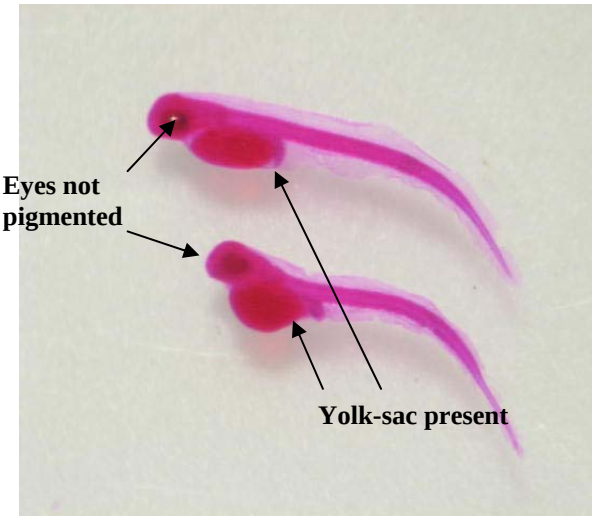


Figure 8. Winter Flounder - Larval Stage 2.

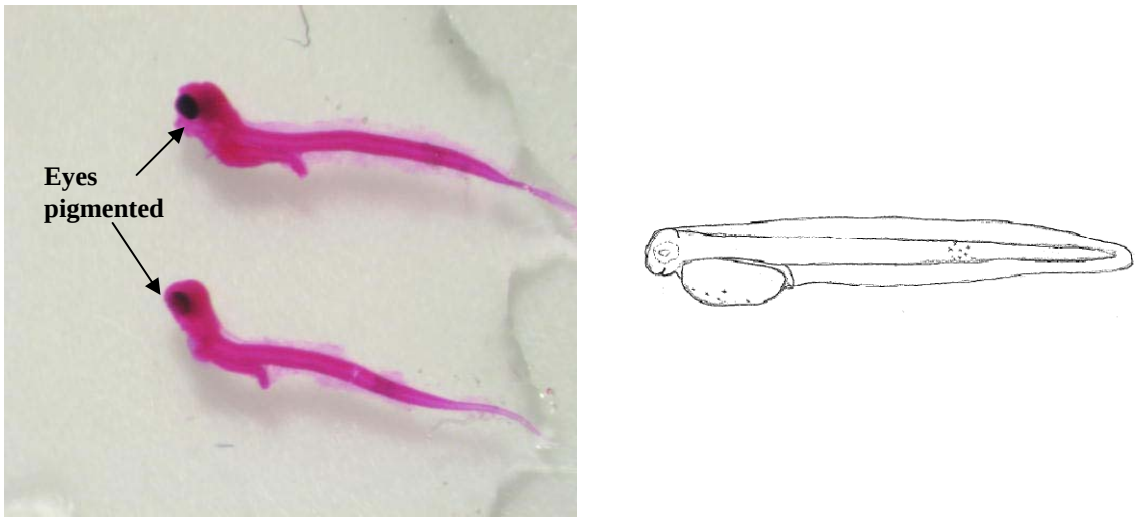


Figure 9. Winter Flounder – Larval Stage 3.

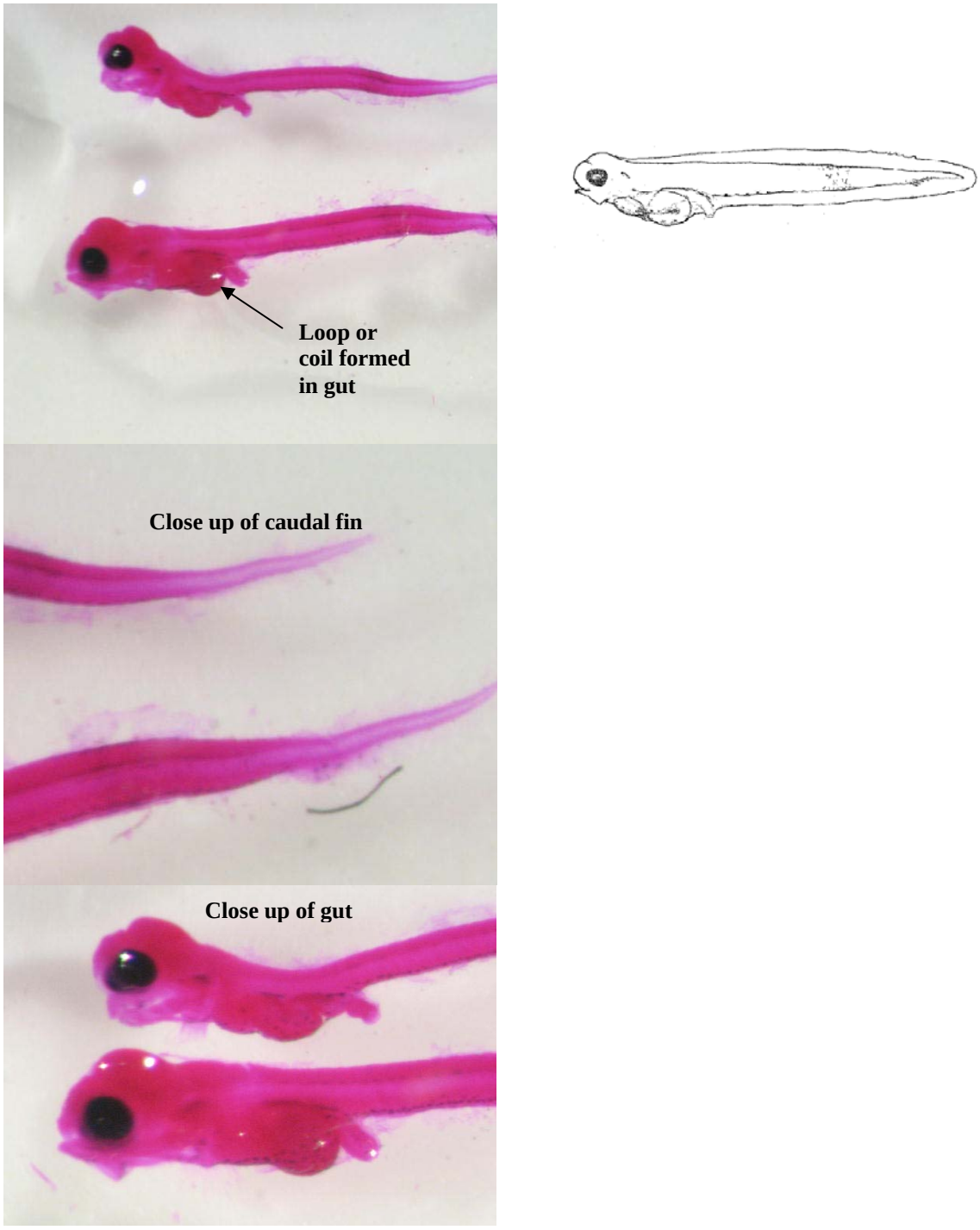
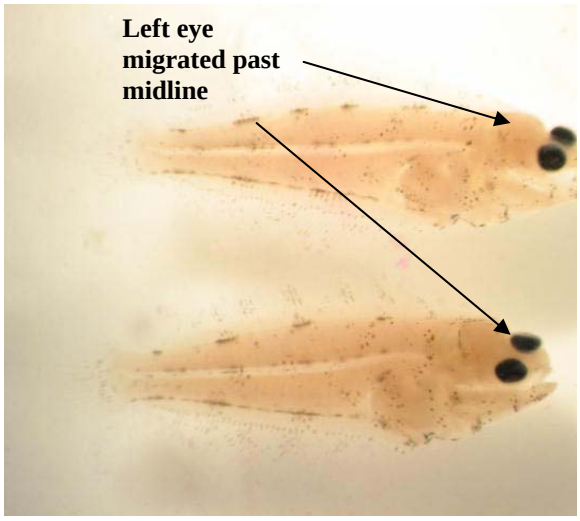


Figure 10. Winter Flounder - Larval Stage 4.



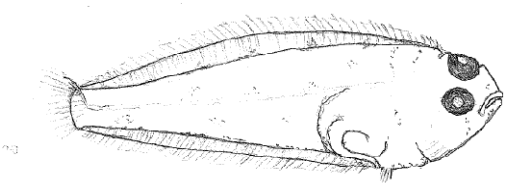


Figure 11. Winter Flounder – Juvenile.

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