

NEW YORK/NEW JERSEY HARBOR DEEPENING PROJECT

2006 MIGRATORY FINFISH REPORT

**Final Report
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LIST OF ACRONYMS

Arthur Kill/Kill Van Kull (AK/KVK),

Newark Bay (NB),

Upper Bay (UB),

Lower Bay (LB),

Catch per Unit Effort (CPUE),

Essential Fish Habitat (EFH),

Percentage of Similarity (PSC),

Analysis of Variance (ANOVA)



1.0 INTRODUCTION

1.1 BACKGROUND

A Migratory Finfish Sampling Program (MFS) was initiated in 2006 to gather information on the timing and spatial distribution of important migratory fish moving through NY/NJ Harbor that would be exposed to dredging operations for deepening and maintenance dredging of channels and berths. Seasonal timing factors include both the upstream movement of spawning adults and the downstream movement of juveniles. Spatial distribution factors include the depth, migratory pathways and relative importance of channels and shoals for both adults and juveniles. American shad, blueback herring, alewife, striped bass, and Atlantic menhaden were selected as target species for this program because of their anadromous migratory behavior (except menhaden) and their importance as forage (shad, blueback herring, alewife, menhaden) or their role as a major predator in the Harbor (striped bass). The general life history of these species is well known, but their migratory behavior while passing through the Harbor has not been well studied. This program will provide data on their behavior that can be evaluated in relation to dredging operations.

Migratory fish have been recognized as potentially vulnerable to habitat disturbance activity such as dredging because their migratory behavior concentrates entire stocks of fish in relatively small areas over short periods of time. For example, the entire adult spawning stocks of American shad, blueback herring, alewife and striped bass that use the Hudson River must pass through the Harbor to access upstream spawning areas and the entire annual juvenile production will pass through the Harbor as they emigrate to the marine environment. A stratified sampling methodology will be implemented which will yield refined information on timing and migratory pathways to better manage dredging operations in relation to these movement patterns.

The MFS complements the long-term Aquatic Biological Survey (ABS) Program by providing data comparable to that being obtained for other species that display seasonal movements within the Harbor, but do not have concentrated movement patterns.



Sampling for MFS adds to the database for the ABS Programs by extending the sampling effort to times and places not covered by the ABS. Sampling of Migratory will occur twice yearly; first during late spring (April, May, June) and again in early fall (September, October, November), to cover the months that are not sampled for ABS. These programs together can provide spatial and temporal distribution information for both migratory species and other managed species (i.e. EFH species) making generalized movements within the Harbor for spawning, foraging, access to nursery areas and overwintering. This information could lead to refinements in the location and duration of work windows that reflect important differences among major areas of the Harbor.

The 2006 MFS is considered a pilot study in that long-term data are needed to reveal patterns in migratory behavior that can be used to predict seasonal activities. The MFS will refine sampling programs over time as these patterns are revealed. The adult migration and juvenile out-migration may differ significantly, thus all aspects of sampling, timing, duration, gear type and location may need adjustment. In addition, species differences may be important in the temporal and spatial distribution of sampling gear. Migratory species are known to experience substantial annual variability and some Hudson River stocks (American shad, blueback herring, and alewife) have experienced recent declines in abundance that are apparently unrelated to dredging in the Harbor. The analysis of a long-term database may need to account for factors beyond the Harbor that are influencing these populations.

1.2 STUDY OBJECTIVES

The goal of the Corps' programs studying the fishery resources of the NY/NJ Harbor is to identify spatial and temporal patterns of managed species. The MFS is a component of the effort to achieve this goal through a program that complements the outgoing ABS Program. The objectives of the MFS program were:

1. identify patterns of migratory movements of selected species as they move through the Harbor where dredging occurs on a continuous basis;



2. Relate temporal and spatial migratory patterns to dredging operations and seasonal work windows;
3. Use patterns of migratory movements to better manage dredging operations in conjunction with the findings of the ABS Program and Harbor fishery studies conducted by others.

Better management of dredging entails both potential adjustments of dredging operations to protect biological resources and potential refinements of protection measures (work windows) to enable more economical dredging operations. This can only be achieved with improved information on the temporal and spatial patterns of biological resources in the Harbor. For example, the depth of migratory fish or whether they utilize shoals or channels would influence their potential exposure to channel dredging or maintenance dredging in berths. Also, the occurrence of migratory fish in the same area and at the same time as important EFH species (winter flounder spawning for example) would enhance concern for that area, whereas if temporal and spatial distributions do not overlap, the duration of protection measures may be able to be relaxed. This level of refinement requires better information on the use of Harbor habitats by all the important species present.

1.3 REPORT ORGANIZATION

For this report, the finfish collected were classified into one of three groups: target species, EFH managed species, and other finfish species. The intent of this organization was to group species to highlight important species identified by resource agencies and their relative importance in the NY/NJ Harbor's finfish community.

Section 2 describes the sampling design/plan, study areas and stations, and provides a summary of the methods and equipment used; Section 3 presents the results of the mid-water and bottom trawl sampling program; Section 4 discusses finfish use of the NY/NJ Harbor as indicated by the data analysis related to NY/NJ Harbor areas, seasonal distribution/movements, and habitat usage on a Harbor-wide scale; and Section 5 provides an evaluation of the survey methodology, data gaps caused by temporal and area



coverage, potential survey findings likely to result from a continuation of the study, and recommendations to modify the survey to better meet the program objectives.

2.0 METHODS

2.1 STUDY AREAS AND SAMPLING LOCATIONS

Sixteen (16) bottom trawl and twenty six (26) mid-water trawl locations were sampled during the 2006 Migratory Finfish Sampling Program (Table 2-1). Of the twenty six (26) mid-water trawl stations, eighteen (18) were located in channel areas and eight were in non-channel areas (Figure 2-1). Of the sixteen (16) bottom trawl stations, twelve (12) were located in channels and four (4) were in non-channel areas (Figure 2-2). This distribution of sampling effort reflects limitations on mid-water trawling by shallow water, the existing distribution of sampling in the ABS program and relative importance of channels and shoals in different points of the harbor.

The NY/NJ Harbor was divided into four study areas based on geography, usage by migratory species, habitat use (i.e. channel vs. non-channel), and varying dredging schedules: the Arthur Kill/Kill Van Kull, Newark Bay, Upper New York Bay, and Lower New York Bay. These are contiguous areas of similar water quality, and were set apart to facilitate data analysis by providing general indications of temporal occurrence and habitat usage within the NY/NJ Harbor area. Sampling stations were distributed within each study area as described in the following:

Arthur Kill and Kill Van Kull (AK/KVK)

Six (6) channel stations were sampled in this area using the mid-water trawl; four (4) (MAK-1 to 4) were in the Arthur Kill and two (MKK-1 & 2) were in the Kill Van Kull. Two (2) channel stations (MAK-1 & 2) were sampled using the bottom trawl. Due to bottom irregularities and ship traffic, bottom trawls were not collected at MAK-3 & 4 and in the Kill Van Kull (stations MKK- 1 & 2). MAK- 2 was sampled several times before it was eliminated due to bottom obstructions.

Newark Bay (NB)



Six (6) stations were sampled in Newark Bay using the mid-water trawl; three (3) (MNB-1, 2, & 5) were in channels and three (3) (MNB-3, 4, & 6) were non-channel areas. MNB- 6 was periodically sampled after the first twelve (12) scheduled surveys had been completed due to in-water construction activities. Bottom trawls were conducted at four (4) stations (MNB-1, 2, 3, & 4).

Upper New York Bay (UB)

Ten (10) stations were sampled in the Upper Bay using the mid-water trawl; eight (MUB-1 – 5 & 8 - 10) were in channels and two (MUB-6 & 7) were non-channel areas. Bottom trawls were conducted at seven channel stations (MUB- 1 - 3, & 8 - 10).

Lower New York Bay (LB)

Four (4) stations were sampled in the Lower Bay using the mid-water trawl; one (1) (MLB-3) was a channel area and three (3) (MLB-1, 2, & 4) were non-channel areas. Bottom trawls were conducted at three stations (MLB-1, 2, & 3).

2.2 FINFISH SAMPLING (MID-WATER & BOTTOM TRAWLS)

Finfish were sampled with a mid-water trawl from late April to early June and alternating weekly with bottom trawl surveys from August to November 2006. During April, May, and June, bottom trawls were conducted as part of the ongoing Aquatic Biological Monitoring Program (USACE-NYD 2007).

The U.S. Army Corps of Engineers' *Hudson* was the primary sampling vessel used for mid-water and bottom trawl surveys. Surveys were scheduled during daylight hours (from one hour after sunrise and one hour before sunset) when the target species are often observed in the water column. Mid-water trawls were conducted using an 18-foot (5.5 m) mid-water balloon trawl (Table 2-2), rigged for mid-water trawling. A minimum cable length of 200 feet of tow cable was deployed to ensure the mid-water trawl extended beyond the boat's prop wash. The float cable length required to fish at mid depth was determined using a chart of sample depth, float cable lengths, and tow speeds. Mid-water trawls were towed into the prevailing current at a speed of approximately 6.6 ft/sec (200



cm/sec). A relatively high tow speed is needed in order for the mid- water tow to fish correctly.

Bottom trawls were conducted using a 30-foot (9.1 m) otter trawl (Table 2-2). A minimum ratio of tow cable length to maximum station water depth of 5:1 was maintained to ensure that the trawl was in contact with the bottom throughout each tow. Target tow duration for both methods was ten minutes, although tow times were adjusted as needed to account for obstructions, limited distances, commercial traffic, and other factors. Bottom trawls were towed at a speed of approximately 4.9 ft/sec (150 cm/sec) over the bottom against the prevailing current.

A total of three hundred and eleven (311) mid-water trawls were collected (216 were channel stations and ninety-five (95) were non-channel stations) during the peak migratory season for target species which spans from late April to early June (spring) and August to November (fall). A total of one hundred and twenty-three (123) bottom trawls were collected (ninety-one (91) were channel stations and thirty two (32) were non-channel stations) from August to November (fall) (USACE 2006).

Mid-water and bottom trawl sampling stations were located using Global Positioning System (GPS) coordinates as well as aids to navigation, soundings, bottom type, and landmarks in the river channel and shoal areas. GPS coordinates were recorded to the nearest one hundredth of a minute (i.e., 40° 35.56' North) for all sampling stations. Tow velocities were monitored using a General Oceanics electronic flowmeter and deck readout. All pertinent information was recorded on a Field Data Sheet (Figure 2-3).

2.3 FINFISH SAMPLE ANALYSIS (MID-WATER & BOTTOM TRAWLS)

Fish analysis consisting of species identification, enumeration, and total length measurements to the nearest mm were conducted on each trawl sample. All fish collected were identified and enumerated on the research vessel immediately following collection. The total length of all target species (Atlantic menhaden, American shad, blueback herring, alewife and striped bass) was recorded. Total length of all non-target species up to twenty-five (25) specimens of each species was recorded for each sample. If more



than 25 fish were collected for any non-target species, twenty-five (25) specimens were randomly selected for length measurements. After analysis, all live organisms were released at the collection site. As needed, one specimen of each new species collected was retained for confirmation of the field identification and quality control purposes. If any finfish were killed during trawl collection or died during handling, they were returned to the Nyack Laboratory for disposal. Survey data and observations were recorded on field data sheets.

Catch per unit effort (CPUE) is defined as the number of individual finfish collected per ten (10) minute trawl; and was determined for each trawl tow based on the duration each net sampled. Catches were standardized to a 10-minute tow when tow times were less than or more than 10 minutes.

2.4 WATER QUALITY (MID-WATER & BOTTOM TRAWLS)

Dissolved oxygen, temperature, conductivity, and salinity were measured after each trawl using calibrated meters (YSI Model 85 Handheld Oxygen, Conductivity, Salinity and Temperature System) and recorded on the Field Data Sheet. Temperature was measured to the nearest +/- 0.2 °C; dissolved oxygen (+/- 0.5 mg/L); conductivity (+/- 100 µS); and salinity (+/- 0.1 ppt). Water quality parameters recorded with mid-water trawls were taken at the sample depth and bottom trawl water qualities were taken one foot (0.3 m) above the bottom substrate.

2.5 DATA ANALYSIS (MID-WATER & BOTTOM TRAWLS)

Community biodiversity was assessed through calculation of species richness, Shannon-Wiener's Index, and evenness (i.e distribution of species at each station) for both mid-water and bottom trawl data. Each index was calculated for each station. Similarity indices, Jaccard's index and Percentage Similarity (PSC), were also calculated as a basic measurement of the similarity in structure between station types. These similarity indices were calculated to compare channel and non-channel station types among the four study areas. Two-way repeated measures ANOVAs were run for mid-water and bottom trawls to test for differences between and among treatments sampled over time.



Species richness is a measure of the total number of species collected in a sample. All fish collected during the 2006 Migratory Finfish Survey were identified to species, and no general taxonomic designations at the generic, familial, and higher taxonomic levels were made. Therefore, species richness was calculated by counting the number of unique species collected at a station throughout the sampling period.

The Shannon-Wiener Diversity Index (H') is a widely used species diversity index. It provides more information about the fish community structure than species richness because it accounts for the relative abundance of each species as well as how many species occur (i.e., richness). The diversity index H' can range between values of 0 and 4. Low values of H' indicate low species richness and an uneven distribution of abundance among species while high values indicate high species richness and an even distribution of abundance among taxa. Typically, a healthy fish community would have a high H' value. Because there may be gear biases, mid-water and bottom trawl samples were analyzed independently. The index is computed as follows:

$$H' = -\sum_{i=1}^S (p_i)(\text{Log}_2 p_i)$$

where S is the total number of species per station (i.e., taxa richness) and p_i is the proportion of total individuals in the i^{th} species. Mathematically, p_i is defined as n_i/N where n_i is the number of individuals of a species at a station and N is the total number of individuals of all species at that station.

The Evenness (E ; or equitability) measures the distribution among species within the community by scaling one of the diversity measures relative to its maximum possible value. The evenness can range from 0 (uneven distribution) to 1 (even distribution). It is computed as follows:

$$E = \frac{H'}{H'_{\text{max}}}$$



where H' is the observed diversity (as cited above) and H'_{\max} is the logarithm of the total number of taxa (S) at that station ($H'_{\max} = \text{Log}_2 S$).

Jaccard's index expresses the percentage of species shared in common, and takes into account species number but not abundance. This index expresses species overlap by determining presence-absence patterns among data sets and can range in value from 0 (no overlap) to 100 (identical). The index is computed as follows:

$$\text{Jaccard's index} = 100 \times \frac{n_c}{n_i + n_j}$$

where n_c is the number of species common to station types i and j , n_i is the number of species in station type i for a particular study area, and n_j is the number of species in station type j for a particular study area.

Percentage similarity (PSC) compares community assemblages by incorporating species number as well as relative abundance into the calculation. Index values range from 0% (no similarity) to 100% (identical) and generally give more weight to dominant taxa than rare taxa. The index is computed as follows:

$$PSC = 100 - 0.5 \sum_{i=1}^K |a - b|$$

where K is the total number of species collected, and a and b are the percent abundance of a species for each station type and region, respectively A and B. The absolute value of the difference between a and b is summed over all species. Percent abundance of the i^{th} species for each station type and study area, A and B, was calculated using CPUE data.

A two-way repeated measures ANOVA was used to test for differences in catch rates for selected finfish species. Twelve finfish species, which were abundant target, EFH, and other species, were analyzed separately using $\log(\text{CPUE}+1)$ -transformed data. Mid-water and bottom trawl data were analyzed separately using the following model to test for differences in catch rates over time:



$$\text{LogCPUE} = R \ S \ W \ R*W \ S*W \ R*S*W$$

where R = region (AK/KVK, NB, UB, LB), S = station type (channel, non-channel), w=week of year, and R*W represents the interaction between region and week of year. Station type was nested within region and both were treated as fixed effects, whereas week of year was a random effect. Significance was determined by $\alpha = 0.05$, such that effects with $P \leq 0.05$ were significant.

When interaction terms were significant, the dataset was truncated to eliminate periods dominated by zero (0) catch. Species-specific results indicate whether analyses were conducted on the whole sampling season or a truncated sampling period.

3.0 RESULTS

Migratory finfish data and results are provided for all four NY/NJ Harbor study areas (Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB)); the data was also sorted and analyzed by sampling method, non-channel and channel areas, and season. Species composition and trends in relative abundance are described in the following sections. Detailed station and sample data, including the CPUE of each finfish species collected in every trawl as well as the recorded water quality values are provided in Appendices A through D, respectively.

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

Number collected (raw numbers not adjusted for differences by area, season, or habitat; or adjusted to ten (10) minute sample duration)

Catch per unit effort (CPUE), defined as number caught per ten (10) minute trawl sample.

Mean CPUE, defined as the average (mean) CPUE by method for area, season, or habitat by species, by selected groups, or for all species combined.



3.1 FINFISH

A total of 55,290 finfish (58 species) were collected during the 2006 Migratory Finfish Sampling Program (Table 3-2). Twenty-seven (27) species were collected during the mid-water trawl surveys and 53 species were collected during the bottom trawl surveys (Table 3-4). The five (5) target species were collected by both survey methods. The most species were collected in August and October, forty-one (41) and forty (40) species, respectively (Table 3-2). Fewer finfish species were collected during the spring when finfish collections were limited to mid-water trawls; thirteen (13), twelve (12), and six (6) species were collected in April, May, and June, respectively. During the August to November sampling period, when both sampling methods were used, mid-water trawls accounted for eleven (11), ten (10), nine (9), and ten (10) species each month, respectively (Table 3-3). During the same period, bottom trawls accounted for thirty-six (36), twenty-nine (29), thirty-nine (39), and thirty-four (34) species each month, respectively (Table 3-4).

Bay anchovy was the dominant finfish species collected in both mid-water and bottom trawl surveys. For mid-water trawl collections (Table 3-3), blueback herring ranked second in abundance followed by Atlantic menhaden, alewife, Atlantic herring, butterfish, American shad, striped anchovy, bluefish, Atlantic moonfish and spotted hake. Except for striped bass, the ten most abundant finfish species collected by mid-water trawl included four target species.

For bottom trawl collections (Table 3-4), scup ranked second in abundance followed by butterfish, weakfish, bluefish, spotted hake, winter flounder, Atlantic menhaden, striped searobin and striped anchovy. The ten (10) most abundant finfish species collected by bottom trawl included one target species (Atlantic menhaden); the other four target species striped bass (56 collected), alewife (36), blueback herring (35) and American shad (16) were not among the ten most common finfish collected by bottom trawl.



Target species represented 7% of the total finfish catch (Table 3-2). The 14 EFH managed species collected represented 4% of the total finfish catch. Thirty-nine (39) other finfish species (49,208 individuals) represented 89% of the total catch. Bay anchovies (48,122 individuals), were included with other finfish species; they were the most abundant species collected in the NY/NJ Harbor during the 2006 sampling program and contributed over 87% of the total catch of finfish.

3.1.1 Mid-water Trawl Sampling

A total of 29,329 finfish from twenty-seven (27) species were collected during the 2006 mid-water trawl survey (Table 3-3). Bay anchovies (24,791 individuals) comprised 85% of the mid-water trawl catch. Target species represented 12% of the total catch. EFH and other finfish species represented 3% and 85% of the total catch, respectively. Six EFH managed species were collected in mid-water trawls; Atlantic herring (618 individuals) were very common¹ and were collected predominately in April. Bluefish and butterfish were also common, however, they were primarily collected during the late summer and early fall. Uncommon species and species generally not collected by mid water trawl included one cobia collected at an Upper Bay channel station in August, two Spanish mackerel collected at an Arthur Kill/Kill Van Kull channel station in August, and one winter flounder collected in the Lower Bay at a non-channel station during October (Table 3-5 & 3-6).

Seasonal Trends

Since the mid-water trawls were conducted from late April through early June and from August to November; they provided greater temporal coverage (7 months) than the bottom trawls (4 months – August to November). Except for striped bass (which use near bottom habitat and are not usually collected in mid-water trawls during the spring and summer), mid-water trawls collected greater numbers of target species than the bottom trawls.

¹ Common refers to the total number caught per trawl, and also takes temporal and spatial distribution into consideration.



The harbor-wide seasonal occurrences of the five target species are provided in Table 3-5 and Figures 3-1 and 3-2a to 2g. The three (3) alosids (alewife, blueback herring and American shad) had similar seasonal occurrences in the harbor with alewife and blueback herring most common during the spring (April and May) and the late fall (November). American shad were also collected in April, May and November but in lower abundance than alewife and blueback herring (Table 3-5). In contrast, blueback herring were also present during the summer. Three (3) of the six (6) EFH managed species were relatively common in mid-water trawl collections; Atlantic herring were collected primarily in April (mean CPUE of 24.5). Bluefish were present in collections from June to October with higher CPUEs in August (mean CPUE of 0.25). Butterfish were collected from April to November, however more were collected in August (mean CPUE of 3.83).

Habitat (Channel – Non-channel)

Habitat information for the NY/NJ Harbor area is provided as the mean CPUE at channel and non-channel stations in each study area (Table 3-6). Of the target species, American shad were present and collected only at channel stations (mean CPUE of 0.12); alewife, Atlantic menhaden, and blueback herring were common and collected primarily at channel stations. Of the common EFH managed species, Atlantic herring were collected predominately at channel stations (mean CPUE of 2.69 vs 0.01). Bluefish and butterfish were collected at both channel and non channel stations; bluefish collections indicated a slight preference for non-channel habitat (mean CPUE of 0.14 vs 0.08) and butterfish collections indicated a slight preference for channel habitat (mean CPUE of 1.12 vs 0.56). Two other finfish species are considered important forage species: Bay anchovy were abundant in channel collections (mean CPUE of 83.34) compared to a mean CPUE of 19.62 for non-channel stations and nine Atlantic silverside were collected primarily from non-channel habitats.

For each study area, channel stations tended to have higher richness, average CPUE, and diversity than non-channel stations (Table 3-7). The Lower Bay, which had one channel station, had low taxa richness (4 species) but high diversity (1.67) and evenness (0.83) compared to non-channel station in Lower Bay. Similar species and catch rates occurred



in channel stations among Arthur Kill/Kill Van Kull, Newark Bay, and Upper Bay, with Jaccard values of 29-33 and PSC values of 48-67 % (Table 3-8). Channel stations in Lower Bay were less similar to other regions. The Lower Bay channel stations had between 15-17 % of species in common with the other regions, and species catch rates in Lower Bay were less than 50% similar to other regions. Regardless of study area, non-channel stations had between 25-29 % of species in common and were 58-85% similar.

Harbor Study Areas

A total of twenty-seven (27) species were collected in the mid-water trawls; the most species (17 and 16) were collected from Newark Bay and the Upper Bay, respectively. The least species (13 and 14) were collected from the Lower Bay and the Arthur Kill/Kill Van Kull, respectively (Table 3-5). The five target species (mean CPUE of 10.0 for all areas of NY/NJ Harbor combined) were collected from Newark Bay stations (including one striped bass), four (4) target species were collected from the Arthur Kill/Kill Van Kull and Upper Bay areas, and two (2) (Atlantic menhaden and blueback herring) were collected from the Lower Bay. The sum of all mean CPUEs for target species was highest for Newark Bay (15.22), followed by the Upper Bay (12.76), and the Arthur Kill/Kill Van Kull (11.91); the sum of all mean CPUEs for target species was very low for the Lower Bay (0.10).

Community and similarity indices revealed interesting patterns among study areas. Taxa richness, species diversity, and evenness were higher in Upper and Newark bays than in the other study areas (Table 3-7). Upper Bay had the highest species diversity (2.04) and Evenness (0.51) scores of any region. Newark Bay had the highest richness, with seventeen (17) species collected. The Arthur Kill/Kill Van Kull and Lower Bay community indices were similar for species richness (13-14 species), diversity (0.49, 0.53), and evenness scores (0.13-0.14).

These patterns among study areas were somewhat reflected in the similarity index values. Channel stations in Arthur Kill/Kill Van Kull were 95% similar to non-channel stations in Lower Bay, mostly due to similar proportions of species in the total catch (Table 3-8).



Arthur Kill/Kill Van Kull channel stations were also very similar to Newark Bay non-channel stations, with 86% similarity. There was more species overlap between Arthur Kill/Kill Van Kull stations and Newark Bay stations, resulting in a high percent similarity. Of the Upper Bay comparisons, non-channel stations were most similar to Newark Bay channel stations (67%) and Upper Bay channel stations (65%). Lower Bay channel stations were least similar to Arthur Kill/Kill Van Kull (Jaccard's = 17; PSC = 35%) and to Newark Bay non-channel stations (Jaccard's = 20; PSC = 36%). Jaccard's index values were generally less than 30 for all comparisons with Upper and Lower Bay stations, indicating that species collected at these stations were typically not collected at stations in other areas.

Three (3) EFH managed species (Atlantic herring, bluefish and butterfish) were common in mid-water trawl collections and were found in all four regions of the harbor. The sum of all mean CPUEs for EFH managed species across all regions was 3.15. The sum of all mean CPUEs for EFH managed species was highest for the Arthur Kill/Kill Van Kull (5.98), followed by Newark Bay (3.36), the Upper Bay (2.12), and the Lower Bay (1.15). Bay anchovy were collected from all four regions and Atlantic silverside were collected from three (Arthur Kill/Kill Van Kull, Newark Bay, and Upper Bay) areas. The sum of all mean CPUEs for other finfish species across all regions of the harbor was 85.86. The sum of all mean CPUEs for other species was highest for the Arthur Kill/Kill Van Kull (271.88), followed by Newark Bay (40.50), the Lower Bay (19.58), and the Upper Bay (11.48).

Of the five (5) target species, alewife (mean CPUE of 2.46 for all regions combined) were collected primarily in the Upper Bay (mean CPUE of 7.43) followed by the AK/KVK (1.81), Newark Bay (0.59), and they were not collected in the Lower Bay (Table 3-5). American shad (mean CPUE of 0.1 for all regions) were not common, they were collected more often in the Upper Bay (0.22), followed by the Arthur Kill/Kill Van Kull (0.14) and Newark Bay (0.04); none were collected in the Lower Bay. Atlantic menhaden (mean CPUE of 4.02 for all regions) were collected in greater numbers in Newark Bay (11.04), followed by the Arthur Kill/Kill Van Kull (4.79); they were least



common in the Upper Bay and Lower Bay (0.18 & 0.04, respectively). Similar to alewife, blueback herring (mean CPUE of 3.42 for all regions) were collected in greater numbers in the Arthur Kill/Kill Van Kull (5.17), followed closely by the Upper Bay (4.93) and Newark Bay (3.52); few were collected in the Lower Bay (0.06).

Of the three EFH managed species that were common to the mid-water trawl collections, Atlantic herring (mean CPUE of 1.97 for all regions) were collected more often in the Arthur Kill/Kill Van Kull (4.14), followed by Newark Bay (2.38), and Upper Bay (1.27); and they were least common in the Lower Bay (0.10). Bluefish (mean CPUE of 0.11 for all regions) were collected more often in Newark Bay (0.21) and the Lower Bay (0.15); and they were least common in the Arthur Kill/Kill Van Kull (0.06) and the Upper Bay (0.02). Butterfish (mean CPUE of 1.06 for all regions) were well distributed through the NY/NJ Harbor area; they were collected slightly more often in the Arthur Kill/Kill Van Kull (1.76) than in the Lower Bay (0.88), Upper Bay (0.83), and Newark Bay (0.76).

Of the important forage fish species, Atlantic silverside were collected in very low numbers: Upper Bay (0.04) and Newark Bay (0.04) followed by the Arthur Kill/Kill Van Kull (0.02); none were collected in the Lower Bay. Bay anchovy were collected in greater numbers in the Arthur Kill/Kill Van Kull (271.61) with fewer collected in Newark Bay (39.84) followed by the Lower Bay (19.35) and the Upper Bay (11.31).

3.1.2 Bottom Trawl Sampling

Bottom trawls sample the finfish occurring on or near bottom habitats and provide data on the finfish species that would not typically be collected by mid-water trawls. The more common bottom or near bottom finfish species collected primarily or only by bottom trawl during the 2006 Migratory Finfish Sampling Program included striped bass (one of the five target species); black sea bass, scup, summer flounder, windowpane, and winter flounder (five (5) of the fourteen (14) EFH managed species collected during the survey); and weakfish one of the common species listed with other finfish species. Of the finfish infrequently collected (defined as twelve (12) or less) during the 2006 Migratory Finfish Sampling Program, four other EFH managed species and twenty-two (22) other finfish



species were only collected by bottom trawl. Although bottom trawl collections included all five target species, considerably more Atlantic menhaden, American shad, blueback herring, and alewife were collected by mid-water trawl. Two (2) EFH managed species (bluefish and butterfish) and two other important forage species for EFH managed species (Atlantic silverside and bay anchovy) were collected by both methods. Overall, bottom trawls were a suitable sampling method for collecting most of the EFH managed species (excluding Atlantic herring) and one of the five target species (striped bass).

A total of 25,961 finfish of fifty three (53) species were collected during the 2006 bottom trawl survey (Table 3-4). Target species represented about 1% of the total bottom trawl catch. EFH and other finfish species represented approximately 5% and 94 % of the total catch, respectively. The five target species, alewife (36 individuals), American shad (16), Atlantic menhaden (101), blueback herring (35), and striped bass (56 individuals) comprised a small portion of the total catch in the Harbor; striped bass were the only target species collected primarily by bottom trawl. Twelve (12) EFH managed species were collected in the bottom trawls; bluefish (153 individuals), butterfish (425), scup (564), and winter flounder (116) were more common. Black sea bass (42 individuals), summer flounder (36), and windowpane (33) were less common; and Atlantic herring (1), clearnose skate (10), little skate (12), red hake (3), and winter skate (3) were uncommon.

A total of 24,319 individuals of thirty six (36) other finfish species were collected. Two (2) important forage species for EFH managed species (Atlantic silverside and bay anchovy) are included in this group. Atlantic silverside (28 individuals) were uncommon in bottom trawl collections and bay anchovy (23,331) was the most abundant species collected in the NY/NJ Harbor area and comprised a significant portion (about 90%) of the total bottom trawl catch. Spotted hake (128 individuals) and weakfish (259) were common (occurred both spatially and temporally throughout sampling) and represented about 1.5 % of the total bottom trawl catch. Atlantic cod (40 individuals), Atlantic croaker (59), smallmouth flounder (54), striped anchovy (78), and striped searobin (93) were less common. Twelve (12) other species (including Atlantic silverside) were



represented by eight (8) to thirty four (34) individuals and sixteen (16) were represented by five (5) or less individuals.

Seasonal Trends

Bottom trawls were conducted from August to November. The harbor-wide seasonal occurrences of five (5) target species, twelve (12) EFH managed species, and fifty three (53) other finfish species collected by bottom trawl are provided in Table 3-9 and Figures 3-3 and 3-4a to 4d.

Five (5) target species were collected during the bottom trawl surveys (Table 3-4). Atlantic menhaden were collected primarily in August (84% of them) and a few were collected in September, October, and November. The four other target species were collected primarily in November: alewife (100% of them), American shad (75%), blueback herring (91%), and striped bass (80%).

Twelve (12) EFH managed species were collected by bottom trawl (Table 3-9); four (4) species (bluefish, butterfish, scup, and winter flounder) were relatively common in collections and eight species were uncommon. Of the four (4) common EFH managed species, bluefish were present from August to October with the highest mean CPUE of 2.90 occurring in September. Butterfish were most common in August (mean CPUE of 9.28) and September (3.19); but were also collected in October (0.93) and November (0.03). Scup followed a similar seasonal pattern, they were common in August (mean CPUE of 15.39), present in September (1.97) and October (1.27), and absent from the collections in November. Winter flounder were present in October (mean CPUE of 1.8) and November (1.02) with fewer collected in August (0.53) and September (0.52). Black sea bass, clearnose skate, and windowpane were uncommon; a few were collected during the August to November sampling period. One (1) Atlantic herring was caught in September, twelve (12) little skate were collected in November, and three (3) winter skate were collected in October; these species were not collected in any other month. Three (3) red hake were collected, one (1) each month in August, October, and November. Summer flounder were present in August, October, and November.



Of the thirty six (36) other finfish species collected, bay anchovy and Atlantic silversides are considered important forage species (Table 3-4). A few Atlantic silversides were collected during October (7 individuals) and November (21). Bay anchovy were abundant in bottom trawl collections; they were abundant in August (14,682) and very common in September (3,530) and October (4,938); one hundred and eighty one (181) bay anchovy were collected in November. Weakfish were collected each month during the bottom trawl surveys, they were more common during August (103 individuals) and October (89) and less common during September (44) and November (23).

Habitat (Channel – Non-channel)

Habitat information for the NY/NJ Harbor area is provided in Table 3-10 as the mean CPUE at channel and non-channel stations. Of the target species, American shad were present primarily in non-channel stations (mean CPUE of 0.48) compared to channel stations (mean CPUE of 0.01). Alewife (non-channel = 0.28; channel = 0.15), Atlantic menhaden (non-channel = 1.56; channel = 0.67), blueback herring (non-channel = 1.02; channel = 0.08), and striped bass (non-channel = 1.6; channel = 0.16) were generally collected more often from non-channel stations. Of the more common EFH managed species, bluefish (non-channel = 3.41; channel = 0.45), butterfish (non-channel = 11.03; channel = 0.64), scup (non-channel = 14.75; channel = 1.62), and summer flounder (non-channel = 0.50; channel = 0.12) showed a preference for non-channel habitats. Black sea bass (non-channel = 0.62; channel = 0.48) was slightly more common in non-channel habitats. Winter flounder (channel = 0.79; non-channel = 0.46), windowpane (channel = 0.19; non-channel = 0.06), and clearnose skate (channel = 0.13; non-channel = 0.12) were slightly more common in channel stations. Atlantic herring, little skate, red hake, and winter skate were only collected at channel habitats.

Of the other important finfish species, bay anchovy were collected primarily in non-channel habitats (mean CPUE of 618.04) versus channel areas (22.98). Atlantic silverside were collected only from non-channel habitats (0.90) while weakfish indicated a preference for channel (3.07) versus non-channel habitats (0.91).



The four (4) community indices were not consistent between channel and non-channel habitat types throughout the NY/NJ Harbor study area. Species richness and average CPUE values were typically higher at non-channel stations than channel stations, but species diversity and evenness values were lower. Non-channel stations in Newark Bay and Lower Bay had diversity values less than 1.0 and evenness scores of 0.06 and 0.17, respectively (Table 3-11). In contrast, channel stations had diversity values ranging from 1.69 in Upper Bay to 3.25 in Lower Bay, and evenness values were greater than 0.50. Channel stations were just as similar to other channel stations as to non-channel stations (Table 3-12). Jaccard's index values were generally less than 30 regardless of the station or area being compared, whereas PSC values ranged from 37 to 89 %.

Harbor Study Areas

Fifty three (53) finfish species were collected by bottom trawl; the most species (43) were collected from the Upper Bay (Table 3-10). The Lower Bay and Newark Bay had 34 and 32 species, respectively. The least species (22) were collected from the Arthur Kill/Kill Van Kull. All five target species were collected from the Lower Bay and Newark Bay; three target species (alewife, American shad, and Atlantic menhaden) were collected from the Upper Bay; and two (Atlantic menhaden and striped bass) were collected from the Arthur Kill/Kill Van Kull stations. Twelve (12) EFH managed species were collected from the Upper Bay, ten were collected from the Lower Bay; seven from Newark Bay; and four were collected from the Arthur Kill/Kill Van Kull stations.

Harbor study areas that were diverse also had high evenness scores. Although Arthur Kill/Kill Van Kull had the lowest species richness, this study area had the highest diversity (2.77) and evenness values (0.67) (Table 3-11). Upper Bay, which had the highest species richness, had moderate diversity and evenness values followed by Lower Bay and Newark Bay. The most similar stations were non-channel station in Lower Bay and Newark Bay, which had a Jaccard's index of 32.08 and a PSC of 89% (Table 3-12). Based on species caught, lower Bay non-channel stations had similar indices to the Newark Bay channel stations (Jaccard's index = 34.25; PSC = 84%). The least similar areas were Arthur Kill/Kill Van Kull channel stations with non-channel station in Newark



Bay (PSC = 37%) and Lower Bay channel stations with Newark Bay non-channel stations (PSC = 37%).

For the target species, alewife were collected primarily in the Upper Bay (mean CPUE of 0.43) and the Lower Bay (0.38); few were collected in Newark Bay (0.09) and none were collected in the Arthur Kill/Kill Van Kull (Table 3-10). Atlantic menhaden were collected from all four areas but were more common in collections from Arthur Kill/Kill Van Kull (1.49), followed by Newark Bay (1.16), Lower Bay (1.04), and the Upper Bay (0.43). American shad were primarily collected in the Lower Bay (0.42) followed by Newark Bay (0.16), and the Upper Bay (0.04); none were collected from the Arthur Kill/Kill Van Kull. Blueback herring were collected from two areas: Newark Bay (0.75) and the Lower Bay (0.52). Striped bass were collected from Newark Bay (1.56), Arthur Kill/Kill Van Kull (0.62), and the Lower Bay (0.05).

Of the EFH managed species, bluefish were collected more often in Newark Bay (2.66) and the Lower Bay (1.42); and were less common in collections from the Arthur Kill/Kill Van Kull (0.23) and the Upper Bay (0.57) (Table 3-10). Butterfish were collected more often in the Lower Bay (12.88) and were less common in Newark Bay (1.94), Upper Bay (0.89) and Arthur Kill/Kill Van Kull (0.37). Scup were collected more often in the Lower Bay (21.08) and were less common in the Upper Bay (1.39), the Arthur Kill/Kill Van Kull (0.32), and Newark Bay (0.13). Winter flounder were well distributed through NY/NJ Harbor and were collected slightly more often in the Upper Bay (1.54) followed by the Arthur Kill/Kill Van Kull (0.63), Lower Bay (0.52) and Newark Bay (0.38). Black sea bass (n = 42) were collected from the Lower Bay (1.0), Newark Bay (0.38), and Upper Bay (0.11); none were collected in the Arthur Kill/Kill Van Kull. Summer flounder (n = 36) were collected from the Lower Bay (0.67), Upper Bay (0.34), Newark Bay (0.03); none were collected in the Arthur Kill/Kill Van Kull. Windowpane (n = 33) were collected from the Upper Bay (0.52) and Lower Bay (0.17); none were collected in Newark Bay or the Arthur Kill/Kill Van Kull. Atlantic herring (n = 1) and winter skate (n = 3) were only collected in the Upper Bay. Clearnose skate (n = 10), little skate (n = 12), and red hake (n = 3) were collected in low numbers in the Lower and Upper bays.



Of the other important species, Atlantic silverside were collected only in Newark Bay. Bay anchovy were collected in greater numbers in Newark Bay (405.45) followed by the Lower Bay (297.57), the Upper Bay (55.59), and the Arthur Kill/Kill Van Kull (10.62) (Table 3-10). Weakfish were distributed through NY/NJ Harbor but were collected slightly more often in the Arthur Kill/Kill Van Kull (6.0), followed by Newark Bay (2.22), the Upper Bay (1.77), and Lower Bay (1.21).

3.2 WATER QUALITY

Water quality parameters, including temperature, dissolved oxygen (DO), and salinity, collected in NY/NJ Harbor were relatively consistent between mid-water and bottom values for each week sampled (Figures 3-5 to 3-7).

Mean weekly temperatures ranged between 11.0 to 25.8°C and 10.5 to 23.9°C during the study period at the mid-water and bottom, respectively (Figure 3-5). Temperatures were slightly higher throughout the study period in Arthur Kill/Kill Van Kull and Newark Bay as compared to the Upper Bay and Lower Bay. Despite this, seasonal temperature fluctuations followed a similar pattern among the four study areas. During the sampling period, mean weekly temperatures peaked during August for all regions and were lowest during late November.

Dissolved oxygen concentrations fluctuate with temperature and are somewhat linked to salinity. The solubility of oxygen in water solution decreases with rising temperatures and increasing salinities. As expected, dissolved oxygen concentrations were generally higher during April and November, and were lowest during August among the four areas (Figure 3-6). During the study period, dissolved oxygen concentration ranged between 3.8 to 10.6 mg/L and 3.6 to 8.6 mg/L for mid-water and bottom measurements, respectively.

Mean salinity ranged between ten (10) to twenty-eight (28) ppt and mean salinities were slightly lower at mid-water (Figure 3-7). The pattern of mean salinity fluctuations in three areas (Arthur Kill/Kill Van Kull, Upper Bay, and Lower Bay) were similar; Newark Bay



mean salinities showed greater fluctuations than observed in the other three areas and the pattern was slightly different. The mean salinity ranges were different between study areas, lowest mean salinities were in Newark Bay followed closely by the Arthur Kill/Kill Van Kull; the Upper Bay mean salinities were slightly lower than the Lower Bay which had the highest mean salinities.

4.0 DISCUSSION

4.1 SPATIAL & TEMPORAL TRENDS

Tables 4-1 to 4-4 summarize the seasonal trends of the five (5) target and fourteen (14) EFH managed species in the NY/NJ Harbor area. The migratory finfish survey results provide important information on the relative abundance of species on both temporal and habitat scales using the four NY/NJ Harbor regions as provided in Table 4-5. Significant spatial and temporal patterns observed for the five target species, five abundant EFH managed species, and bay anchovy and weakfish are reported in Table 4-6.

Although other finfish studies have been conducted throughout the NY/NJ Harbor area (summarized in Table 4-7 and section 4.2), few if any have used the mid-water trawl as the primary collection method over a large study area. The data suggests that the mid-water trawl is relatively efficient collecting four of the five (5) target species when compared to bottom trawl collections. Striped bass was the only target species that was not adequately represented in mid-water trawl collections. The mid-water trawl also collected five (5) of the fourteen (14) EFH managed species, two (2) important finfish forage species, and several other species in the NY/NJ Harbor area.

Stone *et al.* (1994) in particular used available temporal and spatial data collected by various methods (including trawls, gill nets, seines) to compile the seasonal occurrence and relative abundance of numerous juvenile and adult finfish species using the Raritan Bay and Hudson River Estuary. USACE (2004b) also used available information for the New York/New Jersey Harbor Complex from 1989 to 1999 to provide the primary



months of occurrence and the months with high levels and peak numbers. Summaries of their results by species are included in the following as additional information.

4.1.1 Target Species

Alewife

Mid-water and bottom trawl collections indicate that alewife are more likely to use the NY/NJ Harbor during early spring (primarily April); they appear to be generally absent from the area during the summer and early fall, returning during the late fall (November). When present, trawl collections suggest a preference for mid-water (they may also occur near bottom) in channel over non-channel habitats. Alewife were collected in greater numbers in the Upper Bay followed by the Arthur Kill/Kill Van Kull and Newark Bay; few were collected in the Lower Bay. Due to a predominance of zero catch data, patterns between use of channel or non-channel stations or among use of study areas were limited for mid-water or bottom trawl data. The length frequency of the alewife collected (Figure 4-1a) suggests that yearlings are primarily present during the spring with a few older juveniles; no adults were collected during the spring (April to June). During the late fall, young-of-year and some older juveniles were present in collections throughout the NY/NJ Harbor area.

Stone *et al.* (1994) indicates that alewife may be present all year in the Hudson-Raritan estuary with greater abundance of adults from April through early September (spawning in fresher waters from April to June and post spawning movements to the lower estuary) and juveniles from late May through November.

American shad

Mid-water and bottom trawl collections indicate that American shad are more likely to use the NY/NJ Harbor during late fall (primarily November) and appear to be generally out of the area from June through October. American shad were collected by both mid-water and bottom trawls in both channel and non-channel habitats. No patterns were observed between station types and among study areas in mid-water trawls. However, in bottom trawls American shad favored non-channel stations during October and



November 2006 (Table 4-6). American shad were collected more often in the Upper Bay followed by the Arthur Kill/Kill Van Kull, and less often in Newark Bay and the Lower Bay. The length frequency of the American shad collected (Figure 4-1b) suggests a few yearlings or older juveniles may be present during the spring. During the fall, primarily young of the year and a few older juveniles were present.

Stone *et al.* (1994) indicates that American shad may be present all year in the Hudson-Raritan estuary with adults primarily occurring from April through early September (spawning in fresher waters from April to June followed by post spawning movements to the lower estuary). Juveniles may be present all year with highest abundance from June to December.

Atlantic menhaden

Mid-water and bottom trawl collections indicate that Atlantic menhaden are more likely to use the NY/NJ Harbor during the late summer (August) to late fall (November). Trawl collections suggest a strong to slight preference for mid-water habitats and they appear to prefer channel over non-channel areas. Atlantic menhaden caught in mid-water trawls tended to be more abundant at Arthur Kill/Kill Van Kull and Newark Bay stations during August, October, and November (Table 4-6); they were less common in the Lower Bay followed by the Upper Bay. Atlantic menhaden caught in bottom trawls showed a temporal effect with higher catch rates in August and October, but no spatial patterns were observed (Table 4-6). The length frequency of Atlantic menhaden (Figure 4-1c) suggests that yearlings, older juveniles, and adults were present during the spring (April to June). During the summer and fall, young-of-year were present in collections throughout the NY/NJ Harbor. A few older juveniles were present in the Upper and Lower bays primarily during the fall; adults were present in the same areas only during fall.

Stone *et al.* (1994) indicates that adult and juvenile Atlantic menhaden are generally present from April through November. They are rare from December to March and generally abundant from May to November. USACE (2004b) found Atlantic menhaden



primarily occur from May to December with higher concentrations from June to September and peak concentrations from July to August.

Blueback herring

Mid-water and bottom trawl collections indicate that blueback herring are more likely to use the NY/NJ Harbor during early spring (primarily April); they appear to be generally out of the area from June through October and return in lower numbers during the late fall (November). Mid-water trawl collections suggest a strong preference for channel over non-channel areas, although this was not significant. Despite relatively low collections in bottom trawls, blueback herring were predominantly collected at non-channel stations (Table 4-6). There were no significant differences among study areas in mid-water or bottom trawl collections. However, blueback herring were collected in greater numbers in the Arthur Kill/Kill Van Kull, Upper Bay, and Newark Bay; considerably fewer were collected in the Lower Bay. The length frequency of the blueback herring collected (Figure 4-1d) suggests that yearlings are primarily present during the spring with some older juveniles and a few adult sized blueback herring. Some young-of-year and one older juvenile were present during summer; and primarily young-of-year with some yearlings/older juveniles and a couple of adult sized individuals were collected during the late fall.

Stone *et al.* (1994) indicates that juvenile blueback herring may be present all year in the Hudson-Raritan estuary with greater abundance from July through November. Adults move into the NY/NJ Harbor in early March (spawning in fresher waters from May to July followed by post spawning movements to the lower estuary); a few may be present from August to April the following year.

Striped bass

Bottom trawl collections indicate that striped bass are more likely to use the NY/NJ Harbor during the late fall (November) and are almost exclusively using near bottom habitat. Striped bass were collected from both channel and non-channel areas, however, in Newark Bay they were collected primarily in non-channel habitats. Striped bass were



collected in greater numbers in Newark Bay, followed by the Arthur Kill/Kill Van Kull; a few were collected in the Lower Bay and none were collected in the Upper Bay. There were strong spatial and temporal interactions in bottom trawl data. When the dataset was truncated to October and November 2006, station type became more important than study area. Striped bass were collected in higher frequency at non-channel stations in November (Table 4-6). The length frequency of the striped bass collected (Figure 4-1e) suggests that a few older juveniles were present in Newark bay during the late summer and primarily yearlings were present during the late fall.

Stone *et al.* (1994) indicates that striped bass may be present all year in the Hudson-Raritan estuary with adults primarily occurring from early March through early September (spawning in fresher waters from late April to June and followed by post spawning movements). Juveniles are common all year with higher abundance from late April to November. USACE (2004b) found striped bass occur throughout the year with higher concentrations from November to March and peak concentrations from January to March.

4.1.2 EFH Managed Species

Atlantic herring,

Mid-water and bottom trawl collections indicate that Atlantic herring are more likely to use the NY/NJ Harbor during spring. Trawl collections suggest a preference for mid-water primarily in channel over non-channel habitats, particularly during April 2006 (Table 4-6). Although there were no significant effects among study areas based on the 2-way ANOVA analysis, Atlantic herring were collected in greater numbers in the Arthur Kill/Kill Van Kull (7.03) followed by Newark Bay (8.02) and then the Upper Bay (2.70); few were collected in the Lower Bay (0.57). The length frequency of the Atlantic herring collected (Figure 4-1f) suggests that yearlings were primarily collected during the spring with a few older juveniles.



Stone *et al.* (1994) indicates that adult and juvenile Atlantic herring are generally present from January through May during migration, and are rare from May through December after their peak migration season.

Bluefish

Mid-water and bottom trawl collections indicate that bluefish are more likely to use the NY/NJ Harbor during late summer (August) to early fall (October). Bluefish were collected by both mid-water and bottom trawls in both channel and non-channel habitats, although this species preferred near bottom habitat in non-channel areas during August through October (Table 4-6). However, bluefish were collected more frequently in Newark Bay, followed by the Lower Bay; fewer were collected in the Upper Bay and the Arthur Kill/Kill Van Kull. The length frequency of the bluefish collected (Figure 4-1g) suggests that young-of-year are primarily present during the summer and early fall with a few older juveniles.

Stone *et al.* (1994) indicates that adult and juvenile bluefish are generally present from late April through October. Juvenile bluefish may be abundant during this period. USACE (2004b) found bluefish primarily occur from June to October with higher concentrations from July to September and peak concentrations in July.

Butterfish

Mid-water and bottom trawl collections indicate that butterfish are more likely to use the NY/NJ Harbor during the summer (June) to late fall (November); they were most common in August (Table 4-6). Butterfish were collected by both mid-water and bottom trawls in both channel and non-channel habitats, but no significant patterns between channel and non-channel station types were observed. The data suggest a preference for near bottom habitat in non-channel areas. Although there were also no significant effects among study areas based on the 2-way ANOVA analysis, Butterfish were collected more frequently in the Lower Bay, followed by Newark Bay; fewer were collected in the Upper Bay and the Arthur Kill/Kill Van Kull. The length frequency of the butterfish collected (Figure 4-1h) suggests that yearlings and older juveniles are present during the



spring; young-of-year and yearlings are primarily present during the summer; and yearlings are present during the fall. Young-of-year leave the NY/NJ Harbor area by late September and yearlings remain into November.

Stone *et al.* (1994) indicates that adult and juvenile butterfish are generally present in the Hudson-Raritan estuary from April through November.

Scup

Bottom trawl collections indicate that scup are more likely to use the NY/NJ Harbor during the summer (August) to early fall (October) but are most common in August (Table 4-6). Trawl collections suggest scup are almost exclusively using near bottom habitat. There were more scup collected from non-channel stations in the Lower Bay during late summer. A few scup were collected in the Upper Bay followed by the Arthur Kill/Kill Van Kull and Newark Bay. The length frequency of the collected scup (Figure 4-1i) suggests that young-of-year and some older juveniles (primarily yearlings) are present during the summer and fall.

Stone *et al.* (1994) indicates that adult and juvenile scup are generally present from late May through October. Juvenile scup may be abundant during this period.

Winter flounder

Bottom trawl collections indicate that winter flounder are found from August to November in the NY/NJ Harbor area but were most common in the fall (October and November). Trawl collections suggest winter flounder are almost exclusively using bottom habitat. There were no significant spatial or temporal effects observed. Winter flounder were collected in both channel and non-channel habitats. They were relatively more common in the Upper Bay, followed by the Arthur Kill/Kill Van Kull, Lower Bay, and Newark Bay. The length frequency of the collected winter flounder (Figure 4-1j) suggests that young-of-year and some older juveniles (primarily yearlings) are present during the summer and fall.



Stone *et al.* (1994) indicates that adult and juvenile winter flounder may be present all year. Spawning adults, however, are most abundant from December through April with juveniles most abundant from November to the following July. USACE (2004b) found winter flounder occur throughout the year with higher concentrations from November to June and peak concentrations from November to March.

Other EFH Managed Species Collected (Back sea bass, Clearnose skate, Cobia, Little skate, Red hake, Spanish mackerel, Summer flounder, Windowpane, Winter skate)

Back sea bass, clearnose skate, cobia, little skate, red hake, Spanish mackerel, summer flounder, windowpane, winter skate were collected infrequently within the study area. Back sea bass were collected by bottom trawl from August to November but were most common in October. More were collected in the Lower Bay followed by Newark Bay, and the Upper Bay; none were collected in the Arthur Kill/Kill Van Kull. Black sea bass were collected in slightly higher abundance in non-channel habitats.

Clearnose skate were collected by bottom trawl in very low abundance from August to November. They were collected only in the Lower Bay and Upper Bay with a slight preference for channel habitats.

One cobia was collected in a mid-water trawl from an Upper Bay channel station in August.

Little skate were only collected by bottom trawls in November. They were most common in the Lower Bay and were found only in channel habitats.

Red hake were collected in very low abundance by bottom trawl in August, October, and November. They were found only in the Lower Bay and Upper Bay in channel habitats.

Two Spanish mackerel were collected by mid-water trawl in August in the channel areas of the Arthur Kill/Kill Van Kull.

Summer flounder were collected by bottom trawl in August, October, and November with the highest abundances found in the Lower Bay in non-channel habitats.



Windowpane were collected by bottom trawl from August to November with the highest abundance occurring in November. They were found exclusively in the Lower Bay and Upper Bay with a preference for channel habitats.

Winter skate were collected in very low abundance by bottom trawl during October in channel habitats of the Upper Bay.

4.1.3 Other Finfish Species

Atlantic silverside

Atlantic silverside was collected in mid-water and bottom trawls during the fall (October and November) in the NY/NJ Harbor sampling. They were collected primarily in non-channel areas of Newark Bay and Upper Bay in both bottom and mid-water habitats.

Stone *et al.* (1994) indicates that adult and juvenile Atlantic silverside are generally abundant all year in the Hudson-Raritan estuary with highest abundances from May to August. USACE (2004b) found Atlantic silverside primarily occur in shoal habitats from May to December with higher concentrations from June to September and peak concentrations from July to August.

Bay anchovy

Mid-water and bottom trawl collections indicate that bay anchovy use the NY/NJ Harbor primarily from May to October with peak occurrence in mid summer (August). Because of this, the data were truncated to June through September for mid-water trawls and August through October for bottom trawls, and then analyzed. For mid-water trawl collections, bay anchovy show a strong preference for channel habitat over non-channel habitat due to high collections in Arthur Kill/Kill Van Kull. There were no significant spatial patterns observed in mid-water trawl data, only high catch rates during August (Table 4-6). Bay anchovy were collected more frequently in bottom trawls, particularly at non-channel stations. Although there were no significant effects among study areas based on the 2-way ANOVA analysis, bay anchovy were collected in greater numbers in the



Arthur Kill/Kill Van Kull and Newark Bay followed by the Lower Bay; they were least common in the Upper Bay.

Bay anchovy were the most common species collected from May through October. When both collection methods (mid-water and bottom trawls) were used (August to November), the data suggests bay anchovy were distributed in the water column from near bottom through the mid-water zone in August and September, they oriented towards the near bottom in October and many had moved out of the NY/NJ Harbor area by November. The length frequency of the collected bay anchovy (Figure 4-1k) suggests older juveniles and adults were present during the spring, late summer, and fall. Young-of-year were present during late summer and fall.

Stone *et al.* (1994) indicates that bay anchovy are generally present all year in the Hudson-Raritan estuary. Adult bay anchovy are usually abundant from April through December and juveniles (including YOY) are abundant from July through December. Adults generally spawn between May and August. USACE (2004b) found bay anchovy primarily occur from June to December with higher concentrations from June to July and peak concentrations in July.

Weakfish

Weakfish were collected by only bottom trawl from August to November with peak abundance in August. Weakfish were one of the few species that showed a preference for specific study areas in the harbor. During August through October, weakfish were collected more commonly at Arthur Kill/Kill Van Kull stations (Table 4-6). There were no differences in catch rates between channel and non-channel stations. Collections in Newark Bay were also abundant, followed by Lower Bay then Upper Bay. The length frequency of the collected weakfish (Figure 4-1l) suggests young-of-year and a few older juveniles (yearlings) are primarily present during the late summer and fall. Weakfish are generally considered to be a mid-water species, however, all 259 weakfish were collected by bottom trawl suggesting that while they were in the NY/NJ Harbor area they used near bottom habitats.



Stone *et al.* (1994) indicates that adult and juvenile weakfish are present in the harbor from late April through early December. Juvenile weakfish may be abundant from August to November. USACE (2004b) found weakfish primarily occur from May to December with higher concentrations from August to November and peak concentrations from August to October.

4.2 NY/NJ HARBOR STUDY AREAS

A discussion of the results as divided within the four geographic sub-regions of the Harbor (Arthur Kill/Kill Van Kull, Newark Bay, Upper Bay and Lower Bay) is presented below. Table 4-7 summarizes other relevant aquatic biological surveys conducted within each of the four study areas. The only other NY/NJ Harbor finfish study to sample all four (4) areas is the Biological Monitoring Program of the USACE. The results of this ongoing bottom trawl study to determine juvenile and adult finfish use of four (4) New York/New Jersey Harbor areas are included in the following reports:

- USACE-NYD (1999a) including monthly bottom trawl surveys in December 1998 & April to November 1999 and surveys twice each month in January to March 1999. (includes one Lower Bay station)
- USACE-NYD (2003a) including monthly bottom trawl surveys in December 2001 & April to June 2002 and surveys twice each month in January to March 2002. (additional Lower Bay stations added to the sampling program in 2002)
- USACE-NYD (2003b) including monthly bottom trawl surveys in December 2002 & April to June 2003 and surveys twice each month in January to March 2003.
- USACE-NYD (2004a) includes temporal – spatial distribution patterns and habitat requirements of fish and includes data collected from December 1998 to November 1999 and winter and spring data collected in 2001 through 2003.



- USACE-NYD (2005) including bottom trawl surveys twice each month in January to March 2004 and monthly April to June 2004.
- USACE-NYD (2006) including bottom trawl surveys twice each month in January to March 2005 and monthly April to June 2005.
- USACE-NYD (2007) including bottom trawl surveys twice each month in January to March 2006 and monthly April to June 2006.
- USACE-NYD (In Prep) including bottom trawl surveys twice each month in January to March 2007 and monthly April to June 2007.

4.2.1 Arthur Kill/Kill Van Kull

The Arthur Kill and Kill Van Kull provide migration routes to and from Newark Bay. The Arthur Kill connects Newark Bay to Raritan and Sandy Hook Bays and the Lower New York Bay. The Kill Van Kull connects Newark Bay to the Upper New York Bay. The Arthur Kill/Kill Van Kull region includes mostly channel habitat; there is relatively little non-channel habitat and none of the stations sampled were located in non-channel areas. Numerous obstructions limit areas where a valid bottom trawl could be conducted; two (2) bottom trawls were initially conducted in this region; one (MAK-2) was eliminated after three (3) surveys.

The Arthur Kill/Kill Van Kull area had the lowest number of species (31) collected of the four NY/NJ Harbor Study areas (fourteen (14) species were collected by mid-water trawl and twenty-two (22) were collected by bottom trawl).

Four (4) target species (alewife, American shad, Atlantic menhaden, and blueback herring), four EFH managed species (Atlantic herring, bluefish butterfish, and Spanish mackerel), and six other finfish including two (2) EFH forage species (Atlantic silverside and bay anchovy) were collected by mid-water trawl in the Arthur Kill/Kill Van Kull. The mean mid-water trawl CPUEs for Atlantic herring, bay anchovy, blueback herring,



butterfish, and Spanish mackerel were higher in the Arthur Kill/Kill Van Kull than in the other three NY/NJ Harbor areas.

Two (2) target species (Atlantic menhaden and striped bass), four (4) EFH managed species (bluefish, butterfish, scup, and winter flounder), and sixteen (16) other finfish including two (2) EFH forage species (Atlantic silverside and bay anchovy) and weakfish were collected by bottom trawl. The mean bottom trawl CPUEs for Atlantic menhaden and weakfish were higher in the Arthur Kill/Kill Van Kull than in the other three (3) NY/NJ Harbor areas.

4.2.2 Newark Bay

Newark Bay provides spawning, foraging, and nursery habitat for a variety of species. During migrations, Newark Bay provides a connection to the Passaic and Hackensack rivers and inland waters to the north and a connection to the estuarine waters of the Arthur Kill, Kill Van Kull, and Upper and Lower New York Bays.

The Newark Bay region had the second lowest number of species thirty five (35) collected of the four NY/NJ Harbor Study areas (17 species were collected by mid-water trawl and thirty two (32) were collected by bottom trawl).

The five (5) target species, three EFH managed species (Atlantic herring, bluefish, and butterfish), and nine other finfish including two EFH forage species (Atlantic silverside and bay anchovy) were collected by mid-water trawl in Newark Bay. The mean mid-water trawl CPUEs for Atlantic menhaden, Atlantic silverside, and bluefish were higher in Newark Bay than in the other three (3) NY/NJ Harbor regions.

The five (5) target species, seven EFH managed species (black sea bass, bluefish, butterfish, little skate, scup, summer flounder, and winter flounder), and 20 other finfish including two (2) EFH forage species (Atlantic silverside and bay anchovy) and weakfish were collected by bottom trawl in Newark Bay. The mean bottom trawl CPUEs for Atlantic silverside, bay anchovy, blueback herring, bluefish, and striped bass were higher in Newark Bay than in the other three NY/NJ Harbor regions.



4.2.3 Upper Bay

The Upper Bay provides spawning, foraging, and nursery habitat for a variety of species. During migrations, the Upper Bay provides a connection to the Kill Van Kull, Hudson River, and East River to the north and a connection to the Lower Bay and Atlantic Ocean to the south.

The Upper Bay had the highest number of species forty-eight (48) collected of the four (4) NY/NJ Harbor Study regions (16 species were collected by mid-water trawl and 43 were collected by bottom trawl).

Four (4) target species (alewife, American shad, Atlantic menhaden, and blueback herring), four EFH managed species (Atlantic herring, bluefish, butterfish, and cobia), and eight other finfish including two EFH forage species (Atlantic silverside and bay anchovy) were collected by mid-water trawl in the Upper Bay. The mean mid-water trawl CPUEs for alewife, American shad, and Atlantic silverside were higher in the Upper Bay than in the other three NY/NJ Harbor regions.

Three target species (alewife, American shad, and Atlantic menhaden), twelve EFH managed species (Atlantic herring, black sea bass, bluefish, butterfish, clearnose skate, little skate, red hake, scup, summer flounder, windowpane, winter flounder, and winter skate), and twenty-eight (28) other finfish including one EFH forage species (bay anchovy) and weakfish were collected by bottom trawl in the Upper Bay. The mean bottom trawl CPUEs for alewife, Atlantic herring, windowpane, winter flounder, and winter skate were higher in the Upper Bay than in the other three NY/NJ Harbor areas.

4.2.4 Lower Bay

The Lower Bay provides spawning, foraging, and nursery habitat for a variety of species. During migrations, the Lower Bay provides a connection to the Upper Bay to the north, the Arthur Kill to the west, and the Atlantic Ocean to the south and east.



The Lower Bay had the second highest number of species forty-eight (48) collected of the four NY/NJ Harbor Study regions (13 species were collected by mid-water trawl and thirty four (34) were collected by bottom trawl).

Two (2) target species (Atlantic menhaden and blueback herring), four EFH managed species (Atlantic herring, bluefish, butterfish, and winter flounder), and seven other finfish including one EFH forage species (bay anchovy) were collected by mid-water trawl in the Lower Bay. The mean mid-water trawl CPUEs were generally low compared to the other three NY/NJ Harbor areas. The second highest mean mid-water trawl CPUE for bluefish and butterfish were from the Lower Bay.

The five target species, ten EFH managed species (black sea bass, bluefish, butterfish, clearnose skate, little skate, red hake, scup, summer flounder, windowpane, and winter flounder), and nineteen (19) other finfish including one (1) EFH forage species (bay anchovy) and weakfish were collected by bottom trawl in the Lower Bay. The mean bottom trawl CPUEs for American shad, black sea bass, butterfish, clearnose skate, little skate, red hake, scup, and summer flounder were higher in the Lower Bay than in the other three NY/NJ Harbor regions.

4.3 WATER QUALITY

The water quality and habitat characteristics of the areas sampled may affect the spatial and temporal occurrence of finfish in the Harbor. As previously demonstrated, the Lower Bay is more characteristic of a marine/oceanic environment than the Arthur Kill/Kill Van Kull, Newark Bay, and the Upper Bay, which are more characteristic of nearshore, estuarine environments (USACE 2003a). However, the Upper Bay may exhibit more marine characteristics in comparison to the Arthur Kill/Kill Van Kull or Newark Bay because the wide channel at the Narrows connecting the Lower Bay and Upper Bay allows relatively unobstructed flow between the two areas. Moreover, the complex hydrology of the Newark Bay and Arthur Kill/Kill Van Kull system is influenced by several freshwater sources including the Hackensack, Passaic, Raritan and Elizabeth



Rivers as well as a semi-diel tide that enters from both the Raritan Bay to the south and the Upper Bay to the west (USACE 1999b).

5.0 SUMMARY AND RECOMMENDATIONS

The 2006 Migratory Finfish Sampling Program was successful in collecting sufficient numbers of the target species to provide the beginning of a database for describing migratory movements in the Harbor. In addition, the sampling enhanced the existing database for EFH species that are currently being studied in the ABS Program. The two programs can be complementary and ultimately the refinements to managing dredging operations in the Harbor can be based on the composite picture of temporal and spatial habitat utilization from these two programs.

The MFS Program provides useful information for designing future sampling programs for the target species to maximize the data relevant to dredging operations. The following recommendations are based on the findings and observations from the 2006 sampling program:

- Mid-water trawling was effective for capturing American shad, blueback herring, alewife and Atlantic menhaden, but not for sampling striped bass. Mid-water trawling should be continued as the principal sampling gear for four (4) of the five (5) target species. Striped bass must be sampled with bottom trawls. Mid-water trawling could be used to investigate depth distribution for the species that prefer channels by sampling over a series of depths within the channels. Data from this sampling could define the depth distribution of the fish in relation to the bottom disturbance of dredging and the associated turbidity plume.
- Mid-water trawling was effective for sampling Atlantic herring and butterfish among the EFH species. Butterfish also occur in bottom trawls, thus the MFS will supplement the ABS Program data for this species. The MFS provides Atlantic herring information previously unavailable in the ABS Program. Mid-



water trawling also showed the occurrence of some EFH species (cobia, Spanish mackerel) which did not occur in ABS sampling. These species apparently occur in low abundance so that the MFS will not provide information on temporal and spatial distribution. However, use of mid-water trawling may show changes in the relative abundance of uncommon pelagic species over time.

- Striped bass, among the target migratory species, requires an adjustment to the temporal distribution of sampling. Previous studies of striped bass have shown that young-of-the-year (YOY) striped bass can move into the Harbor by mid-summer and may be widely distributed by that time. Bottom trawling from July through the end of the year would provide a more complete picture of the use of the Harbor by juvenile striped bass, while providing an expanded temporal database for EFH species.
- Among the target migratory species, Atlantic menhaden more closely resemble EFH species that have a generalized movement from offshore marine waters to inshore waters on a seasonal basis. Adjustment of the spatial distribution of sampling to place more sampling in the Lower Bay (only one channel station in 2006) could provide better definition of movement patterns for both Atlantic menhaden and the marine pelagic EFH species. An expansion of the sampling in Lower Bay should include mid-water trawling to accommodate the open water pelagic species

The results of the 2006 MFS Program represent a successful initial attempt to bring refined definition to the movements of migratory fish in the Harbor. Migrations occur on an annual basis, thus multiple years of consistent sampling, incorporating changes adapted to an increasing knowledge base, are needed to reveal predictable patterns of movements and habitat use. Integrating the ABS and MFS results in the future will promote more efficient dredging operations.



6.0 LITERATURE CITED

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Table 2-1. Description of mid-water and bottom trawl stations sampled during the 2006 Migratory Finfish Sampling Program.

Station	Harbor Area	Depth Sampled	Habitat	Site Location
MLB-1	Lower Bay	Mid & Bottom	Non-channel	Gravesend Bay
MLB-2	Lower Bay	Mid & Bottom	Non-channel	N of West Bank/Hoffman Is.
MLB-3	Lower Bay	Mid & Bottom	Channel	Outside Ambrose Channel; E of Swinburne Is.
MLB-4	Lower Bay	Mid	Non-channel	On flats SW of West Bank
MUB-1	Upper Bay	Mid & Bottom	Channel	Middle of The Narrows, just N of Verrazano
MUB-2	Upper Bay	Mid & Bottom	Channel	In Anchorage Channel, just S of 24 buoy
MUB-3	Upper Bay	Mid & Bottom	Channel	Bay Ridge Channel, just SE of marker 7
MUB-4	Upper Bay	Mid	Channel	In Anchorage channel, just W Bay Ridge Flats
MUB-5	Upper Bay	Mid & Bottom	Channel	E of Jersey Flats; N of channel to MOT
MUB-6	Upper Bay	Mid	Non-channel	Jersey Flats
MUB-7	Upper Bay	Mid	Non-channel	Shallows off Caven Point
MUB-8	Upper Bay	Mid & Bottom	Channel	Edge of Anchorage Channel; just SE of Liberty Is.
MUB-9	Upper Bay	Mid & Bottom	Channel	Edge of Anchorage Channel; just E of Ellis Is.
MUB10	Upper Bay	Mid & Bottom	Channel	Edge of Anchorage Channel; just E of Liberty Is.
MNB-1	Newark Bay	Mid & Bottom	Channel	Mouth of S. Elizabeth Channel
MNB-2	Newark Bay	Mid & Bottom	Channel	Just S of Elizabeth Channel
MNB-3	Newark Bay	Mid & Bottom	Non-channel	On flats opposite Elizabeth & Port Newark channels
MNB-4	Newark Bay	Mid & Bottom	Non-channel	Off channel just S of NJTPK Ext. bridge
MNB-5	Newark Bay	Mid	Channel	In channel; mouth of Hackensack River
MNB-6	Newark Bay	Mid	Non-channel	On flats at mouth of Passaic River
MAK-1	Arthur Kill	Mid & Bottom	Channel	In channel off Elizabethport
MAK-2	Arthur Kill	Mid & Bottom	Channel	In channel at mouth of Piles Creek
MAK-3	Arthur Kill	Mid	Channel	In channel at mouth of Rahway River
MAK-4	Arthur Kill	Mid	Channel	In channel, just S of Fresh Kills/Cedar Point
MKK-1	Kill Van Kull	Mid	Channel	In channel off Constable Hook
MKK-2	Kill Van Kull	Mid	Channel	In channel off tip of Bayonne



Table 2-2. Specifications of the mid-water trawl and bottom trawl used to collect finfish during the 2006 Migratory Finfish Sampling Program.

Specifications of the 18-ft mid-water trawl:

Part	Specification
Trawl type	Four seam balloon trawl designed for fishing the water column from surface to near bottom.
Headrope	18 ft. (5.49 m)
Footrope	18 ft (5.49 m)
Wing height/siderope	6.0 ft. (1.83 m)
Total length	21.3 ft (6.5m)
Wing mesh (square)	1.0-in. (2.54 cm)
Body mesh (square)	1.0-in. (2.54 cm)
Cod end mesh (square)	0.75-in. (1.9 cm)
Cod end liner mesh (square)	0.25-in. (0.6 cm)
Trawl doors	32.0 x 17.0 x 0.75-in (79.2 x 39.6 x 3.1 cm)
Tow line length	200 feet
Spreader Bars	5-ft, 0.75-inch galvanized pipe attached to head and foot rope on each net wing to maintain vertical net opening.
Door Floats	18-inch round foam, attached to door with cable of varying length depending on fishing depth.
Float line length	As per table specifications
Tow line/cable length	200 feet

Specifications of the 30-ft bottom trawl

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)	1.0-in. (2.54 cm)
Body mesh (square)	1.0-in. (2.54 cm)
Cod end mesh (square)	0.75-in. (1.9 cm)
Cod end liner mesh (square)	0.25-in. (0.6 cm)
Trawl doors	32.0 x 17.0 x 0.75-in (79.2 x 39.6 x 3.1 cm)
Tow cable length	200 feet in up forty feet of water then 5 times maximum station water depth. In shallow water with soft bottom, tow line length may be reduced if collecting mud.



Table 2-3. Water quality parameters and meter specifications for water quality measurements taken during the 2006 Migratory Finfish Sampling Program.

Water Quality Parameter	Units and Accuracy	Sample Depths	
		Mid-water Trawl	Bottom Trawl
Temperature	+/- 0.2	At sample depth	1 ft off bottom
Dissolved oxygen	+/- 0.5 mg/L	At sample depth	1 ft off bottom
Conductivity	+/- 100 microseimens	At sample depth	1 ft off bottom
Salinity	+/- 0.1 ppt	At sample depth	1 ft off bottom





Table 3-1. Checklist of finfish species (common and scientific names) collected in mid-water and bottom trawl samples during the 2006 Migratory Finfish Sampling Program. (X = Present in catch; Ranked 1-10 with 1 being most common species.) (1 of 2)

Group	Common Name	Scientific Name	MWT	BT
Target Species	Alewife	<i>Alosa pseudoharengus</i>	4	X
	American shad	<i>Alosa sapidissima</i>	7	X
	Atlantic menhaden	<i>Brevoortia tyrannus</i>	3	8
	Blueback herring	<i>Alosa aestivalis</i>	2	X
	Striped bass	<i>Morone saxatilis</i>	X	X
Essential Fish Habitat Species	Atlantic herring	<i>Clupea harengus</i>	5	X
	Black sea bass	<i>Centropristis striata</i>		X
	Bluefish	<i>Pomatomus saltatrix</i>	9	5
	Butterfish	<i>Peprilus triacanthus</i>	6	3
	Clearnose skate	<i>Raja eglanteria</i>		X
	Cobia	<i>Rachycentron canadum</i>	X	
	Little skate	<i>Leucoraja erinacea</i>		X
	Red hake	<i>Urophycis chuss</i>		X
	Scup	<i>Stenotomus chrysops</i>		2
	Spanish mackerel	<i>Scomberomorus spp.</i>	X	
	Summer flounder	<i>Paralichthys dentatus</i>		X
	Windowpane	<i>Scopthalmus aquosus</i>		X
	Winter flounder	<i>Pseudopleuronectes americanus</i>	X	7
	Winter skate	<i>Leucoraja ocellata</i>		X
Other Species	American eel	<i>Anguilla rostrata</i>		X
	American sandlance	<i>Ammodytes americanus</i>	X	
	Atlantic cod	<i>Gadus morhua</i>		X
	Atlantic croaker	<i>Micropogonias undulatus</i>	X	X
	Atlantic cutlassfish	<i>Trichiurus lepturus</i>	X	
	Atlantic moonfish	<i>Selene setapinnis</i>	10	X
	Atlantic silverside	<i>Menidia menidia</i>	X	X
	Atlantic tomcod	<i>Microgadus tomcod</i>		X
	Bay anchovy	<i>Anchoa mitchilli</i>	1	1
	Conger eel	<i>Conger oceanicus</i>		X
	Crevalle jack	<i>Caranx hippos</i>		X
	Cunner	<i>Tautoglabrus adspersus</i>		X
	Feather blenny	<i>Hypsoblennius hentzi</i>		X
	Four beard rockling	<i>Enchelyopus cimbrius</i>	X	
	Fourspot flounder	<i>Hippoglossina oblonga</i>		X
	Gizzard shad	<i>Dorosoma cepedianum</i>		X
	Grubby	<i>Myoxocephalus aeneus</i>	X	X
	Hickory shad	<i>Alosa mediocris</i>	X	X
	Hogchocker	<i>Trinectes maculatus</i>		X
	Inshore lizardfish	<i>Synodus foetens</i>		X
	Lined seahorse	<i>Hippocampus erectus</i>	X	X
	Longhorn sculpin	<i>Myoxocephalus octodecemspinosus</i>		X
	Lookdown	<i>Selene vomer</i>	X	X



Table 3-1 (cont). Checklist of finfish species (common and scientific names) collected in mid-water and bottom trawl samples during the 2006 Migratory Finfish Sampling Program. (X = Present in catch; Ranked 1-10 with 1 being most common species.) (2 of 2)

Group	Common Name	Scientific Name	MWT	BT
Other Species	Naked goby	<i>Gobiosoma bosc</i>		X
	Northern kingfish	<i>Menticirrhus saxatilis</i>		X
	Northern pipefish	<i>Syngnathus fuscus</i>	X	X
	Northern searobin	<i>Prionotus carolinus</i>		X
	Northern stargazer	<i>Astroscopus guttatus</i>	X	X
	Oyster toadfish	<i>Opsanus tau</i>		X
	Silver hake	<i>Merluccius bilinearis</i>		X
	Smallmouth flounder	<i>Etropus microstomus</i>		X
	Smooth dogfish	<i>Mustelus canis</i>		X
	Spot	<i>Leiostomus xanthurus</i>		X
	Spotted hake	<i>Urophycis regia</i>	10	6
	Striped anchovy	<i>Anchoa hepsetus</i>	8	10
	Striped searobin	<i>Prionotus evolans</i>	X	9
	Tautog	<i>Tautoga onitis</i>		X
	Weakfish	<i>Cynoscion regalis</i>		4
White perch	<i>Morone americana</i>		X	



Table 3-2. Total number of finfish collected by species each month in mid-water and bottom trawl samples during the 2006 Migratory Finfish Sampling Program.

Group	Common Name	April	May	June	August	September	October	November	Total	
Target Species	Alewife	198	34					865	1,097	
	American shad	2	3		1		3	46	55	
	Atlantic menhaden	9	8		261	24	730	222	1,254	
	Blueback herring	575	60	1	30	1	4	577	1,248	
	Striped bass	1			1	4	6	45	57	
	<i>Sub-total</i>	<i>785</i>	<i>105</i>	<i>1</i>	<i>293</i>	<i>29</i>	<i>743</i>	<i>1,755</i>	<i>3,711</i>	
Essential Fish Habitat Species	Atlantic herring	607	9	2		1			619	
	Black sea bass				13	4	22	3	42	
	Bluefish			4	48	101	29		182	
	Butterfish	8	13	65	496	109	28	28	747	
	Clearnose skate				1	2	4	3	10	
	Cobia				1				1	
	Little skate							12	12	
	Red hake				1		1	1	3	
	Scup				465	61	38		564	
	Spanish mackerel				2				2	
	Summer flounder				13		17	6	36	
	Windowpane				6	3	8	16	33	
	Winter flounder				17	16	55	29	117	
	Winter skate						3		3	
	<i>Sub-total</i>	<i>615</i>	<i>22</i>	<i>71</i>	<i>1,063</i>	<i>297</i>	<i>205</i>	<i>98</i>	<i>2,371</i>	
Other Species	American eel				1	1		1	3	
	American sandlance		4						4	
	Atlantic cod				40				40	
	Atlantic croaker	1			53		2	4	60	
	Atlantic cutlassfish							1	1	
	Atlantic moonfish					20	12	11	43	
	Atlantic silverside	1					10	26	37	
	Atlantic tomcod							1	1	
	Bay anchovy	74	1,865	395	34,403	5,751	5,172	462	48,122	
	Conger eel				1				1	
	Creville jack				2	1	1		4	
	Cunner				1	3	6	1	11	
	Feather blenny						1	1	2	
	Four beard rockling		1						1	
	Fourspot flounder				7	2	2	1	12	
	Gizzard shad						1	3	4	
	Grubby				2	1	2		5	
	Hickory shad		3	2				5	10	
	Hogchocker				3			5	8	
	Inshore lizardfish				3				3	
	Lined seahorse	2			1	5	2	1	11	
	Longhorn sculpin							1	1	
	Lookdown				4	1	1		6	
	Naked goby					2			2	
	Northern kingfish				4	2	2		8	
	Northern pipefish	1	1		1	2	3	1	9	
	Northern searobin				13				2	15
	Northern stargazer				6	2			8	
	Oyster toadfish				8	2	5	1	16	
	Silver hake							5	28	33
	Smallmouth flounder				20	1	6	27	54	
	Smooth dogfish				5	6	5		16	
	Spot					1			2	3
	Spotted hake	6	4		23			9	96	138
	Striped anchovy				66	41	4			111
	Striped searobin				46	33	13		2	94
	Tautog				2	7	8		1	18
	Weakfish				103	44	89		23	259
	White perch				1				33	34
	<i>Sub-total</i>	<i>85</i>	<i>1,878</i>	<i>397</i>	<i>34,819</i>	<i>5,928</i>	<i>5,372</i>	<i>729</i>	<i>49,208</i>	
Total Number	1,485	2,005	469	36,175	6,254	6,320	2,582	55,290		
Number of Species	13	12	6	41	32	40	36	58		

Table 3-3. Total number of finfish collected by species each month in mid-water trawl samples during the 2006 Migratory Finfish Sampling Program.

Group	Common Name	April	May	June	August	September	October	November	Total
Target Species	Alewife	198	34					829	1,061
	American shad	2	3					34	39
	Atlantic menhaden	9	8		176	23	718	219	1,153
	Blueback herring	575	60	1	30		2	545	1,213
	Striped bass	1							1
Essential Fish Habitat Species	Atlantic herring	607	9	2					618
	Bluefish			4	13	11	1		29
	Butterfish	8	13	65	199	10		27	322
	Cobia				1				1
	Spanish mackerel				2				2
	Winter flounder						1		1
Other Species	American sandlance		4						4
	Atlantic croaker	1							1
	Atlantic cutlassfish							1	1
	Atlantic moonfish							10	10
	Atlantic silverside	1					3	5	9
	Bay anchovy	74	1,865	395	19,721	2,221	234	281	24,791
	Four beard rockling		1						1
	Grubby					1			1
	Hickory shad		3	2					5
	Lined seahorse	2			1	4	1	1	9
	Lookdown					1	1		2
	Northern pipefish	1	1		1		1		4
	Northern stargazer				5	2			7
	Spotted hake	6	4						10
	Striped anchovy				6	27			33
	Striped searobin					1			1
Total Number		1,485	2,005	469	20,155	2,301	962	1,952	29,329
Number of Species		13	12	6	11	10	9	10	27



Table 3-4. Total number of finfish collected by species each month in bottom trawl samples during the 2006 Migratory Finfish Sampling Program.

Group	Common Name	August	September	October	November	Total
Target Species	Alewife				36	36
	Atlantic menhaden	85	1	12	3	101
	American shad	1		3	12	16
	Blueback herring		1	2	32	35
	Striped bass	1	4	6	45	56
Essential Fish Habitat Species	Atlantic herring		1			1
	Black sea bass	13	4	22	3	42
	Bluefish	35	90	28		153
	Butterfish	297	99	28	1	425
	Clearnose skate	1	2	4	3	10
	Little skate				12	12
	Red hake	1		1	1	3
	Scup	465	61	38		564
	Summer flounder	13		17	6	36
	Windowpane	6	3	8	16	33
	Winter flounder	17	16	54	29	116
	Winter skate			3		3
Other Species	American eel	1	1		1	3
	Atlantic cod	40				40
	Atlantic croaker	53		2	4	59
	Atlantic moonfish		20	12	1	33
	Atlantic silverside			7	21	28
	Atlantic tomcod				1	1
	Bay anchovy	14,682	3,530	4,938	181	23,331
	Conger eel	1				1
	Crevalle jack	2	1	1		4
	Cunner	1	3	6	1	11
	Feather blenny			1	1	2
	Fourspot flounder	7	2	2	1	12
	Gizzard shad			1	3	4
	Grubby	2		2		4
	Hickory shad			5		5
	Hogchocker	3		5		8
	Inshore lizardfish	3				3
	Lined seahorse		1	1		2
	Longhorn sculpin			1		1
	Lookdown	4				4
	Naked goby		2			2
	Northern kingfish	4	2	2		8
	Northern pipefish		2	2	1	5
	Northern searobin	13			2	15
	Northern stargazer	1				1
	Oyster toadfish	8	2	5	1	16
	Silver hake			5	28	33
	Smallmouth flounder	20	1	6	27	54
	Smooth dogfish	5	6	5		16
	Spot		1		2	3
	Spotted hake	23		9	96	128
	Striped anchovy	60	14	4		78
	Striped searobin	46	32	13	2	93
Tautog	2	7	8	1	18	
Weakfish	103	44	89	23	259	
White perch	1			33	34	
Total Number		16,020	3,953	5,358	630	25,961
Number of Species		36	29	39	34	53



Table 3-5. Average mid-water trawl CPUE (± 1 standard error) by species for all navigation channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2006 Finfish Monitoring Sampling Program (1 of 2).

Common Name	Station Type	Region								Avg. CPUE	SE
		AK/KVK		NB		UB		LB			
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Target Species</i>											
Alewife	Channel	1.806	0.988	0.583	0.268	9.292	5.726			2.920	2.157
	Non-Channel			0.600	0.356					0.200	0.200
	Combined	1.806	0.988	0.592	0.220	7.433	4.588			2.458	1.701
American shad	Channel	0.139	0.075	0.083	0.047	0.271	0.104			0.123	0.057
	Non-Channel										
	Combined	0.139	0.075	0.042	0.024	0.217	0.084			0.099	0.049
Atlantic menhaden	Channel	4.792	2.908	17.917	15.404	0.208	0.084			5.729	4.210
	Non-Channel			3.971	2.759	0.083	0.083	0.056	0.039	1.370	1.301
	Combined	4.792	2.908	11.042	7.917	0.183	0.069	0.042	0.029	4.015	2.589
Blueback herring	Channel	5.174	3.271	5.694	3.046	6.052	3.116			4.230	1.421
	Non-Channel			1.293	0.917	0.444	0.444	0.083	0.061	0.607	0.358
	Combined	5.174	3.271	3.525	1.619	4.931	2.500	0.063	0.046	3.423	1.178
Striped bass	Channel			0.028	0.028					0.007	0.007
	Non-Channel										
	Combined			0.014	0.014					0.004	0.004
Sum of combined CPUE for station		11.910		15.215		12.764		0.104		9.998	
<i>Essential Fish Habitat Species</i>											
Atlantic herring	Channel	4.135	3.072	4.694	3.282	1.583	1.510	0.333	0.333	2.687	1.036
	Non-Channel							0.028	0.028	0.009	0.009
	Combined	4.135	3.072	2.380	1.676	1.267	1.208	0.104	0.085	1.972	0.858
Bluefish	Channel	0.056	0.027	0.167	0.116	0.031	0.018	0.083	0.083	0.084	0.029
	Non-Channel			0.257	0.155			0.167	0.102	0.141	0.075
	Combined	0.056	0.027	0.211	0.096	0.025	0.014	0.146	0.079	0.109	0.043
Butterfish	Channel	1.764	0.746	0.806	0.363	1.010	0.281	0.917	0.668	1.124	0.217
	Non-Channel			0.719	0.474	0.083	0.058	0.861	0.483	0.555	0.239
	Combined	1.764	0.746	0.763	0.295	0.825	0.228	0.875	0.396	1.057	0.237
Cobia	Channel					0.010	0.010			0.003	0.003
	Non-Channel										
	Combined					0.008	0.008			0.002	0.002
Spanish mackerel	Channel	0.028	0.028							0.007	0.007
	Non-Channel										
	Combined	0.028	0.028							0.007	0.007
Winter flounder	Channel										
	Non-Channel							0.028	0.028	0.009	0.009
	Combined							0.021	0.021	0.005	0.005
Sum of combined CPUE for station		5.983		3.355		2.125		1.146		3.152	
<i>Other Species</i>											
American sandlance	Channel					0.042	0.042			0.010	0.010
	Non-Channel										
	Combined					0.033	0.033			0.008	0.008
Atlantic cutlassfish	Channel					0.010	0.010			0.003	0.003
	Non-Channel										
	Combined					0.008	0.008			0.002	0.002
Atlantic moonfish	Channel	0.056	0.039	0.139	0.099	0.010	0.010			0.051	0.032
	Non-Channel										
	Combined	0.056	0.039	0.070	0.050	0.008	0.008			0.034	0.017
Atlantic silverside	Channel	0.017	0.017							0.004	0.004
	Non-Channel			0.086	0.063	0.208	0.208			0.098	0.060
	Combined	0.017	0.017	0.042	0.031	0.042	0.042			0.025	0.010
Atlantic tomcod	Channel										
	Non-Channel										
	Combined										
Bay anchovy	Channel	271.613	149.157	47.194	17.441	13.885	4.588	0.667	0.432	83.340	63.516
	Non-Channel			32.275	19.035	1.000	0.715	25.583	16.253	19.619	9.508
	Combined	271.613	149.157	39.840	12.832	11.308	3.700	19.354	12.249	85.529	62.318



Table 3-5. Average mid-water trawl CPUE (± 1 standard error) by species for all navigation channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2006 Finfish Monitoring Sampling Program (2 of 2).

Common Name	Station Type	Region								Avg. CPUE	SE
		AK/KVK		NB		UB		LB			
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
Four beard rockling	Channel										
	Non-Channel							0.028	0.028	0.009	0.009
	Combined							0.021	0.021	0.005	0.005
Grubby	Channel										
	Non-Channel							0.028	0.028	0.009	0.009
	Combined							0.021	0.021	0.005	0.005
Hickory shad	Channel			0.111	0.066	0.010	0.010			0.030	0.027
	Non-Channel										
	Combined			0.056	0.034	0.008	0.008			0.016	0.014
Lined seahorse	Channel					0.042	0.021			0.010	0.010
	Non-Channel							0.139	0.058	0.046	0.046
	Combined					0.033	0.016	0.104	0.045	0.034	0.025
Lookdown	Channel	0.014	0.014	0.028	0.028					0.010	0.007
	Non-Channel				0.000						
	Combined	0.014	0.014	0.014	0.014					0.007	0.004
Northern pipefish	Channel			0.056	0.039					0.014	0.014
	Non-Channel			0.041	0.041					0.014	0.014
	Combined			0.048	0.028					0.012	0.012
Northern stargazer	Channel	0.014	0.014			0.042	0.025			0.014	0.010
	Non-Channel					0.042	0.042	0.028	0.028	0.023	0.012
	Combined	0.014	0.014			0.042	0.022	0.021	0.021	0.019	0.009
Spot	Channel										
	Non-Channel										
	Combined										
Spotted hake	Channel			0.111	0.111					0.028	0.028
	Non-Channel			0.184	0.147			0.028	0.028	0.070	0.057
	Combined			0.147	0.091			0.021	0.021	0.042	0.035
Striped anchovy	Channel	0.167	0.095	0.222	0.133					0.097	0.057
	Non-Channel			0.314	0.216			0.056	0.056	0.123	0.097
	Combined	0.167	0.095	0.268	0.125			0.042	0.042	0.119	0.061
Striped searobin	Channel			0.028	0.028					0.007	0.007
	Non-Channel										
	Combined			0.014	0.014					0.004	0.004
Sum of combined CPUE for station			271.880		40.500		11.483		19.583		85.862



Table 3-6. Monthly average mid-water CPUE (± 1 standard error) by species for all channel and non-channel stations combined during the 2006 Finfish Monitoring Sampling Program. (1 of 2)

Common Name	Station Type	April		May		June		August		September		October		November		Monthly Mean	Monthly SE	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE			
<i>Target Species</i>																		
Alewife	Channel	11.111	5.727	0.528	0.330										22.889	14.943	4.933	3.371
	Non-Channel			1.000	0.736										0.313	0.254	0.188	0.142
	Combined	8.000	4.215	0.673	0.319										15.942	10.403	3.516	2.351
American shad	Channel	0.111	0.076	0.083	0.061										0.944	0.282	0.163	0.131
	Non-Channel																	
	Combined	0.080	0.055	0.058	0.043										0.654	0.203	0.113	0.091
Atlantic menhaden	Channel	0.500	0.246	0.222	0.170			3.611	2.810	0.556	0.320	17.444	15.418	5.972	5.127	4.044	2.386	
	Non-Channel							2.875	2.394	0.188	0.101	5.625	5.625	0.250	0.171	1.277	0.825	
	Combined	0.360	0.181	0.154	0.118			3.385	2.067	0.442	0.224	13.808	10.788	4.212	3.554	3.194	1.882	
Blueback herring	Channel	31.583	13.710	1.472	0.793	0.056	0.056	0.806	0.438			0.056	0.056	14.028	7.861	6.857	4.546	
	Non-Channel	1.524	1.524	0.453	0.276			0.063	0.063					2.500	1.981	0.648	0.373	
	Combined	23.167	10.179	1.159	0.557	0.038	0.038	0.577	0.306			0.038	0.038	10.481	5.502	5.066	3.340	
Striped bass	Channel	0.056	0.056														0.008	0.008
	Non-Channel																	
	Combined	0.040	0.040														0.006	0.006
Sum of combined CPUE for station		31.647		2.043		0.038		3.962		0.442		13.846		31.288		11.895		
<i>Essential Fish Habitat Species</i>																		
Atlantic herring	Channel	34.042	14.463	0.222	0.120	0.111	0.111										4.911	4.855
	Non-Channel			0.063	0.063												0.013	0.011
	Combined	24.510	10.789	0.173	0.086	0.077	0.077										3.537	3.496
Bluefish	Channel					0.056	0.056	0.083	0.047	0.250	0.122	0.028	0.028				0.060	0.034
	Non-Channel					0.375	0.375	0.625	0.340	0.125	0.085						0.161	0.093
	Combined					0.154	0.120	0.250	0.113	0.212	0.088	0.019	0.019				0.091	0.042
Butterfish	Channel	0.333	0.181	0.333	0.120	2.389	1.067	4.806	1.475	0.111	0.087			0.722	0.224	1.242	0.668	
	Non-Channel	0.286	0.286	0.063	0.063	2.772	2.065	1.625	1.012	0.375	0.221			0.063	0.063	0.740	0.400	
	Combined	0.320	0.150	0.250	0.086	2.507	0.951	3.827	1.081	0.192	0.091			0.519	0.161	1.088	0.559	
Cobia	Channel							0.028	0.028								0.004	0.004
	Non-Channel																	
	Combined							0.019	0.019								0.003	0.003
Spanish mackerel	Channel							0.056	0.056								0.008	0.008
	Non-Channel																	
	Combined							0.038	0.038								0.005	0.005
Winter flounder	Channel																	
	Non-Channel											0.063	0.063				0.009	0.009
	Combined	0.000		0.000		0.000		0.000		0.000		0.019	0.019	0.000			0.003	0.003



Table 3-6 (cont). Monthly average mid-water CPUE (\pm 1 standard error) by species for all channel and non-channel stations combined during the 2006 Finfish Monitoring Sampling Program. (2 of 2)

Common Name	Station Type	April		May		June		August		September		October		November		Monthly Mean	Monthly SE
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Essential Fish Habitat Species</i>																	
Sum of combined																	
CPUE for station		24.830		0.423		2.738		4.135		0.404		0.038		0.519		4.727	
<i>Other Species</i>																	
(14 Species)	Channel	1.958	0.883	50.111	16.720	14.778	14.369	520.583	294.282	37.309	14.534	6.000	5.375	6.944	1.921	91.098	71.900
(9 Species)	Non-Channel	7.122	6.658	5.031	2.514	17.015	11.633	53.875	38.655	57.125	38.580	1.438	0.811	3.000	1.432	20.658	9.200
(16 Species)	Combined	3.404	1.930	36.240	11.911	15.466	10.435	376.981	205.404	43.406	15.385	4.596	3.724	5.731	1.416	69.403	51.616
<i>Total All Species</i>																	
(24 Species)	Channel	79.694	23.175	52.972	16.817	17.389	14.664	529.972	297.172	38.225	14.701	23.528	20.813	51.500	17.459	113.326	69.881
(15 Species)	Non-Channel	8.932	6.504	6.609	2.921	20.162	12.075	59.063	40.519	57.813	38.584	7.125	6.283	6.125	3.553	23.690	9.155
(27 Species)	Combined	59.881	17.859	38.707	12.005	18.242	10.670	385.077	207.443	44.252	15.460	18.481	14.509	37.538	12.432	86.025	50.144



Table 3-7. Finfish community species richness, average CPUE, Diversity (H'), and Evenness (E) collected in midwater trawls during the 2006 Migratory Finfish Sampling Program.

Area	Station Type	Station	Richness	Average CPUE	Diversity (H')	Evenness (E)	
AK/KVK	Channel	MAK-1	7	182.33	0.54	0.19	
		MAK-2	8	156.33	0.22	0.07	
		MAK-3	8	971.17	0.28	0.09	
		MAK-4	7	366.67	0.42	0.15	
		MKK-1	10	40.42	2.15	0.65	
		MKK-2	8	21.72	1.60	0.53	
<i>Total AK/KVK</i>			14	289.77	0.49	0.13	
NB	Channel	MNB-1	9	62.08	1.51	0.48	
		MNB-2	12	49.42	1.45	0.40	
		MNB-5	13	122.08	1.50	0.40	
	<i>Total Channel</i>			16	77.86	1.68	0.42
	Non-Channel	MNB-3	3	0.74	1.23	0.78	
		MNB-4	4	2.00	1.46	0.73	
		MNB-6	8	123.46	1.05	0.35	
	<i>Total Non-Channel</i>			10	42.07	1.10	0.33
	<i>Total NB</i>			17	59.96	1.54	0.38
UB	Channel	MUB-1	8	32.67	1.00	0.33	
		MUB-2	8	12.92	1.77	0.59	
		MUB-3	8	30.25	0.98	0.33	
		MUB-4	7	11.33	1.86	0.66	
		MUB-5	7	38.25	2.23	0.80	
		MUB-8	7	24.00	1.66	0.59	
		MUB-9	9	51.58	0.64	0.20	
		MUB-10	7	59.00	1.04	0.37	
	<i>Total Channel</i>			15	32.50	2.03	0.52
	Non-Channel	MUB-6	2	2.22	0.97	0.97	
		MUB-7	5	1.50	1.97	0.85	
	<i>Total Non-channel</i>			6	1.86	1.85	0.72
	<i>Total UB</i>			16	26.37	2.04	0.51
LB	Channel	MLB-3	4	2.00	1.67	0.83	
	Non-Channel	MLB-1	6	17.25	0.42	0.16	
		MLB-2	10	55.25	0.39	0.12	
		MLB-4	5	8.83	0.61	0.26	
	<i>Total Non-Channel</i>			13	27.11	0.44	0.12
<i>Total LB</i>			13	20.83	0.53	0.14	
Average among study regions			26	99.24	0.91	0.19	



Table 3-8. Similarity indices for mid-water trawls to compare station types within and among areas using Jaccard's index (top) and percent similarity (bottom).

Jaccard's index

Area	Station Type	AK/KVK		NB		UB		LB	
		Channel	Non-Channel	Channel	Non-Channel	Channel	Non-Channel	Channel	Non-Channel
AK/KVK	Channel	--	--	33.33	32.00	31.03	28.57	16.67	25.93
	Non-Channel		--	--	--	--	--	--	--
NB	Channel			--	33.33	29.03	17.39	15.00	24.14
	Non-Channel				--	23.08	27.78	20.00	29.17
UB	Channel					--	22.73	15.79	25.00
	Non-Channel						--	18.18	25.00
LB	Channel							--	17.65
	Non-Channel								--

Percent Similarity

Area	Station Type	AK/KVK		NB		UB		LB	
		Channel	Non-Channel	Channel	Non-Channel	Channel	Non-Channel	Channel	Non-Channel
AK/KVK	Channel	--	--	66.86	86.00	47.90	57.79	35.39	95.04
	Non-Channel		--	--	--	--	--	--	--
NB	Channel			--	76.38	57.60	66.56	40.61	62.78
	Non-Channel				--	50.04	63.47	35.76	84.49
UB	Channel					--	65.22	41.41	46.77
	Non-Channel						--	37.81	57.52
LB	Channel							--	37.23
	Non-Channel								--



Table 3-9. Monthly average bottom trawl CPUE (± 1 standard error) by species for all channel and non-channel stations combined during the 2006 Finfish Monitoring Sampling Program. (1 of 2)

Common Name	Station Type	August		September		October		November		Monthly	Monthly
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
<i>Target Species</i>											
Alewife	Channel							1.23	0.62	0.31	0.31
	Non-Channel							1.13	0.79	0.28	0.28
	Combined							1.20	0.49	0.30	0.30
American shad	Channel	0.04	0.04			0.05	0.05			0.04	0.00
	Non-Channel					0.25	0.25	1.66	0.73	0.95	0.50
	Combined	0.03	0.03			0.10	0.07	0.44	0.23	0.19	0.11
Atlantic menhaden	Channel	1.58	0.77	0.04	0.04	0.57	0.25	0.05	0.05	0.56	0.36
	Non-Channel	6.00	2.49					0.25	0.25	3.13	2.03
	Combined	2.68	0.90	0.03	0.03	0.42	0.19	0.10	0.07	0.81	0.63
Blueback herring	Channel					0.09	0.09	0.09	0.06	0.09	
	Non-Channel			0.13	0.13			3.94	1.58	2.03	1.35
	Combined			0.03	0.03	0.07	0.07	1.12	0.51	0.41	0.31
Striped bass	Channel			0.04	0.04			0.27	0.19	0.15	0.08
	Non-Channel	0.13	0.13	0.38	0.38	0.63	0.50	5.28	2.08	1.60	1.23
	Combined	0.03	0.03	0.13	0.10	0.17	0.14	1.60	0.68	0.48	0.37
Sum of combined CPUE for station		2.75		0.19		0.75		4.46		2.19	
<i>Essential Fish Habitat Species</i>											
Atlantic herring	Channel			0.04	0.04					0.01	0.01
	Non-Channel										
	Combined			0.03	0.03					0.01	0.01
Black sea bass	Channel	0.04	0.04	0.17	0.14	0.64	0.23	0.14	0.14	0.25	0.13
	Non-Channel	1.50	1.00			1.00	0.60			1.25	0.18
	Combined	0.41	0.27	0.13	0.10	0.73	0.23	0.10	0.10	0.34	0.15
Bluefish	Channel	0.13	0.07	1.43	0.62	0.39	0.18			0.65	0.35
	Non-Channel	4.00	2.71	7.13	3.20	2.50	1.09			4.54	1.18
	Combined	1.09	0.71	2.90	1.02	0.95	0.35			1.65	0.54
Butterfish	Channel	1.42	0.51	1.52	1.09	0.14	0.10			1.03	0.39
	Non-Channel	32.88	21.81	8.00	4.14	3.13	1.77	0.13	0.13	11.03	7.46
	Combined	9.28	5.74	3.19	1.39	0.93	0.52	0.03	0.03	3.36	2.08
Clearnose skate	Channel	0.04	0.04	0.09	0.09	0.09	0.06	0.05	0.05	0.07	0.01
	Non-Channel					0.25	0.16	0.25	0.16	0.25	
	Combined	0.03	0.03	0.06	0.06	0.13	0.06	0.10	0.06	0.08	0.02
Little skate	Channel							0.55	0.41	0.14	0.14
	Non-Channel										
	Combined							0.40	0.30	0.10	0.10
Red hake	Channel	0.04	0.04			0.05	0.05	0.05	0.05	0.03	0.01
	Non-Channel										
	Combined	0.03	0.03			0.03	0.03	0.03	0.03	0.02	0.01
Scup	Channel	2.27	1.33	2.26	1.37	0.59	0.31			1.28	0.58
	Non-Channel	54.75	37.39	1.13	0.61	3.13	1.52			14.75	13.35
	Combined	15.39	9.83	1.97	1.02	1.27	0.49			4.66	3.60
Summer flounder	Channel	0.21	0.10			0.64	0.47	0.05	0.05	0.22	0.15
	Non-Channel	1.00	0.73			0.38	0.38	0.63	0.50	0.50	0.21
	Combined	0.41	0.20			0.57	0.35	0.20	0.14	0.29	0.12
Windowpane	Channel	0.17	0.13	0.13	0.07	0.36	0.28	0.73	0.42	0.35	0.14
	Non-Channel	0.25	0.16							0.06	0.06
	Combined	0.19	0.10	0.10	0.05	0.27	0.20	0.53	0.31	0.27	0.09
Winter flounder	Channel	0.58	0.33	0.48	0.16	2.45	1.49	1.09	0.67	1.15	0.45
	Non-Channel	0.38	0.18	0.63	0.32			0.84	0.36	0.46	0.18
	Combined	0.53	0.25	0.52	0.15	1.80	1.11	1.02	0.49	0.97	0.30

Table 3-9 (cont). Monthly average bottom trawl CPUE (± 1 standard error) by species for all channel and non-channel stations combined during the 2006 Finfish Monitoring Sampling Program. (2 of 2)

Common Name	Station Type	August		September		October		November		Monthly Mean	Monthly SE
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Essential Fish Habitat Species</i>											
Winter skate	Channel					0.14	0.10			0.03	0.03
	Non-Channel										
	Combined					0.10	0.07			0.03	0.03
Sum of combined CPUE for station		27.36		8.90		6.78		2.42		11.78	
<i>Other Species</i>											
(34 Species)	Channel	63.32	40.82	95.78	53.34	17.38	5.86	11.08	2.77	46.89	20.03
(23 Species)	Non-Channel	1,697.50	1,249.29	183.38	116.54	594.25	532.47	24.41	8.03	624.88	377.15
(36 Species)	Combined	471.87	324.32	118.39	49.14	171.21	143.22	14.64	3.07	194.02	98.16
<i>Total All Species</i>											
(51 Species)	Channel	69.84	42.44	102.00	54.97	23.56	6.46	15.35	3.40	52.69	20.35
(36 Species)	Non-Channel	1,798.38	1,244.51	200.75	120.30	605.50	535.12	38.50	8.29	660.78	397.50
(53 Species)	Combined	501.97	326.35	127.48	50.77	178.74	144.01	21.52	3.76	207.43	103.49



Table 3-10. Average bottom trawl CPUE (± 1 standard error) by species for all navigation channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2006 Finfish Monitoring Sampling Program (1 of 3).

Common Name	Station Type	Region								Avg. CPUE	SE
		AK/KVK		NB		UB		LB			
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Target Species</i>											
Alewife	Channel			0.188	0.101	0.429	0.252			0.154	0.102
	Non-Channel							0.563	0.408	0.281	0.281
	Combined			0.094	0.052	0.429	0.252	0.375	0.275	0.224	0.105
American shad	Channel					0.036	0.025			0.009	0.009
	Non-Channel			0.328	0.257			0.625	0.364	0.477	0.148
	Combined			0.164	0.130	0.036	0.025	0.417	0.248	0.154	0.094
Atlantic menhaden	Channel	1.489	0.950	0.750	0.348	0.429	0.288			0.667	0.314
	Non-Channel			1.563	1.158			1.563	1.000	1.563	
	Combined	1.489	0.950	1.156	0.599	0.429	0.288	1.042	0.677	1.029	0.221
Blueback herring	Channel			0.188	0.136			0.125	0.125	0.078	0.047
	Non-Channel			1.313	0.845			0.719	0.492	1.016	0.297
	Combined			0.750	0.433			0.521	0.332	0.318	0.189
Striped bass	Channel	0.621	0.358							0.155	0.155
	Non-Channel			3.125	1.179			0.078	0.078	1.602	1.523
	Combined	0.621	0.358	1.563	0.644			0.052	0.052	0.559	0.363
Sum of combined CPUE for station		2.110		3.727		0.893		2.406		2.284	
<i>Essential Fish Habitat Species</i>											
Atlantic herring	Channel					0.018	0.018			0.004	0.004
	Non-Channel										
	Combined					0.018	0.018			0.004	0.004
Black sea bass	Channel			0.188	0.188	0.107	0.049	1.625	0.532	0.480	0.384
	Non-Channel			0.563	0.500			0.688	0.350	0.625	0.063
	Combined	0.000		0.375	0.265	0.107	0.049	1.000	0.301	0.371	0.224
Bluefish	Channel	0.227	0.227	0.250	0.112	0.571	0.261	0.750	0.620	0.450	0.127
	Non-Channel			5.063	1.748			1.750	1.359	3.406	1.656
	Combined	0.227	0.227	2.656	0.964	0.571	0.261	1.417	0.923	1.218	0.541
Butterfish	Channel	0.368	0.280	0.938	0.595	0.893	0.472	0.375	0.263	0.643	0.157
	Non-Channel			2.938	1.556			19.125	11.263	11.031	8.094
	Combined	0.368	0.280	1.938	0.839	0.893	0.472	12.875	7.652	4.018	2.970
Clearence skate	Channel					0.036	0.025	0.500	0.267	0.134	0.122
	Non-Channel							0.250	0.112	0.125	0.125
	Combined	0.000		0.000		0.036	0.025	0.333	0.115	0.092	0.081
Little skate	Channel			0.063	0.063	0.036	0.025	1.125	1.125	0.306	0.273
	Non-Channel										
	Combined	0.000		0.031	0.031	0.036	0.025	0.375	0.375	0.110	0.089
Red Hake	Channel					0.036	0.025	0.125	0.125	0.040	0.030
	Non-Channel										
	Combined	0.000		0.000		0.036	0.025	0.042	0.042	0.019	0.011
Scup	Channel	0.321	0.321			1.393	0.598	4.750	3.802	1.616	1.086
	Non-Channel			0.250	0.112			29.250	19.237	14.750	14.500
	Combined	0.321	0.321	0.125	0.059	1.393	0.598	21.083	12.968	5.731	5.125
Summer flounder	Channel					0.339	0.189	0.125	0.125	0.116	0.080
	Non-Channel			0.063	0.063			0.938	0.452	0.500	0.438
	Combined	0.000		0.031	0.031	0.339	0.189	0.667	0.311	0.259	0.156
Windowpane	Channel					0.518	0.202	0.250	0.250	0.192	0.124
	Non-Channel							0.125	0.085	0.063	0.063
	Combined	0.000		0.000		0.518	0.202	0.167	0.098	0.171	0.122
Winter flounder	Channel	0.634	0.376	0.250	0.194	1.536	0.650	0.750	0.491	0.792	0.270
	Non-Channel			0.516	0.186			0.406	0.200	0.461	0.055
	Combined	0.634	0.376	0.383	0.134	1.536	0.650	0.521	0.207	0.768	0.261
Winter skate	Channel					0.054	0.040			0.013	0.013
	Non-Channel										
	Combined	0.000		0.000		0.054	0.040	0.000		0.013	0.013
Sum of combined CPUE for station		1.550		5.539		5.536		38.479		12.776	

Table 3-10 (cont). Average bottom trawl CPUE (± 1 standard error) by species for all navigation channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2006 Finfish Monitoring Sampling Program (2 of 3).

Common Name	Station Type	Region								Avg-CPUE	SE
		AK/KVK		NB		UB		LB			
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Other Species</i>											
American eel	Channel	0.107	0.107	0.063	0.063	0.018	0.018			0.047	0.024
	Non-Channel										
	Combined	0.107	0.107	0.031	0.031	0.018	0.018			0.039	0.024
Atlantic cod	Channel					0.714	0.646			0.179	0.179
	Non-Channel										
	Combined					0.714	0.646			0.179	0.179
Atlantic croaker	Channel			0.188	0.136	0.875	0.636			0.266	0.208
	Non-Channel							0.375	0.375	0.188	0.188
	Combined			0.094	0.069	0.875	0.636	0.250	0.250	0.305	0.197
Atlantic moonfish	Channel	0.182	0.182	0.500	0.274	0.286	0.192	0.125	0.125	0.273	0.083
	Non-Channel							0.375	0.221	0.188	0.188
	Combined	0.182	0.182	0.250	0.142	0.286	0.192	0.292	0.153	0.252	0.025
Atlantic silverside	Channel										
	Non-Channel			1.797	0.746					0.898	0.898
	Combined			0.898	0.401					0.225	0.225
Atlantic tomcod	Channel	0.101	0.101							0.025	0.025
	Non-Channel										
	Combined	0.101	0.101							0.025	0.025
Bay anchovy	Channel	10.623	5.687	16.688	6.993	55.589	27.263	9.000	5.666	22.975	10.997
	Non-Channel			794.219	640.527			441.859	274.230	618.039	176.180
	Combined	10.623	5.687	405.453	322.719	55.589	27.263	297.573	185.769	192.309	94.962
Conger eel	Channel					0.018	0.018			0.004	0.004
	Non-Channel										
	Combined					0.018	0.018			0.004	0.004
Crevalle jack	Channel										
	Non-Channel			0.063	0.063			0.188	0.101	0.125	0.063
	Combined			0.031	0.031			0.125	0.069	0.039	0.030
Cunner	Channel					0.179	0.089			0.045	0.045
	Non-Channel							0.063	0.063	0.031	0.031
	Combined					0.179	0.089	0.042	0.042	0.055	0.042
Feather blenny	Channel	0.101	0.101			0.018	0.018			0.030	0.024
	Non-Channel										
	Combined	0.101	0.101			0.018	0.018			0.030	0.024
Fourspot flounder	Channel					0.089	0.038	0.125	0.125	0.054	0.032
	Non-Channel							0.313	0.254	0.156	0.156
	Combined					0.089	0.038	0.250	0.173	0.085	0.059
Gizzard shad	Channel					0.018	0.018			0.004	0.004
	Non-Channel			0.203	0.143					0.102	0.102
	Combined			0.102	0.073	0.018	0.018			0.030	0.024
Grubby	Channel	0.096	0.096			0.054	0.040			0.037	0.023
	Non-Channel										
	Combined	0.096	0.096			0.054	0.040			0.037	0.023
Hickory shad	Channel					0.089	0.064			0.022	0.022
	Non-Channel										
	Combined					0.089	0.064			0.022	0.022
Hogchocker	Channel	0.091	0.091	0.063	0.063	0.107	0.066			0.065	0.024
	Non-Channel										
	Combined	0.091	0.091	0.031	0.031	0.107	0.066			0.057	0.025
Inshore lizardfish	Channel							0.125	0.125	0.031	0.031
	Non-Channel			0.125	0.125					0.063	0.063
	Combined			0.063	0.063			0.042	0.042	0.026	0.016
Lined seahorse	Channel					0.018	0.018			0.004	0.004
	Non-Channel							0.063	0.063	0.031	0.031
	Combined					0.018	0.018	0.042	0.042	0.015	0.010
Longhorn sculpin	Channel					0.018	0.018			0.004	0.004
	Non-Channel										
	Combined					0.018	0.018			0.004	0.004
Lookdown	Channel					0.071	0.056			0.018	0.018
	Non-Channel										
	Combined					0.071	0.056			0.018	0.018

Table 3-10 (cont). Average bottom trawl CPUE (± 1 standard error) by species for all navigation channel and non-channel stations in the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB) and Lower Bay (LB) during the 2006 Finfish Monitoring Sampling Program (3 of 3).

Common Name	Station Type	Region								Avg-CPUE	SE
		AK/KVK		NB		UB		LB			
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Other Species (cont.)</i>											
Naked goby	Channel					0.036	0.036			0.009	0.009
	Non-Channel										
	Combined					0.036	0.036			0.009	0.009
Northern kingfish	Channel							0.500	0.500	0.125	0.125
	Non-Channel			0.250	0.171					0.125	0.125
	Combined			0.125	0.087			0.167	0.167	0.073	0.043
Northern pipefish	Channel	0.227	0.152							0.057	0.057
	Non-Channel			0.125	0.085			0.063	0.063	0.094	0.031
	Combined	0.227	0.152	0.063	0.043			0.042	0.042	0.083	0.050
Northern searobin	Channel	0.208	0.140			0.196	0.164	0.125	0.125	0.132	0.048
	Non-Channel							0.063	0.063	0.031	0.031
	Combined	0.208	0.140			0.196	0.164	0.083	0.058	0.122	0.049
Northern stargazer	Channel					0.018	0.018			0.004	0.004
	Non-Channel										
	Combined					0.018	0.018			0.004	0.004
Oyster toadfish	Channel	0.321	0.321	0.188	0.101	0.161	0.080			0.167	0.066
	Non-Channel			0.063	0.063					0.031	0.031
	Combined	0.321	0.321	0.125	0.059	0.161	0.080			0.152	0.066
Silver hake	Channel	0.114	0.114	0.125	0.125	0.464	0.260	0.375	0.263	0.269	0.089
	Non-Channel							0.063	0.063	0.031	0.031
	Combined	0.114	0.114	0.063	0.063	0.464	0.260	0.167	0.098	0.202	0.090
Smallmouth flounder	Channel	0.205	0.138			0.500	0.360	1.500	0.824	0.551	0.333
	Non-Channel			0.188	0.136			0.578	0.378	0.383	0.195
	Combined	0.205	0.138	0.094	0.069	0.500	0.360	0.885	0.373	0.421	0.177
Smooth dogfish	Channel					0.036	0.025	1.125	0.581	0.290	0.278
	Non-Channel							0.313	0.254	0.156	0.156
	Combined					0.036	0.025	0.583	0.262	0.155	0.143
Spot	Channel			0.188	0.136					0.047	0.047
	Non-Channel										
	Combined			0.094	0.069					0.023	0.023
Spotted hake	Channel	0.639	0.377	0.750	0.443	1.571	0.824	1.875	1.608	1.209	0.304
	Non-Channel							0.438	0.258	0.219	0.219
	Combined	0.639	0.377	0.375	0.228	1.571	0.824	0.917	0.558	0.875	0.257
Striped anchovy	Channel							0.125	0.125	0.031	0.031
	Non-Channel			4.375	2.354			0.438	0.438	2.406	1.969
	Combined			2.188	1.223			0.333	0.293	0.630	0.525
Striped searobin	Channel	1.032	0.429	0.875	0.455	1.161	0.539			0.767	0.262
	Non-Channel			0.063	0.063			0.125	0.125	0.094	0.031
	Combined	1.032	0.429	0.469	0.238	1.161	0.539	0.083	0.083	0.686	0.251
Tautog	Channel					0.286	0.107			0.071	0.071
	Non-Channel							0.125	0.085	0.063	0.063
	Combined					0.286	0.107	0.083	0.058	0.092	0.067
Weakfish	Channel	5.992	2.686	4.375	2.095	1.768	0.950	0.125	0.125	3.065	1.310
	Non-Channel			0.063	0.063			1.750	0.915	0.906	0.844
	Combined	5.992	2.686	2.219	1.101	1.768	0.950	1.208	0.625	2.797	1.085
White perch	Channel	0.669	0.567	0.375	0.375	0.107	0.091			0.288	0.150
	Non-Channel			1.047	0.472					0.523	0.523
	Combined	0.669	0.567	0.711	0.303	0.107	0.091			0.372	0.185
Sum of combined CPUE for station		20.706		413.477		64.482		302.708		200.453	

Table 3-11. Finfish community species richness, average CPUE, Diversity (H'), and Evenness (E) collected in bottom trawls during the 2006 Migratory Finfish Sampling Program.

Area	Station Type	Station	Richness	Average CPUE	Diversity (H')	Evenness (E)
AK/KVK	Channel	MAK-1	19	28.17	2.60	0.61
		MAK-2	6	14.22	1.58	0.61
<i>Total AK/KVK</i>			22	21.19	2.77	0.62
NB	Channel	MNB-1	18	13.13	3.07	0.74
		MNB-2	14	41.25	1.71	0.45
	<i>Total Channel</i>		20	27.19	2.18	0.50
	Non-Channel	MNB-3	18	222.75	0.83	0.20
		MNB-4	19	1,413.84	0.18	0.04
<i>Total Non-Channel</i>		23	818.30	0.29	0.06	
<i>Total NB</i>			32	422.74	0.41	0.08
UB	Channel	MUB-1	17	8.75	3.17	0.78
		MUB-2	11	15.63	2.40	0.69
		MUB-3	17	185.38	0.51	0.12
		MUB-5	24	41.25	3.11	0.68
		MUB-8	21	143.00	1.07	0.24
		MUB-9	21	31.38	3.30	0.75
		MUB-10	22	70.88	1.20	0.27
<i>Total UB</i>			43	70.89	1.69	0.31
LB	Channel	MLB-3	23	25.63	3.25	0.72
	Non-Channel	MLB-1	27	929.25	0.74	0.16
		MLB-2	23	77.28	1.53	0.34
<i>Total Non-Channel</i>		30	503.27	0.83	0.17	
<i>Total LB</i>			34	344.05	0.94	0.18
Average among study regions			53	214.72	0.92	0.16



Table 3-12. Similarity indices for bottom trawls to compare station types within and among areas using Jaccard's index (top) and percent similarity (bottom).

Jaccard's index

Area	Station Type	AK/KVK		NB		UB		LB	
		Channel	Non-Channel	Channel	Non-Channel	Channel	Non-Channel	Channel	Non-Channel
AK/KVK	Channel	--	--	33.33	28.89	29.23	--	24.44	28.85
	Non-Channel		--	--	--	--	--	--	--
NB	Channel			--	25.58	28.57	--	25.58	28.00
	Non-Channel				--	22.73	--	28.26	32.08
UB	Channel					--	--	28.79	34.25
	Non-Channel						--	--	--
LB	Channel							--	35.85
	Non-Channel								--

Percent Similarity

Area	Station Type	AK/KVK		NB		UB		LB	
		Channel	Non-Channel	Channel	Non-Channel	Channel	Non-Channel	Channel	Non-Channel
AK/KVK	Channel	--	--	67.39	37.27	50.63	--	46.72	42.33
	Non-Channel		--	--	--	--	--	--	--
NB	Channel			--	62.99	74.23	--	44.03	66.58
	Non-Channel				--	79.99	--	36.99	89.21
UB	Channel					--	--	47.75	83.85
	Non-Channel						--	--	--
LB	Channel							--	44.23
	Non-Channel								--



Table 4-1. Monthly average mid-water trawl CPUE (± 1 standard error) by species for all channel stations in Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2006 Migratory Finfish Sampling Program (1 of 2).

Common Name	Region	April		May		June		August		September		October		November		Monthly Mean	Monthly SE
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Target Species</i>																	
Alewife	AK/KVK	10.17	8.33											5.75	4.02	2.27	1.54
	NB	3.33	2.03	0.17	0.17									1.67	0.95	0.74	0.49
	UB	16.13	11.51	1.13	0.72									46.56	33.10	9.12	6.63
	LB																
American shad	AK/KVK													0.83	0.41	0.12	0.12
	NB	0.67	0.33											0.17	0.17	0.12	0.09
	UB			0.19	0.14									1.44	0.53	0.23	0.20
	LB																
Atlantic menhaden	AK/KVK	0.50	0.22					10.42	8.30	0.92	0.83			17.17	15.29	4.14	2.60
	NB			0.17	0.17			0.83	0.83	1.33	0.95	104.67	90.32	0.50	0.34	15.36	14.89
	UB	0.75	0.53	0.44	0.38					0.06	0.06			0.38	0.18	0.23	0.11
	LB																
Blueback herring	AK/KVK	48.58	36.86					1.92	1.18					4.83	2.99	7.90	6.81
	NB	35.00	33.02	0.33	0.33							0.33	0.33	16.00	6.04	7.38	5.12
	UB	21.50	10.88	3.19	1.71	0.13	0.13	0.38	0.38					21.94	17.46	6.73	3.89
	LB																
Striped bass	AK/KVK																
	NB	0.33	0.33													0.05	0.05
	UB																
	LB																
<i>Essential Fish Habitat Species</i>																	
Atlantic herring	AK/KVK	48.79	34.24	0.42	0.34											7.03	6.96
	NB	56.00	28.75	0.17	0.17											8.02	8.00
	UB	18.50	18.07	0.13	0.09	0.25	0.25									2.70	2.63
	LB	4.00														0.57	0.57
Bluefish	AK/KVK							0.08	0.08	0.25	0.13					0.05	0.04
	NB							0.17	0.17	0.67	0.67	0.17	0.17			0.14	0.09
	UB					0.13	0.13	0.06	0.06	0.06	0.06					0.04	0.02
	LB									0.50	0.50					0.07	0.07
Butterfish	AK/KVK	0.33	0.21			1.00	0.63	9.08	3.91					0.83	0.47	1.61	1.26
	NB			0.50	0.34	0.33	0.33	3.17	1.92	0.67	0.49			0.33	0.21	0.71	0.42
	UB	0.50	0.38	0.56	0.22	4.25	2.25	2.25	1.00					0.88	0.35	1.21	0.58
	LB					2.00		4.50	3.50							0.93	0.66
Cobia	AK/KVK																
	NB																
	UB							0.06	0.06							0.01	0.01
	LB																



Table 4-1 (cont). Monthly average mid-water trawl CPUE (± 1 standard error) by species for all channel stations in Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2006 Migratory Finfish Sampling Program (2 of 2).

Common Name	Region	April		May		June		August		September		October		November		Monthly Mean	Monthly SE
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Essential Fish Habitat Species (cont.)</i>																	
Spanish Mackerel	AK/KVK							0.17	0.17							0.02	0.02
	NB																
	UB																
	LB																
<i>Other Species</i>																	
(7 Species)	AK/KVK	3.04	1.74	55.33	28.26			1536.50	828.02	29.09	24.68	1.92	1.74	6.92	1.84	233.26	217.34
(8 Species)	NB	1.67	1.20	93.50	71.00	1.67	1.67	36.33	33.17	104.83	61.95	32.17	32.17	18.83	9.33	41.29	15.82
(7 Species)	UB	1.50	1.50	36.13	17.78	32.63	32.34	5.31	2.45	22.50	12.34			3.25	1.37	14.47	5.88
(1 Species)	LB			0.50	0.50					2.50	2.50			1.00	1.00	0.57	0.35
<i>Total All Species</i>																	
(15 Species)	AK/KVK	111.42	43.57	55.75	28.22	1.00	0.63	1558.17	835.77	30.26	25.49	1.92	1.74	36.33	17.54	256.41	217.42
(16 Species)	NB	97.00	10.26	94.83	71.18	2.00	1.53	40.50	33.41	107.50	61.62	137.33	122.76	37.50	12.73	73.81	18.08
(15 Species)	UB	58.88	40.23	41.75	18.38	37.38	32.74	8.06	2.57	22.63	12.36			74.44	36.58	34.73	10.09
(4 Species)	LB	4.00		0.50	0.50	2.00		4.50	3.50	3.00	3.00			1.00	1.00	2.14	0.66



Table 4-2. Monthly average mid-water trawl CPUE (± 1 standard error) by species for all non-channel stations in Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2006 Migratory Finfish Sampling Program.

Common Name	Region	April		May		June		August		September		October		November		Monthly Mean	Monthly SE
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Target Species</i>																	
Alewife	NB			2.67	1.86									0.83	0.65	0.50	0.38
	UB																
	LB																
Atlantic menhaden	NB							7.67	6.21	0.17	0.17	15.00	15.00	0.33	0.33	3.31	2.22
	UB													0.50	0.50	0.07	0.07
	LB									0.33	0.21					0.05	0.05
Blueback herring	NB			0.88	0.66									6.67	5.08	1.08	0.94
	UB	5.33	5.33													0.76	0.76
	LB			0.33	0.33			0.17	0.17							0.07	0.05
<i>Essential Fish Habitat Species</i>																	
Atlantic Herring	NB																
	UB																
	LB			0.17	0.17											0.02	0.02
Bluefish	NB							1.33	0.80	0.17	0.17					0.21	0.19
	UB																
	LB					1.00	1.00	0.33	0.33	0.17	0.17					0.21	0.14
Butterfish	NB					0.39	0.39	3.67	2.59	0.17	0.17			0.17	0.17	0.63	0.51
	UB					0.50	0.50	0.25	0.25							0.11	0.07
	LB	0.67	0.67	0.17	0.17	6.67	5.24	0.50	0.34	0.83	0.54					1.26	0.91
Winter flounder	NB																
	UB																
	LB											0.17	0.17			0.02	0.02
<i>Other Species</i>																	
(5 Species)	NB	1.43	1.43	6.75	5.22	14.37	10.21	122.83	99.94	47.67	46.67	2.33	1.76	4.67	3.31	28.58	16.85
(3 Species)	UB			4.00	4.00			0.50	0.29					3.00	3.00	1.07	0.64
(8 Species)	LB	15.67	15.67	4.00	4.00	31.00	31.00	20.50	20.30	104.67	93.94	1.50	1.31	1.33	0.84	25.52	13.84
<i>Total All Species</i>																	
(10 Species)	NB	1.43	1.43	10.29	6.12	14.76	10.59	135.50	104.01	48.17	46.98	17.33	16.74	12.67	9.02	34.31	17.75
(6 Species)	UB	5.33	5.33	4.00	4.00	0.50	0.50	0.75	0.48					3.50	3.50	2.01	0.83
(14 Species)	LB	16.33	15.34	4.67	4.47	38.67	30.56	21.50	20.31	106.00	93.67	1.67	1.48	1.33	0.84	27.17	14.07

Note: There were no non-channel station in the Arthur Kill/Kill Van Kull region.



Table 4-3. Monthly average bottom trawl CPUE (± 1 standard error) by species for all channel stations in Arthur Kill (AK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2006 Migratory Finfish Sampling Program (1 of 2).

Common Name	Region	August		September		October		November		Monthly Mean	Monthly SE
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Target Species</i>											
Alewife	AK										
	NB							0.75	0.25	0.19	0.19
	UB							1.71	0.95	0.43	0.43
	LB										
American shad	AK										
	NB										
	UB	0.07	0.07			0.07	0.07			0.04	0.02
	LB										
Atlantic menhaden	AK	3.22	2.50			1.75	0.75			1.24	0.78
	NB	1.00	0.71	0.25	0.25	1.50	1.19	0.25	0.25	0.75	0.31
	UB	1.50	1.13			0.21	0.11			0.43	0.36
	LB										
Blueback herring	AK										
	NB					0.50	0.50	0.25	0.25	0.19	0.12
	UB										
	LB							0.50	0.50	0.13	0.13
Striped bass	AK			0.33	0.33			2.92	0.42	0.81	0.71
	NB										
	UB										
	LB										
<i>Essential Fish Habitat Species</i>											
Atlantic Herring	AK										
	NB										
	UB			0.07	0.07					0.02	0.02
	LB										
Black sea bass	AK										
	NB					0.75	0.75			0.19	0.19
	UB			0.07	0.07	0.36	0.17			0.11	0.09
	LB	0.50	0.50	1.50	1.50	3.00		1.50	1.50	1.63	0.52
Bluefish	AK					1.25	1.25			0.31	0.31
	NB			0.50	0.29	0.50	0.29			0.25	0.14
	UB	0.21	0.11	1.79	0.97	0.29	0.22			0.57	0.41
	LB			3.00	2.00					0.75	0.75
Butterfish	AK	1.01	0.71							0.25	0.25
	NB	3.50	2.02	0.25	0.25					0.94	0.86
	UB	1.07	0.60	2.29	1.77	0.21	0.15			0.89	0.52
	LB	0.50	0.50	1.00	1.00					0.38	0.24
Clearnose skate	AK										
	NB										
	UB	0.07	0.07			0.07	0.07			0.04	0.02
	LB			1.00	1.00	0.50	0.50	0.50	0.50	0.50	0.20
Little skate	AK										
	NB							0.25	0.25	0.06	0.06
	UB							0.14	0.10	0.04	0.04
	LB							4.50	4.50	1.13	1.13
Red hake	AK										
	NB										
	UB	0.07	0.07			0.07	0.07			0.04	0.02
	LB							0.50	0.50	0.13	0.13



Table 4-3 (cont). Monthly average bottom trawl CPUE (± 1 standard error) by species for all channel stations in Arthur Kill (AK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) during the 2006 Migratory Finfish Sampling Program (2 of 2).

Common Name	Region	August		September		October		November		Monthly Mean	Monthly SE
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Essential Fish Habitat Species (cont)</i>											
Scup	AK	0.88	0.88							0.22	0.22
	NB	0.00	0.00								
	UB	3.64	2.22	1.36	0.63	0.57	0.36			1.39	0.80
	LB			16.50	14.50	2.50	2.50			4.75	3.96
Summer flounder	AK										
	NB										
	UB	0.29	0.16			1.00	0.73	0.07	0.07	0.34	0.23
	LB	0.50	0.50							0.13	0.13
Windowpane	AK										
	NB										
	UB	0.29	0.22	0.21	0.11	0.57	0.43	1.00	0.65	0.52	0.18
	LB							1.00	1.00	0.25	0.25
Winter flounder	AK					0.50	0.50	2.99	0.76	0.87	0.71
	NB					1.00	0.71			0.25	0.25
	UB	1.00	0.54	0.71	0.24	3.43	2.33	1.00	1.00	1.54	0.63
	LB			0.50	0.50	0.50	0.50	2.00	2.00	0.75	0.43
Winter skate	AK										
	NB										
	UB					0.21	0.15			0.05	0.05
	LB										
<i>Other Species</i>											
(17 Species)	AK	28.92	13.99	13.67	6.89	20.13	1.13	15.42	2.08	19.53	3.41
(12 Species)	NB	4.25	1.65	35.75	18.59	42.75	29.95	14.75	5.47	24.38	8.97
(28 Species)	UB	97.43	69.40	140.14	86.55	11.71	3.03	8.57	3.98	64.46	32.56
(12 Species)	LB	11.50	11.50	28.50	17.50	3.50	1.50	17.00	4.00	15.13	5.25
<i>Total All Species</i>											
(23 Species)	AK	34.04	13.24	14.00	7.02	23.63	2.63	21.32	2.43	23.25	4.14
(20 Species)	NB	8.75	2.87	36.75	18.87	47.00	30.77	16.25	5.44	27.19	8.87
(43 Species)	UB	105.64	72.15	146.64	89.29	18.79	5.23	12.50	4.84	70.89	33.00
(23 Species)	LB	13.00	11.00	52.00	3.00	10.00	4.00	27.50	10.50	25.63	9.59

Note: No channel stations in the Kill Van Kull (KVK).

Table 4-4. Monthly average bottom trawl CPUE (± 1 standard error) by species for all non-channel stations in Newark Bay (NB) and Lower Bay (LB) during the 2006 Migratory Finfish Sampling Program.

Common Name	Region	August		September		October		November		Monthly Mean	Monthly SE
		Mean	SE	Mean	SE	Mean	SE	Mean	SE		
<i>Target Species</i>											
Alewife	NB										
	LB							2.25	2.25	0.56	0.56
American shad	NB							1.31	1.31	0.33	0.33
	LB					0.50	0.50	2.00	2.00	0.63	0.47
Atlantic menhaden	NB	6.25	6.25							1.56	1.56
	LB	5.75	5.75					0.50	0.50	1.56	1.40
Blueback herring	NB			0.25	0.25			5.00	5.00	1.31	1.23
	LB							2.88	2.88	0.72	0.72
Striped bass	NB	0.25	0.25	0.75	0.75	1.25	1.25	10.25	10.25	3.13	2.38
	LB							0.31	0.31	0.08	0.08
<i>Essential Fish Habitat Species</i>											
Black sea bass	NB	2.00	2.00			0.25	0.25			0.56	0.48
	LB	1.00	1.00			1.75	1.75			0.69	0.43
Bluefish	NB	2.00	2.00	13.50	13.50	4.75	4.75			5.06	2.98
	LB	6.00	6.00	0.75	0.75	0.25	0.25			1.75	1.43
Butterfish	NB	0.25	0.25	7.75	7.75	3.75	3.75			2.94	1.82
	LB	65.50	65.50	8.25	8.25	2.50	2.50	0.25	0.25	19.13	15.55
Clearence skate	NB										
	LB					0.50	0.50	0.50	0.50	0.25	0.14
Scup	NB	0.25	0.25	0.25	0.25	0.50	0.50			0.25	0.10
	LB	109.25	109.25	2.00	2.00	5.75	5.75			29.25	26.69
Summer flounder	NB	0.25	0.25							0.06	0.06
	LB	1.75	1.75			0.75	0.75	1.25	1.25	0.94	0.37
Windowpane	NB										
	LB	0.50	0.50							0.13	0.13
Winter flounder	NB	0.50	0.50	0.50	0.50			1.06	1.06	0.52	0.22
	LB	0.25	0.25	0.75	0.75			0.63	0.63	0.41	0.17
<i>Other Species</i>											
(13 Species)	NB	2,933.50	2,477.35	250.50	220.24	6.25	3.88	20.06	5.16	802.58	712.51
(17 Species)	LB	461.50	357.21	116.25	108.96	1,182.25	1,045.28	28.75	16.17	447.19	262.22
<i>Total All Species</i>											
(23 Species)	NB	2,945.25	2,479.95	273.50	229.45	16.75	8.72	37.69	6.00	818.30	711.37
(30 Species)	LB	651.50	448.02	128.00	106.57	1,194.25	1,051.27	39.31	16.85	503.27	267.01

Note: No non-channel stations were sampled in the Arthur Kill/Kill Van Kull (AK/KVK) or Upper Bay (UB).



Table 4-5. Observed preferences of target, EFH managed species, important forage species and other common species collected during the 2006 Migratory Finfish Sampling Program

Primary temporal, area, and habitat usage observed from April to November 2006				
Species	Season/Month of Concern	NY/NJ Harbor Areas of Concern	Habitat Usage (mid-water/bottom) and (channel/non-channel)	Comments and additional seasonal information (based on other studies)
Target Species				
Alewife*	April, May and November	Upper Bay and Arthur Kill/Kill Van Kull, and Newark Bay	Indicated preference for channel over non-channel habitat;	Yearlings during spring; YOY and a few yearlings during fall. (May be present all year; common January - April, July – September, & December. ^{a)}
American Shad*	November (Uncommon)	Upper Bay and Arthur Kill/Kill Van Kull	Use channel and deeper non-channel habitats - no preference indicated	Yearlings during spring; YOY and a few yearlings/older juveniles during fall. (May be present all year; higher numbers collected during January - March & November-December. ^{a)}
Atlantic Menhaden*	Late summer (August) to late fall (November)	Newark Bay and Arthur Kill/Kill Van Kull	Present in mid-water and near bottom of both channel and non-channel habitats. Indicated preference for channel habitat	Yearlings and older juveniles/adults during spring; YOY during summer and fall with a few yearlings/older juveniles during fall. (May be present all year; higher numbers collected in January, August, & December. ^{a)}
Blueback Herring*	April, May, August, and November	Arthur Kill/Kill Van Kull, Newark Bay and Upper Bay	Primarily mid-water, also present near bottom; Primarily in channel habitat, also common in non-channel habitats.	Yearlings during spring; YOY and some yearlings during fall. (May be present all year; common during January - May & November-December. ^{a)}
Striped Bass**	October and November	Primarily Newark Bay; fewer in the Arthur Kill/Kill Van Kull	Indicated preference for near bottom waters of non-channel habitats. Also present in channels.	Older juveniles during late summer and yearlings during fall. (Present all year; common during January – April, July - August, & November-December. ^{a)} (Highest densities during summer. ^{o)}



Table 4-5 (cont). Observed preferences of target, EFH managed species, important forage species and other common species collected during the 2006 Migratory Finfish Sampling Program

Primary temporal, area, and habitat usage observed from April to November 2006				
Species	Season/Month of Concern	NY/NJ Harbor Areas of Concern	Habitat Usage (mid-water/bottom) and (channel/non-channel)	Comments and additional seasonal information (based on other studies)
EFH Species				
Atlantic Herring*	April	Arthur Kill/Kill Van Kull, Newark Bay and Upper Bay.	Channel; mid-water	Yearlings (Present January – June; common during April – June. ^a)
Black Sea Bass**	October followed by September	Lower Bay and Newark Bay	Channel and non-channel; exclusively near bottom	(Present January, April – June, August – October, & December. ^a)
Bluefish***	August to October	Newark Bay and Lower Bay	Slight preference for non-channel over channel; collected near bottom and slightly less often in mid-water	YOY and a few older juveniles (Present June - October ^b) (Present during spring with highest densities during summer. ^o)
Butterfish***	June and August to November	Lower Bay and Newark Bay	Channel and non-channel; mid-water to near bottom.	Yearlings and older juveniles during spring; YOY and yearlings during summer and early fall; yearlings during late fall. (Present May – December; common July - October. ^a)
Scup**	August to October		Primarily non-channel; exclusively near bottom	(Present May – October; common May - September. ^a)
Summer Flounder**	October followed by August	Lower Bay and Upper Bay	Channel and non-channel; exclusively on or near bottom	(May be present all year; common during May – July. ^a) (Highest densities during summer. ^o)
Windowpane**	November followed by October	Lower Bay and Upper Bay	Channel and non-channel; exclusively on or near bottom	(May be present all year; common during January – June. ^a) (Highest densities during spring. ^o)
Winter Flounder**	October and November	Upper Bay and Arthur Kill/Kill Van Kull; followed by the Lower Bay and Newark Bay	Channel and non-channel; exclusively on or near bottom	YOY and a few older juveniles. (Present all year; common during January – June & December. ^a) (Highest densities of adults during winter; YOY during fall. ^o)



Table 4-5 (cont). Observed preferences of target, EFH managed species, important forage species and other common species collected during the 2006 Migratory Finfish Sampling Program

Primary temporal, area, and habitat usage observed from April to November 2006				
Species	Season/Month of Concern	NY/NJ Harbor Areas of Concern	Habitat Usage (mid-water/bottom) and (channel/non-channel)	Comments and additional seasonal information (based on other studies)
Other Species				
Atlantic Silverside***	November followed by October	Newark Bay and Upper Bay	Non-channel; mid-water to near bottom.	(Present January – March, July – September, & November – December; more collected in July followed by January, February, and December. ^{a)})
Bay Anchovy***	May, June, and August to October	Arthur Kill/Kill Van Kull, Newark Bay, Lower Bay, and Upper Bay	Channel; mid-water to near bottom.	Older juveniles and adults during spring, late summer and fall; YOY during late summer and fall. (May be present all year; common during May – October. ^{a)} (Highest densities during summer. ^{o)})
Weakfish**	August to October	Arthur Kill/Kill Van Kull, Newark Bay	Channel and non-channel; near bottom	YOY and a few older juveniles during late summer and fall. (Present January & May – December; common July - October. ^{a)} (Highest densities during summer. ^{o)})



Table 4-6. Significant results of the two-way repeated measures ANOVA for select target, EFH, and other species collected in mid-water and bottom trawls. For each tested effect, the degrees of freedom (df: numerator, denominator), *F*-value, and *P*-value are listed, with $\alpha = 0.05$.

Group	Species	Trawl type	Effect	df	F-value	P-value
Target species	American shad	Bottom	Station type	1,10	19.69	< 0.001
			Week of Year	7,65	7.94	< 0.001
			Station type*Week of Year	7,65	6.18	< 0.001
	Atlantic menhaden	Mid-water	Region	3,19	3.61	0.032
			Week of Year	11,208	2.29	0.011
			Region*Week of Year	33,208	3.28	< 0.001
		Bottom	Week of Year	7,65	7.43	< 0.001
			Station type*Week of Year	7,65	2.55	0.022
			Region*Week of Year	21,65	2.00	0.018
	Blueback herring	Mid-water	Week of Year	11,208	4.07	< 0.001
		Bottom	Station type	1,10	8.64	0.015
			Station type*Week of Year	7,65	14.83	< 0.001
Striped bass	Bottom [†]	Station type	1,13	8.43	0.012	
		Week of Year	2,26	9.12	0.001	
		Station type*Week of Year	2,26	5.74	0.009	
EFH species	Atlantic herring	Mid-water	Station type	1,19	6.94	0.016
			Week of Year	11,208	5.69	< 0.001
			Station type*Week of Year	11,208	3.43	< 0.001
	Bluefish	Mid-water	Week of Year	11,208	3.13	0.001
		Bottom	Station type	1,10	15.47	0.003
			Week of Year	7,65	6.77	< 0.001
	Butterfish	Mid-water [†]	Station type*Week of Year	7,65	2.80	0.013
			Week of Year	2,24	7.55	0.003
			Bottom	Region	3,10	5.00
	Scup	Bottom	Week of Year	7,65	5.14	< 0.001
			Region*Week of Year	21,65	1.89	0.027
			Station type*Week of Year	7,65	4.69	< 0.001
Other species	Bay anchovy	Mid-water [†]	Week of Year	4,88	2.57	0.044
			Region*Week of Year	12,88	4.06	< 0.001
			Bottom [†]	Station type	1,14	6.04
	Weakfish	Bottom	Week of Year	5,67	2.36	0.049
			Station type*Week of Year	5,67	2.45	0.042
			Region	3,12	5.01	0.018
	Weakfish	Bottom	Week of Year	7,12	43.23	< 0.001
			Region*Week of Year	21,12	8.42	< 0.001

[†] Analyses were run on truncated datasets.



Table 4-7. Other relevant aquatic biological studies conducted in the Hudson-Raritan Estuary

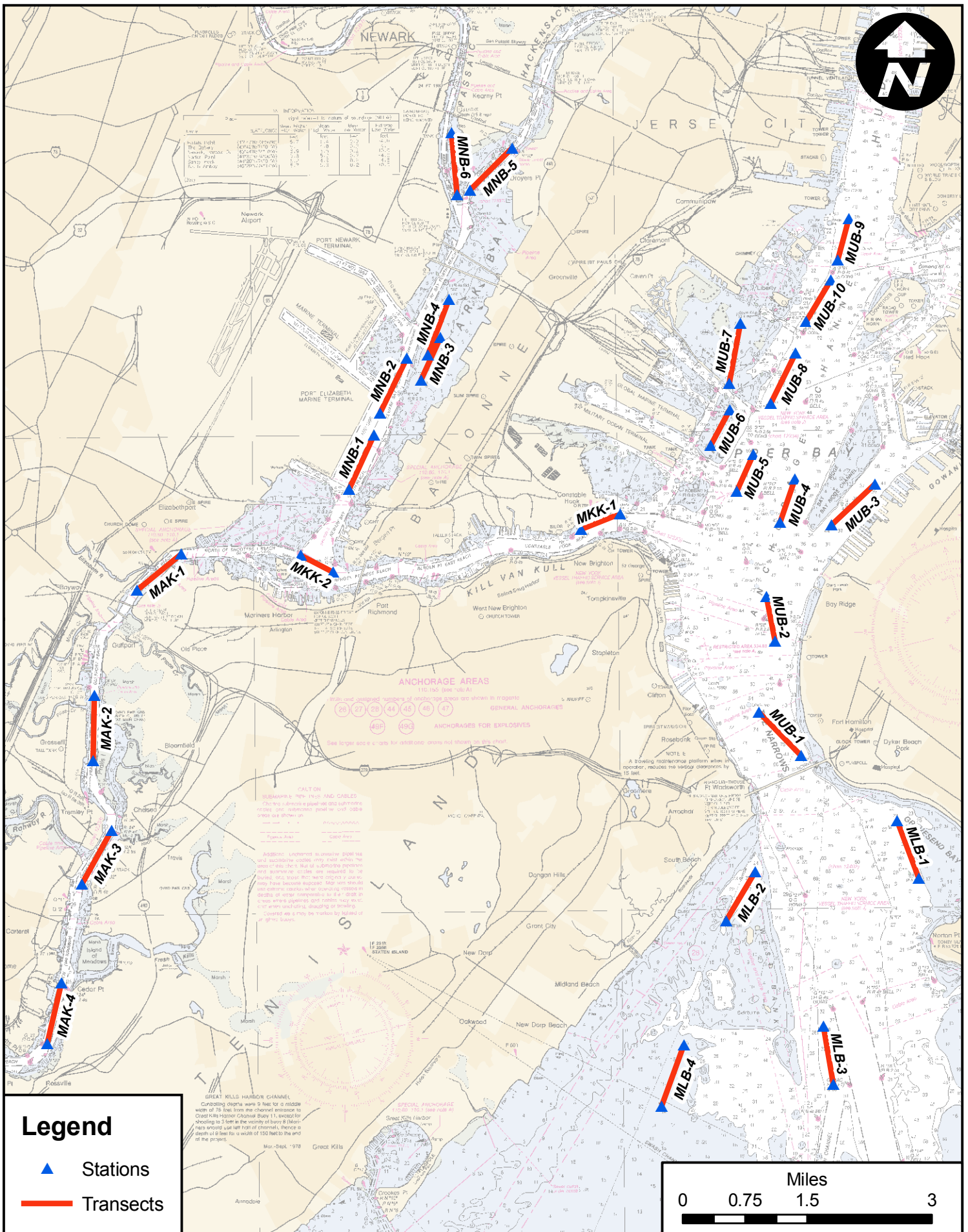
Region	Year	Authors	Title	Summary
Arthur Kill/Kill Van Kull	1996	Lawler, Matusky & Skelly Engineers, LLP. (LMS)	Biological Survey of Newark Bay Shoal Areas and Kill Van Kull and Arthur Kill Channels	Monthly bottom trawling at one Arthur Kill channel station and one Kill Van Kull channel area and four Newark Bay non-channel areas from April 1995 March 1996.
	1995	U.S. Coast Guard (USCG)	Draft Environmental Impact Statement/Draft Section 4(f) Statement. Staten Island Bridges Program, Modernization and Capacity Enhancement Project	Bottom trawls in the Arthur Kill in the vicinity of the Goethals Bridge from March 1994 to February 1995. Fish were collected from channel and non-channel areas; winter flounder (60% of fish collected) was the dominant species collected and was followed by striped bass (8.9%), Atlantic tomcod (6.4%), and grubby (5.9%).
	1993	Lawler, Matusky & Skelly Engineers, LLP. (LMS)	Arthur Kill Impingement and Entrainment Report	Fish were collected from the intake screens at the Arthur Kill Generating Station from September 1991 to September 1992.
	1989a	EA	Sewaren Generating Station, Units 1 through 4 Supplemental 316(b) Report	Fish were collected from the intake screens at Sewaren from February 1988 to January 1989.
	1989b	EA	Linden Generating Station, 316(b) Report	Fish were collected from the intake screens at Linden from February 1988 to January 1989.
	1974	Ichthyological Associates (IA)	An ecological study of the Arthur Kill in the vicinity of the Linden Generating Station	Seine and bottom trawl surveys in the vicinity of the Linden and Sewaren Generating Stations on the Arthur Kill; the studies also included impingement collections.
Newark Bay	1996	Lawler, Matusky & Skelly Engineers, LLP. (LMS)	Biological Survey of Newark Bay Shoal Areas and Kill Van Kull and Arthur Kill Channels	Monthly bottom trawls in four Newark Bay non-channel areas and two Arthur Kill/Kill Van Kull channel areas from April 1995 March 1996.
	1995	NOAA: National Marine Fisheries Service (NMFS)	Results of biological and hydrological characterization of Newark Bay, New Jersey, May 1993- April 1994.	Monthly trawls in Newark Bay from May 1993 to April 1994, using a 4.9m otter trawl to sample shoal stations and a larger 8.5m otter trawl to sample channel stations. The data provides species usage and relative abundance on temporal and habitat (channel and non-channel) levels.
	1992	Will, R. & L.J. Houston	Fish distribution survey of Newark Bay, New Jersey, May 1987 - April 1988. PP 428-445 in L.C. Smith ed. Estuarine Research in the 1980's	Monthly bottom trawls and gill netting in Newark Bay channel and non-channel areas from May 1987 to April 1988. They used the same trawl to sample all stations and they provided channel and non-channel CPUE information for the 12 common species.
	1974	Ichthyological Associates (IA)	An ecological study of the Arthur Kill in the vicinity of the Linden Generating Station	Seine and bottom trawl surveys in the vicinity of the Kearny Generating Station at the mouth of the Hackensack River just north of Newark Bay. Their studies also included monthly impingement collections from March 1972 to November 1973. Similar studies were conducted by IA at the Essex Generating Station at the mouth of the Passaic River just north of Newark Bay.



Table 4-7. Other relevant aquatic biological studies conducted in the Hudson-Raritan Estuary

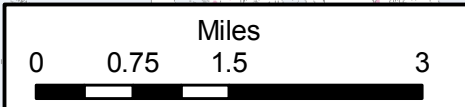
Upper Bay	2003	USACE	Characterization of adult & early life stages of finfish in the Upper Bay of the NY/NJ Harbor near the peninsula at Bayonne Harbor & Ellis Island	Bottom trawls and side-scan sonar surveys of three stations located near Ellis Island and Bayonne, NJ from March through June 2003.
	1994	Lawler, Matusky & Skelly Engineers, LLP. (LMS)	World Trade Center Impingement & Entrainment Report	World Trade Center Impingement Study (located just north of the Upper Bay). Weekly impingement collections of fish and invertebrates washed of the traveling screens were collected from March 1991 to February 1993.
	1980	Lawler, Matusky & Skelly Engineers, LLP. (LMS)	Biological and water quality data collected in the Hudson River near the proposed Westway Project during 1979-1980. Volume 1.	Monthly winter trawl survey (January to April 1980 at four stations in the Lower Bay (two deep and two shallow stations) and the Upper Bay (two deep and two shallow stations). The fisheries data was provided by date and location for the seven common species and lumped for all other species (29 species) collected.
	1976	Texas Instruments, Inc. (TI)	Liberty State Park Ecological Study	Fisheries Survey at Liberty State Park August 1975 to July 1976; monthly sampling using beach seines, trap nets, & bottom trawl in the non-channel areas around liberty and Ellis islands.
Lower Bay	1998	Wilk, S.J., Pikanowski, R.A., McMillan, D.G., MacHaffie, E.M.	Seasonal distribution and abundance of 26 species of fish and megainvertebrates collected in the Hudson-Raritan Estuary, January 1992 – December 1997. Northeast Fish. Sci. Cent. Ref. Doc. 98-10.	Seasonal distribution of fish collected by trawl in both channel and non-channel areas in the Hudson-Raritan Estuary (Lower Bay) between January 1992 and December 1997.
	1991	Woodhead, P.M.	Inventory and assessment of habitat and fish resources and assessment of information on toxic effects in the New York/New Jersey Harbor Estuary. New York/New Jersey Harbor Estuary Program.	Woodhead (1991) conducted a trawl inventory and assessment of habitat and fish resources in Raritan Bay and Sandy Hook Bay.
	1980	Lawler, Matusky & Skelly Engineers, LLP. (LMS)	Biological and water quality data collected in the Hudson River near the proposed Westway Project during 1979-1980. Volume 1.	Monthly winter trawl survey (January to April 1980 at four stations in the Lower Bay (two deep and two shallow stations) and the Upper Bay (two deep and two shallow stations). The fisheries data was provided by date and location for the seven common species and lumped for all other species (29 species) collected.
	1977	Wilk, S.J., W.W. Morse, D.E. Ralph, and T.R. Azarovitz.	Fishes and associated environmental data collected in New York Bight, June 1974-June 1975. NOAA Technical Report NMFS SSRF-716.	Monthly trawl surveys in the New York Bight and Lower Bay from June 1974 to 1975. The fish data is provided by month and location in the report tables.
	1977	Ichthyological Associates (IA)	Impingement and Entrainment at the Werner Generating Station and a Fisheries Study of the Fishes of the Raritan River and Bay Near the Station April 1976 – March 1977.	Trawl, seine, and impingement studies in the vicinity of the mouth of the Raritan River and in Raritan Bay for the Werner Generating Station. Trawls, seines, and gill netting surveys were conducted from April 1976 to March 1977 and impingement samples were collected from April 1976 to March 1977.





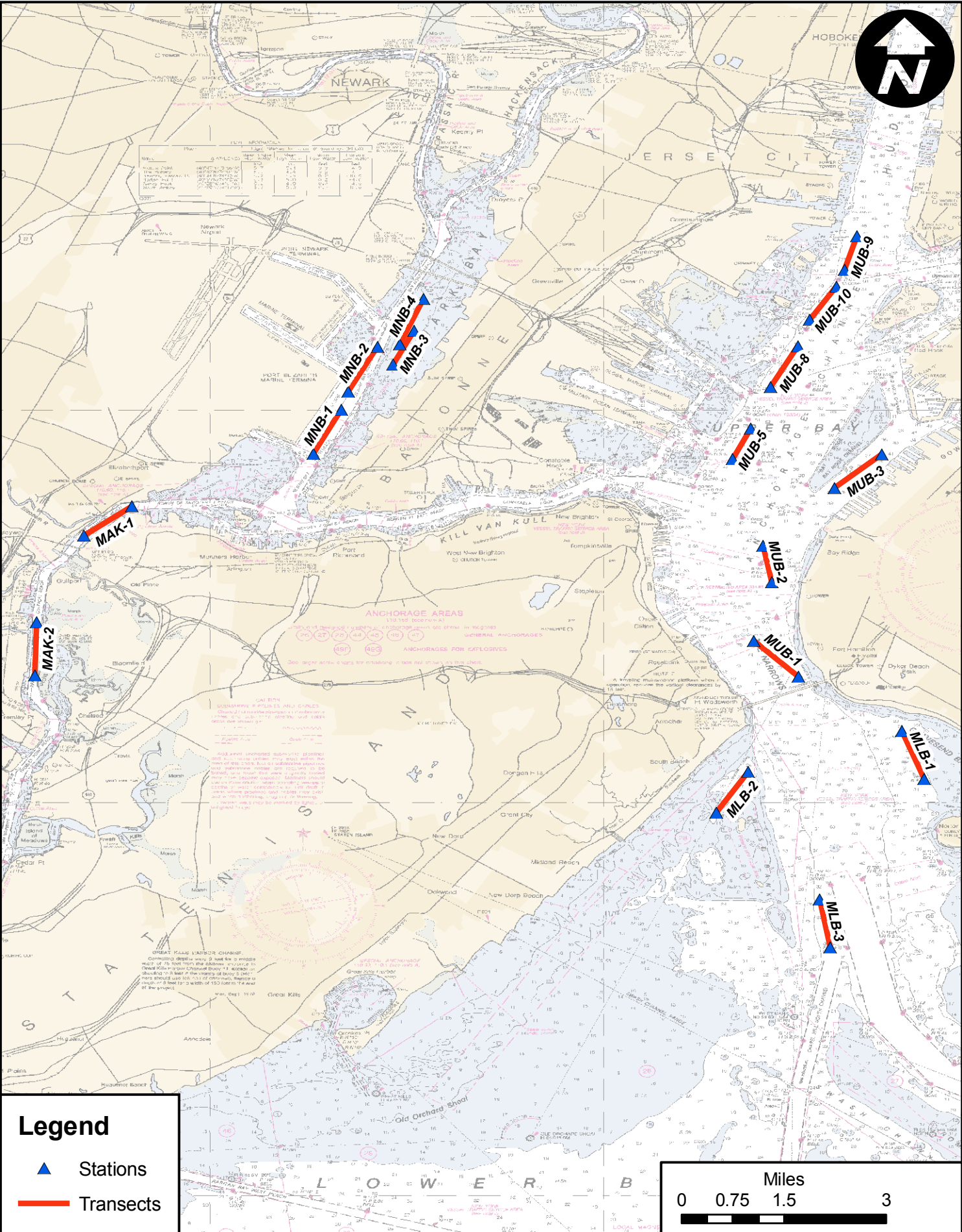
Legend

- Stations
- Transects



2006 Migratory Finfish Mid-Water Trawl Locations

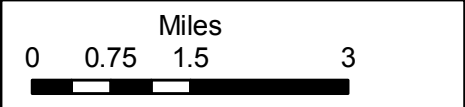
Job No.	Date	Figure No.
41048	05/15/07	2-1



Symbol	Meaning
Blue Triangle	Station
Red Line	Transect

Legend

- ▲ Stations
- Transects



2006 Migratory Finfish Bottom Trawl Sampling Locations

Job No.	Date	Figure No.
41048	05/15/07	2-2

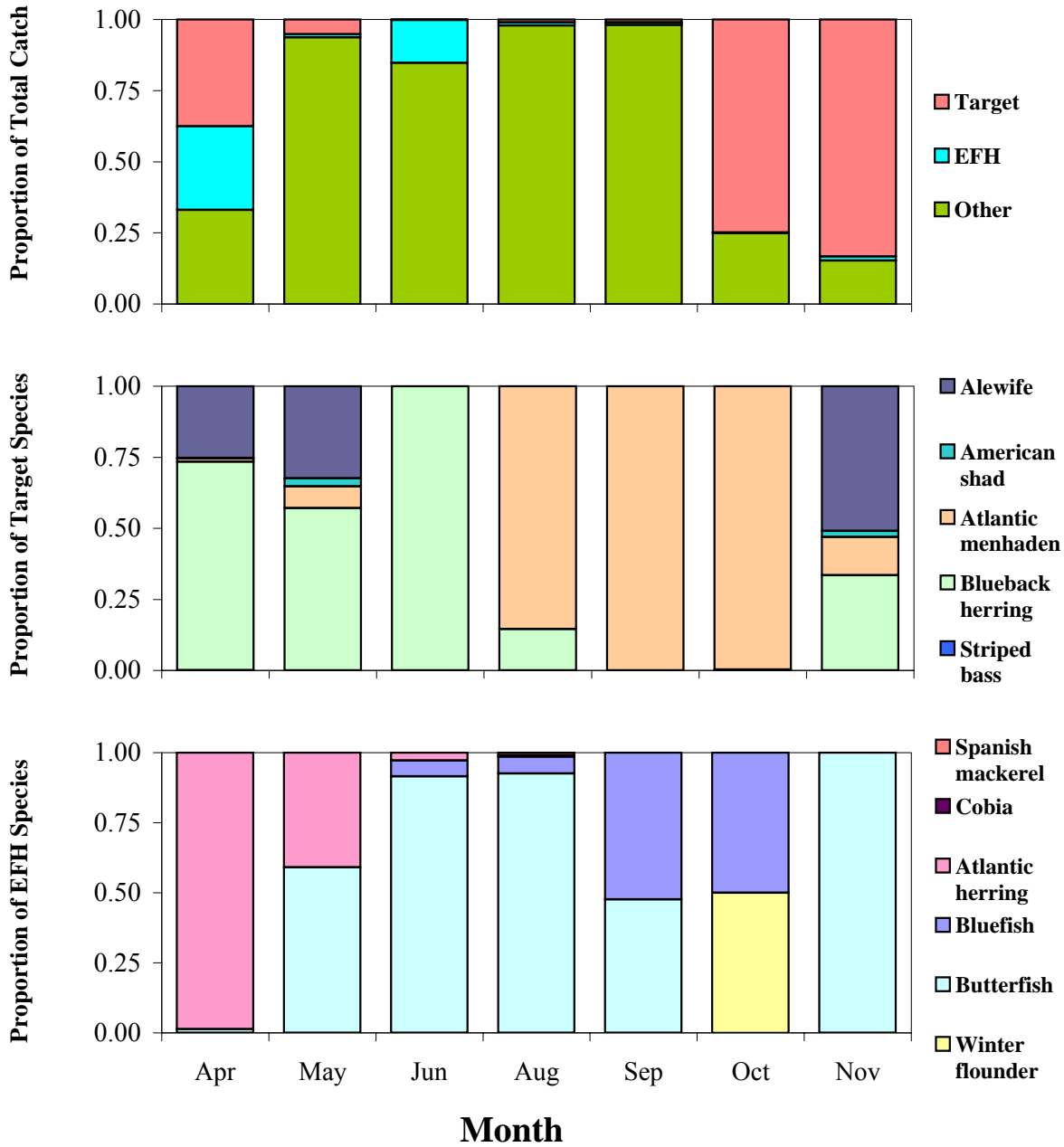
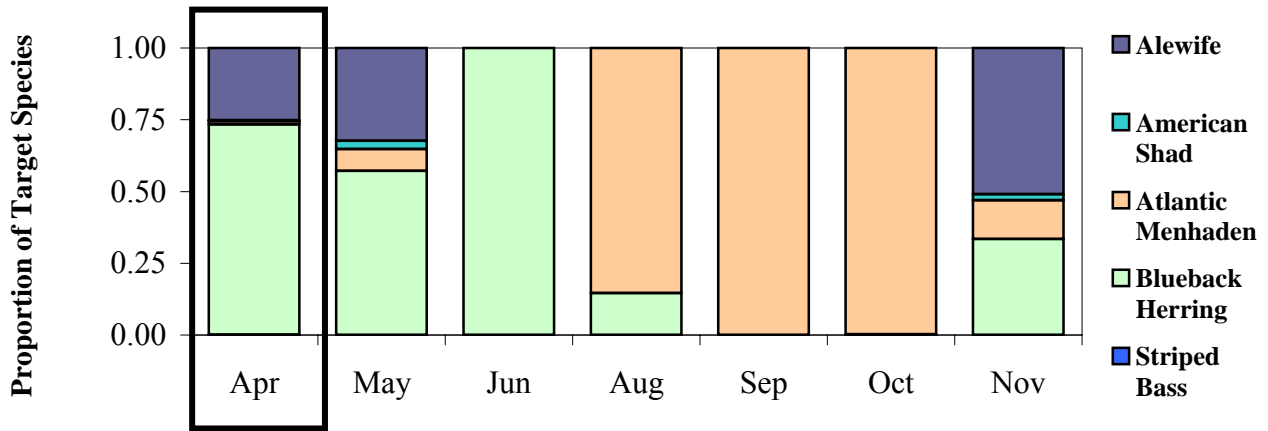
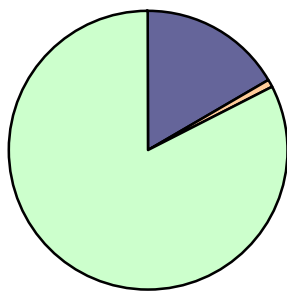


Figure 3-1 Percent composition of target and EFH managed species by month in mid-water trawl catches from the four study areas combined, 2006 Migratory Finfish Sampling Program.



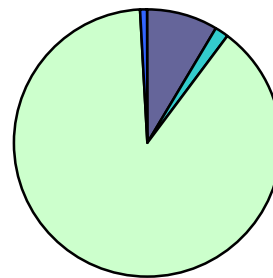


Arthur Kill/Kill Van Kull



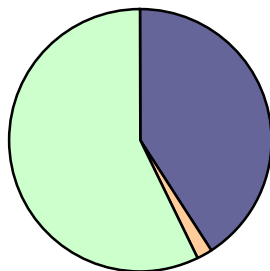
■ Alewife (N = 59)
 ■ Atlantic menhaden (N = 3)
 ■ Blueback herring (N = 290)

Newark Bay



■ Alewife (N = 10)
 ■ American shad (N = 2)
 ■ Blueback herring (N = 105)
 ■ Striped bass (N = 1)

Upper Bay



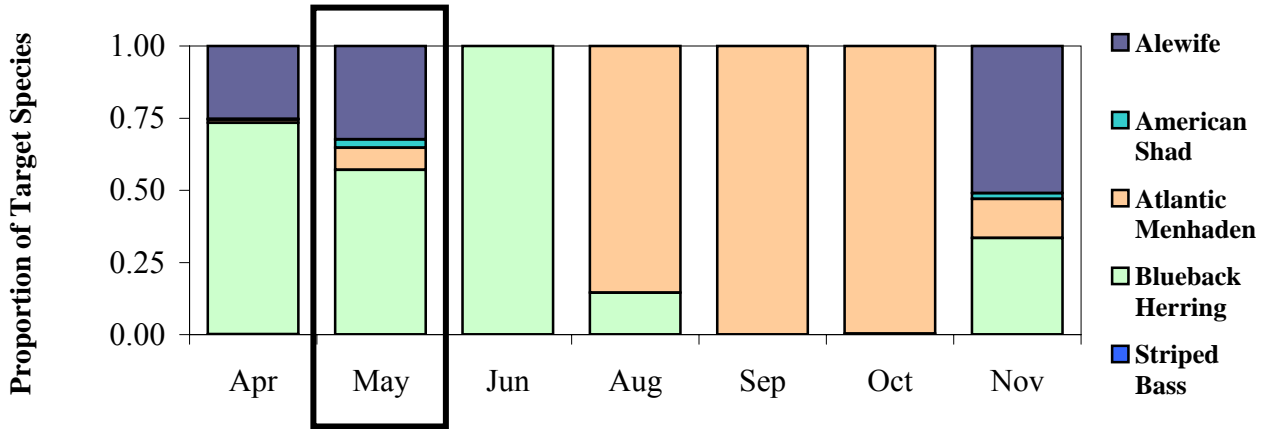
■ Alewife (N = 129)
 ■ Atlantic menhaden (N = 6)
 ■ Blueback herring (N = 180)

Lower Bay

No Target Fish Caught

Figure 3-2 a Percent composition of target species in April mid-water trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.

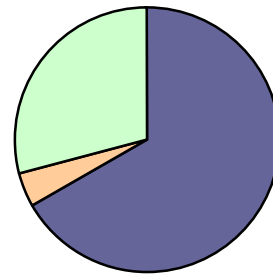




Arthur Kill/Kill Van Kull

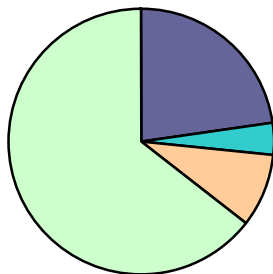
Newark Bay

No Target Fish Caught



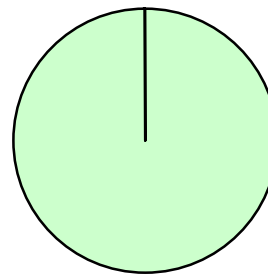
■ Alewife (N = 16)
 ■ Atlantic menhaden (N = 1)
 ■ Blueback herring (N = 7)

Upper Bay



■ Alewife (N = 18)
 ■ American shad (N = 3)
 ■ Atlantic menhaden (N = 7)
 ■ Blueback herring (N = 51)

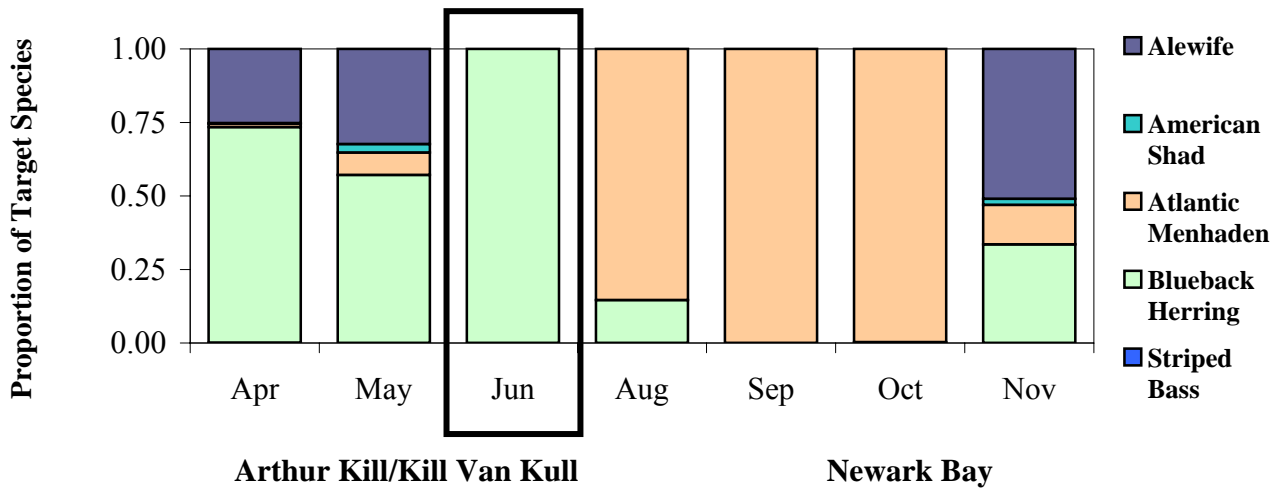
Lower Bay



■ Blueback herring (N = 2)

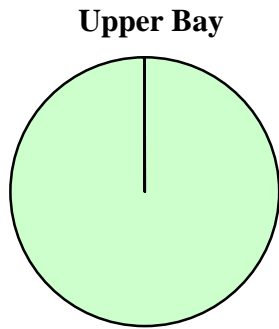
Figure 3-2 b Percent composition of target species in May mid-water trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.





No Target Fish Caught

No Target Fish Caught



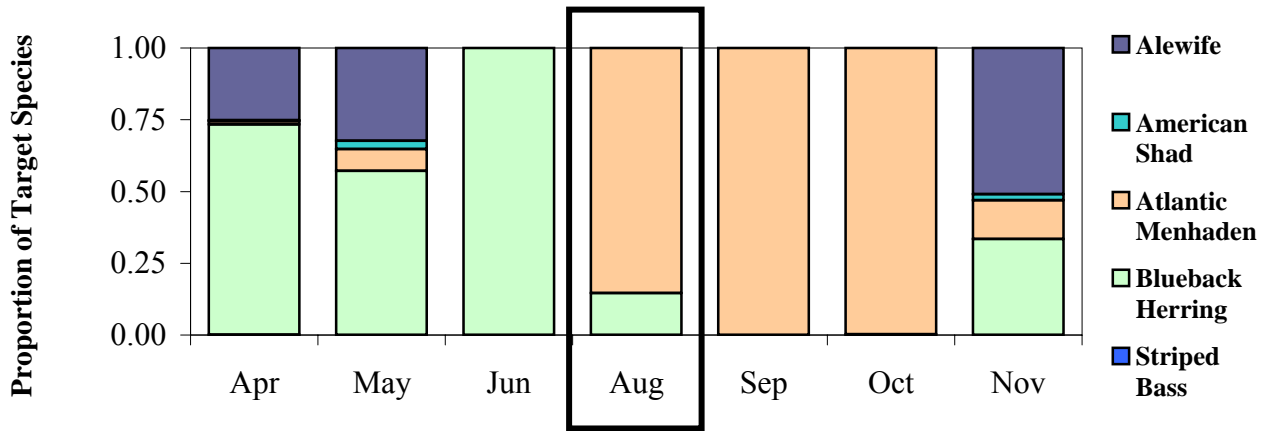
Lower Bay

No Target Fish Caught

Blueback herring (N = 180)

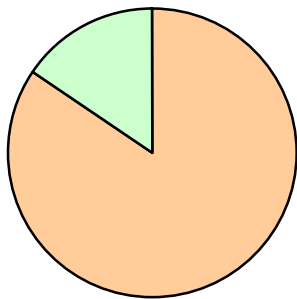
Figure 3-2 c Percent composition of target species in June mid-water trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.



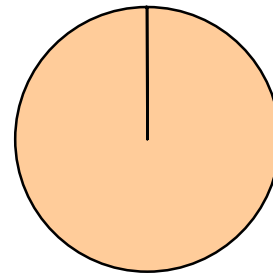


Arthur Kill/Kill Van Kull

Newark Bay



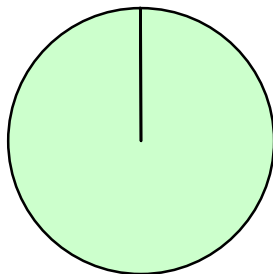
Atlantic menhaden (N = 125)
Blueback herring (N = 23)



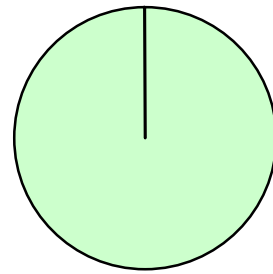
Atlantic menhaden (N = 51)

Upper Bay

Lower Bay



Blueback herring (N = 6)



Blueback herring (N = 1)

Figure 3-2 d Percent composition of target species in August mid-water trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.



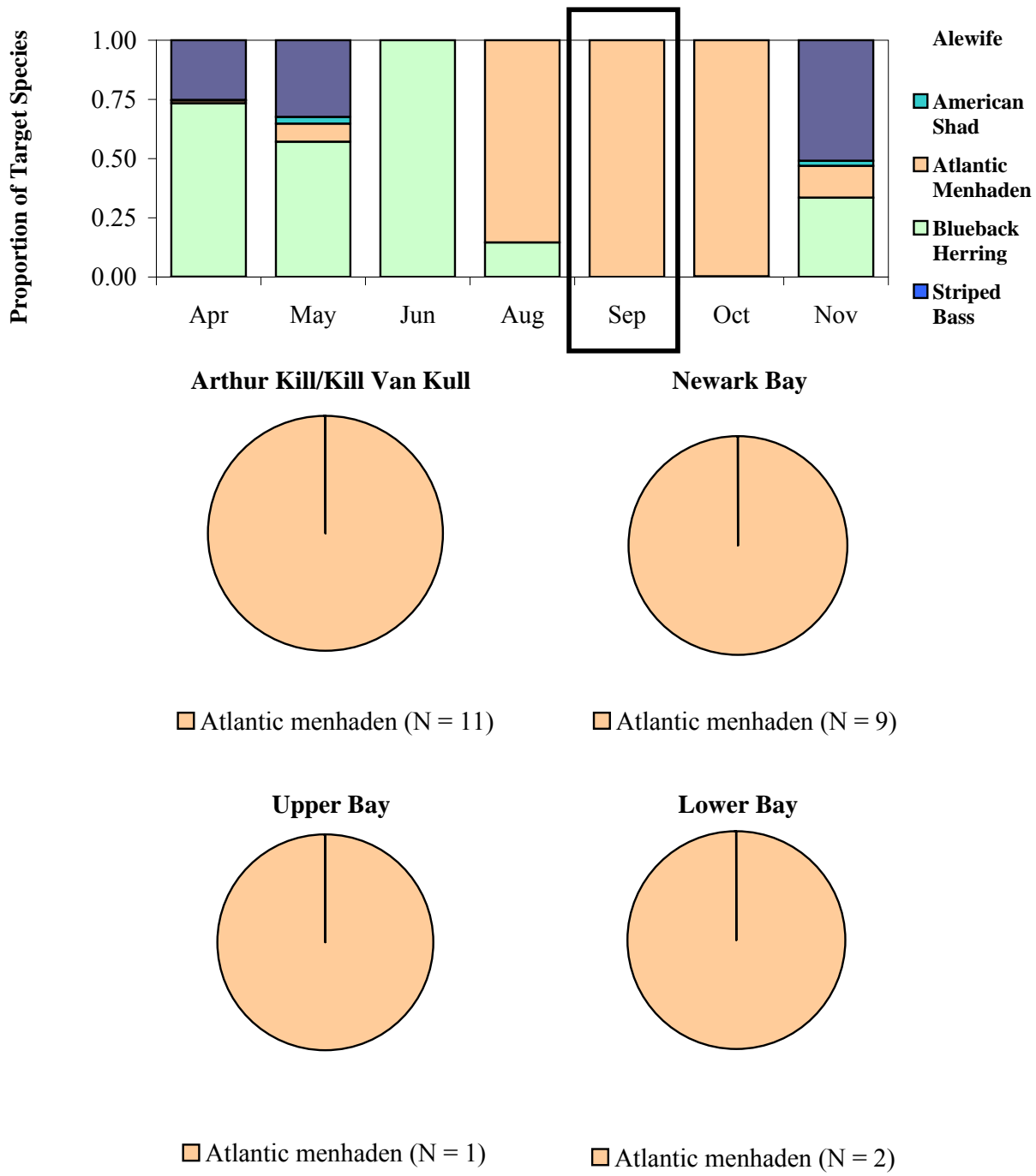
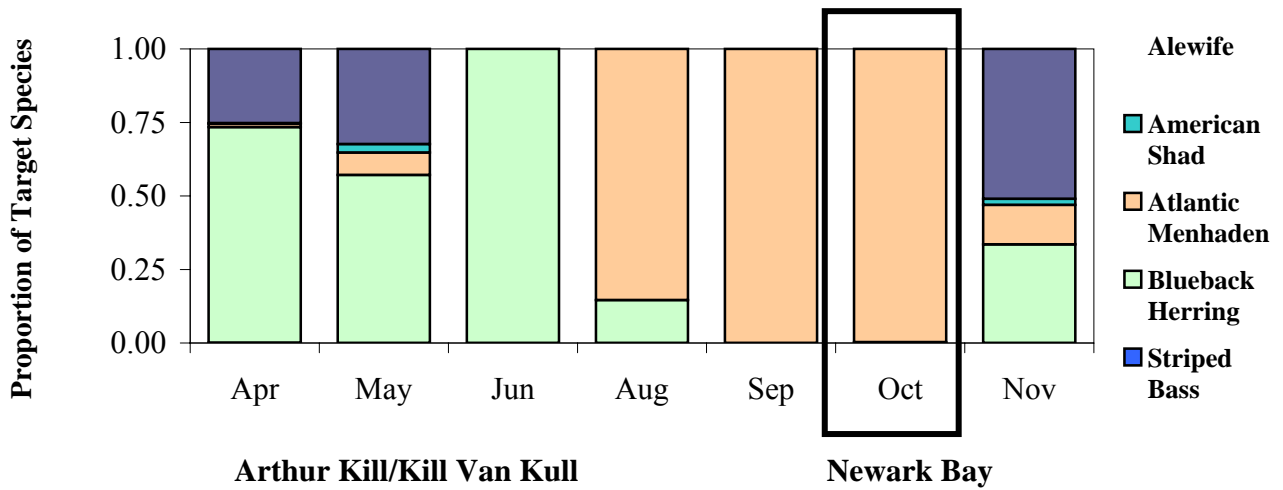
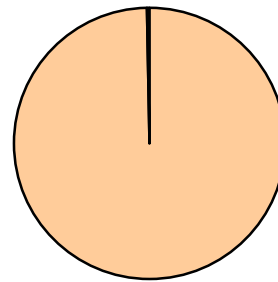


Figure 3-2 e Percent composition of target species in September mid-water trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.





No Target Fish Caught



Atlantic menhaden (N = 718)
Blueback herring (N = 2)

Upper Bay

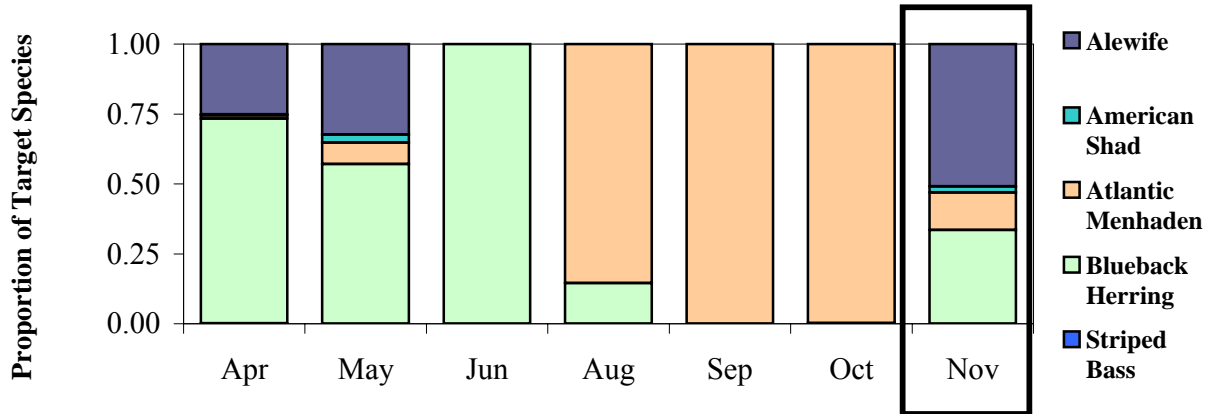
Lower Bay

No Target Fish Caught

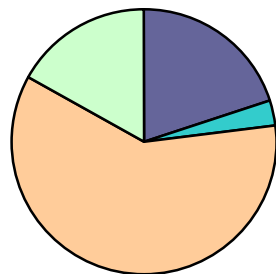
No Target Fish Caught

Figure 3-2 f Percent composition of target species in October mid-water trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.



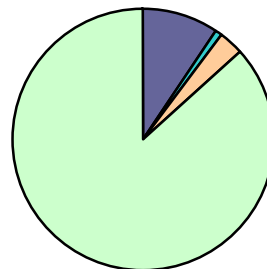


Arthur Kill/Kill Van Kull



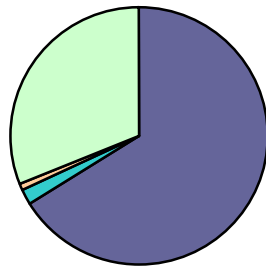
■ Alewife (N = 69)
 ■ American shad (N = 10)
 ■ Atlantic menhaden (N = 206)
 ■ Blueback herring (N = 58)

Newark Bay



■ Alewife (N = 15)
 ■ American shad (N = 1)
 ■ Atlantic menhaden (N = 51)
 ■ Blueback herring (N = 136)

Upper Bay



■ Alewife (N = 745)
 ■ American shad (N = 23)
 ■ Atlantic menhaden (N = 8)
 ■ Blueback herring (N = 351)

Lower Bay

No Target Fish Caught

Figure 3-2 g Percent composition of target species in November mid-water trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.



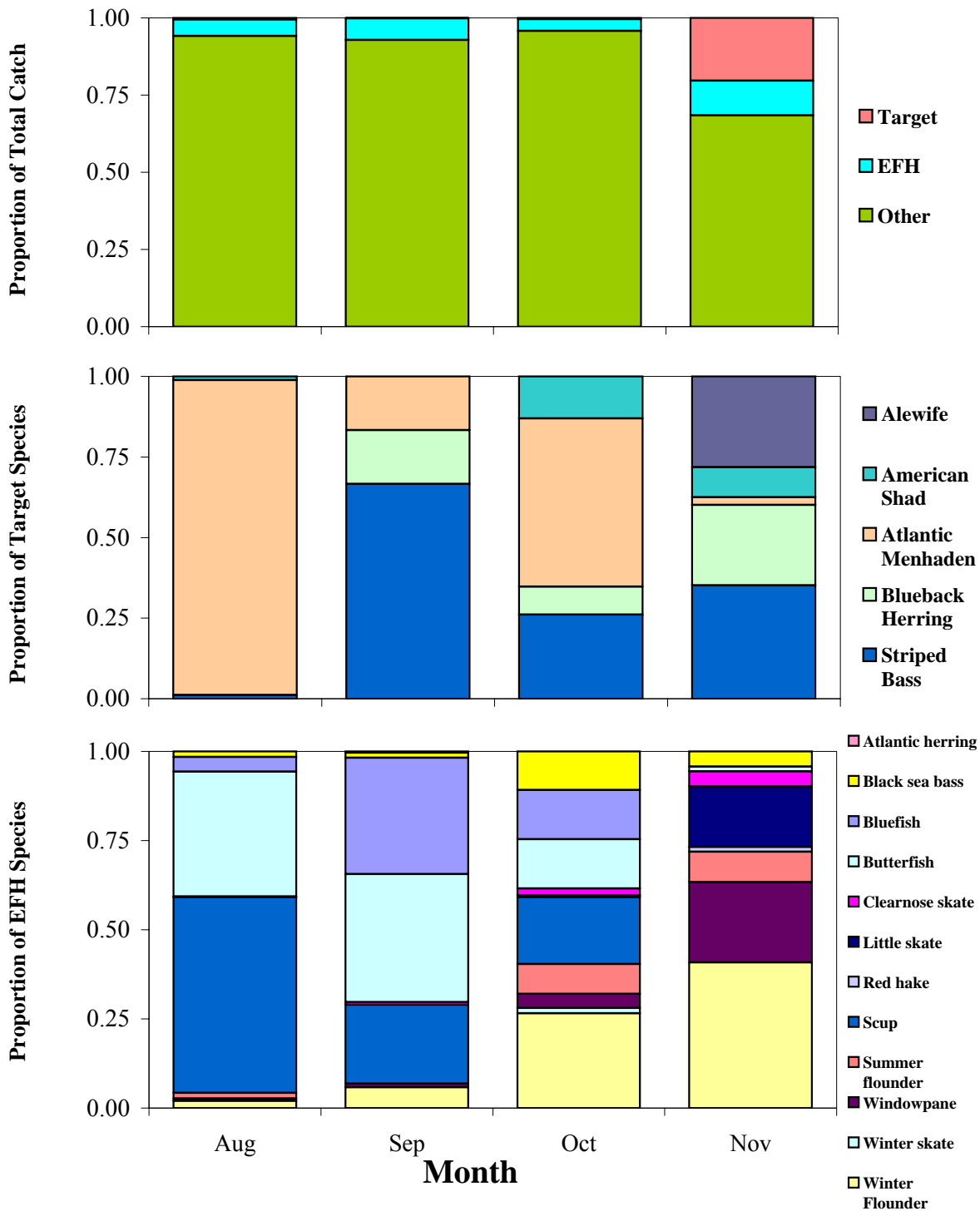
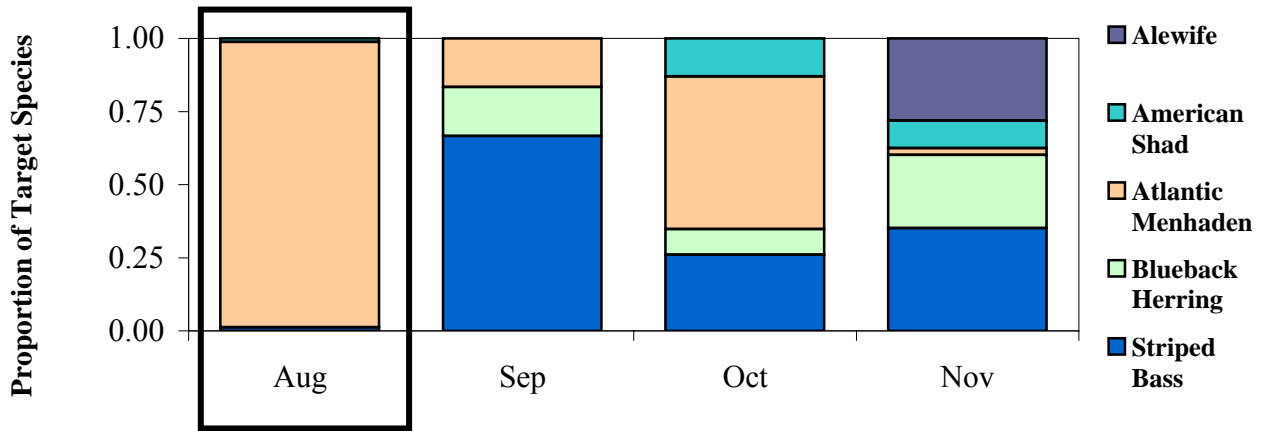
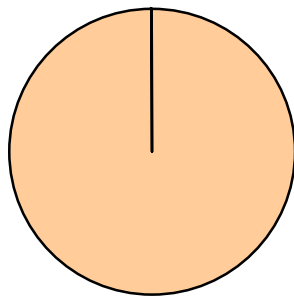


Figure 3-3 Percent composition of target and EFH managed species by month in bottom trawl catches from the four study areas combined, 2006 Migratory Finfish Sampling Program.



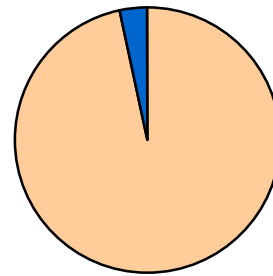


Arthur Kill/Kill Van Kull



Atlantic menhaden (N = 12)

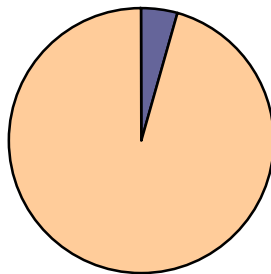
Newark Bay



Atlantic menhaden (N = 29)

Striped bass (N = 1)

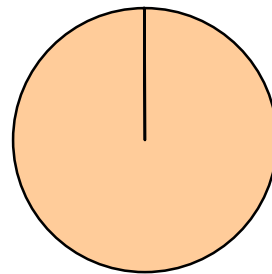
Upper Bay



American shad (N = 1)

Atlantic menhaden (N = 21)

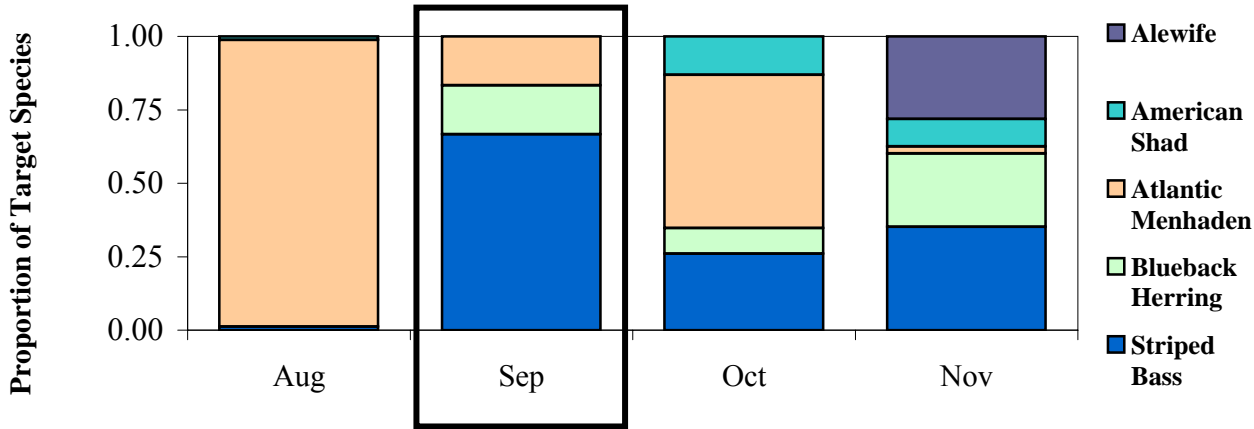
Lower Bay



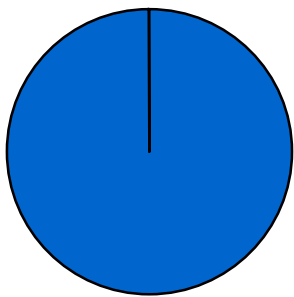
Atlantic menhaden (N = 23)

Figure 3-4 a Percent composition of target species in August bottom trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.



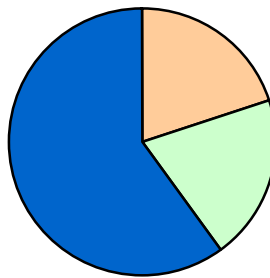


Arthur Kill/Kill Van Kull



■ Striped bass (N = 1)

Newark Bay



■ Atlantic menhaden (N = 1)
 ■ Blueback herring (N = 1)
 ■ Striped bass (N = 3)

Upper Bay

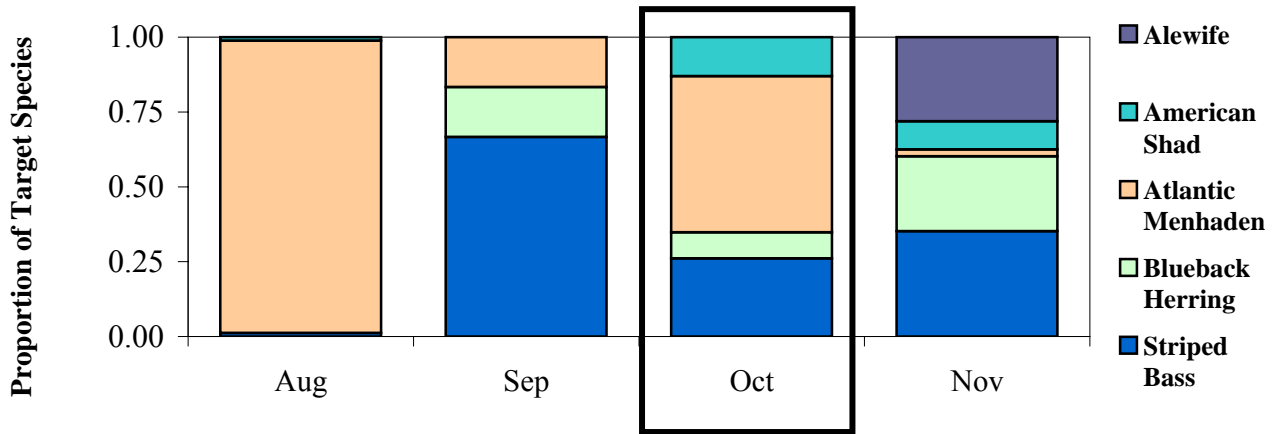
No Target Fish Caught

Lower Bay

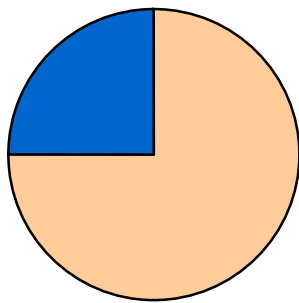
No Target Fish Caught

Figure 3-4 b Percent composition of target species in September bottom trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.



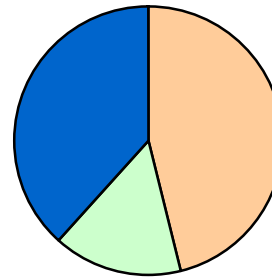


Arthur Kill/Kill Van Kull



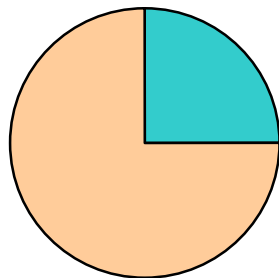
■ Atlantic menhaden (N = 3)
■ Striped bass (N = 1)

Newark Bay



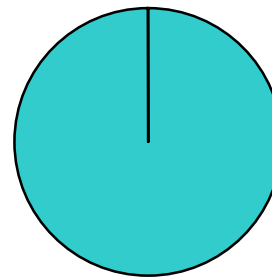
■ Atlantic menhaden (N = 6)
■ Blueback herring (N = 2)
■ Striped bass (N = 5)

Upper Bay



■ American shad (N = 1)
■ Atlantic menhaden (N = 3)

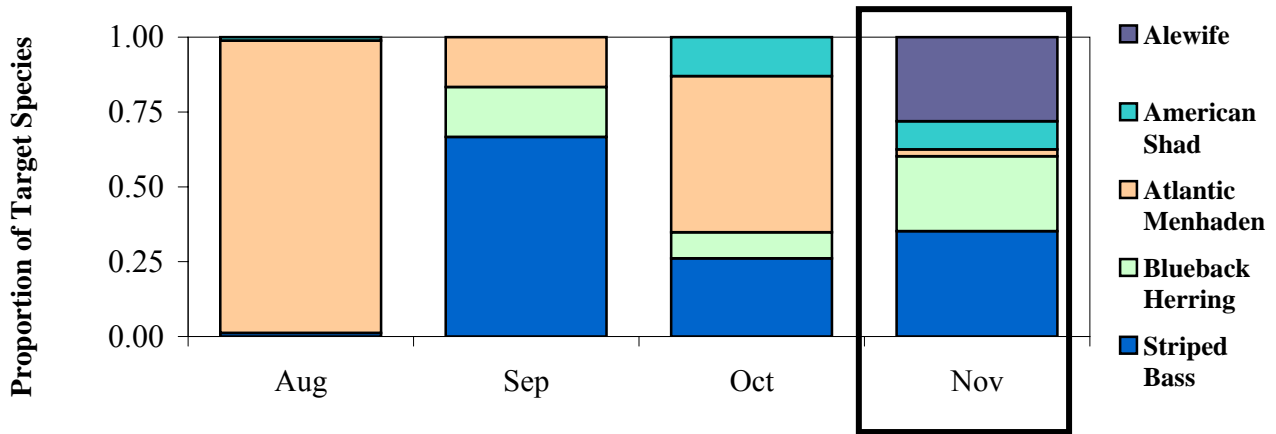
Lower Bay



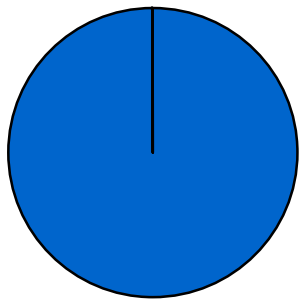
■ American shad (N = 2)

Figure 3-4 c Percent composition of target species in October bottom trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.



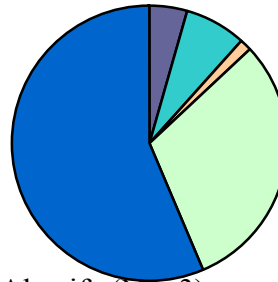


Arthur Kill/Kill Van Kull



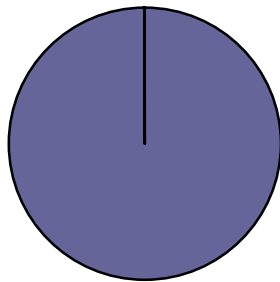
■ Striped bass (N = 5)

Newark Bay



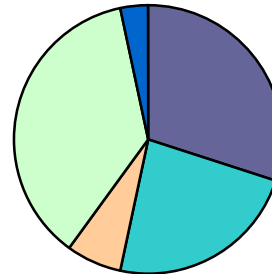
■ Alewife (N = 3)
 ■ American shad (N = 5)
 ■ Atlantic menhaden (N = 1)
 ■ Blueback herring (N = 21)
 ■ Striped bass (N = 39)

Upper Bay



■ Alewife (N = 24)

Lower Bay



■ Alewife (N = 9)
 ■ American shad (N = 7)
 ■ Atlantic menhaden (N = 2)
 ■ Blueback herring (N = 11)
 ■ Striped bass (N = 1)

Figure 3-4 d Percent composition of target species in November bottom trawl catches from the Arthur Kill/Kill Van Kull (AK/KVK), Newark Bay (NB), Upper Bay (UB), and Lower Bay (LB) study areas, 2006 Migratory Finfish Sampling Program.



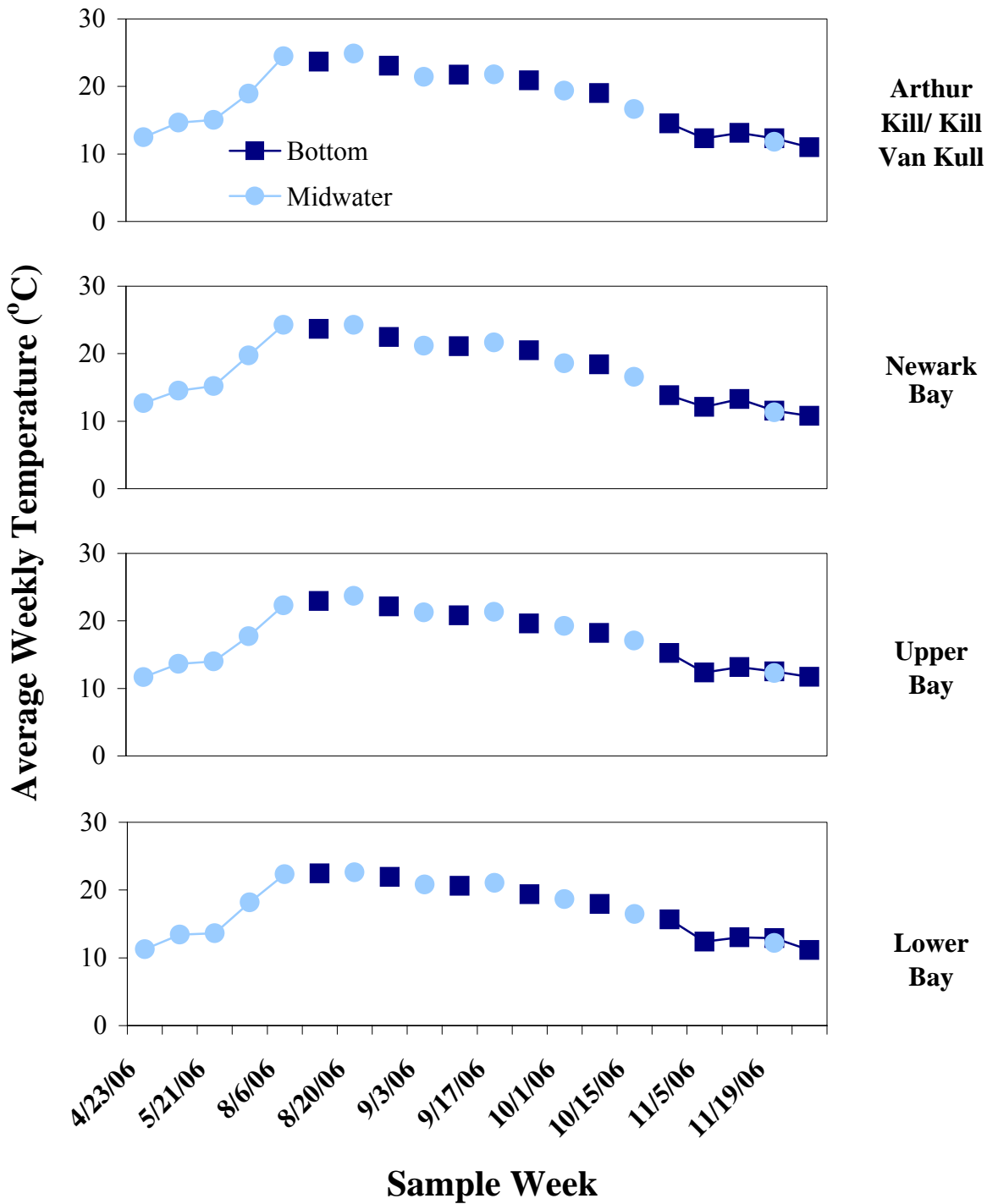


Figure 3-5 Average mid-water and bottom temperatures in the four study areas during each sampling period, 2006 Migratory Finfish Sampling Program.



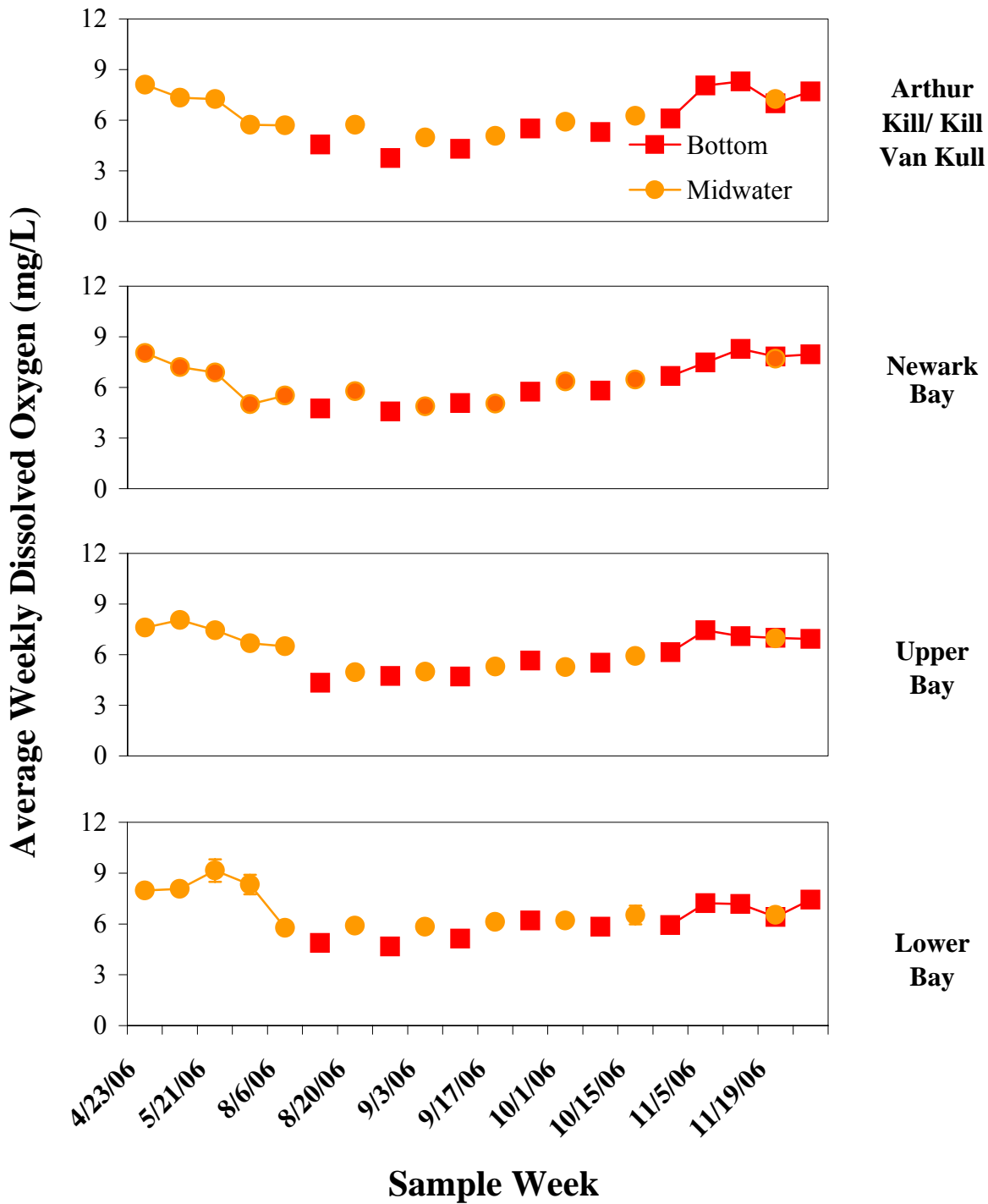


Figure 3-6 Average mid-water and bottom dissolved oxygen in the four study areas during each sampling period, 2006 Migratory Finfish Sampling Program.



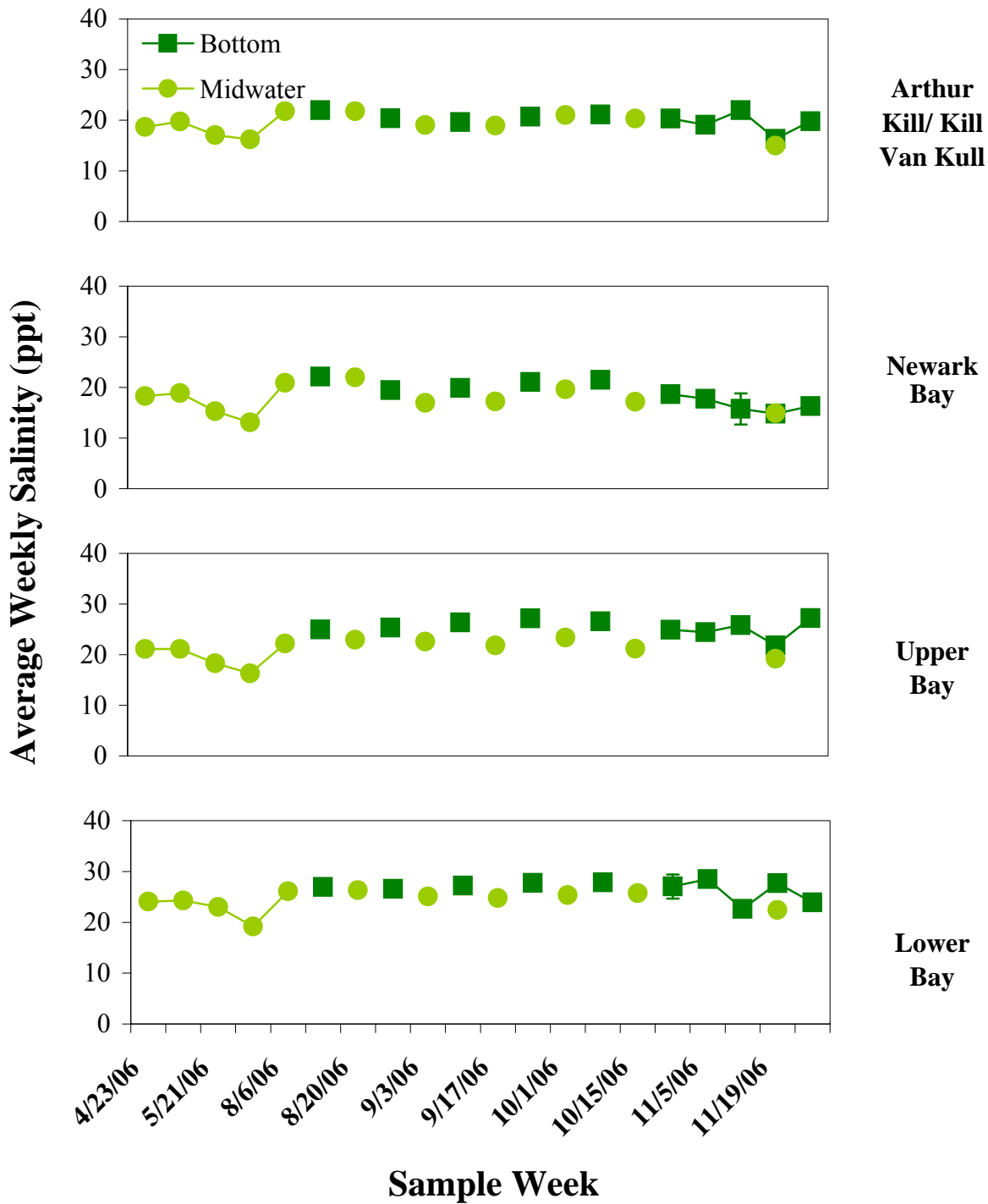


Figure 3-7 Average mid-water and bottom salinities in the four study areas during each sampling period, 2006 Migratory Finfish Sampling Program.



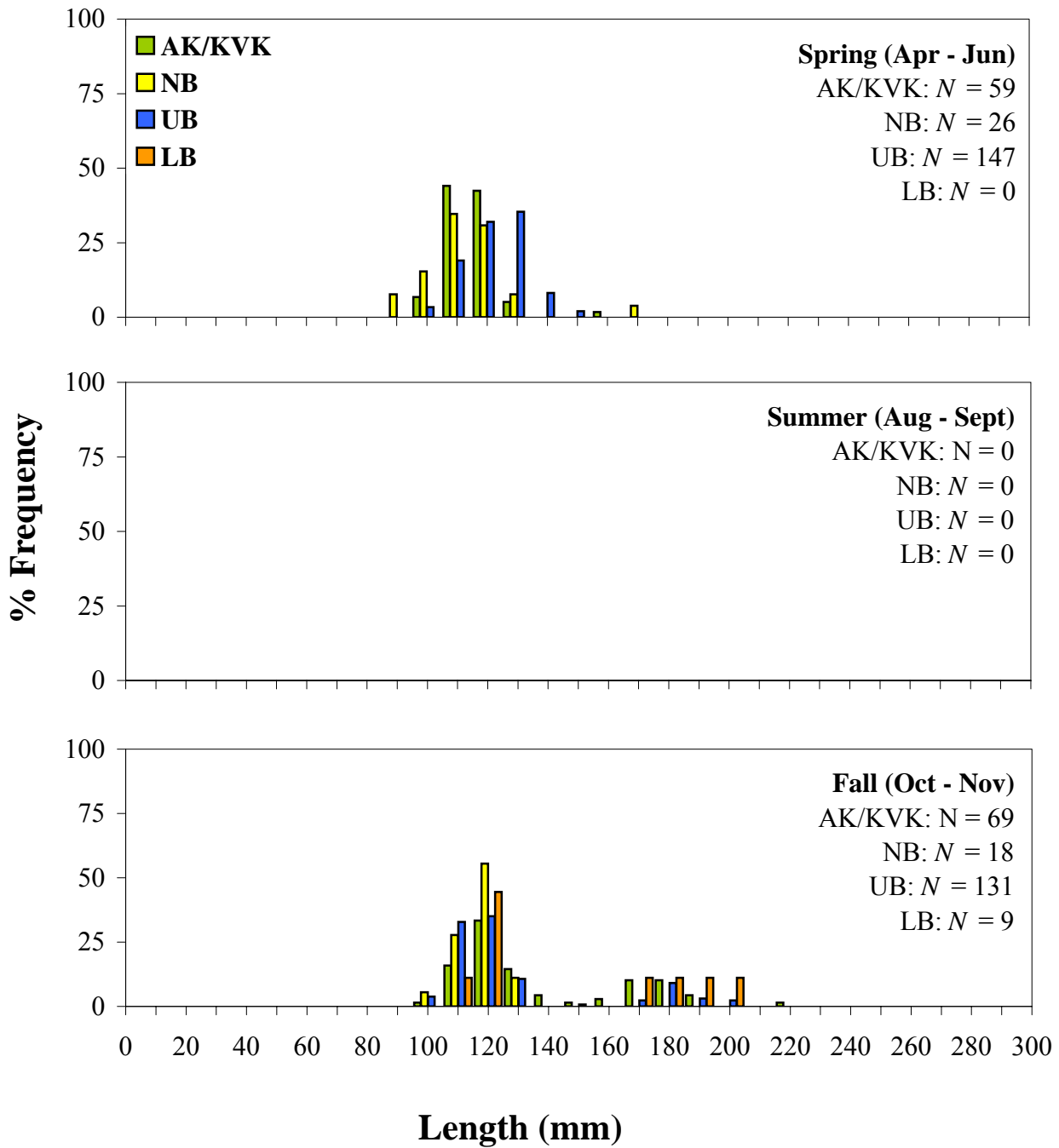


Figure 4-1 a Length frequency distribution (10 mm intervals) by season and all study areas for Alewife collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June.



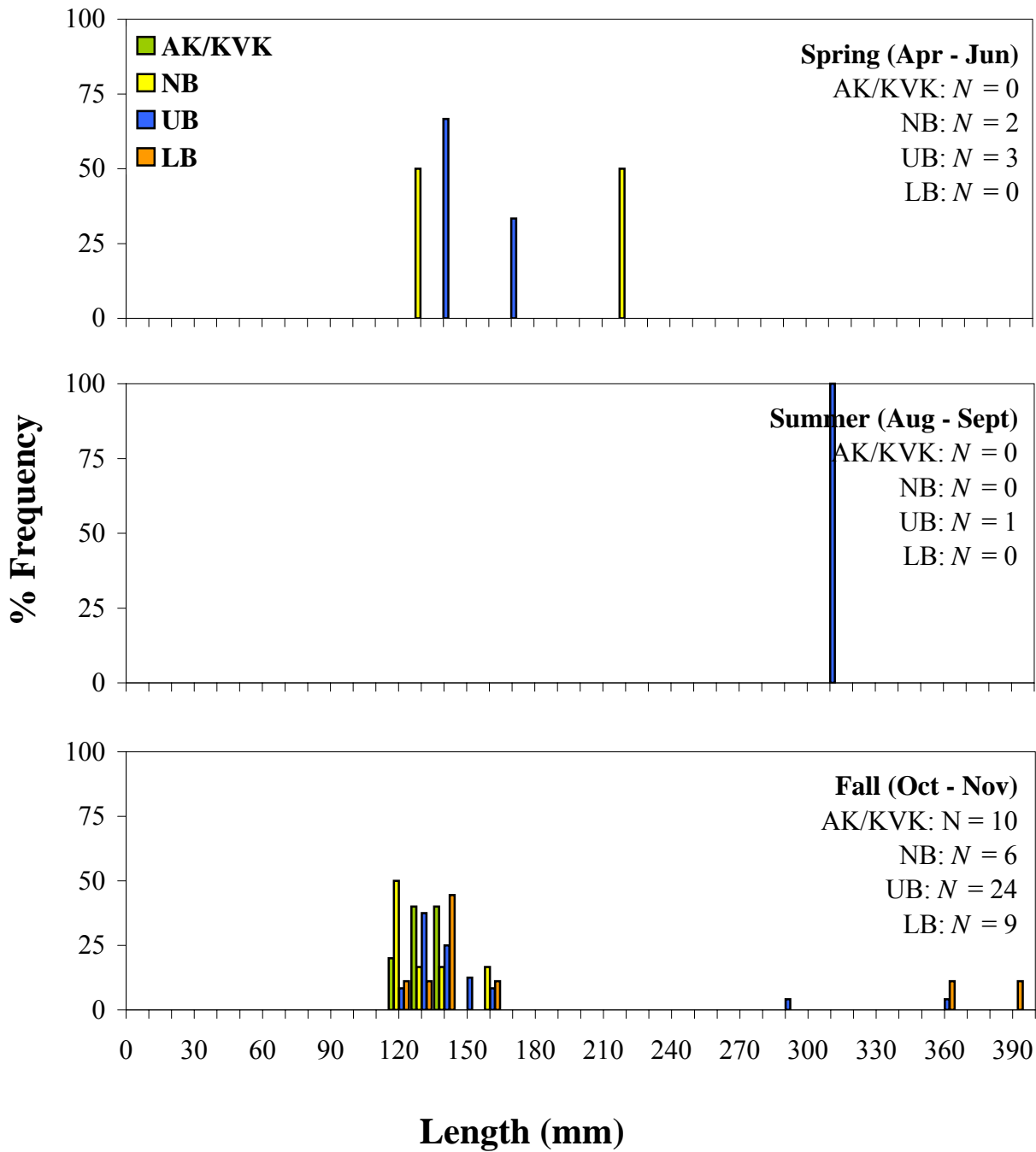


Figure 4-1 b Length frequency distribution (10 mm intervals) by season and all study areas for American shad collected during the 2006 Migratory Finfish Sampling Program.
 Note: No bottom trawls conducted during April - June.



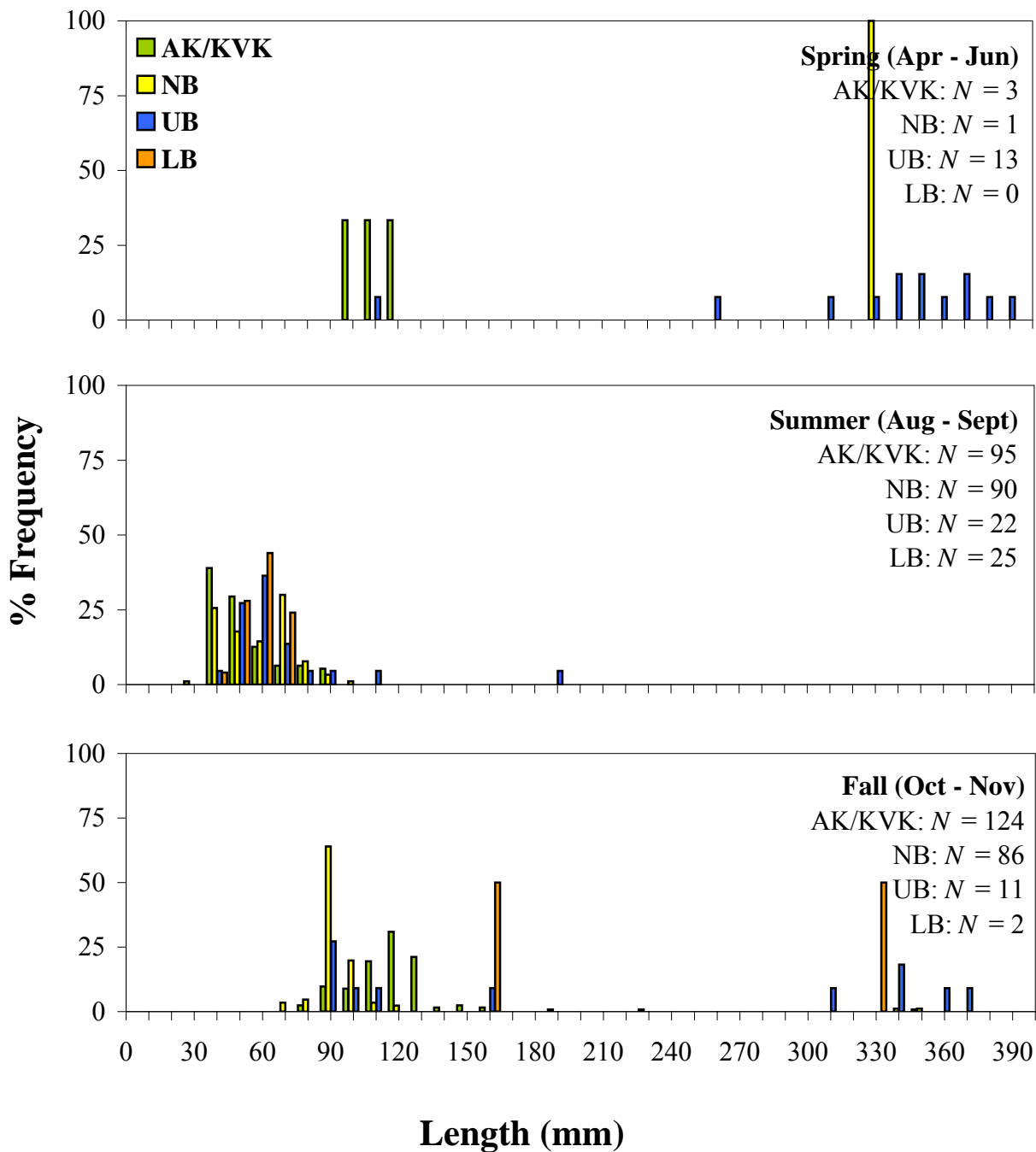


Figure 4-1 c Length frequency distribution (10 mm intervals) by season and all study areas for Atlantic menhaden collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June.



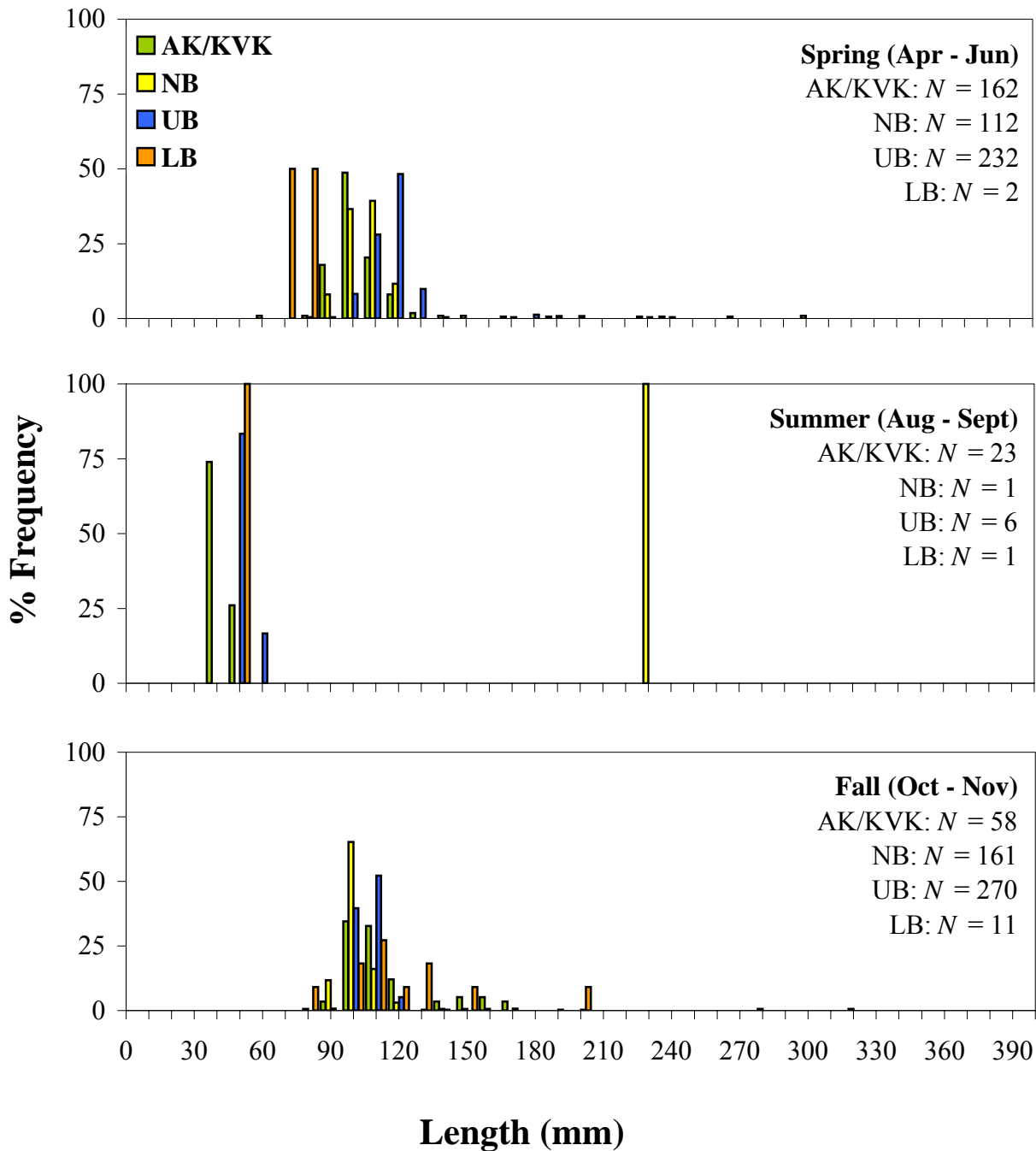


Figure 4-1 d Length frequency distribution (10 mm intervals) by season and all study areas for Blueback herring collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June.



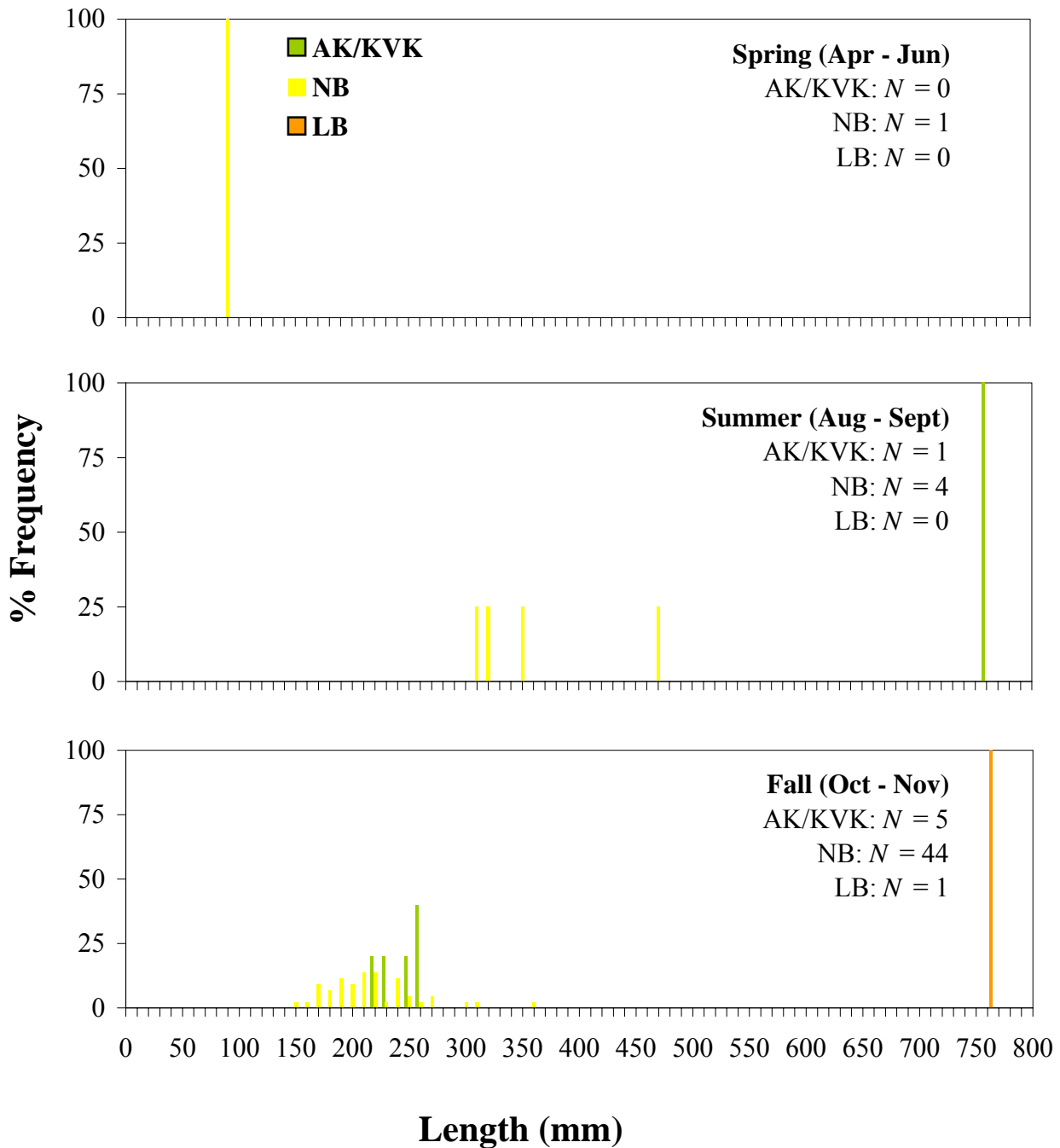


Figure 4-1 e Length frequency distribution (10 mm intervals) by season and all study areas for Striped bass collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June. No striped bass were caught in Upper Bay.



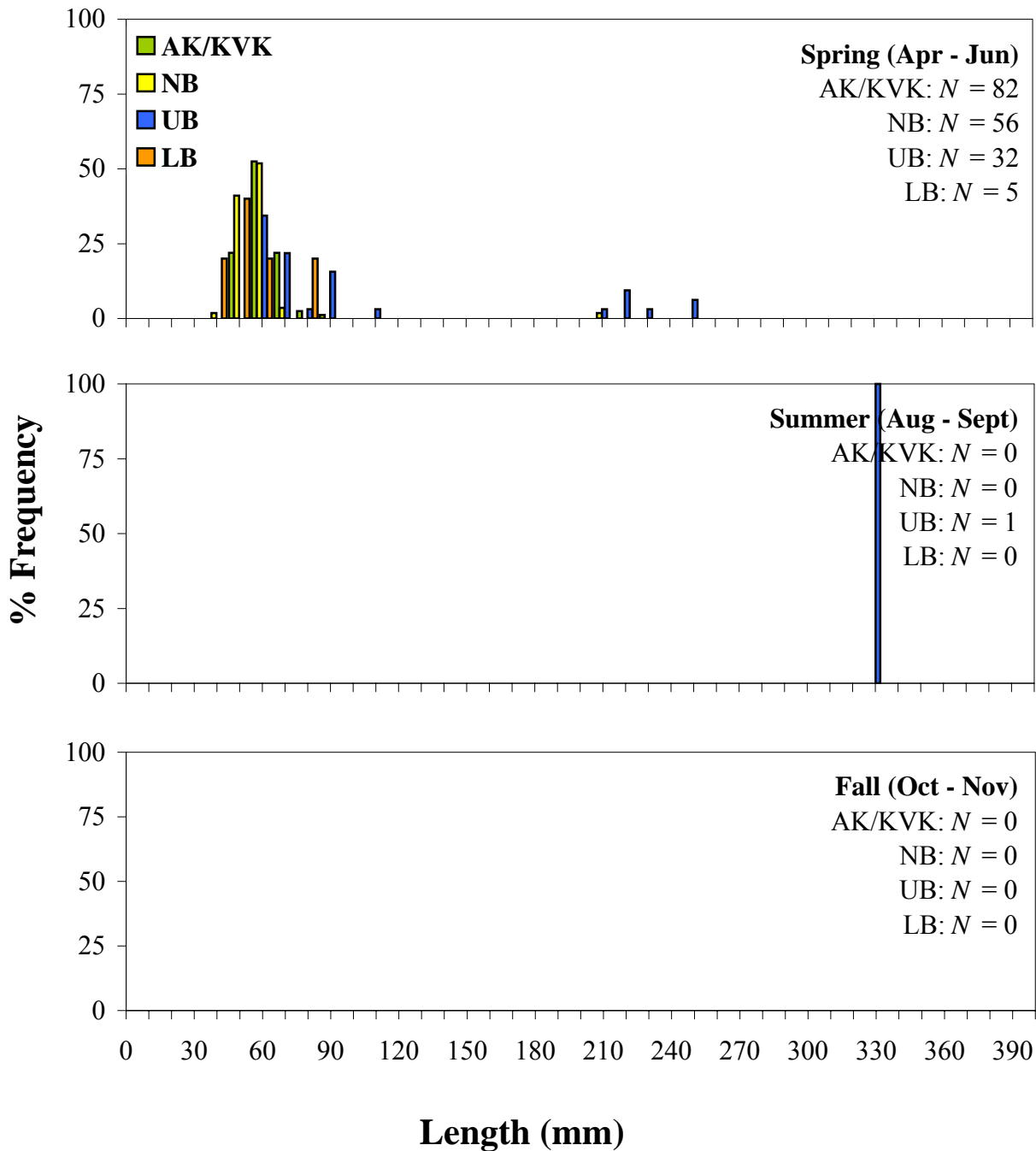


Figure 4-1 f Length frequency distribution (10 mm intervals) by season and all study areas for Atlantic herring collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June.



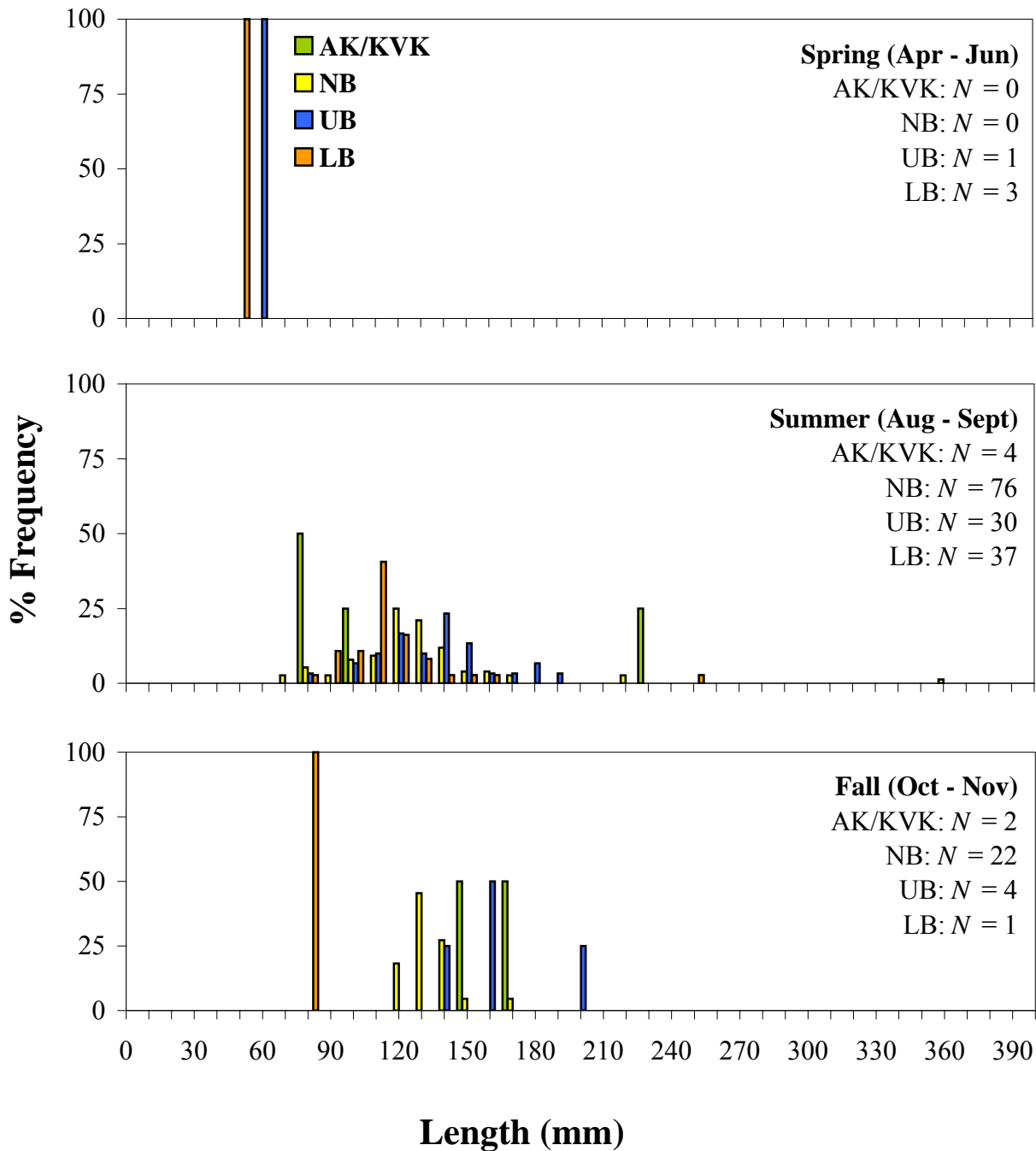


Figure 4-1 g Length frequency distribution (10 mm intervals) by season and all study areas for Bluefish collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June.



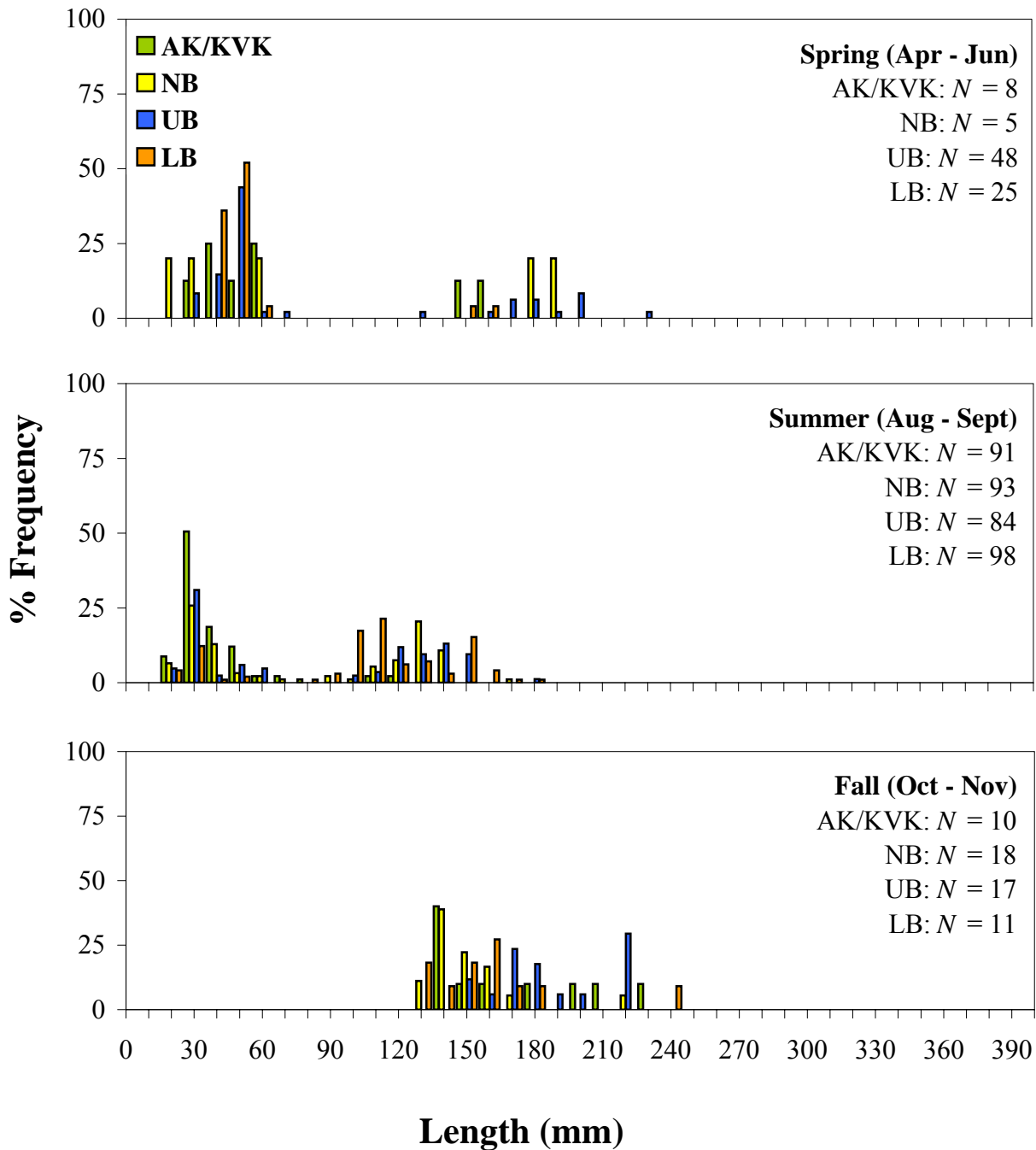


Figure 4-1 h Length frequency distribution (10 mm intervals) by season and all study areas for Butterfish collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June.



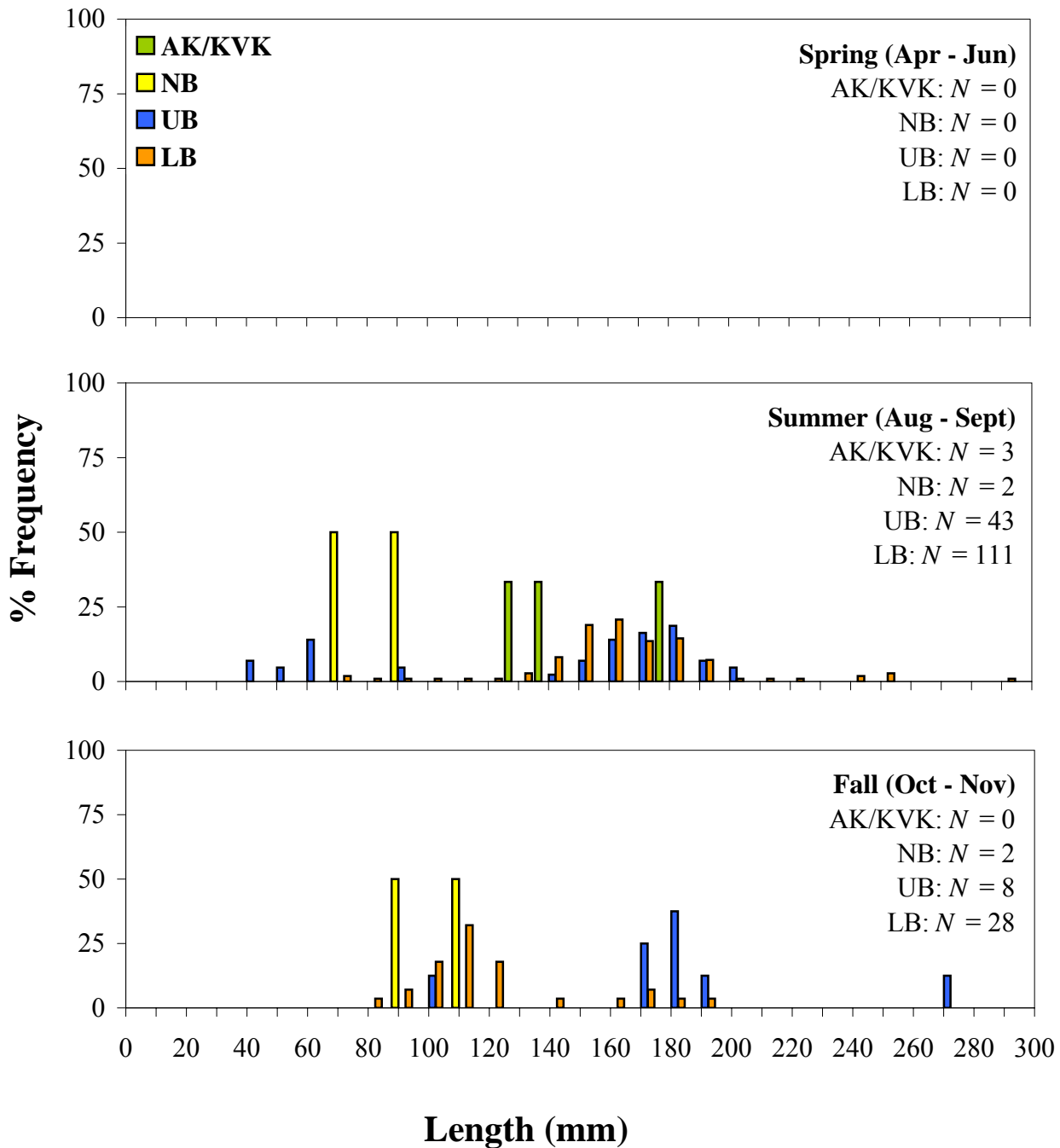


Figure 4-1 i Length frequency distribution (10 mm intervals) by season and all study areas for Scup collected during the 2006 Migratory Finfish Sampling Program.
 Note: No bottom trawls conducted during April - June.



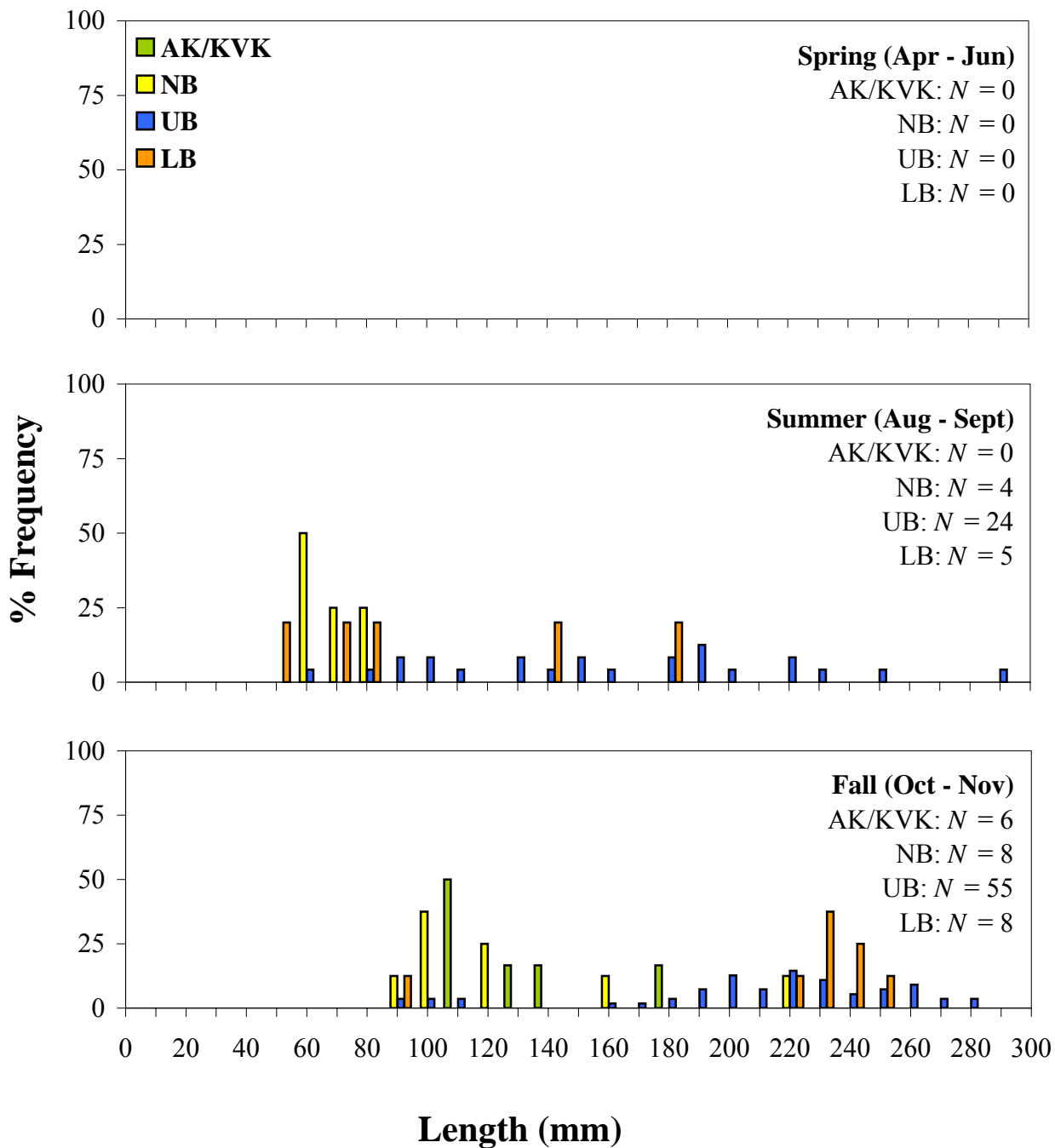


Figure 4-1 j Length frequency distribution (10 mm intervals) by season and all study areas for Winter flounder collected during the 2006 Migratory Finfish Sampling Program.
 Note: No bottom trawls conducted during April - June.



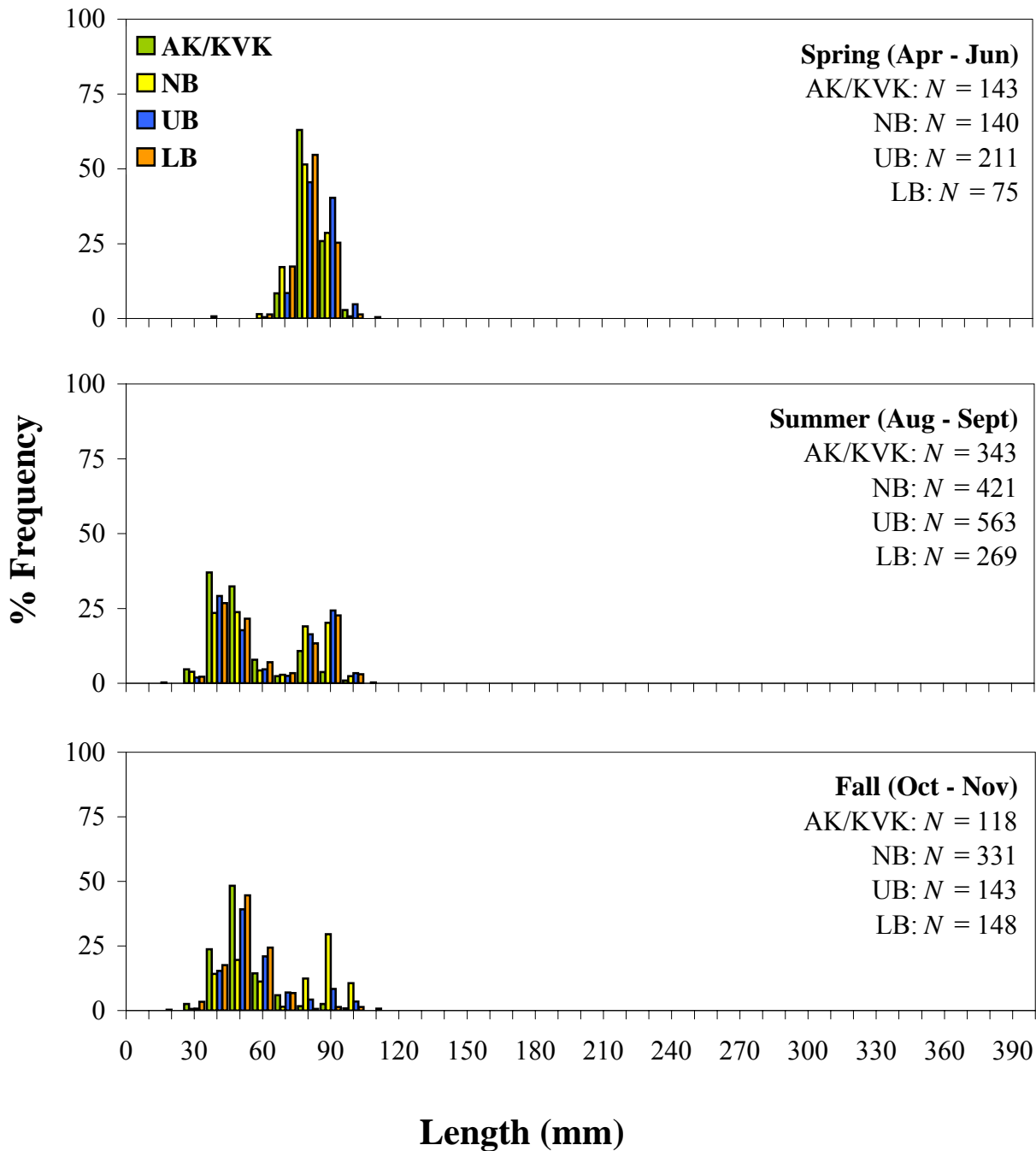


Figure 4-1 k Length frequency distribution (10 mm intervals) by season and all study areas for Bay anchovy collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June.



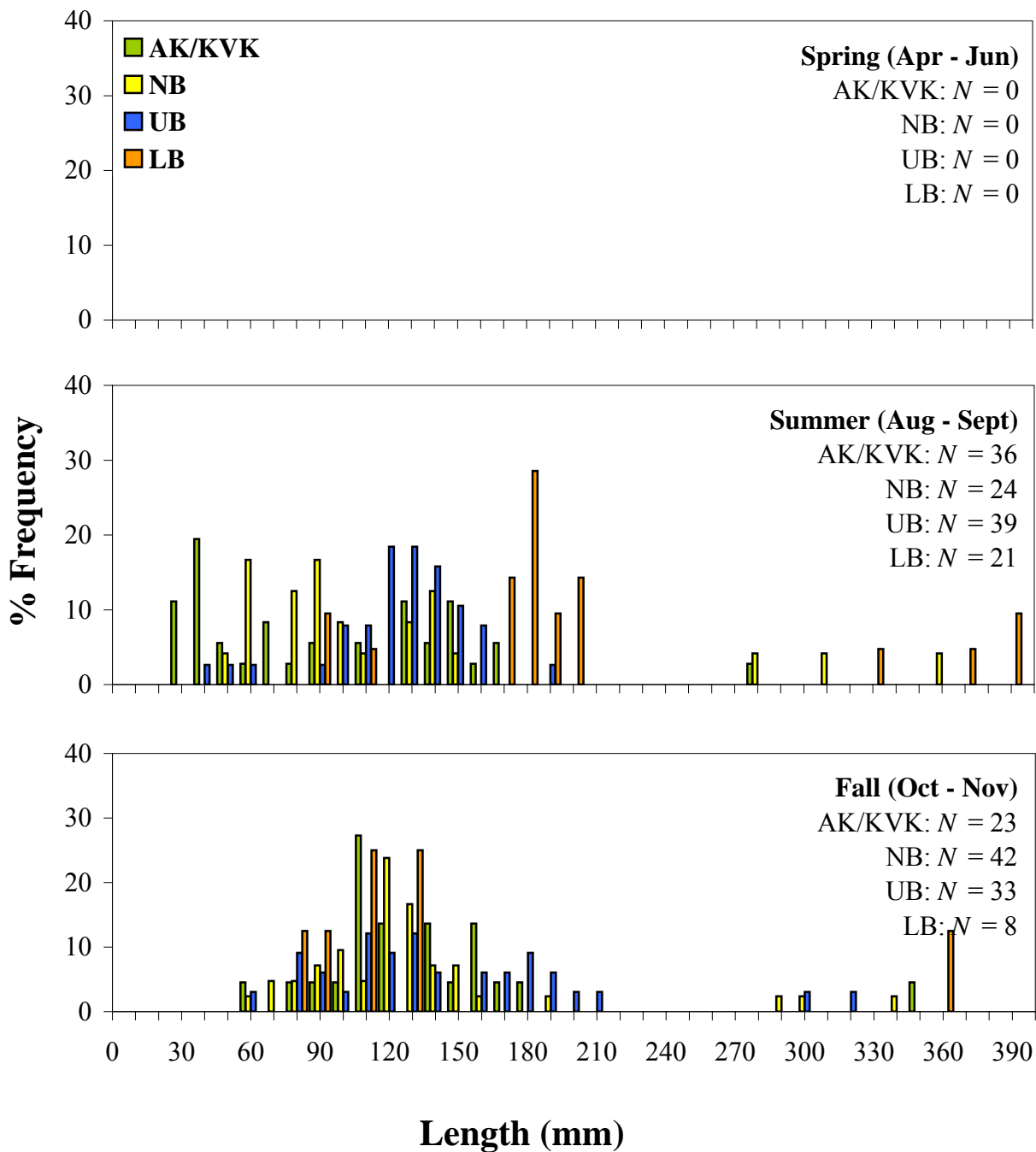


Figure 4-11 Length frequency distribution (10 mm intervals) by season and all study areas for Weakfish collected during the 2006 Migratory Finfish Sampling Program.

Note: No bottom trawls conducted during April - June.



Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
4/24/06	MAK-1	Channel	Blueback Herring	10
4/24/06	MAK-3	Channel	Atlantic Menhaden	1
4/24/06	MAK-3	Channel	Blueback Herring	231
4/24/06	MAK-4	Channel	Atlantic Herring	215
4/24/06	MAK-4	Channel	Atlantic Menhaden	1
4/24/06	MAK-4	Channel	Bay Anchovy	8
4/24/06	MAK-4	Channel	Blueback Herring	6
4/24/06	MAK-4	Channel	Butterfish	1
4/24/06	MKK-2	Channel	Alewife	10
4/24/06	MKK-2	Channel	Atlantic Herring	28.75
4/24/06	MKK-2	Channel	Atlantic Silverside	1.25
4/24/06	MKK-2	Channel	Blueback Herring	7.5
4/24/06	MNB-1	Channel	Atlantic Herring	98
4/24/06	MNB-1	Channel	Bay Anchovy	1
4/24/06	MNB-1	Channel	Blueback Herring	4
4/24/06	MNB-2	Channel	Alewife	7
4/24/06	MNB-2	Channel	American Shad	1
4/24/06	MNB-2	Channel	Atlantic Herring	69
4/24/06	MNB-3	Non-Channel	Northern Pipefish	1.428571429
4/24/06	MNB-3	Non-Channel	Spotted Hake	1.428571429
4/24/06	MNB-5	Channel	Alewife	3
4/24/06	MNB-5	Channel	American Shad	1
4/24/06	MNB-5	Channel	Atlantic Herring	1
4/24/06	MNB-5	Channel	Blueback Herring	101
4/24/06	MNB-5	Channel	Spotted Hake	4
4/24/06	MNB-5	Channel	Striped Bass	1
4/25/06	MLB-1	Non-Channel	Bay Anchovy	45
4/25/06	MLB-1	Non-Channel	Lined Seahorse	1
4/25/06	MLB-1	Non-Channel	Spotted Hake	1
4/25/06	MLB-2	Non-Channel	Butterfish	2
4/25/06	MLB-3	Channel	Atlantic Herring	4
4/25/06	MUB-2	Channel	Blueback Herring	23
4/25/06	MUB-2	Channel	Butterfish	3
4/25/06	MUB-3	Channel	Alewife	3
4/25/06	MUB-3	Channel	Atlantic Herring	1
4/25/06	MUB-3	Channel	Blueback Herring	9
4/25/06	MUB-4	Channel	Alewife	32
4/25/06	MUB-4	Channel	Blueback Herring	64
4/25/06	MUB-5	Channel	Alewife	92
4/25/06	MUB-5	Channel	Atlantic Herring	145
4/25/06	MUB-5	Channel	Atlantic Menhaden	4
4/25/06	MUB-5	Channel	Bay Anchovy	11
4/25/06	MUB-5	Channel	Blueback Herring	75
4/25/06	MUB-5	Channel	Butterfish	1
4/25/06	MUB-5	Channel	Lined Seahorse	1
4/26/06	MKK-1	Channel	Alewife	51
4/26/06	MKK-1	Channel	Atlantic Herring	49
4/26/06	MKK-1	Channel	Atlantic Menhaden	1

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
4/26/06	MKK-1	Channel	Bay Anchovy	9
4/26/06	MKK-1	Channel	Blueback Herring	37
4/26/06	MKK-1	Channel	Butterfish	1
4/26/06	MUB-10	Channel	Alewife	2
4/26/06	MUB-10	Channel	Atlantic Herring	2
4/26/06	MUB-10	Channel	Atlantic Menhaden	2
4/26/06	MUB-10	Channel	Blueback Herring	1
4/26/06	MUB-6	Non-Channel	Blueback Herring	10.66666667
5/8/06	MUB-2	Channel	American Sandlance	4
5/8/06	MUB-8	Channel	Bay Anchovy	1
5/9/06	MAK-1	Channel	Atlantic Herring	4
5/9/06	MAK-1	Channel	Bay Anchovy	2
5/9/06	MNB-6	Non-Channel	Alewife	11
5/9/06	MNB-6	Non-Channel	Blueback Herring	4
5/10/06	MNB-1	Channel	Blueback Herring	2
5/10/06	MNB-2	Channel	Bay Anchovy	1
5/22/06	MAK-2	Channel	Bay Anchovy	23
5/22/06	MAK-3	Channel	Bay Anchovy	26
5/22/06	MAK-4	Channel	Bay Anchovy	1
5/22/06	MNB-1	Channel	Bay Anchovy	98
5/22/06	MNB-1	Channel	Butterfish	2
5/22/06	MNB-2	Channel	Alewife	1
5/22/06	MNB-2	Channel	Bay Anchovy	20
5/22/06	MNB-2	Channel	Butterfish	1
5/22/06	MNB-2	Channel	Hickory Shad	1
5/22/06	MNB-2	Channel	Northern Pipefish	1
5/22/06	MNB-3	Non-Channel	Bay Anchovy	3
5/22/06	MNB-4	Non-Channel	Bay Anchovy	5
5/22/06	MNB-5	Channel	Atlantic Herring	1
5/22/06	MNB-5	Channel	Atlantic Menhaden	1
5/22/06	MNB-5	Channel	Bay Anchovy	438
5/22/06	MNB-5	Channel	Hickory Shad	2
5/22/06	MNB-6	Non-Channel	Alewife	5
5/22/06	MNB-6	Non-Channel	Bay Anchovy	27.5
5/22/06	MNB-6	Non-Channel	Blueback Herring	1.25
5/22/06	MNB-6	Non-Channel	Spotted Hake	5
5/22/06	MUB-6	Non-Channel	Bay Anchovy	16
5/23/06	MAK-1	Channel	Bay Anchovy	302
5/23/06	MKK-2	Channel	Atlantic Herring	1
5/23/06	MKK-2	Channel	Bay Anchovy	126
5/23/06	MUB-1	Channel	Bay Anchovy	19
5/23/06	MUB-1	Channel	Blueback Herring	18
5/23/06	MUB-1	Channel	Butterfish	1
5/23/06	MUB-10	Channel	Alewife	4
5/23/06	MUB-10	Channel	Atlantic Herring	1
5/23/06	MUB-10	Channel	Atlantic Menhaden	6
5/23/06	MUB-10	Channel	Bay Anchovy	40
5/23/06	MUB-10	Channel	Butterfish	2

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
5/23/06	MUB-2	Channel	Bay Anchovy	41
5/23/06	MUB-3	Channel	Bay Anchovy	8
5/23/06	MUB-3	Channel	Blueback Herring	22
5/23/06	MUB-3	Channel	Butterfish	1
5/23/06	MUB-4	Channel	Bay Anchovy	2
5/23/06	MUB-4	Channel	Blueback Herring	1
5/23/06	MUB-5	Channel	Atlantic Herring	1
5/23/06	MUB-5	Channel	Bay Anchovy	75
5/23/06	MUB-5	Channel	Blueback Herring	7
5/23/06	MUB-5	Channel	Butterfish	3
5/23/06	MUB-8	Channel	Alewife	11
5/23/06	MUB-8	Channel	American Shad	2
5/23/06	MUB-8	Channel	Atlantic Menhaden	1
5/23/06	MUB-8	Channel	Bay Anchovy	116
5/23/06	MUB-8	Channel	Blueback Herring	3
5/23/06	MUB-8	Channel	Butterfish	1
5/23/06	MUB-9	Channel	Alewife	3
5/23/06	MUB-9	Channel	American Shad	1
5/23/06	MUB-9	Channel	Bay Anchovy	272
5/23/06	MUB-9	Channel	Butterfish	1
5/24/06	MKK-1	Channel	Bay Anchovy	184
5/24/06	MLB-1	Non-Channel	Butterfish	1
5/24/06	MLB-2	Non-Channel	Atlantic Herring	1
5/24/06	MLB-2	Non-Channel	Bay Anchovy	23
5/24/06	MLB-2	Non-Channel	Blueback Herring	2
5/24/06	MLB-2	Non-Channel	Four Beard Rockling	1
5/24/06	MLB-3	Channel	Bay Anchovy	1
6/5/06	MLB-2	Non-Channel	Butterfish	17
6/5/06	MLB-3	Channel	Butterfish	2
6/5/06	MLB-4	Non-Channel	Bay Anchovy	93
6/5/06	MLB-4	Non-Channel	Bluefish	3
6/5/06	MLB-4	Non-Channel	Butterfish	3
6/5/06	MUB-10	Channel	Bay Anchovy	1
6/5/06	MUB-10	Channel	Butterfish	1
6/5/06	MUB-3	Channel	Bluefish	1
6/5/06	MUB-4	Channel	Butterfish	1
6/5/06	MUB-9	Channel	Atlantic Herring	2
6/5/06	MUB-9	Channel	Bay Anchovy	258
6/5/06	MUB-9	Channel	Blueback Herring	1
6/5/06	MUB-9	Channel	Butterfish	4
6/5/06	MUB-9	Channel	Hickory Shad	1
6/6/06	MKK-1	Channel	Butterfish	1
6/6/06	MNB-1	Channel	Butterfish	1
6/6/06	MNB-5	Channel	Bay Anchovy	4
6/6/06	MNB-5	Channel	Hickory Shad	1
6/6/06	MNB-6	Non-Channel	Bay Anchovy	34.11764706
6/6/06	MNB-6	Non-Channel	Butterfish	1.176470588
6/6/06	MUB-5	Channel	Butterfish	17

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
6/6/06	MUB-8	Channel	Bay Anchovy	1
6/6/06	MUB-8	Channel	Butterfish	11
6/7/06	MAK-3	Channel	Butterfish	4
6/7/06	MAK-4	Channel	Butterfish	1
6/7/06	MNB-4	Non-Channel	Bay Anchovy	9
6/7/06	MUB-7	Non-Channel	Butterfish	1
8/7/06	MKK-1	Channel	Butterfish	6
8/7/06	MUB-10	Channel	Bay Anchovy	31
8/7/06	MUB-10	Channel	Butterfish	5
8/7/06	MUB-2	Channel	Butterfish	14
8/7/06	MUB-3	Channel	Butterfish	1
8/7/06	MUB-4	Channel	Butterfish	9
8/7/06	MUB-4	Channel	Northern Stargazer	1
8/7/06	MUB-5	Channel	Bay Anchovy	5
8/7/06	MUB-7	Non-Channel	Bay Anchovy	1
8/7/06	MUB-7	Non-Channel	Butterfish	1
8/7/06	MUB-8	Channel	Butterfish	3
8/7/06	MUB-9	Channel	Bay Anchovy	8
8/8/06	MAK-1	Channel	Bay Anchovy	161
8/8/06	MAK-2	Channel	Bay Anchovy	1637
8/8/06	MAK-2	Channel	Blueback Herring	12
8/8/06	MAK-2	Channel	Butterfish	15
8/8/06	MAK-3	Channel	Bay Anchovy	796
8/8/06	MAK-3	Channel	Blueback Herring	2
8/8/06	MAK-3	Channel	Butterfish	43
8/8/06	MAK-4	Channel	Bay Anchovy	837
8/8/06	MAK-4	Channel	Blueback Herring	9
8/8/06	MAK-4	Channel	Butterfish	29
8/8/06	MNB-4	Non-Channel	Butterfish	1
8/8/06	MNB-5	Channel	Butterfish	1
8/8/06	MNB-6	Non-Channel	Atlantic Menhaden	8
8/8/06	MNB-6	Non-Channel	Bay Anchovy	612
8/8/06	MNB-6	Non-Channel	Bluefish	1
8/8/06	MNB-6	Non-Channel	Butterfish	16
8/9/06	MKK-2	Channel	Bay Anchovy	5
8/9/06	MKK-2	Channel	Butterfish	6
8/9/06	MLB-1	Non-Channel	Bay Anchovy	1
8/9/06	MLB-1	Non-Channel	Butterfish	2
8/9/06	MLB-2	Non-Channel	Blueback Herring	1
8/9/06	MLB-3	Channel	Butterfish	8
8/9/06	MNB-1	Channel	Butterfish	12
8/9/06	MNB-1	Channel	Northern Pipefish	1
8/9/06	MNB-2	Channel	Bay Anchovy	202
8/9/06	MNB-2	Channel	Butterfish	5
8/9/06	MUB-1	Channel	Blueback Herring	6
8/9/06	MUB-1	Channel	Butterfish	1
8/9/06	MUB-1	Channel	Northern Stargazer	2
8/21/06	MAK-1	Channel	Atlantic Menhaden	6

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
8/21/06	MAK-1	Channel	Bay Anchovy	1486
8/21/06	MAK-1	Channel	Bluefish	1
8/21/06	MAK-1	Channel	Butterfish	3
8/21/06	MAK-2	Channel	Bay Anchovy	144
8/21/06	MAK-2	Channel	Blue crab	1
8/21/06	MAK-3	Channel	Atlantic Menhaden	100
8/21/06	MAK-3	Channel	Bay Anchovy	10094
8/21/06	MAK-3	Channel	Blue crab	7
8/21/06	MAK-3	Channel	Butterfish	2
8/21/06	MAK-3	Channel	Spanish Mackerel	2
8/21/06	MAK-3	Channel	Striped Anchovy	1
8/21/06	MAK-4	Channel	Atlantic Menhaden	19
8/21/06	MAK-4	Channel	Bay Anchovy	3264
8/21/06	MAK-4	Channel	Blue crab	3
8/21/06	MAK-4	Channel	Butterfish	2
8/21/06	MKK-2	Channel	Bay Anchovy	11
8/21/06	MKK-2	Channel	Blue crab	2
8/21/06	MUB-10	Channel	Bay Anchovy	28
8/21/06	MUB-8	Channel	Bay Anchovy	1
8/21/06	MUB-8	Channel	Blue crab	2
8/21/06	MUB-9	Channel	Bay Anchovy	1
8/22/06	MLB-1	Non-Channel	Bay Anchovy	122
8/22/06	MLB-1	Non-Channel	Butterfish	1
8/22/06	MLB-2	Non-Channel	Bluefish	2
8/22/06	MLB-3	Channel	Butterfish	1
8/22/06	MUB-1	Channel	Bay Anchovy	6
8/22/06	MUB-1	Channel	Northern Stargazer	1
8/22/06	MUB-2	Channel	Cobia	1
8/22/06	MUB-3	Channel	Bluefish	1
8/22/06	MUB-3	Channel	Butterfish	3
8/22/06	MUB-4	Channel	Lined Seahorse	1
8/22/06	MUB-7	Non-Channel	Northern Stargazer	1
8/23/06	MKK-1	Channel	Bay Anchovy	2
8/23/06	MKK-1	Channel	Butterfish	3
8/23/06	MNB-1	Channel	Bay Anchovy	3
8/23/06	MNB-1	Channel	Butterfish	1
8/23/06	MNB-2	Channel	Bay Anchovy	1
8/23/06	MNB-4	Non-Channel	Bluefish	5
8/23/06	MNB-5	Channel	Atlantic Menhaden	5
8/23/06	MNB-5	Channel	Bay Anchovy	7
8/23/06	MNB-5	Channel	Bluefish	1
8/23/06	MNB-5	Channel	Striped Anchovy	4
8/23/06	MNB-6	Non-Channel	Atlantic Menhaden	38
8/23/06	MNB-6	Non-Channel	Bay Anchovy	124
8/23/06	MNB-6	Non-Channel	Bluefish	2
8/23/06	MNB-6	Non-Channel	Butterfish	5
8/23/06	MNB-6	Non-Channel	Striped Anchovy	1
9/5/06	MLB-1	Non-Channel	Bay Anchovy	9

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
9/5/06	MLB-1	Non-Channel	Butterfish	3
9/5/06	MLB-1	Non-Channel	Grubby	1
9/5/06	MLB-1	Non-Channel	Lined Seahorse	1
9/5/06	MLB-1	Non-Channel	Northern Stargazer	1
9/5/06	MLB-2	Non-Channel	Atlantic Menhaden	1
9/5/06	MLB-2	Non-Channel	Bay Anchovy	22
9/5/06	MLB-2	Non-Channel	Bluefish	1
9/5/06	MLB-2	Non-Channel	Lined Seahorse	1
9/5/06	MLB-2	Non-Channel	Striped Anchovy	2
9/5/06	MLB-4	Non-Channel	Atlantic Menhaden	1
9/5/06	MLB-4	Non-Channel	Butterfish	2
9/5/06	MUB-1	Channel	Bay Anchovy	40
9/5/06	MUB-1	Channel	Lined Seahorse	1
9/5/06	MUB-2	Channel	Bay Anchovy	25
9/5/06	MUB-2	Channel	Bluefish	1
9/5/06	MUB-3	Channel	Atlantic Menhaden	1
9/5/06	MUB-3	Channel	Bay Anchovy	89
9/5/06	MUB-4	Channel	Bay Anchovy	13
9/5/06	MUB-5	Channel	Lined Seahorse	1
9/5/06	MUB-8	Channel	Bay Anchovy	1
9/6/06	MAK-1	Channel	Bay Anchovy	3
9/6/06	MAK-2	Channel	Bay Anchovy	13
9/6/06	MAK-2	Channel	Striped Anchovy	3
9/6/06	MAK-3	Channel	Atlantic Menhaden	10
9/6/06	MAK-3	Channel	Bay Anchovy	294
9/6/06	MAK-3	Channel	Striped Anchovy	6
9/6/06	MAK-4	Channel	Bay Anchovy	2
9/6/06	MAK-4	Channel	Bluefish	1
9/6/06	MAK-4	Channel	Striped Anchovy	1
9/6/06	MNB-1	Channel	Atlantic Menhaden	1
9/6/06	MNB-1	Channel	Bay Anchovy	398
9/6/06	MNB-1	Channel	Butterfish	1
9/6/06	MNB-1	Channel	Striped Anchovy	2
9/6/06	MNB-2	Channel	Atlantic Menhaden	6
9/6/06	MNB-2	Channel	Bay Anchovy	13
9/6/06	MNB-2	Channel	Bluefish	4
9/6/06	MNB-2	Channel	Lookdown	1
9/6/06	MNB-5	Channel	Atlantic Menhaden	1
9/6/06	MNB-5	Channel	Bay Anchovy	25
9/6/06	MNB-5	Channel	Butterfish	3
9/6/06	MNB-6	Non-Channel	Atlantic Menhaden	1
9/6/06	MNB-6	Non-Channel	Bay Anchovy	274
9/6/06	MNB-6	Non-Channel	Butterfish	1
9/6/06	MNB-6	Non-Channel	Striped Anchovy	7
9/7/06	MKK-1	Channel	Atlantic Menhaden	1
9/7/06	MKK-1	Channel	Bay Anchovy	11
9/7/06	MKK-1	Channel	Bluefish	1
9/7/06	MKK-2	Channel	Bay Anchovy	1.1111111111

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
9/7/06	MUB-9	Channel	Bay Anchovy	4
9/18/06	MLB-1	Non-Channel	Bay Anchovy	14
9/18/06	MLB-2	Non-Channel	Bay Anchovy	574
9/18/06	MLB-3	Channel	Bay Anchovy	5
9/18/06	MLB-3	Channel	Bluefish	1
9/18/06	MLB-4	Non-Channel	Bay Anchovy	3
9/18/06	MUB-1	Channel	Bay Anchovy	1
9/18/06	MUB-3	Channel	Bay Anchovy	185
9/18/06	MUB-4	Channel	Blue crab	2
9/19/06	MNB-1	Channel	Blue crab	1
9/19/06	MNB-1	Channel	Striped Searobin	1
9/19/06	MNB-2	Channel	Bay Anchovy	129
9/19/06	MNB-3	Non-Channel	Blue crab	1
9/19/06	MNB-5	Channel	Bay Anchovy	58
9/19/06	MNB-5	Channel	Striped Anchovy	2
9/19/06	MNB-6	Non-Channel	Bay Anchovy	2
9/19/06	MNB-6	Non-Channel	Bluefish	1
9/19/06	MNB-6	Non-Channel	Striped Anchovy	3
9/20/06	MAK-2	Channel	Bay Anchovy	1
9/20/06	MAK-2	Channel	Northern Stargazer	1
9/20/06	MAK-2	Channel	Striped Anchovy	1
9/20/06	MAK-4	Channel	Blue crab	1
9/20/06	MKK-1	Channel	Bay Anchovy	12
9/20/06	MKK-1	Channel	Bluefish	1
10/3/06	MAK-1	Channel	Bay Anchovy	1
10/3/06	MAK-3	Channel	Blue crab	1
10/3/06	MKK-2	Channel	Bay Anchovy	21
10/3/06	MKK-2	Channel	Blue crab	2
10/5/06	MUB-9	Channel	Blue crab	1
10/6/06	MKK-1	Channel	Blue crab	1
10/6/06	MKK-1	Channel	Lookdown	1
10/6/06	MNB-4	Non-Channel	Atlantic Silverside	2
10/16/06	MLB-2	Non-Channel	Bay Anchovy	8
10/16/06	MLB-2	Non-Channel	Blue crab	3
10/16/06	MLB-2	Non-Channel	Winter Flounder	1
10/16/06	MLB-4	Non-Channel	Lined Seahorse	1
10/17/06	MAK-4	Channel	Blue crab	1
10/17/06	MUB-5	Channel	Blue crab	1
10/18/06	MNB-1	Channel	Atlantic Menhaden	76
10/18/06	MNB-1	Channel	Blue crab	3
10/18/06	MNB-2	Channel	Blue crab	3
10/18/06	MNB-4	Non-Channel	Atlantic Silverside	1
10/18/06	MNB-5	Channel	Atlantic Menhaden	552
10/18/06	MNB-5	Channel	Bay Anchovy	193
10/18/06	MNB-5	Channel	Blue crab	13
10/18/06	MNB-5	Channel	Blueback Herring	2
10/18/06	MNB-5	Channel	Bluefish	1
10/18/06	MNB-6	Non-Channel	Atlantic Menhaden	90

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
10/18/06	MNB-6	Non-Channel	Bay Anchovy	11
11/6/06	MLB-1	Non-Channel	Bay Anchovy	4
11/6/06	MLB-2	Non-Channel	Bay Anchovy	3
11/6/06	MLB-2	Non-Channel	Blue crab	2
11/6/06	MLB-2	Non-Channel	Lined Seahorse	1
11/6/06	MLB-3	Channel	Bay Anchovy	2
11/6/06	MUB-1	Channel	Alewife	4
11/6/06	MUB-1	Channel	American Shad	5
11/6/06	MUB-1	Channel	Atlantic Menhaden	1
11/6/06	MUB-1	Channel	Blueback Herring	282
11/6/06	MUB-1	Channel	Butterfish	1
11/6/06	MUB-2	Channel	Alewife	1
11/6/06	MUB-2	Channel	American Shad	2
11/6/06	MUB-2	Channel	Blueback Herring	33
11/6/06	MUB-2	Channel	Butterfish	1
11/6/06	MUB-7	Non-Channel	Atlantic Menhaden	2
11/6/06	MUB-7	Non-Channel	Atlantic Silverside	5
11/6/06	MUB-7	Non-Channel	Bay Anchovy	7
11/7/06	MKK-2	Channel	Alewife	1
11/7/06	MKK-2	Channel	Atlantic Moonfish	2
11/7/06	MKK-2	Channel	Bay Anchovy	6
11/7/06	MKK-2	Channel	Blueback Herring	3
11/7/06	MKK-2	Channel	Butterfish	2
11/7/06	MNB-1	Channel	Bay Anchovy	6
11/7/06	MNB-1	Channel	Blueback Herring	27
11/7/06	MNB-1	Channel	Butterfish	1
11/7/06	MNB-2	Channel	Alewife	2
11/7/06	MNB-2	Channel	American Shad	1
11/7/06	MNB-2	Channel	Atlantic Moonfish	3
11/7/06	MNB-2	Channel	Bay Anchovy	57
11/7/06	MNB-2	Channel	Blue crab	2
11/7/06	MNB-2	Channel	Blueback Herring	32
11/7/06	MNB-2	Channel	Butterfish	1
11/7/06	MNB-3	Non-Channel	Bay Anchovy	3
11/7/06	MNB-5	Channel	Alewife	6
11/7/06	MNB-5	Channel	Atlantic Moonfish	2
11/7/06	MNB-5	Channel	Bay Anchovy	30
11/7/06	MNB-5	Channel	Blue crab	1
11/7/06	MNB-5	Channel	Blueback Herring	1
11/7/06	MNB-6	Non-Channel	Alewife	1
11/7/06	MNB-6	Non-Channel	Atlantic Menhaden	2
11/7/06	MNB-6	Non-Channel	Bay Anchovy	21
11/7/06	MNB-6	Non-Channel	Blueback Herring	31
11/7/06	MNB-6	Non-Channel	Butterfish	1
11/7/06	MUB-10	Channel	Alewife	21
11/7/06	MUB-10	Channel	American Shad	2
11/7/06	MUB-10	Channel	Blueback Herring	4
11/7/06	MUB-10	Channel	Butterfish	3

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
11/7/06	MUB-5	Channel	Bay Anchovy	1
11/7/06	MUB-5	Channel	Blueback Herring	3
11/7/06	MUB-8	Channel	Alewife	34
11/7/06	MUB-8	Channel	Atlantic Cutlassfish	1
11/7/06	MUB-8	Channel	Blue crab	1
11/7/06	MUB-8	Channel	Blueback Herring	1
11/7/06	MUB-8	Channel	Butterfish	1
11/8/06	MAK-1	Channel	Alewife	2
11/8/06	MAK-1	Channel	Atlantic Menhaden	185
11/8/06	MAK-1	Channel	Bay Anchovy	13
11/8/06	MAK-1	Channel	Blue crab	1
11/8/06	MAK-1	Channel	Blueback Herring	5
11/8/06	MAK-2	Channel	Atlantic Menhaden	9
11/8/06	MAK-2	Channel	Bay Anchovy	10
11/8/06	MAK-3	Channel	Alewife	4
11/8/06	MAK-3	Channel	Atlantic Menhaden	2
11/8/06	MAK-3	Channel	Bay Anchovy	23
11/8/06	MAK-3	Channel	Blue crab	1
11/8/06	MAK-3	Channel	Butterfish	3
11/8/06	MAK-4	Channel	Bay Anchovy	3
11/8/06	MKK-1	Channel	Alewife	49
11/8/06	MKK-1	Channel	American Shad	3
11/8/06	MKK-1	Channel	Atlantic Menhaden	9
11/8/06	MKK-1	Channel	Atlantic Moonfish	2
11/8/06	MKK-1	Channel	Bay Anchovy	4
11/8/06	MKK-1	Channel	Blue crab	4
11/8/06	MKK-1	Channel	Blueback Herring	37
11/8/06	MKK-1	Channel	Butterfish	5
11/8/06	MUB-9	Channel	Alewife	47
11/8/06	MUB-9	Channel	American Shad	1
11/8/06	MUB-9	Channel	Atlantic Menhaden	2
11/8/06	MUB-9	Channel	Atlantic Moonfish	1
11/8/06	MUB-9	Channel	Bay Anchovy	10
11/8/06	MUB-9	Channel	Blue crab	2
11/8/06	MUB-9	Channel	Butterfish	1
11/20/06	MKK-1	Channel	Bay Anchovy	4
11/20/06	MKK-1	Channel	Blueback Herring	1
11/20/06	MLB-1	Non-Channel	Blue crab	1
11/20/06	MLB-4	Non-Channel	Blue crab	1
11/20/06	MUB-1	Channel	Blueback Herring	3
11/20/06	MUB-2	Channel	Bay Anchovy	3
11/20/06	MUB-2	Channel	Blueback Herring	3
11/20/06	MUB-3	Channel	Alewife	9
11/20/06	MUB-3	Channel	American Shad	4
11/20/06	MUB-3	Channel	Atlantic Menhaden	2
11/20/06	MUB-3	Channel	Bay Anchovy	20
11/20/06	MUB-3	Channel	Blueback Herring	3
11/20/06	MUB-4	Channel	American Shad	1

Appendix A. Finfish CPUE (Mid-water Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
11/20/06	MUB-4	Channel	Bay Anchovy	8
11/20/06	MUB-4	Channel	Blue crab	1
11/20/06	MUB-4	Channel	Blueback Herring	3
11/21/06	MAK-1	Channel	Bay Anchovy	2
11/21/06	MAK-1	Channel	Blueback Herring	2
11/21/06	MAK-2	Channel	Alewife	1
11/21/06	MAK-2	Channel	American Shad	2
11/21/06	MAK-2	Channel	Atlantic Menhaden	1
11/21/06	MAK-2	Channel	Bay Anchovy	3
11/21/06	MAK-3	Channel	Alewife	2
11/21/06	MAK-3	Channel	American Shad	1
11/21/06	MAK-3	Channel	Bay Anchovy	2
11/21/06	MAK-3	Channel	Blueback Herring	5
11/21/06	MUB-10	Channel	Alewife	536
11/21/06	MUB-10	Channel	American Shad	7
11/21/06	MUB-10	Channel	Bay Anchovy	2
11/21/06	MUB-10	Channel	Blue crab	1
11/21/06	MUB-10	Channel	Blueback Herring	2
11/21/06	MUB-10	Channel	Butterfish	5
11/21/06	MUB-5	Channel	Alewife	14
11/21/06	MUB-5	Channel	Bay Anchovy	2
11/21/06	MUB-5	Channel	Blueback Herring	1
11/21/06	MUB-8	Channel	Alewife	79
11/21/06	MUB-8	Channel	American Shad	1
11/21/06	MUB-8	Channel	Bay Anchovy	4
11/21/06	MUB-8	Channel	Blueback Herring	13
11/21/06	MUB-8	Channel	Butterfish	2
11/21/06	MUB-9	Channel	Atlantic Menhaden	1
11/22/06	MKK-2	Channel	Alewife	10
11/22/06	MKK-2	Channel	American Shad	4
11/22/06	MKK-2	Channel	Bay Anchovy	9
11/22/06	MKK-2	Channel	Blueback Herring	5
11/22/06	MNB-1	Channel	Alewife	2
11/22/06	MNB-1	Channel	Atlantic Menhaden	2
11/22/06	MNB-1	Channel	Bay Anchovy	4
11/22/06	MNB-1	Channel	Blueback Herring	1
11/22/06	MNB-2	Channel	Atlantic Menhaden	1
11/22/06	MNB-2	Channel	Bay Anchovy	4
11/22/06	MNB-2	Channel	Blueback Herring	29
11/22/06	MNB-4	Non-Channel	Bay Anchovy	1
11/22/06	MNB-5	Channel	Bay Anchovy	7
11/22/06	MNB-5	Channel	Blueback Herring	6
11/22/06	MNB-6	Non-Channel	Alewife	4
11/22/06	MNB-6	Non-Channel	Bay Anchovy	3
11/22/06	MNB-6	Non-Channel	Blueback Herring	9

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
8/14/06	MLB-1	Non-Channel	Atlantic Croaker	6
8/14/06	MLB-1	Non-Channel	Atlantic Menhaden	1
8/14/06	MLB-1	Non-Channel	Bay Anchovy	49
8/14/06	MLB-1	Non-Channel	Black Sea Bass	1
8/14/06	MLB-1	Non-Channel	Butterfish	153
8/14/06	MLB-1	Non-Channel	Northern Searobin	1
8/14/06	MLB-1	Non-Channel	Scup	89
8/14/06	MLB-1	Non-Channel	Striped Anchovy	7
8/14/06	MLB-1	Non-Channel	Tautog	1
8/14/06	MLB-3	Channel	Butterfish	1
8/14/06	MLB-3	Channel	Summer Flounder	1
8/14/06	MUB-1	Channel	Atlantic Menhaden	1
8/14/06	MUB-1	Channel	Bay Anchovy	7
8/14/06	MUB-1	Channel	Blue crab	1
8/14/06	MUB-3	Channel	Bay Anchovy	4
8/14/06	MUB-5	Channel	Blue crab	30
8/14/06	MUB-5	Channel	Scup	30
8/14/06	MUB-8	Channel	Bay Anchovy	16
8/15/06	MAK-1	Channel	Atlantic Menhaden	2.352941176
8/15/06	MAK-1	Channel	Bay Anchovy	64.70588235
8/15/06	MAK-1	Channel	Blue crab	7.058823529
8/15/06	MAK-1	Channel	Northern Searobin	1.176470588
8/15/06	MAK-2	Channel	Bay Anchovy	2
8/15/06	MAK-2	Channel	Blue crab	12
8/15/06	MAK-2	Channel	Butterfish	3
8/15/06	MNB-1	Channel	Blue crab	4
8/15/06	MNB-1	Channel	Butterfish	7
8/15/06	MNB-1	Channel	Oyster Toadfish	1
8/15/06	MNB-2	Channel	Atlantic Menhaden	3
8/15/06	MNB-2	Channel	Bay Anchovy	3
8/15/06	MNB-2	Channel	Blue crab	5
8/15/06	MNB-2	Channel	Butterfish	7
8/15/06	MNB-2	Channel	Spotted Hake	1
8/15/06	MNB-2	Channel	Striped Searobin	1
8/15/06	MNB-2	Channel	Weakfish	1
8/15/06	MNB-3	Non-Channel	Atlantic Menhaden	6
8/15/06	MNB-3	Non-Channel	Bay Anchovy	654
8/15/06	MNB-3	Non-Channel	Blue crab	16
8/15/06	MNB-3	Non-Channel	Inshore Lizardfish	2
8/15/06	MNB-3	Non-Channel	Striped Anchovy	1
8/15/06	MNB-3	Non-Channel	Striped Searobin	1
8/15/06	MNB-3	Non-Channel	Winter Flounder	1
8/15/06	MNB-4	Non-Channel	Atlantic Menhaden	18
8/15/06	MNB-4	Non-Channel	Bay Anchovy	686
8/15/06	MNB-4	Non-Channel	Blue crab	6
8/15/06	MNB-4	Non-Channel	Bluefish	1
8/15/06	MNB-4	Non-Channel	Butterfish	1
8/15/06	MUB-10	Channel	Atlantic Cod	4

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
8/15/06	MUB-10	Channel	Atlantic Menhaden	2
8/15/06	MUB-10	Channel	Bay Anchovy	3
8/15/06	MUB-10	Channel	Blue crab	45
8/15/06	MUB-10	Channel	Grubby	1
8/15/06	MUB-10	Channel	Northern Searobin	2
8/15/06	MUB-10	Channel	Scup	2
8/15/06	MUB-10	Channel	Tautog	1
8/15/06	MUB-10	Channel	Winter Flounder	7
8/15/06	MUB-9	Channel	Atlantic Cod	36
8/15/06	MUB-9	Channel	Atlantic Croaker	35
8/15/06	MUB-9	Channel	Atlantic Menhaden	1
8/15/06	MUB-9	Channel	Bay Anchovy	1
8/15/06	MUB-9	Channel	Blue crab	231
8/15/06	MUB-9	Channel	Hogchocker	2
8/15/06	MUB-9	Channel	Northern Searobin	9
8/15/06	MUB-9	Channel	Northern Stargazer	1
8/15/06	MUB-9	Channel	Oyster Toadfish	3
8/15/06	MUB-9	Channel	Smallmouth Flounder	20
8/15/06	MUB-9	Channel	Spotted Hake	18
8/15/06	MUB-9	Channel	Striped Searobin	24
8/15/06	MUB-9	Channel	Summer Flounder	1
8/15/06	MUB-9	Channel	White Perch	1
8/30/06	MLB-1	Non-Channel	Atlantic Menhaden	15
8/30/06	MLB-1	Non-Channel	Bay Anchovy	1500
8/30/06	MLB-1	Non-Channel	Bluefish	22
8/30/06	MLB-1	Non-Channel	Butterfish	109
8/30/06	MLB-1	Non-Channel	Fourspot Flounder	4
8/30/06	MLB-1	Non-Channel	Scup	304
8/30/06	MLB-1	Non-Channel	Striped Searobin	2
8/30/06	MLB-1	Non-Channel	Summer Flounder	6
8/30/06	MLB-1	Non-Channel	Weakfish	14
8/30/06	MLB-1	Non-Channel	Windowpane	1
8/30/06	MLB-2	Non-Channel	Atlantic Menhaden	7
8/30/06	MLB-2	Non-Channel	Bay Anchovy	252
8/30/06	MLB-2	Non-Channel	Black Sea Bass	3
8/30/06	MLB-2	Non-Channel	Bluefish	2
8/30/06	MLB-2	Non-Channel	Creville Jack	1
8/30/06	MLB-2	Non-Channel	Fourspot Flounder	1
8/30/06	MLB-2	Non-Channel	Scup	44
8/30/06	MLB-2	Non-Channel	Smooth Dogfish	4
8/30/06	MLB-2	Non-Channel	Summer Flounder	1
8/30/06	MLB-2	Non-Channel	Weakfish	4
8/30/06	MLB-2	Non-Channel	Windowpane	1
8/30/06	MLB-2	Non-Channel	Winter Flounder	1
8/30/06	MLB-3	Channel	Bay Anchovy	17
8/30/06	MLB-3	Channel	Black Sea Bass	1
8/30/06	MLB-3	Channel	Inshore Lizardfish	1
8/30/06	MLB-3	Channel	Northern Kingfish	4

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
8/30/06	MLB-3	Channel	Striped Anchovy	1
8/30/06	MUB-1	Channel	Bay Anchovy	1
8/30/06	MUB-1	Channel	Spotted Hake	1
8/30/06	MUB-10	Channel	Atlantic Menhaden	1
8/30/06	MUB-10	Channel	Bay Anchovy	52
8/30/06	MUB-10	Channel	Bluefish	1
8/30/06	MUB-10	Channel	Conger Eel	1
8/30/06	MUB-10	Channel	Winter Flounder	3
8/30/06	MUB-3	Channel	Bay Anchovy	28
8/30/06	MUB-3	Channel	Butterfish	4
8/30/06	MUB-3	Channel	Scup	1
8/30/06	MUB-3	Channel	Summer Flounder	1
8/30/06	MUB-9	Channel	Bay Anchovy	2
8/30/06	MUB-9	Channel	Butterfish	4
8/30/06	MUB-9	Channel	Weakfish	1
8/31/06	MAK-1	Channel	Atlantic Menhaden	10.52631579
8/31/06	MAK-1	Channel	Bay Anchovy	8.421052632
8/31/06	MAK-1	Channel	Butterfish	1.052631579
8/31/06	MAK-1	Channel	Grubby	1.052631579
8/31/06	MAK-1	Channel	Spotted Hake	1.052631579
8/31/06	MAK-1	Channel	Striped Seabream	2.105263158
8/31/06	MAK-1	Channel	Weakfish	1.052631579
8/31/06	MAK-2	Channel	American Eel	1.176470588
8/31/06	MAK-2	Channel	Oyster Toadfish	3.529411765
8/31/06	MAK-2	Channel	Scup	3.529411765
8/31/06	MAK-2	Channel	Weakfish	29.41176471
8/31/06	MNB-1	Channel	Bay Anchovy	2
8/31/06	MNB-2	Channel	Atlantic Croaker	2
8/31/06	MNB-2	Channel	Atlantic Menhaden	1
8/31/06	MNB-2	Channel	Bay Anchovy	6
8/31/06	MNB-3	Non-Channel	Striped Anchovy	37
8/31/06	MNB-3	Non-Channel	Summer Flounder	1
8/31/06	MNB-3	Non-Channel	Weakfish	1
8/31/06	MNB-4	Non-Channel	Atlantic Menhaden	1
8/31/06	MNB-4	Non-Channel	Bay Anchovy	10336
8/31/06	MNB-4	Non-Channel	Black Sea Bass	8
8/31/06	MNB-4	Non-Channel	Bluefish	7
8/31/06	MNB-4	Non-Channel	Creville Jack	1
8/31/06	MNB-4	Non-Channel	Oyster Toadfish	1
8/31/06	MNB-4	Non-Channel	Scup	1
8/31/06	MNB-4	Non-Channel	Striped Anchovy	14
8/31/06	MNB-4	Non-Channel	Striped Bass	1
8/31/06	MNB-4	Non-Channel	Winter Flounder	1
8/31/06	MUB-5	Channel	American Shad	1
8/31/06	MUB-5	Channel	Atlantic Croaker	2
8/31/06	MUB-5	Channel	Bay Anchovy	80
8/31/06	MUB-5	Channel	Bluefish	1
8/31/06	MUB-5	Channel	Clearnose Skate	1

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
8/31/06	MUB-5	Channel	Fourspot Flounder	1
8/31/06	MUB-5	Channel	Lookdown	1
8/31/06	MUB-5	Channel	Red Hake	1
8/31/06	MUB-5	Channel	Scup	6
8/31/06	MUB-5	Channel	Smooth Dogfish	1
8/31/06	MUB-5	Channel	Spotted Hake	2
8/31/06	MUB-5	Channel	Striped Searobin	13
8/31/06	MUB-5	Channel	Weakfish	4
8/31/06	MUB-5	Channel	Windowpane	1
8/31/06	MUB-5	Channel	Winter Flounder	1
8/31/06	MUB-8	Channel	Atlantic Croaker	7
8/31/06	MUB-8	Channel	Atlantic Menhaden	16
8/31/06	MUB-8	Channel	Bay Anchovy	918
8/31/06	MUB-8	Channel	Bluefish	1
8/31/06	MUB-8	Channel	Butterfish	7
8/31/06	MUB-8	Channel	Cunner	1
8/31/06	MUB-8	Channel	Fourspot Flounder	1
8/31/06	MUB-8	Channel	Hogchocker	1
8/31/06	MUB-8	Channel	Lookdown	3
8/31/06	MUB-8	Channel	Scup	12
8/31/06	MUB-8	Channel	Striped Searobin	3
8/31/06	MUB-8	Channel	Summer Flounder	2
8/31/06	MUB-8	Channel	Weakfish	52
8/31/06	MUB-8	Channel	Windowpane	3
8/31/06	MUB-8	Channel	Winter Flounder	3
9/11/06	MLB-1	Non-Channel	Bay Anchovy	443
9/11/06	MLB-1	Non-Channel	Blue crab	2
9/11/06	MLB-1	Non-Channel	Bluefish	1
9/11/06	MLB-1	Non-Channel	Butterfish	2
9/11/06	MLB-1	Non-Channel	Scup	1
9/11/06	MLB-2	Non-Channel	Bay Anchovy	3
9/11/06	MLB-2	Non-Channel	Bluefish	1
9/11/06	MLB-2	Non-Channel	Butterfish	1
9/11/06	MLB-3	Channel	Bay Anchovy	46
9/11/06	MLB-3	Channel	Bluefish	1
9/11/06	MLB-3	Channel	Scup	2
9/11/06	MUB-1	Channel	American Eel	1
9/11/06	MUB-1	Channel	Bay Anchovy	8
9/11/06	MUB-1	Channel	Blue crab	4
9/11/06	MUB-1	Channel	Fourspot Flounder	1
9/11/06	MUB-1	Channel	Scup	1
9/11/06	MUB-1	Channel	Striped Searobin	14
9/11/06	MUB-1	Channel	Weakfish	1
9/11/06	MUB-1	Channel	Windowpane	1
9/11/06	MUB-10	Channel	Bay Anchovy	38
9/11/06	MUB-10	Channel	Blue crab	3
9/11/06	MUB-10	Channel	Oyster Toadfish	2
9/11/06	MUB-10	Channel	Weakfish	1

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
9/11/06	MUB-10	Channel	Winter Flounder	1
9/11/06	MUB-2	Channel	Bay Anchovy	31
9/11/06	MUB-2	Channel	Blue crab	1
9/11/06	MUB-2	Channel	Butterfish	1
9/11/06	MUB-2	Channel	Lined Seahorse	1
9/11/06	MUB-2	Channel	Naked Goby	2
9/11/06	MUB-2	Channel	Weakfish	1
9/11/06	MUB-2	Channel	Windowpane	1
9/11/06	MUB-3	Channel	Bay Anchovy	101
9/11/06	MUB-3	Channel	Blue crab	5
9/11/06	MUB-3	Channel	Striped Searobin	2
9/11/06	MUB-3	Channel	Weakfish	1
9/11/06	MUB-5	Channel	Bay Anchovy	6
9/11/06	MUB-5	Channel	Blue crab	3
9/11/06	MUB-5	Channel	Cunner	1
9/11/06	MUB-5	Channel	Scup	1
9/11/06	MUB-5	Channel	Windowpane	1
9/11/06	MUB-8	Channel	Bay Anchovy	14
9/11/06	MUB-8	Channel	Blue crab	1
9/11/06	MUB-8	Channel	Bluefish	2
9/11/06	MUB-8	Channel	Butterfish	1
9/11/06	MUB-9	Channel	Blue crab	1
9/12/06	MAK-1	Channel	Atlantic Moonfish	2
9/12/06	MAK-1	Channel	Bay Anchovy	12
9/12/06	MAK-1	Channel	Striped Searobin	4
9/12/06	MAK-1	Channel	Weakfish	4
9/12/06	MNB-1	Channel	Atlantic Menhaden	1
9/12/06	MNB-1	Channel	Atlantic Moonfish	2
9/12/06	MNB-1	Channel	Bay Anchovy	6
9/12/06	MNB-1	Channel	Blue crab	1
9/12/06	MNB-2	Channel	Bay Anchovy	73
9/12/06	MNB-2	Channel	Blue crab	4
9/12/06	MNB-2	Channel	Bluefish	1
9/12/06	MNB-2	Channel	Weakfish	1
9/12/06	MNB-3	Non-Channel	Bay Anchovy	906
9/12/06	MNB-3	Non-Channel	Blue crab	18
9/12/06	MNB-3	Non-Channel	Bluefish	27
9/12/06	MNB-3	Non-Channel	Butterfish	22
9/12/06	MNB-3	Non-Channel	Scup	1
9/12/06	MNB-3	Non-Channel	Striped Anchovy	3
9/12/06	MNB-4	Non-Channel	Bay Anchovy	75
9/12/06	MNB-4	Non-Channel	Blue crab	41
9/12/06	MNB-4	Non-Channel	Blueback Herring	1
9/12/06	MNB-4	Non-Channel	Bluefish	7
9/12/06	MNB-4	Non-Channel	Butterfish	9
9/12/06	MNB-4	Non-Channel	Northern Kingfish	2
9/12/06	MNB-4	Non-Channel	Northern Pipefish	1
9/12/06	MNB-4	Non-Channel	Striped Anchovy	4

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
9/12/06	MNB-4	Non-Channel	Striped Bass	3
9/12/06	MNB-4	Non-Channel	Winter Flounder	2
9/25/06	MAK-1	Channel	Bay Anchovy	9
9/25/06	MAK-1	Channel	Blue crab	2
9/25/06	MAK-1	Channel	Striped Bass	1
9/25/06	MAK-1	Channel	Striped Searobin	3
9/25/06	MAK-1	Channel	Weakfish	7
9/25/06	MNB-1	Channel	Blue crab	3.092783505
9/25/06	MNB-2	Channel	Bay Anchovy	32
9/25/06	MNB-2	Channel	Blue crab	21
9/25/06	MNB-2	Channel	Bluefish	1
9/25/06	MNB-2	Channel	Butterfish	1
9/25/06	MNB-2	Channel	Spot	1
9/25/06	MNB-2	Channel	Striped Searobin	7
9/25/06	MNB-2	Channel	Weakfish	21
9/25/06	MNB-3	Non-Channel	Blue crab	4
9/25/06	MNB-3	Non-Channel	Bluefish	10
9/25/06	MNB-3	Non-Channel	Striped Anchovy	2
9/25/06	MNB-4	Non-Channel	Bay Anchovy	3
9/25/06	MNB-4	Non-Channel	Blue crab	3
9/25/06	MNB-4	Non-Channel	Bluefish	10
9/25/06	MNB-4	Non-Channel	Northern Pipefish	1
9/25/06	MNB-4	Non-Channel	Striped Anchovy	5
9/25/06	MUB-10	Channel	Bay Anchovy	383
9/25/06	MUB-10	Channel	Blue crab	13
9/25/06	MUB-10	Channel	Bluefish	4
9/25/06	MUB-10	Channel	Scup	8
9/25/06	MUB-10	Channel	Smooth Dogfish	1
9/25/06	MUB-10	Channel	Tautog	1
9/25/06	MUB-10	Channel	Winter Flounder	1
9/25/06	MUB-8	Channel	Atlantic Moonfish	4
9/25/06	MUB-8	Channel	Bay Anchovy	25
9/25/06	MUB-8	Channel	Blue crab	2
9/25/06	MUB-8	Channel	Bluefish	5
9/25/06	MUB-8	Channel	Butterfish	4
9/25/06	MUB-8	Channel	Scup	5
9/25/06	MUB-8	Channel	Striped Searobin	1
9/25/06	MUB-8	Channel	Tautog	1
9/25/06	MUB-8	Channel	Winter Flounder	1
9/25/06	MUB-9	Channel	Atlantic Herring	1
9/25/06	MUB-9	Channel	Atlantic Moonfish	1
9/25/06	MUB-9	Channel	Bay Anchovy	63
9/25/06	MUB-9	Channel	Blue crab	3
9/25/06	MUB-9	Channel	Bluefish	1
9/25/06	MUB-9	Channel	Striped Searobin	1
9/25/06	MUB-9	Channel	Weakfish	4
9/25/06	MUB-9	Channel	Winter Flounder	3
9/26/06	MLB-1	Non-Channel	Bay Anchovy	2

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
9/26/06	MLB-1	Non-Channel	Bluefish	1
9/26/06	MLB-1	Non-Channel	Butterfish	30
9/26/06	MLB-1	Non-Channel	Crevalle Jack	1
9/26/06	MLB-1	Non-Channel	Scup	5
9/26/06	MLB-1	Non-Channel	Winter Flounder	1
9/26/06	MLB-2	Non-Channel	Bay Anchovy	12
9/26/06	MLB-2	Non-Channel	Blue crab	1
9/26/06	MLB-2	Non-Channel	Scup	2
9/26/06	MLB-2	Non-Channel	Smooth Dogfish	1
9/26/06	MLB-2	Non-Channel	Weakfish	3
9/26/06	MLB-2	Non-Channel	Winter Flounder	2
9/26/06	MLB-3	Channel	Atlantic Moonfish	1
9/26/06	MLB-3	Channel	Bay Anchovy	6
9/26/06	MLB-3	Channel	Black Sea Bass	3
9/26/06	MLB-3	Channel	Bluefish	5
9/26/06	MLB-3	Channel	Butterfish	2
9/26/06	MLB-3	Channel	Clearnose Skate	2
9/26/06	MLB-3	Channel	Scup	31
9/26/06	MLB-3	Channel	Smooth Dogfish	4
9/26/06	MLB-3	Channel	Winter Flounder	1
9/26/06	MUB-1	Channel	Cunner	2
9/26/06	MUB-1	Channel	Scup	1
9/26/06	MUB-1	Channel	Tautog	5
9/26/06	MUB-1	Channel	Winter Flounder	1
9/26/06	MUB-2	Channel	Bay Anchovy	2
9/26/06	MUB-2	Channel	Butterfish	1
9/26/06	MUB-2	Channel	Scup	1
9/26/06	MUB-3	Channel	Atlantic Moonfish	10
9/26/06	MUB-3	Channel	Bay Anchovy	1201
9/26/06	MUB-3	Channel	Blue crab	3
9/26/06	MUB-3	Channel	Bluefish	13
9/26/06	MUB-3	Channel	Butterfish	25
9/26/06	MUB-3	Channel	Scup	2
9/26/06	MUB-3	Channel	Smallmouth Flounder	1
9/26/06	MUB-3	Channel	Winter Flounder	1
9/26/06	MUB-5	Channel	Bay Anchovy	30
9/26/06	MUB-5	Channel	Black Sea Bass	1
9/26/06	MUB-5	Channel	Winter Flounder	2
10/10/06	MLB-1	Non-Channel	Atlantic Moonfish	2
10/10/06	MLB-1	Non-Channel	Bay Anchovy	4309
10/10/06	MLB-1	Non-Channel	Black Sea Bass	5
10/10/06	MLB-1	Non-Channel	Bluefish	1
10/10/06	MLB-1	Non-Channel	Butterfish	10
10/10/06	MLB-1	Non-Channel	Clearnose Skate	1
10/10/06	MLB-1	Non-Channel	Crevalle Jack	1
10/10/06	MLB-1	Non-Channel	Lined Seahorse	1
10/10/06	MLB-1	Non-Channel	Northern Pipefish	1
10/10/06	MLB-1	Non-Channel	Scup	13

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
10/10/06	MLB-2	Non-Channel	American Shad	2
10/10/06	MLB-2	Non-Channel	Black Sea Bass	1
10/10/06	MLB-2	Non-Channel	Blue crab	7
10/10/06	MLB-2	Non-Channel	Scup	2
10/10/06	MLB-2	Non-Channel	Weakfish	2
10/10/06	MLB-3	Channel	Black Sea Bass	3
10/10/06	MLB-3	Channel	Clearnose Skate	1
10/10/06	MLB-3	Channel	Smooth Dogfish	2
10/10/06	MUB-10	Channel	Black Sea Bass	1
10/10/06	MUB-10	Channel	Blue crab	36
10/10/06	MUB-10	Channel	Cunner	2
10/10/06	MUB-10	Channel	Grubby	2
10/10/06	MUB-10	Channel	Oyster Toadfish	2
10/10/06	MUB-10	Channel	Scup	1
10/10/06	MUB-10	Channel	Striped Searobin	1
10/10/06	MUB-10	Channel	Tautog	2
10/10/06	MUB-10	Channel	Weakfish	10
10/10/06	MUB-10	Channel	Winter Flounder	10
10/10/06	MUB-3	Channel	American Shad	1
10/10/06	MUB-3	Channel	Bay Anchovy	17
10/10/06	MUB-3	Channel	Black Sea Bass	1
10/10/06	MUB-3	Channel	Blue crab	99
10/10/06	MUB-3	Channel	Bluefish	1
10/10/06	MUB-3	Channel	Gizzard Shad	1
10/10/06	MUB-3	Channel	Scup	1
10/10/06	MUB-3	Channel	Striped Searobin	1
10/10/06	MUB-3	Channel	Weakfish	3
10/10/06	MUB-5	Channel	Atlantic Croaker	2
10/10/06	MUB-5	Channel	Bay Anchovy	2
10/10/06	MUB-5	Channel	Black Sea Bass	2
10/10/06	MUB-5	Channel	Blue crab	27
10/10/06	MUB-5	Channel	Cunner	4
10/10/06	MUB-5	Channel	Fourspot Flounder	1
10/10/06	MUB-5	Channel	Hickory Shad	2
10/10/06	MUB-5	Channel	Red Hake	1
10/10/06	MUB-5	Channel	Scup	1
10/10/06	MUB-5	Channel	Silver Hake	1
10/10/06	MUB-5	Channel	Spotted Hake	4
10/10/06	MUB-5	Channel	Striped Searobin	2
10/10/06	MUB-5	Channel	Tautog	1
10/10/06	MUB-5	Channel	Weakfish	8
10/10/06	MUB-5	Channel	Windowpane	6
10/10/06	MUB-5	Channel	Winter Flounder	32
10/10/06	MUB-5	Channel	Winter Skate	2
10/10/06	MUB-8	Channel	Atlantic Menhaden	1
10/10/06	MUB-8	Channel	Bay Anchovy	3
10/10/06	MUB-8	Channel	Blue crab	10
10/10/06	MUB-8	Channel	Hogchocker	3

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
10/10/06	MUB-9	Channel	Blue crab	10
10/10/06	MUB-9	Channel	Spotted Hake	2
10/10/06	MUB-9	Channel	Tautog	1
10/10/06	MUB-9	Channel	Winter Flounder	1
10/11/06	MAK-1	Channel	Atlantic Menhaden	1
10/11/06	MAK-1	Channel	Bay Anchovy	1
10/11/06	MAK-1	Channel	Blue crab	4
10/11/06	MAK-1	Channel	Hogchocker	1
10/11/06	MAK-1	Channel	Smallmouth Flounder	1
10/11/06	MAK-1	Channel	Striped Searobin	1
10/11/06	MAK-1	Channel	Weakfish	15
10/11/06	MAK-1	Channel	Winter Flounder	1
10/11/06	MNB-1	Channel	Bay Anchovy	9
10/11/06	MNB-1	Channel	Blue crab	10
10/11/06	MNB-1	Channel	Striped Searobin	1
10/11/06	MNB-1	Channel	Weakfish	2
10/11/06	MNB-1	Channel	Winter Flounder	3
10/11/06	MNB-2	Channel	Bay Anchovy	3
10/11/06	MNB-2	Channel	Blue crab	2
10/11/06	MNB-2	Channel	Hogchocker	1
10/11/06	MNB-2	Channel	Striped Searobin	1
10/11/06	MNB-3	Non-Channel	Blue crab	19
10/11/06	MNB-3	Non-Channel	Bluefish	7
10/11/06	MNB-3	Non-Channel	Scup	1
10/11/06	MNB-4	Non-Channel	Bay Anchovy	10
10/11/06	MNB-4	Non-Channel	Black Sea Bass	1
10/11/06	MNB-4	Non-Channel	Blue crab	25
10/11/06	MNB-4	Non-Channel	Bluefish	7
10/11/06	MNB-4	Non-Channel	Butterfish	12
10/11/06	MNB-4	Non-Channel	Northern Kingfish	2
10/11/06	MNB-4	Non-Channel	Scup	1
10/11/06	MNB-4	Non-Channel	Striped Anchovy	4
10/11/06	MNB-4	Non-Channel	Striped Bass	4
10/11/06	MUB-1	Channel	Atlantic Menhaden	1
10/11/06	MUB-1	Channel	Bay Anchovy	2
10/11/06	MUB-1	Channel	Black Sea Bass	1
10/11/06	MUB-1	Channel	Feather Blenny	1
10/11/06	MUB-1	Channel	Fourspot Flounder	1
10/11/06	MUB-1	Channel	Longhorn Sculpin	1
10/11/06	MUB-1	Channel	Spotted Hake	1
10/11/06	MUB-1	Channel	Striped Searobin	3
10/11/06	MUB-1	Channel	Windowpane	1
10/11/06	MUB-1	Channel	Winter Flounder	5
10/11/06	MUB-1	Channel	Winter Skate	1
10/11/06	MUB-2	Channel	Bay Anchovy	9
10/11/06	MUB-2	Channel	Blue crab	1
10/11/06	MUB-2	Channel	Butterfish	1
10/11/06	MUB-2	Channel	Hickory Shad	3

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
10/11/06	MUB-2	Channel	Smallmouth Flounder	1
10/11/06	MUB-2	Channel	Windowpane	1
10/23/06	MLB-1	Non-Channel	Atlantic Moonfish	3
10/23/06	MLB-1	Non-Channel	Bay Anchovy	259
10/23/06	MLB-1	Non-Channel	Blue crab	1
10/23/06	MLB-1	Non-Channel	Scup	4
10/23/06	MLB-1	Non-Channel	Silver Hake	1
10/23/06	MLB-2	Non-Channel	Atlantic Moonfish	1
10/23/06	MLB-2	Non-Channel	Bay Anchovy	142
10/23/06	MLB-2	Non-Channel	Black Sea Bass	1
10/23/06	MLB-2	Non-Channel	Blue crab	7
10/23/06	MLB-2	Non-Channel	Clearnose Skate	1
10/23/06	MLB-2	Non-Channel	Scup	4
10/23/06	MLB-2	Non-Channel	Smallmouth Flounder	1
10/23/06	MLB-2	Non-Channel	Summer Flounder	3
10/23/06	MLB-2	Non-Channel	Tautog	1
10/23/06	MLB-2	Non-Channel	Weakfish	5
10/23/06	MLB-3	Channel	Black Sea Bass	3
10/23/06	MLB-3	Channel	Blue crab	2
10/23/06	MLB-3	Channel	Scup	5
10/23/06	MLB-3	Channel	Smallmouth Flounder	2
10/23/06	MLB-3	Channel	Smooth Dogfish	3
10/23/06	MLB-3	Channel	Winter Flounder	1
10/23/06	MUB-10	Channel	Blue crab	20
10/23/06	MUB-5	Channel	Atlantic Moonfish	1
10/23/06	MUB-5	Channel	Bay Anchovy	5
10/23/06	MUB-5	Channel	Blue crab	11
10/23/06	MUB-5	Channel	Scup	5
10/23/06	MUB-5	Channel	Silver Hake	3
10/23/06	MUB-5	Channel	Summer Flounder	10
10/23/06	MUB-5	Channel	Tautog	2
10/23/06	MUB-5	Channel	Weakfish	3
10/23/06	MUB-8	Channel	Atlantic Menhaden	1
10/23/06	MUB-8	Channel	Bay Anchovy	2
10/23/06	MUB-8	Channel	Blue crab	20
10/23/06	MUB-8	Channel	Bluefish	3
10/23/06	MUB-8	Channel	Butterfish	2
10/23/06	MUB-8	Channel	Clearnose Skate	1
10/23/06	MUB-8	Channel	Summer Flounder	3
10/23/06	MUB-8	Channel	Weakfish	5
10/23/06	MUB-9	Channel	Bay Anchovy	1
10/23/06	MUB-9	Channel	Blue crab	1
10/23/06	MUB-9	Channel	Oyster Toadfish	2
10/23/06	MUB-9	Channel	Smallmouth Flounder	1
10/23/06	MUB-9	Channel	Summer Flounder	1
10/23/06	MUB-9	Channel	Tautog	1
10/23/06	MUB-9	Channel	Weakfish	1
10/26/06	MAK-1	Channel	Atlantic Menhaden	2.5

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
10/26/06	MAK-1	Channel	Bay Anchovy	17.5
10/26/06	MAK-1	Channel	Blue crab	2.5
10/26/06	MAK-1	Channel	Bluefish	2.5
10/26/06	MAK-1	Channel	Northern Pipefish	1.25
10/26/06	MAK-1	Channel	Weakfish	2.5
10/26/06	MNB-1	Channel	Atlantic Menhaden	1
10/26/06	MNB-1	Channel	Atlantic Moonfish	4
10/26/06	MNB-1	Channel	Bay Anchovy	14
10/26/06	MNB-1	Channel	Black Sea Bass	3
10/26/06	MNB-1	Channel	Blue crab	7
10/26/06	MNB-1	Channel	Blueback Herring	2
10/26/06	MNB-1	Channel	Bluefish	1
10/26/06	MNB-1	Channel	Weakfish	4
10/26/06	MNB-1	Channel	Winter Flounder	1
10/26/06	MNB-2	Channel	Atlantic Menhaden	5
10/26/06	MNB-2	Channel	Atlantic Moonfish	1
10/26/06	MNB-2	Channel	Bay Anchovy	96
10/26/06	MNB-2	Channel	Blue crab	9
10/26/06	MNB-2	Channel	Bluefish	1
10/26/06	MNB-2	Channel	Oyster Toadfish	1
10/26/06	MNB-2	Channel	Spotted Hake	2
10/26/06	MNB-2	Channel	Striped Searobin	3
10/26/06	MNB-2	Channel	Weakfish	29
10/26/06	MNB-3	Non-Channel	Atlantic Silverside	7
10/26/06	MNB-3	Non-Channel	Bay Anchovy	2
10/26/06	MNB-3	Non-Channel	Blue crab	50
10/26/06	MNB-3	Non-Channel	Bluefish	4
10/26/06	MNB-3	Non-Channel	Butterfish	3
10/26/06	MNB-3	Non-Channel	Striped Bass	1
10/26/06	MNB-4	Non-Channel	Blue crab	23
10/26/06	MNB-4	Non-Channel	Bluefish	1
10/26/06	MUB-3	Channel	Bay Anchovy	38
10/26/06	MUB-3	Channel	Blue crab	18
11/14/06	MLB-1	Non-Channel	Alewife	3
11/14/06	MLB-1	Non-Channel	American Shad	3
11/14/06	MLB-1	Non-Channel	Bay Anchovy	28
11/14/06	MLB-1	Non-Channel	Blue crab	2
11/14/06	MLB-1	Non-Channel	Blueback Herring	1
11/14/06	MLB-1	Non-Channel	Butterfish	1
11/14/06	MLB-1	Non-Channel	Smallmouth Flounder	6
11/14/06	MLB-1	Non-Channel	Spotted Hake	1
11/14/06	MLB-2	Non-Channel	American Shad	5
11/14/06	MLB-2	Non-Channel	Bay Anchovy	3.75
11/14/06	MLB-2	Non-Channel	Blue crab	3.75
11/14/06	MLB-2	Non-Channel	Blueback Herring	7.5
11/14/06	MLB-2	Non-Channel	Smallmouth Flounder	1.25
11/14/06	MLB-2	Non-Channel	Striped Bass	1.25
11/14/06	MLB-2	Non-Channel	Winter Flounder	2.5

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
11/14/06	MLB-3	Channel	Bay Anchovy	1
11/14/06	MLB-3	Channel	Black Sea Bass	3
11/14/06	MLB-3	Channel	Blue crab	63
11/14/06	MLB-3	Channel	Little Skate	9
11/14/06	MLB-3	Channel	Northern Searobin	1
11/14/06	MLB-3	Channel	Red Hake	1
11/14/06	MLB-3	Channel	Silver Hake	2
11/14/06	MLB-3	Channel	Smallmouth Flounder	4
11/14/06	MLB-3	Channel	Spotted Hake	13
11/14/06	MLB-3	Channel	Winter Flounder	4
11/14/06	MUB-1	Channel	Bay Anchovy	2
11/14/06	MUB-1	Channel	Smallmouth Flounder	1
11/14/06	MUB-1	Channel	Spotted Hake	2
11/14/06	MUB-10	Channel	Alewife	1
11/14/06	MUB-10	Channel	Bay Anchovy	1
11/14/06	MUB-10	Channel	Blue crab	6
11/14/06	MUB-10	Channel	Spotted Hake	2
11/14/06	MUB-2	Channel	Blue crab	6
11/14/06	MUB-2	Channel	Silver Hake	12
11/14/06	MUB-2	Channel	Smallmouth Flounder	3
11/14/06	MUB-2	Channel	Spotted Hake	42
11/14/06	MUB-2	Channel	Windowpane	9
11/14/06	MUB-3	Channel	Alewife	13
11/14/06	MUB-3	Channel	Bay Anchovy	2
11/14/06	MUB-3	Channel	Blue crab	2
11/14/06	MUB-3	Channel	Little Skate	1
11/14/06	MUB-3	Channel	Weakfish	1
11/14/06	MUB-8	Channel	Alewife	5
11/14/06	MUB-8	Channel	Bay Anchovy	2
11/14/06	MUB-8	Channel	Blue crab	2
11/14/06	MUB-8	Channel	Spotted Hake	2
11/14/06	MUB-9	Channel	Alewife	3
11/14/06	MUB-9	Channel	Spotted Hake	1
11/15/06	MAK-1	Channel	Atlantic Tomcod	1.111111111
11/15/06	MAK-1	Channel	Bay Anchovy	2.222222222
11/15/06	MAK-1	Channel	Blue crab	4.444444444
11/15/06	MAK-1	Channel	Feather Blenny	1.111111111
11/15/06	MAK-1	Channel	Northern Searobin	1.111111111
11/15/06	MAK-1	Channel	Spotted Hake	2.222222222
11/15/06	MAK-1	Channel	Striped Bass	3.333333333
11/15/06	MAK-1	Channel	Weakfish	4.444444444
11/15/06	MAK-1	Channel	White Perch	1.111111111
11/15/06	MAK-1	Channel	Winter Flounder	2.222222222
11/15/06	MNB-1	Channel	Alewife	1
11/15/06	MNB-1	Channel	Bay Anchovy	13
11/15/06	MNB-1	Channel	Blue crab	10
11/15/06	MNB-1	Channel	Oyster Toadfish	1
11/15/06	MNB-1	Channel	Spot	2

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
11/15/06	MNB-1	Channel	Spotted Hake	1
11/15/06	MNB-1	Channel	Striped Searobin	1
11/15/06	MNB-1	Channel	Weakfish	6
11/15/06	MNB-2	Channel	Alewife	1
11/15/06	MNB-2	Channel	American Eel	1
11/15/06	MNB-2	Channel	Atlantic Moonfish	1
11/15/06	MNB-2	Channel	Bay Anchovy	9
11/15/06	MNB-2	Channel	Blue crab	13
11/15/06	MNB-2	Channel	Spotted Hake	7
11/15/06	MNB-2	Channel	Weakfish	4
11/15/06	MNB-3	Non-Channel	American Shad	4
11/15/06	MNB-3	Non-Channel	Atlantic Silverside	3
11/15/06	MNB-3	Non-Channel	Bay Anchovy	26
11/15/06	MNB-3	Non-Channel	Blue crab	44
11/15/06	MNB-3	Non-Channel	Blueback Herring	5
11/15/06	MNB-3	Non-Channel	Smallmouth Flounder	2
11/15/06	MNB-3	Non-Channel	Striped Bass	5
11/15/06	MNB-3	Non-Channel	White Perch	4
11/15/06	MNB-3	Non-Channel	Winter Flounder	1
11/15/06	MNB-4	Non-Channel	Atlantic Silverside	7
11/15/06	MNB-4	Non-Channel	Bay Anchovy	4
11/15/06	MNB-4	Non-Channel	Blue crab	50
11/15/06	MNB-4	Non-Channel	Blueback Herring	13
11/15/06	MNB-4	Non-Channel	Smallmouth Flounder	1
11/15/06	MNB-4	Non-Channel	Striped Bass	13
11/15/06	MNB-4	Non-Channel	White Perch	5
11/15/06	MNB-4	Non-Channel	Winter Flounder	2
11/15/06	MUB-5	Channel	Bay Anchovy	1
11/15/06	MUB-5	Channel	Blue crab	29
11/15/06	MUB-5	Channel	Little Skate	1
11/15/06	MUB-5	Channel	Silver Hake	8
11/15/06	MUB-5	Channel	Spotted Hake	10
11/15/06	MUB-5	Channel	Weakfish	2
11/15/06	MUB-5	Channel	Windowpane	2
11/15/06	MUB-5	Channel	Winter Flounder	14
11/27/06	MLB-1	Non-Channel	Clearnose Skate	1
11/27/06	MLB-1	Non-Channel	Spotted Hake	3
11/27/06	MLB-1	Non-Channel	Summer Flounder	4
11/27/06	MLB-2	Non-Channel	Alewife	6
11/27/06	MLB-2	Non-Channel	Atlantic Menhaden	2
11/27/06	MLB-2	Non-Channel	Bay Anchovy	67
11/27/06	MLB-2	Non-Channel	Blue crab	2
11/27/06	MLB-2	Non-Channel	Blueback Herring	3
11/27/06	MLB-2	Non-Channel	Clearnose Skate	1
11/27/06	MLB-2	Non-Channel	Cunner	1
11/27/06	MLB-2	Non-Channel	Smallmouth Flounder	1
11/27/06	MLB-2	Non-Channel	Spotted Hake	3
11/27/06	MLB-2	Non-Channel	Summer Flounder	1

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
11/27/06	MLB-3	Channel	Bay Anchovy	2
11/27/06	MLB-3	Channel	Blue crab	6
11/27/06	MLB-3	Channel	Blueback Herring	1
11/27/06	MLB-3	Channel	Clearnose Skate	1
11/27/06	MLB-3	Channel	Fourspot Flounder	1
11/27/06	MLB-3	Channel	Silver Hake	1
11/27/06	MLB-3	Channel	Smallmouth Flounder	6
11/27/06	MLB-3	Channel	Spotted Hake	2
11/27/06	MLB-3	Channel	Weakfish	1
11/27/06	MLB-3	Channel	Windowpane	2
11/27/06	MUB-1	Channel	Bay Anchovy	1
11/27/06	MUB-10	Channel	Atlantic Croaker	2
11/27/06	MUB-10	Channel	Bay Anchovy	2
11/27/06	MUB-10	Channel	Blue crab	5
11/27/06	MUB-10	Channel	Smallmouth Flounder	1
11/27/06	MUB-10	Channel	Summer Flounder	1
11/27/06	MUB-10	Channel	Weakfish	1
11/27/06	MUB-10	Channel	White Perch	5
11/27/06	MUB-2	Channel	Bay Anchovy	1
11/27/06	MUB-2	Channel	Silver Hake	1
11/27/06	MUB-2	Channel	Windowpane	1
11/27/06	MUB-3	Channel	Alewife	1
11/27/06	MUB-3	Channel	Bay Anchovy	3
11/27/06	MUB-3	Channel	Blue crab	1
11/27/06	MUB-3	Channel	Spotted Hake	1
11/27/06	MUB-3	Channel	Windowpane	2
11/27/06	MUB-5	Channel	Atlantic Croaker	1
11/27/06	MUB-5	Channel	Bay Anchovy	2
11/27/06	MUB-5	Channel	Tautog	1
11/27/06	MUB-8	Channel	Bay Anchovy	1
11/27/06	MUB-8	Channel	Blue crab	1
11/27/06	MUB-8	Channel	Silver Hake	1
11/27/06	MUB-9	Channel	Alewife	1
11/27/06	MUB-9	Channel	Bay Anchovy	2
11/28/06	MAK-1	Channel	Blue crab	5
11/28/06	MAK-1	Channel	Northern Pipefish	1.25
11/28/06	MAK-1	Channel	Silver Hake	1.25
11/28/06	MAK-1	Channel	Smallmouth Flounder	1.25
11/28/06	MAK-1	Channel	Spotted Hake	3.75
11/28/06	MAK-1	Channel	Striped Bass	2.5
11/28/06	MAK-1	Channel	Striped Searobin	1.25
11/28/06	MAK-1	Channel	Weakfish	2.5
11/28/06	MAK-1	Channel	White Perch	6.25
11/28/06	MAK-1	Channel	Winter Flounder	3.75
11/28/06	MNB-1	Channel	Alewife	1
11/28/06	MNB-1	Channel	Atlantic Croaker	1
11/28/06	MNB-1	Channel	Bay Anchovy	1
11/28/06	MNB-1	Channel	Blue crab	7

Appendix B. Finfish CPUE (Bottom Trawl) by date and station sampled during the 2006 Migratory Finfish Sampling Program

Date	Station	Station Type	Common Name	CPUE_10min
11/28/06	MNB-1	Channel	Blueback Herring	1
11/28/06	MNB-1	Channel	Little Skate	1
11/28/06	MNB-1	Channel	Silver Hake	2
11/28/06	MNB-1	Channel	Spotted Hake	1
11/28/06	MNB-1	Channel	Weakfish	2
11/28/06	MNB-1	Channel	White Perch	6
11/28/06	MNB-2	Channel	Atlantic Menhaden	1
11/28/06	MNB-2	Channel	Blue crab	1
11/28/06	MNB-3	Non-Channel	Atlantic Silverside	8
11/28/06	MNB-3	Non-Channel	Bay Anchovy	3
11/28/06	MNB-3	Non-Channel	Blue crab	16
11/28/06	MNB-3	Non-Channel	Blueback Herring	2
11/28/06	MNB-3	Non-Channel	Gizzard Shad	2
11/28/06	MNB-3	Non-Channel	Striped Bass	13
11/28/06	MNB-3	Non-Channel	White Perch	4
11/28/06	MNB-4	Non-Channel	American Shad	1.25
11/28/06	MNB-4	Non-Channel	Atlantic Silverside	3.75
11/28/06	MNB-4	Non-Channel	Bay Anchovy	2.5
11/28/06	MNB-4	Non-Channel	Blue crab	2.5
11/28/06	MNB-4	Non-Channel	Gizzard Shad	1.25
11/28/06	MNB-4	Non-Channel	Striped Bass	10
11/28/06	MNB-4	Non-Channel	White Perch	3.75
11/28/06	MNB-4	Non-Channel	Winter Flounder	1.25

Appendix C. Water quality data (Mid-water Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
4/24/2006	MAK-4	12.9	8.2	18.2	29360	20
4/24/2006	MAK-3	13	7.9	19.1	30660	20
4/24/2006	MAK-2	12.7	8.1	19.1	30740	20
4/24/2006	MAK-1	12.7	8.1	19.1	30740	20
4/24/2006	MNB-3	13.1	8.2	16.6	26980	3
4/24/2006	MNB-5	13.1	7.4	17.2	27850	16
4/24/2006	MNB-2	12.3	8.2	19.5	31260	20
4/24/2006	MNB-1	12.3	8.2	19.5	31260	20
4/24/2006	MNB-4	12.6	8.2	18.7	30060	4
4/24/2006	MKK-2	11.8	8.6	18.7	30290	20
4/25/2006	MLB-3	11.1	8	25.3	39660	16
4/25/2006	MLB-4	11.5	8.4	21.5	34180	7
4/25/2006	MLB-2	11.2	7.8	25.2	39600	15
4/25/2006	MLB-1	11.3	7.7	24.2	38000	15
4/25/2006	MUB-3	11.7	7.3	20.3	32570	18
4/25/2006	MUB-4	11.8	7.9	21	33660	16
4/25/2006	MUB-2	11.9	7.7	19.2	31010	20
4/25/2006	MUB-5	11.4	7.9	20.1	32250	20
4/26/2006	MUB-7	11.6	7.5	18.7	29980	4.5
4/26/2006	MUB-1	11	7.8	26.6	41430	20
4/26/2006	MKK-1	11.7	7.7	17.7	28690	20
4/26/2006	MUB-6	11.6	7.5	18.1	29340	5
4/26/2006	MUB-8	12	7.5	22.6	36060	20
4/26/2006	MUB-10	12	7.5	22.6	36060	20
4/26/2006	MUB-9	11.7	7.4	21.8	34880	20
5/8/2006	MLB-3	13.1	7.8	24.9	38860	14
5/8/2006	MLB-4	14	7.8	23.4	35720	7
5/8/2006	MLB-2	13.1	8.2	24.3	37890	13
5/8/2006	MLB-1	13.5	8.5	24.5	38160	13
5/8/2006	MUB-1	13.9	8.7	21.7	34460	20
5/8/2006	MUB-2	13.9	8.7	21.7	34460	20
5/8/2006	MUB-3	13.2	8	23.6	37240	20
5/8/2006	MUB-4	13.2	8	23.6	37240	20
5/8/2006	MUB-5	13.7	7.7	20.5	32320	20
5/8/2006	MUB-8	13.7	7.7	20.5	32330	20
5/9/2006	MNB-3	14.7	7.4	18.5	30130	5
5/9/2006	MNB-4	14.7	7.4	18.5	30130	5
5/9/2006	MNB-5	14.7	7	17.8	28940	15
5/9/2006	MNB-6	14.6	6.8	18.6	30040	10
5/9/2006	MAK-4	14.9	6.8	20.3	32460	20
5/9/2006	MAK-3	15.2	6.9	19.6	31470	20
5/9/2006	MAK-2	15.2	6.9	19.6	31470	20
5/9/2006	MAK-1	14.7	7.8	18.7	30470	20
5/9/2006	MUB-6	14.1	8.4	16.2	25200	5
5/10/2006	MUB-7	13.6	8	18.4	29650	6
5/10/2006	MKK-1	13.6	7.9	20.8	33160	20
5/10/2006	MKK-2	14.2	7.7	19.3	30950	20

Appendix C. Water quality data (Mid-water Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
5/10/2006	MNB-1	14.2	7.3	20	32060	20
5/10/2006	MNB-2	14.2	7.3	20	36060	20
5/10/2006	MUB-10	13.6	7.7	22.4	33900	20
5/10/2006	MUB-9	13.6	7.7	22.4	33900	20
5/22/2006	MUB-6	14.3	7.4	15.9	25830	4
5/22/2006	MAK-4	15.3	6.5	17	27540	20
5/22/2006	MAK-3	15.3	6.5	17	27540	20
5/22/2006	MAK-2	15.2	6.9	17.1	27770	20
5/22/2006	MNB-6	15.6	6.2	13.2	21360	11
5/22/2006	MNB-5	15.5	6.3	13.9	22870	15
5/22/2006	MNB-2	14.8	7	17.1	27800	20
5/22/2006	MNB-1	14.8	7	17.1	27880	20
5/22/2006	MNB-4	15.3	7.4	15.2	24940	6
5/22/2006	MNB-3	15.3	7.4	15.2	24940	6
5/23/2006	MAK-1	15.1	7	16.9	27340	17
5/23/2006	MKK-2	14.6	7.4	16.8	272400	25
5/23/2006	MUB-1	14.1	7.4	18.7	29720	25
5/23/2006	MUB-2	13.5	7.6	21.8	34350	21
5/23/2006	MUB-3	14	7.3	19.2	30860	20
5/23/2006	MUB-4	13.2	7.7	23.1	35980	20
5/23/2006	MUB-5	13.1	7.5	23.1	35910	20
5/23/2006	MUB-8	14.5	7.4	15.3	25670	21
5/23/2006	MUB-10	14.5	7.4	15.3	25670	21
5/23/2006	MUB-9	14.4	7.3	16.1	26960	25
5/24/2006	MUB-7	14.4	7.4	14.6	24180	4
5/24/2006	MLB-1	13.3	8.3	23.3	37150	15
5/24/2006	MLB-3	14	9.9	23.2	36330	15
5/24/2006	MLB-4	14	10.6	23.6	36500	8
5/24/2006	MLB-2	13.2	7.8	21.9	33500	12
5/24/2006	MKK-1	14.8	9.2	17.4	28030	25
6/5/2006	MLB-3	17.5	7.3	20.8	33230	15
6/5/2006	MLB-4	18.6	9	18.6	29820	8
6/5/2006	MLB-2	17.8	7.4	21	33410	13
6/5/2006	MLB-1	18.8	9.6	16.3	26600	13
6/5/2006	MUB-1	17.8	6.9	15	25000	25
6/5/2006	MUB-2	17.5	6.5	18.1	29480	22
6/5/2006	MUB-4	17.5	6.2	18.4	29780	20
6/5/2006	MUB-3	17.7	6.7	17.1	27970	20
6/5/2006	MUB-9	17	6.5	18	28450	25
6/5/2006	MUB-10	16.8	6.7	22.1	36040	25
6/6/2006	MKK-1	18.2	6.3	17	27610	25
6/6/2006	MKK-2	18.9	5.8	15.9	25990	24
6/6/2006	MNB-1	19.3	5.5	15.2	24910	23
6/6/2006	MNB-2	19	5.2	16.2	26410	23
6/6/2006	MNB-6	20	4.7	9	15000	10
6/6/2006	MNB-5	21.5	3.8	11.5	19350	14
6/6/2006	MUB-8	17.8	6.2	16.1	25990	23

Appendix C. Water quality data (Mid-water Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
6/6/2006	MUB-6	19	7.2	9.5	16560	6
6/7/2006	MUB-7	18.4	7.2	12.4	20710	5
6/7/2006	MNB-3	19.3	5.4	13.3	21990	5
6/7/2006	MNB-4	19.3	5.4	13.3	21990	5
6/7/2006	MAK-4	19.2	5.2	16.8	23990	20
6/7/2006	MAK-3	19.3	5.4	16.2	26450	20
6/7/2006	MAK-1	18.8	6.3	15.1	24770	20
6/7/2006	MAK-2	19.3	5.4	16.2	26450	20
8/7/2006	MUB-7	22.6	7	19.5	31330	3
8/7/2006	MUB-6	23.1	8.5	18.9	30530	4
8/7/2006	MKK-1	21.8	6.1	23.2	37570	25
8/7/2006	MUB-2	21.8	6.7	24.2	38000	20
8/7/2006	MUB-4	21.8	6.3	23.4	36830	20
8/7/2006	MUB-3	21.7	6.1	23.5	36960	20
8/7/2006	MUB-5	21.8	6	23.1	37010	25
8/7/2006	MUB-8	22.2	5.6	22.8	35850	25
8/7/2006	MUB-10	23.2	7.6	19	30790	20
8/7/2006	MUB-9	22.3	5.6	21.1	33560	25
8/8/2006	MNB-3	23.9	5.8	21	33560	4
8/8/2006	MNB-4	23.9	5.8	21	33560	4
8/8/2006	MNB-5	24.5	5.4	20.7	32630	15
8/8/2006	MNB-6	25.1	4.5	19.8	31800	12
8/8/2006	MAK-4	25.8	5.1	21.8	34740	17
8/8/2006	MAK-3	25.3	5.1	21.3	33980	17
8/8/2006	MAK-2	25.3	5.1	21.3	33980	17
8/8/2006	MAK-1	24.5	6.5	21.5	34150	17
8/9/2006	MUB-1	22.3	5.6	26.2	40980	25
8/9/2006	MLB-1	22.4	5	26.3	40990	12
8/9/2006	MLB-3	22.2	6.2	27.4	42640	15
8/9/2006	MLB-4	22.5	6	25.6	40070	8
8/9/2006	MLB-2	22.3	5.9	25.1	39380	15
8/9/2006	MKK-2	24	6.3	21.4	34040	22
8/9/2006	MNB-1	24.1	5.8	21.4	34040	25
8/9/2006	MNB-2	24.1	5.8	21.4	34040	23
8/21/2006	MKK-2	24	6.2	22.1	35100	24
8/21/2006	MAK-1	24.5	6.1	21.3	33980	23
8/21/2006	MAK-4	25.7	5.1	21.4	34160	19
8/21/2006	MAK-3	25.6	5.7	21.4	34130	19
8/21/2006	MAK-2	25.6	5.7	21.4	34130	19
8/21/2006	MUB-5	23.8	4.9	23.5	37100	25
8/21/2006	MUB-8	24.4	4.7	22.8	36020	24
8/21/2006	MUB-10	23.9	5.2	22.3	35300	24
8/21/2006	MUB-9	24	5.1	21.1	33560	24
8/22/2006	MUB-7	23.3	4.8	20.5	34160	4
8/22/2006	MUB-6	23.3	5.2	22.9	36280	5
8/22/2006	MLB-2	22.5	6	26.2	40800	9
8/22/2006	MLB-4	22.6	5.8	25.8	40210	10

Appendix C. Water quality data (Mid-water Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
8/22/2006	MLB-3	22.2	6.5	27.2	42630	17
8/22/2006	MLB-1	23.2	5.3	26.1	40680	12
8/22/2006	MUB-1	23.2	5.4	25.1	39650	23
8/22/2006	MUB-2	23.7	5	23.1	36550	21
8/22/2006	MUB-3	23.8	4.6	24.2	38110	20
8/22/2006	MUB-4	23.5	4.7	24.1	38020	20
8/23/2006	MKK-1	23.8	5.6	22.9	36340	23
8/23/2006	MNB-2	24.3	5.9	22.4	35490	24
8/23/2006	MNB-4	24	5.9	22.1	35150	5
8/23/2006	MNB-3	24	5.9	22.1	35150	5
8/23/2006	MNB-5	24.6	5.6	21.4	34050	15
8/23/2006	MNB-6	24.5	5.5	21.6	34290	10
8/23/2006	MNB-1	24.3	5.9	22.4	35490	22
9/5/2006	MLB-3	20.8	5.9	25	39260	14
9/5/2006	MLB-4	20.9	6.1	24	37600	7
9/5/2006	MLB-2	20.8	5.6	25.6	40100	14
9/5/2006	MLB-1	20.7	5.7	25.8	40320	14
9/5/2006	MUB-1	21.2	5.5	22.8	35820	25
9/5/2006	MUB-2	21.3	5.3	22.3	35460	22
9/5/2006	MUB-3	21.3	4.7	21.3	36000	20
9/5/2006	MUB-4	21.3	5	22.4	35500	20
9/5/2006	MUB-5	21.3	5.2	21.7	34460	23
9/5/2006	MUB-8	21.3	5.1	21.7	34450	24
9/6/2006	MNB-3	21	5	17	27500	4
9/6/2006	MNB-4	21	5.1	17	27470	4
9/6/2006	MNB-5	21.2	4.7	17.2	27770	17
9/6/2006	MNB-6	21.2	4.7	16.4	26680	12
9/6/2006	MNB-1	21.2	4.9	17.5	28320	25
9/6/2006	MNB-2	21.4	4.9	16.7	27340	24
9/6/2006	MAK-4	21.4	4.8	18.9	30370	17
9/6/2006	MAK-3	21.7	4.8	18	29000	18
9/6/2006	MAK-2	21.5	5.3	17.5	28290	19
9/6/2006	MAK-1	21.5	5.3	17.5	28420	20
9/7/2006	MUB-7	21.1	4.9	22.6	35700	5
9/7/2006	MUB-6	20.9	4.8	24.4	38320	7
9/7/2006	MKK-1	21.1	4.7	22.6	35770	25
9/7/2006	MKK-2	21.2	4.9	19.6	31480	27
9/7/2006	MUB-10	21.5	4.7	23	36560	20
9/7/2006	MUB-9	21.4	4.7	23.6	37280	24
9/18/2006	MUB-7	21.2	5.8	19.3	31140	8
9/18/2006	MLB-3	21.3	6.6	23.1	36560	17
9/18/2006	MLB-4	21	6	24.4	38230	8
9/18/2006	MLB-2	20.9	6	26.2	40890	14
9/18/2006	MLB-1	21	5.9	25.4	39780	13
9/18/2006	MUB-1	21.2	5.5	22.1	35580	25
9/18/2006	MUB-2	21.1	5.5	22.8	36050	21
9/18/2006	MUB-3	21.5	4.9	22.1	35340	19

Appendix C. Water quality data (Mid-water Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
9/18/2006	MUB-4	21.3	4.9	22	34950	20
9/19/2006	MNB-3	21.4	4.9	18.4	29660	4
9/19/2006	MNB-4	21.5	5.4	16.3	27060	4
9/19/2006	MNB-5	21.8	4.7	17.3	27740	16
9/19/2006	MNB-6	22	4.6	16.5	27010	12
9/19/2006	MNB-1	21.7	5.5	17.6	28420	23
9/19/2006	MNB-2	21.6	5.1	17.3	28150	23
9/19/2006	MUB-8	21.4	5.2	22.2	34910	23
9/19/2006	MUB-10	21.4	5.2	21.9	34660	21
9/19/2006	MUB-9	21.3	5.2	22.7	35820	25
9/19/2006	MUB-5	21.4	5.2	21.6	34440	25
9/20/2006	MAK-1	21.6	5.2	18.9	30510	24
9/20/2006	MAK-2	22	5.1	18.8	30330	21
9/20/2006	MAK-4	21.9	4.8	19.2	30890	22
9/20/2006	MAK-3	22.3	5.1	18.6	29890	20
9/20/2006	MKK-2	21.4	5.2	18.5	30020	26
9/20/2006	MUB-6	21.4	5.5	21.5	34010	4
9/20/2006	MKK-1	21.4	5	19.6	31500	24
10/2/2006	MLB-4	18.2	6.9	25.7	40140	7
10/2/2006	MLB-2	18.6	5.8	25.7	40240	14
10/2/2006	MLB-3	18.9	6	25.5	39960	15
10/2/2006	MLB-1	18.9	6.1	24.6	39080	13
10/3/2006	MKK-2	18.8	5.9	20.6	32900	27
10/3/2006	MAK-4	19.6	5.6	21.3	33800	17
10/3/2006	MAK-3	19.6	5.7	21.2	33670	19
10/3/2006	MAK-2	19.6	5.9	21	33500	18
10/3/2006	MAK-1	19.8	6.2	20.7	33050	21
10/5/2006	MUB-7	19.1	5.6	22.6	35750	4
10/5/2006	MUB-6	18.8	5.3	23.8	37440	8
10/5/2006	MUB-1	18.8	5.3	26.7	41450	25
10/5/2006	MUB-2	18.9	5.5	24.5	38260	20
10/5/2006	MUB-3	19.5	4.9	23.5	37030	20
10/5/2006	MUB-4	19.3	5.2	23.9	37550	20
10/5/2006	MUB-5	19.3	5.5	23.3	36700	25
10/5/2006	MUB-8	19.6	4.9	22.6	35710	27
10/5/2006	MUB-10	19.6	5.3	21.2	33660	21
10/5/2006	MUB-9	19.7	5.2	21.4	35390	27
10/6/2006	MNB-1	18.8	6.4	20.5	32810	26
10/6/2006	MNB-2	18.7	6.1	20	32160	25
10/6/2006	MNB-3	18.5	6.7	20	32160	5
10/6/2006	MNB-4	18.5	6.7	20.1	32180	5
10/6/2006	MNB-5	18.2	6.1	19.9	31790	16
10/6/2006	MNB-6	18.7	6.1	17.4	28180	12
10/6/2006	MKK-1	18.8	6.1	21.2	33750	25
10/16/2006	MLB-3	16.1	6.7	25.2	39490	15
10/16/2006	MLB-4	15.4	8	25.1	39490	7
10/16/2006	MLB-2	17.2	5.5	26.9	41780	14

Appendix C. Water quality data (Mid-water Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
10/16/2006	MLB-1	17.1	5.9	25.7	40160	13
10/16/2006	MUB-1	17.2	6	21.8	34750	27
10/16/2006	MUB-2	17.3	5.6	22.6	35390	23
10/16/2006	MUB-3	17.3	5.9	23.1	36710	19
10/16/2006	MUB-4	17.4	5.5	22.4	36350	20
10/16/2006	MUB-10	17.4	5.4	20.4	32600	20
10/16/2006	MUB-9	17.3	5.6	20.3	32790	30
10/17/2006	MUB-7	16.4	6.8	18.2	29390	6
10/17/2006	MUB-6	16.5	6.4	19.2	30750	6
10/17/2006	MKK-1	16.6	6.1	22	35020	25
10/17/2006	MAK-4	16.7	6	19.8	31660	17
10/17/2006	MAK-3	16.6	6.2	19.5	31210	20
10/17/2006	MAK-2	16.5	6.2	19.7	31480	17
10/17/2006	MAK-1	16.6	6.3	20.1	32330	22
10/17/2006	MUB-5	17	5.9	21.5	32200	27
10/18/2006	MKK-2	16.9	6.7	20.9	33210	20
10/18/2006	MNB-1	16.7	6.5	20.4	32750	20
10/18/2006	MNB-2	16.7	6.5	20.4	32750	20
10/18/2006	MNB-3	16.4	6.7	15.9	25930	4
10/18/2006	MNB-4	16.4	6.7	15.9	25930	4
10/18/2006	MNB-5	16.9	6.1	15.2	24730	16
10/18/2006	MNB-6	16.3	6.3	15.3	24290	11
10/18/2006	MUB-8	17.2	6.1	22.5	35450	20
11/20/2006	MUB-7	11.8	8.4	13.1	20750	6
11/20/2006	MLB-4	11.8	6.7	20.2	33050	7
11/20/2006	MLB-2	12.5	6.4	24	38000	12
11/20/2006	MLB-1	12.3	6.5	23	36510	15
11/20/2006	MUB-1	12.2	6.8	18.1	29380	25
11/20/2006	MUB-2	12.2	6.8	20.1	32110	21
11/20/2006	MUB-3	12.5	6.4	20.3	32500	20
11/20/2006	MUB-4	12.6	6.4	24.3	35010	20
11/20/2006	MKK-1	12.3	6.7	15.3	25440	25
11/22/2006	MNB-2	11.3	7.7	14.9	24280	25
11/22/2006	MNB-1	11.3	7.7	14.9	24880	25
11/22/2006	MKK-2	11.3	7.8	14.7	24650	25

Appendix D. Water quality data (Bottom Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
8/14/2006	MLB-1	22.6	4.7	41510	26.6	27
8/14/2006	MLB-3	22.4	5.1	42430	27.3	32
8/14/2006	MLB-2	22.4	4.8	41890	26.9	22
8/14/2006	MUB-1	22.9	4.5	39450	25.2	49
8/14/2006	MUB-2	22.8	4.5	40510	25.9	49
8/14/2006	MUB-3	22.9	4.4	40020	25.6	38
8/14/2006	MUB-8	22.8	4.3	40250	25.7	50
8/14/2006	MUB-5	22.8	4.4	40600	26	58
8/15/2006	MUB-10	23.1	4.2	37370	23.6	42
8/15/2006	MUB-9	23.3	4	35530	22.7	55
8/15/2006	MAK-1	23.5	4.7	35010	22	42
8/15/2006	MAK-2	23.8	4.4	34990	22	38
8/15/2006	MNB-2	23.5	4.7	35630	22.5	50
8/15/2006	MNB-1	23.3	4.7	36760	23.1	48
8/15/2006	MNB-4	23.9	4.8	34450	21.7	8
8/15/2006	MNB-3	23.9	4.8	34380	21.3	8
8/30/2006	MLB-1	22	4.5	42470	27.3	29
8/30/2006	MLB-3	22	4.6	42100	27	33
8/30/2006	MLB-2	21.8	4.9	39810	25.4	24
8/30/2006	MUB-1	22.1	4.4	41220	26.5	50
8/30/2006	MUB-2	22.1	4.5	41190	26.4	50
8/30/2006	MUB-3	22.1	4.4	38820	26.3	34
8/30/2006	MUB-9	22.2	5.7	41060	26.1	57
8/30/2006	MUB-10	22.1	5.8	41660	26.6	45
8/31/2006	MUB-8	22.2	4.1	37570	22.3	46
8/31/2006	MUB-5	22.3	4.2	33890	23.4	47
8/31/2006	MAK-1	22.7	3.6	32740	20.4	43
8/31/2006	MAK-2	23.4	3.9	32510	20.3	37
8/31/2006	MNB-4	22.5	4.6	29580	18.1	7
8/31/2006	MNB-3	22.5	4.6	29580	18.1	6
8/31/2006	MNB-2	22.4	4.5	33360	20.9	48
8/31/2006	MNB-1	22.4	4.6	33060	20.8	46
9/11/2006	MLB-2	20.8	5.3	41220	26.4	19
9/11/2006	MLB-3	20.5	5.2	43030	27.9	32
9/11/2006	MLB-1	20.5	4.9	42580	27.4	23
9/11/2006	MUB-1	20.7	4.7	42290	27.2	49
9/11/2006	MUB-2	20.8	4.7	41770	26.9	47
9/11/2006	MUB-3	20.9	4.6	40990	26.2	39
9/11/2006	MUB-9	21	4.7	38820	24.6	54
9/11/2006	MUB-10	20.9	4.6	40250	26.1	39
9/11/2006	MUB-8	20.9	4.6	41080	26.3	49
9/11/2006	MUB-5	20.6	5	42490	27.4	57
9/12/2006	MNB-2	21.3	5.2	32600	20.2	46
9/12/2006	MNB-1	21.1	5.1	31860	20.7	45
9/12/2006	MNB-4	21	5	31050	19.3	7
9/12/2006	MNB-3	21	5	31050	19.3	7
9/12/2006	MAK-1	21.4	4.3	31980	20	44

Appendix D. Water quality data (Bottom Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
9/12/2006	MAK-2	22.1	4.3	30880	19.2	39
9/25/2006	MNB-4	20.6	6	30590	19	10
9/25/2006	MNB-3	20.6	6	30590		8
9/25/2006	MNB-1	20.4	5.6	35500	21.6	49
9/25/2006	MNB-2	20.4	5.4	35600	22.6	51
9/25/2006	MAK-1	20.9	5.5	33000	20.7	46
9/25/2006	MUB-8	19.9	5.4	41320	26.5	51
9/25/2006	MUB-10	19.9	5.4	41040	26.3	45
9/25/2006	MUB-9	19.9	5.5	41070	26.4	55
9/26/2006	MLB-2	19.6	6.5	41950	27	22
9/26/2006	MLB-3	19.1	5.9	45220	29.3	35
9/26/2006	MLB-1	19.4	6.2	41960	26.9	25
9/26/2006	MUB-1	19.3	5.7	44140	28.5	50
9/26/2006	MUB-2	19.3	6.1	42670	27.3	50
9/26/2006	MUB-3	19.7	5.7	42380	27.3	40
9/26/2006	MUB-5	19.4	5.7	43160	27.8	55
10/10/2006	MLB-2	18	5.8	41970	27	26
10/10/2006	MLB-3	17.9	5.9	45580	28.1	34
10/10/2006	MLB-1	17.9	5.8	44050	28.5	27
10/10/2006	MUB-3	18.2	5.4	41170	26.4	42
10/10/2006	MUB-10	18.3	5.4	40590	26	47
10/10/2006	MUB-8	18.2	5.4	40850	26.2	54
10/10/2006	MUB-9	18.2	5.3	40620	26	52
10/10/2006	MUB-5	18.2	5.7	41990	27	51
10/11/2006	MUB-2	18.2	5.5	41550	26.7	47
10/11/2006	MUB-1	18.1	5.9	42800	27.6	49
10/11/2006	MNB-1	18.4	5.8	34770	21.9	49
10/11/2006	MNB-2	18.4	5.8	34200	21.5	51
10/11/2006	MNB-4	18.4	5.8	33710	21.3	9
10/11/2006	MNB-3	18.4	5.8	33710	21.3	9
10/11/2006	MAK-1	19	5.3	33550	21.1	49
10/23/2006	MLB-2	16	6	38680	24.5	23
10/23/2006	MLB-3	15.5	5.6	46830	31.8	38
10/23/2006	MLB-1	15.5	6.2	40000	24.8	25
10/23/2006	MUB-10	16	5.9	37100	23.6	47
10/23/2006	MUB-9	16	5.6	38660	26.5	54
10/23/2006	MUB-5	15.9	5.9	41890	26.6	49
10/23/2006	MUB-8	16	5.8	40890	25.3	49
10/26/2006	MUB-3	14.7	5.8	41910	26.8	39
10/26/2006	MUB-2	13.8	7.2	34030	21.4	50
10/26/2006	MUB-1	14.2	6.8	37870	24.1	50
10/26/2006	MNB-4	13.6	6.9	28140	17.4	10
10/26/2006	MNB-3	13.5	6.9	28870	17.6	9
10/26/2006	MNB-2	13.9	6.6	31280	19.2	45
10/26/2006	MNB-1	14.4	6.3	33670	20.5	49
10/26/2006	MAK-1	14.5	6.1	32430	20.3	40
11/14/2006	MLB-1	13.1	7.2	36820	23.3	26

Appendix D. Water quality data (Bottom Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
11/14/2006	MLB-3	13	7.3	37600	23.8	31
11/14/2006	MLB-2	13	7	33310	20.8	23
11/14/2006	MUB-1	13.2	7	44550	29.2	50
11/14/2006	MUB-2	13.2	7	43630	27.9	45
11/14/2006	MUB-3	13.2	7	32600	20.4	38
11/14/2006	MUB-9	13.1	6.6	39630	24.8	59
11/14/2006	MUB-10	13.1	6.6	36050	22.8	46
11/14/2006	MUB-8	13.2	6.8	40320	28	52
11/15/2006	MNB-1	13.2	8	34490	21.7	48
11/15/2006	MNB-2	13.1	8.1	32970	20.4	47
11/15/2006	MNB-3	13.5	8.6	15930	10.2	5
11/15/2006	MNB-4	13.3	8.4	17210	10.7	6
11/15/2006	MAK-1	13.1	8.3	34960	22	43
11/15/2006	MUB-5	13.2	8.6	40280	27.7	54
11/27/2006	MLB-3	11.7	7.3	39990	25.3	31
11/27/2006	MLB-2	10.6	7.7	33610	21	22
11/27/2006	MLB-1	11.1	7.3	39910	25.5	24
11/27/2006	MUB-1	11.8	6.9	44440	28.6	49
11/27/2006	MUB-2	11.6	6.9	43210	27.7	51
11/27/2006	MUB-3	11.7	6.9	42750	27.4	39
11/27/2006	MUB-9	11.7	6.9	41600	26.5	54
11/27/2006	MUB-10	11.8	6.8	44170	28.5	44
11/27/2006	MUB-8	11.8	7.1	38630	24	48
11/27/2006	MUB-5	11.7	7	37700	27.8	54
11/28/2006	MAK-1	11	7.7	31780	19.8	43
11/28/2006	MNB-1	11	7.8	29930	18.5	47
11/28/2006	MNB-2	11	7.8	29930	18.5	51
11/28/2006	MNB-4	10.5	8.2	22020	13.3	9
11/28/2006	MNB-3	10.7	8	24770	15	8
11/6/2006	MUB-7	12.5	7.7	34270	21.5	9
11/6/2006	MUB-6	12.3	7.4	38550	24.4	16
11/6/2006	MUB-4	12.2	7.3	42380	27.2	42
11/6/2006	MUB-3	12.2	7.3	42400	27.2	46
11/6/2006	MLB-1	12.1	7.5	42800	27.7	24
11/6/2006	MLB-3	12.6	7	46090	29.9	29
11/6/2006	MLB-4	12.4	7.2	43510	28.1	12
11/6/2006	MLB-2	12.4	7.2	44010	28.3	21
11/6/2006	MUB-1	12.3	7.1	42520	27.1	49
11/6/2006	MUB-2	12.3	7.1	40700	26	51
11/7/2006	MNB-5	12.1	7.5	28330	17.5	42
11/7/2006	MNB-6	12.1	7.5	28550	17.6	20
11/7/2006	MNB-3	12	7.5	28110	17.3	9
11/7/2006	MNB-4	12.1	7.5	28290	17.6	9
11/7/2006	MNB-1	12.2	7.4	29790	18.5	50
11/7/2006	MNB-2	12.2	7.5	28110	18	50
11/7/2006	MKK-2	12.2	7.4	30260	18.8	55
11/7/2006	MUB-5	12.4	7.3	40730	26	52

Appendix D. Water quality data (Bottom Trawl) by date and station collected during the 2006 Migratory Finfish Sampling Program

Date	Station	Temp (deg C)	Dissolved Oxygen (mg/l)	Salinity (ppt)	Conductivity (SPC@25)	Water Depth (ft)
11/7/2006	MUB-8	12.3	7.6	35450	21.7	49
11/7/2006	MUB-10	12.4	7.3	36650	23.1	39
11/8/2006	MUB-9	12.7	8.4	32660	20	54
11/8/2006	MAK-1	12.7	8.2	27280	16.8	50
11/8/2006	MAK-3	12.1	8.1	29020	18.3	50
11/8/2006	MAK-4	11.9	8.3	32260	20.1	43
11/8/2006	MAK-2	12.3	8.1	28210	17.4	42
11/8/2006	MKK-1	12.6	8.2	36460	23.2	50
11/20/2006	MUB-6	11.6	7.4	22750	14.1	16
11/20/2006	MLB-3	12.9	6.4	43300	27.7	30
11/21/2006	MAK-2	12.1	7.3	24660	15	41
11/21/2006	MAK-4	12.3	6.7	28180	17.4	43
11/21/2006	MAK-3	12.5	6.8	26110	16	39
11/21/2006	MAK-1	12.4	7.2	26380	16.8	45
11/21/2006	MUB-5	13.1	6.6	41590	27	54
11/21/2006	MUB-8	12.7	7	34210	25.3	52
11/21/2006	MUB-10	12.2	7.3	32160	19	45
11/21/2006	MUB-9	12.9	6.7	37660	23.7	47
11/22/2006	MNB-5	11.9	7.7	24800	15.1	34
11/22/2006	MNB-6	11.7	7.6	26400	16.3	17
11/22/2006	MNB-3	11.3	8	23200	13.9	9
11/22/2006	MNB-4	11.3	8	23200	13.9	9